



Fixed access market reviews:
wholesale local access, wholesale
fixed analogue exchange lines,
ISDN2 and ISDN30 – Annexes

Non-confidential version

Draft Statement

Notified to the European
Commission:

19 May 2014

Contents

Annex		Page
1	Regulatory framework	4
2	Equality Impact Assessment	13
3	General analytical approach to market definition and SMP assessment	16
4	TRC/SFI ordering steps and processes	27
5	TRCs and SFIs cost accounting template	29
6	Copper and duct valuation (Regulatory Asset Value)	30
7	BT RAV model	45
8	Cost modelling for simultaneously provided services	46
9	Estimation of LRIC differentials	58
10	Technical requirements of migrations	74
11	Cost model documentation	78
12	Cost Model	96
13	Detailed cost modelling assumptions	97
14	Cost of capital	165
15	Brattle Group report: Estimate of BT's Equity Beta	238
16	Efficiency	239
17	Service Quality Modelling	258
18	Analysys Mason Comments on QoS Model Consultation Responses	301
19	Service Level resource differentials	302
20	Fault Rates	323
21	Cartesian Updated Fault Rates Report	391
22	Choice of base year data for cost modelling	392
23	Correspondence on base year data	404
24	Volumes forecasting	405
25	Volumes forecasting model	452
26	Treatment of cumulo rates within the charge control	453
27	Single Jumpered MPF	473
28	Model results and sensitivities	481
29	Proposed Legal Instruments	488

30	Quality of service: Current performance, impact of poor delivery and establishing a reasonable level of performance	489
31	Quality of service: Analysis of recent Openreach performance	544
32	Sources of evidence	573
33	Glossary	617

Annex 1

Regulatory framework

Introduction

- A1.1 This annex provides an overview of the market review process to give some additional context and understanding of the matters discussed in this Statement, including the legal instruments (statutory notifications) published at Annex 29.
- A1.2 Market review regulation is technical and complex, including the legislation and the recommendations and guidelines that we need to consider as part of the process. There may be many relevant documents depending on the market and/or issues in question. This overview does not purport to give a full and exhaustive account of all such materials that we have considered in reaching our preliminary views on this market. Some of the key aspects of materials relevant to this market review are, however, discussed in this annex.

Market review concept

- A1.3 The concept of a market review refers to procedures under which we, at regular intervals, identify relevant markets appropriate to national circumstances and carry out analyses of these markets to determine whether they are effectively competitive before then deciding on appropriate remedies, known as SMP obligations or conditions (we explain the concept of SMP below).
- A1.4 In carrying out this work, we act in our capacity as the sector-specific regulator for the UK communications industries, particularly relating to our role as the regulator for telecommunications. Our functions in this regard are to be found in Part 2 of the CA03.¹ We exercise those functions within the framework harmonised across the European Union for the regulation of electronic communications by the Member States (known as the CRF), as transposed by the CA03. The applicable rules² are contained in a package of five EC Directives, of which two Directives are immediately relevant for present purposes, namely:
- Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services ('the Framework Directive'); and
 - Directive 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities ('the Access Directive').
- A1.5 The Directives require that NRAs (such as Ofcom) carry out reviews of competition in communications markets to ensure that SMP regulation remains appropriate and proportionate in the light of changing market conditions.
- A1.6 Each market review normally involves three analytical stages, namely:
- the procedure for the identification and definition of the relevant markets ('the market definition procedure');

¹ <http://www.legislation.gov.uk/ukpga/2003/21/contents>

² The Directives were subsequently amended on 19 December 2009. The amendments have been transposed into the national legislation and applied with effect from 26 May 2011 and any references in this document to the CA03 should be read accordingly.

- the procedure for the assessment of competition in each market, in particular whether the relevant market is effectively competitive ('the market analysis procedure'); and
- the procedure for the assessment of appropriate regulatory obligations ('the remedies procedure').

A1.7 These stages are normally carried out together.

Market definition procedure

A1.8 The CA03 provides that, before making a market power determination³, we must identify the market which is, in our opinion, the one which, in the circumstances of the UK, is the market in relation to which it is appropriate to consider making such a determination and to analyse that market.

A1.9 The Framework Directive requires that NRAs shall, taking the utmost account of the Relevant Markets Recommendation⁴ and EC SMP Guidelines⁵ published by the EC, define the relevant markets appropriate to national circumstances, in particular relevant geographic markets within their territory, in accordance with the principles of competition law.

A1.10 The Relevant Markets Recommendation identifies a set of product and service markets within the electronic communications sector in which *ex ante* regulation may be warranted. Its purpose is twofold. First, it seeks to achieve harmonisation across the single market by ensuring that the same markets will be subject to a market analysis in all Member States. Second, the Relevant Markets Recommendation seeks to provide legal certainty by making market players aware in advance of the markets to be analysed.

A1.11 However, NRAs are able to regulate markets that differ from those identified in the Relevant Markets Recommendation where this is justified by national circumstances, taking account of the three cumulative criteria referred to in the Relevant Markets Recommendation⁶ ('the three-criteria test') and where the EC does not raise any objections.

³ The market power determination concept is used in the CA03 to refer to a determination that a person has SMP in an identified services market.

⁴ EC, *Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, (2007/879/EC)*, http://ec.europa.eu/information_society/policy/ecomm/doc/library/proposals/rec_markets_en.pdf. The Relevant Markets Recommendation is currently under review. The EC is expected to publish a revised recommendation in due course.

⁵ EC, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services (2002/C 165/03)*, 11 July 2002, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF>.

⁶ The Relevant Markets Recommendation states that, "[w]hen identifying markets other than those set out in the Annex, national regulatory authorities should ensure that the following three criteria are cumulatively met: (a) the presence of high and non-transitory barriers to entry. These may be of a structural, legal or regulatory nature; (b) a market structure which does not tend towards effective competition within the relevant time horizon. The application of this criterion involves examining the state of competition behind the barriers to entry; (c) the insufficiency of competition law alone to adequately address the market failure(s) concerned".

- A1.12 Under the three-criteria test, when identifying markets other than those in the Relevant Markets Recommendation, the NRA needs to ensure that each of the following three criteria are cumulatively met:
- the presence of high and non-transitory barriers to entry. These may be of a structural, legal or regulatory nature;
 - a market structure which does not tend towards effective competition within the relevant time horizon. The application of this criterion involves examining the state of competition behind the barriers to entry; and
 - the insufficiency of competition law alone to adequately address the market failure(s) concerned.
- A1.13 The fact that an NRA identifies the product and service markets listed in the Relevant Markets Recommendation or identifies other product and service markets that meet the three-criteria test does not automatically mean that regulation is warranted. Market definition is not an end in itself but rather a means of assessing effective competition. The three-criteria test is also different from the SMP assessment because the test's focus is on the general structure and market characteristics.
- A1.14 The relationship between the market definitions identified in this review and those listed in the Relevant Markets Recommendation is discussed in relevant parts of this Statement.⁷
- A1.15 The EC SMP Guidelines make clear that market definition is not a mechanical or abstract process. It requires an analysis of any available evidence of past market behaviour and an overall understanding of the mechanics of a given market sector. As market analysis has to be forward-looking, the EC SMP Guidelines state that NRAs should determine whether the market is prospectively competitive, and thus whether any lack of effective competition is durable, by taking into account expected or foreseeable market developments over the course of a reasonable period. The EC SMP Guidelines clarify that NRAs enjoy discretionary powers which reflect the complexity of all the relevant factors that must be assessed (economic, factual and legal) when identifying the relevant market and assessing whether an undertaking has SMP.
- A1.16 The EC SMP Guidelines also describe how competition law methodologies may be used by NRAs in their analysis. In particular, there are two dimensions to the definition of a relevant market: the relevant products to be included in the same market and the geographic extent of the market. Ofcom's approach to market definition follows that used by the UK competition authorities, which is in line with the approach adopted by the EC.
- A1.17 While competition law methodologies are used in identifying the *ex ante* markets, the markets identified will not necessarily be identical to markets defined in individual competition law cases, especially as the *ex ante* markets are based on an overall forward-looking assessment of the structure and the functioning of the market under examination. Accordingly, the economic analysis carried out for the purpose of this review, including the markets we have identified, is without prejudice

⁷ See, in particular, where we set out how we consider the three criteria test is cumulatively satisfied for each of the relevant markets which are not included in the Relevant Markets Recommendation, but for which we have concluded are markets in which *ex ante* regulation is warranted.

to any analysis that may be carried out in relation to any investigation pursuant to the Competition Act 1998⁸ (relating to the application of the Chapter I or II prohibitions or Article 101 or 102 of the Treaty on the Functioning of the European Union⁹) or the Enterprise Act 2002.¹⁰

Market analysis procedure

Effective competition

- A1.18 The CA03 requires that we carry out market analyses of identified markets for the purpose of making or reviewing market power determinations. Such analyses are normally to be carried out within 2 years from the adoption of a revised recommendation on markets, where that recommendation identifies a market not previously notified to the EC, or within 3 years from the publication of a previous market power determination relating to that market.¹¹
- A1.19 In carrying out a market analysis, the key issue for an NRA is to determine whether the market in question is effectively competitive. The 27th recital to the Framework Directive clarifies the meaning of that concept. Namely, “[it] is essential that ex ante regulatory obligations should only be imposed where there is not effective competition, i.e. in markets where there are one or more undertakings with significant market power, and where national and Community competition law remedies are not sufficient to address the problem”.
- A1.20 The definition of SMP is equivalent to the concept of dominance as defined in competition law. In essence, it means that Ofcom needs to determine whether any undertaking in the relevant market is in a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers, and ultimately consumers. The Framework Directive requires that NRAs must carry out their market analysis taking the utmost account of the EC SMP Guidelines, which emphasise that NRAs should undertake a thorough and overall analysis of the economic characteristics of the relevant market before coming to a conclusion as to the existence of SMP.
- A1.21 In that regard, the EC SMP Guidelines set out, additionally to market shares, a number of criteria that can be used by NRAs to measure the power of an undertaking to behave to an appreciable extent independently of its competitors, customers and consumers, including:
- the overall size of the undertaking;
 - control of infrastructure not easily duplicated;
 - technological advantages or superiority;

⁸ <http://www.legislation.gov.uk/ukpga/1998/41/contents>

⁹ Previously Article 81 and Article 82 of the EC Treaty, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:FULL:EN:PDF>.

¹⁰ <http://www.legislation.gov.uk/ukpga/2002/40/contents>

¹¹ The CA03 was amended on 26 May 2011 to include these requirements following amendment to the Directives on 19 December 2009. However, the CA03 provides for a transitional provision which means that the requirement to notify the EC within 3 years from a previous market power determination only applies where that market power determination was made after 25 May 2011. The market power determinations under review in this document were all made prior to 25 May 2011.

- absence of or low countervailing buying power;
- easy or privileged access to capital markets/financial;
- resources;
- product/services diversification (e.g. bundled products or services);
- economies of scale;
- economies of scope;
- vertical integration;
- highly developed distribution and sales network;
- absence of potential competition; and
- barriers to expansion.

A1.22 A dominant position can derive from a combination of these criteria, which when taken separately may not necessarily be determinative.

Sufficiency of competition law

A1.23 As part of our overall forward-looking analysis, we also assess whether competition law by itself (without *ex ante* regulation) is sufficient, within the relevant markets we have defined, to address the competition problems we have identified. Aside from the need to address this issue as part of the three-criteria test, we also consider this matter in our assessment of the appropriate remedies which, as explained below, are based on the nature of the specific competition problems we identify within the relevant markets as defined. We also note that the EC SMP Guidelines clarify that, if NRAs designate undertakings as having SMP, they must impose on them one or more regulatory obligations.

A1.24 In considering this matter, we bear in mind the specific characteristics of the relevant markets we have defined. Generally, the case for *ex ante* regulation is based on the existence of market failures which, by themselves or in combination, mean that the establishment of competition might not be possible if the regulator relied solely on *ex post* competition law powers that have been established for dealing with more conventional sectors of the economy. Therefore, it is appropriate for *ex ante* regulation to be used to address these market failures along with any entry barriers that might otherwise prevent effective competition from becoming established within the relevant markets we have defined. By imposing *ex ante* regulation that promotes competition, it may be possible to reduce such regulation over time as markets become more competitive, allowing greater reliance on *ex post* competition law.

A1.25 *Ex post* competition law is also unlikely in itself to bring about (or promote) effective competition, as it prohibits the abuse of dominance rather than the holding of a dominant position itself. In contrast, *ex ante* regulation is normally aimed at actively promoting the development of competition through attempting to reduce the level of market power (or dominance) in the identified relevant markets, thereby encouraging the establishment of effective competition. This is particularly the case when addressing the effects of network externalities, which generally re-enforce a

dominant position. As noted above, under *ex post* competition law there is no prohibition on the holding of a position of dominance in itself and it is, therefore, normally more appropriate to address the impact of network externalities through *ex ante* obligations.

A1.26 Additionally, unless we consider otherwise in relation to a specific obligation in this review, we generally take the view that *ex ante* regulation is needed to create legal certainty for the market under review. Linked to that certainty is the fact that the SMP obligations we have imposed are necessary to enable us to intervene in a timely manner. For some other specific obligations, we generally consider that they are needed as competition law would not remedy the particular market failure, or we believe that specific clarity and detail of the obligation is required to achieve a particular result.

Remedies procedure

Powers and legal tests

A1.27 The Framework Directive prescribes what regulatory action NRAs must take depending upon whether or not an identified relevant market has been found effectively competitive. Where a market has been found effectively competitive, NRAs are not allowed to impose SMP obligations and must withdraw such obligations where they already exist. On the other hand, where the market is found not effectively competitive, the NRAs must identify the undertakings with SMP in that market and then impose appropriate obligations.

A1.28 NRAs have a suite of regulatory tools at their disposal, as reflected in the CA03. Specifically, the Access Directive specifies a number of SMP obligations, including transparency, non-discrimination, accounting separation, access to and use of specific network elements and facilities, price control and cost accounting. When imposing a specific obligation, the NRA will need to demonstrate that the obligation in question is based on the nature of the problem identified, proportionate and justified in the light of the policy objectives as set out in Article 8 of the Framework Directive.

A1.29 Specifically, for each and every SMP obligation, we explain why it satisfies the test that the obligation is:

- objectively justifiable in relation to the networks, services, facilities, apparatus or directories to which it relates;
- not such so as to discriminate unduly against particular persons or against a particular description of persons;
- proportionate to what the condition or modification is intended to achieve; and
- transparent in relation to what is intended to be achieved.

A1.30 Additional legal requirements may also need to be satisfied depending on the SMP obligation in question. For example, in the case of price controls, the NRA's market analysis must indicate that the lack of effective competition means that the CP concerned may sustain prices at an excessively high level or may apply a price squeeze to the detriment of end-users. In that instance, NRAs must take into account the investment made by the CP and allow it a reasonable rate of return on adequate capital employed, taking into account any risks specific to a particular new

investment, as well as ensure that any cost recovery mechanism or pricing methodology that is mandated serves to promote efficiency and sustainable competition and maximise consumer benefits. Where an obligation to provide third parties with network access is considered appropriate, NRAs must take into account factors including the feasibility of the network access, the technical and economic viability of creating networks¹² that would make the network access unnecessary, the investment of the network operator who is required to provide access¹³, and the need to secure effective competition¹⁴ in the long term.

A1.31 To the extent relevant to this review, we demonstrate the application of these requirements to the SMP obligations in question in the relevant parts of this document. In doing so, we also set our assessment of how, in our opinion, the performance of our general duties under section 3 of the CA03 is secured or furthered by our regulatory intervention, and that it is in accordance with the six Community requirements in section 4 of the CA03. This is also relevant to our assessment of the likely impact of implementing our conclusions.

Ofcom's general duties - section 3 of the CA03

A1.32 Under the CA03, our principal duty in carrying out functions is to further the interests of citizens in relation to communications matters and to further the interests of consumers in relevant markets, where appropriate by promoting competition.

A1.33 In doing so, we are required to secure a number of specific objectives and to have regard to a number of matters set out in section 3 of the CA03.

A1.34 In performing our duties, we are also required to have regard to a range of other considerations, as appear to us to be relevant in the circumstances. For the purpose of the FAMR, we consider that a number of such considerations are relevant, in particular:

- the desirability of promoting competition in relevant markets;
- the desirability of encouraging investment and innovation in relevant markets; and
- the desirability of encouraging the availability and use of high speed data transfer services throughout the UK.

A1.35 We have also had regard to the principles under which regulatory activities should be transparent, accountable, proportionate, consistent, and targeted only at cases in which action is needed, as well as the interest of consumers in respect of choice, price, quality of service and value for money.

A1.36 Ofcom has, however, a wide measure of discretion in balancing its statutory duties and objectives. In doing so, we have taken account of all relevant considerations, including responses received during our consultation process, in reaching our conclusions.

¹² Including the viability of other network access products, whether provided by the dominant provider or another person.

¹³ Taking account of any public investment made.

¹⁴ Including, where it appears to us to be appropriate, economically efficient infrastructure-based competition.

European Community requirements for regulation - sections 4 and 4A of the CA03 and Article 3 of the BEREC Regulation

A1.37 As noted above, our functions exercised in this review fall under the CRF. As such, section 4 of the CA03 requires us to act in accordance with the six European Community requirements for regulation. In summary, these six requirements are:

- to promote competition in the provision of electronic communications networks and services, associated facilities and the supply of directories;
- to contribute to the development of the European internal market;
- to promote the interests of all persons who are citizens of the EU;
- to take account of the desirability of Ofcom's carrying out of its functions in a manner which, so far as practicable, does not favour one form of or means of providing electronic communications networks, services or associated facilities over another (i.e. to be technologically neutral);
- to encourage, to such extent as Ofcom considers appropriate for certain prescribed purposes, the provision of network access and service interoperability, namely securing efficient and sustainable competition, efficient investment and innovation, and the maximum benefit for customers of CPs; and
- to encourage compliance with certain standards in order to facilitate service interoperability and secure freedom of choice for the customers of CPs.

A1.38 We considered that the first, third, fourth and fifth of those requirements are of particular relevance to the matters under review and that no conflict arises in this regard with those specific objectives in section 3 of the CA03 that we consider are particularly relevant in this context.

A1.39 Section 4A of the CA03 requires Ofcom, in carrying out certain of its functions (including, among others, Ofcom's functions in relation to market reviews under the CRF) to take due account of applicable recommendations issued by the EC under Article 19(1) of the Framework Directive. Where we decide not to follow such a recommendation, we must notify the EC of that decision and the reasons for it.

A1.40 Similarly, Article 3(3) of the Regulation establishing BEREC¹⁵ requires NRAs to take utmost account of any opinion, recommendation, guidelines, advice or regulatory best practice adopted by BEREC.

A1.41 Accordingly, we have taken due account of the applicable EC recommendations and utmost account of the applicable opinions, recommendations, guidelines, advice and regulatory best practices adopted by BEREC relevant to the matters under consideration in this review.

¹⁵ Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators of Electronic Communications (BEREC) and the Office (the BEREC Regulation) <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0001:0010:EN:PDF>.

Impact assessment – section 7 of the CA03

- A1.42 The analysis presented in the whole of this document represents an impact assessment, as defined in section 7 of the CA03.
- A1.43 Impact assessments provide a valuable way of assessing different options for regulation and showing why the preferred option was chosen. They form part of best practice policy-making. This is reflected in section 7 of the CA03, which means that generally Ofcom has to carry out impact assessments where there is likely to be a significant effect on businesses or the general public, or when there is a major change in Ofcom's activities. However, as a matter of policy Ofcom is committed to carrying out and publishing impact assessments in relation to the great majority of its policy decisions. For further information about Ofcom's approach to impact assessments, see the guidelines, Better policy-making: Ofcom's approach to impact assessment, which are on the Ofcom website:
http://www.ofcom.org.uk/consult/policy_making/guidelines.pdf.
- A1.44 Specifically, pursuant to section 7, an impact assessment must set out how, in our opinion, the performance of our general duties (within the meaning of section 3 of the CA03) is secured or furthered by or in relation to the regulation we impose.
- A1.45 Ofcom is separately required by statute to assess the potential impact of all our functions, policies, projects and practices on race, disability and gender equality. This assessment is set out in Annex 2.

Regulated entity

- A1.46 The power in the CA03 to impose an SMP obligation by means of an SMP services condition provides that it is to be applied only to a 'person' whom we have determined to be a 'person' having SMP in a specific market for electronic communications networks, electronic communications services or associated facilities (i.e. the 'services market').
- A1.47 The Framework Directive requires that, where an NRA determines that a relevant market is not effectively competitive, it shall identify 'undertakings' with SMP in that market and impose appropriate specific regulatory obligations. For the purposes of EU competition law, 'undertaking' includes companies within the same corporate group (for example, where a company within that group is not independent in its decision making).¹⁶
- A1.48 We consider it appropriate to prevent a dominant provider to whom an SMP services condition is applied, which is part of a group of companies, exploiting the principle of corporate separation. The dominant provider should not use another member of its group to carry out activities or to fail to comply with a condition, which would otherwise render the dominant provider in breach of its obligations.
- A1.49 To secure that aim, we apply the SMP conditions to the person in relation to which we have made the market power determination in question by reference to the so-called 'Dominant Provider', which we define as "*[X plc], whose registered company number is [000] and any [X plc] subsidiary or holding company, or any subsidiary of that holding company, all as defined in section 1159 of the Companies Act 2006*".

¹⁶ *Viho v Commission*, Case C-73/95 P [1996] ECR I-5447, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:61995CJ0073:EN:PDF>.

Annex 2

Equality Impact Assessment

- A2.1 Ofcom is required by statute to assess the potential impact of all our functions, policies, projects and practices on race, disability and gender equality.¹⁷
- A2.2 We fulfil these obligations by carrying out an Equality Impact Assessment ('EIA'), which examines whether or not the remedies that we have imposed for the fixed access markets under review would have an adverse impact on equality.
- A2.3 In this way, the EIA assists us in making sure that we are meeting our principal duty of furthering the interests of citizens and consumers, regardless of their background or identity.

Fixed access market reviews

- A2.4 The aim of these reviews is to assess the state of competition in the WFAEL, wholesale ISDN30, wholesale ISDN2 and WLA markets and, if any market is not found to be effectively competitive, to identify CPs which have SMP and to impose on them regulatory obligations at the wholesale level to address that SMP.
- A2.5 Our approach to regulating wholesale fixed access markets is to impose appropriate regulatory obligations on CPs with SMP that will promote competition by requiring them to provide other CPs with access to their networks on regulated terms.
- A2.6 The effect of this approach has been, among others, to promote competition at the retail level, thereby ensuring all consumers in these markets have:
- a meaningful choice between suppliers and a range of different products and services (e.g. voice, broadband, superfast broadband, ISDN);
 - competitive prices and quality of service; and
 - high levels of take up arising from the nexus of price, quality of service, choice and innovation.
- A2.7 In order to achieve this, we have imposed specific access remedies and charge controls, in addition to a number of general remedies, for the WLA, WFAEL, wholesale ISDN30 and wholesale ISDN2 markets:

¹⁷ Ofcom has a general duty under the 2010 Equality Act to advance equality of opportunity in relation to age, gender, disability, ethnicity, religious belief, sexual orientation, gender reassignment and pregnancy and maternity.

Table A2.1: Remedies

Wholesale market	Remedies
WLA	<p>BT:</p> <ul style="list-style-type: none"> Local Loop Unbundling ('LLU') including charge controls and Basis of charges Virtual Unbundled Local Access ('VULA'), including charge control on GEA-to-GEA migrations Sub Loop Unbundling ('SLU'), including Basis of charges Physical Infrastructure Access ('PIA'), including Basis of charges General remedies¹⁸ Requirement to meet minimum standards for specified services Requirement to provide and publish Key Performance Indicators ('KPIs') <p>KCOM: General remedies</p>
WFAEL	<p>BT:</p> <ul style="list-style-type: none"> Wholesale Line Rental ('WLR') including charge controls General remedies Requirement to meet minimum standards for specified services Requirement to provide and publish KPIs <p>KCOM: General remedies</p>
ISDN30	<ul style="list-style-type: none"> BT: ISDN30 WLR, charge control, general remedies, requirement to provide and publish KPIs <p>KCOM: General remedies</p>
ISDN2	<ul style="list-style-type: none"> BT: ISDN2 WLR, charge control, general remedies, requirement to provide and publish KPIs <p>KCOM: General remedies</p>

Source: Ofcom

A2.8 It is important to determine whether or not the impact of our conclusions falls disproportionately on particular groups of consumers as our remedies will have an indirect effect on consumers at the retail level.

¹⁸ General remedies are remedies not specific to any particular product or service, but which provide general obligations which aim to promote competition. These include: a requirement to provide network access on reasonable request; request for new network access; no undue discrimination; Equivalence of Inputs, requirement to publish a Reference Offer (including specifying services subject to SLAs/SLGs); requirement to notify charges, terms and conditions; requirement to notify technical information; cost accounting; and accounting separation.

Assessment

- A2.9 Due to the complexity of competition at the retail level, it is difficult to predict in advance how retail offers will be changed, if at all, in response to remedies at the wholesale level. This is because CPs have discretion over the level and structure of their prices and product/service offerings, and are therefore likely to pursue a variety of retail strategies when confronted with regulatory changes at the wholesale level. In addition, it is also difficult to determine precisely how end consumers will respond to these changes. As a result, we can only make broad inferences about the effect on consumers.
- A2.10 We have had regard to our understanding of how different groups in society engage with communications services. We refer in particular to our Policy Evaluation Report of 28 January 2014¹⁹ in which we looked at groups such as people with disabilities, older consumers, those on low incomes and different ethnic communities. We have also had regard to our Research Document of January 2014²⁰ which, amongst other things, looked at the age and gender profile of consumers who have taken up fixed-line services.
- A2.11 Whilst our research identifies the differences in take-up and use of fixed-line services by different groups within society, our conclusions in this review concerning wholesale network access remedies are aimed at promoting competition across the range of fixed line services and therefore it is not apparent that they are likely to have any particular impact at the retail level on race, disability and gender equality.
- A2.12 We do not consider it necessary to carry out separate EIAs in relation to race or gender equality or equality schemes under the Northern Ireland and Disability Equality Schemes. This is because we anticipate that our regulatory intervention will not have a differential impact on people of different gender or ethnicity, on consumers in Northern Ireland or on disabled consumers compared to consumers in general.
- A2.13 We believe that our interventions will not have a particular effect on one group of consumers over another or envisage that the impact of our conclusions will be detrimental to any group of society. Rather, we consider that they will further the aim of advancing equality of opportunity between different groups in society by furthering the interests of all consumers in retail fixed access markets by promoting competition in the supply of fixed-line services and ensuring minimum standards of service.

¹⁹ Ofcom, *The Consumer Experience of 2013: Telecoms, internet, digital broadcasting and post – Policy Evaluation Report*, 28 January 2013, http://stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-13/TCE_Policy_Final.pdf.

²⁰ Ofcom, *The Consumer Experience of 2013*, January 2014, http://stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-13/TCE_Research_final.pdf.

Annex 3

General analytical approach to market definition and SMP assessment

Introduction

A3.1 This annex sets out in general terms the processes that we have followed in defining the markets within this review, how and on what basis we assess whether anyone has SMP in a given market, whether SMP conditions should be imposed in a relevant market, and in what form. Sections 3-7, Volume 1 (market definition and SMP analysis) and Sections 8-19, Volume 1 (remedies) set out in more detail how we have applied our approach in each relevant market.

The time period under review

A3.2 Rather than just looking at the current position, market reviews look ahead to how competitive conditions may change in future. Our evaluation of the current market takes into account past developments and evidence, before then considering the foreseeable market changes that we expect to affect its development over the period to March 2017. This forecast period reflects the period covered by this market review.

A3.3 The forward look period that we have used does not preclude us reviewing the market before that point should the market develop in way we have not foreseen to the extent that it is likely to affect the competitive conditions that are operating.

Approach to market definition

A3.4 In defining markets for market review purposes, our main EU law obligation is to define relevant markets appropriate to national circumstances in accordance with the principles of competition law, taking the utmost account of the Relevant Markets Recommendation and the EC SMP Guidelines.²¹

A3.5 There are two dimensions to the definition of the relevant market: the relevant products to be included within the market and the geographic extent of the market. It is often practical to define the relevant product market before exploring the geographic dimension of the market.

A3.6 While we describe below our analytical approach to market definition, it should be borne in mind that this is not a mechanical or abstract process. The approach is a dynamic one based on our overall understanding of the relevant markets, taking account of available evidence of past behaviour as well as our forward-looking analysis over the forecast period, reflecting the characteristics of the relevant retail and wholesale markets and the factors likely to influence their competitive development.

²¹ Article 15(3), EC, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

- A3.7 It should therefore be recognised that the market definition exercise is not an end in itself, but, rather, a means to an end. Market definition aids the assessment of whether end-users of a product are protected by effective competition and thus whether there is a requirement for the imposition of *ex ante* regulation. It is in this light that we have conducted our market definitions in this review.
- A3.8 In particular, when identifying markets that differ from those in the Relevant Markets Recommendation, the three-criteria test is applied to identify markets that are susceptible to *ex ante* regulation. The market definition exercise goes to this end.
- A3.9 To re-iterate, the three criteria that must cumulatively be met are:²²
- the presence of high and non-transitory barriers to entry, which may be of a structural, legal or regulatory nature;
 - a market structure which does not tend towards effective competition within the relevant time horizon (the application of this criterion involves examining the state of competition behind the barriers to entry); and
 - the insufficiency of competition law alone to adequately address the market failure(s) concerned.
- A3.10 If these conditions are met, it may be appropriate to impose *ex-ante* regulation in the market. In formulating our final positions, we have taken utmost account of the EC SMP Guidelines and the Relevant Markets Recommendation as well as the accompanying Explanatory Memorandum (the ‘Explanatory Memorandum’).²³

Sequencing of our analysis

- A3.11 We now provide an overview of the stages involved in assessing whether or not it is appropriate to impose *ex ante* regulation. Figure A3.1 sets out the sequencing of our analysis.

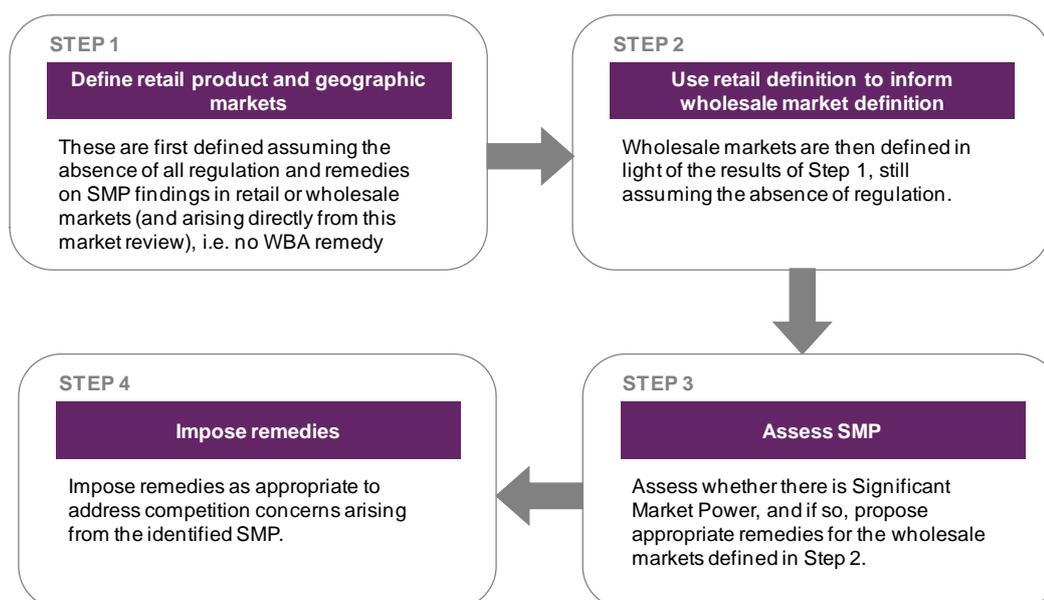
²² As set out in paragraph 5 of EC, *Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, (2007/879/EC)*,

www.ec.europa.eu/information_society/policy/ecomms/doc/library/proposals/rec_markets_en.pdf.

²³ EC, *Explanatory note accompanying the Commission recommendation on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and the Council on a common regulatory framework for electronic communications networks and services,*

www.ec.europa.eu/information_society/policy/ecomms/doc/implementation_enforcement/eu_consultation_procedures/sec_2007_1483_2.pdf.

Figure A3.1: Sequencing of market definition, SMP and remedies analysis



Source: Ofcom.

- A3.12 The order in which we carry out the various steps is linked with another aspect that often needs to be taken into account – especially in the electronic communications sector – namely the level of the supply chain (e.g. retail, wholesale) that is being analysed. Our usual starting point for identifying markets where there may be a requirement for the imposition of *ex ante* regulation is the definition of retail markets from a forward-looking perspective (Step 1). The wholesale market is defined subsequent to this exercise being carried out (Step 2).
- A3.13 The analysis of retail market definition is logically prior to the definition of wholesale markets because the demand for the upstream wholesale service is a derived demand – i.e. the level of the demand for the upstream input depends on the demand for the retail service. Hence the range of available substitutes at the downstream (retail) level will inform the likely range of substitutes for the upstream (wholesale) service. This is because a rise in the price of a wholesale service which is passed through in the price of downstream retail services will cause retail customers to switch to substitute retail products, reducing demand for the wholesale input. We refer to this as an indirect constraint.
- A3.14 Consequently, Step 1 (retail market definition) and Step 2 (wholesale market definition) should be regarded as one exercise, the ultimate purpose of which is to define those wholesale markets in the UK where there may be a requirement for the imposition of *ex ante* regulation.²⁴

²⁴ See, in this respect, Recital 4 of the Relevant Markets Recommendation which states that “[h]aving defined retail markets, it is then appropriate to identify relevant wholesale markets” (emphasis added) (EC, Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, (2007/879/EC), www.ec.europa.eu/information_society/policy/ecom/doc/library/proposals/rec_markets_en.pdf). See also section 2.1, EC, Explanatory note accompanying the Commission recommendation on relevant product and service markets within the electronic communications sector susceptible to *ex ante* regulation in accordance with Directive 2002/21/EC of the European Parliament and the Council on a

A3.15 We have thus considered the definition of retail and wholesale markets and, in relevant cases, whether the wholesale market is one in which *ex ante* regulation may be appropriate (if so, we have then formally identified a relevant market).²⁵ Step 3 in our analysis is assessing whether or not there is SMP. In the event that we find that SMP exists, we then go on to consider appropriate remedies for the relevant market (Step 4).

Market definition

Demand-side and supply-side substitution

A3.16 Market boundaries are determined by identifying constraints on the price setting behaviour of firms.²⁶ There are two main constraints to consider:

- first, to what extent it is possible for a customer to substitute other services for those in question in response to a relative price increase ('demand-side substitution'); and
- second, to what extent suppliers can switch, or increase, production to supply the relevant products or services in response to a relative price increase ('supply-side substitution').

A3.17 The hypothetical monopolist test ('HMT') is a useful tool often used to identify close demand-side and supply-side substitutes. In this test, a product is considered to constitute a separate market if the hypothetical monopolist supplier could impose a small but significant non-transitory increase in price ('SSNIP') above the competitive level without losing sales to such a degree as to make this price rise unprofitable. If such a price rise would be unprofitable, because consumers would switch to other products or because suppliers of other products would begin to compete with the hypothetical monopolist, then the market definition should be expanded to include the substitute products.

A3.18 We must first therefore address the issue of which product(s) should form the starting point for the application of the HMT. We refer to this starting point as the 'focal product'.²⁷ Paragraph 41 of the EC SMP Guidelines states that "*As a starting point, an NRA should apply this test firstly to an electronic communications service*

common regulatory framework for electronic communications networks and services, www.ec.europa.eu/information_society/policy/ecom/doc/implementation_enforcement/eu_consultation_procedures/sec_2007_1483_2.pdf) and paragraph 44, (EC, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF).

²⁵ See Recital 5 and Recommendation 2 of EC, *Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services*, (2007/879/EC),

www.ec.europa.eu/information_society/policy/ecom/doc/library/proposals/rec_markets_en.pdf).

²⁶ See paragraph 38 of EC, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

²⁷ This reflects the terminology used by the OFT (OFT, *Market definition*, December 2004, OFT403, www.of.gov.uk/shared_of/business_leaflets/ca98_guidelines/oft403.pdf).

*or product offered in a given geographical area, the characteristics of which may be such as to justify the imposition of regulatory obligations ...*²⁸

- A3.19 We define markets first on the demand-side, considering if other services could be considered as substitutes by consumers in the event of the hypothetical monopolist supplier introducing a SSNIP above the competitive level.
- A3.20 Then, where relevant, we assess supply-side substitution possibilities to consider whether they provide any additional constraints on the pricing behaviour of the hypothetical monopolist which have not been captured by the demand-side analysis. In this assessment, supply-side substitution is considered to be a low cost form of entry which can take place within a reasonable timeframe (e.g. up to 12 months). The key point is that, for supply-side substitution to be relevant, not only must suppliers be able, in theory, to enter the market quickly and at low cost by virtue of their existing position in the supply of other products or geographic areas, but there must also be an additional competitive constraint arising from such entry into the supply of the service in question.
- A3.21 Therefore, in identifying potential supply-side substitutes, it is important that providers of these services have not already been taken into consideration. There might be suppliers who provide other services but who might also be materially present in the provision of demand-side substitutes to the service for which the hypothetical monopolist has raised its price. Such suppliers are not relevant to supply-side substitution since they supply services already identified as demand-side substitutes. As such, their entry has already been taken into account and so supply-side substitution from these suppliers cannot provide an additional competitive constraint on the hypothetical monopolist. However, the impact of expansion by such suppliers can be taken into account in the assessment of market power.

Bundling

- A3.22 A common feature of the telecoms sector is the supply of bundles of different services. The Explanatory Memorandum explains that in most cases the individual services in a bundle are not good demand-side substitutes of each other, yet may be considered as part of the same retail market if there is no independent demand for individual parts of the bundle.
- A3.23 However, the Explanatory Memorandum goes on to say that if, in the presence of a SSNIP there is evidence that a sufficient number of customers would “unpick” the bundle and obtain the service elements of the bundle separately, then it can be concluded that the service elements constitute the relevant markets in their own right.
- A3.24 BEREC’s report on bundles expands on this and says that economies of scope and transaction cost savings might make it less likely that consumers will “unpick” a bundle.²⁹ It also suggests that evidence relating to consumer switching between bundled and unbundled products, switching costs, and the take-up of bundles

²⁸ Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

²⁹ BEREC, BoR (10) 64, *BEREC report on the impact of bundled offers in retail and wholesale market definition*, December 2010, http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/?doc=209.

compared to individual products (and the availability of individual products) can be used to infer substitutability of bundled and unbundled products.

Homogeneous competitive conditions

A3.25 In certain circumstances, it may also be appropriate to define a product market by grouping together services which are subject to homogeneous competitive conditions, despite the absence of demand- and supply-side substitutability. Homogeneity of competitive conditions is chiefly used in defining geographic markets to combine, into a single market, different geographic areas in which competitive conditions are nonetheless sufficiently homogeneous. However, it can also be used in the product market definition analysis. This approach can help streamline the subsequent market power analysis by reducing the need to review multiple markets for products the provision of which is subject to homogeneous competitive conditions.

A3.26 However, combining products and services based on homogenous competition conditions, is – by definition – only appropriate where this would not alter any subsequent findings on SMP (relative to defining those markets separately and making separate market power assessments accordingly). Provided this is the case, then we consider applying this criterion to both our product and geographic market definition analysis is appropriate since market definition, as explained above, is a means to an end and the end is an assessment of the effectiveness of competition in the relevant market which involves carrying out the market power analysis.

A3.27 Our approach also takes into account the EC SMP Guidelines. In particular, paragraph 56 of the EC SMP Guidelines states that:

“According to established case-law, the relevant geographic market comprises an area in which the undertakings concerned are involved in the supply and demand of the relevant products or services, in which area the conditions of competition are similar or sufficiently homogeneous and which can be distinguished from neighbouring areas in which the prevailing conditions of competition are appreciably different...”

A3.28 Hence, subject to the relevant caveats above, where there are geographic areas where competitive conditions are sufficiently homogeneous, the definition of the relevant geographic market will include all of those areas within one market.

Common pricing constraints

A3.29 Another factor that is sometimes considered in setting market boundaries is whether there exist common pricing constraints across customers, services or geographic areas (i.e. areas in which a firm voluntarily offers its services at a geographically uniform price). Where common pricing constraints exist, the geographic areas in which they apply could be included within the same relevant market even if demand-side and supply-side substitutes are not present. Failure to consider the existence of a common pricing constraint could lead to unduly narrow markets being defined.

Relevance of existing regulation – the modified Greenfield approach

- A3.30 When we conduct our analysis to define the relevant retail and wholesale markets we assume that there is no SMP regulation in place in the market under consideration or in downstream markets – the so-called ‘modified Greenfield approach’.³⁰
- A3.31 This approach means we conduct Step 1 and Step 2 of the approach set out in Figure A3.1 in the absence of SMP regulation. To do otherwise would mean that the subsequent wholesale market power assessment (Step 3) would be informed by a previous retail market definition that itself relied on a wholesale regulatory remedy arising from the finding of wholesale market power. This would be a circular and incorrect approach to market definition.
- A3.32 However, at both Steps 1 and 2, it remains appropriate to take into account *ex ante* regulation arising from SMP findings in markets other than those being defined. Further, having defined the wholesale market, it may be necessary to go on to consider whether *ex ante* regulation is necessary at the retail level. In carrying out this retail level assessment, it is appropriate to take into account any regulation that is upstream of the market being considered, as upstream regulation (e.g. wholesale remedies) has the potential to affect the competitive state of downstream (i.e. retail) markets (indeed, this is generally one of the main intentions of upstream regulation).

Geographic market

- A3.33 In addition to the product(s) to be included within a market, market definition also requires the geographic extent of the market to be specified. The geographic market is the area within which demand side and/or supply side substitution can take place and is defined using a similar approach to that used to define the product market. We have considered the geographic extent of each relevant market covered in this market review.
- A3.34 There are a number of possible approaches to geographic market definition. One approach would be to begin with a narrowly-defined area and then consider whether a price increase by a hypothetical monopolist in that narrowly defined area would encourage customers to switch to suppliers located outside the area (demand-side substitution) or CPs outside the area to begin to offer services in the area (supply-side substitution). If demand and/or supply side substitution is sufficient to constrain prices then it is appropriate to expand the geographic market boundary.
- A3.35 We recognise that in certain communications (product) markets in the UK, there could be different competitive pressures in different geographic areas. In this case, we therefore have to consider whether it would be appropriate to identify separate geographic markets for some services (note also that the discussion in paragraphs A3.25-A3.29 above about homogenous competitive conditions and common pricing constraints is relevant). Defining separate markets by geographic area may be

³⁰ See also section 2.5 of EC, *Explanatory note accompanying the Commission recommendation on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and the Council on a common regulatory framework for electronic communications networks and services*, www.ec.europa.eu/information_society/policy/ecomms/doc/implementation_enforcement/eu_consultation_procedures/sec_2007_1483_2.pdf.

problematic because, due to the dynamic nature of communications markets, the boundary between areas where there are different competitive pressures may be unstable and change over time, rendering the market definition obsolete.

- A3.36 An alternative approach is to define geographic markets in a broader sense. This involves defining a single geographic market but recognising that this single market has local geographical characteristics. That is to say, recognising that within the single market there are geographic areas where competition is more developed than in other geographic areas. This avoids the difficulties of proliferation and instability in the definition.

Market power assessment

- A3.37 As we recognise above, market definition is not an end in itself. The definition of the scope of the relevant economic market is carried out in order to identify the product(s) and the geographic area over which a competition assessment can be made of CPs' ability to act to an appreciable extent independently of competitors, customers and consumers, i.e. whether there are any CPs that hold a position of SMP within a particular market.

Definition of SMP

- A3.38 Sections 45, 46 and 78 of the CA03 grant us the power under certain circumstances to set conditions which require CPs to do certain things. Specifically, sections 46(7) and 46(8) state that SMP services conditions may be imposed on a particular person who is either a CP or a person who makes associated facilities available, and who has been determined to have SMP in a services market (i.e. a specific market for electronic communications networks, electronic communications services or associated facilities).
- A3.39 Accordingly, having identified the relevant product and geographic market(s) and, where relevant having identified the market as susceptible to *ex ante* regulation, we go on to analyse each market in order to assess whether any person or persons have SMP as defined in section 78 of the CA03 (construed in accordance with Article 14 of the Framework Directive). Section 78 of the CA03 provides that SMP is defined as being equivalent to the competition law concept of dominance in accordance with Article 14(2) of the Framework Directive which provides:

"An undertaking shall be deemed to have significant market power if, either individually or jointly with others, it enjoys a position equivalent to dominance, that is to say a position of economic strength affording it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers".

- A3.40 Further, Article 14(3) of the Framework Directive states that:

"Where an undertaking has significant market power on a specific market, it may also be deemed to have significant market power on a closely related market, where the links between the two markets are such as to allow the market power held in one market to be leveraged into the other market, thereby strengthening the market power of the undertaking".

- A3.41 Therefore, in the relevant market, one or more undertakings may be designated as having SMP where that undertaking or undertakings enjoy a position of dominance.

Also, an undertaking may be designated as having SMP where it could lever its market power from a closely related market into the relevant market, thereby strengthening its market power in the relevant market.

- A3.42 In assessing whether an undertaking has SMP, we take due account of the EC SMP Guidelines as we are required to do under section 79 of the CA03.

The criteria for assessing SMP

- A3.43 The EC SMP Guidelines require NRAs to assess whether competition in a market is effective. This assessment is undertaken through a forward looking evaluation of the market (i.e. determining whether the market is prospectively competitive), taking into account foreseeable developments and a number of relevant criteria.³¹
- A3.44 Our assessments of SMP are concerned with the prospects for competition over the review period of three years. Ultimately, we want to understand how the markets are likely to develop, and whether competition is likely to be, or become, effective during this review period. Below we set out certain key factors that we are likely to consider when assessing SMP.³²
- A3.45 Where a market is found to be competitive then no SMP conditions can be imposed. Section 84(4) of the CA03 requires that any SMP condition in that market, applying to a person by reference to a market power determination made of the basis of an earlier analysis, must be revoked.

Market shares

- A3.46 In the EC SMP Guidelines, the EC discusses market shares as being an indicator of (although not sufficient alone to establish) market power:

“...Market shares are often used as a proxy for market power. Although a high market share alone is not sufficient to establish the possession of significant market power (dominance), it is unlikely that a firm without a significant share of the relevant market would be in a dominant position. Thus, undertakings with market shares of no more than 25% are not likely to enjoy a (single) dominant position on the market concerned. In the Commission's decision making practice, single dominance concerns normally arise in the case of undertakings with market shares of over 40%, although the Commission may in some cases have concerns about dominance even with lower market shares, as dominance may occur without the existence of a large market share. According to established case-law, very large market shares — in excess of 50% — are in

³¹ See, for example, paragraphs 19 and 20, and the opening words of paragraph 75, of the EC SMP Guidelines.

³² The factors listed in this annex are not intended to be exhaustive – other evidence may be relevant. Paragraph 78 of the EC SMP Guidelines lists the following criteria that could be used to assess market power: overall size of the undertaking; control of infrastructure not easily duplicated; technological advantages or superiority; absence of, or low, countervailing buying power; easy or privileged access to capital markets/financial resources; product/services diversification (e.g. bundled products or services); economies of scale; economies of scope; vertical integration; a highly developed distribution and sales network; absence of potential competition; and barriers to expansion.

*themselves, save in exceptional circumstances, evidence of the existence of a dominant position...*³³

A3.47 Market shares and market share trends provide an indication of how competitive a market has been in the past. If a firm has a persistently high market share, then that in itself gives rise to a presumption of SMP. However, changes in market share are also relevant to our assessment of prospects for competition. For example, a market share trend which shows a decline may suggest that competition will provide an effective constraint within the time period over which the SMP assessment is being conducted, although it does not preclude the finding of SMP.³⁴

Barriers to entry and expansion

A3.48 Entry barriers are important in the assessment of potential competition.³⁵ The lower entry barriers are, the more likely it is that potential competition will prevent undertakings already within a market from profitably sustaining prices above competitive levels. Moreover, the competitive constraint imposed by potential entrants is not simply about introducing a new product to the market. To be an effective competitive constraint, a new entrant must be able to attain a large enough scale to have a competitive impact on undertakings already in the market. This may entail entry on a small scale, followed by growth. Accordingly, whether there are barriers to expansion is also relevant to an SMP assessment. Many of the factors that may make entry harder might also make it harder for undertakings that have recently entered the market to expand their market shares and hence their competitive impact.

A3.49 A related factor is the growth in demand in the market. In general, CPs are more willing to invest in a growing market (and less willing in a declining market). As a result, barriers to entry and expansion tend to be less of an impediment to competition in rapidly growing markets.

Countervailing buyer power

A3.50 A concentrated market need not lead to harmful outcomes if buyers have sufficient countervailing buyer power to curtail the exercise of market power. In general, purchasers may have a degree of buyer power where they purchase large volumes and can make a credible threat to switch supplier or to meet their requirements through self-supply to a significant degree. It is important to note, however, that the volumes involved must be large enough to make a material difference to the profitability of the current supplier. That is, an individual wholesale customer must represent a significant proportion of the total volume supplied by the relevant CP.

³³ Paragraph 75, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

³⁴ See, for example, paragraph 75, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

³⁵ Paragraph 80, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

Excessive pricing and profitability

- A3.51 In a competitive market, individual firms should not be able to persistently raise prices above costs and sustain excess profits. As costs fall, prices should be expected to fall too if competition is effective.
- A3.52 The ability, therefore, to price at a level that keeps profits persistently and significantly above the competitive level is an important indicator of market power. The EC SMP Guidelines refer to the importance, when assessing market power on an *ex-ante* basis, of considering the power of undertakings to raise prices without incurring a significant loss of sales or revenue (factors that may explain excess profits in the short term, such as greater innovation and efficiency, or unexpected changes in demand, should however be considered in interpreting high profit figures).³⁶
- A3.53 The reverse is not true: consistently low profits, i.e. profits at or below the cost of capital, cannot be taken as evidence of an absence of market power. It may simply be evidence of inefficiency. For example, if a firm with SMP were to have inefficiently high costs, it may charge a price above the level we would expect to see in a competitive market but this would not result in high profits. In addition, price regulation exists in many of the wholesale markets considered, and therefore low profits may simply be the result of regulation rather than a reflection of the underlying competitive conditions.

³⁶ Paragraph 73, *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services* (2002/C 165/03), 11 July 2002, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF.

Annex 4

TRC/SFI ordering steps and processes

Step 1: Remote diagnostics – customer reports problem.

A4.1 The customer reports a problem. They may explain whether it is data or voice related, and also the nature of the service problem (e.g. an intermittent dial tone).

Step 2: Remote diagnostics – Openreach and CP line tests.

A4.2 CPs currently use a combination of their own system line tests with Openreach's line test to identify whether there is a fault or not and to assist customer service agents identify where they need to concentrate diagnostics with the customer (see next step below). We summarise these below:

- Openreach line test: The main purpose of the line test is to determine whether there may be a fault on the line, but it will also give a broad indication of where a fault may be located. It may specify that a fault is “near or within a customer’s premise” (in which case an engineer may be required (and thus a TRC may be incurred) – see below).³⁷ If the line tests as ‘ok’³⁸, then a SFI or TRC may ultimately be ordered for further investigation of the customer’s issues.
- CP line tests: TalkTalk operates its own system test to identify the potential type of problem and location of a suspected fault.³⁹ The system test will show a fail and identify a hard line fault and specify that the problem is potentially ‘external to the customer home’ (though this may still be found to be a fault within the end-user premise). Alternatively, the system test will show a fail, but identify an ‘indeterminate or no line fault’ which specifies that it is a potential “in-home problem”. Finally, the system test may show a line test pass which specifies that it is a potential “in-home” problem. While TalkTalk’s line test can provide more granular sub-descriptions of the potential issue than those described above, in most instances the testing does not provide the capability of ascertaining with accuracy whether the fault is on or off the Openreach network. TalkTalk largely relies on its own test to determine whether it uses Openreach or third party engineers.

Step 3: Remote diagnostics – In-home checks.

A4.3 The purpose of this step is for CPs to check with the customer that their home connections are correctly set-up. For example, to ensure that broadband equipment (e.g. router) is connected to the telephone socket and the customer’s wireless connectivity with the router is connected. CPs may use Openreach’s best practice diagnostic guidelines, although the guidelines do not assist in identifying with accuracy whether the problem is on- or off-net. The CP may carry out multiple

³⁷ If the line tests as ‘not ok’ it may also indicate whether the fault in question is caused by Openreach on its network, in which case this is resolved under the Openreach service level agreement (i.e. not resulting in a TRC or SFI2) and the fault process ends.

³⁸ In this scenario, the result of the line test will be a pass (‘LTOK’) and the test indicates the line is working okay to SIN 349 standard at the NTE.

³⁹ Sky currently does not operate such a line test. However, it does have its own line test to determine whether the broadband service is ‘stable’ and what speed is being provided to the end-user.

checks by escalating to a support team with more advanced technical skills.⁴⁰ This stage is optional as customers may by-pass it at their request if they do not want to go through the diagnostic checks.

Step 4: Validation. CPs will decide whether to book and despatch an engineer.

- A4.4 Where a fault is identified at the in-home set up point and resolved by the support team and customer, then the fault is resolved and the fault process ends.
- A4.5 Where the in-home checks have not resolved the issue, customers may consent to an engineering visit. Where the TalkTalk line test results identify a hard line fault external to the customers home it will use an Openreach engineer to carry out a TRC or SFI. If the test results have beyond doubt identified an off-net problem it will use a third party engineer to try and resolve the issue. Sky, on the other hand, will always use Openreach engineers to carry out work if the BT line test indicates a fault near to or at the customer premise (and therefore incur TRCs), or to carry out an SFI where the BT line tests as ok but problems persist.

Step 5: Engineer visit.

- A4.6 At this point the engineer will visit the home to undertake the work. It is worth noting that for SFIs the initial home visit is compulsory in order to undertake an initial assessment of the cause of the broadband problems (the Base Module), but this investigative work may later result in the use of other optional modules depending on the nature of the problem.

⁴⁰ For example, Sky passes potential faults from a 'Tier 1' to 'Tier 2' agent before deciding whether to order an SFI.

Annex 5

TRCs and SFIs cost accounting template

A5.1 Please see the separate Excel file published alongside this Statement entitled *TRCs and SFIs cost accounting template*. This is available here:

<http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/annex5.xlsx>

Annex 6

Copper and duct valuation (Regulatory Asset Value)

Summary of our decisions

A6.1 In this annex we set out the basis of the valuation for BT’s access copper and duct assets that we have adopted for the purposes of setting the LLU and WLR charge controls. A summary of the position is set out in Table A6.1 below.

Table A6.1 Basis of access assets valuation

	Basis of valuation for pre-1997 assets (from 2004/05 onwards)	Basis of valuation for post-1997 assets (from 2004/05 onwards)
Access Duct	HCA indexed by RPI	CCA, based on capital expenditure indexed by RPI
Access Copper	HCA indexed by RPI	CCA, based on absolute valuation

Source: Ofcom

The RAV adjustment for pre-1997 copper and duct assets

- A6.2 The Regulatory Asset Value (RAV) adjustment was first established by Ofcom in the 2005 Cost of Copper Review which specified that pre-1997 access duct and copper investment should be valued on an Historic Cost Accounting (HCA) basis indexed by Retail Price Index (RPI) from 2005.⁴¹ Post-1997 access assets were to be valued on a Current Cost Accounting (CCA) basis.
- A6.3 In 2005, Ofcom set the value of the RAV for the pre-1997 assets equal to their closing HCA value for the 2004/5 financial year.⁴² This was less than the CCA value by an amount known as the RAV adjustment. The RAV has been increased in each year since 2005 by the increase in the RPI.
- A6.4 The RAV adjustment has been applied for each LLU and WLR charge control since 2005 as well as in other BT charge controls covering assets which make significant use of copper and/or duct.

⁴¹ Ofcom, *Valuing Copper Access – Final statement*, 18 August 2005, <http://stakeholders.ofcom.org.uk/binaries/consultations/copper/statement/statement.pdf> (2005 Cost of Copper Review).

⁴² The value of the RAV for the pre-1 August 1997 assets was set to equal their closing depreciated historical cost accounting value (that is, their closing net book value, or NBV) for the 2004/5 financial year.

Comparison between the RAV and CCA approaches

- A6.5 In the July 2013 LLU WLR Consultation, we compared the RAV adjustment and CCA approaches to access copper and duct valuation. We set out in detail our reasoning on the following points:
- whether using the full CCA valuation would lead to charges that are more economically efficient;
 - whether returning to full CCA valuation would lead to a windfall gain (i.e. over-recovery of costs);
 - the implications of the RAV adjustment for incentives to invest in the provision of NGA services; and
 - why we considered making the RAV adjustment to be consistent with our statutory duties.
- A6.6 Responses are summarised and discussed in Section 3, Volume 2. Most respondents who commented on the RAV adjustment agreed with our proposal. We note that BT no longer contests the RAV adjustment.
- A6.7 We set out our conclusions on the RAV adjustment below.

Economically efficient charges

- A6.8 BT's duct network is, in economic terms, a "sunk asset"; that is, one that will not require replacement in order for BT to remain in the market. As it is a sunk asset, we consider that setting charges on the basis of CCA asset values would not achieve allocative efficiency. This is because, for allocative efficiency, charges should reflect only forward-looking costs and, as duct does not need replacement, the cost of replacing it is not part of forward-looking costs.
- A6.9 Because duct is a sunk asset, the true forward-looking costs of BT's duct network are likely to be very low. The forward-looking incremental costs of creating a new duct network will therefore almost certainly be higher than the forward-looking incremental costs of using BT's existing network. In addition, BT's economies of scale and scope are such that, even if duct were valued on a full CCA basis, it would still be difficult for a new competing fixed network operator to achieve lower unit costs. In practice therefore, we consider that making the RAV adjustment is unlikely to postpone efficient competitive entry.
- A6.10 We also note that, in its determination of BT's appeal of the 2012 LLU and WLR charge controls, the CC agreed with Ofcom that:
- duct costs are largely sunk and that this means that "increasing the price would reduce allocative and productive efficiency, as Ofcom said"⁴³;

⁴³ Paragraph 8.235, Competition Commission, *References under section 193 of the Communications Act 2003: British Telecommunications Plc v Office of Communications, Case1193/3/3/12; British Sky Broadcasting Limited and TalkTalk Telecom Group Plc v Office of Communications, Case1192/3/3/12 – Determinations*, 27 March 2013, http://catribunal.org/files/1192-93_BSkyB_CC_Determination_270313.pdf (March 2013 CC Determination).

- Ofcom was correct to place some weight on the benefits for regulatory stability of keeping the RAV adjustment⁴⁴;
- although the RAV adjustment could deter some investment, “this should only be a concern if *efficient* investment would be deterred” (emphasis in original).⁴⁵

A6.11 We therefore consider that reverting to a full CCA valuation for the pre-1997 local access assets would mean that charges would be raised further above forward-looking costs, thereby reducing allocative and productive efficiency.

A6.12 We also consider that removing the RAV adjustment could harm dynamic efficiency and reduce future investment in the sector as a whole, not just in LLU, if it signalled that regulation might not be stable. In its determination of the appeal, the CC said “*this seems to us an important point*”.⁴⁶ Making the RAV adjustment in the current review is consistent with maintaining the stability of regulation and will enhance dynamic efficiency.⁴⁷

A6.13 We therefore consider that, on efficiency grounds, the RAV adjustment remains justified.

Over-recovery of costs

A6.14 In Annex 5 of the July 2013 LLU WLR Consultation, we used the diagram reproduced below as Figure A6.1 to explain why, in the absence of the RAV adjustment, BT would over-recover the costs of pre-1 August 1997 duct.⁴⁸

A6.15 Figure A6.1 shows two alternative price paths, one based on CCA and one on HCA. Both allow recovery of the initial cost of the asset over its lifetime, including the required return on capital. In the case of assets with rising values, such as duct, CCA costs are initially below HCA costs because CCA depreciation is reduced by the amount of the holding gain (the increase in the value of the asset) in each year. In later years, CCA costs are higher than HCA costs, reflecting the higher CCA valuation of the assets. This means that, as the diagram shows, a change from HCA to CCA during the lifetime of the asset, as happened in 1997, would result in windfall gains for BT.

⁴⁴ Paragraph 8.236, March 2013 CC Determination.

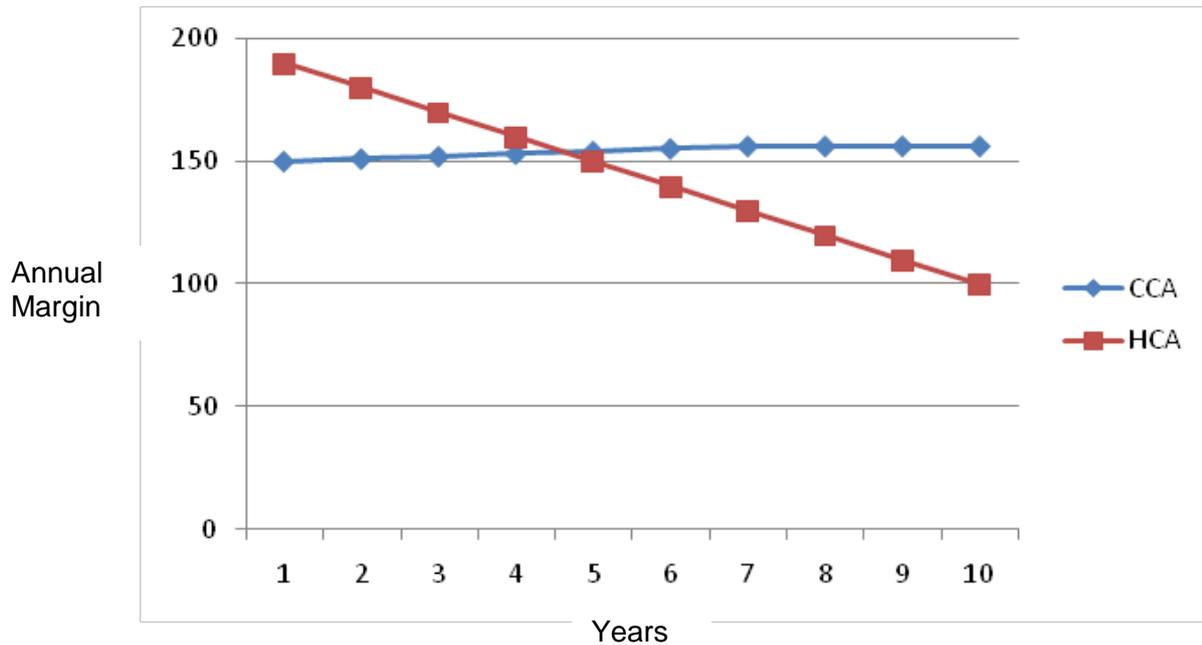
⁴⁵ Paragraphs 8.240 – 8.242, March 2013 CC Determination.

⁴⁶ Paragraph 7.128(d), March 2013 CC Determination.

⁴⁷ The CC’s decision is itself likely to have influenced CPs’ expectations of Ofcom’s approach to the charge control in this review.

⁴⁸ This diagram appeared as Figure A5.1 in Annex 5 of the July 2013 LLU WLR Consultation.

Figure A6.1: Gross margins required for a constant cost of capital over the lifetime of a single asset experiencing appreciation in value



Source: Ofcom⁴⁹

A6.16 The model shows that a *one-off* move from HCA to CCA would result in a windfall gain if:

- a) the asset was initially valued at its purchase cost; and
- b) the price increased monotonically in nominal terms.⁵⁰

A6.17 This latter condition is very likely to be met by duct.⁵¹ On this basis, we can conclude that moving from HCA to CCA for pre-1997 duct would lead to BT over-recovering its investment.

A6.18 We can also conclude that a move from HCA to CCA and back again will result in over-recovery if the first shift occurs after the ‘crossing point’ (as seen in Figure A6.1). Ofcom’s analysis in its 1996 review showed that its move to CCA in 1997 had the effect of increasing prices, from which it followed that it occurred to the right of the crossing-point. This meant that there was no risk of the RAV adjustment resulting in under-recovery for BT.

A6.19 In the light of this, we consider that the RAV adjustment is necessary in order to avoid over-recovery of the costs of pre-1997 local access assets in the charge control to apply from 1 April 2014.

⁴⁹ This figure also appears as Figure 2 in: Ofcom, *Valuing Copper Access – Final statement*, 18 August 2005, <http://stakeholders.ofcom.org.uk/binaries/consultations/copper/statement/statement.pdf>

⁵⁰ Paragraphs A6.16 – A6.18 of this annex are based on paragraphs 8.69 – 8.71 of the March 2013 CC Determination, which summarise evidence submitted by Ofcom in its Defence.

⁵¹ The appropriate initial value of BT’s ducts was a matter of contention in the appeal. The CC “*found an HCA valuation to be the most appropriate approach*”, paragraph 8.177, March 2013 CC Determination.

A6.20 We note more generally that on appeal, the CC found that this “theoretical model” was sufficient to demonstrate that over-recovery would occur in the absence of the RAV adjustment. The CC said:

“it was our view that Ofcom could rely on its theoretical model in making its assessment...We therefore disagreed with BT’s argument that under-recovery was still plausible.”⁵²

The RAV adjustment and incentives to invest in the provision of NGA services

A6.21 We consider that the RAV adjustment is consistent with Ofcom’s objective of encouraging efficient investment in NGA that will be to the benefit of consumers.

A6.22 In particular, we do not consider that we could encourage operators to invest in, and customers to take up, NGA services by reverting to full CCA valuation for all access copper and duct (i.e. not making the RAV adjustment). We note that this view is consistent with the results of work by Charles River Associates (CRA) which concludes that the direction of the effect of changes in the copper access price on investment in NGA is ambiguous.⁵³

A6.23 We consider that the competitive interaction between BT and the other actual and potential investors in fibre networks is likely to be more important for investment in NGA than the copper access price. We also observe that, in practice, Virgin has made substantial investments in upgrading its existing network to provide NGA services, notwithstanding the fact that BT’s wholesale access prices have reflected the RAV adjustment – including for years prior to Virgin’s initial investment in fibre.⁵⁴

Consistency with our statutory duties

A6.24 We consider that applying the RAV adjustment in the way described above is consistent with our statutory duties, including our principal duty to further the interests of citizens in relation to communications matters, and to further the interests of consumers in relevant markets, where appropriate by promoting competition.

A6.25 Further, we consider that our approach also meets the requirements in Section 88 of the Act that:

⁵² Paragraph 8.177, March 2013 CC Determination. Note that Figure 8.1 in the March 2013 CC Determination, which illustrates the “theoretical model”, is identical to Figure A6.1 in this annex.

⁵³ See for example, page 62 of Charles River Associates for DG Information Society and Media, “*Costing methodologies and incentives to invest in fibre*”, July 2012, http://www.crai.com/ecp/assets/20120705_finalreport_costing_cra.pdf. CRA were commissioned by the EC to advise it on setting access prices to encourage investment in fibre networks. Earlier work by WIK had concluded that fibre investment could be stimulated by *reducing* the copper access price. The CRA report refers extensively to the WIK report.

⁵⁴ For example, Virgin’s 2008 Annual Report indicates the commitment it made to investment in next generation access in that year: “*During 2008, we further invested in our cable network with the deployment of the next generation of wideband cable broadband technology...Our investment in the next generation broadband access technologies is the latest in a series of significant infrastructure investments to support our position at the forefront of communication and entertainment services in the U.K. In 2009, we expect to complete the roll-out of wideband cable broadband technology, allowing 50Mb service to be made available to over 96% of our network.*” (page 15, Virgin, *Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. For the fiscal year ended December 31, 2008*, 29 April 2009, at <http://investors.virginmedia.com/phoenix.zhtml?c=135485&p=irol-reportsannual>)

- the setting of a charge control condition should be appropriate for the purposes of promoting efficiency, promoting sustainable competition and conferring the greatest possible benefits on the end-users of public electronic communications services; and
- in setting such a condition, Ofcom must take account of the extent of the investment in the matters to which the condition relates of the person to whom it is to apply.

A6.26 We consider that the RAV adjustment is consistent with promoting efficiency and sustainable competition, and more so than setting charges for the use of pre-1997 assets on the basis of full CCA, for the reasons set out. In particular, the RAV adjustment means that charges depart from the statically efficient level only to the extent required to allow cost recovery in the interests of dynamic efficiency. It is also consistent with regulatory stability and hence with the promotion of dynamic efficiency. By allowing BT to recover its costs, including the cost of capital, the RAV adjustment means that charges take account of the extent of BT's investment in the relevant assets, as required by the Act.

A6.27 By contrast, setting charges on the basis of full CCA costs would allow BT to recover more than its efficiently incurred costs. It could encourage inefficient investment, in that an incentive for competing investment would exist even though the forward-looking costs of such investment were above BT's forward-looking costs by more than is necessary for recovery of sunk costs. Other, efficient, investment could be deterred by the signal that regulation would not be stable over time.

Valuing BT's post-1997 access assets

Valuing post-1997 assets on a CCA basis

A6.28 We decided in the 2005 Cost of Copper Review that post-1997 assets would be valued using CCA. This approach has been confirmed in subsequent reviews. We have again concluded that post-1997 assets will be valued on a CCA basis.

A6.29 There are two reasons for this. First, as the post-1997 assets have been valued consistently on a CCA basis throughout their lives, there is no concern about windfall gains from continuing to do so. Second, we consider that this approach will encourage infrastructure investment in the longer term as the proportion of the total value of duct represented by pre-1997 assets (valued at indexed HCA) declines.⁵⁵

A6.30 We also consider that unanticipated changes to the basis of valuation would be undesirable as they would create investor uncertainty. Continuing to set the value of post-1997 assets at CCA is consistent with maintaining regulatory stability and hence again will encourage infrastructure investment in the longer term, while avoiding over-recovery of costs.

2011/12 basis of valuation

A6.31 In the July 2013 LLU WLR Consultation we used information from the 2011/12 financial year as the starting point for the charge control modelling as this was the latest year for which such data was available. Since then BT has published the

⁵⁵ Paragraph 3.3 Ofcom, *Valuing Copper Access – Final statement*, 18 August 2005, <http://stakeholders.ofcom.org.uk/binaries/consultations/copper/statement/statement.pdf>

2012/13 RFS. For the reasons explained in Annex 22, we have not used the 2012/13 data as the base year in our modelling and have continued to use the financial year 2011/12. As explained below, we have considered whether it would be appropriate to move away from this general approach for the purpose of determining the appropriate RAV to be used in the price control calculations, but concluded that it would not be and have instead decided to continue with the approach set out in the July 2013 LLU WLR Consultation.

Duct: Determining a valuation of post-1997 duct assets

Proposals in the July 2013 LLU WLR Consultation

- A6.32 In Annex 5 of the July 2013 LLU WLR Consultation, we set out our proposal to determine the CCA value of post-1997 access duct assets on the basis of capital expenditure, plus indexation using RPI.
- A6.33 This proposal was consistent with our decision to value post-1997 access duct assets on the basis of capital expenditure indexed by RPI in the March 2012 Statement. The choice of RPI as an appropriate index was subject to an appeal following the March 2012 Statement. The CC concluded that we did not err in using RPI to value post-1997 duct assets.⁵⁶
- A6.34 In the March 2012 Statement we noted that our starting point for determining the appropriate valuation of BT's network assets has typically been BT's estimate of the cost of replacing the entire network, as reflected in the RFS (referred to as the 'absolute valuation'). BT's absolute duct valuation has fluctuated significantly over recent years despite no major change to the underlying duct asset. In the March 2012 Statement⁵⁷, as the absolute valuation method used by BT did not appear to change in line with the expected movements in the underlying asset values, we explained that it did not seem to be an appropriate basis for setting charge controls. We therefore considered alternative approaches to valuing duct assets.
- A6.35 We considered approaches derived from indexation of actual expenditure and looked at alternative indices. In the March 2012 Statement we concluded that RPI was an appropriate index to use to index post-1997 access duct. In particular, RPI indexation provided a value similar to that using the GBCI⁵⁸ index less a national discount. Moreover, RPI had the advantage of being a well recognised and used index and using it meant that it was not necessary to estimate the national discount, which was difficult to do with any degree of accuracy.
- A6.36 In the July 2013 LLU WLR Consultation we noted that in its 2011/12 RFS, BT continued to derive its estimate of the CCA valuation of the duct assets on the basis of an absolute valuation. We considered that the valuation was subject to unusual fluctuations unrelated to the underlying value of duct assets that were previously identified. We therefore remained of the view that BT's absolute valuation was not an appropriate basis for deriving the post-1997 duct asset valuation.

⁵⁶ Paragraph 12.78, March 2013 CC Determination.

⁵⁷ Paragraph 3.74, Ofcom, *Charge control review for LLU and WLR services – Statement*, 7 March 2012: <http://stakeholders.ofcom.org.uk/consultations/wlr-cc-2011/statement-march2012/> (March 2012 Statement).

⁵⁸ General Building Cost Index.

- A6.37 Having concluded that indexation provided an appropriate basis for estimating the value of duct, we proposed that RPI continues to provide an appropriate index to use as the basis for deriving an opening duct valuation for use in the charge control.
- A6.38 We noted that while there are other available general price indices, such as CPI and RPIJ, RPI provides the advantage of being consistent with our previous regulatory decisions.
- A6.39 We considered that for the purpose of forecasting changes in the replacement cost of duct over the duration of the charge control, there were advantages in using a similar basis to the one chosen to set the opening value. Therefore, as we determined that RPI was an appropriate index for deriving the opening access duct valuation, we considered that RPI should also be used to forecast the valuation in future years, in order to provide a predictable and consistent basis for forecasting changes during the charge control period.

Stakeholder responses

- A6.40 We received six responses from stakeholders on this issue. All responding CPs and BT supported our proposal to value post-1997 access duct on the basis of historical expenditure indexed by RPI.
- A6.41 Verizon commented that it is advantageous that RPI is a well recognised index used by other regulators and said that the use of RPI would alleviate concerns over fluctuating duct valuations.⁵⁹
- A6.42 Frontier Economics submitted a report on behalf of Sky and TalkTalk which stated, among other things, that “*economic efficiency benefits of accurately estimating the replacement costs of the access network are likely to be relatively small. As such, financial and regulatory consistency considerations can be given a relatively high weight. This would indicate the continued use of RPI for revaluation purposes is appropriate, even though RPI is no longer considered to be an accurate measure of general inflation.*”⁶⁰
- A6.43 BT agreed with our proposal. BT also noted in its response that the CCA valuation of duct and copper assets in BT’s RFS has recently been reviewed by BT and has been changed from an absolute basis to an indexed RPI approach for the 2012/13 RFS. BT considered this a more appropriate methodology in light of the complexity, size and nature of its access network as well as the uncertainty and volatility introduced by varying commodity prices.⁶¹

Our analysis

- A6.44 We have concluded that indexing capital expenditure by RPI remains an appropriate method for valuing BT’s post-1997 access duct for the purpose of setting LLU WLR charge controls.
- A6.45 As noted above, our starting point for determining the appropriate valuation of BT’s network assets has previously been BT’s estimate of the cost of replacing the entire

⁵⁹ Paragraph 12, page 2, Verizon Response to the July 2013 LLU WLR Consultation.

⁶⁰ Paragraph 4.61, Frontier Economics, *Ofcom’s LLU and WLR Charge Controls Proposals. A report prepared for Sky and TalkTalk*, October 2013:

http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Frontier_Economics_report.pdf.

⁶¹ Paragraph 185, Openreach Response to the July 2013 LLU WLR Consultation.

network, as reflected in its RFS. Consistent with the difficulties faced by BT in establishing a reliable and transparent absolute valuation, we do not consider that it would be practicable or proportionate for us to establish an alternative absolute valuation of our own. Therefore, we have considered the alternatives and, consistent with the approach used in the March 2012 Statement, we consider that valuing BT's post-1997 duct on the basis of capital expenditure indexed by RPI is appropriate for the following reasons:

- 6.45.1 using a general price index reduces volatility in the valuation while setting appropriate incentives;
 - 6.45.2 RPI is a well recognised index that is used by other regulators for determining regulatory asset values;
 - 6.45.3 the use of RPI will enable a more transparent calculation without the need to estimate a national discount;
 - 6.45.4 it sets an opening value that is similar to the valuation indicated by BT's absolute valuation; and
 - 6.45.5 it gives a valuation consistent with our recent decisions.
- A6.46 Since the July 2013 LLU WLR Consultation, we note that BT has changed its approach to valuing access duct for the purpose of its regulatory reporting.
- A6.47 BT has moved from an absolute valuation to a methodology based on indexing capital expenditure by RPI. This change in approach brings BT's approach in its RFS into line with our duct valuation policy as proposed in the July 2013 LLU WLR Consultation. As well as changing the basis of valuation, BT has also changed the data it uses for some of the historic capital expenditure and write outs in the 2012/13 RAV model to align to the fixed asset register.
- A6.48 The fixed asset register was available as a data source before 2012/13 and indeed some of the RAV model incorporates fixed register data already. To the extent that BT's decision to change its data source during 2012/13 results in a change in its estimated valuation that does not reflect a change in the underlying value of the asset during this period, we would be cautious about moving to BT's new data source without a clear understanding of the reasons for and effect of the change and clear evidence that it provided a better assessment of the underlying value of the asset.
- A6.49 Since duct is to be valued on the basis of indexed capital expenditure, the 2011/12 valuation, as set out in the July 2013 LLU WLR Consultation, should provide a reasonable basis for forecasting an indexed-based valuation for 2012/13 and beyond. We have compared our "forecast" valuation for 2012/13 with BT's new duct valuation in 2012/13 and note that Mean Capital Employed in 2012/13 is very similar on the basis of both valuations after excluding the effect of the difference in the capital expenditure forecast.
- A6.50 Therefore, given that the 2012/13 data only reflects a change in estimated asset values that reflect only changes in methodology or data sources, we have decided to continue to use the 2011/12 valuation as the basis for our forecast, calculated on the same basis and using the same data source as we did in the July 2013 LLU WLR Consultation (updated to include indexation and capital expenditure forecasts for 2012/13).

A6.51 We note that the decision to use the 2011/12 data for the base year in our model is consistent with the data used for most other costs in our cost modelling.

Conclusion

A6.52 We have continued to value post-1997 duct assets on the basis of capital expenditure indexed by RPI and used 2011/12 as the base year.

Copper – Determining a valuation of post-1997 copper assets

Proposals in the July 2013 LLU WLR Consultation

A6.53 For the purpose of our base year asset values, we proposed in the July 2013 LLU WLR Consultation to continue to use CCA to value post-1997 access copper assets consistent with the 2005 Cost of Copper Review and our approach in previous charge controls. Consistent with that we proposed to use BT's absolute valuation in 2011/12 as the opening value for post-1997 copper assets.

A6.54 For the purposes of *forecasting changes* in asset values, we proposed to index copper by RPI because it is difficult to forecast movements in copper prices going forward. This is the approach we have adopted in other charge controls including the previous LLU WLR charge controls and the recent leased lines charge control.⁶²

A6.55 We noted that, similarly to duct, BT had signalled its intention to move from an absolute valuation methodology to a methodology based on RPI indexation in its 2012/13 RFS. We noted that this change might affect our proposal for estimating the opening value for post-1997 copper assets using the absolute valuation in the 2011/12 RFS. We said that we would consider if and how to take this information into account once it was available.

Stakeholder responses

A6.56 The Responses to the July 2013 LLU WLR Consultation did not include any objections to valuing copper on the basis of an absolute valuation for the base year, subsequently indexed by RPI.

A6.57 In its response, BT highlighted that the methodology for valuing copper in the 2012/13 RFS has changed from an absolute valuation basis to an indexed RPI approach. BT therefore agreed (even though this is not what we proposed in the consultation) that copper should be valued on a CCA basis based on capital expenditure indexed by RPI. BT said that this was a more appropriate methodology given 'the complexity, size and nature of its network as well as the uncertainty and volatility introduced by varying commodity prices, in particular copper'⁶³. BT did not make any further arguments to support the change of valuation methodology at the time.

A6.58 Subsequently, in an email dated 6 April 2014,⁶⁴ BT argued that "*there are convincing reasons connected with how Ofcom made the RAV adjustment that*

⁶² Ofcom, *Business connectivity market review. Review of retail leased lines, wholesale symmetric broadband origination and wholesale trunk segments - Statement*, 28 March 2013, <http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/>

⁶³ Paragraphs 184-185, Openreach Response to the July 2013 LLU WLR Consultation.

⁶⁴ Email from <, Director of Regulatory Finance, BT, to David Brown, Director of Competition Finance, Ofcom dated 6 April 2014, entitled: "RAV as discussed".

makes the use of the 2012/13 RAV model more appropriate [than the 2011/12 model] for use in the WLR LLU Charge control". In the email, BT explained that "The main difference between the valuation methods for 2012/13 and 2011/12 is that the 2012/13 modelling used a new basis of estimating the current cost valuation of copper based on capital expenditure indexation.

A6.59 BT further stated that, "The benefits of using the 2012/13 modelling for Ofcom and all stakeholders are...":

6.59.1 "Understanding and transparency - it is far easier to understand the indexation approach than the complex absolute valuation approach that requires far more information to produce...";

6.59.2 "Ease of forecasting - it allows a straightforward approach to forecasting, only requiring assumptions on future RPI, capital expenditure and depreciation profile";

6.59.3 "Volatility - capital expenditure indexation removes the unpredictable volatility inherent in the CCA valuation as reported in the RFS and used in the base year for charge control modelling. This volatility can occur due to changes in prices (copper) or underlying assumptions in the valuation (change of line and exchange data). The indexation valuation will only change with changes in the underlying historic assets and movement in the RPI index..";

6.59.4 "Objectivity -the indexation approach to RAV means there is no subjective judgements to value assets (other than the above mentioned assumptions on RPI and capital expenditure)..."; and

6.59.5 "Consistency - the new CCA valuation approach is more consistent...With Ofcom's RAV adjustment for Duct... Between Ofcom's RAV methodology for valuing copper and duct...[and] ...With Ofcom's WLR LLU Charge control modelling".

A6.60 BT also noted that "*if Ofcom uses the 2011-2012 CCA valuation as contained in the 2011-12 RAV model, Ofcom will be relying on cost data that uses a data source (PiPeR) on which both BT and the auditors have publically expressed concerns*".

Our analysis

A6.61 For the reasons set out below, we have decided to value access copper based on BT's 2011/12 absolute valuation and to use RPI to forecast future costs in line with the proposals that we consulted on.

A6.62 We note that our starting point for valuing post-1997 access copper has historically been an absolute valuation and this was also the approach we took in the July 2013 LLU WLR Consultation. In taking this approach, we took account of the research done by Analysis Mason in the context of the March 2012 Statement which concluded that if a CCA approach remained appropriate, an absolute valuation was desirable. Analysis Mason also noted that in the absence of a robust absolute valuation, indexation is an acceptable second best method.⁶⁵

⁶⁵ Paragraph A1.132, March 2012 Statement.

- A6.63 We note that BT has argued that we should depart from the absolute valuation approach set out in the July 2013 LLU WLR Consultation and instead adopt an approach based on capital expenditure indexed by RPI. Further, we also note that the most recent version of the RAV model values access copper on this basis. We have therefore considered whether we should set the charge controls using a capital expenditure approach.
- A6.64 In summary, we do not consider that the benefits of a capital expenditure approach are sufficient to justify us departing from an absolute valuation methodology in the context of these charge controls.
- A6.65 We consider that there are some benefits of using an indexation basis in circumstances where there is no reliable absolute valuation, such as in the case of the duct valuation where the absolute valuation method used by BT did not appear to change in line with the expected movements in the underlying asset values and included a number of assumptions that were difficult to verify, such as an estimate of a national discount. However, in the case of copper for the purposes of this charge control we did not consider that a move away from BT's absolute valuation is justified. Unlike the methodology previously used to estimate the absolute value of duct, BT's methodology for calculating an absolute valuation for copper includes fewer assumptions and is therefore easier to understand and more transparent. Absolute valuation of copper can also be in part calculated by reference to an exogenous element – i.e. the copper price – which is easy to verify by reference to external sources and BT has no control over it.
- A6.66 We do not consider that any of the arguments put to us by BT demonstrate that we should set the charge controls using an indexed capital expenditure approach. In particular:
- 6.66.1 While the indexation approach is easier to understand than the absolute valuation approach, we do not consider that this provides a reason to move away from the absolute valuation methodology, as described in the July 2013 LLU WLR Consultation, particularly as the absolute valuation approach was not challenged by stakeholders on grounds of clarity.
- 6.66.2 Indexation does allow a straightforward approach to forecasting. However, while this supports the use of indexation as a basis for forecasting future changes in the value (as we have done) it does not provide a reason to use indexation as the basis for estimating historical values (as we are trying to do here) other than the benefits of a consistency, which we consider below.
- 6.66.3 A methodology based on indexation reduces the volatility inherent in the CCA valuation as reported in the RFS and an indexation approach to RAV involves fewer subjective judgements to value assets. However, while these are benefits in the longer term, the immediate effect of a move to an indexation approach would be to create (rather than reduce) volatility, as the change in approach causes a significant increase in the asset value. Further, while the on-going use of indexation could increase objectivity by reducing the number of subjective judgements that BT has to make, we consider that the decision to *change* methodology to an indexation based approach and the decision as to *when* that change is made are both subjective (and we note that the effect of BT's decision has been to increase the value during a charge control review). We do not consider that a desire to reduce volatility and increase objectivity in the longer term

necessarily supports a change in valuation methodology from the methodology in place at the start of the Consultation.

- 6.66.4 While consistency between our approach here and our RAV methodology for valuing duct is desirable, we do not consider that it should mean that approaches should be the same if there are reasons for them to be different. For each of the examples identified by BT, we consider that there are good reasons for the difference in approach.
- 6.66.5 We do not consider that a valuation of post 97 copper assets should necessarily be consistent with a valuation of pre 97 assets as BT suggests. The pre 97 assets are valued on a fundamentally different basis – i.e. reflect the RAV adjustment. The purpose of the RAV adjustment is to prevent over recovery on these assets and it is therefore based on HCA. As explained above, we consider that it is appropriate to value post 97 copper assets using CCA and therefore the most appropriate starting point for the valuation is an absolute valuation, unless we have significant concerns over how robust the valuation is.
- 6.66.6 We also do not consider that copper and duct should necessarily be valued on the same basis. These are different assets with different trends in changes of the underlying value of the assets. For example, as mentioned above, the copper value is partly dependent on the price of copper, whereas the value of duct is not. We consider that each asset (including copper and duct) should be valued on the basis that is most appropriate to the specific asset, rather than to achieve consistency at the expense of an accurate valuation.
- 6.66.7 We agree with BT's point that it is advantageous to forecast changes in copper value in the same way for the charge control modelling and for copper valuation. However, as we said above, while this is an advantage for forecasting the changes in the valuation, it does not provide a reason to use indexation as the basis for estimating historical values.
- A6.67 We therefore do not consider that, as a basis for determining the appropriate valuation of the copper network at a particular time (rather than as a basis for forecasting changes in valuations in the future), an indexed capital expenditure basis is necessarily better than an absolute valuation. We also consider that we should be cautious about adopting an increased valuation that reflects a change in BT's choice of valuation methodology during the year rather than a change in the underlying value of the asset (which due to falling copper prices might have been expected to reduce) and potentially delivers a windfall gain to BT. We note that the effect of BT's decision to change its methodology is significant; the 2012/13 CCA valuation on BT's new basis is c.£170m higher than the 2011/12 valuation on BT's previous basis even though copper prices fell in the year.⁶⁶
- A6.68 The most recent data we have as to the absolute valuation is from the 2011/12 RFS and we have decided to use this for the purposes of modelling the charge control.
- A6.69 In reaching this decision, we reject BT's argument about the reliability of the cost data used to derive its 2011/12 valuation, due to the concerns that both BT and the auditors have previously expressed.

⁶⁶ London Metal Exchange 3 months copper rolling forward , Bloomberg.

- A6.70 We consider that BT's concerns over the reliability of cost data apply specifically to duct rather than copper. We referred to this issue in the July 2013 LLU WLR Consultation. BT described the issue with the new PIPeR system in the 2012 RFS: 'The valuation of access network duct assets requires data in respect of the type and length of duct as well as the information regarding the type of surface under which the duct is situated. A new management system has been implemented which now provides the majority of the data supporting the duct valuation. Until the additional sampling and verification is complete there remains uncertainty over the accuracy of this surface mix data'⁶⁷. BT's auditors then referred to this explanation given by BT in their audit opinion on the 2012 RFS.⁶⁸
- A6.71 From this information, it appears that the only issue identified by BT and its auditors refers to the surface mix, which based on our knowledge of the methodology and BT's explanations, is only an input for valuing duct rather than copper. Given that the cost data issue appears to be specific to duct, we do not consider that this provides a reason for us to reject an absolute valuation for copper.

Conclusion

- A6.72 For the reasons set out above, we have decided to value access copper based on BT's 2011/12 absolute valuation and used RPI to forecast future costs.

Modelling approach

Proposals in the July 2013 LLU WLR Consultation

- A6.73 We explained our modelling approach in the consultation as follows. In order to model the RAV adjustment for duct,⁶⁹ we substituted BT's reported access duct values for Gross Replacement Cost (GRC), Net Replacement Cost (NRC) and depreciation with the equivalent outputs from the RAV model. Given that the LLU and WLR services consume a proportion of access duct and copper, we took the relevant percentage of GRC, NRC and depreciation that is allocated to the LLU and WLR services as identified by BT in 2011/12. The relevant percentages were approximately 69% for duct and approximately 93% for copper. The percentage of access duct RAV for GRC, NRC and depreciation were then apportioned to all components that use access duct in the same proportion as the equivalent CCA values in BT's RFS.

Stakeholder responses

- A6.74 Sky and TalkTalk submitted a report from Frontier Economics⁷⁰ which argued that the calculation of accumulated holding gains on written out copper assets in the RAV model was incorrect. The holding gains on write outs are calculated on the basis of an average GRC/GBV ratio for the total asset base. Frontier Economics

⁶⁷ Section 4, page 16, BT, *Current Cost Financial Statements for 2012 including Openreach Undertakings*, 31 July 2012, and associated documents: <http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/index.htm> (BT's 2011/12 RFS).

⁶⁸ Paragraph 21, page 13, BT's 2011/12 RFS.

⁶⁹ This is not required for Copper as there is no longer a RAV adjustment for copper after 2015/16 due to the assets capitalised before 1997 coming to the end of their accounting life.

⁷⁰ Frontier Economics, *Fixed Access markets reviews: Call for Inputs. A report on Ofcom's proposals for the cost standard to be used for LLU and WLR charge controls*, January 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/BSkyB_and_TTG_cost_standard1.pdf

pointed out that the older assets are likely to attract greater accumulated inflation than average due to their age. Frontier Economics therefore argued that the write outs were understated in the earlier years due to insufficient holding gains applied with the remaining asset base being overstated. Frontier Economics also suggested that the holding gains calculation is the reason why the RAV valuation does not converge to unadjusted CCA valuation in the model.⁷¹

Our analysis

A6.75 In the light of the comments received from Frontier Economics we have investigated the issue of written out copper assets. We note that there is no longer a RAV adjustment for copper after 2015/16 due to the assets capitalised before 1997 coming to the end of their accounting life. The copper RAV adjustment therefore does not affect the projected costs in 2016/17 which form the basis of the glide paths for WLR and MPF. As a result, we have decided not to make changes to the calculation of copper write outs.

Conclusion

A6.76 We have decided to model the RAV adjustment as originally proposed.

⁷¹ Paragraphs 5.6-5.7, page 62, Frontier Economics, *Ofcom's LLU and WLR Charge Controls Proposals. A report prepared for Sky and TalkTalk*, October 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Frontier_Economics_report.pdf

Annex 7

BT RAV model

A7.1 The BT RAV model will be published with the final statement.

Annex 8

Cost modelling for simultaneously provided services

Introduction

- A8.1 In Section 4 of Volume 2, we set out our decision to set the charge controls so as to discount the price of:
- the two services within the WLR Connections⁷² basket when either of those services is provided simultaneously with SMPF New Provide⁷³ (we refer to this as “WLR+SMPF Simultaneous Connections”); and
 - WLR Conversions⁷⁴ when provided simultaneously with SMPF New Provide (we refer to this as “WLR+SMPF Simultaneous Migrations”).
- A8.2 In addition, we referred to our decision to re-allocate costs across services involving jumpering work at the exchange to address some concerns raised by Openreach relating to under-recovery of its costs of providing these services, which arise out of our decision in relation to simultaneously provided services.⁷⁵
- A8.3 In this Annex we explain our methodology for deriving the costs of the WLR+SMPF Simultaneous Connections and Migration services and provide further detail on our proposal to reallocate costs across services involving jumpering work at the exchange.
- A8.4 In response to statutory information requests, Openreach has indicated to us that it does not hold information on the costs associated with the simultaneous provision of WLR and SMPF services.⁷⁶ In the absence of cost information on simultaneously

⁷² The two connection services in this basket are “Supply of new Basic line - Per line” which we refer to as “WLR Standard Connection” and “Supply of new line - Per line – using previously stopped LLU MPF line” which we refer to as “WLR Start of Stopped MPF Line”, as in Openreach’s price list, WLR Pricing, Wholesale Access (Analogue Lines), 25 March 2014, <http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=ccWy9ZJoVff1gb2YRVL3pYskcG%2Bc%2B30URCuKyqKmgSNUNelS4WkJBRh6z%2FRUAlt8maxtgrEro1A7%0Aw5V8nzAZpQ%3D%3D>.

⁷³ This service relates to “SMPF Connection charge, Basic Provide on existing narrowband, Simultaneous Provide of SMPF with narrowband, Singleton Migration (Transfer or change of CP migrations) from Narrowband, MPF, SMPF and ISDN/ Highway” in Openreach price list, LLU Pricing, shared MPF, 25 March 2014, <http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=LI%2BLzfp8sh2Y2DndjiRMoqOJDXc5GerAOSBb9tNt8RglMnGHsqdC0vzO163bJmh34D91D7M0q8u%2F%0AllSgtlFAKw%3D%3D>.

⁷⁴ This service relates to “Conversion of Local Loop Unbundling (LLU) Metallic Path Facility (MPF) to a single Wholesale Access line” in Openreach price list, WLR pricing, Wholesale Access (Analogue Lines), 25 March 2014, <http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=PgMT6el2nnlo4hhO70Yda27EtHRtVUAuOBA%2F5MusDN1UNelS4WkJBRh6z%2FRUAlt8maxtgrEro1A7%0Aw5V8nzAZpQ%3D%3D>.

⁷⁵ See paragraph 243, Openreach Response to the July 2013 LLU WLR Consultation.

⁷⁶ See BT’s response dated 30 October 2013 to question 12 of the Twelfth LLU WLR BT Information Request.

provided services, we have used other services for which Openreach does report cost information to estimate the costs of those simultaneously provided services. This is the approach we proposed for simultaneously provided services in Annex 11 of the December 2013 LLU WLR Consultation and this annex updates that analysis.

A8.5 We did not receive comments from stakeholders on our proposed approach to deriving the costs of simultaneously provided services. For this reason we only update the analysis we presented in the December 2013 LLU WLR Consultation. In contrast, we address several stakeholder comments and update our approach to re-allocating costs across services involving jumpering. In this Annex we summarise (where relevant) stakeholder comments, describe our updated analysis and set out our final decision. We have structured this annex as follows:

- first, we set out our approach to estimating the costs of automating Openreach's billing systems;
- second, we update our analysis for WLR+SMPF Simultaneous Migration;
- third, we explain our decision in relation to WLR+SMPF Simultaneous Connections; and
- finally, we respond to stakeholder comments and update our approach to re-allocating costs across services involving jumpering work (to account for the fact that the costs for these services in BT's RFS already reflect the cost savings associated with their simultaneous provision).

Automated billing system for simultaneously provided connections and migrations

A8.6 In the December 2013 LLU WLR Consultation we noted that there were significant differences between the cost estimates for the automation of billing systems for simultaneously provided services that Openreach had provided at the time of the July 2013 LLU WLR Consultation and its latest view of these costs. The increase in the estimated development costs was from ⓧ [£75-150K] to ⓧ [£400-650K] since the July 2013 LLU WLR Consultation. Openreach has confirmed these cost estimates in its response to the December 2013 LLU WLR Consultation and we have therefore decided to use them to estimate the unit cost of automating Openreach's billing systems.

A8.7 We have set out our decision to set a charge control on the simultaneous provision of WLR Connections and SMPF New Provide in Section 4, Volume 2. We expect also that an automated billing system would be used to provide WLR+SMPF Simultaneous Connections. For this reason our estimate of the unit cost of Openreach's automated billing systems assumes that this fixed cost is spread across both WLR+SMPF Simultaneous Migrations and Connections.

A8.8 In Table A8.1 we estimate the unit costs of such an automated billing system. We assume a unit cost of ⓧ [£0-£0.50] in 2014/15 (to reflect the costs of a manual billing system).⁷⁷ In contrast, the unit cost is lower in the remaining years of the

⁷⁷ We obtain the manual billing cost from Ofcom, *Dispute between BT and TalkTalk relating to MPF to WLR+SMPF simultaneous migration offer - Determination*, 23 April 2013: http://stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01097/Final_Determination_Non_Con1.pdf (2013 WLR+SMPF Simultaneous Migration Dispute Determination). In this dispute we estimated that Openreach's existing manual billing system

control, as we assume that Openreach will have developed an automated billing system from year 2015/16. We have updated our unit cost estimates to reflect the latest volume forecasts for simultaneously provided services in Annex 24. We only estimate the unit costs up to 2016/17, the last year of the charge control.

Table A8.1: Annual unit cost from the automated billing system

	2014/15	2015/16	2016/17
Annuited cost (£000)	N/a	⌘ [£100-200K]	⌘ [£100-200K]
Volumes (000) – Migrations	N/a	886	965
Volumes (000) - Connections	N/a	904	888
Unit cost	⌘ [£0-0.50]	⌘ [£0-0.10]	⌘ [£0-0.10]

Source: BT's response to the July 2013 Consultation and Ofcom calculations.

A8.9 In order to estimate the unit cost for the automated billing system we have updated the assumptions we used in the July 2013 and December 2013 LLU WLR Consultations:

- we amortise the costs of the automated billing system (an upfront billing system cost of ⌘ [£400K-£650K]) using an annuity approach;
- we assume the expected asset life of the billing systems will be 5 years;
- we apply an annual rate of return on this asset that is consistent with our estimate of Openreach's pre-tax nominal cost of capital (which has moved from 8.8% in the December 2013 LLU WLR Consultation to 8.6% now, as discussed in Annex 14); and
- we use the volumes for WLR+SMPF Simultaneous Migrations and Connections in our Base case volume forecast in Annex 24.

A8.10 Using these assumptions we estimate the annuited cost to be ⌘ [£100-200K]. Taking into account our base case volume forecast, this results in a unit cost of ⌘ [£0-0.10] for each of WLR+SMPF Simultaneous Migration and WLR+SMPF Simultaneous Connection for the years 2015/16 and 2016/17 (when Openreach expects to have developed its automated billing system). This unit cost for automated billing is below the unit cost of ⌘ [£0-£0.50] for manual billing, as estimated in the 2013 WLR+SMPF Simultaneous Migration Dispute Determination.⁷⁸

A8.11 We explained in Section 4, Volume 2 that we will align the charges of WLR+SMPF Simultaneous Migrations with other migration services at the beginning of the charge control using a one-off adjustment. Openreach has argued that we should delay the alignment of these charges until April 2015 to allow it to recover the

had a unit cost of ⌘ [£0-£0.50] in 2012/13 prices (see Table 6 of the dispute). We inflate this cost by our pay inflation assumption to reflect costs in 2014/15.

⁷⁸ Paragraph 3.60, 2013 WLR+SMPF Simultaneous Migration Dispute Determination, which as noted in the preceding footnote we have adjusted for labour cost inflation.

additional costs of its manual billing. We estimate that the extra cost from having a manual billing rather than an automated billing in 2014/15 is likely to be around \pounds [£0-300k]⁷⁹. For the reasons described in Section 4, Volume 2 we remain of the view that it is preferable to align all migration charges from the start of the control, as any alternative approach would run contrary to our objective of simplifying migration charges from the start of the charge control period.

WLR Conversion when provided simultaneously alongside SMPF New Provide

A8.12 Consistent with our approach in the December 2013 LLU WLR Consultation, we have derived the costs of WLR+SMPF Simultaneous Migrations by looking at the differences between these services and MPF Single Migration estimated in the WLR+SMPF Simultaneous Migration Dispute Determination. In addition, we have updated the costs of jumpering using our estimates in the Single Jumpered MPF Dispute.⁸⁰ In Table A8.2 below we present the differences between the costs of MPF Single Migration and WLR+SMPF Simultaneous Migration using jumpering costs consistent with those presented in the Single Jumpered MPF Dispute. These cost estimates in Table A8.2 below are the same as we presented in the December 2013 LLU WLR Consultation.

Table A8.2: LRIC differences between WLR+SMPF Simultaneous Migration (excluding automated billing system) and MPF Single Migration (2012/13)

Cost component	Incremental cost difference between WLR+SMPF simultaneous migration and MPF Single Migrations
MDF Hardware Jumpering	\pounds [£0 - £1.50] ⁸¹
Service Centres - Provision	Negligible
LLU Systems Development	-
Sales Product Management	\pounds [£0-£0.20]
Total	\pounds [£0-£1.70]

Source: Single Jumpered MPF Dispute.

⁷⁹ We estimate 799k WLR+SMPF Simultaneous Migrations in 2014/15 and we estimate that the unit cost difference between a manual and an automated billing is \pounds [£0-£0.50] (i.e. \pounds , the unit cost of the manual and automated billing, respectively – as shown in Table A8.1 above).

⁸⁰ Paragraphs 4.101-4.105, CW/01109/06/13, *Dispute between TalkTalk Group and BT Openreach about single jumpered MPF*, 15 November 2013,

http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01109/ (Single Jumpered MPF Dispute).

⁸¹ In the 2013 WLR+SMPF Simultaneous Migration Dispute Determination (which we use to derive the costs of WLR+SMPF Simultaneous Migrations, as noted above) we estimated that the average number of jumper movements of the MPF Single Migration was \pounds [3.5–4], compared to 4 jumper movements in the case of the WLR+SMPF Simultaneous Migration. In the recent Single Jumpered MPF Dispute we estimated that the cost associated with a single jumper removal should be approximately \pounds [£1.5-£3] (see paragraph 4.105 of the Single Jumpered MPF Dispute). Using these two assumptions we derive an incremental cost difference between the two services in terms of jumpering of \pounds [£0-£1.50] which is close to the differential we estimated in the 2013 WLR+SMPF Simultaneous Migration Dispute Determination.

A8.13 Table A8.3 sets out our estimates of the cost differences between MPF Single Migration and WLR+SMPF Simultaneous Migration using the same approach as in the December 2013 LLU WLR Consultation.⁸²

Table A8.3: Cost differences between MPF Single Migration and WLR+SMPF Simultaneous Migration (nominal prices) (2012/13-2016/17)

	2012/13	2013/14	2014/15	2015/16	2016/17
MPF Single Migration (FAC)	32.73	31.80	30.94	30.08	29.24
% change		-2.84%	-2.71%	-2.77%	-2.80%
LRIC difference (from Table A8.2)	0.69	0.67	0.65	0.64	0.62
Billing costs – manual and automated (from Table A8.1)	0.39	0.39	0.39	0.07	0.07
Total LRIC difference	1.08	1.06	1.04	0.71	0.69
Total FAC difference⁸³	1.16	1.14	1.12	0.76	0.74
WLR+SMPF Simultaneous Migrations (FAC)	33.89	32.94	32.06	30.84	29.98

Source: Ofcom calculations.

A8.14 We use the above estimate of the differences in costs between MPF Single Migration and WLR+SMPF Simultaneous Migration as an input to estimating the costs for WLR+SMPF Simultaneous Migration in the Cost Model. The costs in Table A8.3 are the costs before we reallocate costs across services sharing jumpering-related work (as described from paragraph A8.20 below).

WLR Connections when provided simultaneously alongside SMPF New Provide

A8.15 In Section 4, Volume 2 we have set out our decision to create a new WLR Connections basket that would encompass two services: (i) WLR Standard Connection (when there is no line in the exchange) and (ii) WLR Start of Stopped MPF Line. In Section 4, Volume 2 we have explained that we are setting the charge controls such that there is a discount on the price of these two WLR Connections when either of them is provided simultaneously alongside SMPF New Provide. We set out below our approach to deriving the underlying costs of the services within the WLR Connections basket and SMPF New Provide when provided simultaneously.

⁸² For more details see paragraphs 4.65 to 4.68 of the July 2013 LLU WLR Consultation.

⁸³ The FAC difference is obtained applying the estimated LRIC:FAC ratio of 0.93 to the LRIC difference.

- A8.16 We requested information on the simultaneous provision of connection services from Openreach using our statutory information gathering powers (including cost, volume and revenue data) at the time of the December 2013 LLU WLR Consultation. Openreach confirmed that it does not capture any information on these services.⁸⁴ In addition, Openreach had no cost information on the WLR Start of Stopped MPF Line service. In these circumstances, we have decided to derive the costs of these WLR and SMPF services as follows:
- **WLR Start of Stopped MPF Line:** we have decided to use the costs of the WLR Standard Connection service as a benchmark (as this is the closest WLR service in terms of the underlying activities involved);
 - **WLR Connections simultaneously provided alongside SMPF New Provide:** we have assessed the costs of each of WLR Standard Connection and WLR Start of Stopped MPF Line, as well as those associated with an SMPF New Provide, and from this derive the costs of both services when provided simultaneously. In addition, we have undertaken a cross-check of our calculation against the costs of the equivalent MPF New Provide service.
- A8.17 In Table A8.4 we update the costs allocated to each of (i) MPF New Provide; (ii) WLR Standard Connection; and (iii) SMPF New Provide in 2016/17 in the final version of the Cost Model. We also present our estimate of the costs of (i) WLR Start of Stopped MPF Line and (ii) the simultaneous provision of WLR Connections (including for both WLR Standard Connection and WLR Start of Stopped MPF Line). The costs in Table A8.4 are the costs before we reallocate costs across services sharing jumpering-related work (as described from paragraph A8.20 below).

⁸⁴ BT's response dated 30 October 2013 to question 12 to the Twelfth LLU WLR BT Information Request.

Table A8.4: FAC of MPF New Provide, WLR Connections, SMPF New Provide and WLR+SMPF Simultaneous Connections in 2016/17 (£)

	MPF New Provide	WLR Standard Connection	SMPF New Provide	WLR Start of Stopped MPF Line	WLR+SMPF Simultaneous Connection
Jumper movements	0, 2, 3 or 4 ⁸⁵	1	3	3	2 or 4 ⁸⁶
Wholesale Access Specific	0.00	1.13	0.00	1.13	1.13
Routing and Records	5.26	5.26	0.00	5.26	5.26
MDF Hardware Jumpering	26.63	18.49	22.19	22.19	✂
Service centres-Provision	2.58	8.89	2.58	2.58	✂
Sales Product Management	0.30	0.09	0.15	0.09	0.30
LLU Systems Development	0.14	0.00	0.14	0.00	0.14
Automated billing costs	N/a	N/a	N/a	N/a	✂
TOTAL	34.91	33.86	25.06	31.26	✂

Note: The unit cost for MPF New Provide, WLR Standard Connection and SMPF New Provide (in black) is obtained from the Cost Model. Using these we derive the unit cost of WLR Start of Stopped MPF Line and WLR+SMPF Simultaneous Connections (in green).

Source: Ofcom calculations.

A8.18 In terms of the costs of WLR Start of Stopped MPF Line, our estimated costs assume that the main differences between the costs of a WLR Standard Connection and the WLR Start of Stopped MPF Line are that the latter: (i) requires less engineering activity (because the line is already in place – e.g. it is unlikely to require a visit to the cabinet or the customer premises) and (ii) involves 3 jumper

⁸⁵ The jumper movements will depend on the underlying service within the MPF New Provides basket: (i) MPF Standard Connection: 2 jumper movements; (ii) MPF Start of Stopped Line: 0 jumpers (if same CP), 2 jumpers (from MPF), 3 jumpers (from WLR) and 4 jumpers (from WLR+SMPF); (iii) MPF Working Line Take Over: 0 jumpers (if same CP), 2 jumpers (from MPF), 3 jumpers (from WLR) and 4 jumpers (from WLR+SMPF).

⁸⁶ There will be 2 jumper movements when simultaneously supplying WLR Standard Connection and SMPF New Provide and 4 jumper movements when simultaneously supplying WLR Start of Stopped MPF Line and SMPF New Provide.

movements (i.e. remove 2 and install 1 jumper) compared to only 1 jumper movement in the case of the WLR Standard Connection. Thus, we assume the following on a cost component basis:

- **Wholesale Access Specific:** this cost component captures the cost of research and development projects, undertaken on behalf of Openreach, that are specific to access products including WLR. Development projects can range from high-level strategy, down to operational and logistical development.⁸⁷ We therefore assume identical costs in the case of WLR Standard Connection and WLR Start of Stopped MPF Line (as they are both WLR services).
- **Routing and Records:** this component captures the pay, non-pay, depreciation and balance sheet costs of routing and records work for provision of PSTN, ISDN, LLU and Private Circuits.⁸⁸ Routing and records is the physical verification of routings within the network, and records the time associated with the initial recording of routing details on BT systems.⁸⁹ We therefore assume identical costs in the case of WLR Standard Connection and WLR Start of Stopped MPF Line (as they are both WLR services).
- **MDF Hardware Jumpering:** this component captures the pay, stores and other non-pay, depreciation and capital costs associated with jumpering activities on the Main Distribution Frame (MDF). MDFs are the interface between the Exchange-side cables and the Exchange-side switching equipment.⁹⁰ An MDF jumper is a copper connection that provides a flexible connection between two terminal ends, commonly used to connect the Line-Side to the Exchange-Side of the MDF. On the Exchange side the jumper is connected to tie cables that connect to various pieces of equipment: for example, in the case of WLR a PSTN Switch, for MPF a Test Access Matrix (TAM) and MPF operator equipment (e.g. MSAN), and for SMPF a DSLAM and subsequently the PSTN Switch. We assume that the MDF Hardware Jumpering cost for WLR Start of Stopped MPF Line should be higher than that allocated to a WLR Standard Connection (which involves only one jumper movement) and equal to the cost of the SMPF New Provide (which like WLR Start of Stopped MPF Line also involves 3 jumper movements).
- **Service centres – Provision:** this component captures the costs associated with Openreach's service division. These teams are call centre based and support the provisioning and repair of Openreach services. These costs cannot be directly attributed in a causal way.⁹¹ We assume that the provision cost is the

⁸⁷ The majority of operating and capital costs within Wholesale Access Specific come from Openreach's "Openreach Systems and Development (Product Specific)" plant group (PG772A). The description of this plant group can be found on page 237, BT, *Detailed Attribution Methods (DAM) 2012*, 31 July 2012, http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/DAM_2012.pdf (BT's 2012 DAM).

⁸⁸ Page 170, BT's 2012 DAM.

⁸⁹ Page 129, BT's 2012 DAM.

⁹⁰ The Exchange-side cable is the cable that links the exchange to the primary cross connection point (PCP). In general, each pair of copper wires run from the customer's premises to PCP. The PCP's are the cabinets that are located at the side of the road. The PCP connects the wires from the customer's premises to a pair of wires from the exchange. Inside the exchange the wires in the external cable are terminated on the main distribution frame (MDF) and then are connected to the internal exchange equipment.

⁹¹ This point is reflected in the supplementary documents to BT's RFS, for example, page 224, BT's 2012 DAM, which state that they cannot be spread on a direct pay or revenue basis. Even though

same as for MPF New Provide and SMPF New Provide. This is because in the case of WLR Start of Stopped MPF Line the line is already in place and tested and therefore the costs associated with this component should be lower than in the case of WLR Standard Connection.

- **Sales and Product Management:** these costs cover non-engineering costs incurred within the Sales and Product Management division of Openreach. These costs cannot be directly attributed in a causal way.⁹² We therefore assume identical costs in the case of WLR Standard Connection and WLR Start of Stopped MPF Line (as both are WLR services).
- **LLU Systems Development:** this captures the cost of research and development projects, undertaken on behalf of Openreach, that are specific to products including LLU.⁹³ There is no LLU Systems Development in the case of WLR Start of Stopped MPF Line and we thus assume a zero cost in this category.

A8.19 In terms of the costs of the simultaneous provision of WLR Connections (both "Standard" and Start of Stopped MPF Line) and SMPF New Provide, our cost estimates are based on the following assumptions:

- **Wholesale Access Specific:** identical costs to WLR Standard Connection and WLR Start of Stopped MPF Line (as there are no SMPF New Provide costs involved);
- **Routing and Records:** identical costs to WLR Standard Connection and WLR Start of Stopped MPF Line (as there are no SMPF New Provide costs involved);
- **MDF Hardware Jumpering:** the simultaneous provision of WLR Standard Connection with SMPF New Provide would result in only 2 jumper movements, compared to 4 jumper movements in the case of WLR Start of Stopped MPF Line with SMPF New Provide. We estimate that the WLR Connections basket when provided simultaneously with SMPF New Provide is likely to result in approximately \propto . We therefore assume \propto for this cost component⁹⁴;
- **Service centres – Provision:** the cost associated with this component will depend on whether the WLR service is either a WLR Standard Connection (which incurs higher provision costs) or a WLR Start of Stopped MPF Line (which incurs lower provision costs – as the line is already in place). We assume that service centre provision costs will be incurred once. We therefore assume \propto for this cost component⁹⁵;
- **Sales Product Management:** we assume the same level of costs for the MPF New Provides and WLR+SMPF Simultaneous Connections since these involve the same services (i.e. products sold to CPs providing both voice and broadband to the same customer) and similar engineering activity;

revenue does not reflect cost causation, we see the RFS as supporting our inference of the difficulty in making a causal attribution.

⁹² See previous footnote, the relevant reference this time being, page 222, BT's 2012 DAM.

⁹³ Page 237, BT's 2012 DAM.

⁹⁴ \propto

⁹⁵ \propto

- **LLU Systems Development:** we use the total costs allocated to SMPF New Provide.

Re-allocation of costs across services involving jumpering

December 2013 LLU WLR Consultation

A8.20 In response to the July 2013 LLU WLR Consultation, Openreach stated that it already reflected the cost savings associated with the simultaneous provision of WLR and SMPF services in the costs reported in its RFS. However, it noted that it spread these savings across other services involving jumpering work in the exchange (rather than being attributed to the services that generated them). To address this, in the December 2013 LLU WLR Consultation we proposed to identify the services to which these cost savings are attributed and to re-allocate costs to ensure that they reflect the true underlying costs of provision.⁹⁶

December 2013 LLU WLR Consultation responses

- A8.21 One confidential respondent ~~X~~⁹⁷, Verizon⁹⁸ and EE agreed with our re-allocation of costs between services, as it considered that prices should reflect the underlying resource costs and that Openreach should not be required to under-recover its costs. However, EE urged Ofcom to scrutinize carefully Openreach's claims that the cost savings were already reported in the RFS to ensure that Openreach was not allowed to over-recover its costs. It noted that the proposed 15% increase in costs in our methodology's step 1 was three times higher than the 5% gross efficiency target set by Ofcom for Openreach in the WLR/LLU charge control, suggesting that the 15% figure may be too generous to Openreach.⁹⁹
- A8.22 Openreach's comments were unclear. When commenting on our approach to WLR+SMPF Simultaneous Migrations it considered that Ofcom had not taken into account its comments that the cost savings from simultaneous provision were already reflected in the costs used in the charge control modelling. Openreach argued that if the price of a simultaneous provide was brought down specifically to reflect this cost saving, this should be reflected in the total costs modelled with a corresponding increase elsewhere in the control.¹⁰⁰ Then, in responding to question 6.4 (which specifically asked stakeholders about our approach to re-allocating costs of services involving jumpering), Openreach recognised that Ofcom had proposed to reduce the price of the simultaneous provision of WLR Conversion and SMPF New Provide but that to compensate for this Ofcom had increased the cost of other services. Openreach agreed with this approach, although it noted that we had calculated the increased costs to be recovered from Hard Ceases but had not included these when calculating the unit costs of this service. It urged Ofcom to correct this in the final version of the charge control model.¹⁰¹

Our analysis

A8.23 We welcome stakeholders' support for our approach to re-allocating costs of simultaneously provided services. We agree with the proposition that charges

⁹⁶ Annex 11, December 2013 LLU WLR Consultation.

⁹⁷ ~~X~~ response to question 6.4 of the December 2013 LLU WLR Consultation.

⁹⁸ Paragraph 57, Verizon Response to the December 2013 LLU WLR Consultation.

⁹⁹ Page 12, EE Response to the December 2013 LLU WLR Consultation.

¹⁰⁰ Paragraph 394 Openreach Response to the December 2013 LLU WLR Consultation.

¹⁰¹ Paragraphs 396-397, Openreach Response to the December 2013 LLU WLR Consultation.

should reflect the underlying costs of provision and that Openreach should not be required to under-recover its costs.

- A8.24 In terms of EE's concerns that we should scrutinise carefully Openreach's costs, we have derived the underlying costs of simultaneously provided services as well as we have been able to with the cost information available from Openreach. However, we note that the introduction of charge controls on simultaneously provided services has associated requirements on Openreach in terms of cost reporting. We believe that this will improve the cost information available on these services in the next charge control review.
- A8.25 In response to question 6.4 of the December 2013 LLU WLR Consultation, Openreach has indicated that it agrees with our approach to re-allocating costs of simultaneously provided services, with the exception of our treatment of Hard Ceases. In response to this, we have made changes to our charge control model to ensure that Hard Ceases pick up the costs from the re-allocation exercise that we describe below.

Methodology to re-allocate costs across services sharing jumpering-related work

- A8.26 In order to re-allocate the costs and attribute the cost savings associated with simultaneous provision only to those services that generate them, our approach follows three steps.
- A8.27 In **Step 1**, we identify the services to which Openreach has spread the cost savings from the simultaneous provision of WLR and SMPF services. We note that these cost savings stem from a reduction in the work done at the exchange, in terms of reduced jumpering work and other activities for Openreach engineers. These costs are reported by Openreach in the cost component MDF Hardware Jumpering (described above). Thus, we assume that the cost savings from the simultaneous provision of WLR and SMPF services will have been spread across the services that have costs attributed from the MDF Hardware Jumpering component. These services are:
- Migration services, specifically: MPF Single Migration, SMPF Single Migration, MPF Bulk Migrations, SMPF Bulk Migrations and WLR Conversion;
 - MPF and SMPF Hard ceases; and
 - Connection services, specifically: MPF New Provide, SMPF New Provide and WLR Connections.
- A8.28 In **Step 2**, we note that the costs of the services identified in **Step 1** in BT's 2011/12 RFS already reflect the cost savings associated with the simultaneous provision of WLR and SMPF services. Thus, the total costs for these services in BT's 2011/12 RFS (i.e. the volumes multiplied by their FAC in 2011/12) provides the total FAC that should be recovered from the services identified in **Step 1** after introducing the discount on charges for WLR+SMPF Simultaneous Migration and Connection services. The costs that need to be re-allocated across the services identified in **Step 1** to ensure that the total costs recovered through these services does not change can be calculated as the sum of:

- $(FAC_{SMPF\ New\ Provide} + FAC_{WLR\ Conversion} - FAC_{WLR+SMPF\ Simultaneous\ Migration}) \times Volumes_{WLR+SMPF\ Simultaneous\ Migration}$;

and

- $(FAC_{SMPF\ New\ Provide} + FAC_{WLR\ Connections} - FAC_{WLR+SMPF\ Simultaneous\ Connections}) \times Volumes_{WLR+SMPF\ Simultaneous\ Connections}$

- A8.29 **Step 3**, we spread the costs calculated under **Step 2** across the services identified in **Step 1** according to their cost-based weighting (i.e. volumes x FAC).¹⁰² In Annex 24 we explain how we derive the volumes forecast (for each of these services) that is needed for the re-allocation of costs.
- A8.30 For reference, the re-allocation of costs can be found in sheet “SPM cost recovery” in the Cost Model. The implication of the re-allocation of costs is to increase the costs of the services identified in **Step 1** by approximately 15% when compared to the approach without the re-allocation of costs. In contrast, we are expecting reductions in the prices of WLR+SMPF Simultaneous Migrations and Connections of nearly 50% over the charge control period.
- A8.31 We consider however that EE’s comparison of the increase in the costs of these services due to this re-allocation with our efficiency target is not appropriate. Our efficiency target reflects the expected reduction in unit costs in every year of the charge control due to improvements in BT’s production processes. Conversely, the exercise we have described above does not change the total costs of supplying these services (it does not increase or reduce them) but rather consists of a re-allocation of the total costs attributed to each service. In addition, the reduction in costs resulting from the efficiency assumption is 5% annually (accumulating over time), whereas the re-allocation of costs is only a one-off change.

Our conclusions

- A8.32 We have decided to re-allocate costs across services sharing jumpering-related work to account for the fact that Openreach already reflects the cost savings associated with simultaneously providing WLR and SMPF connection and migration services in the costs reported in its RFS (which we have used as the basis from which we project costs, from 2011/12 onwards).

¹⁰² This is equivalent to an EPMU allocation with a constant percentage mark-up on the unit FAC across services in every year.

Annex 9

Estimation of LRIC differentials

Introduction and Summary

A9.1 In this annex we estimate the difference in LRICs between WLR+SMPF/WLR and MPF. We estimate the WLR+SMPF minus MPF LRIC differential to be £1.79 and the WLR minus MPF LRIC differential to be £-0.82. Together these imply the LRIC for SMPF is £2.61, that is, the difference between £1.79 and £-0.82.

Proposals in July 2013 and December 2013 LLU WLR Consultations

A9.2 In the July 2013 LLU WLR Consultation, we estimated the LRIC differentials using a top-down approach of multiplying the FAC for each service by the service level LRIC to FAC ratios from BT's RFS.¹⁰³

A9.3 In the December 2013 LLU WLR Consultation, we considered in more detail the LRIC differentials. As well as using the top-down approach as in the July 2013 LLU WLR Consultation, we also estimated the LRIC differentials using a bottom-up approach that involved estimating the costs of the individual components that were different for the different services.¹⁰⁴ On the balance of the available evidence, our preliminary view was that:

9.3.1 the LRIC differential between WLR+SMPF and MPF was likely to be in the range £0 to £4 per line per annum in 2016/17, and we consulted on using the mid-point of this range of £2; and

9.3.2 the LRIC differential between WLR and MPF was likely to be in the range -£3 to £2 per line per annum, and for a point estimate we consulted on the view that WLR and MPF have the same LRIC, that is, that there is no LRIC differential between WLR and MPF (in this regard we placed less weight on the very bottom end of the range).

Responses to the July 2013 and December 2013 LLU WLR Consultations

A9.4 Openreach agreed with Ofcom's assessment of the list of differences between WLR+SMPF and MPF. However, Openreach disagreed with an adjustment Ofcom proposed to make to the incremental cost of line cards. In the December 2013 LLU WLR Consultation, we considered adjusting up the LRIC to FAC ratio for line cards from 70% to 92% on the basis of the heavily depreciated nature of these assets. Openreach considered that there was no basis for this and that the 70% ratio (which was lower than in some earlier years) reflected improvements in the cost volume relationships in the LRIC model.¹⁰⁵

¹⁰³ Paragraphs 6.153 to 6.164, July 2013 LLU WLR Consultation.

¹⁰⁴ Paragraphs 7.48 to 7.81, December 2013 LLU WLR Consultation.

¹⁰⁵ Paragraphs 433 to 444, Openreach Response to December 2013 LLU WLR Consultation.

- A9.5 TalkTalk regarded the bottom-up approach based on the costs of the different components as materially superior to a top-down approach. However, it had a number of concerns with Ofcom's bottom-up approach.¹⁰⁶ It considered:
- 9.5.1 **Fault repair costs:** in life failures for MPF are lower than for WLR+SMPF and this should be reflected in fault repair costs;
 - 9.5.2 **TAMs:** the incremental costs for a TAM might be around £4;¹⁰⁷
 - 9.5.3 **evoTAMs:** it may be appropriate to have two SMPF variants, one that used evoTAMs and included the evoTAM costs and one that did not use evoTAMs and excluded evoTAM costs;¹⁰⁸
 - 9.5.4 **Service assurance costs:** the costs of service assurance should be allocated in the same proportion as fault rates;¹⁰⁹
 - 9.5.5 **Line cards:** Ofcom needed to provide greater transparency on line cards. It was unclear to TalkTalk why the LRIC:FAC ratio should have declined so sharply (from 92% to 70%) over a mere two year period. It suggested that absent other data the LRIC to FAC ratio for public switched telephone network (PSTN) line cards should be equal to or higher than that for TAMs since it is likely that non-incremental costs have been 'loaded' onto TAMS;
 - 9.5.6 **Frame costs:** Ofcom's adjustment to lower the LRIC to FAC ratio for frame capital costs was appropriate. However, Ofcom should apply the same logic to frame maintenance costs, using its judgement to determine an appropriate ratio, though TalkTalk considered a LRIC to FAC ratio in the range 20% to 30% to be plausible;
 - 9.5.7 **Re-jumpering for the PSTN:** the normal on-going operation of the PSTN/TDM network will involve some migration of WLR lines that will involve re-jumpering on the MDF. For example, TalkTalk said that if a PSTN switch needed replacing then the lines would need to be migrated from the old switch to the new PSTN switch or MSAN, that is, manual jumpering would be needed. This cost should be included in the WLR specific costs.
- A9.6 The table below shows Ofcom's view from the December 2013 LLU WLR Consultation alongside TalkTalk's view, which it considered took into account the points made above.

¹⁰⁶ Section 5, TalkTalk Response to December 2013 LLU WLR Consultation.

¹⁰⁷ Paragraph 5.5, TalkTalk Response to December 2013 LLU WLR Consultation.

¹⁰⁸ We consider this from paragraph A13.140.

¹⁰⁹ We consider this from paragraph A13.43.

Table A9.1– Ofcom’s December 2013 LLU WLR Consultation and TalkTalk’s view of the differential

	Ofcom range from Dec LLU WLR 2013 Consultation	TalkTalk’s view
WLR+SMPF minus MPF	£0 to +£4	+£5 to +£6
WLR minus MPF	-£3 to +£2	+£3 to +£4

Source: TalkTalk¹¹⁰

A9.7 Sky considered that Ofcom could have underestimated the incremental cost differences between WLR and MPF for the following reasons:

- 9.7.1 Ofcom had equalised certain cost allocations between MPF and WLR where it considered there was insufficient evidence to support an alternative – potentially causal – allocation. Sky considered that this approach would bias the LRIC differential towards zero;¹¹¹
- 9.7.2 Ofcom’s estimate of TAM costs appeared too high, was set at an inefficient level and was potentially insufficiently robust.¹¹²
- 9.7.3 The top-down methodology used in the July 2013 LLU WLR Consultation did not actually calculate the true LRIC differential and would provide only rough approximations of the true LRIC differentials;¹¹³

A9.8 Sky considered that BT’s allocation of service assurance costs appeared flawed as it was unsupported by any cogent evidence or explanation. Therefore, Sky said it agreed with Ofcom that it could be appropriate to equalise cost allocations of service assurance costs. (Note that while we had set the service assurance costs for WLR and MPF at similar levels in the December 2013 LLU WLR Consultation, we had not assumed they were exactly the same.)

A9.9 EE broadly agreed with our estimates of the likely ranges for the LRIC differentials, subject to the following:¹¹⁴

- 9.9.1 EE did not agree that fault rates should be equalised between WLR and MPF,¹¹⁵ and for this reason did not think that an adjustment should be made to service centre assurance costs;
- 9.9.2 EE urged Ofcom to carefully scrutinize the appropriateness of any additional common costs proposed to be allocated from Caller ID to line cards;¹¹⁶

¹¹⁰ Table after paragraph 5.26, TalkTalk Response to the December 2013 LLU WLR Consultation.

¹¹¹ Paragraph 6.3 and footnote 32, Sky Response to the December 2013 LLU WLR Consultation.

¹¹² Paragraph 6.7(i), Sky Response to the December 2013 LLU WLR Consultation. We discuss TAMs costs from paragraph A13.110.

¹¹³ Paragraph 4.26, Sky Response to the July 2013 LLU WLR Consultation.

¹¹⁴ Page 14, EE Response to the December 2013 LLU WLR Consultation.

¹¹⁵ We note that we did not propose in the December 2013 LLU WLR Consultation to equalise fault rates for MPF and WLR, as made clear in paragraph 5.3 of that consultation. Our final decision on fault rates is set out in Annex 20, of this Statement.

¹¹⁶ We consider caller display costs from paragraph 4.201 in Section 4, Volume 2.

- 9.9.3 EE did not consider it appropriate to adjust the LRIC to FAC ratio for PSTN line cards from 70% to 92% based on the information presented in the December 2013 LLU WLR Consultation;
- 9.9.4 EE considered that Ofcom's rounding simplifications introduce a rounding error which made the differential bigger than it would otherwise be; and
- 9.9.5 EE did not consider that Ofcom should reduce the frames capital LRIC to FAC ratio from 80% to 10%, and it therefore was not convinced that less weight should be placed on the lower end of Ofcom's LRIC differential range estimate for MPF and WLR of -£3. Nevertheless, given the uncertainties involved in estimating this differential, EE supported Ofcom's proposal of an assumed £0 differential between MPF and WLR for the purposes of the current charge control period.

Our analysis of the WLR+SMPF minus MPF LRIC differential

Approach to LRIC differential estimates

Bottom-up assessment of differences

- A9.10 In line with some responses, we have decided that it is most appropriate to estimate the LRIC differentials using a bottom-up approach that considers the costs of the various components that make up the differential as we did in the December 2013 LLU WLR Consultation, rather than using the top-down approach which we used in the July 2013 LLU WLR Consultation. We consider that this gives greater transparency and should result in a more internally consistent and reliable estimate of the LRIC differentials.¹¹⁷ However, we note that the LRIC differential is not something that is directly identifiable and that there is uncertainty in its estimation which involves an element of judgement. In carrying out the further analysis explained below we have carefully considered the information provided by all stakeholders in their consultation responses.

Assessment of forward looking costs

- A9.11 We want to estimate the LRIC differential on the basis of forward looking costs, so as to induce efficient decisions in the future.
- A9.12 As a result of considering responses on frame capital costs (see from paragraph A9.57 below), we have considered whether this assessment of forward looking costs should take account of the existing assets and available capacity which BT has, or whether it should be on a steady state basis (that is, more independent of availability of existing capacity). To induce the efficient choice of wholesale inputs, we consider that we should estimate the LRIC differential by considering forward looking costs, taking account of existing assets and available capacity. This means that the differences between charges will reflect real resource costs, and hence provide good incentives for CPs and consumers regarding the choice between copper products.

¹¹⁷ In particular, estimating the LRIC differentials using a top-down approach based on the service level LRIC to FAC ratios from the RFS will not reflect various adjustments to costs that we consider appropriate. These include excluding directory costs from WLR, excluding the line length adjustment, excluding evoTAMs from WLR and SMPF and a significantly lower estimate of TAM costs for MPF. The bottom-up estimates by component are also easier to understand and to review.

Differences between WLR+SMPF and MPF

- A9.13 For the purposes of the assessment of the LRIC differential, we do not need to consider the components that are the same in the two cost stacks. We only need to consider components that are different. This means we do not need to consider a number of significant cost components, such as those relating to duct and copper capital costs. These components are used equally by lines, whether MPF or WLR+SMPF (partly because of our policy decisions, for example, on line length). This also includes the use of the Main Distribution Frame (MDF or frame), as both WLR+SMPF and MPF involve two jumpers across the frame.^{118,119}
- A9.14 We have therefore focussed our analysis mainly on the small number of differences between WLR+SMPF and MPF services. We consider the main differences to be:¹²⁰
- 9.14.1 WLR includes a PSTN line card (whereas MPF does not);
 - 9.14.2 MPF includes a TAM (whereas WLR does not); and
 - 9.14.3 MPF is delivered to a higher Service Level than WLR.
- A9.15 We consider these three differences in turn, and then consider other minor differences between WLR+SMPF and MPF.

PSTN line cards

LRIC for PSTN line cards for a hypothetical on-going network

- A9.16 In the Cost Model, which assumes a hypothetical on-going network, the FAC for PSTN line cards is around £10 in 2016/17. A ratio of around 70% can be derived from the Cost Model for the LRIC to FAC ratio. After adjustments to the line card costs for Caller Display and cumulo (which are described further below), this gives a LRIC of around $\pounds 7$.¹²¹
- A9.17 As we noted in the December 2013 LLU WLR Consultation, the LRIC to FAC ratio for PSTN line cards was typically over 90% in earlier years.¹²² In that consultation we said that we believed the lower LRIC to FAC ratio may result from the heavily depreciated nature of the assets.

¹¹⁸ This can be seen by comparing Figure A10.2 and Figure A10.3 in Annex 10.

¹¹⁹ While the provision of both WLR+SMPF and MPF products involve three tie cables connecting to the main distribution frame, with WLR+SMPF two tie cables are bought separately whereas for MPF only one tie cable is bought separately. This means that there is one more tie cable included in the MPF rental compared to the WLR+SMPF rentals. In our assessment of the LRIC differential in the March 2012 Statement we included a separate line item for the extra tie cable associated with the MPF rental. We have not done so here because this extra tie cable is already included in the TAM costs we are using. See paragraphs 7.129-7.131 of the March 2012 Statement for more explanation of the recovery of tie cable costs.

¹²⁰ Given that we have decided to set the SMPF charge to exclude evoTAMs (as discussed from paragraph A13.140), we do not include that as a difference between the two sets of products.

¹²¹ We have estimated the LRIC in 2016/17 by using the AVE and CVE in our model for that year. We have used a weighted average of the AVEs and CVEs, with the weighting determined by the relative share of capital costs and operating costs in the total unit costs. See from A13.200 for our approach on CVEs and AVEs.

¹²² Paragraph 7.61.2, December 2013 LLU WLR Consultation.

- A9.18 In its response to the December 2013 LLU WLR Consultation, Openreach said that the reason for the reduction in the LRIC to FAC ratio from 90% to 70% was due to changes it had made to the cost volume relationships in its LRIC model. We understand from Openreach that it made these changes in the LRIC model in 2011/12 and included changes to the cost volume relationships for some accommodation categories, some concentrators, computing and general management costs.
- A9.19 While we have gone through a process of reviewing the AVEs and CVEs used in the Cost Model (as described from paragraph A13.200), the extent of this analysis is not such that we are able to determine whether a LRIC to FAC ratio of around 70% would be more appropriate than a ratio of around 90% for PSTN line cards.
- A9.20 We are cautious of simply relying on the changes that BT has made to the LRIC model. This is partly because BT may have a commercial incentive to understate the incremental cost of line cards. We therefore consider that the incremental costs for a hypothetical on-going network may be within the range implied by a LRIC to FAC ratio of around 70% to around 90%.
- A9.21 For the purposes of assessing differences between WLR+SMPF and MPF, we have also included in our estimate of the PSTN line card costs some of the costs we have reallocated from Caller Display to WLR. We have included these costs with the line card costs because they relate to equipment used to provide voice services. These costs are common between Caller Display and WLR, but are incremental when those two services are considered together.¹²³ This reallocation of Caller Display costs means that the cost difference between WLR+SMPF and MPF is about 30p more than it would otherwise be.
- A9.22 As explained in Annex 26, the FAC for line cards includes a small amount for cumulo costs, which we consider should be removed when considering the LRIC differential.^{124, 125}
- A9.23 If we add the Caller Display costs to the PSTN line card costs and deduct the cumulo cost that we wish to exclude from the LRIC differential, then the FAC is around \pounds [£10]. Using a ratio for LRIC to FAC of 70% to 90% implies a LRIC of around \pounds [£7] to \pounds [£9].

Incremental costs for PSTN line cards given continuation of existing equipment

- A9.24 As we set out earlier, we consider that the efficient choice of wholesale inputs would be better ensured by setting charges to reflect the expected differences in LRIC taking account of existing assets and available capacity that BT has. Given that BT is likely to want to avoid significant investment in new equipment because PSTN line cards are expected to become redundant at some point in the future, we

¹²³ See from paragraph 4.201, Section 4, Volume 2 for more explanation of the adjustments for Caller Display costs.

¹²⁴ As shown in Annex 26, the cumulo cost included in PSTN line cards in BT's 2011/12 RFS was \pounds , based on a PSTN line card cost of £8.13 in BT's 2011/12 RFS. We have calculated what the equivalent amount would be *pro rata* when the PSTN line card cost in the model is around £10 (ie, the line card cost in the Cost Model before adjustments). This implies an adjustment of \pounds .

¹²⁵ In Annex 26, we also note that there are very small cumulo contributions in the general frames capital and broadband line testing cost components in the 2011/12 RFS. However, for these two cost components, we use our own estimate of the LRIC differential rather than relying on the 2011/12 RFS. We therefore do not need to make an adjustment for cumulo costs for these two cost components.

consider that it is likely to be more relevant to consider BT's forecast line card costs, rather than those forecast for a hypothetical on-going network.

- A9.25 BT's PSTN line card equipment is old and heavily depreciated. If BT avoids significant new investment, there is an argument that the actual incremental costs of PSTN line card equipment should be relatively low. We would, however, expect the costs of maintaining this equipment to rise as it ages, meaning that sustaining existing PSTN line cards may become increasingly costly over time.
- A9.26 BT has provided us with forecasts of its FAC for PSTN line cards over the period to 2016/17.¹²⁶ We have made various adjustments to this forecast. First, there are a small number of WLR lines where the voice service is provided through the use of combi cards rather than PSTN line cards.¹²⁷ This means that if we divided the total PSTN line card costs by the number of WLR lines, it would understate the unit cost, because some of these lines are served by combi cards. We have therefore summed the PSTN line card costs with an estimate of the combi card costs and divided that by our forecast of the WLR volumes.¹²⁸ Second, as with the FAC in a hypothetical on-going network above, we add to the FAC figure that takes account of BT's existing assets and available capacity an amount related to Caller Display (as discussed in paragraph A9.21) and deduct an amount relating to cumulo (as discussed in paragraph A9.22). This results in a FAC of around £8.20 per line in 2016/17. The forecasts rise slightly over the period, mainly due to rising operating costs in BT's forecasts.
- A9.27 In terms of the LRIC to FAC ratio, we do not consider that the ratio from the hypothetical on-going network will necessarily be relevant when considering the actual FAC for line cards. For example, the forecast actual FAC for PSTN line cards has a much higher proportion (and level) of operating costs than that for the hypothetical on-going network. We would typically expect operating costs to exhibit a higher LRIC to FAC ratio than capital costs (which is generally the case in our cost model which draws on BT's actual network cost information). This suggests that a higher LRIC to FAC ratio is likely to be appropriate for the forecast actual FAC for line cards. For example, if we applied a 90% LRIC to FAC ratio to an FAC estimate of around £8.20 per line in 2016/17, it would imply a LRIC of around £7.40.

Conclusion on incremental PSTN line card costs

- A9.28 We would prefer to estimate the LRIC for line cards based on BT's plans for maintaining its existing assets rather than that implied by a hypothetical on-going network which assumes a steady state level of investment. Based on a forecast of

¹²⁶ BT's response dated 31 March 2014 to question 1 of the Eighteenth LLU WLR BT Information Request.

¹²⁷ Combi cards (or combination cards) are based on MSANs (Multi Service Access Nodes) and are capable of supporting both voice and broadband. From 2007/08, BT made a limited investment in combi cards for a trial (known as the 'Pathfinder' trial). The original intention was to use these combi cards for both voice and broadband. However, due to the change in BT's strategy, these combi cards will now be used only for voice services, and not for broadband services. BT allocates the cost of these combi cards to WLR.

¹²⁸ Our estimate of line card costs is therefore a weighted average of the PSTN line card costs and combi cards. However, it will be heavily weighted towards PSTN line card costs given the very small proportion of lines that have combi cards.

As we explain from paragraph A13.99, combi cards are not relevant for the Cost Model, as our main modelling assumes a hypothetical on-going network in which PSTN line cards are maintained, and this results in an upward adjustment to PSTN line card costs in the Cost Model.

the actual FAC and an assumption about the likely LRIC to FAC ratio for the actual network, this implies a LRIC of around £7.40.

- A9.29 However, we have also considered the LRIC implied by a hypothetical on-going network. This is partly because this approach may be more robust to significant changes in volumes. However, there is considerable uncertainty over this estimate due to uncertainty over the LRIC to FAC ratio. We consider that the costs for a hypothetical on-going network may be in the range of around \times £7 to \times £9. That £7.40 is within this range gives us more confidence in that figure.
- A9.30 On balance, we consider it reasonable to assume £7.40 for the LRIC for line cards by 2016/17.¹²⁹ This is consistent with our estimate of the LRIC for line cards taking account of how we expect BT to actual run its network and is also within the range which might be applicable for a hypothetical on-going network.

TAMs

- A9.31 We set out from paragraph A13.109 our analysis of the cost of TAMs. We have set out our view that we consider £3.75 per line to be a reasonable estimate of the LRIC of a TAM in 2016/17. This is mostly driven by the additional capital expenditure on TAMs that is required for new MPF lines.

Fault rates and service levels

- A9.32 As we have set out in Annex 20, we consider that there should be no difference in fault rates between WLR+SMPF and MPF. However, MPF and SMPF are delivered to a higher Service Level than WLR, which tends to increase costs. As described from paragraph A13.58, we have adjusted relevant costs so they reflect the ratios in Table A9.2 below.¹³⁰

Table A9.2: Ratios for costs affected by fault rates and service levels

	WLR Basic Rentals	MPF Rentals	SMPF Rentals
Combined usage factor applied to all relevant components	0.83	1.21	0.21

Source: Ofcom

- A9.33 In the December 2013 LLU WLR Consultation, we did not adjust the service centre assurance costs to reflect the ratios in Table A9.2 in our main modelling, but in considering the LRIC differential we sought stakeholder views on the relative service centre assurance costs.¹³¹ As described from paragraph A13.43, we have now decided that it is appropriate to adjust the service centre assurance costs as well so that they reflect the ratios above.

¹²⁹ We include in our assumed PSTN line cards LRIC the caller display related costs that are common to Caller Display and WLR, but are incremental when considering those services together.

¹³⁰ The cost components we have applied these ratios to are: D-side copper current, E-side copper current, Local exchange general frames current (which we refer to here as frame maintenance), drop wire maintenance, DSLAM capital/maintenance, and Service Centre Assurance.

¹³¹ Paragraph 7.61.1, December 2013 LLU WLR Consultation.

A9.34 For each cost component, the LRIC is calculated by using a weighted average of the AVEs and CVEs, with the weighting depending on the relative share of capital costs and operating costs in the total unit costs.¹³² All the cost components we have adjusted for different service levels are dominated by operating costs.

A9.35 This results in a WLR+SMPF minus MPF LRIC difference for service levels of -£1.91.¹³³

Other cost differences

A9.36 We consider that the factors considered above (i.e. line cards, TAMs and service level) are the material differences between WLR+SMPF and MPF. Nevertheless, we have also considered other small differences.

A9.37 In the Cost Model, there are very small differences in a few other cost components, the largest of which is sales product management. In total the LRIC derived from the Cost Model for these other differences is £0.05. We have included this in our assessment of the LRIC differential.

WLR+SMPF minus MPF LRIC differential

A9.38 Table A9.3 below summarises our estimate of the WLR+SMPF minus MPF cost differential.¹³⁴

Table A9.3: WLR+SMPF minus MPF LRIC differential

<i>£ per line per year, 2016/17, nominal prices</i>	(WLR+SMPF) – MPF
PSTN line cards	7.40
TAMs	-3.75
Service level (including D-side and E-side copper current, drop wire maintenance, frame maintenance, and service centre assurance)	-1.91
Other cost differences	0.05
Total	1.79

Source: Ofcom

A9.39 We estimate the WLR+SMPF minus MPF LRIC differential to be £1.79, and we have used this to set the difference between the charges in the final year of the charge control (2016/17).

¹³² The CVEs that we used were adjusted as explained from paragraph A13.200.

¹³³ This is comprised of: -£0.64 for D-side copper current, -£0.19 for E-side copper current, -£0.27 for Local exchange general frames current (which we refer to here as frame maintenance), -£0.64 for Drop Wire maintenance, -£0.02 for DSLAM capital/maintenance, and -£0.16 for Service Centre Assurance.

¹³⁴ In the December 2013 LLU WLR Consultation, we presented a number of different calculations for the LRIC differential. Here we only set out what we consider to be the most reasonable calculation, after having taken responses into account.

Comparison to the LRIC differential estimate in the March 2012 Statement

A9.40 This estimate is much lower than the range we set out in the March 2012 Statement, where we estimated a likely range for the LRIC differential of £10 to £14 (for 2013/14). It is also lower than the £9.90 base case LRIC differential in our July 2013 LLU WLR Consultation (for 2016/17).¹³⁵ However, it is close to the middle of the range of £0 to £4 on which we consulted in the December 2013 LLU WLR Consultation.

A9.41 Table A9.4 below compares the LRIC estimate for 2013/14 from the March 2012 Statement and our current estimate for 2016/17.

Table A9.4: Comparison to Ofcom’s forecasts of the LRIC differential¹³⁶

<i>£ per line per year, nominal prices</i>	March 2012 Statement (for 2013/14)	May 2013 (for 2016/17)
PSTN line cards	11 to 13	7.40
Line testing ¹³⁷	-1.15 to -1	-3.75
Service level and faults ¹³⁸	-0.80 to 0.20	-1.91
Directories	0.50	-
Other cost differences	0.50 to 1	0.05
Total	10 to 14	1.79

Source: Ofcom

A9.42 As can be seen from the table, there are a number of reasons for the differences.

A9.43 One significant difference is that we are now using a lower estimate for the PSTN line card incremental costs. We have now estimated this at £7.40 for 2016/17, compared to an estimate of £11 to £13 in the March 2012 Statement for 2013/14. This results in a reduction in the differential of between £3.60 and £5.60.

A9.44 Another significant difference relates to the changes in our analysis relating to broadband line testing costs:

- In the March 2012 Statement, we considered that WLR+SMPF and MPF would be similar in terms of line testing costs.¹³⁹ Similarly, in our base case in the July

¹³⁵ See Table A6.2 of the July 2013 LLU WLR Consultation.

¹³⁶ See Figure 7.9 from the March 2012 Statement.

¹³⁷ In the March 2012 Statement we included a separate line for the extra tie cable that MPF employed, whereas that tie cable cost is included in the TAMs costs shown here so we have summed the line test equipment and the tie cables lines from Figure 7.9 of the March 2012 Statement.

¹³⁸ In the March 2012 Statement we separated the frame repair costs from the network fault repair costs and service level costs. We have combined them in this table to allow comparison.

¹³⁹ See Figure 7.9 of the March 2012 Statement, which shows very little difference for line testing costs, though the additional tie cable (which is included as part of the TAM) was included as a separate line item in Figure 7.9.

2013 LLU WLR Consultation, we assumed that there would be no difference in broadband line testing costs between WLR+SMPF and MPF.¹⁴⁰

- Our revised proposal is not to include any evoTAM costs in the SMPF charge.¹⁴¹
- We have also reviewed the costs of TAMs, and now consider that a reasonable estimate of the LRIC is £3.75 per MPF line.

A9.45 This change in assessment of broadband line testing costs results in a reduction of around £2.70 in our estimate of the LRIC difference compared to the March 2012 Statement.

A9.46 We are now assuming a much smaller difference in other costs compared to the March 2012 Statement. In the Cost Model, the largest of these 'other costs' relates to sales product management.

Our analysis of the WLR minus MPF LRIC differential

A9.47 In the past, we have focussed particularly on the differential between WLR+SMPF and MPF, and have considered the differential between WLR and MPF to be less important.¹⁴² This was because in the past MPF has been almost exclusively used to provide voice and broadband services. However, where the customers of CPs deploying MPF take fibre broadband, it is becoming more prevalent for MPF to be used to provide voice services, with the broadband being provided via FTTC. This may make the differential between WLR and MPF charges more important than it has been in the past.

A9.48 Moreover, we are setting the SMPF charge at LRIC, and we calculate that as being the difference between the WLR+SMPF minus MPF LRIC differential and the WLR minus MPF LRIC differential. The WLR minus MPF LRIC differential is therefore used directly in determining the level of the SMPF charge control.

Differences between WLR and MPF

A9.49 In addition to the differences that we have identified above (related to PSTN line cards, TAMs and service levels), for the MPF and WLR comparison there are also differences relating to:

9.49.1 fault levels, as WLR is associated with lower fault levels than MPF (as explained in Annex 20); and

9.49.2 use of the frame, as WLR involves one jumper on the frame, compared to two jumpers for MPF.¹⁴³

A9.50 For PSTN line cards and TAMs, we use the same costs as set out for the WLR+SMPF minus MPF differential above. Below we consider the differences

¹⁴⁰ In the July 2013 LLU WLR Consultation, in our base case, we assumed that broadband line testing costs would be £3.77 for both SMPF and MPF, see from paragraph 6.151 of the July 2013 LLU WLR Consultation for an explanation of this.

¹⁴¹ See from paragraph A13.140 for an explanation of why we exclude recovery of evoTAM costs from the SMPF charge.

¹⁴² See for example from paragraph 5.14, Ofcom, *Charge control for Wholesale Line Rental and related services – Statement and consultation*, 26 October 2009,

www.stakeholders.ofcom.org.uk/binaries/consultations/wlr/summary/wlrcondoc.pdf

¹⁴³ This can be seen by comparing Figure A10.1 and Figure A10.3 in Annex 10.

related to faults and service levels (including frame maintenance) and also differences in frame capital costs.

Faults and service levels, including frame maintenance costs

- A9.51 Our approach to differences in fault and service level costs for WLR minus MPF is the same as that for the WLR+SMPF minus MPF differential, as described at paragraph A9.32 above.
- A9.52 For the reasons set out in Annex 20 we consider that all cost components affected by faults and service levels (including the service centre assurance cost components) should reflect the ratio of 0.83:1.21 in terms of the WLR:MPF costs (as shown in Table A9.2 above). The Cost Model implies that the WLR minus MPF LRIC difference is -£4.19 for differences due to faults and service levels (including frame maintenance costs).
- A9.53 It is not meaningful to consider each of the components affected by faults and service levels on its own, for the reasons explained below.¹⁴⁴
- A9.54 The same usage factors have been applied to all cost components affected, including frame maintenance costs. These usage factors are shown in the first row in Table A9.5 below. As set out in Annex 20, our views on relative fault rates for MPF, WLR and SMPF are on a full service basis, specifically they include faults in the exchange and in the network outside the exchange. This means that the usage factors in the table below already take into account the differences in the number of jumpers for each service. It would therefore not be appropriate to make a further adjustment to the usage factor solely for the frame maintenance cost component.

Table A9.5: Usage factors for components affected by fault rate and service level

	WLR Basic Rentals	MPF Rentals	SMPF Rentals
Combined usage factor applied to all relevant components	0.83	1.21	0.21
Number of jumpers	1	2	1

Source: Ofcom

- A9.55 We recognise that the ratios are unlikely to be appropriate for the frame maintenance costs when that cost component is considered in isolation. This is because MPF has two jumpers while WLR and SMPF each have one jumper, as shown in the second row in Table A9.5 above. We would expect the frame maintenance costs to relate directly to the number of jumpers and therefore frame maintenance costs for WLR to be lower relative to MPF than is implied by our usage factors, and for SMPF to be higher.
- A9.56 It is therefore only meaningful to compare the impact on the WLR minus MPF differential of faults and service level when considering all the components affected

¹⁴⁴ This is different to the WLR+SMPF minus MPF differential, where it is meaningful to consider the different cost components impacted by different service levels individually. We show that breakdown in footnote 133 above. It is possible to do that for the WLR+SMPF minus MPF differential because both sets of services involve two jumpers on the main distribution frame.

in aggregate. We consider that this estimate of the total cost difference related to faults and service levels is reasonable. In Table A9.6 below we have therefore aggregated in one row all the components affected by service levels and faults, including frame maintenance.

Frame capital costs

- A9.57 WLR involves one jumper on the frame, whereas MPF uses two. In order to estimate the LRIC of the additional jumper used by MPF, we have relied on the analysis undertaken for the purposes of the Single Jumpered MPF Dispute Determination. This analysis is relevant because it involved reviewing the extent to which frame capital costs were expected to vary if only a single jumper were used to provide MPF instead of two jumpers.¹⁴⁵ The analysis therefore estimated the cost of an additional jumper.
- A9.58 As described from paragraph A9.11 above, we now consider it appropriate to consider what the LRIC for frame capital costs would be over the period, taking account of existing assets and available capacity. For frame capital costs, we consider that this approach results in a significantly lower estimate of LRIC compared to if we had considered a steady state assumption that involved incremental investment when a jumper was added. Because we are adopting this approach, the analysis conducted for the Single Jumpered MPF Dispute Determination is directly relevant for our purposes, as that analysis also considered the incremental costs taking the existing assets and available capacity as given.¹⁴⁶
- A9.59 In the Single Jumpered MPF Dispute Determination, we concluded that it was unlikely that, on a forward-looking basis, frame capital costs would vary much with the number of jumpers used for MPF. We found that the largest single element in BT's frame capital cost component (also known as the 'Local Exchange general frames capital' cost component) actually related to accommodation costs, which consists predominantly of payments to Telereal Trillium and facilities management costs.¹⁴⁷ We considered it unlikely that, on a forward-looking basis, there would be material savings in accommodation costs as a result of reducing the number of jumpers used to provide MPF. We also considered it unlikely that there would be material savings in the costs of the ironwork, ladders or physical infrastructure of frames if the number of jumpers were reduced. In short, we considered that the incremental savings in frames capital costs due to only using a single jumper would be small.¹⁴⁸
- A9.60 We have therefore set the LRIC for frame costs to be consistent with our findings in the Single Jumpered MPF Dispute Determination, which implies a cost per incremental jumper of around £0.15.¹⁴⁹

¹⁴⁵ Paragraphs 4.106 to 4.127, Ofcom, *Dispute between TalkTalk Group and BT Openreach about single jumpered MPF – Statement and determination*, 15 November 2013, http://stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/open-cases/all-open-cases/cw_01019/determination.pdf (Single Jumpered MPF Dispute Determination).

¹⁴⁶ In the base case we considered a seven year period in the Dispute, but other scenarios were considered with different periods.

¹⁴⁷ Paragraph 4.122, Single Jumpered MPF Dispute Determination.

¹⁴⁸ Paragraph 4.114, Single Jumpered MPF Dispute Determination.

¹⁴⁹ This is based on the annuitized cost of two frame blocks, given that the only incremental capital expenditure we identified in the Single Jumpered MPF Dispute Determination related to frame blocks. In this calculation, we have assumed \approx .

Other cost differences

A9.61 In the Cost Model, there are also small differences between WLR and MPF in a few other cost components, the largest of which is LLU systems development. In total the LRIC derived from the Cost Model for these other differences is -£0.13. We have included this in our assessment of the LRIC differential.

WLR minus MPF LRIC differential

A9.62 Table A9.6 below summarises our assessment of the WLR minus MPF LRIC differential.

Table A9.6: WLR minus MPF LRIC differential

<i>£ per line per year, 2016/17, nominal prices</i>	WLR - MPF
PSTN line cards	7.40
TAMs	-3.75
Service level and faults (including D-side and E-side copper current, drop wire maintenance, frame maintenance and service centre assurance)	-4.19
Local exchange general frames capital	-0.15
Other cost differences	-0.13
Total	-0.82

Source: Ofcom

A9.63 Our estimate of the WLR minus MPF LRIC differential is therefore £-0.82, and we have used this to determine the SMPF charge, as discussed below.

SMPF charge

A9.64 In order to set both the differential between WLR+SMPF and MPF charges at our estimate of LRIC, and also the differential between WLR and MPF charges at LRIC, it is necessary to set the charge for SMPF at LRIC. This implies that the SMPF charge needs to be set at the difference between £1.79 and £-0.82, which implies an SMPF charge of £2.61.

A9.65 We recognise that a charge at this level appears low particularly when compared with the current SMPF charge of £9.89, or the FAC in BT's 2011/12 RFS of £7.25. However, SMPF is an overlay service to WLR and requires very little additional capital. Specifically, SMPF involves the cost of one additional jumper on the frame and while SMPF also requires adding two tie cables beyond the configuration for WLR, the cost of these two tie cables is charged for separately (i.e. is not included in the SMPF rental charge itself). As noted previously, we have now excluded evoTAM costs from regulated SMPF charges, so this asset is no longer relevant to the SMPF cost stack. In terms of operating costs these are again incremental to those arising from WLR and so reflect first, the higher faults expected on a broadband line relative to a voice only line (i.e. WLR only) and, second, a higher service level for SMPF (relative to WLR).

A9.66 In light of the above, we consider that there are a priori grounds to expect the incremental costs for the SMPF rental to be low, and we consider that £2.61 is a reasonable estimate of the LRIC for the SMPF rental.

Ofcom's response to stakeholder comments

A9.67 We have set out above our assessment of LRIC differentials. This takes account of our assessment of responses to the July 2013 LLU WLR Consultation and the December 2013 LLU WLR Consultation. Below we reply to some of the points raised in responses that have not been explicitly addressed above.

Re-jumpering costs for WLR

A9.68 TalkTalk argued that another difference between WLR and LLU services relates to WLR having costs associated with re-jumpering on the MDF that are not recovered from other charges.

A9.69 We have assumed that the relevant costs of maintaining the required equipment are included in the PSTN line card cost provided by Openreach. This includes the costs of the normal operation and maintenance of the PSTN line cards that require engineering activity in the exchange.

No systematic bias to underestimate the differential

A9.70 Sky argued that we had assessed differences between WLR/WLR+SMPF and MPF to be zero unless there was sufficient evidence to support an alternative allocation. Sky considered that this approach would bias the LRIC differential towards zero.

A9.71 Since WLR+SMPF and MPF involve the use of very similar assets to deliver voice and broadband over copper access lines, we think that it is appropriate to focus attention on the limited number of cost components of difference. In any case, we have also included in our estimate other minor differences between WLR+SMPF/WLR and MPF. We therefore do not consider that our estimates are biased towards zero.

Rounding to derive point estimates

A9.72 EE considered that Ofcom's rounding simplifications introduce a rounding error that made the differential bigger than it would otherwise be.

A9.73 As can be seen from the above, we have not rounded our estimates in this final assessment, although we note that some of the estimations of LRIC differences are subject to some uncertainty and in this context, some rounding could be appropriate, although we have chosen not to do so.

Fault repair and service level costs

A9.74 TalkTalk argued that fault repair costs should be higher for WLR+SMPF than MPF. We reject this for the reasons set out in Annex 20.

A9.75 EE argued that there should be no adjustment for different service centre assurance costs. We reject this for the reasons set out from A13.43.

Frame maintenance costs

- A9.76 TalkTalk argued that we should reduce the LRIC to FAC ratio for frame maintenance costs, because it considered that some of these costs were not incremental.
- A9.77 We do not consider that there is a strong justification to change the approach to frame maintenance costs in our modelling. We explored frame maintenance costs in the Single Jumpered MPF Dispute Determination, and for that used a figure broadly consistent with the incremental costs that in BT's RFS.¹⁵⁰ We are not able to directly compare the assumption in the Single Jumpered MPF Dispute Determination with that used for the assessment of the LRIC differential because we can only compare the cost components affected by faults and service levels in aggregate, for the reasons explained from paragraph A9.53 above.

¹⁵⁰ In the Single Jumpered MPF Dispute Determination we said, in paragraph 4.124, "*We have used BT's LE general frames current component [i.e. frames maintenance costs] as the basis for our estimate of operating cost savings of £1.00. TalkTalk argues the savings on this component should be calculated as £1.35 x 94% which equals £1.27. As noted above this will include capital costs (depreciation and a return on capital employed) which will cover expenditure on software that we have included in development costs.*" However, using incremental costs of £1 per line per jumper for setting these charge controls would understate the incremental frame maintenance costs assumed in the Single Jumpered MPF Dispute Determination, because there were also software development costs that were included separately.

Annex 10

Technical requirements of migrations

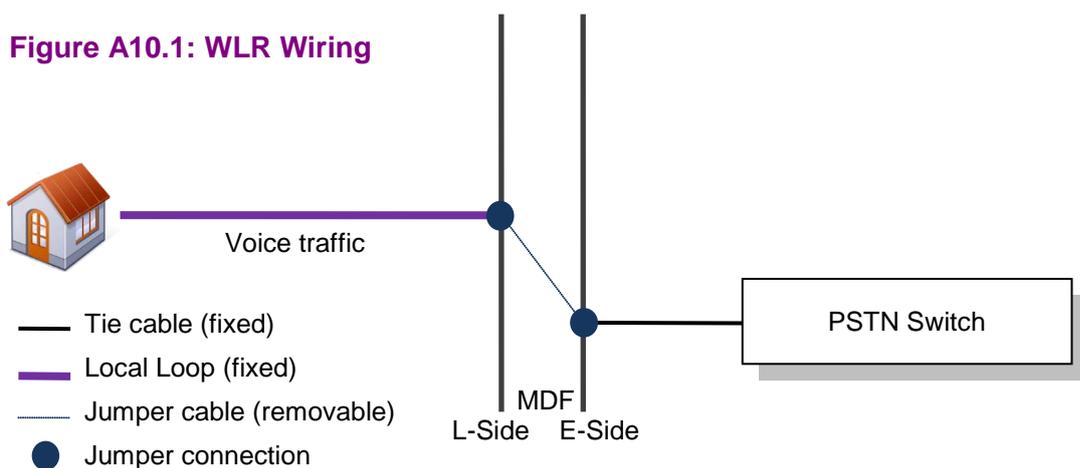
Introduction

A10.1 This annex provides a brief description of the exchange wiring arrangements associated with the provision of core LLU and WLR Rental products. Understanding these wiring arrangements is necessary to understand the engineering activity that is required at the exchange to migrate a customer from one CP to another. This activity is one of the main drivers of migration costs.

Wiring arrangements for core WLR and LLU rental products

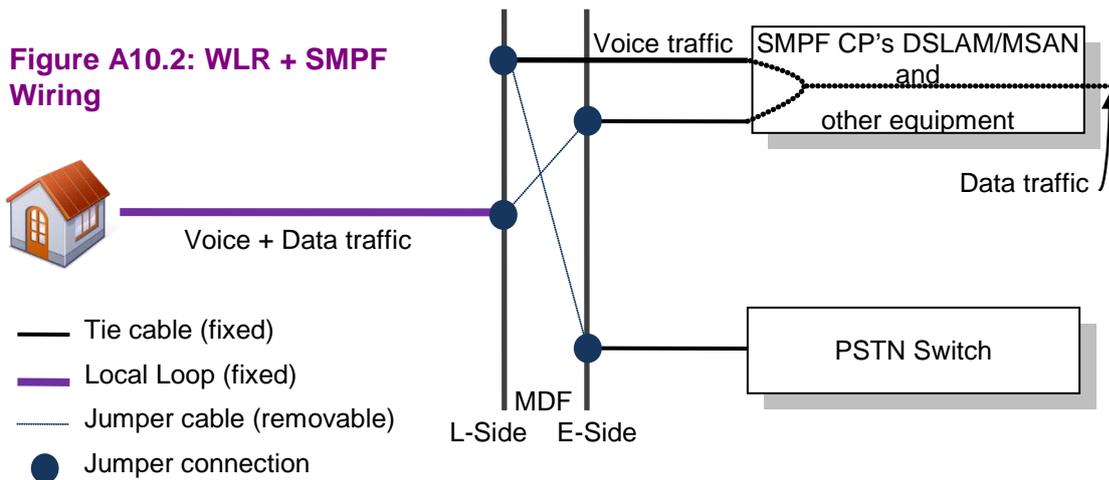
A10.2 There are three principal means by which LLU and WLR products are used to provide voice and voice + broadband services, namely: for voice only, WLR, for voice + broadband, either WLR+SMPF or MPF. Each of these products requires different wiring on the Main Distribution Frame ('MDF') at the exchange. The MDF is the termination point of the local loops of the telecommunications network (all copper telephone lines used to provide telecommunications services are terminated here). The MDF is then used to connect these local loops to additional equipment located at the exchange using jumper wires. A jumper is a copper cable that provides a flexible connection between two terminal ends, commonly used to connect the Line-Side (L-Side) to the Exchange-Side (E-Side) of the MDF.

A10.3 When migrating a customer from one CP to another the number of jumper movements needed varies according to the service required by the customer and the technology used by the gaining and losing providers. To explain this, we provide stylised representations of the MDF wiring arrangements for the various WLR and LLU products in the diagrams below.



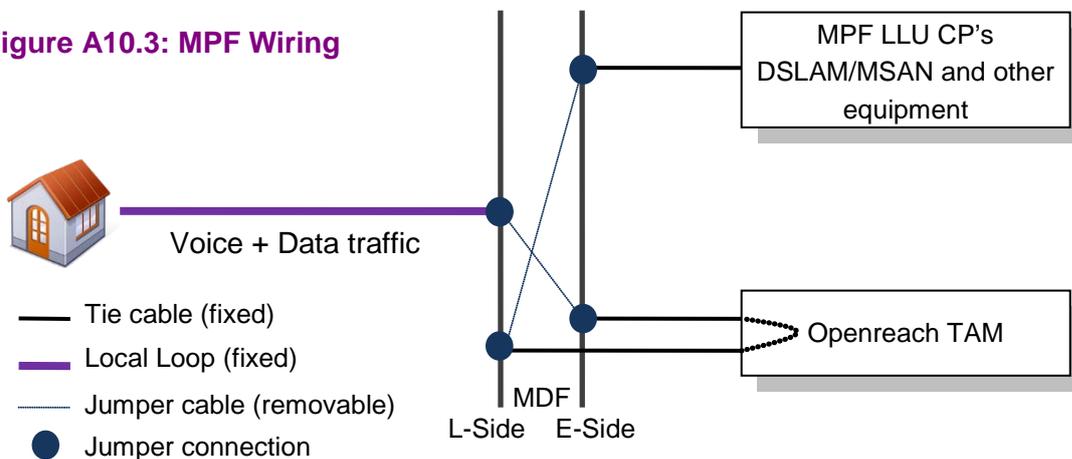
Source: Ofcom

Figure A10.2: WLR + SMPF Wiring



Source: Ofcom

Figure A10.3: MPF Wiring



Source: Ofcom

A10.4 The above diagrams show the MDF jumpering configuration (and the number of jumpers) that applies to each rental product. Each rental product relates to a different set up and must be changed where a customer requires different services or services from a different LLU operator (Migrations).

A10.5 The provision of WLR involves one tie cable, whilst both the WLR+SMPF and MPF products involve three tie cables connecting to the main distribution frame. The WLR and WLR+SMPF rental products include one tie cable; however the MPF rental product includes two tie cables. Therefore, with WLR+SMPF two tie cables must be bought separately, whereas with MPF only one tie cable is bought separately.

Jumper movements for WLR and LLU migration services

A10.6 There are eight different migration services offered by Openreach. The key difference between each of these lies in the technology used by the gaining and losing CP, which determines the number of jumper movements at the exchange's MDF. We show this in Table A10.1 below.

Table 10.1 Migration services and number of jumper movements

Service name	From	To	Jumpers		
			Removed	Installed	Total
MPF Single Migration	WLR	MPF	1	2	3
MPF Single Migration	WLR+SMPF	MPF	2	2	4
MPF Single Migration	MPF	MPF	1	1	2
SMPF Single Migration	WLR+SMPF	WLR+SMPF	2	2	4
SMPF New Provide	WLR	WLR+SMPF	1	2	3
SMPF Simultaneous Provide	MPF	WLR+SMPF	2	2	4
WLR Conversion	MPF	WLR	2	1	3
WLR Transfer	WLR	WLR	None	None	None

Source: BT's response dated 22 March 2013 to questions 6-7 of the Third LLU WLR BT Information Request.

A10.7 The different migration services are as follows:

- **MPF Single Migration** (WLR to MPF – service 1 above): involves moving from the set up in Figure A10.1 above to that shown in Figure A10.3. This means that 1 jumper is removed and a further 2 jumpers are installed.
- **MPF Single migration** (WLR+SMPF to MPF – service 2): involves moving from the set up in Figure A10.2 to that shown in Figure A10.3. This means that 2 jumpers are removed and 2 jumpers are installed.
- **MPF Single Migration** (MPF to MPF – service 3): involves remaining with the set up in Figure A10.3 but switching to another CP's DSLAM or MSAN. Thus, this requires removing the 1 jumper connecting to the equipment of the losing CP and installing 1 new jumper connecting to the equipment of the gaining CP.
- **SMPF Single Migration** (WLR+SMPF to WLR+SMPF – service 4): involves remaining with the set up in Figure A10.2 but switching to the DSLAM or MSAN of another CP. Thus, this requires removing 2 jumpers connecting to the equipment of the losing CP and installing 2 new jumpers connecting to the equipment of the gaining CP.
- **SMPF New Provide** (WLR to WLR+SMPF – service 5): involves moving from the set up in Figure A10.1 to that shown in Figure A10.2. This means that 1 jumper is removed and a further 2 jumpers are installed.

- **SMPF Simultaneous Provide** (MPF to WLR+SMPF – service 6): this service relates to the simultaneous provision of a WLR Conversion and SMPF New Provide. It involves moving from the set up in Figure A10.3 to that shown in Figure A10.2. This means that 2 jumpers are removed and a further 2 jumpers are installed.
- **WLR Conversion** (MPF to WLR – service 7): involves moving from the set up in Figure A10.3 to that shown in Figure A10.1. This means that 2 jumpers are removed and 1 jumper is installed.
- **WLR Transfers** (WLR to WLR – service 8): this service does not involve any jumpering activity at the MDF (it only consists of a systems update to reflect the change of CP).

Annex 11

Cost model documentation

Introduction

- A11.1 In Section 3, , Volume 2 we explain that we have set these controls with reference to our view of the efficient cost of a hypothetical on-going copper network. In Section 5, , Volume 2 we give an overview of the 2014 LLU WLR cost model (the Cost Model) that we have built to determine the costs of a hypothetical on-going copper network and determine the charges to be set as part of this review.
- A11.2 The Cost Model is a current cost accounting (CCA) fully allocated cost (FAC) model that incorporates a RAV adjustment (see Annex 6 for details). The Cost Model is a top-down accounting model that is based on BT's cost data provided to Ofcom under our statutory information gathering powers. The Cost Model is used to estimate how the cost of providing the relevant services will change over the period of the charge control. These costs are then used to calculate the values of X for the CPI-X control.
- A11.3 Alongside the final statement, we will publish:
- a version of the Cost Model that includes non-confidential input data and the formulae; and
 - a volume forecasting model.
- A11.4 The remainder of this annex provides detail on the following areas:
- our conceptual approach to the Cost Model;
 - the structure and implementation of the Cost Model;
 - updates and adjustments since the July 2013 WLR LLU Consultation and December 2013 WLR LLU Consultation; and
 - our approach to ensuring the model is robust.
- A11.5 Detailed explanations of the inputs to the Cost Model can be found in:
- Annex 9: LRIC calculations;
 - Annex 13: General model adjustments and inputs
 - Annex 14: WACC
 - Annex 16: Efficiency; and
 - Annex 24: Service volume forecasts.

Conceptual approach to modelling

- A11.6 Cost models can take a number of different forms. When building cost models for setting charge controls, we have historically built the following types of models, depending on the case in hand:
- Top-down model – based on total network cost data which is then allocated to services based on usage factors;
 - Bottom-up model – based on how much network equipment is needed for a projected level of volumes for specified cost drivers; or
 - Hybrid model – based on bottom-up cost drivers and then calibrated against top down cost data.
- A11.7 As described in Section 5, , Volume 2, we have constructed the Cost Model using a top-down cost modelling approach using relevant cost components contained in and underpinning BT's published RFS. We have identified from the RFS the cost components relevant to the services which are to be charge controlled.
- A11.8 We have used an anchor pricing approach to set charges, based on the efficient on-going costs of providing services over a copper network, ensuring all incremental fibre costs are excluded from the base year (and forecast) costs.
- A11.9 Once we have determined these base year costs, we then forecast the costs forwards using asset volume elasticities (AVEs) and cost volume elasticities (CVEs) applied to our forecast of service volumes.

Anchor pricing approach

- A11.10 The anchor pricing approach means that we have based our model on a copper only network that excludes any NGA equipment. As explained in Annex 24, we assume that all of the service volume demand is met by the copper network.

Stakeholder responses to July 2013 LLU WLR Consultation

- A11.11 Openreach¹⁵¹ stated that our proposed approach to modelling the costs of a hypothetical all-copper network failed to accurately reflect the true costs of such a network. Openreach stated that it was concerned that our approach to calculating the amount of common costs allocated to FTTC lines would result in an understatement of costs as FTTC lines absorb more overheads than the SMPF volumes we are using to replace them.
- A11.12 Openreach considered that our approach appeared to overlook the fact that actual NGA volumes in the base year are being allocated fixed common costs that would have been allocated to CGA services. Openreach believed that this would mean that the base year FAC data for CGA services will give an understated view of the FAC of providing the hypothetical all-copper network. Openreach considered that Ofcom should identify the fixed common costs across NGA and CGA services and reallocate that cost in a way that is consistent with the allocation methodologies in BT's RFS and reflects the adjusted base year volume of SMPF rentals and the removal of all NGA volumes. Openreach estimated that our approach understates

¹⁵¹ Paragraphs 29, 68-72, and 195-199, Openreach Response to the July 2013 LLU WLR Consultation.

the fixed common costs in the hypothetical all-copper model by around £10-£20m.¹⁵²

Our analysis and conclusion

- A11.13 We consider that our implementation of the hypothetical on-going network approach enables Openreach to recover the costs of an on-going efficient copper operator. Alongside our anchor pricing approach, we have made various adjustments to Openreach's actual costs to reflect the costs of providing an on-going copper network. For instance, as described below, we assume in our modelling that capex is equal to OCM depreciation in the base year.¹⁵³ We also ensure that the NRC/GRC ratios fall within the range that we would expect for an on-going network.
- A11.14 We are of the opinion that were we to make the adjustment Openreach is suggesting, we would be diverging significantly from the hypothetical on-going network approach which is key to our modelling of costs. We believe that the adjustments to costs that we have performed to bring them into line with a hypothetical on-going network are sufficient and no further adjustments are required.
- A11.15 Also, we do not necessarily agree that actual contribution to common costs from NGA markets should be picked up by the CGA markets. There may be a higher margin over LRIC on NGA than on CGA, but this does not mean we should increase the common costs recovered from CGA in the absence of NGA. It may not be appropriate or efficient for charges for CGA services to increase if NGA is removed.
- A11.16 In any case, in terms of actual cost recovery, we note that the level of BT's pricing of FTTC services is not constrained by ex-ante regulation. Therefore, BT has the opportunity to recover any existing overhead costs apportioned to FTTC today from its pricing of FTTC services over the control period (subject to meeting any VULA margin obligations as will be discussed in the forthcoming 2014 VULA Margin Consultation).

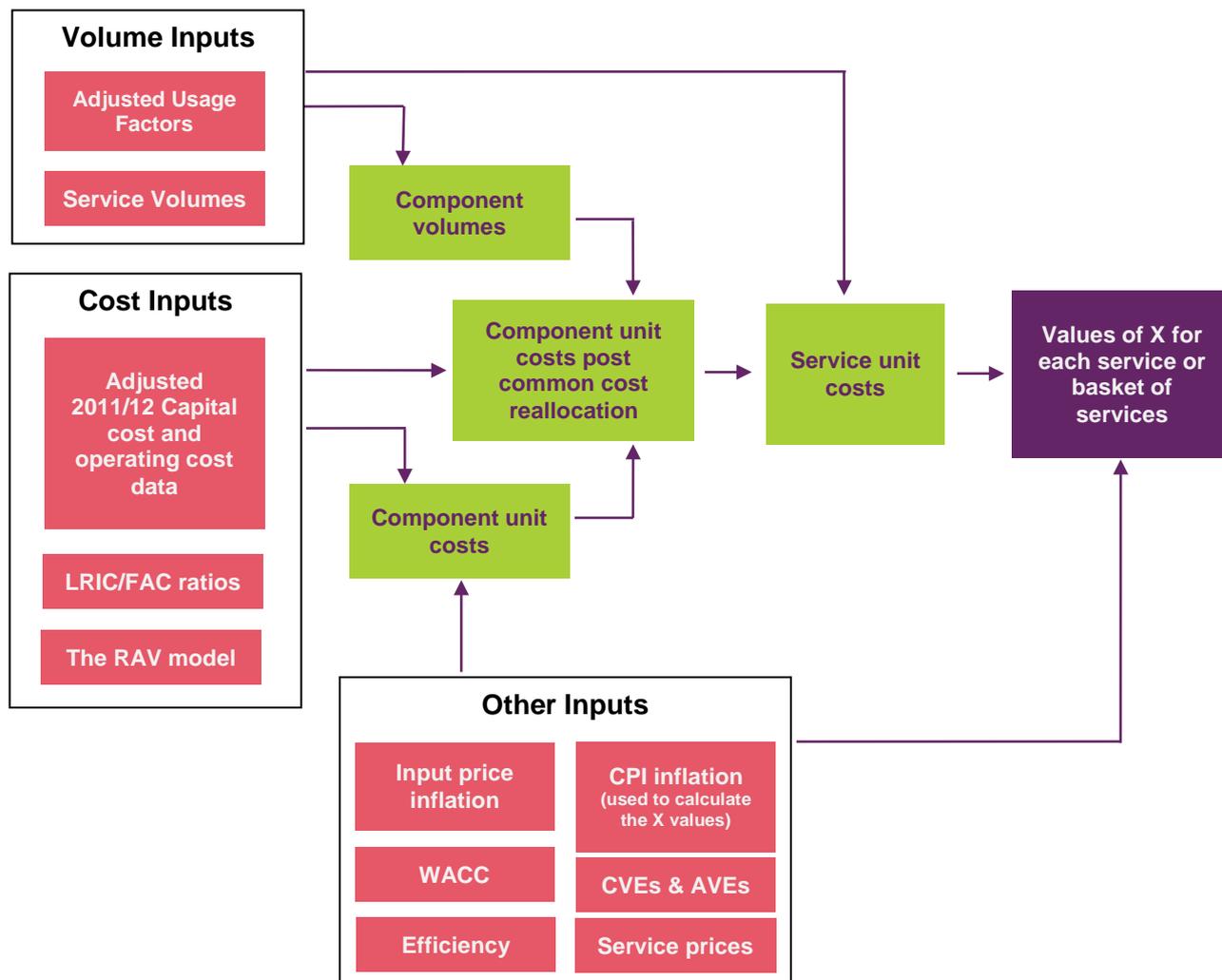
Structure and implementation of our modelling approach

- A11.17 The structure of the Cost Model is illustrated in Figure A11.1 below. The input and data assumptions are used to forecast the unit cost of each of the network components used in the delivery of WLR and LLU services. These component costs are used to determine the service costs, which are in turn used to calculate the X values for the CPI+/-X formula.

¹⁵² Paragraph 197, Openreach Response to the July 2013 LLU WLR Consultation

¹⁵³ This uplift to capex does not apply to copper- and duct-related assets.

Figure A11.1: Cost Model structure diagram



Source: Ofcom

Key model calculations

A11.18 The model performs six key calculations:

- Step 1: Calculate the forecast service volumes over the modelling period.
- Step 2: Convert service volumes to cost component volumes using service usage factors.¹⁵⁴
- Step 3: Calculate forecasts of the capital costs and opex for each component using the asset price changes, efficiency forecasts and by applying the AVEs and CVEs to component volumes.
- Step 4: Calculate service costs based on the amount that services use specific components (i.e. by using the usage factors).

¹⁵⁴ Where appropriate these usage factors reflect adjustments to take account of our decisions on service levels and quality of service.

- Step 5: Reallocate common costs to reflect incremental cost differences.
- Step 6: Calculate the X-values to be used in the CPI-X controls for each service or basket of services, as appropriate.

A11.19 The calculations are described in detail in the following paragraphs. Calculations are performed in nominal terms with a base year of 2011/12.

SMPF internal volumes

A11.20 We make an exception to our general approach to modelling services for volumes of internal SMPF services. WLA services reported in the RFS, exclude internal costs and volumes (including equivalence of input¹⁵⁵ (EOI) volumes). The information provided to us by BT under our statutory information gathering powers did not include internal costs or volumes for the WLA market as these are not included in the RFS data we requested. As a result, in the absence of any adjustment, the base year costs and total volumes of WLA services are understated in the Cost Model compared to the Openreach aggregate figures.

A11.21 For services with significant internal volumes (SMPF Rentals, SMPF Migrations and SMPF New Provide), we therefore need to ensure that the costs and volumes for SMPF services are internally consistent within the Cost Model.

Proposals in July 2013 WLR LLU Consultation

A11.22 In the July 2013 LLU WLR Consultation, we proposed to use the unit costs that we estimate from the external costs and volumes for SMPF as a proxy for the unit costs of all SMPF (internal and external) services, to ensure that the Cost Model is internally consistent.

A11.23 We stated that one complication of this approach relates to our forecast of external volumes. If the forecast trend for external volumes were to differ from our forecast trend of internal volumes, our cost forecast would no longer be representative of the total SMPF unit cost. For example, if our forecast for external volumes was to decline significantly, the unit cost would rise. However, if internal volumes were increasing to offset this, the total unit cost would not change as a result of these service volume changes.

A11.24 In order to ensure that our approach to estimating external SMPF unit cost remains consistent with our service volume forecasts, we used external SMPF volumes for the 2011/12 base year. We then forecast external SMPF volumes using our forecast trend (i.e. the forecast percentage change per year) in total SMPF volumes. This ensures that the unit cost estimate is consistent with the growth in total SMPF volumes and so will be relevant for both internal and external volumes.

Stakeholder responses to July 2013 LLU WLR consultation

A11.25 BT agreed with our proposed approach and stated that “*unit costs for external SMPF and internal SMPF will be the same*”. Using the unit costs from external

¹⁵⁵ Equivalence of input is the concept established by the undertakings in which BT provides, in respect of a particular product or service, the same product or service to all CPs (including BT) on the same timescales, terms and conditions (including price and service levels) by means of the same systems and processes, and includes the provision to all CPs (including BT) of the same commercial information about such products, services, systems and processes.

SMPF which are published in the RFS and applying these unit costs to all SMPF is reasonable.¹⁵⁶

A11.26 TalkTalk stated that:

“inclusion of internal SMPF in the (external) SMPF volume means that the volume driver for LLU systems costs includes internal SMPF volumes. This would appear to be inappropriate as our understanding is that internal SMPF does not use LLU systems and thus does not drive the costs of LLU systems”.¹⁵⁷

Our analysis and conclusion

A11.27 Following TalkTalk’s response, we have considered whether it is appropriate to use the unit costs we estimate from the external costs and volumes for SMPF as a proxy for all SMPF (internal and external). We believe that this is appropriate because, on an EOI basis, the activities through which SMPF internal and SMPF External volumes are processed should be identical and our review of the processes involved in the delivery of both has not shown that there is a difference. Therefore we disagree with TalkTalk’s view that internal and external SMPF will have different cost drivers.

A11.28 We have investigated the cost of these services further and still believe that the approach we took in the July 2013 LLU WLR Consultation is the most appropriate for capturing these internal volumes and costs.

A11.29 We calculate the costs of external SMPF services and use the external unit cost as a proxy for the total unit cost for the following SMPF services:

- SMPF Rentals;
- SMPF New Provides;
- SMPF single Migrations;
- SMPF bulk Migrations; and
- Tie Cables.

Calculations of network component volumes

A11.30 The first stage of calculations in the Cost Model derive a measure of the total required usage of each component, based on service volumes¹⁵⁸ and usage factors. We calculate network component volumes as the product of service volumes and the associated usage factor by network component.¹⁵⁹

A11.31 For 2011/12, the Cost Model derives the total utilisation of each component (i.e. component volumes) based on service volumes and usage factors. For future years

¹⁵⁶ Paragraph 501, Openreach Response to the December 2013 LLU WLR Consultation.

¹⁵⁷ Paragraph 6.8, TalkTalk, *LLU/WLR Charge Control consultation. TalkTalk comments on BT’s response*, December 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/TalkTalk_Group_Comments_on_BTs_Response.pdf (TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation).

¹⁵⁸ We discuss our approach to calculating service volumes in detail in Annex 24.

¹⁵⁹ This exercise relates to Steps 1 and 2 in the above list.

(from 2012/13 to 2016/17), future service volumes and usage factors are used to calculate future component volumes.

A11.32 Usage factors describe the quantity of each component used by each service (e.g. the usage factor of PSTN line cards for WLR will be 1, as a single PSTN line card is used for each WLR service); these usage factors are later used for cost allocation. As discussed in Annex 13, some components have their usage factors adjusted in order to reflect changes in the relative quality of service for WLR, MPF and SMPF rentals.

Calculation of total network capital costs

A11.33 Openreach capital cost data have been provided for each component (partially redacted within the published version of the Cost Model) such as the gross replacement cost (GRC), net replacement cost (NRC), and holding loss/gain.

A11.34 The total capital cost for each component is calculated in three stages:

- the “steady state”, i.e. we forecast the costs assuming no volume growth;
- the “additional”, i.e. changes in forecast costs caused by volume changes; and
- total network capital costs obtained by summing the “steady state” and the “additional” costs.

A11.35 Table A11.1 defines the terms we use in the tables summarising the model calculations.

Table A11.1: Abbreviations used in our cost forecast

Abbreviation	Description
GRC_t	The value of Gross Replacement Cost (GRC) of a component in year t (taken as a year-end figure)
NRC_t	The value of the Net Replacement Cost (NRC) of a component in year t (taken as a year-end figure)
$Capex_t$	The capital expenditure on a component in year t
$Disp_t$	The value of disposals for a component in year t
$OCM\ dep_t$	The amount of operational capability maintenance depreciation for a component in year t
Eff	The percentage reduction in projected expenditure arising from efficiency gains (the same parameter is used for both capex and opex)
ChP_t	The change in price of a component in year t

Source: Ofcom

A11.36 Table A11.2 below shows the capital cost calculations for the steady state part of the model.

Table A11.2: Steady state calculations

Calculation	Description
Gross Replacement Cost	<p>The base year (2011/12) GRC values are used as the starting point. The forecasts are calculated as the addition of:</p> <ul style="list-style-type: none"> a) the previous year's GRC multiplied by the nominal asset price trend; and b) the difference between the current year's capital expenditure and the current year's disposals. $GRC_t = GRC_{t-1} * (1 + ChP_t) + (Capex_t - Disp_t)$
OCM Depreciation	<p>The base year (2011/12) OCM depreciation is the sum of HCA depreciation and Supplementary depreciation. It is used to calculate asset lives, which have then been adjusted and used to calculate the adjusted OCM depreciation</p> $OCM\ dep_t = GRC_t / \text{asset life}$
Capital expenditure	<p>The base year capital expenditure is set equal to the OCM depreciation. The forecasts are calculated by multiplying the previous year's capex value by the nominal asset price change and the assumed year-on-year efficiency gain.</p> $Capex_t = Capex_{t-1} * (1 + ChP_t) * (1 - Eff)$
Disposals	<p>We assume that the base year disposals are equal to capex. The forecasts are calculated by inflating prior year values by the nominal asset price trends.</p> $Disp(BY) = Capex(BY)$ $Disp_t = Disp_{t-1} * (1 + ChPt)$
Net Replacement Cost	<p>We calculate the forecasts of NRC as the addition of the previous year's NRC multiplied by the nominal asset price trend and the difference between the current year capex and the current year's OCM depreciation.</p> $NRC_t = NRC_{t-1} * (1 + ChP_t) + (Capex_t - OCM\ dep_t)$
Net current assets	<p>The base year NCA values by service type are equal to the 2011/12 values reported by BT. We would not necessarily expect the nominal unit NCA per service to vary materially with volumes and so we have kept the nominal unit NCA cost constant over time. As a modelling simplification, we have applied the contribution from NCA at the service level. See Annex 13 for a discussion of this approach.</p>

Source: Ofcom

Additional capital cost calculations

A11.37 The additional element of the capital cost calculation is caused by changing volumes relative to the steady state. If volumes decline, these values will be negative. If volumes increase, these values will be positive. The base year always has the additional capital cost set to zero. By model design, in the base year there is no volume growth and so no additional capital costs. Table A11.3 shows how we calculate the additional capital costs as volumes change.

Table A11.3: Additional capital costs associated with volume growth

Calculation	Description
Additional Capex	<p>We calculate the forecast as the product of:</p> <ul style="list-style-type: none"> a) The previous year's total GRC multiplied by the asset price trend; and b) The AVE and component volume change. <p>Add Capex_t = Total GRC_{t-1} * (1 + ChP_t) * AVE * % change vol_t</p>
Additional GRC	<p>We calculate the forecast as the addition of:</p> <ul style="list-style-type: none"> a) The product of the previous year's additional GRC and the asset price trend; and b) The current year's additional capex. <p>Add GRC_t = Add GRC_{t-1} * (1 + ChP_t) + Add Capex_t</p>
Additional OCM	<p>We calculate the forecast by dividing the current year's additional GRC by the asset life.</p> <p>Add OCM dep_t = Add GRC_t/asset life</p>
Additional cumulative OCM depreciation	<p>We calculate the forecast by multiplying the previous year's additional cumulative depreciation by the asset price trend and then adding the current year's additional OCM depreciation.</p> <p>Cumulative Add OCM dep_t = Cumulative Add OCM dep_{t-1} * (1 + ChP_t) + Add OCM dep_t</p>
Additional NRC	<p>We calculate the forecast by subtracting the additional cumulative OCM depreciation from the additional GRC.</p> <p>Add NRC_t = Add GRC_t – Add cumulative OCM dep_t</p>

Source: Ofcom

A11.38 Using the steady state and additional cost calculations, we can determine the total capital costs (i.e. OCM depreciation, return on capital employed and holding gain/loss). The total capital cost calculations are described in Table A11.4 below.

Table A11.4: Total capital costs

Calculation	Description
Total GRC	Sum of the steady state (ss) GRC and additional (add) GRC. $\text{Total GRC}_t = \text{ss GRC}_t + \text{add GRC}_t$
Total capex	Sum of the steady state capex and additional capex. $\text{Total Capex}_t = \text{ss Capex}_t + \text{add Capex}_t$
Total NRC	Sum of steady state NRC and additional NRC. $\text{Total NRC}_t = \text{ss NRC}_t + \text{add NRC}_t$
Total OCM depreciation	Sum of steady state OCM depreciation and additional OCM depreciation. $\text{Total OCM}_t = \text{ss OCM dep}_t + \text{add OCM dep}_t$
Total return on capital	Sum of NCA and total NRC all multiplied by the pre tax nominal cost of capital. We apply NCA at the service level, so when component costs are calculated total capital employed is equal to the total NRC. $\text{Return on capital employed}_t = (\text{NCA}_t + \text{Total NRC}_t) * \text{WACC}$
Total holding loss	Product of the nominal price change and the total NRC. $\text{Holding loss}_t = \text{Total NRC}_{t-1} * \text{ChP}_t$
Total capital costs	The sum of the return on capital employed, the total OCM depreciation and the total holding loss.

Source: Ofcom

- A11.39 For future years, the total network capital costs by component are forecast based on the AVE, efficiency gains, component volumes and asset price changes. The component unit capital cost is derived from these data, using the component volumes calculated previously.
- A11.40 Within these calculations, the capital cost values for the duct and cable asset classes are replaced by RAV values for the years covered by these charge controls (2014/15 to 2016/17). We discuss these RAV calculations in Annex 6.
- A11.41 The capital costs input data including GRC, NRC, Supplementary Depreciation and HCA Depreciation for some components have been adjusted to reflect changes in relative quality of service for WLR, MPF and SMPF rentals. These adjustments are explained in detail in Annex 13.

Calculation of total network operating costs

A11.42 Openreach has provided pay and non-pay opex by component for 2011/12, which when summed provides us with total opex per component. Similar to capital costs calculations, the opex data for some components have been adjusted to reflect changes in the relative quality of service for WLR, MPF rentals and SMPF rentals. These adjustments are explained in detail in Annex 13.

A11.43 We calculate the forecast opex as described in Table A11.5 below.

Table A11.5: Opex cost calculations

Calculation	Description
Productivity adjusted opex change factor	We calculate this factor as the combined effect of factor price changes and the assumed efficiency gain, split by pay and non-pay categories. $\text{Prod Adj}_t = (1 + \text{ChP}_t) * (1 - \text{eff})$
Total opex (non-pay)	We calculate the forecast by multiplying the previous year's non-pay opex by the productivity adjusted operating cost change factor and by the volume growth factor, given by 1 plus the product of the component volume change and the CVE for non-pay. $\text{Non-pay}_t = \text{Non-pay}_{t-1} * \text{Prod Adj}_t * (1 + \% \text{ change vol}_t * \text{CVE})$
Total opex (pay)	We calculate the forecast by multiplying the previous year's pay opex by the productivity adjusted operating cost change factor and by the volume growth factor, given by 1 plus the product of the component volume change and the CVE for pay. $\text{Pay}_t = \text{Pay}_{t-1} * \text{Prod Adj}_t * (1 + \% \text{ change vol}_t * \text{CVE})$
Total opex	The sum of the total non-pay and pay operating costs.

Source: Ofcom

Calculation of total unit component costs and service unit costs

A11.44 Using the total capital and operating costs, the total costs for components, unit cost for components and unit cost for services are described in Table A11.6.

Table A11.6: Total cost calculations

Calculation	Description
Total component costs	Sum of the total capital costs (Table A11.3) and the total operating costs (Table A11.4) by component.
Component unit costs	The total component costs divided by component volumes.
Unit costs by service type	The product of the unit cost by component and the usage factor by component type for each service.

Source: Ofcom

Reallocation of common costs based on the LRIC differential

A11.45 We have set the charges for some services with reference to their forecast LRIC rather than forecast FAC costs, or based on the difference in their LRIC compared with that of another regulated service. Forecast long-run incremental cost (LRIC) has been calculated by applying an historical LRIC:FAC ratio to the forecast FAC at the component level.

A11.46 For prices regulated at LRIC, the unrecovered common cost is then recovered over the main rental services. This is done in such a way so as to ensure the price differentials for the main rental services reflect their LRIC difference.

SMPF internal common costs

A11.47 As discussed above, the model does not directly capture SMPF internal volumes. When we estimate the common costs to be recovered from SMPF services, which we proposed to set at LRIC in 2016/17 (see Section 3, , Volume 2), we need to use the total SMPF volumes to estimate the total amount of common cost to be recovered from WLR and MPF Rental services. We calculate the common costs to be reallocated as:

$$\begin{aligned}
 & \text{Common cost to be reallocated} \\
 & = (\text{SMPF rental Unit FAC} * \text{Total SMPF rental volumes}) \\
 & - (\text{SMPF rental LRIC 16/17} * \text{Total SMPF rental volumes})
 \end{aligned}$$

A11.48 We multiply the FAC and price by total volumes (i.e. internal and external) as we propose that the prices set are applicable to both internal and external volumes. Therefore, in order to ensure that Openreach has the opportunity to recover its efficiently incurred costs, the correct volume of total SMPF services for this calculation is the total volume. This is applicable to all SMPF services where we set prices based on LRIC.

Stakeholder responses to July 2013 LLU WLR consultation

A11.49 In its response to the July 2013 LLU WLR Consultation, EE was concerned about the way we reallocated the common costs from SMPF to MPF and WLR. As set out

above we proposed to set the charges to reflect the difference in LRIC in 2016/17. EE was concerned that because the LRIC for SMPF was declining over the period, this approach would result in the over-recovery from MPF and WLR of the common costs that would otherwise have been recovered from SMPF.¹⁶⁰

Conclusion

A11.50 We have adopted a glide path approach for the core rental services for the reasons set out in Section 6, Volume 2. By using a glide path approach, it is possible that charges may be higher (or lower) than costs during the first two years of the charge control.

A11.51 Because we have followed the glide path approach, we do not propose to further consider further the reallocation of common costs from SMPF to MPF and WLR on a year by year basis as suggested by EE. We have calculated the common costs to be recovered from SMPF services in 2016/17 (i.e. the end of the glide path) using the same approach as we proposed in the July 2013 LLU WLR Consultation.

Calculation of the X value for each regulated service and basket

A11.52 The X in a CPI-X glide path is the yearly percentage change required to equalise unit costs and unit charges at the end of the glide path, i.e. in 2016/17, the final year of the charge control.

A11.53 The X-value is fixed for the control period and as such it must be based on the forecast for CPI inflation, rather than the inflation figure for the base year. To ensure the correct unit cost target is achieved, the value for X is based on a geometric average of the forecast CPI inflation rates for the period of the charge controls.

A11.54 To perform this calculation for individual service caps (such as the core rentals), the following inputs are used for each service:

- proposed charge (as adjusted for LRIC adjustments) in 2016/17;
- CPI geometric mean (for the charge control period, 2013/14–2016/17); and
- service price in 2013/14.

A11.55 For the Hard Ceases basket that consists of MPF Hard Ceases and SMPF Hard Ceases. We use the following inputs for the calculation of X for the basket comprising these two services:

- service price in 2013/14;
- forecast service volume in 2016/17;
- forecast service FAC in 2016/17; and
- CPI geometric mean (for the charge control period, 2013/14–2016/17).

A11.56 The forecast FACs of MPF and SMPF Ceases in the Cost Model include a mix of both hard ceases and soft ceases (we do not have the cost data disaggregated between hard and soft ceases at the component level, however we do have cost

¹⁶⁰ Page 35, EE Response to the July 2013 LLU WLR Consultation.

data at the product level which we have used to calculate the value of X for the Hard Ceases basket). However, the trend of the FAC changes in the Cost Model provides a useful proxy for the trend change for the hard ceases FAC. The forecast hard ceases FAC in 2016/17 is therefore calculated based on the FAC in 2011/12 and the trend of FAC growth in the Cost Model, which is then adjusted to reflect the simultaneous migrations and connections cost adjustments (described in Annex 8, paragraphs A8.20-A8.32).

A11.57 For the Co-Mingling ancillaries basket, we use the following inputs:

- volume forecasts for MPF Room Build and MPF hostel rentals in 2016/17;
- FACs for MPF Room Build and MPF hostel rentals in 2016/17;
- CPI geometric mean (for the forecast period, 2014/15–2016/17); and
- Prices of MPF Room Build and MPF hostel rentals in 2013/14.

A11.58 We do not have any data on the costs of individual services included in the MPF New Provides and MPF Tie Cables baskets. We therefore calculate the X-values for these two baskets at the aggregate level using data including:

- aggregate volume forecasts in 2016/17;
- aggregate FACs in 2016/17;
- average prices in 2013/14 weighted by volumes of individual services in the baskets; and
- CPI geometric mean (for the forecast period, 2014/15–2016/17).

A11.59 We do not have any cost data on the services in the LLU Ancillaries basket. Given that most of these services are used internally by BT, we have made the decision to set the X at the same level as the general efficiency rate (i.e. 5%). For more explanation please refer to Section 4, Volume 2.

Rounding of X

A11.60 In the July 2013 LLU WLR Consultation we presented the X within the charge controls rounded to the nearest 0.25%. This was different to the March 2012 Statement in which we rounded the X to the nearest 0.1%.

A11.61 Some stakeholders commented on this level of rounding. BT said that X should continue to be rounded to the nearest 0.1% in the interests of accuracy. It said that *“[g]iven the number of different individual controls the potential cumulative effect could be very material across the Charge Controls as a whole.”*¹⁶¹ BT also noted that Ofcom had not provided a rationale for this change in approach.

A11.62 TalkTalk also said that X should be rounded to the nearest 0.1% rather than the nearest quarter of a per cent.¹⁶² TalkTalk said rounding to the nearest 0.25% is “coarse” and noted that previously Ofcom had set X to the nearest 0.1%.

¹⁶¹ Paragraphs 173-174, Openreach Response to the July 2013 LLU WLR Consultation.

¹⁶² See paragraphs 3.3 and 7.1, TalkTalk Response to the July 2013 LLU WLR Consultation.

A11.63 Following the above stakeholders' responses on rounding of X, we have considered further the appropriate level of rounding.

A11.64 Firstly, we note that rounding to the nearest 0.1% would be consistent with the rounding level of the inflation statistics reported by ONS. As explained above, the inflation indexed cap is calculated on the basis of CPI which is reported by the Office for National Statistics (ONS) with an accuracy of 0.1%.

A11.65 Secondly, we also agree with BT and TalkTalk that rounding the X to the nearest 0.1% will be consistent with the previous LLU WLR charge control. Although the March 2012 Statement and the consultations preceding it¹⁶³ did not discuss this matter, we set the X in that statement to the nearest 0.1%.

Conclusions

A11.66 We have decided that for the purposes of these LLU WLR charge controls we will round the X to the nearest 0.1%. This will make the rounding for the charge controls consistent with that used in the March 2012 Statement and consistent with the way inflation is reported by the ONS

Updates and revisions to the Cost Model since the December 2013 LLU WLR Consultation

A11.67 Since the publication of the July 2013 LLU WLR Consultation and the December 2013 LLU WLR Consultations, we have received a number of responses from stakeholders regarding our modelling. We have considered the responses and made our policy decisions. Where applicable, we have also made further changes to the model.

Updates and revisions with no structural changes to the Cost Model

A11.68 We have made changes to either update parameter values based on new information we have obtained or revise some input values based on new information or policy decisions. These updates and revisions do not lead to structural changes to the model.

- Update on services volumes: We have replaced the volumes forecasts for 2013 with the outturns and updated the services volumes forecasts. Please refer to Annex 24 for details.
- Update on RAV adjustments: The basis for the RAV adjustment is the RAV model as published with the July 2013 LLU WLR Consultation. We updated two sets of assumptions in the RAV model: RPI and the capital expenditure forecast. The capital expenditure forecast with the RAV is based on a forecast provided by BT that we adjust in the Cost Model for our volumes and efficiency assumptions.
- Update on WACC: The pre-tax nominal WACC for Openreach was estimated to be 8.8% in the December model and is now updated to 8.6%. Please refer to Annex 14 for details.

¹⁶³ Ofcom, *Charge control review for LLU and WLR services – Consultation*, 31 March 2011, <http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/summary/wlr-cc-2011.pdf> and Ofcom, *LLU and WLR Charge Control – Further Consultation*, 23 November 2011, <http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc/summary/condoc.pdf>.

- Update on TAM costs: The TAM cost has been updated from £5.50 in the December model to £5.15. Please refer to Annex 13 for details.
- Update on the LRIC differential between WLR+SMPF rentals and MPF rentals: The differential has been reduced from £10 in the December 2013 model to £1.79 in the Cost Model. Please refer to Annex 9 for details.
- Update on SMPF rentals: The value of SMPF rentals has been updated from £7 in the December 2013 model to £2.61 in the Cost Model. Please refer to Annex 9 for details.
- Revision to factor price changes: The factor price changes for non-pay have been revised. Please refer to Annex 13 for details.
- Update on inflation rates including RPI and CPI: We have replaced the forecast RPI and CPI for 2013 with the actual March 2013 rates and updated the forecasts using the latest March 2013 forecasts compiled by HM Treasury.
- Update on the Directories charge in 2013/14: The cost related to the provision of directories which has been included in the WLR rentals charge has been updated from £2.23 in the December 2013 model to £1.43 as we updated our calculations. Please refer to Annex 13 for details.
- Revision to MPF, SMPF and WLR charges: The charge controls for the core rentals of MPF, SMPF and WLR in 2013/14 have been revised in line with the corrections made to the 2012 charge controls following the Competition Commission's determination of the appeals against those charge controls.¹⁶⁴
- Revision to the LRIC:FAC ratio of WLR transfers: The LRIC:FAC ratio of WLR transfers has been revised from 93% in the December 2013 model to 87% in the Cost Model. Please refer Section 4, Volume 2 for details.

Updates and revisions with structural changes to the Cost Model

A11.69 In addition to the updates and revisions above, we have also made a number of adjustments to the Cost Model, which have involved structural changes to the model.

- Update on QoS adjustments: We have updated cost uplifts and usage factors to reflect relative changes in the quality of service for WLR, MPF and SMPF Rentals. Please refer to Annex 13 for details.
- Revision to the allocation of NCA costs: The NCA costs were allocated to cost components for the capital costs calculation in the December 2013 model. We have changed the methodology and they are now applied to services costs directly at the service level. Please refer to Annex 13 for details.
- Adjustments to MPF tie cable costs: The information we have requested from BT shows that the FAC of MPF tie cables has been over-stated by £3.43 per tie

¹⁶⁴ The revision is made pursuant to order 3 of the Competition Appeal Tribunal, *British Telecommunications Plc v Office of Communications, Case 1193/3/3/12; British Sky Broadcasting Limited and TalkTalk Telecom Group Plc v Office of Communications, Case 1192/3/3/12 – Ruling on disposal of the appeals*, 29 April 2013, http://www.catribunal.org.uk/files/1192-93_BSkyB;BT_Ruling_290413.pdf.

cable and the cost should be reduced by that amount. Given that we do not have the corresponding base year cost data for the relevant components, e.g. on GRC, NRC or operating costs, we have calculated the total cost difference that should be removed and then removed it from the capital costs and operating costs in proportion to their costs before the adjustments in order to bring down the unit FAC of MPF tie cables in 2011/12 by £3.43.

- Removal of deafness costs from the total costs: We have obtained the unit cost associated with health related claims for deafness¹⁶⁵ on a per component level for 2011/12. We remove these costs from the base year capital and operating costs via a percentage mark-down.
- Adjustments to SMPF New Provides: The volume of SMPF New Provides also includes WLR+SMPF Simultaneous Migrations and WLR+SMPF Simultaneous Connections in the calculations for the cost forecasts, which is consistent with the cost data. However, when we calculate the LRIC differentials and cost recovery from simultaneous migrations and connections, we need to exclude the volumes of these two services to avoid double counting. In addition, the control on SMPF New Provides has been aligned with the control on other single migrations. As a result, the charges of all single migrations have been set at their volume-weighted average LRIC costs.
- Revision to Hard Ceases: In the December 2013 model, we forecast the FAC of Hard Ceases based on the FAC data for 2012/13 because we did not receive the 2011/12 data in time to be incorporated in the model. We have now updated the FAC forecast using the 2011/12 data obtained from BT. In addition, we have also revised the calculation of the X-value to take account of the cost mark-up for simultaneous migrations and connections.¹⁶⁶
- Adjustment to Soft Ceases costs: We have added in adjustments to Soft Ceases costs to reallocate the FAC of Soft Ceases to WLR and MPF rentals. The LRIC of Soft Ceases is likely to be relatively low. We have therefore used its FAC as a proxy of its common costs. We forecast the FAC of Soft Ceases based on the 2011/12 data we have obtained from BT and calculate the total cost of Soft Ceases in 2016/17, which is then allocated to MPF and WLR Rentals on an equal per line basis.
- Adjustment to Combi Card costs: The cost of Combi Cards has been removed from the capital costs and operating costs in the calculation of services costs following our policy decision discussed in detail in Annex 13.
- Corrections of errors: Since the publication of the December 2013 model, we have identified several errors in the Cost Model regarding Scenario 8 of MPF product volume demand, Class of Work price changes for some components, Holding Loss/Gain calculations in the unit capital costs calculation, and the 2011/12 GRC for QoS cost mark-up calculations. We have now corrected these errors in the Cost Model.

¹⁶⁵ BT had set aside a “Specific Group Provision” relating to claims for deafness arising from the historical use of copper line testing equipment previously used by engineers.

¹⁶⁶ As explained in Section 4, Volume 2, we re-allocate costs across services involving jumpering work at the exchange to address Openreach’s concerns relating to under-recovery of the costs of providing these services, which arise out of our decision in relation to simultaneously provided services. We explain in more detail the mechanics of this reallocation of costs in Annex 8.

Ensuring the model's outputs are robust

Reconciliation of the model

A11.70 The starting place for the Cost Model is BT data, which is drawn from the same data source as that used for the 2011/12 RFS. We would therefore expect the Cost Model to closely reconcile to BT's 2011/12 RFS. We considered that it was important to ensure that the Cost Model (absent any adjustments) closely reconciled to the RFS to ensure that the starting place for the Cost Model would provide Openreach with the opportunity to recover its forward looking efficiently incurred costs.

A11.71 Prior to making adjustments to the Cost Model parameters (e.g. changing usage factors or cost allocation assumptions among the modelled services) we checked that the Cost Model reconciled to the RFS. We did this by comparing the model as populated with the cost data provided by BT in response to our statutory information requests with the cost information reported in BT's RFS. This was done at the level of the unit FAC for all services in the Cost Model.

A11.72 We considered at a service level, where the difference between the 2011/12 cost stack in the Cost Model differed from the 2011/12 cost stack in the RFS by:

- more than 1%; and
- more than £0.15,

we would make an adjustment to the Cost Model.

A11.73 This led us to adjust two services: MPF rentals and MPF hostel rentals. We examined the component unit costs of these services and identified two cost components which did not reconcile to the 2011/12 RFS, namely:

- Broadband line testing; and
- LLU Hostel rentals.

A11.74 We therefore adjusted the operating costs¹⁶⁷ to reflect this. This added £3.4m to the total operating costs in the Cost Model.

A11.75 As discussed in Annex 22, we have used the data contained in BT's 2011/12 RFS as the base year for the Cost Model. Given our reasons for not using the data in BT's 2012/13 RFS, we do not believe that it would be appropriate for us to attempt to reconcile the Cost Model's outputs in 2012/13 to the 2012/13 data provided by BT.

Model review

A11.76 In addition to the financial reconciliation, we have undertaken multiple reviews to ensure the model is robust and fit-for-purpose. The model has undergone an Ofcom internal peer review and has been externally reviewed by Cartesian. At a high level the Cartesian review "*did not find any significant issues that would undermine the validity and accuracy of the charge control*". As part of its review, Cartesian did identify some minor issues with the Cost Model, which we have addressed.

¹⁶⁷ We only adjusted the opex as a modelling simplification.

Annex 12

Cost Model

A12.1 The Cost Model will be published with the final statement.

Annex 13

Detailed cost modelling assumptions

Introduction

A13.1 This annex explains the detailed modelling adjustments and assumptions used in the Cost Model that are not covered elsewhere in Volume 2. This annex explains and, where relevant, quantifies the impact of our decisions. The results of the Cost Model are set out in Annex 28.

Summary of our decisions

A13.2 In this annex we set out our decisions on the following adjustments and assumptions and summarise their impact on the unit costs of the rental services. For the purposes of this annex, we have split our analysis of the detailed modelling assumptions into three categories:

- assumptions that change the base year costs as reported in the July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation, namely:
 - Resource uplift for minimum Quality of Service standards, fault and service level cost differential (A13.5 to A13.61);
 - Group Overheads (A13.62 to A13.70);
 - Deafness Provision (A13.71 to A13.79);
- changes to forecast assumptions made after the July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation, including to incorporate updated input data, namely:
 - Net Current Asset (NCA) adjustments (A13.81 to A13.88);
 - Room build adjustment (A13.89 to A13.98);
 - Combi card adjustment (A13.99 to A13.108);
 - Broadband line testing costs (TAM adjusted only) (A13.109 to A13.147);
 - Inflation update (including for the RAV adjustment) (A13.148 to A13.199); and
- other assumptions where we have maintained the approach set out in the July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultations, namely:
 - CVEs (A13.200 to A13.221);
 - AVEs (A13.222 to A13.236);
 - recovery of common costs from the 2013 BCMR Statement (A13.237 to A13.240);
 - BT pension costs (A13.241 – A13.260);

- DSLAM capital maintenance (A13.261 – A13.275);
- copper recovery income (A13.276 – A13.282);
- IT costs (A13.283 – A13.289);
- Northern Ireland (A13.290 – A13.292);
- Career Transition Centre (CTC) Costs (A13.293 – A13.297);
- telephone directories (A13.298 – A13.330);
- dropwire (A13.331 – A13.337);
- pair gain (A13.338 – A13.346); and
- PSTN line test (A13.347 – A13.350).

Changes to base year cost assumptions since the December 2013 LLU WLR Consultation

A13.3 We set out below the detailed modelling adjustments that we have made to the base year costs since the December 2013 LLU WLR Consultation. As set out in Annex 22, the Cost Model takes as its starting point (or base year) the costs for 2011/12 reported in BT's 2011/12 RFS.

A13.4 We consider each of these adjustments in turn, below, starting with the Resource uplift, fault rates and service level cost differential.

Resource level uplift for minimum Quality of Service standards and Fault and service level cost differential.

Proposals in the December LLU WLR 2013 Consultation

A13.5 In Sections 3, 4 and 5 of the December 2013 LLU WLR Consultation we set out our substantive analysis of the appropriate total costs of fault related activities and the allocation of these costs between different services. In Annex 12 of the December 2013 LLU WLR Consultation we set out our approach to modelling these assumptions. In broad terms, we consider two issues, as follows:

- the resource level uplift for minimum Quality of Service standards (“Resource Uplift”) where we uplifted eight quality of service related cost components by 3.9% to reflect the additional costs associated with the proposed minimum standard for quality of service;
- the fault and service level cost differential (“Fault and Service Differentials”), where we adjusted the combined fault rate and service level usage factor to reflect the proposed allocations set out in Sections 4 and 5 of the December 2013 LLU WLR Consultation. We applied the proposed combined service level allocation and fault rate allocation to five repair related cost components.¹⁶⁸

¹⁶⁸ Note that the Resource Uplift is applied to three additional cost components that include provisioning elements being MDF Jumping, Routing and Records and PSTN Line testing Equipment.

A13.6 We provide a summary of our proposals on these issues below, before considering stakeholders' responses and setting out our final decision.

The Resource Uplift

A13.7 As set out in section 3 of the December 2013 LLU WLR Consultation, we proposed minimum standards for the provision and repair of LLU and WLR services. As these proposed minimum standards represented an improvement in quality of service, there was a cost implication which was encompassed in the 3.9% Resource Uplift.

A13.8 In order to apply the 3.9% uplift within the Cost Model, we undertook a detailed assessment of the repair and provision costs within the 2011/12 base year.

A13.9 We used our statutory information gathering powers to request information from BT on the 2011/12 engineering costs associated with the provision and repair of LLU and WLR services, as recorded in BT's 2011/12 RFS. In response, BT provided the costs for the eight cost components involved in provisioning and fault repair for LLU and WLR.¹⁶⁹ For each of these cost components, BT provided a breakdown of operating cost and capital expenditure.

A13.10 The operating costs for these eight cost components comprise the engineering costs directly allocated to the component by Class of Work¹⁷⁰ and other costs which would not arise in the absence of repair and provisioning work, e.g. training and transport costs. We first isolate the variable engineering costs within each of these components, as this is the subset to which we consider the uplift should be applied. We deducted some costs from the cost to be uplifted in two steps; (a & b) and then apply the uplift to the remaining costs (c). We do not uplift all the cost but a proportion because pre-emptive and routine maintenance costs relate to investment in the network as a whole rather than being reactive to faults. To calculate the uplift we:

- a) deduct engineering costs identified as pre-emptive or routine maintenance costs;
- b) deduct the same proportion from other costs as we had deducted from engineering costs; and
- c) adjust the resultant total operating cost (a + b) downwards to take account of internal LLU¹⁷¹. We then applied a 3.9% uplift to the resultant total operating cost. The resultant uplift was then added to the base year total operating costs in the same proportion as the existing pay and non-pay split.

A13.11 The capital expenditure cost for the Dropwire capital & PSTN NTE¹⁷² cost component that we uplift was calculated in the same manner and for the same reasons as explained as for the treatment of operating costs. The same 3.9% uplift was applied to the resultant the net capital expenditure and added back to the base year costs as follows:

¹⁶⁹ D-side Current, E-side Current, LE Frames Current, MDF Jumpering, Drop Wire Maintenance, Dropwire Capital & PSTN NTE, PSTN Line Test Equipment & Routeing and Records.

¹⁷⁰ Class of Work refers to the type of activity or asset type on which an engineer is engaged and refers to the code used to collect and post such engineering costs to the General Ledger. The General Ledger is the accounting database used to capture raw financial data.

¹⁷¹ The data provided by BT included internal LLU cost data, whilst The Cost Model excluded it.

¹⁷² The Dropwire capital & PSTN NTE cost component was the only cost component related to provisioning and repairs with material capital expenditure.

- Gross Replacement Cost (GRC) was increased by the total uplift;
- Net Replacement Cost (NRC) was increased by the GRC addition less a year of uplifted depreciation¹⁷³; and
- OCM Depreciation (i.e. HCA plus supplementary depreciation) was uplifted by the same proportion as the GRC uplift.

The Fault and Service Differentials

A13.12 In Sections 4 (Service level) and 5 (Faults) of the December 2013 LLU WLR Consultation we explained that LLU and WLR services had different levels of service and faults. For service levels, the time taken to repair WLR basic differed from WLR Premium and MPF. On faults, lines that carried data (MPF, WLR+SMPF) had a higher propensity to fault than lines that did not (WLR only). Both these differentials had cost implications we needed to reflect in the Cost Model. In particular we said that both the E-side and D-side copper current cost components' usage factors should be adjusted for both the fault rate allocation and the service level differential.

A13.13 Having conducted further analysis, we also considered that the usage factors relating to the cost of repairs to two other network components, PSTN drop maintenance and local exchange general frames current should also be driven by the fault rate allocation in addition to the service level allocation as proposed in the July 2013 LLU WLR Consultation.¹⁷⁴ We considered that this would provide a more representative allocation of repair costs overall, as faults relating to these network components are included in the calculation of the fault rate allocations.

A13.14 We also proposed to also apply the fault rate and service level differential to the DSLAM (capital maintenance) cost component.¹⁷⁵

A13.15 We set out in Tables 4.3 and 5.8 of the December 2013 LLU WLR Consultation our revised allocations that we proposed to apply to the fault rate and service level allocation. We proposed to apply the revised allocations to five faults-related cost components.¹⁷⁶ The proposed allocations are summarised below in a combined usage factor, which is the product of the fault rate and service level allocations.

Table A13.1: Proposed allocation of fault rate and service level allocations in December 2013 LLU WLR Consultation

	WLR Basic Rentals	MPF Rentals	SMPF Rentals
Fault rate allocation	0.87	1.00	0.13

¹⁷³ As this is 'new' capital expenditure, we remove a full year's depreciation in the year of acquisition.

¹⁷⁴ The service level allocations are based on an assessment of the copper network outside the exchange. It may therefore be possible that they may not be completely representative of service level differences within the exchange. However, in the absence of better information, we have used the same ratios.

¹⁷⁵ We understand from BT that the cost component DSLAM capital/maintenance is incorrectly named (see paragraphs A13.254 to A12.275 below) and does not relate to DSLAM but broadband faults. As such we consider that it would be captured by our analysis of fault rates and should be treated consistently with the other fault related cost components.

¹⁷⁶ D-side Copper Current, E-side Copper Current, LE General Frames Current, Drop Wire Maintenance and DSLAM capital/maintenance.

Service level allocation	1.00	1.141	1.141
Combined usage factor – used in cost modelling ¹⁷⁷	0.87	1.141	0.15

A13.16 We explained that the Cost Model does not include internal SMPF volumes or costs. We stated that as we were adjusting usage factors which include SMPF rentals, we made an off-model adjustment to reflect the fact that total costs included in the Cost Model will change as they are moved to/from SMPF internal rentals. For example, where the allocation to SMPF rentals had increased, we removed an appropriate proportion of the costs from the Cost Model to reflect the fact that some costs would move from MPF rentals and WLR rentals and into internal SMPF rentals which were not captured by the model. We explained that if we did not do this, we would be overstating the costs within the Cost Model.

A13.17 We explained that we calculated this adjustment to total costs in the Cost Model by calculating the total costs for each cost component for each service, including internal SMPF (calculated as the SMPF unit cost multiplied by SMPF internal volumes). We then reallocated these costs using the new component volumes and usage factors to derive an adjusted unit cost for each service. Finally, we explained that we calculated the new total to be included in the Cost Model (total costs less internal SMPF costs) and increased/decreased proportionally the costs in the Cost Model to reflect the increase/decrease to costs as a result of the re-allocation.

Stakeholder responses

A13.18 We have considered stakeholder responses within two categories, as follows¹⁷⁸:

- General responses on our approach to modelling Quality of Service costs; and
- Responses relating to the Resource Uplift and the Fault and Service Differentials.

Stakeholders' responses relating to our general approach to the Quality of Service

A13.19 We have considered stakeholders' comments under the following headings:

- Early life failure (ELF) costs
- Network investment costs
- CVEs and AVEs

A13.20 We consider these in turn, below.

Early Life Failure costs

¹⁷⁷ The combined usage factor is calculated as the fault rate allocation multiplied by the service level allocation.

¹⁷⁸ The responses received in connection with Service assurance costs related to both the Resource Uplift and Fault and Service Differentials, We have therefore considered these responses together.

- A13.21 In the December 2013 LLU WLR Consultation we explained that we did not consider that any further adjustment needed to be made in relation to ELF rates over and above what was captured in the overall faults rates.
- A13.22 TalkTalk argued that it would be more appropriate to recover ELF repair costs and related service assurance costs from provisioning and migration activities rather than from the main rental services. However, in TalkTalk's view, in-life failures (ILF) repair and related service assurance costs should be recovered from rental charges. It considered that this would better reflect cost causality and therefore mean that charges would better reflect costs. It also considered that this approach would avoid a mis-estimation of the overall level of faults that would result from Ofcom's current approach, due to the proportion of MPF provisions reducing.
- A13.23 While we accept that there are advantages from setting rental and connection charges to reflect costs, in the case of fault rates we do not consider that it is appropriate to disaggregate fault related cost in this manner on incentive grounds.
- A13.24 As we have set out in Annex 20, we have chosen to equalise the faults rates between MPF and WLR+SMPF as we consider the evidence for a material difference between the propensity to fault of the services to be unsound on engineering and process grounds.
- A13.25 Further, to the extent ELF rates are higher than might be expected there is evidence that this is due to Openreach processes and operator testing issues which are currently the subject of investigation by the industry. In any event it is clear that ELF levels, where they differ from ILF are significantly influenced by Openreach's processes.
- A13.26 Our conclusion is that we would be concerned about disaggregating costs which are so susceptible to BT process choices. This might act as an incentive on Openreach to deprioritise fault reduction activity related to services more actively used by non-BT CPs.

Network Investment Costs

- A13.27 In the December 2013 LLU WLR Consultation we did not separately describe whether any costs in relation to specialist engineers were included within our overall engineering costs.
- A13.28 Openreach questioned whether the costs associated with specialist repair jobs referred to as 'Network Investment Activity' were included in the engineering costs that we uplifted by 3.9%.
- A13.29 We can confirm that this cost activity has been included in the engineering costs we have uplifted.

Cost volume elasticities (CVEs) and Asset volume elasticities (AVEs)

- A13.30 We explained in the July 2013 LLU WLR Consultation that part of the purpose of the Cost Model is to forecast how costs change as volumes of services change. As described in Annex 11, the Cost Model translates service volumes into component

volumes using usage factors. The relationship between the percentage change in the component volumes and the percentage change in total cost is determined by the CVEs and AVEs. For instance, if we have a CVE of 0.5 and component volumes increase by 1%, total operating costs will increase by 0.5%.

- A13.31 In its response, Openreach noted our proposal that there is a 14.1% cost difference between Care Level 2 services and Care Level 1 services. Openreach also noted that as the volume of MPF lines increases over the control period (while the volume of WLR lines falls), the ratio of Care Level 2 services to Care Level 1 services increases. This will mean that the total costs associated with faults should increase even if the number of faults does not increase. Openreach considered that the increase in cost from this migration between WLR and MPF was less than it should be because of the application of CVEs. Openreach gave the example of E-side copper current where the CVE is 0.54. Openreach observed that because of this CVE, the effective differential of those WLR volumes that migrate to MPF was 7% rather than 14.1%. Openreach believed that this was an inappropriate application of our CVEs.
- A13.32 Having considered Openreach's response, we believe that the current implementation in our Cost Model is correct and accurately captures the change in costs when services migrate from WLR rentals to MPF rentals. The 14.1% resource difference between Care Level 2 and Care Level 1 services has been calculated by analysing engineering activity associated with the different services. It is not in itself an estimate of the total cost difference because it will not consider common and fixed costs.
- A13.33 In a static cost allocation exercise, these common and fixed costs are likely to be allocated based on the incremental costs and so the 14.1% cost difference is an acceptable proxy for the total cost difference. However, as a line moves from being a WLR line to an MPF line, we would not expect the total cost of that line to increase by 14.1%. Rather, the incremental part of the cost would increase by 14.1%. The interaction of the AVEs and CVEs with the usage factors will mean that as volumes switch between services the increase in total cost will only reflect the difference in incremental costs of the two services.
- A13.34 In conclusion, we would not expect additional resource usage to require an equivalent increase in costs.

Stakeholder responses relating to the Resource Uplift and the Fault and Service Differentials

- A13.35 Comments from stakeholders relating to the Resource Uplift and Fault and Service Differentials are considered below under the following headings:
- 13.35.1 Capital expenditure uplift (Resource Uplift)
 - 13.35.2 Adjustment to the usage factors (Resource Uplift)
 - 13.35.3 Service assurance costs (Resource Uplift and Fault and Service Differentials)

Capital expenditure uplift

A13.36 Openreach stated that Ofcom had made an error in its modelling for the December 2013 LLU WLR Consultation in the capital expenditure uplift applied as part of the resource uplift calculation¹⁷⁹:

“Ofcom calculates capital expenditure uplifts to be applied in rows 7, 8, 9 and 10 of the ‘data ref sheet 4b’. However, when applying this uplift to the dropwire capital cost component later in the model, Ofcom erroneously multiplies the uplift by the contents of an empty cell. This has the effect of multiplying the capital expenditure uplifts by zero, thereby reducing it to zero. This can be seen in rows 20 and 56 of the ‘capital costs 11-12’ sheet. The model therefore understates the capital element of the Quality of Service uplift.”¹⁸⁰

A13.37 We have checked the Cost Model and Openreach has correctly identified an error in the non-confidential redacted version of the model we published in December.

A13.38 We have satisfied ourselves that the error was only located in the redacted December 2013 LLU WLR Consultation version. The confidential version which we use to model the costs for the purposes of the charge control did not replicate this error.

Adjustment to the usage factors

A13.39 Openreach argued that the methodology we employed for the resource uplift resulted in a lower cost increase than should have been modelled. Openreach stated that reducing the direct and indirect costs appropriate for the resource uplift (as per steps a) and b) set out above) by the proportion of 2011/12 volumes in the Cost Model plus internal LLU volumes (as set out step (c) above) might be reasonable in principle, but ‘when applying it in practice Ofcom overstates the reduction’¹⁸¹ as:

“In particular, the reduction to ‘a & b’ is applied to e-side and d-side copper repair cost by introducing internal SMPF rental volumes. The SMPF rental volumes are at an equal weighting to WLR and MPF rental volumes. However, SMPF has a much lower usage factor of e-side and d-side copper. Therefore, if internal SMPF volumes are to be introduced into the calculation at all, they should have a reduced weighting which reflects their lower usage factor.”¹⁸²

A13.40 We believe that Openreach has expressed a valid concern and that the usage factors used to derive the component volumes for each of the eight cost components on which we apply the resource uplift should reflect the usage factors calculated by Openreach for all the services we are modelling (including internal LLU volumes).

A13.41 Previously in our cost modelling we used the cost component volumes derived using Ofcom’s adjusted usage factors. For the purposes of calculating the cost reduction, we have used the original usage factors provided by BT. This means that the cost component volumes excluding internal volumes are consistent with those

¹⁷⁹ Paragraph 339, Openreach Response to the December 2013 LLU WLR Consultation.

¹⁸⁰ *Ibid.*

¹⁸¹ Paragraph 338, Openreach Response to the December 2013 LLU WLR Consultation.

¹⁸² *Ibid.*

component volumes we use from the RFS to provide the equivalent cost component volumes inclusive of internal LLU volumes.

A13.42 We have concluded that we should use the Openreach usage factors provided in order to calculate the cost reduction we apply to the relevant engineering costs appropriate for the resource uplift.

Service assurance costs

A13.43 In the December 2013 LLU WLR Consultation we explained that service centre assurance costs relate to the costs of operating the service centres which deal with repairs and also include the payments to customers under the repair SLG schemes. A number of responses to the July 2013 LLU WLR Consultation questioned the relativities of the service assurance costs for the MPF and WLR rentals.

A13.44 In paragraph 7.61.1 in the December 2013 LLU WLR Consultation, we explained that it might be appropriate to amend the allocation of service centre assurance costs in the same way as we have adjusted other cost components (such as D-side copper current costs) that are affected by faults and Service Levels. We sought stakeholder views on whether this would be appropriate.

A13.45 In its response, Openreach suggested that the uplift for quality of service minimum targets being applied to the field force cost components should also be applied to its service management functions. Openreach argued that any increase in service delivery activity will result in consequent additional requirements in the service management centres. As they carry out active job/fault control and the level of this activity will increase as more short term deadlines are targeted and more manual intervention is required. Openreach identified the location of the service management costs as the cost components 'OR Service Centre Assurance LLU', 'OR Service Centre Assurance WLR', 'OR Service Centre Provision LLU' and 'OR Service Centre Provision WLR'.

A13.46 TalkTalk considered that the costs of service assurance should be allocated in the same proportion as fault rates. It did not agree that higher service assurance costs should be allocated to MPF than to WLR + SMPF.

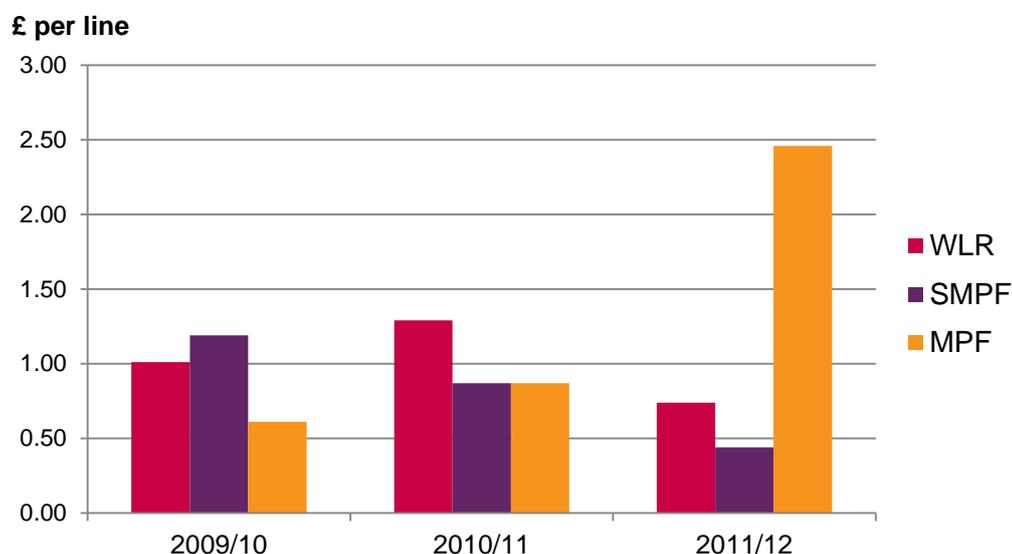
A13.47 Regarding Openreach's comments on the Resource Uplift, we accept that the establishment of the minimum targets is likely to have an impact on the Service Management function but it is not clear that the impact on the Service Centre costs listed above is proportionate to the estimated change in the field force.

A13.48 Firstly, as we noted in the December 2013 LLU WLR Consultation, the 'service assurance' costs have two main elements: the costs of running Openreach service centres and the Service Level Guarantee (SLG) payments to CPs.

A13.49 The impact of the new minimum standards is likely to have differing impacts on both these elements. It is likely there will be some increase in effort in service assurance as noted by Openreach, but with improved performance we would expect that issues related to the escalation of poor performance issues by CPs is likely to be reduced. On the other hand, it is not clear that there will be any increase in the costs associated with SLG payments, in fact with better performance it may be the case that such costs may reduce.

A13.50 Regarding the allocation of Costs to Services, the level of service assurance costs attributed to each of WLR, SMPF and MPF in the RFS has varied significantly over time, as can be seen in Figure A13.1 below.

Figure A13.1: Allocation of service assurance costs in the RFS over time



Source: BT's RFS.

A13.51 Given this variability, relying on the results from the RFS for any particular year could be subject to considerable error over the charge control period.

A13.52 In Annexes 17, 19 and 20, we have considered in detail how the fault and Service Level costs might be expected to differ for the three different services, and how this may impact on relevant costs. We have used the ratios derived from that work to distribute relevant cost components (such as E-side and D-side copper current costs). We consider that the service centre assurance costs would be expected to vary with faults and Service Levels in the same way as these other cost components.

A13.53 In conclusion, we do not consider that it is appropriate to apply the Resource Uplift to these cost categories as this is likely to lead to a substantial over-estimate of the cost change. However, we have adjusted service centre assurance costs so that they are in line with the usage factors used for other cost components affected by faults and Service Levels.

Conclusions on our approach to modelling the Resource uplift for minimum Quality of Service standards and Fault and Service level cost Differentials

A13.54 As a result of the updated analysis and the decisions we have presented above, we have updated the Cost Model to take account of our decisions on the resource uplift for minimum Quality of Service and the Fault and Service rate Differentials. In summary, the updates to the Cost Model are as follows:

- we apply an uplift to costs for eight quality of service related cost components to reflect the additional costs associated with the proposed minimum standard for quality of service;

- we adjust the fault rate and service level usage factor to reflect the proposed allocations as set out in Annexes 19 and 20; and
- we have concluded that there is a 21% cost difference between Care Level 2 services and Care Level 1 services in Annex 19. We apply this combined service level allocation and fault rate allocation to five repair provisioning related cost components.

A13.55 We set out our decision relating the Resource Uplift and Service Level Differential, in more detail, below.

Resource Uplift

A13.56 We uplift the costs of repair and provision within the Cost Model by 3.9%.

A13.57 In response to Stakeholder comments we have changed the way we calculate the adjustment taking account for internal LLU volumes in part (c) of the calculation set out in paragraph A13.10. For both operating cost and capital costs we apply the 2011/12 usage factors provided by Openreach to calculate the 2011/12 cost component volumes.

The Fault and Service Differentials

A13.58 We adjust the usage factors for the five cost components' usage factors we believe should be adjusted for both the fault rate allocation and the service level differential. In Table A13.2 below we set out the revised allocations we now apply to the five fault and service related cost components based on our further analysis (set out in Annex 19 and 20).¹⁸³

Table A13.2: Allocation of fault rate and service level allocations for Statement

	WLR Basic Rentals	MPF Rentals	SMPF Rentals
Fault rate allocation	0.83	1.00	0.17
Service level allocation	1.00	1.21	1.21
Combined usage factor – used in modelling¹⁸⁴	0.83	1.21	0.21

A13.59 We apply the revised fault rate and service level allocations in Table A13.2 against two service centre cost components¹⁸⁵ so that they are reflected in the 2011-12 unit cost differentials for each of these services.

A13.60 The Cost Model does not include internal SMPF volumes or costs. As we are adjusting usage factors which include SMPF rentals, we make an off-model

¹⁸³ D-side Copper Current, E-side Copper Current, LE General Frames Current, Drop Wire Maintenance and DSLAM capital/maintenance.

¹⁸⁴ The combined usage factor is calculated as the fault rate allocation multiplied by the service level allocation.

¹⁸⁵ CL575 OR Service Centre – Assurance WLR PSTN/ISDN2 and CL577 OR Service Centre – Assurance LLU.

adjustment to reflect the fact that total costs included in the Cost Model will change as they are moved to/from SMPF internal rentals.

A13.61 We have calculated this adjustment to total costs in the Cost Model by calculating the total costs for each cost component for each service, including internal SMPF (calculated as the SMPF unit cost multiplied by SMPF internal volumes). We have then reallocated these costs using the new component volumes and usage factors to derive an adjusted unit cost for each service. Finally, we have calculated the new total to be included in the Cost Model (total costs less internal SMPF costs) and increased/decreased proportionally the costs in the Cost Model to reflect the increase/decrease to costs as a result of the re-allocation.

Group Overheads

Proposals in December 2013 LLU WLR Consultation

A13.62 In the December 2013 LLU WLR Consultation, we asked stakeholders for views on specific BT RFS cost items which they considered merited further investigation by Ofcom to establish whether they properly constitute efficiently incurred forward looking costs.

Stakeholder responses to December 2013 LLU WLR consultation

A13.63 In response to the December 2013 LLU and WLR consultations, TalkTalk questioned whether the allocation of BT Group corporate overheads should be examined. In particular TalkTalk stated that “*previously no allocation has been made to overseas activities even though overseas divisions would have benefitted from such activity meaning that the cost allocated to WLR/MPF services was excessive*”.¹⁸⁶

Our analysis

A13.64 Using our statutory information gathering powers we asked BT for a further breakdown of BT Group’s corporate overheads. We reviewed the answer provided for 2011/12¹⁸⁷ and found that only one sub-category, ‘Olympic costs’, was indirectly, allocated to overseas subsidiaries. None of the other five sub-categories of costs (‘Group property’, ‘NGA’, ‘Group functions’, ‘Own Use’, and ‘Fleet’) incorporate an allocation to overseas subsidiaries.

A13.65 BT argued that there are good reasons why there is no allocation of costs in the five sub-categories of its corporate overheads to overseas subsidiaries. BT explained that the costs of each of these five sub-categories are either costs where the overseas subsidiaries have their own resource to perform that function, e.g. ‘Group Property’, or the nature of the cost is such that it is a UK only cost, e.g. ‘NGA’ is a wholly UK driven cost.

Table A13.3: Corporate overheads: allocation overseas

Sub-category	Methodology	Allocation Overseas
--------------	-------------	---------------------

¹⁸⁶ Paragraph 2.63, TalkTalk Response to the July 2013 LLU WLR Consultation.

¹⁸⁷ BT’s response dated 21 March 2013 to question 5 of the Sixteenth LLU WLR BT Information Request.

Group property	Usage	No
NGA	100% allocation to Openreach	No
Own Use	Factored Pay	No
Fleet	100% allocation to BT Fleet	No
Olympics	Specific split	Yes (indirectly)
Group Functions	Factored Pay	No

Source: BT¹⁸⁸

A13.66 For the sub-categories ‘Group Property’, ‘NGA’¹⁸⁹, ‘Own Use’ and ‘Fleet’ as set out in Table A13.3 above, we agree with BT’s argument that the nature of the costs are such that an allocation to overseas would not be appropriate.

A13.67 We do not agree, however, with BT’s argument that none of the ‘Group Functions’ subcategory should be allocated to overseas subsidiaries. Whilst we accept BT’s explanation that certain sub-divisions of central costs within this category, such as ‘Human Resources’, are not utilised by the overseas subsidiaries as they have their own functions and as such should not be allocated overseas, our view is that this justification cannot be applied to all the costs in this category. We consider that costs such as ‘Strategy’, ‘Treasury’, and ‘Group Finance’ within the ‘Group Functions’ subcategory represent areas where it would be reasonable to expect an element of the activity to be driven and consumed by overseas subsidiaries.

A13.68 Indeed, in the context of the previous charge controls, BT did allocate Group HQ costs by Global FTE to reflect the fact that overseas divisions do use an element of these functions. It is therefore appropriate that a proportion of these costs are allocated overseas.¹⁹⁰

A13.69 We have, therefore, estimated¹⁹¹ the proportion of the total ‘Group Functions’ cost that we consider it is reasonable to assume would be consumed by overseas subsidiaries (‘Tax/Treasury’, ‘Group Finance Control’ and ‘Strategy’) and have allocated these costs using the total average employees within the respective BT subsidiaries.

¹⁸⁸ BT’s response dated 21 March 2013 to question 5 of the Sixteenth LLU WLR BT Information Request.

¹⁸⁹ We did not investigate further whether NGA overheads (which are not incremental) were correctly allocated as the total cost of that category was low \pounds .

¹⁹⁰ Paragraph A4.155, Annex 4, March 2012 Statement.

¹⁹¹ The calculation estimated the proportion of ‘Group Functions’ cost that we consider should have an overseas allocation \pounds , using the statutory accounts we used the proportions of UK (82%) and non-UK employees (18%) to re-distribute across UK and Overseas. This resulted in \pounds attributable to UK subsidiaries, which was re-allocated across the UK subsidiaries using the employee distribution. The resulting reduction of \pounds to the Openreach costs was applied to the ‘Regulatory entity’ operating cost to calculate a percentage reduction of \pounds which was then applied to the 2011-12 operating cost base in the model.

Conclusion

A13.70 We have therefore identified that a cost reduction of ⓧ¹⁹² [£5m to £10m] should be made to the base year costs.

Deafness provision

Proposals in December 2013 LLU WLR Consultation

A13.71 In paragraphs 7.100 to 7.102 of the December 2013 LLU WLR Consultation we identified provisions for deafness claims as being an area we were investigating further in order to decide whether the costs were appropriate to be recovered through charge controls.

A13.72 In the December 2013 LLU WLR Consultation we identified that BT had set aside a “Specific Group Provision” relating to claims for deafness arising from the historical use of copper line testing equipment previously used by engineers.¹⁹³ Similar costs had been excluded in previous LLU WLR charge controls.¹⁹⁴

A13.73 We had previously rejected their inclusion in the cost base of regulated charges because they did not constitute a forward-looking cost, and therefore would not constitute an efficiently incurred forward-looking cost for the purposes of the services on which we imposed charge controls.

Stakeholder responses to December 2013 LLU WLR Consultation

A13.74 Stakeholders, with the exception of Openreach agreed with the proposal that the costs associated with deafness claims should be excluded.

A13.75 Openreach argued that they should be allowed to recover the costs of the full deafness provision, or at the very least, replace them with a “notional” charge to represent the cost to BT of insuring for its employee health liabilities. Openreach argued that any notional amount (a fair premium that BT would pay) should be related to the expected costs they would pay for insurance cover at a commercial rate.¹⁹⁵

Our analysis

A13.76 BT suggested the principle of allowing it to recover a notional amount representing insurance costs late in the review process leading to setting these charge controls. BT has confirmed it does not purchase such an insurance policy and has never done so.¹⁹⁶ At one level therefore, this is simply a re-labelling of the same costs, which have previously not been recovered in regulated charges. Before we could allow Openreach to recover these “notional charges” from regulated charges, we would need to be satisfied that this would be appropriate in the light of our duties and that the recovery would be consistent with our regulatory treatment of similar costs (such as pension deficit repayments).

¹⁹² ⓧ

¹⁹³ Page 28, October RFS Report.

¹⁹⁴ Paragraph A10.16, March 2012 Statement.

¹⁹⁵ Paragraph 328, page 78, Openreach Response to December 2013 LLU WLR Consultation.

¹⁹⁶ BT’s response dated 20 December 2013 to question 9d of the Fourteenth LLU WLR BT Information Request.

- A13.77 On the information provided from BT, the deafness provision costs in question are not entirely forward-looking because they relate either to past claims or to insuring against future claims for injuries or damage to health sustained in the past. Payments for historic claims, or insurance to protect against retrospective potential claims, are not causally-related to the provision of MPF and WLR services on a forward looking basis, because BT should be capable of delivering the services efficiently without the risk of causing preventable permanent injury to its current employees.
- A13.78 In respect of genuinely forward looking costs associated potential deafness claims, if we were to allow a “notional” insurance premium we would want to be satisfied that these were efficiently incurred. We would expect BT to be able to provide an explicit efficiency justification, identifying the source of any savings from getting these risks commercially underwritten rather than self insuring and making sure its employees were properly equipped and trained to operate in a safe manner which minimised risks to their health. As part of this assessment, we would want to see evidence that insurance against such risks is best practice in the industry and that the premiums are in line with efficient levels. BT has not provided any information to make such an assessment.

Our Conclusion

- A13.79 In light of the above, we agree with other CPs that the provision for deafness claims should be excluded from the charge controls. BT has informed us that the cost attributed to the WLA and WFAEL in 2010/11 was \times [£8m to £12m] which we have excluded from our base year costs as described in Annex 11.

Changes to detailed forecast modelling assumptions since the December 2013 LLU WLR Consultation

- A13.80 We set out below a number of changes to forecast modelling assumptions since the December 2013 LLU WLR Consultation, which have been used in the Cost Model for this Statement.

Net Current Asset (NCA) adjustments

Proposals in December 2013 LLU WLR Consultation

- A13.81 As described in Annex 11, the NCA contributes to the mean capital employed of a component. For the Cost Model in the July 2013 LLU WLR Consultation, we only had data for NCA at the service level.¹⁹⁷ We allocated these service level NCAs to components using usage factors.

Stakeholder responses to July 2013 LLU WLR Consultation

- A13.82 In response to the July 2013 LLU WLR Consultation, Frontier Economics (in a report accompanying TalkTalk and Sky’s submissions) disagreed with the way we had allocated the NCA.¹⁹⁸ They argued that the approach used in the Cost Model

¹⁹⁷ BT’s response dated 1 March and 8 March 2013 to question 9 of the First LLU WLR BT Information Request. Using this information request we requested NCA by component but this data was not available at the time.

¹⁹⁸ See Frontier Economics, *Ofcom’s LLU and WLR Charge Controls Proposals. A report prepared for Sky and TalkTalk*, October 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Frontier_Economics_report.pdf.

did not reflect cost causality because it did not adjust for the volume of services using a component, or the cost of the component. Frontier Economics argued that a more appropriate approach would be to turn the NCA into a mark-up on overall costs.

Our analysis

A13.83 Having considered this matter further, we agree with TalkTalk and Sky that the approach used in the Cost Model was not appropriate, because it did not reflect the cost contribution of components to services. However, we do not believe that the approach suggested by Frontier Economics would be an appropriate alternative. This is because the level of NCA is typically determined by the terms of payment for a particular service. Due to the way services are purchased, we would expect different services to attract different levels of NCA. By using a blanket mark-up across components, we lose this relationship between the NCA and the service being purchased.

A13.84 We have considered two further options for treating NCA in the model:

- a) Requesting that Openreach provides NCA allocated by component; or
- b) Keeping NCA at the service level and apply the return on capital employed associated with NCA to services after the component cost calculations have taken place.

A13.85 We first requested information on NCA allocated by component from BT, which BT provided.¹⁹⁹ On scrutinising this data we found that it reconciled at the aggregate level with the previous NCA costs at the services level. However, we were not able to reconcile these two sets of data from the services to the component level using usage factors that BT had provided. We could not therefore use this data in the Cost Model.

A13.86 Option b) involved us calculating the unit cost contribution the NCA makes to the service cost stack in the base year. We then assume that this unit cost contribution remains constant during the modelling period. We have no reason to believe that changing volumes of services or efficiency would cause the unit cost contribution to change.²⁰⁰ We consider this to be an acceptable modelling simplification in the light of the problems with our previous approach and obtaining more detailed data. We then apply this unit cost mark-up once the service costs have been calculated from the component costs. By using this approach, we maintain the relationship between NCA and the regulated service.

Conclusion

A13.87 We agree with TalkTalk and Sky that we should change the way we calculate the NCA. We disagree with the approach suggested by Frontier Economics and we also do not believe it is appropriate for us to use the BT allocations of NCA by component.

¹⁹⁹ BT's response dated 28 February 2014 to question 1 of the Seventeenth LLU WLR BT Information Request.

²⁰⁰ We have examined the historic trend in unit NCA cost contribution on a service bases and found no relationship with changes in volumes of the services.

A13.88 In order to maintain the relationship between NCA and the regulated service, and as a modelling simplification, we have calculated the NCA contribution to the unit cost stack for each service. We have then assumed that these unit cost contributions remain the same over time and we have applied them to their respective services for each year of the modelling period.

Room Build adjustment

Proposals in the December 2013 LLU WLR Consultation

A13.89 In the Cost Model for the July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation, the cost forecast of component “CL131 Local Loop Unbundling Room Build” (hereafter “Room Build”) was conducted following the general approach of the Cost Model, i.e. the total cost consisted of capital costs and opex, which were forecast based on the AVEs/CVEs, component volumes forecast, efficiency gains and asset/factor price changes. This cost component was not consumed by the rental services, and therefore does not affect their costs.

Stakeholder responses to December 2013 LLU WLR Consultation

A13.90 In response to the July 2013 and December 2013 LLU WLR Consultations, Openreach argued that there was an error in our modelling of the Room Build service because the model predicted negative capex over the forecast period. Openreach argued that there would be increased points of presence over the forecast period, which would require additional Room Build capex. Openreach therefore believed that to have negative capex would significantly understate the capex that it will incur.

Our Analysis

A13.91 In the Cost Model, we forecast a significant decline in the volume of Room Build services over the charge control period. As discussed in Annex 11, as service volumes decline, component volumes will also decline. The decline in component volumes will have the AVE applied to it to give us the decline in capex. It is possible that if the decline in component volumes is large enough, some assets that are not fully depreciated are being removed from the asset base because they are no longer needed. This appears in our forecast as negative capex.

A13.92 In considering whether the above relationship is appropriate for the Room Build component, we have considered a number of issues:

- i) Why do we see such a large decline in Room Build volumes?
- ii) Is the level of capital employed for Room Build service correct?
- iii) Would an operator dispose of Room Build assets if they were no longer needed?

Why do we see such a large decline in Room Build volumes?

A13.93 The Room Build forecasts in the Cost Model in the July 2013 LLU WLR Consultation were based on our expectation of the number of new Room Builds that would be required. Due to the number of exchanges being unbundled reducing, we expected that there would be a sharp decrease in the number of Room Builds. We now understand that the Room Build service also includes Room Build upgrades.

Although new Room Builds will decrease over the forecast period, we expect Room Build upgrades to increase.

A13.94 We do not believe that we can accurately forecast the increase in upgrades over the modelled period. We also believe that we are not able to accurately forecast the change in cost for the Room Build service as volumes switch from Room Build to Room Build upgrades.

Is the level of capital employed for Room Build service correct?

A13.95 Whilst investigating the cost of the Room Build service, we discovered a large increase in the mean capital employed for the Room Build component between 2010/11 and 2011/12 (c. 3x). BT explained to us that this was caused by an historical error in the allocation of certain building work and equipment costs that should have been allocated to the Room Build service.²⁰¹ This made attempting to model Room Build costs using volumes an even more difficult exercise.

Would an operator dispose of Room Build assets if they were no longer needed?

A13.96 An efficient operator may or may not choose to dispose of Room Build assets – for example, it may be efficient to dispose of assets if no future recovery of volumes is expected. However, given that we do not believe the current modelling approach is appropriate for the Room Build service, this is a moot point, which we have not considered further.

A13.97 Given the uncertainty around the development of the Room Build service, we have sought to develop an appropriate modelling simplification with which to forecast costs. We believe that the costs for Room Build in the base year present an acceptable starting point and so have assumed that unit costs remain constant over time, but have an efficiency factor applied to them.

Conclusion

A13.98 Given the uncertainty around the forecast of the volumes of Room Build services over the control period, we do not believe that it is appropriate for us to model Room Builds in the same way as other services. We believe that an acceptable modelling simplification is for us to calculate the unit cost of Room Build services in the base year and forecast them as constant over time but with the efficiency factor applied to them. The impact of the adjustment is on the LLU ancillary baskets rather than the rental services. The impact on the Comingling and New Provides Basket was to add £0.1m in 2016/17.

Combi card adjustment

Proposals in the July 2013 LLU WLR Consultation

A13.99 Linecards are the electronic equipment that connects the copper pairs from BT's access network into the BT core network at the local exchange. Linecards represent an important input for WLR Rentals but do not form part of the provision of MPF Rentals.

A13.100 In the July 2013 LLU WLR Consultation the starting point for the Cost Model input was BT's 2011/12 RFS data. This included two types of linecards based on different

²⁰¹ BT's response to question 2 of the Seventeenth LLU WLR BT Information Request.

technology. PSTN Line cards are the most commonly used line cards and uses Time Division Multiplexing (TDM) technology. The PSTN line cards only recognise voice traffic. Usually when BT provides a data service it generally uses an additional piece of equipment (a DSLAM) that takes the data traffic. The PSTN asset base includes fully depreciated linecard assets.

A13.101 There are also newer Combi cards that were installed within MSANs prior to 2009 in certain exchanges as part of a trial. The MSANs and Combi cards are capable of supporting both voice and broadband; however the trial never progressed beyond providing the voice service.

A13.102 In the July 2013 LLU WLR Consultation we explained that the 2011/12 RFS linecard cost was £8.13 per WLR rental, and the Combi card cost was £0.24 per WLR rental. This had fallen from the 2010/11 cost, reported in the RFS, of £8.51 and Combi card costs of £0.84 per WLR rental.

A13.103 We proposed to estimate linecard costs by uplifting the NRC of the linecard cost component to set the annual per line cost at £11 in 2011/12. This approach was consistent with the estimate of linecard costs in the March 2012 Statement.²⁰² To implement the proposal we suggested this should be done by adding £690m to the NRC.

A13.104 We also proposed to gather more data on the NRC/GRC ratios of the linecard assets in order to determine whether we could adjust the ratio between the NRC and GRC to one which replicated the NRC/GRC ratio over a period which we deemed to be steady state in the March 2012 Statement (e.g. 2004-2009).

Stakeholder responses to July 2013 WLR LLU Consultation

A13.105 BT agreed that the PSTN linecard costs should be inflated to a steady state basis. This was because “Prices based on costs for mature products will sometimes be too low because some of the assets that support them are fully depreciated. If there is no adjustment for this, then mature products prices will decrease and customers will be discouraged from moving to new services”.²⁰³

A13.106 BT suggested that Ofcom should not uplift line card costs to £11 but should instead uplift the ratio of NRC to GRC to 50% and make a revision to the asset life. BT believed that this option would better reflect the value of an ongoing asset in the mid-point of its life-cycle, and is consistent with what was used for the ISDN30 charge control and previous charge controls. BT said that the current NRC to GRC ratio was 11%²⁰⁴ and proposed that we change the calculation of asset lives to allow for a higher base year depreciation in the ratio of 50% / 11% which BT calculated to be 14 years.

Our analysis

A13.107 BT did not provide us with an impact of its proposed methodology. We have attempted to replicate the calculation based on appendix 1 of the 2011/12 RFS²⁰⁵ using BT’s 11% NRC:GRC ratio. We made some broad assumptions on how

²⁰² The reasoning for the Line card cost used in the March 2012 Statement was set out in the March 2011 Consultation.

²⁰³ Paragraph 508, page 81, Openreach Response to the July 2013 LLU WLR Consultation.

²⁰⁴ Paragraph 511, page 81, Openreach Response to the July 2013 LLU WLR Consultation.

²⁰⁵ Page 96, BT’s 2011/12 RFS.

operating costs (excluding depreciation) might change in line with an uplifted asset base. We assumed that costs were more likely to fall (as newer line cards may be more reliable and require less maintenance) than rise (as newer line cards may give rise to other issues), and assumed a range of opex falling by 20% or rising by 10%. This resulted in a range of £9.90 - £13.50. We consider that this represents the range for reasonable steady state estimates for PSTN line card costs. Given that the estimate of £11 sits within this range, we have decided to use £11 as the steady state PSTN line card estimate in 2011/12. It would be inappropriate to include an allocation of Combi Card costs (which are spread over all WLR volumes in BT's 2011/12 RFS) in addition to this £11, because the £11 represents a steady state PSTN line card cost, per WLR line.

Conclusion

A13.108 We have decided to set the cost of PSTN line cards at £11 by increasing the NRC for the linecard cost component by £715m. As the £11 reflected a steady state PSTN line card component in the Cost Model, we have reduced the cost of the Combi Card component to zero.

Broadband line testing costs (TAM and evoTAM costs)

A13.109 Broadband line testing costs are composed of two components:

- TAMs (Test Access Matrices) used by every MPF line; and
- evoTAMs (evolutionary Test Access Matrices) used by some SMPF lines.

A13.110 For the reasons set out in the sections that follow, we have decided that TAMs costs should be recovered only from MPF, and that a reasonable estimate of a TAM in 2011/12 is £5.15 per MPF line. We have also decided that evoTAM costs should not be recovered from any of the services covered by the charge controls.

Proposals in July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation²⁰⁶

A13.111 In both the July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation we proposed to recover TAM costs only from MPF lines. At the time of the December 2013 LLU WLR Consultation our view was that, on the basis of the available evidence, TAM costs were likely to be around £5.50 per MPF line in 2011/12, and that this was unlikely to vary significantly over time.²⁰⁷ This was based on a seven year asset life.

A13.112 EvoTAM costs have previously been recovered from SMPF and WLR, based on a ratio of 0.6 for WLR to 1.00 for SMPF. In the July 2013 LLU WLR Consultation, we proposed to recover evoTAM costs only from SMPF lines.²⁰⁸ We revised our proposals in the December 2013 LLU WLR Consultation and proposed to exclude evoTAM costs from SMPF (as well as excluding them from WLR).²⁰⁹ We considered

²⁰⁶ A brief explanation of TAMs and evoTAMs is contained in the glossary. For a diagrammatic representation of the wiring for these assets in the access network see Annex 10.

²⁰⁷ Paragraphs 3.83 to 3.95 and also from 6.136 of the July 2013 LLU WLR Consultation, and also paragraphs 7.19 to 7.27 of the December 2013 LLU WLR Consultation.

²⁰⁸ Paragraphs 6.148 to 6.150, July 2013 LLU WLR Consultation.

²⁰⁹ Paragraphs 7.28 to 7.33, December 2013 LLU WLR Consultation.

this would better reflect cost causation, the distribution of benefits and contribute to the promotion of effective competition.

Responses to the December 2013 LLU WLR Consultation proposals

A13.113 Although Openreach's accounting life for TAMs is five years, it agreed with using a seven year asset life for TAMs for the purposes of the charge control in order to ensure consistency with the asset life used in the Single Jumper MPF dispute.²¹⁰ However, it revised the calculation it had previously provided to Ofcom of what the TAM costs would be with a seven year asset life in order that Ofcom might use estimates of the overhead rate for TAMs consistent with the RFS. Based on the RFS overhead rate, Openreach considered that Ofcom should use \times [£5 to £7] to reflect its estimate of the higher unit costs.²¹¹

A13.114 Openreach disagreed with excluding evoTAM costs from SMPF. It said that "the appropriateness of preventing the recovery of these efficiently incurred costs in this adjustment is at least debatable given that evoTAMs could be used by other CPs". Openreach also argued for a gradual removal of evoTAM costs, which we consider in Section 6, Volume 2.²¹²

A13.115 TalkTalk considered Ofcom's estimate of the incremental cost of TAMs to be too high.²¹³ It noted that Ofcom's provisional estimate in the December 2013 LLU WLR Consultation was of an incremental TAM cost of £5.07, based on a FAC of £5.50 multiplied by a LRIC to FAC ratio of 92%. It considered that the incremental cost of TAMs that Ofcom used in the Single Jumpered MPF Dispute Determination could be approximately derived from the NPV outputs and Cost Model, and that these implied an incremental TAM cost of around £4. TalkTalk provided its calculation to Ofcom.

A13.116 TalkTalk believed that Ofcom should apply particularly rigorous oversight of TAM costs, given that TAMs are only used to a material degree by competitors to BT. It said that BT therefore had an incentive to inflate the costs of TAMs in order to damage its competitors. It considered that, in principle, costs could be inflated in two ways:

13.116.1 first, BT could over-allocate costs to TAMs. TalkTalk considered that such over-allocation appeared to have taken place; and

13.116.2 second, BT had little incentive to make cost efficiencies in the procurement or usage of TAMs, as by doing so it would reduce the costs of its downstream competitors.

A13.117 TalkTalk also said that given BT's lack of incentive to be efficient in respect of TAMs, it might be worth Ofcom benchmarking the efficient cost of TAMs by comparison with evoTAMs. Based on some high level assumptions, TalkTalk considered that this might imply a FAC for TAMs of £5 and a LRIC of £4.60.

A13.118 TalkTalk also said that with "*a straightforward switch from a five year depreciation policy to a seven year depreciation policy, without undertaking any offsetting adjustments, there may be a windfall gain to BT from the change. As such, TalkTalk*

²¹⁰ Paragraph 418, Openreach Response to the December 2013 LLU WLR Consultation.

²¹¹ Paragraph 420, Openreach Response to the December 2013 LLU WLR Consultation.

²¹² Paragraph 460, Openreach Response to the December 2013 LLU WLR Consultation.

²¹³ Paragraph 5.4, TalkTalk Response to the December 2013 LLU WLR Consultation.

*considers that it is imperative that the asset value of a TAM is adjusted at the time of the switch in depreciation policy, so as to eliminate the windfall gains which would otherwise accrue to BT.*²¹⁴

A13.119 TalkTalk supported Ofcom's approach of not recovering evoTAM costs from SMPF in principle, since external purchasers of SMPF use SMPF lines which do not include evoTAMs. However, it considered that excluding the evoTAM cost would only be appropriate if external SMPF customers only use SMPF without evoTAMs in 2016/17. It said it was unclear whether this will be the case, and hence it might be better for there to be two SMPF variants, one with an evoTAM and one without.

A13.120 Sky said that Ofcom's estimates of the LLU TAM costs "*appear to be too high, at an inefficient level and, potentially, insufficiently robust*".²¹⁵

A13.121 Sky said that instead of removing evoTAM cost recovery entirely from SMPF rental charges, Ofcom should instead require that there should be two SMPF variants, namely SMPF that used evoTAMs and SMPF without evoTAMs. It considered that the costs of evoTAMs should then be recovered from an SMPF variant that used evoTAMs. It said that while only BT consumes SMPF with evoTAMs currently, it is still required to be offered to all CPs on an EOI basis and that CPs may in the future purchase SMPF with evoTAMs. It said that to do otherwise could result in inefficient consumption of SMPF lines by CPs.²¹⁶

A13.122 EE agreed with removing evoTAM costs from SMPF.²¹⁷

A13.123 ☒ supported our proposals on evoTAMs and TAMs.²¹⁸

Our analysis of TAM costs

Recovering TAMs only from MPF

A13.124 The TAM is an integral part of the provision of MPF, but is not used by WLR or SMPF. Therefore, the use of MPF can be regarded as causing TAM costs. MPF is also the only service that is likely to benefit from the line testing capability of TAMs. We have therefore decided to recover TAM costs only from MPF.

A13.125 We consider there is some merit in the arguments by TalkTalk and Sky that BT may have less of an incentive to be efficient in the use of TAMs as TAMs are used primarily by BT's rivals in the retail market. We note Sky's argument²¹⁹ that spreading these costs over both MPF and SMPF may give Openreach stronger cost minimisation incentives. However, because of the concern that BT may have a weaker incentive to minimise TAM costs compared to most other costs, we have investigated TAM costs in detail. As a result of this, we consider that we are in a position to determine a reasonable estimate of the efficient cost for TAMs. Moreover, because MPF is subject to a separate charge control by means of price cap regulation with a glide path, BT will have an incentive to minimise costs over time. This effect on the costs of MPF, of which TAM costs are a component, will act in the opposite direction to the effect identified by Sky and TalkTalk.

²¹⁴ Paragraph 5.10, TalkTalk Response to the December 2013 LLU WLR Consultation. TalkTalk also shows this effect with an illustrative example in footnote 58 of its response.

²¹⁵ Paragraph 6.7(i), Sky Response to the December 2013 LLU WLR Consultation.

²¹⁶ Paragraph 6.7(ii), Sky Response to the December 2013 LLU WLR Consultation.

²¹⁷ Page 13, EE Response to the December 2013 LLU WLR Consultation.

²¹⁸ Answer to question 7.1, ☒ Response to the December 2013 LLU WLR Consultation.

²¹⁹ Paragraphs 10.20-10.21, Sky Response to the July 2013 LLU WLR Consultation.

Adjusted TAM costs in RFS

A13.126 In the 2011/12 RFS, the FAC for TAMs was £8.47 per MPF line. This was based on an asset life of five years. In the context of the Single Jumpered MPF Dispute Determination, Openreach told us that currently 80% of TAMs were fully depreciated. In the Dispute we decided that a longer asset life was justified and that a seven year economic life for TAMs was appropriate.²²⁰ We have decided to use the same asset life for the charge control and we note that no respondents to our consultation argued against using seven years.

A13.127 We asked Openreach to calculate what the TAM costs would have been in the 2011/12 RFS had a seven year asset life been used. It calculated this as being £6.56 in 2011/12.²²¹ However, in its response to the December 2013 LLU WLR Consultation, it revised upward this calculation.

A13.128 Its revision related to the size of the mark-up for overheads in the 2011/12 RFS and 2012/13 RFS (using 2011/12 allocations). In its response to statutory information requests, Openreach assumed a mark-up of 80% on top of the capital costs for TAMs to cover overheads. However, in its response to the December 2013 LLU WLR Consultation, Openreach said that a mark-up of 80% on the TAMs capital costs was needed to reconcile to the 2011/12 RFS and 2012/13 RFS (using 2011/12 allocations), when the assets were depreciated over five years. We agree that a mark-up of around 80% is required to achieve this reconciliation. Openreach considered that this percentage mark-up should also be used when calculating what the TAM costs would be when depreciating the assets over seven years. It said this would imply TAM costs of 80% for 2011/12 and 80% for 2012/13 to reconcile to the RFS but with a seven year asset life.

A13.129 However, Openreach had also incorrectly allocated to TAMs some costs relating to the installation of tie cables for evoTAMs. This has a small impact on the capital expenditure allocated to TAMs.²²² After adjusting for this, we calculate that the FAC for TAMs would have been £7.75 in the RFS in 2011/12 had a seven year asset life been used. This assumes the mark-up for overheads is 80%.

Steady state for TAMs costs from capital expenditure in 2011/12

A13.130 In addition to considering what the RFS figures would have been had a seven year asset life been used throughout, we have also considered what a steady state TAM cost would be based on the capital expenditure per TAM added in 2011/12, when that is amortised over seven years.

A13.131 We have two capital expenditure figures from Openreach for 2011/12: first, as used for the RFS and, second, as used in the management accounts, which we gathered using our statutory information gathering powers in the Single Jumpered MPF Dispute Determination. Openreach has explained to us some of the reasons for the

²²⁰ Paragraphs A3.142 and 4.137, Ofcom, *Dispute between TalkTalk Group and BT Openreach about single jumpered MPF – Statement and determination*, 15 November 2013, http://stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/open-cases/all-open-cases/cw_01019/determination.pdf

²²¹ BT's response dated 2 December 2013 to question 6(b) of the Thirteenth LLU WLR BT Information Request.

²²² BT's response dated 25 October 2013 to question 9g of the Eleventh LLU WLR BT Information Request.

differences between these two figures. Nevertheless, there remains a significant unexplained gap.²²³

A13.132 We have more confidence in the capital expenditure figures from the management accounts for 2011/12. This is partly because of what Openreach has told us about the differences between the two sets of capital expenditure futures,²²⁴ and partly because we have a better understanding of these figures from the Single Jumpered MPF Dispute Determination.²²⁵

A13.133 We also need to make an assumption about the utilisation of the 200-port TAM units, and assumed this would be 90% by the end of the period we are considering. This is the same as we made in the Single Jumpered MPF Dispute Determination.²²⁶ In doing this calculation we also have assumed the same percentage mark-up for overheads as implicit in the RFS of 3%.

A13.134 This calculation results in a steady state estimate of around 3%.²²⁷ In terms of incremental costs, if we assumed that incremental costs could be derived by assuming that none of the 3% mark-up for overheads was incremental, it would imply a LRIC to FAC ratio of 3%. This would imply a LRIC estimate for TAMs of around 3% per MPF line.

Bottom-up estimate of TAMs costs

A13.135 As suggested by TalkTalk, we have also reviewed TAMs costs using the unit cost information gathered as part of the Single Jumpered MPF Dispute Determination. This allows us to estimate capital expenditure and direct operating expenditure on TAMs for double jumpered MPF in a steady state. After making assumptions about utilisation of different pieces of equipment and assuming capital expenditure is amortised over seven years, this implies a lower LRIC of around 3% per MPF line. If we assume the same 3% mark-up on capital expenditure as is implicit in the RFS, this would imply an FAC of around 3% per line. However, we consider it possible that some cost elements are not included in this bottom up estimate, resulting in an underestimate.

A13.136 We note that TalkTalk suggests benchmarking TAMs costs by comparing them to evoTAMs costs. We have not relied on benchmarking TAMs costs in this way partly because there are differences between evoTAMs and TAMs, and partly because we do not consider it necessary.²²⁸

²²³ BT's response dated 8 November 2013 to question 9f of the Eleventh LLU WLR BT Information Request, and BT Response to the Fifteenth LLU WLR BT Information Request..

²²⁴ In its response dated 8 November 2013 to question 9f of the Eleventh LLU WLR BT Information Request, BT said "3%
Based on these bullet points, we consider the management accounts are likely to be more accurate. 3%.

²²⁵ We have however added some elements of capital expenditure from the RFS to the capital expenditure from the management accounts, for example relating to planning and computing. These adjustments are relatively small.

²²⁶ Paragraphs 4.34 to 4.47, Single Jumpered MPF Dispute Determination.

²²⁷ In contrast, using the RFS capital expenditure (after an adjustment for the incorrectly allocated costs relating to evoTAM tie cables) results in a steady state estimate of 3% in 2011/12 and 3% in 2012/13.

²²⁸ We note that in the Single Jumpered MPF Dispute between TalkTalk and Openreach, both sides modelled evoTAMs to be higher cost than TAMs. See paragraphs A3.178 and A3.179 of the Single Jumpered MPF Dispute Determination.

Decision on FAC for TAMs

A13.137 In the light of the concerns we have identified regarding the TAMs cost reported in BT's RFS and the further analysis presented above, we consider that £5.15 per line is a reasonable estimate of the FAC for TAM costs for the period for which we are setting charges. This is the average of the steady state calculation using 2011/12 capital expenditure from the management accounts (which gives around $\pounds 5.15$ and a bottom up calculation using information from the Single Jumpered MPF Dispute Determination (which gives around $\pounds 5.15$ when the same mark up for overheads is assumed as in the 2011/12 accounts). We have held this estimate of TAM costs constant over the charge control period, effectively assuming that input price inflation is offset by efficiency gains and gains from volume growth. This is lower than our provisional estimate in the December 2013 LLU WLR Consultation of £5.50.

A13.138 TalkTalk argued that adjusting the asset life of TAMs from 5 years to seven years would result in a windfall gain to BT. We recognise that given our view now that a seven year asset life is more appropriate for TAMs, this may mean that charges were set too high in the past. However, our aim in this charge control is to set forward looking costs at an efficient level. While in this case Openreach will tend to recover more than its TAMs costs when past and future charge controls are considered together, we do not consider there is any systematic bias, as other adjustments could go in the other direction.

A13.139 In terms of the LRIC, we consider that £3.75 is a reasonable estimate of the TAMs cost per MPF line for 2016/17. This is the average of the steady state calculation using 2011/12 capital expenditure from the management accounts (which gives around $\pounds 3.75$ when overhead costs are excluded) and a bottom up calculation using information from the Single Jumpered MPF Dispute Determination (which gives around $\pounds 3.75$).

Our analysis of evoTAM costs

A13.140 EvoTAMs are installed on SMPF lines that are used to provide Wholesale Broadband Connect services (an ADSL2+ service). Externally consumed SMPF lines do not currently use evoTAMs and are not expected to do so in the future.

A13.141 Recovering evoTAM costs from all SMPF lines (or from a combination of WLR and SMPF charges) would mean that lines that do not have evoTAMs would still pay part of the evoTAM cost. This would not reflect cost causation, as evoTAM costs are only caused by those lines that use evoTAMs. Recovering the costs from all SMPF lines (or from a combination of both WLR and SMPF) would not reflect the distribution of benefits either, as any benefits of enhanced testing functionality are only likely to be of benefit to lines connected to evoTAMs, rather than all SMPF lines.

A13.142 Recovering evoTAM costs from all SMPF lines is a particular concern because the only SMPF lines that are connected to evoTAMs are internal SMPF lines, that is, those used by BT Wholesale. This means that CPs other than BT are paying for evoTAMs that are used by BT Wholesale. We have therefore decided that it is not appropriate to recover evoTAM costs from SMPF lines that do not use evoTAMs.

A13.143 Some responses argued that we should set two SMPF charges, namely one for SMPF lines that use evoTAMs and one for SMPF lines that do not use evoTAMs. We have considered this, but consider it unnecessary to set a separate charge

control for SMPF with evoTAMs. This is because only other BT divisions use SMPF with evoTAMs currently and we expect that is likely to remain the case for the period of this review. Even if other CPs did purchase SMPF with evoTAMs, because they would have the option of purchasing the charge controlled SMPF service (without evoTAMs), we would expect the charge controlled service to act as a strong pricing constraint on evoTAM charges. This is because the with-evoTAM and without-evoTAM options are likely to be strong substitutes.

A13.144 We have therefore set a single SMPF charge that does not recover any evoTAM costs. We have made this change by means of a one off adjustment rather than through a glide path, and explain our reasons for this in Section 6, Volume 2.

A13.145 In order to make this one off adjustment to the WLR and SMPF charges, we need to deduct the evoTAM costs allocated to these services from the 2013/14 charge, as the 2013/14 charge is the starting point for the glide path to the 2016/17 target cost. As our Cost Model does not forecast evoTAM costs for 2013/14, we have used the evoTAM costs allocated to the WLR and SMPF rentals in BT's 2011/12 RFS as a proxy for costs in 2013/14. This means that we have deducted £0.49 from WLR and £0.86 from SMPF rentals as the one-off adjustments for evoTAMs.

Conclusion

A13.146 For TAMs, we consider it reasonable to assume a FAC of £5.15 per MPF line and a LRIC of £3.75. We assume these are constant over time.

A13.147 We have set a single SMPF charge that does not recover any evoTAM costs.

Inflation Update (including RAV)

A13.148 In Section 3, Volume 2, we explain our choice of CPI as the measure of inflation for indexing the charge control.

A13.149 Separate from how we index the cap in each year of the charge control, it is also necessary to define how input prices for each cost item vary over the modelling period in the Cost Model. In the Cost Model, we forecast input price inflation for capital costs, pay and non-pay operating costs separately. As with our general modelling approach, we seek to base our forecasts of input price changes on those that we consider would be faced by an efficient operator.

Proposals in the July 2013 and December 2013 LLU WLR Consultations

A13.150 In the July 2013 LLU WLR Consultation²²⁹ we explained that, in the Cost Model, we forecast input price inflation for capital costs, pay and non-pay operating costs separately. Our proposals for forecasting each of these cost categories were:

13.150.1 an assumption of 2.8% (which is the same as the CWU pay deal - effective from 1 April 2013 for one year) to forecast nominal wage inflation; and

13.150.2 a 3% per annum increase for non-pay costs, which uses as a proxy for all non-pay costs the forecast rental rates as part of the sale and purchase agreement with Telereal.

²²⁹See paragraphs 6.120 to 6.133 of the July 2013 LLU WLR Consultation.

A13.151 We proposed that copper and duct ‘sectors’²³⁰ assets within the Cost Model would be inflated at RPI (consistent with our RAV adjustment modelling for copper and duct), with the remaining sectors to increase at 0%.

Stakeholder responses on pay cost inflation

A13.152 EE did not have any specific comments on the input cost inflation proposals but noted that “given ongoing continuing macro-economic uncertainty” our proposed approach pay inflation assumption “appears suitably conservative” and appropriate to provide reasonable incentives on BT to manage and minimise its input costs. EE considered it important that whatever input price inflation is assumed is consistent with both the inflation “assumed for setting the charge control itself”^{231 232} and that used to estimate efficiency gains.

A13.153 BT stated that there was a linkage between pay increases and RPI inflation. BT argued that the pay settlements agreed with the CWU have been close to the rate of RPI in the March preceding the beginning of the agreement period for which the deal was agreed, and provided the table in Table A13.4 below.²³³

Table A13.4: Wage settlements between BT and the CWU, 2008 to 2013

Year	Pay Settlement	RPI in previous March
April 2008	4.3%	3.8%
April 2009	0.0%	-0.4%
April 2010	3.0% + 3 month backdate	4.4%
April 2011	3.0% (part of 3 year deal)	–
April 2012	3.0% (part of 3 year deal)	–
April 2013	2.8% + £200 lump sum	3.3%

Source: Page 97 to 99, BT Response to the July 2013 LLU WLR Consultation.

A13.154 BT also argued that recovery in the economy led it to expect future pay deals to increase by more than the RPI and that this, and the OBR forecasts it identified²³⁴ (see Table A13.5 below), suggested that there was no argument for using CPI.

Table A13.5: Extract from Table 3.5 in Office of Budgetary Responsibility publication Economic and Fiscal Outlook March 2013

	Outturn 2011	Outturn 2012	Outturn 2013	F'cast 14	F'cast 2015	F'cast 2016	F'cast 2017
CPI %	4.5	2.8	2.8	2.4	2.1	2.0	2.0
RPI %	5.2	3.2	3.2	2.8	3.2	3.6	3.9

²³⁰ Sectors are a high level category of asset used in BT’s accounting system.

²³¹ Page 29, EE Response to the July 2013 LLU WLR Consultation.

²³² We discuss the indexation of the charge control and the use of a CPI-X formulation in Section 3 Volume 2, including consideration of the response from EE

²³³ Page 97 to 99, BT Response to the July 2013 LLU WLR Consultation.

²³⁴ Page 98, BT Response to the July 2013 LLU WLR Consultation.

Wages & Salaries	2.7	2.8	2.4	3.1	4.3	4.8	4.8
-----------------------------	-----	-----	-----	-----	-----	-----	-----

Source: Page 82, OBR, *Economic and fiscal outlook - March 2013*, <http://budgetresponsibility.org.uk/wordpress/docs/March-2013-EFO-44734674673453.pdf>

A13.155 Openreach²³⁵ stated that its own pay data shows a profile distinct from that of BT Group, and the Openreach pay data should be used for any analysis of trends. Openreach asserts that comparison of the increase in its pay costs with that of the average RPI over the period from 2007/08 to 2011/12 shows a close correlation.

A13.156 Openreach states that its average pay cost increase over the 5-year period, 3.3%, was 0.1% lower than the average RPI of 3.4% of that period. Openreach believes that Ofcom should adjust its forecast pay costs upwards to reflect the relationship it has shown between RPI and its pay costs, to forecast RPI - 0.1%.

A13.157 Openreach argued that Ofcom’s use of the headline CWU pay settlement, if it were to be used, underestimated the future pay increases that Openreach was likely to experience as it omitted the additional pay progression awards of each October.

A13.158 Openreach stated that the historical trends of its pay costs to the CWU settlement suggested that a 0.3% uplift should be added to the CWU pay deal²³⁶ citing the average difference from 2007/08 to 2011/12 (shown in Table A13.6 below)

Table A13.6: Annual increases in total staff costs per employee with average difference from 2007/08 to 2011/12

	2011/12	2010/11	2009/10	2008/09	2007/08	Average
Increase in staffs costs year on year (%)	4.1	4.3	(0.2)	3.7	4.7	3.3
Published CWU pay settlements	3.0	3.0	-	4.3	4.7	3.0
Difference	1.1	1.3	(0.2)	(0.6)	0.0	0.3

Source: Table 7.6, page 64, Openreach Response to the July 2013 LLU WLR Consultation.

A13.159 TalkTalk²³⁷ and Sky²³⁸ did not think that the CWU deal should be used to forecast pay costs and Ofcom’s proposed pay cost assumption was therefore too high. TalkTalk considered that Openreach pay levels are above market rates and, indeed, are “excessive” due to a combination of factors including “high unionisation (and BT’s acquiescence to those unions”. TalkTalk asserted that the pay levels agreed by BT are “materially above the efficient level” and we should conduct some benchmarking to confirm whether Openreach’s pay levels are efficient. TalkTalk stated that were Ofcom to use the CWU deal, which is set too high, Ofcom is

²³⁵ Paragraphs 366 to 376, Openreach Response to the July 2013 LLU WLR Consultation.

²³⁶ Note that Openreach in its response also argued for a forecast 0.1% increase on the CWU deal on the same basis as it gave for a +0.3% increase.

²³⁷ Paragraphs 3.27 to 3.29, TalkTalk Response to the July 2013 LLU WLR Consultation.

²³⁸ Paragraphs 5.13 to 5.15, Sky Response to the July 2013 LLU WLR Consultation.

effectively allowing these inefficient cost levels to be passed through to prices and thereby weakening any incentive BT management may have to bargain for “efficient” pay level increases; Sky echoed TalkTalk’s assertion and believed that BT’s bargaining position would actually be weakened by Ofcom’s proposal as BT would “not be able to argue that it cannot afford wage rises”.

A13.160 Sky and Frontier Economics²³⁹ considered that to forecast forward using the CWU pay deal of 2.8% could over-state the future level of pay inflation. Frontier stated the use of the 2013/14 CWU pay agreement is not robust, as it relies on a single data point the use of which is fundamentally unreliable. Frontier Economics argued that the forecast pay costs modelled should reflect the fact that average earnings appear to have been more closely correlated with CPI than RPI, that it expects future pay negotiations to reference CPI rather than RPI, and that a downward movement in CPI is given in CPI forecasts whereas our proposal was to forecast forward each year at the same rate (of 2.8%). Both Sky and Frontier Economics considered that the Ofcom assumption assumes a real increase in pay relative to the CPI forecasts, which is inconsistent with the earnings measures in the wider economy which suggests that, across the economy as a whole, workers have suffered real pay decreases. Both Sky and Frontier Economics concluded that a reasonable assumption is that BT pay inflation is 0.5% below CPI for forecast years, or 1.8% over the charge control period.

Our analysis of pay cost inflation

Our framework for forecasting pay inflation

A13.161 Our aim is to forecast the pay inflation faced by an efficient operator of the copper access network over the modelled period. In order to do this, we have considered data points from a number of sources as explained in the sub-sections below.

A13.162 To an extent, we agree with Openreach that using Openreach pay cost data rather than that of BT Group is likely to be more reflective of the costs of the WFAEL and WLA markets that we are modelling, although we note that the services provided in the WFAEL and WLA markets are subject to less competitive pressure (and thus potentially downward cost pressure) than those provided by the rest of BT. We asked Openreach to provide the pay related costs it incurred from 2006-07 to 2012-13 in order to inform our analysis of pay costs.²⁴⁰ We have also collected data on economy wide pay settlements from the ONS.

Benchmarking of Openreach’s pay increases

A13.163 As is consistent with our overall objective, we would only wish to use pay data from Openreach if we believed the pay increases faced by Openreach were an adequate proxy for those faced by an efficient operator of the copper access network. We have also considered TalkTalk’s argument that the Openreach pay increases are overly generous and that to base our forecast of pay costs on the costs faced by Openreach would be accepting an excessive rate. In order to address these points we carried out some benchmarking with suitable comparators.

²³⁹ Paragraphs 4.34 to 4.50, Frontier Economics, *Ofcom’s LLU and WLR Charge Controls Proposals. A report prepared for Sky and TalkTalk*, October 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Frontier_Economics_report.pdf

²⁴⁰ BT’s response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request.

A13.164 Table A13.7, below, compares the Openreach pay increases against the ‘Information & Communication’ Industry average weekly earnings growth averaged for each financial year.²⁴¹ A comparison of the average of the two over the 2007-08 to 2012-13 period, at 2.9% and 2.7% respectively, does not indicate that Openreach’s pay increases have been excessively generous.

A13.165 We also compared the Openreach pay growth against a selection of comparator companies, see Figure A13.2 below, our review of which, again, and does not lead us to conclude that Openreach’s pay increases are materially above these competitors. Consequently, we believe that the Openreach pay growth data does represent an acceptable proxy for that faced by an efficient firm.²⁴² We also note that, as shown in Figure A13.2, Openreach pay inflation is comparable with BT Group pay inflation.

Table A13.7: Openreach average staff cost increase v ‘Information & Communication’ Industry average weekly earnings growth annualised

%	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13
‘Information and Communication’ Industry rate of change	4.5	4.6	(0.9)	2.7	3.4	1.8
Openreach staff costs rate of change	4.7	3.7	(0.2)	4.3	4.1	0.9 ²⁴³

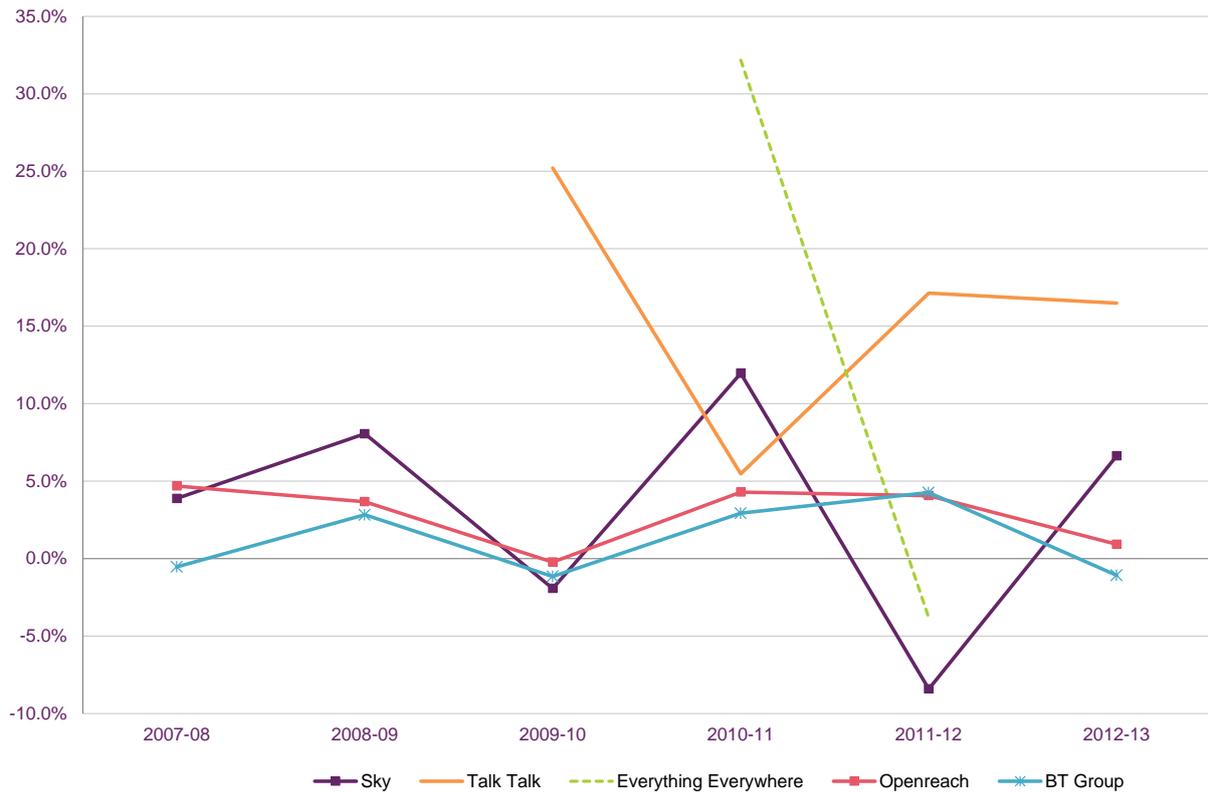
Source: BT’s response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request and ONS, *Average Weekly Earnings Dataset*, 19 March 2014.

²⁴¹ ONS, *Average Weekly Earnings Dataset*, 19 March 2014, <http://www.ons.gov.uk/ons/rel/lms/labour-market-statistics/march-2014/dataset--earnings.html>. In particular, see EARN03: *Average Weekly Earnings by Industry*, Worksheet 5: *NSA ind index ibia, (Not Seasonally Adjusted Average Weekly Earnings - Index figures Including Bonuses, Including Arrears)* for ‘Information & Communication’ industry, K5EX index with Ofcom calculation to average monthly rates over financial years.

²⁴² This analysis only refers to pay costs. A more general discussion of BT’s level of efficiency can be found in Annex 19.

²⁴³ The 0.9% for the increase in average staff costs per employee for 2012/13 is sourced BT’s response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request and is derived from comparing the 2012/13 Total Pay/Average FTEs and comparing to the change from the 2011/12 equivalent. However BT believes this figure is misleading.

Figure A13.2: Openreach pay cost change v comparators



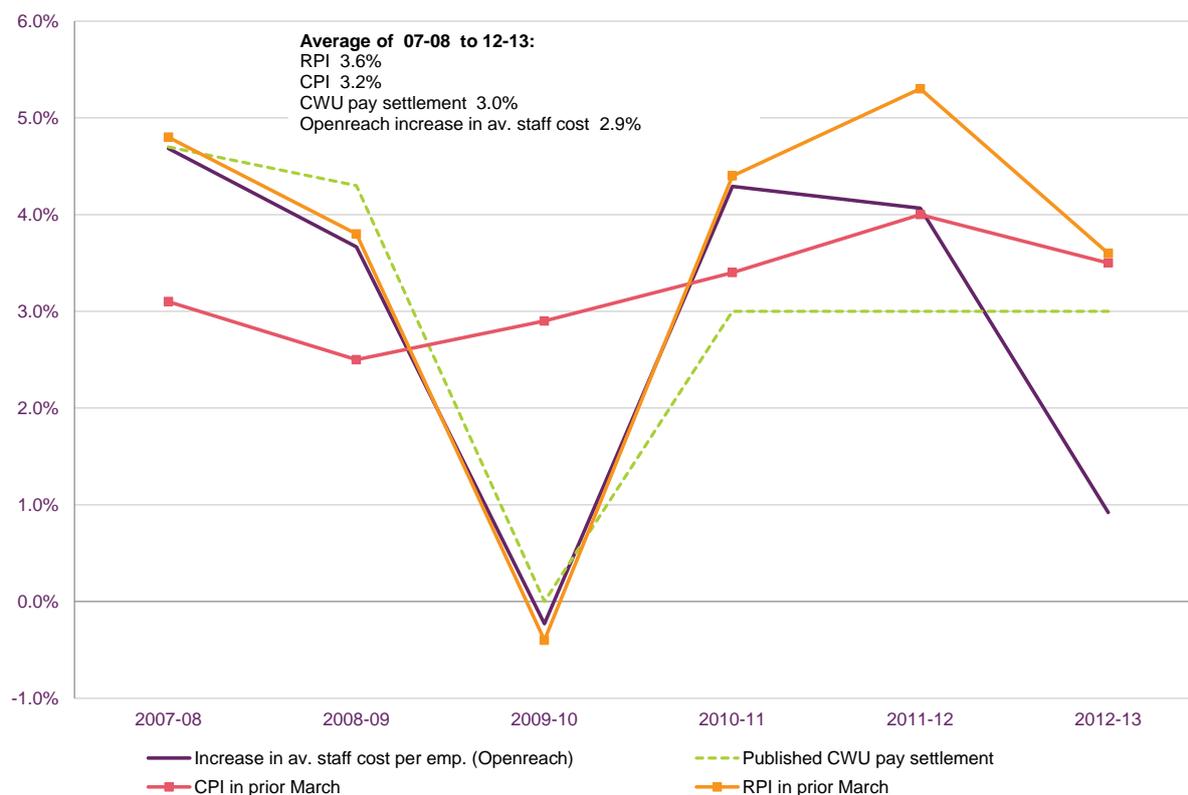
Source: Increase in average staff cost per employee (Openreach) sourced from BT's response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request; and Statutory Accounts of TalkTalk, EE, BT and Sky.

The relationship between pay increases and economy wide inflation

A13.166 Even if BT's historical pay inflation data is an acceptable proxy for that faced by an efficient operator of the copper network, it does not provide us with a forecast for pay inflation. In light of responses to the July 2013 LLU WLR Consultation, we first considered whether a particular inflation index (for which we have independent forecasts) could be used as a proxy for pay inflation growth.

A13.167 BT argued that there is a strong link between the pay increases within a financial year and the preceding March RPI figure. Figure A13.3 below shows the relationship between the prior March RPI figure, the prior March CPI figure and the CWU pay deal and Openreach's actual pay increases over the 2007-08 to 2012/13 period. Whilst we agree that there appears to be positive correlation between RPI and the Openreach average rate of change in pay costs over the 2007/08 to 2010/11 period, the relationship over the period 2011/12 to 2012/13 is much weaker. In terms of the average rates of change over the whole period, Openreach's pay costs (at 2.9%) have been closer to CPI inflation (at 3.2%) than RPI (at 3.6%).

Figure A13.3: Openreach pay cost change v March RPI & March CPI



Source: Increase in average staff cost per employee (Openreach) sourced from BT's response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request.

A13.168 BT also argued that it expected future pay deals to increase by more than RPI and that the OBR forecasts suggested that wages and salaries will rise by more than RPI. The latest OBR forecasts of average earnings growth²⁴⁴ do show an increase in the average earnings for forecast years.²⁴⁵ However, our review of the Openreach pay increases of recent years shows a weak relationship with average earnings growth. Table A13.8 below shows that over the 2009/10 to 2012/13 period there has been no clear correlation between the two rates. Our judgment is that the lack of an evident relationship between the average earnings rate (i.e. an economy-wide measure of general pay inflation) and the pay rates Openreach has experienced in the recent pasts, suggests that there is not a compelling basis for using the OBR forecast of average pay inflation in order to project Openreach pay inflation.

²⁴⁴ We note that in its response BT presented the 'Wages and Salaries' index and forecast rather than the 'Average Earnings' growth however the former measures the total Labour market increase in Wages and Salaries whereas the latter divides this measure by the number of employees, in our view the 'Average Earnings' is a better measure of earnings growth for our purposes.

²⁴⁵ OBR average earnings growth sourced from Table 1.6 in http://budgetresponsibility.org.uk/pubs/March_2014_EFO_Economy_Supplementary_Tables.xls,

Table A13.8: Openreach average staff cost increase v average earnings growth²⁴⁶

%	2009/10	2010/11	2011/12	2012/13	Average
Average earnings growth	3.0	1.0	2.7	1.0	1.9
Openreach staff costs	0.2	4.3	4.1	0.9	2.4
Difference	2.8	(3.3)	(1.4)	0.1	(0.5)

Source: OBR average earnings growth sourced from Table 1.6 in http://budgetresponsibility.org.uk/pubs/March_2014_EFO_Economy_Supplementary_Tables.xls, Openreach staff costs increase sourced from BT's response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request.

A13.169 We have considered Openreach's assertion that the history of the movement in its pay cost increases suggests that Ofcom should adopt a RPI-0.1% pay forecast in the charge control. The Openreach RPI -0.1% proposal is based on a comparison of the average RPI change from 2007-08 to 2011-12 of 3.4% compared to its annual average staff cost movement over the same period of 3.3%. Figure A13.4 below compares the Openreach staff cost increase with the RPI and CPI inflation indices. We note that, using the same argument as Openreach applies could lead one to conclude that CPI is at least as an appropriate index to use, as it averages 3.3%²⁴⁷ over the same period.

A13.170 We have considered Sky and Frontier Economics' view that it is reasonable to assume a pay rate below CPI, of CPI-0.5%. As can be seen from Figure A13.4, it is not clear that Openreach's average earnings are particularly closely correlated with CPI, certainly over the period 2007/08 to 2012/13 taken as a whole. In any case, looking at the average rates of change in Openreach pay (rather than the trend itself) it seems the historic relationship was nearer CPI-0.3%. Furthermore, whilst we note Frontier Economics' belief that it expects future pay negotiations to reference CPI rather than RPI we are unable to test this assertion, but have noted that the CWU is presently referencing RPI in its public correspondence with its members on the negotiations it is having on the future pay deal.²⁴⁸

A13.171 Overall, considering both correlation and expected rates of change over a number of years, it is our view that neither RPI nor CPI could be said to be a better index from which to project the future rate of change in Openreach's pay costs than the other.

²⁴⁶ Please note that Table A13.5 presents the 'Wages and Salaries' index by calendar year for actual and forecast as per p82, OBR, Economic and fiscal outlook, March 2013, whereas this table presents the 'Average earnings' index by financial year as per Table 1.6 of the datasets accompanying the equivalent March 2014 report.

²⁴⁷ Note that Figure A13.3 averages CPI over six years to 3.2%.

²⁴⁸ See CWU, *CWU Rejects BT's Pay Offer*, 1 April 2014, <http://www.cwu-cctv.org/article.php?articleid=563>, "... With RPI inflation currently at 2.7% and forecast to stay around that figure throughout 2014, the CWU Pay Team have rejected the offer on the basis that it represents a real terms cut in pay for team members and ..."

Figure A13.4: Openreach pay cost change v CPI and RPI²⁴⁹



Source: Increase in average staff cost per employee (Openreach) sourced from BT’s response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request.

Using a 2.8% pay inflation figure

A13.172 We have reassessed the appropriateness of using the 2.8% rate that we proposed in the July 2013 WLR LLU Consultation.

A13.173 We have considered what the adoption of a 2.8% pay inflation figure would mean to real wage assumptions when comparison is made to the latest forecasts compiled by HM Treasury available for CPI and RPI. As shown in Table A13.9 below, adoption of the 2.8% pay deal for each of the forecast years would result in a real pay increase relative to the forecast CPI, but a real pay decrease relative to the forecast RPI. However, as found by the ONS, due to the formula used in the calculation of the RPI, it has a “propensity to have an upwards bias”²⁵⁰, which implies that a real pay decrease relative to RPI is likely to be overstated – indeed, given the size of the formula effect (somewhere between 0.5% and 1.0%) is also likely to be directionally incorrect.

²⁴⁹ Please note that the April RPI and CPI figures are shown in this graph, for example the April 2012 RPI and CPI figures are used as a comparison to the costs of financial year 2011-12.

²⁵⁰ See paragraph 35 of ONS, *National Statistician’s consultation on options for improving the Retail Prices Index*, October 2012, http://www.teachers.org.uk/files/consultation-options-for-improving-rpi_0.pdf

Table A13.9: HM Treasury forecasts (February 2014) and 2013/14 CWU Pay Deal

%	2013/14	2014/15	2015/16	2016/17	Average (arithmetic mean)
RPI forecast ²⁵¹	2.5	2.9	3.1	3.2	2.9
CPI forecast	1.6	2.1	2.0	2.10	2.0
CWU Pay Deal ²⁵²	2.8	2.8	2.8	2.8	2.8

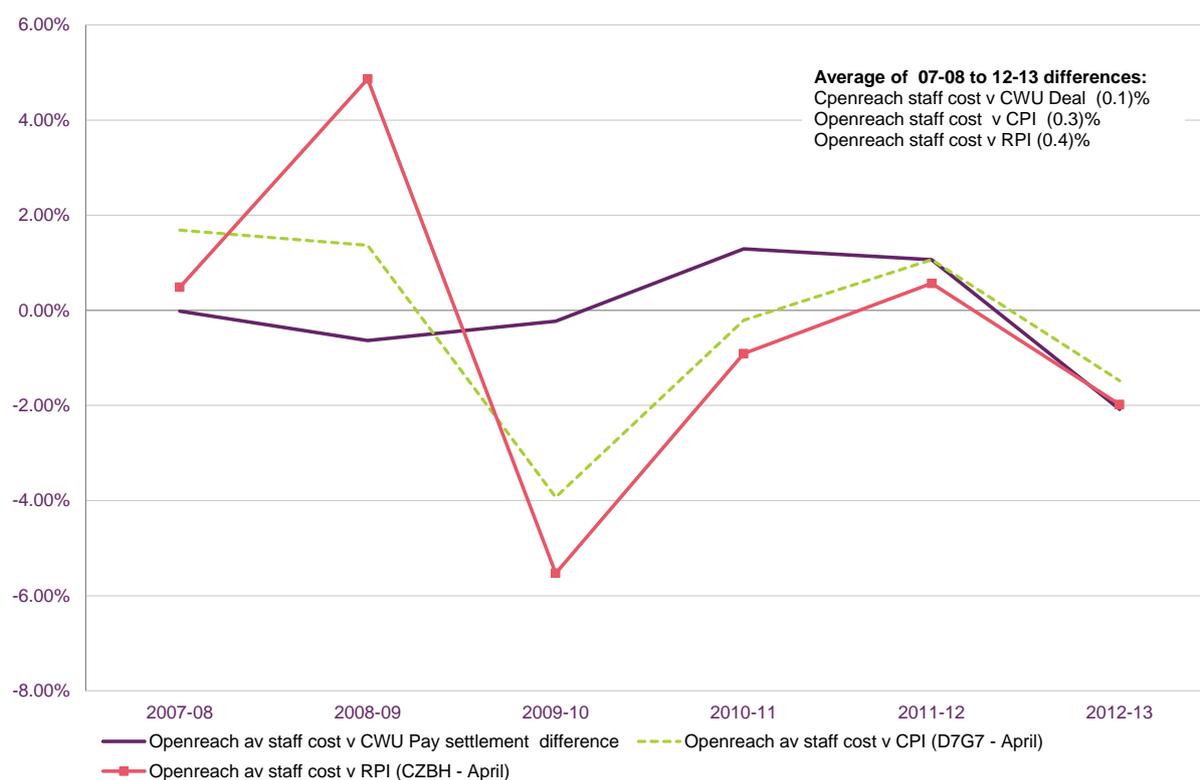
A13.174 We also note that the 2.8% inflation figure is consistent with the current pay deal that BT has with the CWU.²⁵³ We have considered Openreach’s assertion that a 0.3% uplift should be added to the headline CWU pay deal, as it omits additional pay awards made during each year. Openreach supports its proposal with analysis of the difference between the Openreach pay changes and the CWU pay deal over the 2007/08 to 2011/12 period. Openreach calculates that the average of the yearly difference between the two rates shows the CWU deal is 0.3% lower over the period. Our own analysis from 2007-08 to 2012-13 shows that the CWU deal is higher than the Openreach pay changes on average over the period by 0.1%, suggesting a -0.1% reduction on the CWU deal. Figure A13.5 below compares the Openreach pay cost changes with the CWU pay deal, CPI inflation and RPI inflation over the 2007/08 to 2012/13 period.

²⁵¹ CPI and RPI forecasts derived from page 23, Medium-term forecasts of HM Treasury, Forecasts for the UK economy: a comparison of independent forecasts, February 2014. We have converted from calendar years (as reported by HM Treasury) to financial years using quarterly weightings. For 2013/14 we have used the actual figures as reported by the ONS for March 2014 RPI and CPI

²⁵² The latest pay deal at the time of publication is the 2.8% BT pay deal effective for one year from 1 April 2013

²⁵³ Settlement between BT Group and CWU

Figure A13.5: Openreach pay cost change v CWU Pay Deal, CPI and RPI²⁵⁴



Source: Increase in average staff cost per employee (Openreach) sourced from BT's response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request.

A13.175 In our view, the comparison of the trends in the Openreach pay costs changes and the CWU pay deal shows a reasonably strong correlation, with no systematic upward or downward bias evident over the 2007-08 to 2012-13 period. There is a less clear relationship between Openreach's pay inflation and both RPI and CPI.

Consistency of input price inflation

A13.176 EE considered that, where appropriate, it was important that the input price inflation assumptions we use are consistent with the inflation used to index the cap in each year of the charge control and that used to estimate efficiency gains. In response, we note that inflation indices feature in the charge control in at least two ways, i) a single index used to determine how the limit on charges is updated each year (i.e. in the inflation +/- X formula), and ii) various indices might be used forecast certain input costs (and calculations for efficiency should control for cost inflation in a consistent way with how costs are projected). From this it can be seen that where there are many inputs to a cost stack for a service, and where each cost has its own input price trend, it follows that the aggregate price trend is unlikely to be expected to be the same (or even correlated with) a single measure of economy wide inflation (such as CPI or RPI) However, as explained in Section 3, Volume 2, what is more important is that the price cap formula correctly gets regulated charges into line with

²⁵⁴ A negative figure indicates that the comparator index is greater than the Openreach staff cost pay change.

forecast costs at the end of the charge control. We can confirm that we have checked that this is so – on a forecast basis.²⁵⁵

A13.177 As discussed in Annex 16, we have calculated an efficiency assumption of 5%. In estimating that figure, where we have undertaken calculations to control for input cost information, we have done so consistently with how cost inflation is treated in the Cost Model. Finally, although there is not necessarily a direct link between the efficiency assumption and Openreach pay growth, we would expect that as labour productivity increases (a potentially important driver of overall efficiency), some of this increase in productivity could manifest itself in higher real wages. As noted previously, compared to CPI, the preferred measure of general price inflation, our assumed rate of pay inflation would be consistent with increasing real wages within the workforce of the copper access network modelled.

Consequences for incentives on Openreach's pay negotiations

A13.178 We have carefully considered the points raised by Sky and TalkTalk that, were we to adopt the 2.8% pay inflation assumption (which matches the current CWU pay deal), we risk weakening Openreach's incentive to bargain for lower pay increases and potentially its bargaining position. In considering the pay cost increases, and other assumptions, used to forecast costs for these charge controls, we are cognisant that our decisions have the potential to affect the position of stakeholders in the markets concerned.

A13.179 We agree with Sky and TalkTalk that it would be undesirable to simply pass-through pay settlements to regulated services. However, we have carefully considered whether historical pay settlements are outside the reasonable range for an efficient operator. We have also considered how the 2.8% pay inflation assumption compares to forecasts of RPI and CPI. On these measures, we believe that 2.8% is an acceptable proxy for the pay cost inflation faced by an efficient operator.

Conclusions on pay cost inflation

A13.180 Having carefully considered responses to the consultation, we have concluded that, it remains appropriate to retain the pay cost inflation assumption used in our previous consultations, namely 2.8% p.a. over the forecast period. In our view there is no compelling evidence that would lead us to conclude that indexing explicitly to either RPI or CPI is likely to better predict how the pay costs of an efficient operator are likely to change.²⁵⁶

Stakeholder responses on non-pay cost inflation

A13.181 BT stated that it expected accommodation costs to increase by a rate close to RPI.²⁵⁷ It stated that it derived its accommodation calculation by assuming the Rental costs constituent would increase by 3.0% (the rate of the Telereal contract) and the electricity and power costs would inflate by higher rate than inflation and presented the forecast electricity costs published by the Department of Energy & Climate Change (DECC).

²⁵⁵ We show this point through an applied example in Section 3, Volume 2, footnote 122.

²⁵⁶ We note that a pay inflation forecast of 2.5% is used in the 2014 WBA charge control published at the same time as this statement. The figure used in the 2014 WBA charge control has been calculated for a different market and using different underlying data. We therefore do not believe that this figure is inconsistent with our choice of forecast pay inflation of 2.8% for LLU and WLR.

²⁵⁷ Page 98, BT Response to the July 2013 LLU WLR Consultation.

A13.182 Openreach disagreed with our proposed 3% rate and argued that a non-pay cost forecast rate of 3.1% would be more appropriate.²⁵⁸ Openreach stated that it had conducted an analysis of its non-pay costs and derived the 3.1% forecast by identifying those cost categories for which a specific rate could be identified, applying CPI to all other non-pay costs, and weighting each by the respective total costs.²⁵⁹ Openreach's analysis suggested that \times , RPI of 3.3% for 'Plant Support (Cumulo)' costs, an 'ONS (Fuel & Lighting)' rate of 8.5% for Electricity Accommodation costs, and CPI (of 2.3%) for 'Other non-pay' costs²⁶⁰

A13.183 TalkTalk²⁶¹ commented that if we allowed the specific rates presented by BT to inform our non-pay cost forecast, in circumstances where they were "uncertain unlike Telereal costs inflation which is known" we would run the risk of allowing 'cherry picking' by BT. TalkTalk suggested that a pragmatic and proportionate approach would be to use a general measure of inflation unless 'exceptional reasons' could be shown for choosing an alternative measure. TalkTalk also argued that the Openreach assertion that cumulo rates are subject to RPI was a misleading simplification as "the cumulo rates are indexed to RPI but the rateable value (RV) used to derive the cumulo rates is subject to annual review based on updated valuation methodologies and input assumptions and the RV has changed substantially (downwards)".

A13.184 Sky was of the view that the 3% non-pay opex inflation rate we proposed was inappropriate and argued that it was set too high.²⁶² Sky stated that our proposal to use the 3% rate fixed in the Telereal deal as a proxy for all non-pay costs assumed a commonality between the other non-pay costs which had no evidential basis to it. Sky considered that it would be more appropriate to adopt CPI, an economy-wide inflation rate, to those non-accommodation costs. Sky believed that applying its proposals would result in the forecast for non-pay inflation falling to 2.75%. TalkTalk²⁶³ and Frontier Economics²⁶⁴ were also of the view that while 3% was an appropriate rate to use for Accommodation costs, CPI should be used for other costs.

Our analysis of non-pay cost inflation

Adoption of specific rates for cost items

A13.185 We have carefully considered TalkTalk's concern that, where cost inflation is not certain for a cost category, we should not adopt the specific rates proposed by BT and Openreach. We have confidence that we can specifically identify the 'Telereal' Accommodation costs. For the contribution from cumulo to the weighted average

²⁵⁸ Paragraphs 377 to 381, Openreach Response to the July 2013 LLU WLR Consultation.

²⁵⁹ Paragraphs 377 to 381, Openreach Response to the July 2013 LLU WLR Consultation.

²⁶⁰ Paragraph 380, Openreach Response to the July 2013 LLU WLR Consultation (confidential version).

²⁶¹ Paragraphs 3.16 to 3.26, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

²⁶² Paragraphs 5.16 to 5.18, Sky Response to the July 2013 LLU WLR Consultation.

²⁶³ Paragraphs 3.16 to 3.26, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

²⁶⁴ Paragraphs 4.51 to 4.52, Frontier Economics, *Oftcom's LLU and WLR Charge Controls Proposals. A report prepared for Sky and TalkTalk*, October 2013,

http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Frontier_Economics_report.pdf

rate of change for non-pay opex we have used projections of RPI consistent with the annual uprating used by the rating authorities.²⁶⁵

A13.186 Both Openreach and BT in their respective replies present different indices when illustrating their arguments on inflation rates to be used to forecast Electricity Accommodation costs – Openreach presented the ‘Fuel and Lighting’ ONS statistic in its response while BT illustrated its argument with the DECC forecast electricity costs.

A13.187 We have reviewed the ‘Fuel and Lighting’ ONS index and have determined that it would be an inappropriate index to adopt in order to forecast the electricity costs forward. The ‘Fuel and Light’ index comprises four sub-indices – Coal and Solid Fuels, Oil and other Fuels, Gas, and Electricity – only the latter of which is directly relevant to the costs under consideration. We considered whether the ‘Electricity’ sub-index D717 or the ‘Electricity’ sub-index CZCZ could be used as the basis for forecasting. However, in contrast to the CPI and RPI indices, HM Treasury does not collate and publish a forecast for the ‘Electricity’ sub indices that could be used and we are not aware of other independent forecasts for these sub-indices. The history of the measures over recent years shows a great deal of volatility (see Table A13.10 below) that has lead us to conclude that adoption of any trend would be unlikely to provide a robust indicator of the future costs.

Table A13.10: Percentage annual increase in D717 ‘Electricity’ and CZCZ ‘Electricity’ indices²⁶⁶

Sub-index	2008	2009	2010	2011	2012	2013
D717 ‘Electricity’ index (%)	15.6	4.6	(2.5)	7.3	5.7	7.4
CZCZ ‘Electricity’ index (%)	15.6	4.5	(2.5)	7.2	5.7	7.4 ²⁶⁷

Source: ONS, *Consumer Price Inflation Reference Tables*, March 2014

A13.188 We have also considered using the DECC forecast of Electricity prices,²⁶⁸ to inform any forecast that could be made for the charge control. DECC provides historic prices for the ‘Services’ and ‘Industrial’ users and produces a ‘Low’, ‘High’, and Baseline projection for each. The DECC base case projections show a significant increase in the prices (reported in pence per kWh) over the charge control period for both groups of users (see Table A13.11 below), and the price projections are materially higher than both the RPI and CPI projections. We therefore are of the view that the ‘Electricity’ Accommodation costs should be separately identified with its own specific forecast.

²⁶⁵ Our overall approach on cumulo is explained in Annex 26. There we explain that cumulo costs are the result of applying a rate poundage to rateable values, which may then be reassessed as a result of material changes in circumstances (MCCs). We have accounted for potential future reductions in BT’s cumulo costs via the efficiency factor, our reasoning on which is explained in Annex 16.

²⁶⁶ Office for National Statistics, *Consumer Price Inflation Reference Tables*, March 2014, D717 as per Table 10 ‘CPI: Detailed annual average 12 month % change 1999-2013’, and CZCZ as per Table 43 ‘RPI: Detailed annual average 12 months % change: 1990-2013’.

²⁶⁷ We note the values of the two indices in each year are almost identical. However, as we have not relied on these indices in our forecasting it has not been necessary to scrutinise the figures further

²⁶⁸ DECC Price data sourced from DECC, *Energy & Emission Projections*, 17 September 2013, <https://www.gov.uk/government/collections/energy-and-emissions-projections>, Annex F: Price Growth Assumptions, Real Energy Prices Electricity Retail Prices.

Table A13.11 DECC September baseline price forecasts v RPI and CPI forecast

%	2013/14	2014/15	2015/16	2016/17
‘Services’ DECC	5.0%	11.4%	9.9%	5.9%
‘Industrials’ DECC	4.4%	11.4%	10.7%	8.2%
RPI forecast ²⁶⁹	2.5%	2.9%	3.1%	3.2%
CPI forecast	1.6%	2.1%	2.0%	2.1%

Source: DECC Price data sourced from DECC, *Energy & Emission Projections*, 17 September 2013, Annex F: Price Growth Assumptions, Real Energy Prices Electricity Retail Prices Reference scenario for ‘Services’ and ‘Industrial’ with Ofcom calculation to convert to nominal prices and financial years, CPI and RPI forecasts derived from page 23, Medium-term forecasts of HM Treasury, *Forecasts for the UK economy: a comparison of independent forecasts*, February 2014 converted to financial years.

A13.189 BT’s response suggested that the DECC price for the ‘Industrials’ sector would be appropriate for forecasting the Electricity Accommodation costs. We have compared the relationship between the BT Group pence per kWh costs over recent years²⁷⁰ with the actual prices given by DECC for both the ‘Services’ and ‘Industrial’ users and the evidence shows that the ‘Services’²⁷¹ group has better reflected the cost incurred by BT Group and we believe that the analysis shows that the ‘Services’ prices are closely reflective of the actual prices that BT Group faced.

The use of CPI to forecast other non-pay costs

A13.190 Those stakeholders that responded on other the cost inflation assumptions for non-pay costs agreed that, where a specific rate cannot be reliably identified, a measure of general inflation such as CPI would be an appropriate measure to use to forecast non-pay costs. We have performed a review of these costs and considered the use of a variety of indices which could be used, including the Services Producer Price Index, the SPPI sub-index ‘Business Telecoms’ and CPI and RPI. Our analysis leads us to conclude that none of the measures could be shown to be a better predictor than the other indices for the set of non-pay costs under consideration.

A13.191 While our review was inconclusive on the most appropriate index to use we note the agreement amongst stakeholders that a general inflation index such (as CPI) would

²⁶⁹ CPI and RPI forecasts derived from page 23, Medium-term forecasts of HM Treasury, *Forecasts for the UK economy: a comparison of independent forecasts*, February 2014. We have converted from calendar years (as reported by HM Treasury) to financial years using quarterly weightings. For 2013/14 we have used the actual figures as reported by the ONS for March 2014 RPI and CPI

²⁷⁰ BT’s response to question 7 of the Tenth s.135 to BT for ‘Wholesale Broadband Access Market Review’

²⁷¹ DECC, *Updated Energy & Emissions Projections*, 17 September 2013. See Annex F: Price Growth Assumptions, Real Energy Prices, Electricity Retail Prices ‘Reference’ scenario for ‘Services’ and ‘Industrial’ (<https://www.gov.uk/government/publications/updated-energy-and-emissions-projections-2013>), with Ofcom calculation to convert to nominal prices using GDP deflator (HM Treasury, *GDP deflators at market prices, and money GDP: December 2013*, updated 8 January 2014, <https://www.gov.uk/government/publications/gdp-deflators-at-market-prices-and-money-gdp-march-2013>) and then converted to financial years using appropriate weights.

be a reasonable basis on which to forecast the costs for non-pay opex where we do not have an alternative explicit value or index.

The use of RPI to forecast Cumulo costs

A13.192 TalkTalk is correct in its response that the rateable value is subject to appeal and is effectively reassessed more often than the five year cycle of reviews by the rating authorities. However, as explained above, we have captured projected changes in cumulo costs beyond the inflation effect (such as that due to BT’s appeals of its rateable value) within the efficiency measure applied to the cost components in the Cost Model (please see Annex 16 ‘Efficiency’ and Annex 26 ‘Cumulo’).

Conclusions on non-pay cost inflation

A13.193 We have decided to apply the following indices to forecast the relevant non-pay costs:

- The September 2013 DECC ‘baseline’ forecast of ‘Services’ electricity prices for the contribution from Electricity costs (Accommodation) as set out in Table A13.11;
- To use a 3% per annum increase for the contribution from Accommodation costs;
- To use forecast RPI for Cumulo costs, with the exception of 2014-15 where it is known that 2% will be used rather than RPI. (Please note that we have separately captured the potential reduction in cumulo costs separately via the efficiency parameter.); and
- To use forecast CPI for the contribution for all other non-pay costs

A13.194 We have used the Openreach Management Accounts²⁷² cost category breakdown for the base year, 2011-12²⁷³, which we use with the forecast indices to produce a weighted average non-pay cost inflation rate for each year. Table A13.12 below provides the non-pay cost inflation we apply for each year in the Cost Model.

Table A13.12: Non-pay cost inflation

	2012/13	2013/14	2014/15	2015/16	2016/17
Non-pay inflation (%)	3.24	1.84	2.31	2.31	2.31

Stakeholder responses on asset price inflation

A13.195 Openreach was the only respondent that commented explicitly on our proposal for asset price inflation. Openreach stated that “*in recent WLR/LLU charge controls Ofcom has used an average view of RPI in order to set the asset price inflation*”

²⁷² ‘Openreach Management Accounts costs pre re-organisation in 2012-13’ operating cost breakdown as per BT response dated 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request.

²⁷³ BT response 25 October 2013 to question 5 of the Eleventh LLU WLR BT Information Request.

rate".²⁷⁴ Openreach considered that it was important to apply asset price inflation consistently so that holding gains and holding loss adjustments do not create distortions. It stated that as the RPI forecast used was rising, the average RPI rate over the period was lower than the final year forecast RPI, and a higher holding gain was generated in the final year than if an average RPI was used. Openreach proposed that an average rate of RPI should be used throughout the forecast period for the calculation of holding gains.

Our analysis of asset price inflation

A13.196 We have considered Openreach's view that we should use an average for asset price inflation over the charge control period, which would lead to a lower holding gain in 2016/17.²⁷⁵ We wish to base our estimate of costs in the final year of the charge control on our best view of the costs faced by an efficient operator. Where we have reliable independent forecasts available, we believe it is most appropriate for us to reflect those forecasts in our modelling. We have applied these independent forecasts on a yearly basis across both opex trends and asset price trends. The approach adopted of forecasting RPI and CPI on the basis of the independent forecasts available for each year is applied consistently throughout our cost modelling as we consider this to be the most appropriate methodology to determine the final year efficient costs for the services that we are controlling.

A13.197 Moreover, this approach is consistent with the way we usually implement top-down CCA modelling and so maintains consistency between charge controls. As long as our forecast of asset price inflation is unbiased, the regulated firm will face a "fair bet" as to whether it over or under-recovers costs as against the forecast. Consequently, we are of the view that our present approach to forecasting inflation, in the context of the charge control as a whole, is consistent and appropriate in our derivation of final year efficient costs. Therefore, we have decided not to change our approach.

A13.198 We have considered again the asset price trends for each asset sector and have reviewed the recent historical trends as part of this process. We have looked to base the forecasts on the recent historical trends. Table A13.13 below provides the nominal asset price trends by asset sector from 2009/10 to 2011/12. Our review has led us to the view that there is no compelling evidence to lead us to move from our proposed policy of inflating all but the copper and duct sectors at 0%.

Table A13.13: Nominal Asset % Price changes by Sector

Asset Sector	2009-10	2010-11	2011-12
Computers & OM	✂	✂	✂
Intangibles	✂	✂	✂
Land & Buildings	✂	✂	✂

²⁷⁴ Paragraphs 382 to 384, Openreach Response to the July 2013 LLU WLR Consultation.

²⁷⁵ Openreach raised the issue of holding gains in respect of the use of RPI. The only assets that have an RPI price trend applied to them are Duct and Cable as is consistent with the RAV model. As explained further below this issue does not arise for the other asset sectors as we have decided to forecast at 0% for each and every year.

Asset Sector	2009-10	2010-11	2011-12
Local Exchange	✂	✂	✂
Main Exchange	✂	✂	✂
Motor Transport	✂	✂	✂
Other	✂	✂	✂
Other Network Equipment	✂	✂	✂
Transmission	✂	✂	✂

Source: Ofcom Cost Model.

Conclusions on asset price inflation

A13.199 We have concluded in Annex 6 ²⁷⁶ that we will inflate the copper and duct sector assets at RPI. Based on our analysis of historical trends above, our preference is to model the remaining assets on the basis that there is no nominal price inflation (i.e. to apply a 0% rate each year).

Other detailed modelling assumptions and adjustments

Cost volume relationships (CVEs) for operating costs

A13.200 As described in Annex 11, CVEs are used to determine the level of operating costs needed in response to changes in demand (the percentage change in operating costs for a 1% change in volumes). When determining CVEs we are looking to understand the long run relationship between operating costs and the underlying cost volume drivers.

Proposals in the July 2013 and December 2013 LLU WLR Consultations

A13.201 In the July 2013 LLU WLR Consultation we proposed that we would:

- define a set of CVEs most appropriate for the relevant cost components; and
- apply those CVEs to our forecast of service volumes in order to project the operating costs forward from the 2011/12 base year to the final year of the charge control in 2016/17.

A13.202 We explained that we proposed to use the 2011/12 CVEs from BT's LRIC model for the purposes of forecasting costs to 2016/17, which we obtained using our statutory information gathering powers, only adjusting for those CVEs which were greater than 1.

²⁷⁶ Paragraph A 6.1 of Annex 6.

A13.203 In the two instances in which the 2011/12 CVEs were greater than 1, we did not consider it appropriate to use the data provided by BT. In those instances we proposed to use the average of the 2009/10 to 2010/11 CVEs.²⁷⁷

Stakeholder responses

A13.204 Openreach generally agreed that using CVEs in the Cost model had merit, emphasising, in particular, that it led to a level of disclosure appropriate to the setting of charge controls.²⁷⁸

A13.205 Openreach stated that it had conducted a review of the CVE values we had used in our cost modelling and considered that “broadly the cost volume relationships (“CVRs”) appear sensible”. However, it stated that this view was made in the context of where overall volumes of lines “are increasing slightly” and that “in circumstances where volumes are falling, it is not as clear cut that an unadjusted CVE model would be appropriate”. Openreach proceeded to state that for the ‘PSTN Linecards’ cost component it expected most costs to remain fixed over the charge control period despite a forecast decrease in its cost component volumes. Openreach was of the view that we should therefore “assume a CVE nearer to 0 for PSTN Linecards” in order for our cost modelling to “make more sense”.

A13.206 EE also broadly supported the adoption of the CVE approach to cost modelling but stated it was concerned with the degree of scrutiny applied to the cost volume elasticities and asset volume elasticities.²⁷⁹ EE, however, considered that Ofcom had adopted an approach which had taken only a broad view on whether the individual CVEs and AVEs appeared reasonable. EE stated that “these variables warrant a more detailed investigation as to their suitability and appropriateness” and suggested comparing the CVEs with international benchmarks or “investigating the extent to which the relevant cost categories have in fact moved in relation to volume changes in the past to the extent possible”.

A13.207 Verizon²⁸⁰ had concerns over adoption of the CVE/AVE approach stating that “given the importance of the LLU WLR charge control (being the market responsible for the greatest proportion of common costs) arguments for a simpler but potentially unreliable approach should not hold sway”. Verizon stated that it was concerned that the use of a modelling approach used in setting the 2013 leased line charge control which was “subject to appeal” should give Ofcom pause to review the appropriateness of its use for this charge control, and “that the cost forecasting approach used in setting the current LLU WLR charge control also forecast changes in service volumes” and did not see why Ofcom should therefore decide to adopt a different approach.

A13.208 TalkTalk considered that the CVEs adopted looked broadly reasonable “considering that given the small change in volume their impact is limited”.²⁸¹

²⁷⁷ Pay CVEs for ‘PSTN line test equipment’ and ‘Broadband line testing systems’ cost components.

²⁷⁸ Paragraphs 58 to 65, Openreach Response to the July 2013 LLU WLR Consultation.

²⁷⁹ Page 28, EE Response to the July 2013 LLU WLR Consultation.

²⁸⁰ Paragraphs 42 to 44, Verizon Response to the July 2013 LLU WLR Consultation.

²⁸¹ Paragraphs 3.2 to 3.4, TalkTalk Response to the July 2013 LLU WLR Consultation

Our analysis

A13.209 We have considered EE's suggestion of conducting a more comprehensive review of the CVEs and we have performed a review of both the CVEs and AVEs.

A13.210 We considered the option of comparing the CVEs for the cost components used in the cost modelling with that of international comparators and benchmarks. However, we considered that we would not be able to attain comparator CVEs of equivalent cost components that could be used to conduct a meaningful or valid comparison.

A13.211 We have also performed an exercise to consider whether we could identify more appropriate CVEs than those we proposed to use. For the purposes of selecting the CVEs in the Cost Model we have reviewed the CVEs and AVEs provided for 2011/12 and which are used in the Cost Model. We considered the nature of the cost characteristics for the CVEs and AVEs and identified a selection of CVEs and AVEs²⁸² where:

- i) adjusting the value would have a material impact on the Cost Model outputs; and/or
- ii) a significantly different value to the one we were using could be plausible given our understanding of how the cost component was consumed within the services subject to the charge controls.

A13.212 Our review considered the variability of the CVEs over time, and also how the costs modelled (using the CVEs and variants of the CVEs) compared to actual costs over different periods of time. We also reviewed the cost trends to evaluate if we could identify CVEs used in the past that we could use in contrast to those derived from the 2011/12 outputs of BT's LRIC model.

A13.213 Having considered each cost component, we conclude that, overall, the CVEs provided by Openreach and derived from its LRIC model were the most appropriate for our purposes. We are not in a position to be able to provide a more robust or consistent set of CVEs and AVEs than those provided by BT.

A13.214 We also consider that the CVEs/AVEs sourced from BT's LRIC model give the advantage of consistency with the RFS which is used to source the FAC data we use in the model.

A13.215 We have considered Openreach's argument that the 'PSTN Linecard' cost component CVE should have a different value to the CVE we proposed to use and that it should be set nearer to zero as otherwise, with falling component volumes it might exaggerate the amount that costs could be reduced by.

A13.216 We reviewed the drivers of the component's costs and performed analysis which led us to conclude that some of the component's characteristics might lead us to expect costs to be more difficult to take out in the case of falling volumes. For example, we considered that under circumstances of a significant fall in WLR line volumes, to reduce costs Openreach would likely need to re-group customers

²⁸² We considered thirteen CVEs in detail including 'PSTN Linecards', 'Software Jumpering', 'LLU Unbundling Tie Cables', 'LLU Hostel Rentals Power & Vent', 'D-side copper current', 'D-side copper capital', 'E-side copper current', 'E-side copper capital', 'OR Service Centre –Provision WLR PSTN/ISDN2', 'OR Service Centre Assurance WLR PSTN/ISDN2', 'LLU Line Testing Systems', 'OR DSLM (capital/maintenance)', and 'OR ADSL Connections'

across multiple Line cards so that fewer would be needed, and considered this could be a relatively resource intensive exercise.

A13.217 However, our review also showed that the values Openreach had provided for prior years had consistently been much nearer to 1 than 0 for both the pay and non-pay CVEs for 'PSTN Linecards'.

A13.218 We also considered it relevant that to allow an adjustment to the CVEs sourced from BT's LRIC model in the case of a situation of declining volumes would be difficult to justify. That is unless we could, with confidence, derive our own robust and more accurate CVEs for each and every cost component used in the Cost Model than those provided by Openreach from its LRIC model. Despite further analysis, we were unable to identify more robust CVEs.

A13.219 Whilst we recognise Verizon's view that our adoption of the CVE/AVE modelling approach contained some weaknesses when compared to maintaining the approach adopted in the previous charge control, as set out in the CFI and the July 2013 LLU WLR Consultation²⁸³, on balance, we consider that the benefits of the CVE/AVE approach outweighs the relative merits and disadvantages of the CA/CF²⁸⁴ model approach adopted for the prior charge control.

Conclusions

A13.220 We have re-examined the 2011/12 CVEs provided by Openreach and have decided that, on balance, we should continue to employ the CVEs using the same criteria and methodology as proposed, namely:

- To use the 2011/12 CVEs from BT's LRIC model for the purposes of forecasting costs to 2016/17, adjusting for those CVEs provided that were greater than 1.
- In the two instances in which the 2011/12 CVEs were greater than 1, we have used the average of the 2009/10 to 2010/11 CVEs.

A13.221 The CVEs that we have adopted in the Cost Model are set out in Table A13.14 below.

²⁸³ Paragraphs 6.6 to 6.50, July 2012 LLU WLR Consultation

²⁸⁴ The Cost Allocation model and Cost Forecasting model used for the purposes of the LLU and WLR charge controls set in the March 2012 Statement

Table A13.14: 2011/12 CVEs used in the Cost Model

Cost Component	Weighted average of pay and non-pay CVEs
Wholesale Access specific	0.86
Routeing and records	0.97
MDF Hardware jumpering	0.97
Software jumpering	0.95
OR service centre provision WLR PSTN/ISDN2	0.90
OR Service centre provision LLU	0.90
Sales product management	0.93
E side copper capital	0.74
E side copper current	0.52
D side copper capital	0.80
D side copper current	0.56
Local exchanges general frames capital	0.93
Local exchanges general frames current	0.94
PSTN line test equipment	0.94
Dropwire capital and PSTN NTE	0.93
Business PSTN drop maintenance	0.96
PSTN Line cards	0.87
Pair gain	0.95
OR service centre Assurance WLR PSTN/ISDN2	0.91
OR service centre Assurance LLU	0.90
Combi card voice	0.80
Local loop unbundling systems development	0.86
Broadband line testing systems	0.94
Local Loop unbundling Room Build	0.81
Local Loop unbundling hostel rentals	0.89
Local Loop unbundling hostel rentals power and vent	0.87
Local Loop unbundling tie cables	0.74
ADSL connections	0.93
DSLAM capital/maintenance	0.81

Source: Ofcom analysis of Openreach information

Cost volume relationship for capital assets (AVEs)

A13.222 As described in Annex 11, AVEs are used to determine the change in the asset base in response to changes in demand (the percentage change in capex for a 1% change in volumes). When determining AVEs, we are looking to understand the long run relationship between the size of the asset base and the underlying cost volume drivers.

Proposals in the July 2013 and December LLU WLR 2013 Consultations

A13.223 In the July 2013 LLU WLR Consultation we proposed that we would:

- define a set of AVEs most appropriate for the relevant asset sectors; and
- apply the AVEs to our forecast of service volumes in order to project the capital costs from the 2011/12 base year to the final year of the charge control in 2016/17.

A13.224 We proposed to adopt the 2011/12 AVEs submitted by BT in response to requests under our statutory information gathering powers without further adjustment. We considered these figures provided the most up-to-date cost volume relationship for assets and the values obtained were reasonably consistent with what we would expect.

A13.225 We proposed to separately calculate network cable and duct capital expenditure in the RAV model.

Stakeholder responses

A13.226 Verizon stated that it accepted our proposals for forecasting capital costs, and that *“given the fact that the AVEs derived from the LRIC model are designed to estimate a percentage change in GRC for a given percentage change in volumes, which is Ofcom’s aim with the Cost Model, then this methodology seems appropriate”*²⁸⁵.

A13.227 Openreach²⁸⁶ stated that it welcomed Ofcom’s approach of calculating the forecast for copper and duct capital expenditure based on its own capital programmes for Copper and Duct spend. It also agreed that using the forecast volume change multiplied by the relevant AVE is an appropriate methodology for forecasting capital costs in the charge control.

A13.228 Openreach²⁸⁷ believed that the ‘Land and Building’ 2011/12 AVE of 0.73 proposed in the July consultation should be adjusted and a value of 0.59 instead adopted for our modelling. Openreach argued that the original 0.73 AVE was *“calculated based on a weighting of different equipment that requires housing e.g. Local Exchange, Main Exchange etc”* but that *“the majority of the Land and Building costs falling within the scope of these Charge Controls relate to co-mingling in the form of Accommodation Plant, such as electrical lighting, power, ventilation and fire protection”*. Openreach stated that in its 2012/13 LRIC modelling it generated a new Cost Volume Relationship for Accommodation Plant and that as the *“majority of these costs relate to Accommodation Plant, Ofcom should consider adopting the*

²⁸⁵ Paragraphs 45 to 46, Verizon Response to the July 2013 LLU WLR Consultation.

²⁸⁶ Paragraphs 358 to 364, Openreach Response to the July 2013 LLU WLR Consultation.

²⁸⁷ Paragraphs 358 to 364, Openreach Response to the July 2013 LLU WLR Consultation.

methodology used then to generate the AVE' and this would result in an AVE of 0.59.

A13.229 TalkTalk, in response to Openreach's proposal that the AVE for Land and Buildings should be lowered from 0.73 to 0.59 stated that to do so would be inappropriate as there could be seen to be a risk that Openreach was selecting an update to only those CVEs and AVEs that might be to its benefit²⁸⁸ TalkTalk was of the view that Ofcom should, before adopting the proposed new value, check that i) the AVE is clearly better than the old AVE, and ii) ensure that all other AVEs have been reviewed to "a similar level of scrutiny".²⁸⁹

A13.230 TalkTalk proceeded to state that "*the decline in Room Build costs that BT identifies relates to the volume driver for capitalised Room Build costs (not the AVE specifically)*" and that "*the volume driver for Room Build is [the] number of new rooms rather than the total volume of rooms. This means as the volume of new Room Builds has declined the capitalised costs have declined*". It also was of the opinion that if an inappropriate volume driver is used this does not mean that the AVE is wrong per se. Furthermore, it argued Openreach was effectively arguing for "*asymmetric AVEs so that as volumes increase the costs increase but as volumes fall the costs do not fall (as quickly)*", an approach that "*appears inconsistent with the concept of setting prices on the basis of forward looking efficient costs where all costs (including sunk costs) are considered as variable in the long run.*"²⁹⁰

Our analysis

A13.231 As with the CVEs, we conducted a review of the AVEs provided for 2011/12 which we use in the Cost Model to forecast costs.

A13.232 We have undertaken a review to consider the AVEs provided for 2011/12 and which are used in the Cost Model. We considered the nature of the cost characteristics for the AVEs and identified a selection of AVEs where:

- i) adjusting the value would have a material impact on the Cost Model outputs; or
- ii) a significantly different value to the one we were using could be plausible given our understanding of how the cost component was consumed within the service.

A13.233 On balance, our analysis led us to conclude that, overall, the AVEs provided by Openreach and derived from BT's LRIC model were the most appropriate to use for our purposes. We are not in a position to be able to provide a more robust or consistent set of AVEs. We also consider it a benefit that the CVEs and AVEs provided by BT are consistent with the cost information provided in the RFS from which we source the FAC we use in our modelling.

A13.234 We have also considered Openreach's argument that were we to adopt the AVEs and CVEs from the 2012/13 LRIC model which was reflected in BT's 2012/13 RFS we would include a new CVR for Accommodation Plant that would result in a lower value for the Land and Buildings AVE. As noted in Annex 22, we did not consider it appropriate to use BT's 2012/13 RFS as the base year, and therefore we consider it would be inconsistent to then adjust the 2011/12 AVE for a 2012/13 methodology change.

²⁸⁸ Paras 3.6 to 3.10, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

²⁸⁹ *Ibid.*

²⁹⁰ *Ibid.*

Conclusions

A13.235 We have re-examined the 2011/12 AVEs provided by Openreach and have decided that, on balance, we should continue to use them without further adjustment.

A13.236 The AVEs used in the Cost Model are set out in Table A13.15 below.

Table A13.15: 2011/12 AVEs used in the Cost Model

Asset	AVE
Cable	0.31
Duct	0.05
Local Exchange	0.51
Main Exchange	0.47
Intangibles	0.92
Transmission	0.83
Other Network Equipment	0.92
Motor Transport	0.65
Land & Buildings	0.73
Computers & OM	0.72
Other	0.92

Recovery of Common Costs from the 2013 BCMR Statement

Proposals in December 2013 LLU WLR Consultation

A13.237 In the December 2013 LLU WLR Consultation, we asked stakeholders for views on specific RFS cost items which they considered merited further investigation in order to establish whether they properly constituted efficiently incurred forward looking costs.

Stakeholder responses to the December 2013 LLU WLR Consultation

A13.238 In response to the December 2013 LLU WLR Consultation, Verizon said that “*The 2013 RFS moves costs from Ethernet to LLU/WLR and has the result of increasing costs in the WLR market by £24m and £8m for LLU. Verizon’s concern is that the move from Ethernet to LLU/WLR will result in double recovery, as at least some of these costs have already been recovered through the BCMR Charge Control (which was based on BT’s 2011/12 RFS). Therefore, if the Charge Control for LLU/WLR is calculated based on the 2013 RFS some costs will clearly be recovered twice.*”²⁹¹

²⁹¹ Paragraph 78, Verizon Response to the December 2013 LLU WLR Consultation.

Our analysis

A13.239 We agree with Verizon's concern that the 2012/13 RFS would result in some over-recovery of costs from the 2013 BCMR Statement. This was one of the reasons we considered that it would not be appropriate to use BT's 2012/13 RFS as the base year of the Cost Model (see Annex 22).

Conclusion

A13.240 As set out in Annex 22, we have used the 2011/12 RFS as the basis for our cost modelling, in part to prevent potential over-recovery of costs already allocated to be recovered in regulated charges via the controls set out in the 2013 BCMR Statement.

BT Pension costs

Proposals in the July 2013 LLU WLR Consultation

A13.241 In the July 2013 LLU WLR Consultation, we considered the treatment of contributions to BT's pension scheme in two parts; first, ongoing pension costs and, second, additional annual payments required to address any funding shortfall in BT's pension scheme.

A13.242 We referred to our decision, in the Pension Review Statement²⁹² (the 'Pension Review'), which contained our pension cost guidelines ('the Pension Guidelines'). The Pension Guidelines set out our general policy as to the approach we would normally expect to take in relation to the treatment of BT's pension costs when assessing the efficiently incurred costs of providing relevant regulated services.

A13.243 In summary, in the context of setting charge controls, our approach is that pension deficit payments should be disallowed (and any pension holidays should be ignored). As a general rule, unless we consider that there has been a material change in the circumstances and background considered as part of our review, we do not expect to depart from the Pension Guidelines.

A13.244 In the July 2013 LLU/WLR Consultation we noted that BT suggested that a proportion of deficit repair payments should be included in the regulatory asset base (RAB), which could then be amortised over a period of time, consistent with the accounting asset lives for the adjusted assets.²⁹³

A13.245 BT suggested that the RAB (for copper and duct) was understated, and that the existence of the pension deficit demonstrates this. This is because BT capitalises an element of labour costs relating to both copper and duct. Included in these labour costs (for employees) are the ongoing costs which BT pays in relation to pensions of current employees.

A13.246 We explained in the July 2013 LLU WLR Consultation that based on BT's calculation, the RAV would increase by \times relating to copper, which would be spread over an asset life of 18 years. There would be an additional \times increase relating to duct which would be spread over 40 years.

²⁹² Ofcom, *Pensions Review - Statement*, 15 December 2011, <http://stakeholders.ofcom.org.uk/binaries/consultations/btpensions/statement/statement.pdf>

²⁹³ The RAB differs from the RAV adjustment, which refers to the treatment of pre-97 copper and duct assets, this treatment is explained in detail in Annex 6.

A13.247 In the July 2013 LLU WLR Consultation we considered that there were no factors relating to the LLU WLR charge controls which would support the adoption of an alternative approach to that expressed in our Pension Guidelines.

Stakeholder responses to July 2013 LLU WLR Consultation

A13.248 TalkTalk stated that the effect of the approach proposed by BT would be to recover some pension deficit repair costs from services covered by these charge controls.²⁹⁴ It argued that the reasons it was wrong to recover deficit repair payments from regulated charges before (as determined by Ofcom and confirmed by the CAT/CC), also applied today.

A13.249 TalkTalk considered that BT's proposal amounted to retrospection and this is not in the interests of consumers.²⁹⁵ TalkTalk explained that, our valuation of copper and duct is based on an indexation approach which inflates past capital expenditure by RPI to estimate the Gross Replacement Cost (GRC) of duct. TalkTalk disagreed that making an adjustment to the capital costs will produce a better estimate of the GRC. It noted that this approach does not take into account any efficiency savings and that if Ofcom were to re-open the calculation to take account of pension costs, it should also re-assess:

- Efficiency gains on capital expenditure; and
- The extent to which RPI may overstate the increase in expenditure due to methodological issues.²⁹⁶

A13.250 Openreach considered that we had misunderstood BT's arguments and should adjust the RAV to correct for the underestimate of the capitalised labour associated with the building of the copper network.²⁹⁷

A13.251 Openreach explained that it considers that the true cost of building the network has been understated. This is because it considers that the ongoing costs which form part of capitalised labour, included in the cost of building the network, have been historically understated. It therefore considered that Ofcom should make an adjustment to the cost of building the network to reflect its claimed higher ongoing cost of servicing the pension funds of those employees that built the network.

A13.252 Openreach did not consider that an adjustment to the cost of duct or copper to reflect understated ongoing costs would amount to a partial recovery of the pension deficit through regulated charges.²⁹⁸

A13.253 It considered that Ofcom had misunderstood its proposal, by regarding it as an issue covered by the Pension Review. It argues that the current issue relates to ongoing costs and not the pension deficit.

A13.254 Openreach disagreed with Ofcom's statement that the indexed valuation methodology is a proxy for the replacement cost of the network and that it would therefore be inappropriate to adjust this. It stated that its argument is that historical

²⁹⁴ Paragraph 2.65, TalkTalk Response to the July 2013 LLU WLR Consultation.

²⁹⁵ Paragraph 2.16-7, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

²⁹⁶ TalkTalk did not explain what it meant by 'methodological issues' but we interpret this to mean the upward bias inherent in the RPI formula as discussed in paragraph 3.132. We do not consider this formula effect per se to be a concern in the present context.

²⁹⁷ Paragraphs 153-157, Openreach Response to the July 2013 LLU WLR Consultation.

²⁹⁸ Paragraphs 503-507, Openreach Response to the July 2013 LLU WLR Consultation.

capex, which is being indexed, is understated and therefore doesn't reflect the true cost of replacing the network.

Conclusions

A13.255 As set out in our July 2013 LLU WLR Consultation, we consider that an adjustment to take account of past pension costs, which BT argues were understated, would amount to a partial recovery of the pension deficit and for these reasons the Pensions Guidelines would apply.

A13.256 However, we understand that BT considers the issue is not about the pension deficit, but rather about whether Ofcom's method of calculating the CCA values of post-1997 copper and duct assets means they are understated.

A13.257 In principle CCA asset values do not require adjustment for past understatement of pension costs because they necessarily represent the costs of replacing the assets today including a forward-looking measure of pension costs. The question, therefore, is whether Ofcom's valuation method produces a good estimate of the relevant CCA value for the assets in question.

A13.258 Ofcom has used different approaches to arrive at base year (2011/12) CCA valuations of the access copper assets on the one hand and the access duct on the other. The base year value for post-1997 copper assets was BT's absolute valuation in 2011/12. Therefore, we do not consider that the value of these assets is understated as a result of any alleged understatement of past pension costs.

A13.259 Ofcom has arrived at the CCA replacement cost value of the local access ducts by applying an appropriate price index to past capital expenditure. BT argues that this value is too low because past capital expenditure was, in its view, understated. The relevant question, however, is whether the chosen indexation method produces a good estimate of the current cost of replacing the duct assets. We have shown that it does, because the indexed valuation of actual capital expenditure gives a good approximation to the absolute valuation (see paragraph A6.45). That being so, no further adjustment is needed. We note that BT has not shown that the indexed valuation of actual capital expenditure plus an uplift for recovery of historic pension costs would produce a better proxy for the forward looking costs of replacing the network.

A13.260 We therefore do not consider that it would be appropriate to re-calculate the CCA valuation of copper and duct and have not made an adjustment for any alleged under-estimation of pension costs in the past.

DSLAM Capital Maintenance

Summary

A13.261 We have decided to maintain the position proposed in the December LLU WLR 2013 Consultation: i.e. to remove 70% of the 'DSLAM capital/maintenance' cost and to allocate the remaining 30% to the main rental services in accordance with the relative fault rates and service level differential which we have established.

Proposals in the July 2013 and December 2013 LLU WLR Consultations

A13.262 In the July 2013 LLU WLR Consultation, we included the 'DSLAM capital/maintenance' cost component in the SMPF costs. The total value of this cost

component was c.£15m in the base year, which equated to £1.31 for the unit costs of each SMPF Rental service.

A13.263 In the December 2013 LLU WLR Consultation, we proposed to remove 70% of the 'DSLAM capital/maintenance' cost via a one-off adjustment to charges and to allocate the remaining 30% to the main rental services (this re-allocation being phased in via a glide path to 2016/17).

A13.264 We did this because further investigation, following the July 2013 LLU WLR Consultation, revealed that 70% of the inappropriately named 'DSLAM capital/maintenance' cost actually related to special fault investigations (SFI) and the remaining 30% was related to broadband faults²⁹⁹. SFIs are a separately chargeable service and are not controlled as part of the caps on the LLU and WLR rental services and accordingly we proposed to remove them. Costs associated with broadband faults are within the scope of the caps on LLU and WLR rentals and accordingly we proposed to retain them and to allocate them to the main rental services in accordance with the relative fault rates and service level differentials which we established (see Annex 20 and Annex 19 for our final position on these differentials).

Stakeholder responses to the December 2013 LLU WLR Consultation

A13.265 ☒ supported the proposal as did EE "*to remove the costs of evoTAMs and SFI related DSLAM capital maintenance costs from the regulated cost stacks with immediate effect, for the reasons set out by Ofcom in the December 2013 LLU WLR Consultation*".³⁰⁰ However, they did not agree with the proposed re-allocations of the remaining DSLAM capital maintenance costs as they felt these costs were being inappropriately recovered from lines used to provide voice rather than broadband services. Because a large number of WLR lines were voice only, they felt that the £0.15 allocation was too high compared to MPF lines which were virtually never solely used to provide voice only services, where the allocation was £0.12p.³⁰¹

A13.266 TalkTalk, whilst not directly answering the questions posed, did appear to agree with the proposal to remove the costs relating to SFI faults from 'DSLAM Capital maintenance. TalkTalk suggested that historically BT has been double-recovering SFI costs (once in SMPF rental charges and also in SFI charges which are separately levied) and felt it appropriate for us to consider if this past double recovery should have been noticed by BT, and whether it should lead to any further regulatory action or changes.

A13.267 Openreach did not agree that the DSLAM capital/maintenance costs associated with SFI faults should be taken out of the Cost Model. Openreach explained that

"The costs for SFI services were calculated by multiplying the total SFI hours from the Openreach management information by a man-hour rate. These costs were then deducted from the total copper repair costs in the RFS.

²⁹⁹ BT's response dated 18 October 2013 to question 3ii of the Eleventh LLU WLR BT Information Request.

³⁰⁰ Page 5, EE Response to the December 2013 LLU WLR Consultation.

³⁰¹ Page 14, EE Response to the December 2013 LLU WLR Consultation.

Therefore, the copper repair costs in Ofcom's base year are already reduced by the total calculated costs for SFI³⁰².

A13.268 Without explaining how the SFI costs also appeared to comprise 70% of DSLAM capital maintenance costs, Openreach felt that if we were to exclude these costs it would result in the SFI costs being removed twice from Ofcom's base year costs.

A13.269 Openreach agreed that the 30% of DSLAM capital maintenance costs that relate to broadband faults on copper lines should be treated like any other repair cost as part of a common pool of costs that are attributed by using volumes and usage factors. Openreach felt, however, that the reattribution should occur as a base year adjustment rather than on a glidepath. One confidential respondent ☒ agreed with Openreach's position.³⁰³

Analysis

A13.270 As explained earlier, our objective is to project efficiently incurred forward- looking costs. We have not attempted to adjust costs in order to deal with any potential past over-recovery.

A13.271 We did not agree with Openreach's response to the consultation³⁰⁴ that our proposal to remove 70% of the 'DSLAM capital/maintenance' cost, which are SFI costs, would result in this cost being removed twice. This seemed to be contrary to the information provided by BT in response to a number of statutory information requests and follow up clarifications³⁰⁵. Openreach's response suggested that SFI costs had already been removed from the copper repair costs in the base year. However, we had not made any adjustments to the RFS base year numbers provided by BT in relation to SFIs. Further, if BT had already removed all of the SFI costs in the base year, we failed to see how could it be that 70% of the 'DSLAM capital/maintenance' cost in the base year was related to SFIs.

A13.272 In light of this we sought further information from BT³⁰⁶. BT submitted a supplementary consultation response.³⁰⁷ We also had extensive further dialogue with BT on this point. The result of this was that BT produced a schedule to explain

³⁰² Paragraph 424, Openreach Response to December 2013 LLU WLR Consultation.

³⁰³ ☒ response question 7.3 of the December 2013 LLU WLR Consultation.

³⁰⁴ Paragraphs 421 – 430, Openreach Response to December Consultation.

³⁰⁵ BT's response dated 18 October 2013 to question 3 of the Eleventh LLU WLR BT Information Request.; Email from ☒, Group Regulatory Finance, BT to ☒, Competition Policy Manager, Ofcom sent on 7 March 2014 at 17:56 and entitled "Re: efficiency"; Email from ☒, Ofcom to ☒, Regulatory Affairs, BT sent on 23 October 2013 at 10:30 and entitled "RE: Call request from ☒"; Email from ☒, Competition Policy Manager, Ofcom to ☒, Group Regulatory Finance, BT sent on 25 November 2013 at 16:00 and entitled "DSLAM Capital/Maintenance - request for clarification"; Email from ☒, Group Regulatory Finance, BT to ☒, Ofcom, sent on 23 October 2013 at 16:29 and entitled "RE: Call request from ☒"; Email from ☒, Group Regulatory Finance, BT to ☒, Competition Policy Manager, Ofcom, sent on 2 December 2013 at 16:55 and entitled "RE: DSLAM Capital/Maintenance - request for clarification".

³⁰⁶ BT's response dated 26 March 2014 to question 11 of the Nineteenth LLU WLR BT Information Request.

³⁰⁷ Section 3.1 pages 9-10, Openreach, *Openreach supplementary submission relating to Ofcom's fixed access market reviews and charge controls*, 26 March 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Openreach_Supplimentary_submission.pdf

its position³⁰⁸. However, the cost information in its schedule was produced at a very granular level. In particular, it was more granular than the other information sources we had and accordingly it was not possible for us to reconcile the substance of this schedule to any of the other information that we have used to scrutinise costs; and in any event it was at a level of disaggregation greater than that at which we are modelling the charge control.

A13.273 Our assessment was that further explanation from BT on this point would not resolve our inability to scrutinise these costs by reference to other verifiable information was inconsistent with the modelling approach adopted and that to attempt to do so would risk delays to the setting of the charge controls. We therefore decided that we should rely on the information provided to us by BT under our statutory information gathering powers which we had reconciled to the RFS³⁰⁹. Based on this information we have decided that 70% of the 'DSLAM capital/maintenance' cost should be removed from the base year.

A13.274 We have decided to re-allocate the residual 30% of the costs associated with faults in accordance with the relative fault rates and service level differential which we established (see Annex 20 and Annex 19). In setting the ratios of fault and repair costs, we have taken into account the totality of Openreach's faults costs, including their causation. These 'DSLAM capital/maintenance' costs comprise a small part of that total set of fault-related costs. We have therefore decided to allocate them in the same way.

Conclusion

A13.275 We have decided to remove 70% of the 'DSLAM capital/maintenance' cost (c£15m) with immediate effect, and to allocate the remaining 30% to the main rental services in accordance with the relative fault rates and service level differential set out in Annexes 20 and 19. By virtue of our glide path approach, this re-allocation of the 30% of remaining "DSLAM capital/maintenance" costs, takes place over the control period (i.e. up to 2016/17)

Copper Recovery Income

Proposals in the July and 2013 December LLU WLR Consultation

A13.276 As set out in Section 3, Volume 2,³¹⁰ we discuss the arguments made by Frontier Economics on behalf of Sky and TalkTalk on how to account for the income if/when the copper access network is closed down in the context of a hypothetical on going network and anchor pricing. In this section we address the treatment of what Frontier Economics refers to as 'business as usual' (BAU) copper scrap revenue and costs (i.e. income).

A13.277 BT's accounting policy on copper cables is to depreciate them over 18 years with a residual value of zero. The economic life of some cables may be shorter or longer. When a cable reaches the end of its life it can be removed immediately in order to obtain some spare capacity within the duct chamber - it may be removed when

³⁰⁸ Phone call on pm 2nd April 2014 between ☒, Principle Competition Finance, Ofcom and ☒, Group Regulatory Finance, BT and meeting between ☒, Group Regulatory Finance, BT and ☒, Principal Competition Finance, Ofcom 11am 7th April 2014.

³⁰⁹ BT's response dated 4 October 2013 to question 3ii of the Eleventh LLU WLR BT Information Request.

³¹⁰ Paragraphs 3.59 to 3.65, Section 3, Volume 2.

there is an opportune time or when the manpower is available or the price of scrap copper makes the work profitable. In other cases, the cable may be only removed when a new requirement for duct space has been identified.³¹¹

A13.278 As described in Section 4 of March 2013 CC Determination BT accounts for BAU copper scrap using the ‘income’ method, whereby the proceeds of BAU Copper from the Access network are offset against the cost of services that use that Access network. According to BT’s DAM³¹² scrap copper that is not part of an Openreach programmatic recovery programme is allocated between Repayment Works and D-Side Copper (Capex). In 2010/11, the total amount of net income (after the cost of extraction) for scrap copper proceeds was \approx with a relatively small (\approx amount being BAU Copper from the Access network).

Consultation responses

A13.279 In its response TalkTalk³¹³ proposed an alternative method of accounting for BAU Scrap Copper than the income method, which it referred to as “the reduced depreciation approach”. The reduced depreciation method differs from the income approach in TalkTalk’s opinion because the calculation of depreciation takes account of a positive expected residual value of the scrap copper at the end of its useful life rather than the zero value that BT use. TalkTalk also makes the point that the way BT accounts for depreciation³¹⁴ means that it should take account of any expected residual value and therefore how BT actually accounts for the income is inconsistent with its stated accounting policy.

Analysis

A13.280 Attempting to predict the residual value of scrap copper (as discussed in paragraph 3.65) is extremely difficult. In order to attempt to estimate any residual value it would be necessary to make assumptions about the volume of copper that would be extracted. This, in turn, would require information as to where and when copper cables would need to be replaced. To determine the gross revenue, assumptions on how much copper would be sold and at what price would need to be made. Copper prices have fluctuated considerably in recent years and with an 18 year life, predicting future gross revenue would be very difficult. To calculate the net revenue, the cost of extraction would also need to be determined. This would vary depending on where the cabling was located and how difficult it would be to extract. In some cases the extraction cost may make it uneconomic to recover the copper. This uncertainty would also need to be assessed. Given the uncertainties involved, our judgement is that assuming a zero residual value and recognising the income when it occurs rather than making numerous assumptions is the more prudent approach. This is the approach inherent in the RFS cost information on which the Cost Model is based.

³¹¹ Paragraph 4.7, Competition Commission, *References under section 193 of the Communications Act 2003: British Telecommunications Plc v Office of Communications, Case 1193/3/3/12; British Sky Broadcasting Limited and TalkTalk Telecom Group Plc v Office of Communications, Case 1192/3/3/12 – Determinations*, 27 March 2013, http://catribunal.org/files/1192-93_BSkyB_CC_Determination_270313.pdf, (March 2013 CC Determination).

³¹² Page 97, BT’s 2012 DAM.

³¹³ Paragraph 3.1 to 3.15, TalkTalk Response to the December 2013 LLU WLR Consultation.

³¹⁴ Page 37, section 4.5.2, BT, *Primary Accounting Documents*, 31 July 2012, http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/PADS_2012.pdf

A13.281 We do not think that this “income” approach is inconsistent with BT’s stated accounting policy. The “income” approach can be seen as a special case of the ‘reduced depreciation approach’, where the latter calculates depreciation assuming a zero residual value. There is nothing in BT’s Accounting policies to prevent it adopting zero residual values in the face of uncertainty in forecasting copper recovery income. As BT stated in the appeal of the March 2012 Statement “copper assets could not be depreciated to their scrap values unless that value was known at the beginning of their lives, which it was not”.³¹⁵

Conclusion

A13.282 We consider that BT’s treatment of copper recovery income appears to be a prudent and practicable basis for accounting for scrap copper income.

IT Costs

Proposals in December LLU WLR 2013 Consultation

A13.283 In the December 2013 LLU WLR Consultation, we asked stakeholders for views on specific BT RFS cost items which they considered merited further investigation to establish whether they properly constitute efficiently incurred forward looking costs.

Stakeholder responses to December 2013 LLU WLR Consultation

A13.284 In response to both the July 2013 LLU WLR Consultations we received a response from TalkTalk that suggested that we scrutinise whether the IT cost allocation is appropriate, as “*in the 2012 Charge Control Ofcom identified that these were grossly overestimated by BT and adjusted them downwards by about £100m*”³¹⁶. (It should be noted that the actual adjustment that TalkTalk reference was a £125m reduction we made to the 2010/11 base year costs in the prior charge control.) Verizon also suggested that we investigate the Openreach Computing and Development Costs.³¹⁷

Our analysis

A13.285 We have obtained information under our statutory powers from BT to examine concerns as to whether the IT cost allocation in the base year cost stack may be overstated. We were particularly interested in ensuring that non-recurring costs or NGA costs were not included within the base year costs.

A13.286 BT provided the allocation of IT costs from BT Group to Openreach for 2011/12³¹⁸ and 2012/13 of ₤ and ₤ respectively. These costs were broadly in line with the post-adjusted costs projected in the last charge control of £277m for 2011/12, and the projections of £267m for 2012/13 and £262m for 2013/14.

A13.287 We requested from BT a detailed breakdown of IT spend previously provided³¹⁹. In response, BT provided a schedule setting out the ₤ 2011/12 Openreach IT spend

³¹⁵ Paragraph 4.28, March 2013 CC Determination.

³¹⁶ Paragraphs 2.62, TalkTalk Response to the July 2013 LLU WLR Consultation.

³¹⁷ See paragraph 77, Verizon Response to the July 2013 LLU WLR Consultation.

³¹⁸ BT’s response to question 9(b) of the Thirteenth LLU WLR BT Information Request.

³¹⁹ BT’s response dated 27 March 2014 to question 3 of the Nineteenth LLU WLR BT Information Request.

on an F8 code basis³²⁰ greater than £5m. BT also provided a second breakdown of Openreach IT costs in 2011/12 showing that cost which could be identified by reference to specific programmes (greater than £5m) amounting to ₤ (around half the total IT spend) A review of these schedules did not identify any one-off Openreach costs that were unlikely to occur post 2011/12.

A13.288 The schedule setting out the 2011/12 Openreach IT spend on an F8 code basis also included the amounts within each F8 code that had been allocated to NGA. The total amount was ₤. BT confirmed that these identified NGA costs were not allocated to the WLA or WFAEL markets

Conclusions

A13.289 Based on our review of BT's RFS costs we do not consider that there has been over-allocation of IT costs which would lead us to adjust the 2011/12 base year costs.

Allocation of LLU costs to BT Northern Ireland

Stakeholder responses to July 2013 LLU WLR Consultation

A13.290 In response to the July 2013 LLU WLR Consultation, TalkTalk stated that "previously BT had not allocated certain LLU costs (particularly 'IT Net Development' and 'Design costs') that should have properly been allocated to BTNI (since the LLU model effectively modelled the costs of LLU in the UK except NI) meaning that the cost (and so charge) for MPF was excessive."³²¹

Our analysis

A13.291 The base year costs included in the Cost Model includes all costs relating to the United Kingdom including Northern Ireland. This modelling approach means we consider the point identified by TalkTalk is not an item that would require an adjustment.

Conclusion

A13.292 We do not consider that there has been any under-allocation of costs to BT Northern Ireland given the design of the Cost Model.

Career Transition Centre (CTC) costs

Proposals in December 2013 LLU WLR Consultation

A13.293 "Career Transition Centre" costs (CTC) occur when employees within BT are redeployed from one Line of Business (LoB) to another. Examples of when these costs would be incurred are where an employee has left one LoB and has not yet started a role in another LoB or has not yet been made redundant. Whilst the employee resides within the CTC, their employment costs are attributed to their original LoB. In the March 2012 Statement, we did not exclude these costs as they had a minimal impact on charges. In the December 2013 LLU WLR Consultation we asked whether these costs should be included in the cost base of the charge controls.

³²⁰ F8 code is the most granular breakdown available from BT Regulatory Reporting system (ASPIRE)

³²¹ Paragraphs 3.2 to 3.4, TalkTalk Response to the July 2013 LLU WLR Consultation

Stakeholder responses to December 2013 LLU WLR Consultation

A13.294 Stakeholders with the exception of Openreach did not think CTC costs should be included in the cost stack for regulated services. Vodafone considered that there was *“absolutely no rationale for its costs to be distributed to regulated services”*³²². Openreach argued that CTC costs were a legitimate cost to do with managing the Openreach workforce, in that *“[e]ntry into the CTC is usually triggered by BT delivering efficiencies, and as such is driven by the underlying efficiency programme. The cost of the transfer of people into the CTC is far less than having people leave and then having to recruit new employees to work in the areas that we need them. On average the people in the CTC are there for 3 months.”*³²³

Analysis

A13.295 Our approach to setting an efficiency rate is set out in Annex 16 of this Statement. In Annex 16 we describe how we determine a target efficiency rate with reference to the overall reduction in cash costs i.e. a rate that takes into account any additional costs incurred, such as redundancies.³²⁴ We agree with BT’s view that CTC costs are incurred in the management of the Openreach workforce and delivering efficiencies. We have therefore included CTC costs within the cost trends examined as part of our estimation of the efficiency parameter.

A13.296 We have not investigated in depth BT’s view that the cost of transferring people into the CTC is far less than the cost of people leaving plus the cost of having to recruit new employees to work in the areas where they are needed. We are persuaded by BT’s argument that there is likely to be some efficiency in not having to recruit people and/or make people redundant, only to have to undertake costly recruitment activity shortly thereafter. The fact that an average stay in the CTC is three months means that most people are not in the CTC for very long, so even if some people are arguably “inefficiently” in the CTC, this will only apply to a sub-set for on average three months.

Conclusion

A13.297 We consider that CTC costs are a legitimate cost of delivering efficiency savings and should therefore not be removed from the Cost Model.

Directories

Proposals in July 2013 LLU WLR Consultation

A13.298 In paragraphs 3.105 to 3.126 of the July 2013 LLU WLR Consultation, we proposed that the charge control on WLR should no longer include a contribution to the cost of providing printed telephone directories. We proposed to remove the contribution to the cost of printed directories from WLR immediately and not through the mechanism of a glide path.

A13.299 We noted that, if the directory costs were removed from the WLR cost stack, BT might nevertheless continue to deliver the BT Phone Book free of charge, everywhere in the UK, because of the revenue it generates from classified advertisements. However, we recognised that there is a possibility that it may not.

³²² Answer to Q7.7, Vodafone Response to the December 2013 LLU WLR Consultation.

³²³ Page 95, paragraph 452, BT Response to the December 2013 LLU WLR Consultation.

³²⁴ Para A16.1.3, Annex 16.

In that case, it would still need to comply with its obligations under Condition 8 of the General Conditions of Entitlement³²⁵ (“GC8”) to ensure its subscribers were, on request and for a reasonable fee, supplied with a printed directory containing telephone numbers for their local area. Other CPs would also still need to comply with their own obligations under GC8.

A13.300 We recognised that it may take other CPs time to put in place arrangements to ensure they were able to comply with GC8. We said we would welcome views on any arrangements that would be appropriate in the event that CPs considered that it would be helpful to have transitional arrangements in place to enable them to meet their GC8 obligations.

Stakeholder responses to July 2013 LLU WLR Consultation

A13.301 BT³²⁶ said that it understood Ofcom’s reasons for removing printed directory costs from WLR rental charges but did not think it should be done immediately. It suggested delaying the removal of the WLR charge by two years, because all parties needed time to put alternative arrangements in place. BT argued that producing a directory was considerably more complex than most CPs realised, involving processes such as demand forecasting, software for formatting the data, printing and distribution. It argued that a significant proportion of customers still value a printed directory. In its response to the December 2013 LLU WLR Consultation, BT again urged Ofcom to delay the implementation of the one-off adjustment, to allow all parties to put alternative arrangements in place.³²⁷

A13.302 Openreach³²⁸ said that Ofcom’s proposal to make a reduction of £2.23 to the price of WLR rental for directories did not reflect the most up-to-date information that Ofcom had on the forecast of cost for directories in 2013/14. Openreach said Ofcom should use the most up-to-date forecast of the cost for directories in 2013/14, which it said was £2.06 in the 2012/13 RFS.

A13.303 EE³²⁹ welcomed Ofcom’s proposal to immediately remove printed directory costs from the WLR cost stack, and argued that the principle of cost minimisation would be best achieved if the cost were removed immediately. If BT decided to restrict supply of the Phone Book to its own retail customers, “EE would expect commercial drivers towards a mutually beneficial and acceptable arrangement for the industry would motivate BT to give due warning to other CPs and engage constructively in working to develop an acceptable solution for all”. In the meantime, EE argued, customers would have their 2013 BT Phone Book and could also consult the internet for directory information, while benefiting from lower WLR costs being passed through.

A13.304 Although we did not specifically seek views on the matter of the cost of printed directories in the December 2013 LLU WLR Consultation, in its response EE reiterated its view that these costs should be removed immediately from the WLR cost stack.³³⁰ EE also responded to arguments raised by BT and TalkTalk in their responses to the July 2013 LLU WLR Consultation. EE said that BT had been aware of Ofcom’s proposals on the cost of printed directories since July 2013, and

³²⁵ The General Conditions of Entitlement are available on Ofcom’s website at the following URL: <http://stakeholders.ofcom.org.uk/telecoms/ga-scheme/general-conditions/>

³²⁶ Paragraphs 510 to 517, BT Response to the July 2013 LLU WLR Consultation.

³²⁷ Paragraph 36, BT Response to the July 2013 LLU WLR Consultation

³²⁸ Paragraphs 118 to 120, Openreach Response to the July 2013 LLU WLR Consultation.

³²⁹ Response to question 3.9, pages 11 to 14, EE Response to the July 2013 LLU WLR Consultation

³³⁰ Pages 26-29, EE Response to the July 2013 LLU WLR Consultation.

therefore there had been time for it to adjust its contracts for printing and make alternative arrangements. It also noted that BT had not initiated any commercial proposals on directories, and speculated that it would not, until just prior to the removal of the cost of printed directories from the WLR rentals. EE disputed that producing and printing a “no frills” directory would be as complex as suggested by BT. EE³³¹ also produced some results from its own survey of consumer use of printed directories.

A13.305 One other stakeholder, ☒, fully supported Ofcom’s proposal to remove printed directory costs from the charge control. It argued that its users do not value a printed directory, and that the widespread supply of printed material was contrary to the EC Waste Directive. It argued that “only the removal of the cost recovery will incentivise BT to engage with industry to implement an alternative quickly to safeguard its premium listings service”. It also noted that WLR customers are paying towards a phone book that is being distributed to all MPF customers of other CPs.

A13.306 TalkTalk³³² said it accepted that since provision of printed directories is not part of the WLR service then there was no rationale for WLR charges to contribute to the cost. TalkTalk considered that Ofcom proposed to make an immediate adjustment for directories because this would not weaken Openreach’s cost minimisation incentives. It said that if Ofcom considered this approach was reasonable for directories, then there may be other areas where one-off adjustments could or should be made (such as changes in the cost of capital assumptions and asset valuation methodology). TalkTalk considered that on balance it was ‘probably best’ not to diverge from a glide path approach for directories. TalkTalk also felt that a transition period was necessary as it would take “a reasonable period” for CPs to be able to comply with GC8.

A13.307 Sky³³³ considered that it was incorrect to couple the issue of printed directory costs with broader objectives of reducing price differentials between MPF and WLR to reflect their incremental cost differences. Sky considered that it was more appropriate to spread the adjustment to remove the cost of printed directories over the course of the charge control period, in order to allow BT and industry time to make transitional arrangements.

A13.308 Virgin³³⁴ argued that removing the cost of printed directories from WLR charges could have a damaging impact, if it meant that the responsibility to supply a printed directory shifted to individual CPs. Virgin thought that MPF and WLR charges should both contribute to directory costs.

A13.309 Vodafone³³⁵ agreed with Ofcom’s proposal to remove the cost of printed directories immediately from WLR charges.

³³¹ EE highlighted the result that 88% of the 2000 on-line respondents said that they would not pay for a phone book. See Letter from Kip Meek to Stuart McIntosh dated 5 March 2014, entitled “Fixed Market Access Review: Openreach quality of service and approach to setting LLU and WLR Charge Controls”, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/EE_Additional_Evidence_to_Ofcom_on_directories.pdf

³³² Paragraphs 2.47 to 2.59, TalkTalk Response to the July 2013 LLU WLR Consultation

³³³ Paragraphs 10.35 to 10.39, Sky Rresponse to the July 2013 LLU WLR Consultation.

³³⁴ Question 3.9, pages 6 to 8, Virgin Media Response to July 2013 LLU WLR Consultation.

³³⁵ Question 3.9, page 16, Vodafone Response to the July 2013 LLU WLR Consultation.

A13.310 Verizon³³⁶ agreed with Ofcom's proposal, "both in terms of the action and the timing". It believed that removal of the cost of printed directories from WLR charges would ensure that only those subscribers who require a printed directory pay for it.

A13.311 The Federation of Communication Services (FCS)³³⁷ supported Ofcom's proposal. It considered that this was an unfair charge on WLR CPs and believed that CPs would still be able to meet their obligations under GC8 once the removal from the WLR charge took place.

Our analysis

Removal of printed directory costs from WLR

A13.312 Whilst stakeholder views differed on the question of timing, none of the respondents to this aspect of the July 2013 LLU WLR Consultation objected to the removal of the cost of printed directories from regulated WLR charges.

A13.313 A contribution to the cost of printed directories has previously been included in the WLR cost stack because the contract for WLR currently includes an obligation on BT to distribute a telephone directory to the end user on behalf of CPs purchasing that service. In contrast, the MPF rental contract does not, which is why a contribution to the cost of printed directories has never been included in the MPF cost stack.

A13.314 We now consider that it is not appropriate for WLR customers to be compelled to contribute to BT's directory costs by way of the charge controls. This is for the following reasons:

- i) The bundling of directory delivery with WLR is not part of the remedies we have imposed in the WFAEL markets and so does not form part of the cost stack of the regulated access service;
- ii) The major purchasers of WLR favour a service that excludes the charge for printed directories.³³⁸ We consider that, rather than needing to go through the New Product Requirement Process³³⁹ to obtain a 'directory-free' WLR service, it is more appropriate for the basic WLR service to be provided without a contribution to directory costs.

A13.315 However, if CPs wish to purchase a WLR service which includes the provision of printed directories for their end-users, they would be free to negotiate such a service with BT on a commercial basis.

A13.316 In terms of the timing of the removal of directories related costs from WLR charges, we have considered whether a one-off adjustment or a glide path would be more appropriate. As we set out in more detail in section 6, Volume 2 of this statement, we normally prefer to use a glide path when setting charge controls. This is partly because it provides a better balance between static and dynamic efficiency (in particular, it provides greater incentives for efficiency improvement as it allows the

³³⁶ Paragraph 19, Verizon Response to the July 2013 LLU WLR Consultation.

³³⁷ Question 3.9, page 3, FCS, *Ofcom FAMR – Approach to setting LLU and WLR Charge Controls Issued 11 July 2013*, 25 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Federation_of_Communication_Services_Ltd.pdf

³³⁸ EE, TalkTalk, Verizon, FCS, Vodafone and 3 agreed that directories costs should be removed from WLR. Sky did not object to the proposal to remove directories costs from WLR.

³³⁹ Previously SoR - Statement of requirements.

firm to retain the benefits of cost reductions made under a previous charge control for longer, albeit at the expense cost-reflective prices in the short-term). A glide path is also beneficial in that it involves making changes gradually, helping to ensure a stable and predictable regulatory framework.

A13.317 However, for the costs of printed directories recovered in the WLR charge, we do not consider that the dynamic efficiency consideration is as important as it might usually be because the decision at hand is concerned with whether printed directory costs are to be recovered at all from regulated access line charges, not how quickly cost reducing efficiencies should feed through to regulated prices.

A13.318 A glide path would mean that some part of directory costs was implicitly included in the WLR charges during the first two years of the next charge control period (i.e. 2014/15 and 2015/16). Because we now consider that these costs should no longer be included in WLR at all, we consider there is a strong case for setting the WLR charge such that it reduces immediately to a level that excludes the cost of printed directories, rather than via a glide path.

A13.319 We recognise that removing the costs immediately would lead to a more sudden change than using a glide path. In section 6, Volume 2 we therefore consider the overall change in the price paths of the key rental services from our decision. After considering the overall impact of the implied price paths, we conclude that an immediate reduction in the WLR charge is more appropriate than a glide path.

The need for CPs to comply with General Condition 8

A13.320 Under General Condition 8 (“GC8”) all CPs are required to ensure their subscribers are, on request, supplied with a printed directory containing telephone numbers for their local area. GC8 allows CPs to charge a reasonable fee for doing this.³⁴⁰

A13.321 Because of the revenue it generates from classified advertisements, BT currently chooses to go beyond its own GC8 obligation and indeed its WLR contractual obligation in that it delivers a printed directory (i.e. the BT Phone Book) to virtually all premises, and does so free at the point of delivery. The GC8 obligations of other CPs have to date therefore been met courtesy of BT’s universal supply of the BT Phone Book. As part of the July 2013 LLU WLR Consultation, we asked stakeholders whether they felt that there would be a need for a transitional arrangement.

A13.322 On the basis of stakeholder responses – in particular those WLR CPs who contribute to the costs of printed directories and whose contractual arrangement with BT to supply printed directories on their behalf will likely cease – we do not consider that it is likely CPs will fail to meet their GC8 requirements. EE and 3 were confident that they could meet their GC8 obligations, even if BT ceased universal distribution of the BT Phone Book.

A13.323 CPs who supply their end-users with MPF currently benefit from BT providing the BT Phone Book, but we note that BT is currently under no obligation to supply printed directories to MPF customers and could cease this at any time; even if the WLR contribution to directory costs remained in place.

³⁴⁰ See paragraphs 8.2 to 8.4 of the General Conditions, <http://stakeholders.ofcom.org.uk/telecoms/ga-scheme/general-conditions/>

A13.324 In any case, it is not clear that BT will cease universal distribution of the BT Phone Book, at least not over the period of this review. It may still be in BT's interests to continue the universal free distribution of the BT Phone Book in order to receive the revenue from classified advertising. Even if BT were to cease the universal distribution of a free printed directory, it may continue to supply a printed directory to its own retail customers, in order to fulfil its own GC8 obligation, and may find it commercially attractive to supply additional directories to other CPs for an appropriate fee. In addition, third parties may be interested in the business model of printed directories. We consider that this is properly a matter for commercial agreement between parties, as appropriate, rather something of relevance to our SMP regulation of BT's wholesale fixed line business.

A13.325 In the event that BT ceases to provide copies of printed directories universally, free of charge, we will monitor BT's and other CPs' compliance with GC8 to consider if GC8 is working as intended and is adequately protecting consumers and citizens. In particular, we would want to ensure that those consumers who wanted to have a printed directory were able to obtain one easily and at a reasonable price.

A13.326 In the event that CPs were to struggle to meet their GC8 obligations, Ofcom may need to review the supply of directory information to ensure that CPs could obtain the necessary information to produce directories (or purchase them from third parties), so that consumers continue to be able to access printed directories (including at a reasonable price).

Amount to be removed from regulated WLR charges

A13.327 In order to make a one off adjustment to the WLR charge for Directories, we need to deduct the cost of printed directories from the 2013/14 charge that is used as the starting point for the glide path to the 2016/17 target efficient cost for WLR.

A13.328 In the July 2013 LLU WLR Consultation³⁴¹ we said that the WLR charge would reduce by £2.23 with the removal of the contribution to printed directories. This was the amount included for directories in 2013/14 within the cost modelling for the 2012 charge control.³⁴² However, we now consider that it would be more appropriate to adjust the WLR charge in 2013/14 by deducting an amount that reflects a more up to date estimate of the cost of printed directories in 2013/14, as opposed to a forecast of the costs made in 2012.

A13.329 The Cost Model does not forecast directory costs for 2013/14. We have therefore used the cost of printed directories reported in BT's 2011/2 RFS (as our base year for the charge control is 2011/12) as a proxy for costs in 2013/14. The FAC of printed directories reported in the 2011/12 RFS is £1.43 per line.

Conclusions

A13.330 As we proposed in the July 2013 LLU WLR Consultation, we have therefore set the WLR rental charge such that it reduces immediately to a level that excludes the cost of printed directories.

³⁴¹ See footnote 72, on page 42 of the July 2013 LLU WLR 2013 Consultation.

³⁴² This can be seen in the table after paragraph A5.5 in the March 2012 Statement.

Dropwire

Proposals in the July 2013 LLU WLR consultation

A13.331 Dropwire costs relate to the depreciation of the copper pair and NTE that links the end user premises to the distribution point. Given dropwires have a ten year asset life and as the final year of our proposed charge control is 2016/17, we expected that there would be no pre-2006 dropwires in the cost stack for copper access rental services. This was confirmed by reviewing BT's dropwire model which showed that there was no adjustment in 2016/17.

A13.332 We proposed that the dropwire adjustment made in the March 2012 Statement was no longer necessary for the final year of the proposed charge controls (i.e. 2016/17).

Stakeholder responses to July LLU WLR 2013 Consultation

A13.333 Openreach agreed with our proposal on the basis that “there are no assets which require adjusting in the 2016/17 cost stack and that the BT RFS costs, with no adjustment for dropwire, are appropriate for forecasting dropwire costs to 2016/17 and the previously applied ‘dropwire adjustment’ is now time expired.”³⁴³

Conclusions

A13.334 BT has always recovered dropwire costs through Copper Access Rental Charges. Prior to December 2005 these were controlled at the retail level through the retail price control. This was based on the fully expensed cost. In December 2005, we removed the retail price control and in 2006 set wholesale price controls for copper access services.

A13.335 The dropwire costs included in wholesale charge controls have been based on BT's capitalised costs since 2006. We have always recognised that residential dropwires in use at December 2005 had already been paid for once through the retail price control and that those capital costs should be disallowed in subsequent wholesale charge controls to prevent over-recovery.

A13.336 In the March 2012 Statement we made an adjustment to remove the pre-2006 dropwires from the asset base. As with previous charge controls we requested BT's dropwire model, under our statutory information gathering powers. This confirmed that there are no pre-2006 dropwires in the cost stack for copper access in 2016/17.

A13.337 As there are no assets which require adjusting in the 2016/17 cost stack, we consider that the 2011/12 cost stack, with no adjustment for dropwire assets is appropriate for forecasting dropwire costs to 2016/17 (using the relevant AVE).

Pair Gain

Proposals in the July 2013 LLU WLR consultation

A13.338 The use of Digital Access Carrier System (DACS)³⁴⁴ allows for ‘pair gain’ on some WLR voice only lines. Pair gain is where a WLR voice-only line between the dropwire and the exchange can be shared by two end users. This reduces the

³⁴³ Paragraph 515, BT Response to the July 2013 LLU WLR Consultation.

³⁴⁴ DACS are the equipment which enables more than one circuit to be carried over a copper pair.

average amount of copper and duct per WLR customer compared to an MPF customer. This therefore reduces the average cost per copper line of E-side and D-side copper for WLR Rentals, when compared with MPF. However, given the immateriality of this effect, we proposed not to make any adjustment for pair gain.

Stakeholder responses to July 2013 LLU WLR Consultation

A13.339 Only BT responded to this aspect of our proposals. BT agreed that we should exclude any pair gain adjustment.³⁴⁵

Conclusions

A13.340 We noted in the July 2013 LLU WLR Consultation that there were currently \times DACS installed which allow two end users to be served by one copper pair (which amounts to \times lines). BT estimated the impact of pair gain on E-side and D-side copper capital components from 2012/13. If we adjusted the WLR cost stack to reflect the number of end customers served by DACS equipment, the WLR usage factor would reduce from \times to \times .

A13.341 In the July 2013 LLU WLR Consultation we noted that where a single copper pair has DACS installed, it will not always carry the maximum number of two end users. This could be because one end user has ceased on the line or alternatively, it may be because a DACS has been installed for voice quality improvement.

A13.342 We considered that it may be reasonable to make an adjustment to E-side and D-side copper capital cost components to reflect cost savings associated with pair gain, although this should be based on the number of end customers who share a line, rather than the number of DACS installed.

A13.343 Using the usage factor of 0.996, estimated by BT, the impact of the adjustment was to decrease in the WLR basic unit cost stack by less than £0.10 per line.

A13.344 We noted however that the number of customers served by DACS fell by c.10% from 2011/12 to 2012/13 and that BT forecast a further c.10% fall in end customers served by DACS to 2013/14.

A13.345 If we updated the 2011/12 calculation for the number of end users using DACS forecast by BT for 2013/14, the WLR usage factor would be even closer to 1. This would represent a fall of less than £0.05 per line compared to the per line cost arising from a usage factor of 1.

A13.346 Although BT does not forecast the number of DACS beyond 2013/14, based on the trend from 2009/10 to 2013/14, we would expect that end customers served using DACS would fall further. We consider that the appropriate adjustment for forecasting costs to 2016/17 is likely to be lower than the adjustment estimated for 2012/13 or 2013/14. Therefore, we do not consider that an adjustment would be material. For this reason we have decided to make no adjustment to the D-side copper capital costs or E-side copper capital costs.

³⁴⁵ Paragraphs 146-148 and 521-524, BT Response to the July 2013 LLU WLR Consultation.

PSTN Line Test equipment

Proposals in the July 2013 LLU WLR Consultation

A13.347 In the July 2013 LLU WLR Consultation we explained that the costs included within the PSTN line test equipment component are almost entirely³⁴⁶ made up of investment in test head equipment, including the costs of the test heads along with software and associated costs to enable the test heads to work effectively.

A13.348 Test heads are used by Openreach to test whether a copper line meets the technical specification SIN349. This sets out physical and electrical connectivity characteristics that must be met by the copper line. In order to carry out a line test, the copper line needs to be connected to a test head. Having reviewed the allocations adopted following the March 2013 CC Determination and the allocation in BT's 2011/12 RFS, we proposed that no adjustment was required to the Cost Model.

A13.349 The usage allocation of PSTN line testing in our models was as follows. We received no responses on the issue in the July 2013 or December 2013 LLU WLR Consultations.

Table A13.16 –Usage factors for PSTN line testing

	WLR Basic Rental	MPF Rental	SMPF Rental
Usage factor for the PSTN line testing component in the Cost Model	1.0	1.0	0.0

Conclusion

A13.350 We conclude that no adjustment is required to the Cost Model because the PSTN line testing allocations in the 2011/12 RFS are consistent with the usage factors adopted following the 2013 CC Determination and we see no reason to depart from these.

³⁴⁶BT's response dated 22 March 2013 to question 3 of the Third LLU WLR BT Information Request states that ✕

Annex 14

Cost of capital

Introduction

- A14.1 In this Annex, we set out our estimate of BT's weighted average cost of capital (WACC).
- A14.2 We estimate and apply a different WACC for different parts of BT because the different parts of BT are likely to have different systematic risk profiles. We first estimate the WACC for BT Group plc ('BT Group') before splitting it into:
- A WACC for the copper access network assets and services operated by Openreach (which we refer to as 'Openreach'³⁴⁷) and;
 - A WACC for the rest of BT, which is not covered by the Openreach WACC (i.e. the 'Rest of BT').
- A14.3 The WACC is important for setting charge controls, particularly as it makes up a significant proportion of the cost of most regulated telecommunications services. It is also particularly important to investors to provide them with a reasonable expectation that they can recover their investment including the opportunity cost of capital employed.
- A14.4 This means, in turn, that we attach weight to the objective of promoting regulatory predictability by ensuring a consistent regulatory approach over appropriate periods, provided that we are satisfied that the circumstances of a specific case do not warrant us taking a different approach.

Summary of our decisions

- A14.5 We have decided to use a pre-tax nominal WACC for Openreach of 8.6%.
- A14.6 Our estimates of the WACC for BT Group, Openreach and the Rest of BT are shown in Table A14.1 below.

³⁴⁷ For consistency with previous Ofcom consultations and statements we continue to refer to the WACC applicable to the copper access network as 'Openreach'. We note that the Openreach business includes assets and services which are not part of the copper access network covered by LLU and WLR.

Table A14.1: Estimate of BT WACC, April 2014

	Openreach	BT Group	Rest of BT
Real risk free rate	1.3%	1.3%	1.3%
RPI inflation	3.2%	3.2%	3.2%
Nominal risk free rate	4.5%	4.5%	4.5%
ERP	5%	5%	5%
BT Group equity Beta	-	1.01	-
Gearing (2 year average)	32%	32%	32%
Asset beta	0.50	0.72	0.83
Debt beta	0.10	0.10	0.10
Gearing (forward look)	32%	32%	32%
Re-levered equity beta	0.69	1.01	1.17
Debt premium	1.0%	1.25%	1.5%
Corporate tax rate	20%	20%	20%
Pre-tax real WACC	5.2%	6.6%	7.3%
Pre-tax nominal WACC	8.6%	10.0%	10.8%

Source: Ofcom analysis

Note: Real WACC is calculated by deflating the nominal WACC by RPI. Because the charge control Cost Model is in nominal terms, the real WACC is not used in that model.

A14.7 In the July 2013 LLU WLR Consultation we proposed to use a pre-tax nominal WACC for Openreach of 8.8%, consistent with the WACC estimated in the 2013 Business Connectivity Market Review Statement (2013 BCMR Statement)³⁴⁸. This was based on the estimates set out in Table A14.2 below.

³⁴⁸ Ofcom, *Business connectivity market review*, 28 March 2013, <http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/> (2013 BCMR Statement).

Table A14.2: Estimate of BT WACC in the July 2013 LLU WLR Consultation and 2013 BCMR Statement

	Openreach	BT Group	Rest of BT
Real risk free rate	1.3%	1.3%	1.3%
RPI inflation	2.8%	2.8%	2.8%
Nominal risk free rate	4.1%	4.1%	4.1%
ERP	5%	5%	5%
BT Group equity Beta		1.01	
Gearing (2 year average)	40%	40%	40%
Asset beta	0.60	0.67	0.74
Debt beta	0.15	0.15	0.15
Gearing (forward look)	32%	32%	32%
Re-levered equity beta	0.81	0.91	1.01
Debt premium	1.7%	1.7% - 2.3%	2.3%
Corporate tax rate	20%	20%	20%
Pre-tax real WACC	5.9%	6.4%	6.9%
Pre-tax nominal WACC	8.8%	9.3%	9.9%

Source: Ofcom analysis

Note: Real WACC is calculated by deflating the nominal WACC by RPI. Because the charge control Cost Model is in nominal terms, the real WACC is not used in that model.

Overview of Ofcom's methodology

Introduction

- A14.8 Companies have two basic ways of obtaining funding, either through debt or through equity. By knowing the proportion of each type of funding, and estimating the cost of each, we can estimate the cost of capital as weighted between the two forms of funding.
- A14.9 The model we have consistently used for estimating the cost of equity is the Capital Asset Pricing Model (CAPM).
- A14.10 The pre-tax nominal WACC is derived as follows (this is the standard after-tax WACC divided by 1 minus the tax rate)³⁴⁹:

$$WACC = \frac{Ke * (1 - g)}{1 - t} + Kd * g$$

³⁴⁹ A pre-tax real WACC would be obtained with the following formula: ((1+pre-tax nominal WACC)/(1+inflation rate))-1.

- Where K_e = the cost of equity which is given by reference to the risk-free rate (R_f), the expected return on a basket of equities over the risk-free rate (i.e. the equity risk premium, or ERP) and the perceived riskiness of the asset in question (β) such that:

$$K_e = R_f + ERP * \beta$$

- K_d = the forward-looking cost of debt³⁵⁰, which is given by reference to the risk-free rate and the debt premium of the firm, d_p , such that:

$$K_d = R_f + d_p$$

- t is the corporate tax rate; and
- g = gearing (debt funding as a proportion of total debt and equity funding).

A14.11 When we set charge controls for BT Group, we estimate the return that investors require on their invested capital by multiplying the estimated WACC by the asset base (as valued net of accumulated depreciation).

A14.12 In this charge control, we are estimating the cost of capital for a three year charge control period. The methodology that we use to calculate such charge controls typically means that we estimate the efficiently-incurred costs in the final year of the control, and then calculate a glide path towards that level of costs in the first and second years of the control.

A14.13 In this Annex we set out calculations that are relevant for the period April 2016 to March 2017. This is the final year of the proposed charge controls for LLU and WLR services.

Proposals in the July 2013 Consultation

A14.14 In the July 2013 Consultation we proposed to continue to use CAPM to estimate the WACC for BT Group. We considered that it remained the most appropriate method for estimating the cost of capital for regulatory purposes and we placed weight on taking a consistent approach to estimating the WACC over time.

A14.15 We noted that the CC has previously found CAPM to be the most robust way for a regulator to measure the returns required by shareholders. In its Bristol Water Determination in September 2010, the CC said the following:

³⁵⁰ We explained the reasons why we consider a forward looking cost of debt rather than, for example, the cost of embedded debt, in paragraph 6.70, Ofcom, *WBA Charge Control. Charge Control framework for WBA Market 1 Services - Statement*, 20 July 2011, www.stakeholders.ofcom.org.uk/binaries/consultations/823069/statement/statement.pdf (2011 WBA Charge Control Statement). BT appealed this aspect of the 2011 WBA Charge Control Statement, however, the CC found that Ofcom did not err in its approach to estimating the cost of debt, saying: "...we have found that Ofcom did not err for the reasons that BT alleged and that the incorporation of the embedded debt premium would not be a better regulatory practice for Ofcom than its current approach, as alleged by BT". See paragraph 2.238, Competition Commission, *British Telecommunications plc v Office of Communications supported by British Sky Broadcasting Limited, TalkTalk Telecom Group plc Case 1187/3/3/11 - Determination*, 11 June 2011, http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/british-telecommunications-plc-appeal/wba_determination.pdf, (CC WBA Appeal 2012).

“In our 2007 report on Heathrow and Gatwick, we looked at alternatives to CAPM and found that:

- (a) CAPM remains the tool with the strongest theoretical underpinnings;
- (b) it is not at all clear from the academic literature that other models have better predictive power, particularly when applied to UK companies; and
- (c) none of the alternative models helps to overcome the problems that CAPM has in dealing with limited market data.

We believe that these points remain valid. Hence, we also continue to believe that although the CAPM has its limitations, it is the most robust way for a regulator to measure the returns required by shareholders. Moreover, we have placed considerable weight on the CAPM in previous regulatory inquiries and we see benefits in consistency.”³⁵¹

A14.16 In its 2014 NIE Determination the CC said that it believed these points remained valid.³⁵²

A14.17 In proposing to continue using the CAPM we considered comments from BT³⁵³ and Europe Economics³⁵⁴ (in a report commissioned by Sky and TalkTalk) in response to the 2012 FAMR CFI.

A14.18 We noted BT’s concerns that:

“...any potential for the value of WACC to change significantly from one charge control to another risks sending the wrong signals to the market, especially at a time when we are midway through a significant investment programme”³⁵⁵

A14.19 BT also referenced the CC’s comment in its March 2013 CC Determination which stated that:

³⁵¹ Paragraphs 19-20, Page N4, Competition Commission, *Bristol Water plc. A reference under section 12(3)(a) of the Water Industry Act 1991*, 4 August 2010, http://webarchive.nationalarchives.gov.uk/+/http://www.competition-commission.org.uk/rep_pub/reports/2010/fulltext/558_appendices.pdf

³⁵² Paragraph 13.19, page 13-4, Competition Commission, *Northern Ireland Electricity Limited price determination. A reference under Article 15 of the Electricity (Northern Ireland) Order 1992 – Final determination*, 26 March 2014 https://assets.digital.cabinet-office.gov.uk/media/535a5768ed915d0fdb000003/NIE_Final_determination.pdf (2014 NIE Determination).

³⁵³ BT, *BT’s response to Ofcom’s Call for Inputs on the Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30*, 8 January 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/BT.pdf> (BT Response to the 2012 FAMR CFI).

³⁵⁴ Europe Economics, *Methodological issues regarding BT’s WACC Determination*, 28 January 2013, <http://stakeholders.ofcom.org.uk/consultations/fixed-access-markets/?showResponses=true> (Europe Economics Submission for the 2012 FAMR CFI).

³⁵⁵ Pages 27-28, BT Response to the 2012 FAMR CFI.

“...in industries with long-lived assets regulators should take a long-term view of the cost of capital and adjust components only when they believe there has been a permanent shift in the pricing of risk.”³⁵⁶

A14.20 In its report, Europe Economics agreed that CAPM was appropriate, saying that:

“In our view CAPM remains appropriate as the main method for regulatory cost of capital determination for several reasons, including an intuitive theoretical base enabling discussion by non-technical stakeholders, its track record in past regulatory determinations and the lack of viable alternatives.”³⁵⁷

A14.21 Europe Economics suggested that CAPM should be the main approach with an alternative model, the Third Moment CAPM, being used to inform the point estimate within the range. The Third Moment CAPM attempts to adjust the WACC for skewness (i.e. the third moment of the distribution of equity returns), which measures the extent of asymmetry in the distribution of returns. We did not consider that there would be any material impact on the Openreach WACC as a result of positive skewness, and proposed to continue using CAPM, which relies only on the mean, variance and covariance of the distribution of returns, and not higher moments such as skewness.

Stakeholder responses to the July 2013 Consultation

A14.22 Respondents to the consultation broadly agreed with our approach to determining the cost of capital, with comments mostly relating to individual parameters of the cost of capital calculation. We address stakeholders’ comments on the individual parameters under the relevant headings below.

A14.23 BT said it agreed with our proposal to continue to use the CAPM, saying:

“The CAPM approach has been used for some time to estimate the WACC in setting charge controls in the UK. As noted, the Competition Commission has also endorsed this approach on several occasions. Furthermore, investors in BT’s debt and equity will make assumptions around Ofcom’s approach to estimating the WACC in regulating prices and they will invariably place considerable weight on consistency of approach over time”³⁵⁸.

A14.24 BT also agreed with Ofcom’s provisional conclusion that there was unlikely to be a material impact on the Openreach WACC as a result of positive skewness.

Our analysis and conclusions

A14.25 No stakeholder disagreed with our proposal to continue to use the CAPM. For the reasons set out in the July 2013 Consultation, summarised above, we have therefore estimated the cost of capital for BT Group using the CAPM.

³⁵⁶ Paragraph 2.380, Competition Commission, *The Carphone Warehouse Group plc v Office of Communications, Case 1111/3/3/09 - Determination*, 31 August 2010, <http://www.catribunal.org.uk/237-4154/1111-3-3-09-The-Carphone-Warehouse-Group-plc.html>.

³⁵⁷ Paragraph 2.1, Page 6, Europe Economics Submission for the 2012 FAMR CFI.

³⁵⁸ Paragraph 482, page 100, BT Response to the July 2013 LLU WLR Consultation.

Real risk-free rate

Introduction

A14.26 The risk-free rate (RFR) influences both the cost of equity and the cost of debt.

A14.27 Our WACC estimate needs to be relevant for the three year period of the charge control and in particular for the final year of the charge control (2016/17), which is the year in which we estimate BT's costs for the purposes of setting a glide path.

A14.28 Our approach is to estimate a WACC that is based on historic and current data, but which should be relevant for the period covered by the control.

A14.29 We have previously estimated the real RFR by reference to:

- historical averages of indexed linked gilts;
- current spot rates on indexed linked gilts;
- forward rates on indexed linked gilts; and
- regulatory decisions made by other regulators and/or the CC.

A14.30 In the 2013 BCMR Statement we reduced our estimate of the real RFR from 1.4% to 1.3% to reflect the fact that observed data which we use to inform our estimate of the real RFR had continued to fall.

A14.31 In estimating the appropriate reduction to the real RFR, we also considered the implications on the equity risk premium ('ERP'). We explained that if we believed that the real RFR had fallen because equities had become more risky or because investors were becoming more risk averse, then we would expect an increase in the ERP to reflect this.³⁵⁹ However, we found no evidence to support an increase in the ERP and we were therefore reluctant to make any significant change to the real RFR.

Proposals in the July 2013 LLU WLR Consultation

A14.32 We proposed to continue to estimate the WACC using historical averages of the yields on RPI indexed linked gilts and estimates of forward yields on RPI linked gilts. We considered a suggestion from Europe Economics that the RFR could be estimated by reference to the forecast growth rate in the economy. However we had a concern that it would involve forecasting one uncertain variable (the RFR) with another, at least as uncertain, variable (the rate of economic growth). We said for this reason we preferred to place more weight on evidence from observed yields on index-linked gilts and forward rates on those gilts.

A14.33 We said that for the purposes of the consultation the real RFR of 1.3% used in the 2013 BCMR Statement remained reasonable, although we said we would update our analysis for the statement.

³⁵⁹ For example, if equities are considered to be riskier than previously, investors may require a greater premium to compensate them for this risk. At the same time, there may be a substitution effect whereby investors reduce their holding in risky equities and increase their holding in lower risk assets (such as government bonds), the increased demand in government bonds may result in a reduction in the risk-free rate.

A14.34 We said that we continued to believe that there was a link between the ERP and the real RFR. The CC noted the interaction between the ERP and the real RFR, in the Mobile Call Termination appeal in 2011, in response to an argument by Dr Hird that Ofcom had not reflected the tendency of the real RFR to fall during a crisis, at the same time as the tendency of the ERP to increase. The CC noted that Ofcom did not err in this regard as:

“Ofcom was mindful of the tendency of the RFR and ERP to move in opposite directions.”³⁶⁰

A14.35 We said we accepted a suggestion from Europe Economics that there may have been a step change in total market return which could explain a situation where the RFR fell without a concurrent increase in the ERP. Europe Economics justified this by referring to recent downgrades in macro-economic forecasts. However, we said we were cautious about placing too much weight on short term economic forecasts which are subject to fluctuations in themselves.

A14.36 Europe Economics also said that Ofcom should provide a more detailed explanation as to how it arrived at the estimate of the real RFR, given that observed yields on index-linked gilts were low. We considered that, given the current market conditions, we should exercise regulatory judgement in order to balance observed data about past or future conditions, with the need to estimate a real RFR appropriate for estimating costs in 2016/17.

A14.37 We said we continued to believe it was appropriate to exercise caution when interpreting data that may be distorted by current market conditions, for example, the impact of quantitative easing. In estimating the WACC, we take account of a range of data sources and in particular consider movements in the trend to assist us in exercising our regulatory judgement.

Responses to the July 2013 LLU WLR Consultation

A14.38 BT agreed that Ofcom should be cautious when interpreting data and not give excessive weight to historical averages. BT noted that risk-free forward rates had increased recently and said that, although such rates were below historical averages, if Ofcom were minded to make any change to the real RFR, it should increase it to reflect recent evidence.³⁶¹

A14.39 TalkTalk disagreed with BT's arguments that a real RFR above 1.3% would be justified. TalkTalk said that the fact that the observed real RFR had increased since the 2013 LLCC Statement was not reason to raise the real RFR, since the real RFR Ofcom used in the 2013 LLCC Statement was higher than the contemporaneous evidence. Also, TalkTalk said that the fact the forward rate had increased over recent months did not mean that this trend would continue.³⁶²

³⁶⁰ Paragraph 3.915, page 3-156, Competition Commission, *British Telecommunications plc v Office of Communications*, Case 1180/3/3/11; *Everything Everywhere Limited v Office of Communications*, Case 1181/3/3/11; *Hutchison 3G UK Limited v Office of Communications*, Case 1182/3/3/11; *Vodafone Limited v Office of Communications*, Case 1183/3/3/11; and *Telefónica UK Limited - Determination*, 9 February 2012, http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/telecommunications-price-control/appeals/final_determination.pdf.

³⁶¹ Paragraphs 485-490, BT Response to the July 2013 LLU WLR Consultation.

³⁶² Paragraph 4.5, page 19, TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation.

- A14.40 TalkTalk considered that the real RFR proposed by Ofcom was excessive and not supported by market data³⁶³. It considered that an appropriate range for the real RFR would be 0.4% to 1.0% based on historical yields and the data presented in Table A15.3 of the consultation³⁶⁴. In its response to BT's response, TalkTalk said that the highest real RFR that would be supported by market data would be around 0.5%, based on taking out a 10 year gilt in 3 years' time³⁶⁵.
- A14.41 TalkTalk disagreed with Ofcom that there had not been a material change in longer term rates between the December 2012 data used in the 2013 BCMR Statement and the June 2013 data used in the July 2013 Consultation. TalkTalk observed that the ten year average yield on a 10 year gilt had fallen from 1.2% to 1.0% during this period and considered that this was a material reduction.³⁶⁶
- A14.42 TalkTalk also considered that it was inappropriate that Ofcom did not set out any evidence on forward rates in the consultation.³⁶⁷
- A14.43 Sky made two main points. First, Ofcom may have been overly cautious in not decreasing the real RFR further to reflect reductions in yields. It said that the weakness of the post-credit crisis macro-economy may be indicative of a permanent or longer term reduction³⁶⁸. Second, Sky said it was unclear how Ofcom would incorporate movements in historical averages of yields on gilts and estimates of forward yields into its real RFR estimate. Sky was particularly concerned that if yields on index linked gilts began to recover (for example due to an improved economic outlook or an unwinding of the effects of quantitative easing) Ofcom would raise its estimates of the real RFR even though it had not lowered its estimates by the same amount when the indicators had been falling³⁶⁹.

Our analysis and conclusions

- A14.44 We said that in estimating a real RFR appropriate for the final year of the charge control we would consider historical averages of the yields for RPI linked gilts and forward rates on those gilts. We also said we would be mindful of other regulatory decisions from, for example, the CC.
- A14.45 These factors inform our estimate of the real RFR, but we are cautious when interpreting the data because of the level of uncertainty that has persisted and the potential impact of temporary distortions such as quantitative easing. There is no straightforward answer to the question of what interest rates will do in the future and we need to be mindful of current rates, historical rates and future expectations. Therefore, we do not mechanically weight different sources of evidence but rather consider the available evidence and use our regulatory judgement to come to a view on what an appropriate forward-looking risk-free rate would be for 2017, the final year of the charge control.
- A14.46 We have updated our analysis of movements in historical averages of yields on index-linked gilts to February 2014. Table A14.3 compares the latest data to that presented in the consultation for both five and ten year gilts.

³⁶³ Paragraph 4.4, page 28, TalkTalk Response to the July 2013 LLU WLR Consultation.

³⁶⁴ Paragraph 4.9, page 28, TalkTalk Response to the July 2013 LLU WLR Consultation.

³⁶⁵ Paragraph 4.13, page 20, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

³⁶⁶ Paragraph 4.12, page 30, TalkTalk Response to the July 2013 LLU WLR Consultation.

³⁶⁷ Paragraph 4.11, page 30, TalkTalk Response to the July 2013 LLU WLR Consultation.

³⁶⁸ Paragraph 8.6, page 23, Sky Response to the July 2013 LLU WLR Consultation.

³⁶⁹ Paragraph 8.12, page 24, Sky Response to the July 2013 LLU WLR Consultation.

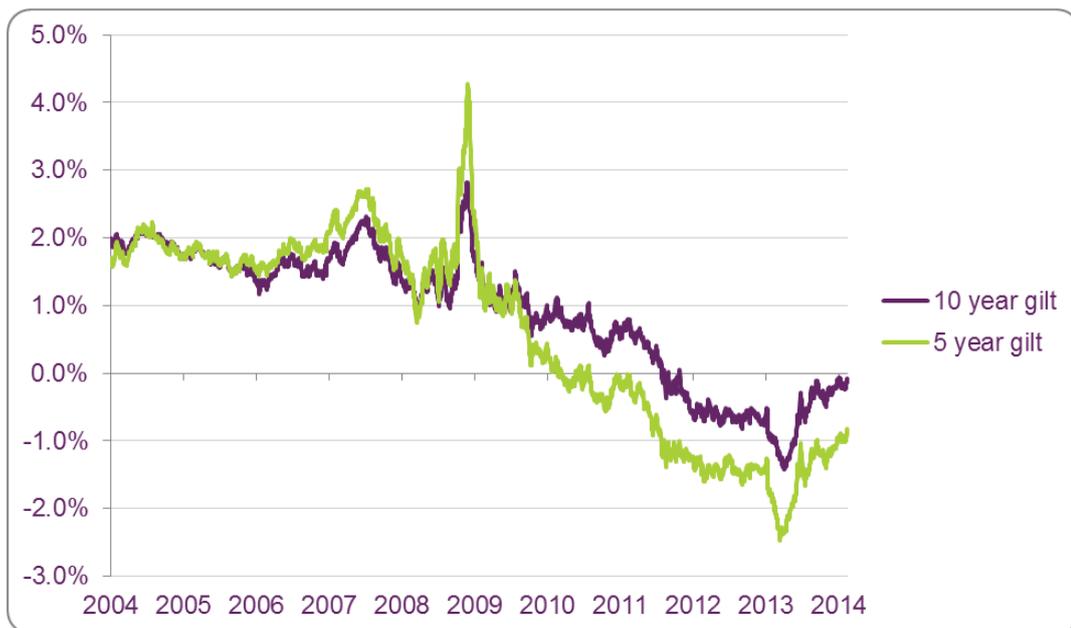
Table A14.3: Yields on index-linked gilts

Averaging period	Five year gilts			Ten year gilts		
	6 Dec 2012 (BCMR)	24 June 2013	17 Feb 2014	6 Dec 2012 (BCMR)	24 June 2013	17 Feb 2014
Spot rate	-1.4	-1.4	-0.9	-0.7	-0.6	-0.1
1 Month	-1.4	-1.6	-0.9	-0.6	-0.8	-0.2
3 Months	-1.4	-2.0	-1.0	-0.6	-1.1	-0.2
1 Year	-1.0	-1.7	-1.5	-0.2	-0.8	-0.6
2 Years	-0.7	-1.5	-1.5	0.1	-0.6	-0.6
5 Years	0.2	-0.2	-0.7	0.6	0.4	0.1
10 Years	1.0	0.8	0.6	1.2	1.0	0.9

Source: Bank of England, Ofcom analysis

A14.47 Table A14.3 shows that, since the July 2013 Consultation, long term averages of index-linked gilt rates (i.e. five year and ten year averages) have reduced but that short term averages (i.e. averages taken over the last year) have increased, although they remain negative. Figure A14.1 illustrates how spot rates on five- and ten-year gilts have started to rise in the last few months.

Figure A14.1: Spot rates on five and ten year index-linked gilts



Source: Bank of England, Ofcom analysis

A14.48 We have also considered forward rates on index-linked gilts. These forward rates may not replicate the rate which will actually apply in the future, but they can indicate what investors expect to happen to real gilt rates. Forward looking rates for a five-year bond taken out in three years' time (i.e. in 2017) are currently positive, between 0.3% and 0.4%. Forward rates for a ten-year bond taken out in three years' time are also positive, between 0.5% and 0.6%. At the time of the consultation both of these forward rates were closer to zero. Figure A14.2 shows how forward rates on a five- and ten-year index-linked gilt taken out in three years have increased over the last year³⁷⁰.

³⁷⁰ The forward rates represent the implied future yield on an investment in a five- or ten-year index-linked gilt made in three years' time. They are calculated using the following formula:

$$f_{t,T} = \left[\frac{(1+r_T)^T}{(1+r_t)^t} \right]^{\frac{1}{T-t}} - 1$$

, where for the 5 year gilt calculation, r_t denotes the yield in the first three years, so $t=3$ and r_T denotes the yield in the first eight years, so $T=8$ in this example. In other words, for the forward five-year gilt calculation we are solving for the future yield required to equalise the difference between the yields on a gilt taken out today with three years to maturity (the proceeds of which can then be reinvested at a future yield for a further 5 years) and the yield on a gilt taken out today with eight years to maturity.

Figure A14.2: Forward rates on 5 and 10 year gilts taken out in three years' time



Source: Bank of England, Ofcom analysis

A14.49 In addition to the data presented above, we note that in its 2014 NIE Determination, the CC assumed that the real RFR would sit in a range of 1% - 1.5%³⁷¹.

A14.50 BT's response indicated that it considered an increase in forward rates would support an increase to our consultation estimate of the real RFR of 1.3%. On the other hand Sky said we should be cautious about reflecting any indication of recovery through an increase in the real RFR. We agree with Sky that we should be cautious about increasing the real RFR from 1.3% on the basis that spot rates and forward rates have recently started to increase. Equally we do not think we should reduce our estimate of the real RFR further, as suggested by TalkTalk, since although short-term average yields on index-linked gilts remain negative, they have started to increase. We consider that it would be inappropriate to simply adopt the current low rates on index-linked gilts without considering the reasons why they could be depressed, for example, the wider macroeconomic environment in recent years and the significant bond market intervention by monetary authorities – such as via quantitative easing. There may also be a relationship between the real RFR and the ERP, so we would be reluctant to make a significant reduction to the real RFR without considering an increase in the ERP, but an increase in the ERP is not supported by the current evidence (see paragraphs A14.122 to A14.139).

A14.51 We continue to believe that a degree of caution is required in interpreting the evidence available since a number of temporary distortions may be affecting the data. Given that we are attempting to estimate a real RFR appropriate for the end of the charge control period in 2017, we consider that 1.3% remains an appropriate estimate of the real RFR for this period. Combined with our RPI inflation assumption of 3.2% (explained in paragraph A14.155), the nominal RFR is 4.5%.

³⁷¹ Paragraph 13.129, page 13-25, 2014 NIE Determination.

Debt Premium

Introduction

A14.52 In estimating BT's cost of debt we require two inputs:

- the nominal RFR; and
- BT's debt premium.

A14.53 We set out our views on the RFR in paragraphs A14.26 - A14.51 above.

A14.54 In the past, we have estimated the debt premium based on observed yields on BT's Sterling denominated debt, over and above benchmark gilt yields. In the 2013 BCMR Statement we used BT's 2016 GBP bond for the purpose of estimating the debt premium for BT Group, since this broadly coincided with the end of that charge control.

A14.55 When estimating the cost of debt, we consider that recent estimates of the yield on BT's debt is a good proxy for the efficiently incurred forward looking cost of debt to be included in the WACC estimate.

Proposals in the July 2013 LLU WLR Consultation

A14.56 We updated our analysis of BT's Sterling denominated debt and considered that the evidence to March 2013 showed that the spread of yields on BT Group debt had not changed significantly from that estimated for the 2013 BCMR Statement, which had considered data to December 2012.

A14.57 After updating the yields to March 2013, we noted that the reduction in yields observed in December 2012 had persisted. However, the average yield on BT's debt over the 12 months to March 2013 was within the range estimated in the 2013 BCMR Statement. As a result, we proposed a range for BT's debt premium of 1.7% - 2.3%; the same as the range used in the 2013 BCMR Statement.

Responses to the July 2013 LLU WLR Consultation

A14.58 Sky said that the debt premium range of 1.7% to 2.3% was too high for the period to March 2013, and that a range of 1.1% to 1.7% would be more appropriate for that period³⁷². It thought a lower range of this order would be justified, particularly if the lower spreads observed since September 2012 persisted.

A14.59 TalkTalk said it broadly agreed with Ofcom's approach to calculating BT's debt premium, including making no adjustment for the cost of embedded debt³⁷³. However, TalkTalk said that not amending BT's debt premium for recent changes risked deriving an inappropriate cost of debt, especially alongside an unchanged RFR³⁷⁴. We have considered recent data on BT's debt premium and updated our estimates as explained below.

³⁷² Paragraph 8.15, page 24, Sky Response to the July 2013 LLU WLR Consultation.

³⁷³ Paragraph 4.16, page 31, TalkTalk Response to the July 2013 LLU WLR Consultation.

³⁷⁴ Paragraph 4.19, page 31, TalkTalk Response to the July 2013 LLU WLR Consultation.

Our analysis and conclusions

A14.60 We have looked at the spread of BT's 2017 bond over nominal UK government gilts and observe that the reduction in this spread has persisted since the March 2013 data considered in the July 2013 LLU WLR Consultation. We have focused on BT's debt maturing in 2017 since this coincides with the end of the charge control period in March 2017³⁷⁵. The spread over the last two years is illustrated in Figure A14.3.

Figure A14.3: Spread of BT's 2017 sterling denominated debt over benchmark yields



Source: Bloomberg, Ofcom analysis

A14.61 In the 12 month period to January 2014 the average debt premium for BT's 2017 debt was around 1.1%, and has been on a general downward trend over this and the preceding period. This suggests that the range of 1.7% to 2.3% proposed in the consultation may no longer be a reasonable proxy for BT's forward looking debt premium.

A14.62 Taking into account the fact that the reduction in the debt premium observed in March 2013 (as part of the 2013 July LLU WLR Consultation) has persisted, we consider that a reasonable range for BT's debt premium is now 1.0% to 1.5%.

A14.63 We continue to estimate a separate debt premium for the Openreach copper access network and the Rest of BT, as discussed from paragraph A14.292 below. For the purposes of calculating the BT Group WACC, we use the mid-point estimate from our range of 1.25%.

Gearing

Introduction

A14.64 Debt funding has a lower cost than equity, because debt is less risky. However, companies need to balance debt and equity financing, since, as the debt level increases, the returns to shareholders become more volatile which will increase the

³⁷⁵ We have not shown the spread for BT's 2016 debt, however the spreads are very similar. For example the average spread over the last year for BT's 2016 debt relative to gilts is the same at 1.1%.

risk (and hence cost) of equity financing.³⁷⁶ However, debt funding is also more tax-efficient than equity funding. So a higher gearing (i.e. higher of debt funding) tends to slightly lower the WACC.

A14.65 Gearing is calculated by dividing a company's debt by its enterprise value, where the enterprise value is the sum of the debt and the market capitalisation. In its report for us, Brattle³⁷⁷ calculates gearing using the face value of BT's outstanding debt, but it can also be calculated using net debt.³⁷⁸ We note that in its 2014 NIE Determination, the CC said:

"With regard to the calculation of gearing for estimating the asset beta, we have used net debt in our calculations, that is long-term debt net of cash balances. We note that this may give lower measures of gearing (and hence higher asset betas) than if long-term debt is used with no adjustment for cash balances. We regard either method as justifiable, although for certain companies one approach or the other may be more appropriate depending on the requirement for working capital"³⁷⁹

A14.66 We use gearing within the WACC calculation for three purposes:

- in the WACC calculation as the weight of debt and equity;
- when de-levering the equity beta to arrive at an asset beta for BT; and
- when re-levering the asset beta to arrive at a forward-looking equity beta.

A14.67 BT appealed our approach to assessing gearing in the 2011 WBA charge control Statement. BT argued that the gearing used to de-lever the equity beta to arrive at an asset beta for BT Group should not be the average gearing observed over the beta estimation period. Instead, it stated that the gearing should be the expected gearing.

A14.68 The CC did not accept BT's argument in relation to the gearing used to de-lever the equity beta. In its determination, it explained that:

"...The conventional approach to de-levering, as adopted by Ofcom, is based on a definitional relationship between the asset beta, the debt beta and the equity beta reflecting the fact that share price movements are amplified by the proportion of debt in the value of a company. Neither BT nor its witness statements (including their reference to Bruner et al) have provided a convincing alternative

³⁷⁶ This is consistent with Modigliani and Miller's first proposition which states that, absent financial market imperfections such as taxation and the costs of financial distress, the overall cost of capital (WACC) will be the same regardless of the firm's capital structure (i.e. the mix of debt and equity).

³⁷⁷ Brattle Group, *Estimate of BT's Equity Beta*, 3 March 2014, http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/15_annex15.pdf (March 2014 Brattle Report). This report can be found in Annex 15. We commissioned Brattle to calculate 1-year and 2-year equity and asset betas for BT Group. Brattle's report also includes data on BT's gearing levels since gearing is needed to calculate asset betas from equity betas.

³⁷⁸ Net debt is equal to the face value of short and long term debt less cash.

³⁷⁹ Paragraph 13.178 page 13-37, 2014 NIE Determination.

account of the de-levering relationship in which current gearing is replaced by expected gearing.”³⁸⁰

A14.69 In relation to the gearing used to re-lever the asset beta, the CC said that it was valid to base a forward-looking assumption for gearing on historical data³⁸¹ but that the approach put forward by BT in the appeal (based on a combination of historical gearing levels and market views of future levels) was preferable³⁸². In the 2013 BCMR Statement we re-levered the asset beta using BT’s current gearing, which we considered was consistent with the CC’s decision in the WBA Appeal 2012³⁸³.

Proposals in the July 2013 LLU WLR Consultation

A14.70 We proposed to de-lever the equity beta to derive an asset beta by using a gearing rate consistent with the calculation of the equity beta, i.e. a 2-year equity beta would be de-levered to an asset beta using the average gearing over that two year period. The two year average gearing used in the July 2013 LLU WLR Consultation was 40%, which related to the two year period to March 2013.

A14.71 We proposed to re-lever the asset beta to a forward-looking equity beta by using BT’s current gearing rate as a proxy for the forward-looking gearing over the charge control period. This gearing rate is also used to weight the cost of equity and cost of debt in the WACC calculation.

Responses to the July 2013 LLU WLR Consultation

A14.72 TalkTalk agreed with Ofcom’s approach of de-levering the equity beta using the average actual gearing over the beta estimation period³⁸⁴. No parties commented on the gearing rate used to re-lever the asset beta.

Our analysis and conclusions

Gearing to derive the asset beta

A14.73 Brattle has calculated an asset beta for BT by de-levering the equity beta using an average gearing ratio consistent with the time period for estimating the equity beta. For example, its 2-year equity beta of 1.01 (calculated to 31 December 2013) has been de-levered to an asset beta of 0.72 using BT’s average 2-year gearing in this period of 32%.

A14.74 In its report Brattle says it calculated gearing as follows:

“We compute financial leverage in the same way as in our previous updates, with reference to the face value of outstanding debt and ignoring BT’s pension fund deficit. The use of the face value of outstanding debt finds support in a leading corporate finance textbook³⁸⁵: first compute working capital (current assets less current liabilities) for each company. If working capital is positive, analysts should zero out short-term debt and estimate financial leverage with reference to long-term debt only. But if working capital

³⁸⁰ Paragraph 3.110, CC WBA Appeal 2012.

³⁸¹ Paragraph 3.50, page 3-10, CC WBA Appeal 2012.

³⁸² Paragraph 3.53, page 3-10, CC WBA Appeal 2012.

³⁸³ Paragraph A14.83, page 361, 2013 BCMR Statement.

³⁸⁴ Paragraph 4.64, page 42, TalkTalk Response to July 2013 LLU WLR Consultation.

³⁸⁵ Page 539, Brealey, R. A., Myers, S. C., and Allen, F., *Principles of Corporate Finance*, 9th Edition, McGraw-Hill (2006).

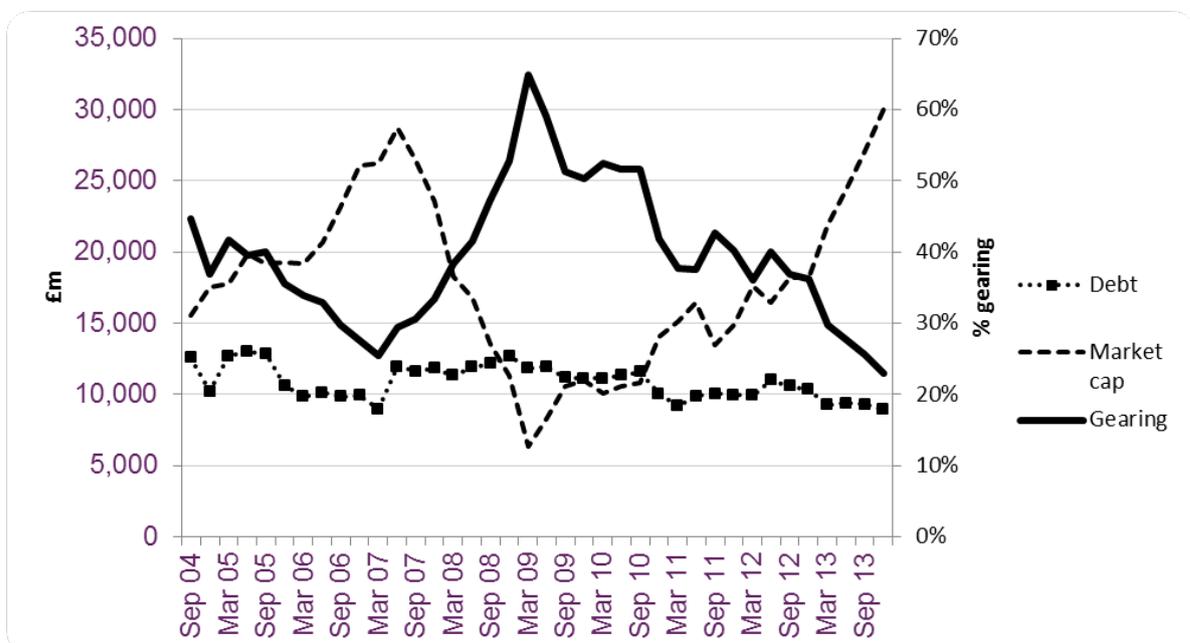
is negative, analysts should estimate financial leverage with reference to the sum of long-term plus short-term debt. Since BT's current liabilities consistently exceed its current assets (including cash), we end-up using the face value of both long-term and short-term debt in the leverage computation."³⁸⁶

Gearing to re-lever the asset beta

A14.75 BT's most recent gearing level is 23% (based on its debt position as at 31 December 2013 and a market capitalisation at that point of £30bn)³⁸⁷.

A14.76 BT's gearing has fallen significantly in recent years. Figure A14.4 illustrates BT's gearing levels over the last ten years. Over this period BT's debt levels have been relatively steady (although in recent years its debt has fallen, consistent with BT's policy of paying off debt³⁸⁸). Instead, changes in BT's gearing have been largely driven by changes in its market capitalisation.

Figure A14.4: BT's gearing over the last ten years



Source: Data provided by Brattle.

A14.77 BT's most recent gearing level of 23% is the lowest it has been in the last ten years. Given that BT's most recent gearing is not typical of the gearing rates witnessed over the last decade (where gearing has typically been between 30% and 45% and averaged around 40%) we have considered whether this would be an appropriate gearing to use on a forward-looking basis.

A14.78 We recognise that the forward-looking gearing we assume needs to be appropriate for both Openreach and the rest of BT since we do not try to derive separate gearing levels for Openreach and the rest of BT. In the 2011 WBA charge control Statement we said:

³⁸⁶ Page 13, March 2014 Brattle Report.

³⁸⁷ Using Brattle's gearing estimates.

³⁸⁸ In its 2011, 2012 and 2013 annual reports BT says one of its financial objectives is to reduce net debt. In the 2012 annual report it talked about targeting a BBB+ credit rating in the medium term.

“In relation to TTG’s argument that we should calculate the WACC for Openreach using a higher gearing level, we refer to the Competition Commission’s view in the LLU Appeal Determination:

“In our view, a business with lower systematic risk will generally be able to support a higher level of debt, although this depends on the overall risk of the business, including the company-specific risk of default on debt. We accept that a business exposed to lower overall risk may be able to target a higher credit rating, and hence a lower cost of raising finance, even at a higher level of indebtedness. However, there is no universally accepted model of an ‘optimal’ capital structure which would permit us to calibrate the relationship between risk and gearing with any precision”.

We have taken into account the argument that a business with a lower systematic risk may have a lower cost of debt in our assessment of Openreach’s debt premium. However, we do not think there is sufficient evidence to additionally support the use of a higher level of gearing for Openreach. The Competition Commission found that we did not err in this regard in the LLU Appeal Determination”.³⁸⁹

- A14.79 Although it is difficult to calculate separate gearing rates for Openreach and the rest of BT, we would expect that a business with lower systematic risk such as Openreach would generally be able to support a higher level of debt than BT Group overall. Given that the forward looking gearing rate we use needs to be appropriate for both Openreach and the rest of BT, we are reluctant to place significant weight on the most recent point estimate of 23% given that it is particularly low by reference to typical gearing levels in the last decade.
- A14.80 The two year average gearing of 32% used to de-lever the equity beta is more in line with the typical gearing we observe for BT over a longer period and we consider that this represents a reasonable forward-looking gearing rate to calculate the BT Group WACC, and in turn that for Openreach.
- A14.81 It is relevant to note that the WACC calculation is not very sensitive to the assumed forward-looking gearing. This has previously been identified by Ofcom and the CC in the CC WBA Appeal 2012. For Openreach and the rest of BT, using a forward gearing of 32% rather than 21% does not impact on the WACC (rounded to one decimal place). It would increase the BT Group WACC by 0.1 percentage points.

Equity beta for BT Group

Introduction

- A14.82 The value of a company’s equity beta reflects movements in returns to shareholders relative to movements in the return from the equity market as a whole.
- A14.83 In previous estimates of BT’s WACC, we have estimated the 1-year and 2-year daily betas and the 5-year weekly beta. However, we have generally placed most weight on the 2-year beta. This is because we consider that it provides the most

³⁸⁹ Paragraphs 6.234 and 6.235, 2011 WBA Charge Control Statement.

appropriate balance between a short enough estimation period to remain relevant whilst having enough data points to be sufficiently statistically robust.³⁹⁰

A14.84 In arriving at a beta estimate, we have commissioned the Brattle Group to calculate the 1-year and 2-year betas for BT Group. Brattle also ran a number of statistical tests to ensure that the beta estimate was sufficiently robust. These included tests for trading illiquidity and time distortions, and tests to ensure that the beta estimates satisfied the standard conditions underlying ordinary least squares regression.

Proposals in the July 2013 LLU WLR Consultation

A14.85 We proposed to give most weight to the 2-year equity beta since it provided a balance between up to date data and a sufficient number of data points to be statistically robust.

A14.86 We recognised that in periods of unusual market conditions, this approach could introduce greater volatility into our WACC estimates. We said that using 1-year and 5-year equity betas to provide a cross-check was appropriate to identify whether the 2-year equity beta was unduly affected by temporary market conditions. If, based on this data, we considered that the 2-year beta was distorted by temporary market conditions we would consider giving greater weight to beta estimates that were not affected by temporary distortions. We also considered that this responded to Europe Economics' suggestion that our approach should be sufficiently flexible to take account of unusual market conditions. We noted however that it was difficult to classify unusual market conditions as either temporary or permanent changes.

A14.87 We considered that it might be appropriate to consider the trend in the beta over time, for example by looking in detail at the evolution of the BT Group 2-year and 1-year beta.

A14.88 We noted that the BT Group 2-year equity beta (against the FTSE All-share) at the end of March 2013 of 1.03 was very similar to that estimated for the 2013 BCMR Statement using data to December 2012 of 1.01. We therefore considered that the estimate of 1.01 from the 2013 BCMR Statement remained appropriate for the purposes of the consultation.

Responses to the July 2013 LLU WLR Consultation

A14.89 TalkTalk said that Ofcom's approach of adopting 2-year equity betas based on the most recent available market data to be broadly appropriate, alongside cross checks using different time periods. It said Ofcom should update the beta estimates using recent data.³⁹¹

A14.90 BT considered data to September 2013 (the date of its response) and noted that 1-year equity betas had been increasing. It considered this was likely to translate into higher 2-year equity betas over the next year.³⁹²

A14.91 In response to BT, TalkTalk said while the 1-year equity beta may have increased during the period BT was looking at, the 2-year equity beta had not changed

³⁹⁰ Wright, S., Mason, R. and Miles, D. on behalf of Smithers and Co, *A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K.*, 13 February 2003, http://ofwat.gov.uk/publications/commissioned/rpt_com_costofcapital130203.pdf

³⁹¹ Paragraphs 4.21 and 4.22, pages 31 and 32, TalkTalk Response to the July 2013 LLU WLR Consultation.

³⁹² Paragraph 493, page 103, BT Response to July 2013 LLU WLR Consultation.

significantly, and the 2-year equity beta was Ofcom’s preferred measure.³⁹³
 TalkTalk also said that, even if BT Group’s beta had increased, it would be incorrect to associate this with an increase in the Openreach beta.³⁹⁴

A14.92 We consider the appropriate asset beta for Openreach in the section on disaggregation. Below we first explain our calculation of the BT Group equity and asset betas.

Our analysis and conclusions

A14.93 We commissioned a report from Brattle to provide estimates of the 1-year and 2-year equity betas for BT in the period to December 2013.

A14.94 For the period to December 2013, Brattle reports a 2-year equity beta of 1.01 and a 1-year equity beta of 1.08, against the FTSE All Share index. These estimates are similar to those reported by Brattle in its previous two reports as shown in Table A14.4.

Table A14.4: Equity betas reported by Brattle

Brattle report dated	Data considered to	1 year equity beta	2 year equity beta
March 2014	Dec 2013	1.08	1.01
April 2013	Mar 2013	1.03	1.03
January 2013	Dec 2012	0.99	1.01

Source: March 2014 Brattle Report; April 2013 Brattle Report;³⁹⁵ January 2013 Brattle Report.³⁹⁶

A14.95 Figure A14.5 illustrates the development of BT’s equity beta against the FTSE All Share over time. The rolling 2-year equity beta has been relatively stable over the last two years.

³⁹³ Paragraph 4.15, page 21, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

³⁹⁴ Paragraph 4.16, page 21, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

³⁹⁵ Brattle Group, *Estimate of BT’s Equity Beta*, April 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/annexes/Brattle_BT_Equity.pdf

³⁹⁶ Brattle Group, *Estimate of BT’s Equity Beta*, January 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/statement/equity-beta.pdf>

Figure A14.5: BT rolling equity betas



Source: March 2014 Brattle Report, Figure 1

A14.96 The chart shows that the increase in the 1-year equity beta towards the end of 2013 identified by BT has not translated into an increase in the 2-year equity beta, since the 1-year beta has started to decrease.

A14.97 We have also calculated BT's 5-year weekly equity beta as at December 2013. This was 1.10. We note that BT's gearing has fallen significantly over the last few years so while the 5-year equity beta is higher than the 2-year equity beta, this does not translate to a higher 5-year asset beta when adjusting for gearing rates (which were higher on average over the last five years than over the last two years). We consider BT's asset beta in the next section.

A14.98 We have decided to use an equity beta for BT Group of 1.01, equivalent to the 2-year equity beta calculated by Brattle as at December 2013. This is also the same as the equity beta used in the 2013 BCMR Statement, reflecting the fact that BT's 2-year equity beta has not changed significantly over the last couple of years.

Asset Beta

Introduction

A14.99 In order to estimate the asset beta for BT Group, we use the following formula:

$$\beta_{asset} = Gearing * \beta_{debt} + (1 - Gearing) * \beta_{equity}$$

A14.100 Therefore, we need to make an assumption about the debt beta for BT Group, alongside the equity beta and gearing discussed above.

A14.101 We have assumed a debt beta of 0.1. We discuss the debt beta in paragraph A14.109 to A14.121 below.

Proposals in the July 2013 LLU WLR Consultation

A14.102 We proposed to estimate the asset beta using the value derived by un-levering the 2-year equity beta and cross checking this against 1-year and 5-year estimates. We also said we would consider the rolling asset beta over time in order to inform our estimate.

A14.103 We proposed using an asset beta for BT Group of 0.67, the same as that used in the 2013 BCMR Statement. This was based on an equity beta of 1.01, a gearing ratio of 40% and a debt beta of 0.15. The gearing used to calculate the asset beta is the average gearing over the period used to calculate the equity beta.

Responses to the July 2013 LLU WLR Consultation

A14.104 BT said Ofcom's asset beta was conservative because it considered the equity beta had increased while gearing had fallen – this combination would result in a higher asset beta than used by Ofcom.³⁹⁷

A14.105 In response TalkTalk noted that the 2-year asset beta presented by BT in its response did not appear to have changed significantly since the July 2013 Consultation.³⁹⁸

Our analysis and conclusions

A14.106 Table A14.5 sets out the asset betas corresponding to the 1-year, 2-year and 5-year equity betas presented in the previous section.

Table A14.5: BT beta estimates using data to December 2013

	1-year	2-year	5-year
Equity beta	1.08	1.01	1.10
Average gearing	27%	32%	42%
Asset beta	0.82	0.72	0.68

Source: 1- and 2-year daily beta estimates come from Table 2 of the March 2014 Brattle Report. The 5-year weekly beta estimate comes from Bloomberg with the gearing from data separately provided by Brattle. Debt beta is 0.1.

A14.107 Although the 2-year equity beta of 1.01 is the same as that used in the July 2013 consultation and 2013 BCMR Statement, the reduction in average gearing from 40% to 32% means that the asset beta has increased slightly from 0.67 to 0.72, as BT anticipated may have happened in its response to the July 2013 Consultation.

A14.108 As proposed in the July 2013 Consultation, we have used the 2-year asset beta, which is now 0.72, in our WACC calculations for BT Group. This estimate does not seem unreasonable compared to the 5-year asset beta. We note that the 2-year asset beta has been relatively stable in 2013, as illustrated in Figure A14.6. The chart also shows that the 1-year asset beta tends to be more volatile. For this reason we generally place more weight on the 2-year beta as it tends to be more stable, as set out in the Consultation.

³⁹⁷ Paragraphs 493 – 496, page 103-105, BT Response to July 2013 LLU WLR Consultation.

³⁹⁸ Paragraph 4.15, page 21, TalkTalk Response to July 2013 LLU WLR Consultation.

Figure A14.6: BT rolling asset betas



Source: Brattle

Debt Beta

Introduction

A14.109 The beta of debt is intended to measure the covariance of the return on debt to the return on the market. The debt beta is used to de-lever the equity beta to estimate the asset beta. If the equity beta has changed substantially and the debt beta is static, it would imply a significant change to the asset beta. However it may be that some of the change in the equity beta is related to movements in the debt beta so it is important to consider changes in the debt beta.

A14.110 However, there are significant practical difficulties in estimating debt betas robustly.³⁹⁹

A14.111 The CC has previously noted when trying to estimate debt betas:

“the regression-based approach was hampered by poor data quality and models with poor statistical properties.”⁴⁰⁰

A14.112 We have therefore considered other sources of evidence such as academic texts and previous CC determinations:

- Brealey, Myers and Allen in their textbook *Principles of Corporate Finance* estimate that debt betas of large firms (which would include BT) are in the range of 0 to 0.2⁴⁰¹; and

³⁹⁹ It is technically possible to calculate a beta of debt where, as in the case of BT, the debt is traded, by using the CAPM formula. However, equity values fluctuate more than the value of debt therefore the correlation between debt returns and market returns is weak.

⁴⁰⁰ Paragraph 7, Page L34, Appendix L, Competition Commission, *Stansted Airport Ltd. Q5 price control review*, 23 October 2008, <http://www.caa.co.uk/default.aspx?catid=78&pageid=10232>

- the CC, in its Heathrow and Gatwick review used a point estimate of 0.1 where the debt premium was 1.4 to 1.7%.

A14.113 In the 2011 WBA charge control Statement, we used a debt beta range of 0.1 to 0.2 and a point estimate of 0.15. This represented an increase from the consultation estimate of 0.125. The increase was because we considered that a part of the debt premium can be attributed to the debt beta. In the 2011 WBA charge control Statement the debt beta of 0.15 was associated with a debt premium range of 2.0 to 2.5%.

Proposals in the July 2013 LLU WLR Consultation

A14.114 We said that we had used a debt beta of 0.15 in the 2013 BCMR Statement alongside a debt premium for BT Group of 1.7% to 2.3%. We maintained these debt beta and debt premium assumptions in the July 2013 LLU WLR Consultation.

A14.115 We recognised that, during periods of volatility, there may be movements in the debt beta and we proposed to take account of high-level expected movements in the debt beta. However, we did not consider that a direct estimate of the debt beta would be sufficiently robust and therefore did not propose to undertake such an analysis.

A14.116 We noted that recent evidence may suggest that BT's debt premium had fallen since the 1.7% to 2.3% range used in the 2013 BCMR Statement, which may in turn suggest that a slightly lower debt beta than 0.15 would be appropriate.

Responses to the July 2013 LLU WLR Consultation

A14.117 Sky said that a fall in BT's debt premium "may imply that its debt beta had also fallen (if the fall in debt premium was, at least in part, attributable to reduced default risk stemming from improved economy wide conditions)".⁴⁰² Sky said it might be appropriate to make a corresponding downwards adjustment if any reduction in BT's debt premium was caused by an economic upturn.⁴⁰³

Our analysis and conclusions

A14.118 In paragraphs A14.52 to A14.63 we explained that we have reduced BT's debt premium from a range of 1.7% to 2.3% in the 2013 BCMR Statement to 1.0% to 1.5% for this Statement.

A14.119 Some of the reduction in the debt premium is likely to reflect a reduction in the debt beta (i.e. if the economy is performing better, this can lead to a lower risk of default in general for a given credit rating – this systematic risk being measured by the debt beta). The debt beta is also likely to have fallen because BT's gearing level has reduced significantly over recent years (see figure A14.4). This is because, as gearing falls, the equity buffer is increased making it less likely that debt default will occur when the economy is performing well.

A14.120 We have decided to reduce the debt beta from 0.15 to 0.10. We note that a debt beta estimate of 0.10 is consistent with the CC's estimate in the Heathrow and

⁴⁰¹ Page 436, Brealey, R., A., Myers, S., C. and Allen, F., *Principles of Corporate Finance*, 11th Edition, McGraw-Hill (2014).

⁴⁰² Paragraph 8.16, page 25, Sky Response to the July 2013 LLU WLR Consultation.

⁴⁰³ Paragraph 8.16, page 25, Sky Response to the July 2013 LLU WLR Consultation.

Gatwick review when it assumed a debt premium of 1.4% to 1.7%. This is similar in magnitude to our debt premium in this Statement.

A14.121 This reduction in the debt beta does not have a significant impact on the WACC calculations. Table A14.6 shows the WACC calculations for BT Group, Openreach and rest of BT using a beta of 0.10 and 0.15.

Table A14.6: WACC calculations using different debt beta assumptions

	BT Group	Openreach	RoBT
Debt beta of 0.10	10.0%	8.6%	10.8%
Debt beta of 0.15	10.0%	8.5%	10.8%

Source: Ofcom analysis

Equity Risk Premium

Introduction

A14.122 Under the CAPM, the Equity Risk Premium (ERP) represents the extra return that investors require as a reward for investing in equities rather than a risk-free asset. It is market-specific, not company-specific.

A14.123 Academics and other users of the CAPM have conducted a large number of investigations into the value of the ERP, using quantitative techniques and surveys. These have produced a range of widely differing estimates, which means that we (and other economic regulators) have to choose a value from within the plausible range implied by these studies.

A14.124 In previous estimates of the cost of capital, we have estimated the ERP by taking into account the following sources:

- Historical data on the premium of UK equities over and above UK Government gilts;
- Academic/user surveys (although we have tended to place little weight on these); and
- Regulatory benchmarks which show recent ERP estimates, by the UK's economic regulators.

A14.125 In more recent estimates of the cost of capital, we have also considered volatility in the UK stock market (as proxied by the FTSE All-share) to inform movements in our estimate of the ERP. We noted that the latest evidence at the time of the 2013 BCMR Statement suggested that volatility had fallen, and was closer to its long run mean. We considered that this did not support an increase to the ERP.

A14.126 In the 2013 BCMR Statement, we noted that, although there was an interesting argument that an increase in the volatility of market volatility could result in investors demanding a higher premium than previously identified, we considered that the evidence for the persistence of such uncertainty in the future was not conclusive and the method by which we would incorporate any such risk premium into our existing methodology was not clear. We said that we placed weight on consistency in our approach and would be reluctant to introduce new datasets or

methodologies (i.e. consideration of the uncertainty of volatility on market returns) unless there was sufficient evidence to support its inclusion, which we did not consider to be the case.

A14.127 Finally, in the 2013 BCMR Statement, we considered the link between the ERP and the risk-free rate. We noted that the risk-free rate and the ERP tended to move in opposite directions.

Proposals in the July 2013 LLU WLR Consultation

A14.128 We proposed to estimate the ERP by reference to historical averages, as well as considering the implied volatility on the FTSE All Share index and recent survey evidence.

A14.129 We considered that the point estimate of 5% used in the 2013 BCMR Statement remained appropriate for the purposes of the consultation. We noted that the 2013 sourcebook⁴⁰⁴ showed that the historical premium of equities over government bonds for the UK was 5%. We also noted that the 2013 sourcebook suggested a long-run arithmetic mean premium for the world index of around 4.5% to 5%.

Responses to the July 2013 LLU WLR Consultation

A14.130 No Stakeholders directly commented on our approach to estimating the ERP.

Our analysis and conclusions

A14.131 According to the 2014 sourcebook, the historical premium of equities over government bonds for the UK was 5.2% between 1900 and 2013.⁴⁰⁵ The 2014 Sourcebook also suggests a long-run arithmetic mean premium for the world index of around 4.5% to 5%.⁴⁰⁶

A14.132 Recent survey evidence suggests that an ERP of 5% would be appropriate. A 2013 survey by Fernandez, Aguirreamalloa and Linares⁴⁰⁷ asked professors, analysts and managers what ERP they had assumed in 2013. For the UK, responses indicated a mean ERP of 5.5% with a median of 5%. These results were consistent with previous surveys carried out by Fernandez et al in 2011 and 2012.

A14.133 We have previously placed relatively little weight on survey evidence and we note that in its 2013 NIE Determination the CC said “the results of [surveys] tend to depend on the identity and outlook of the respondents and how they interpret the questions being asked....In this report we have preferred to consider the underlying data on which survey respondents presumably base their views.”⁴⁰⁸

A14.134 In its 2014 NIE Determination, the CC used an ERP range of 4% to 5%⁴⁰⁹.

⁴⁰⁴ Dimson, E., Marsh, P. and Staunton, M., *Credit Suisse Global Investment Returns Sourcebook 2013*, Credit Suisse Research Institute (February 2013).

⁴⁰⁵ Table 70, page 180, Dimson, E., Marsh, P. and Staunton, M., *Credit Suisse Global Investment Returns Sourcebook 2013*, Credit Suisse Research Institute (February 2014) (2014 Sourcebook).

⁴⁰⁶ Page 41, 2014 Sourcebook

⁴⁰⁷ Fernandez, P., Aguirreamalloa, J. and Linares, P., *Market Risk Premium and Risk Free Rate used for 51 countries in 2013: a survey with 6,237 Answers*, 26 June 2013, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=914160.

⁴⁰⁸ Paragraph 13.156, page 13-31, 2014 NIE Determination.

⁴⁰⁹ Paragraph 13.161, page 13-33, 2014 NIE Determination.

A14.135 We also said we would consider the volatility of the UK stock market, using the FTSE All Share as a proxy. The FTSE publishes factsheets that show volatility for the FTSE All Share over the last year, three years and five years⁴¹⁰. Data from these factsheets is shown in Table A14.7. This indicates that shorter term market volatility (for example, as represented by the 1-year estimates) is the lowest for five years but we note that these shorter term measures are typically more volatile, year-on-year, than longer-term measures. For example, the five-year estimate, has declined a little in the last year, but has varied much less over the historical period shown.

Table A14.7: FTSE All Share volatility

	1 year	3 year	5 year
Dec-13	11.6%	15.9%	14.3%
Dec-12	13.5%	17.0%	17.6%
Dec-11	20.4%	19.5%	17.4%
Dec-10	16.9%	22.3%	16.9%
Dec-09	22.9%	22.3%	15.7%

Source: FTSE All Share factsheets. Volatility is calculated by reference to the standard deviation of daily returns.

A14.136 A reduction in volatility may suggest that the ERP has reduced, although longer term volatility has been relatively stable and the evidence from historical data and surveys would not support a reduction from our July 2013 LLU WLR Consultation estimate of 5%. Further, we have previously said that there was likely to be an inverse relationship between the ERP and RFR. We would be reluctant to reduce the ERP without evidence that the RFR has also increased (and vice versa). As explained in paragraphs A14.26 to A14.51, we have decided to maintain a risk free rate of 1.3%.

A14.137 Overall, when estimating the ERP we put most weight on the historical premium of equities over government bonds. This data suggests that our July 2013 LLU WLR Consultation proposal of 5% is reasonable. Similarly, our 5% assumption does not appear unreasonable when compared to survey evidence and the range recently used by the CC. We have therefore decided to maintain our proposal from the July 2013 Consultation and use an ERP of 5%.

A14.138 We have also considered whether our implied total market return (i.e. the sum of the risk free rate and the ERP) appears reasonable compared to the market return the CC used in its 2014 NIE Determination.

Table A14.8: Implied total market return compared to the CC's recent decision

	Ofcom	CC NIE
Risk free rate	1.3%	1.0% to 1.5%

⁴¹⁰ <http://www.ftse.com/analytics/factsheets/Home/Search#>

ERP	5.0%	4.0% to 5.0%
Total market return	6.3%	5.0% to 6.5%

Source: Ofcom analysis and 2014 NIE Determination.

A14.139 Although our market return of 6.3% is towards the higher end of the range the CC used in its 2014 NIE Determination, the CC considered there was more support for estimates at the higher end of its range. The CC said that “*we consider that the lower bound of 5 per cent for the expected return on the market is less well supported than the upper end of the range of 6.5 per cent*”.⁴¹¹

Tax rate

A14.140 In the 2013 BCMR Statement we took account of the Chancellor’s 2013 budget which announced a fall in the forecast corporation tax rate for 2015/16 to 20%. We proposed to estimate the tax rate for 2016/17, the final year of the charge control, by reference to the proposed tax rate for 2016/17 (or where this is not available, by reference to the 2015/16 20% rate) as announced by the Government.

A14.141 No respondents commented on our proposals in relation to corporation tax and the Government has not announced any revisions to the rate of corporation tax for the period in question. We have therefore used a tax rate of 20% in the WACC calculation.

Inflation

Proposals in the July 2013 LLU WLR Consultation

A14.142 We proposed to estimate the inflation assumption to be used in the WACC using RPI forecasts from HM Treasury. We considered that it was appropriate to calculate the real risk-free rate by reference to RPI because indexed linked gilts, which we use to inform our estimate of the risk-free rate, are linked to RPI. Combining the real risk-free rate with our RPI forecast for 2016/17 enables us to calculate a nominal risk-free rate.

A14.143 We noted that we were proposing to use CPI in the charge control formula. However, this use of CPI relates to how the cap is set to get from current charges to the forecast cost-based charges at the end of the control period. The charge control model forecasts costs in nominal terms and where the cost of capital is built up from a real risk free rate derived from RPI index linked gilts, it is appropriate to generate a nominal WACC consistent with that index – i.e. using forecast RPI, rather than forecast CPI.

A14.144 We said that if we were to estimate a real WACC (as is the case for some models used by Ofcom to forecast BT’s costs), we would calculate the nominal WACC (using forecast RPI added to the real risk-free rate derived from yields on RPI indexed gilts). We would then express the real WACC relative to CPI or RPI depending on which is appropriate for that charge control Cost Model. The real WACC relative to RPI would typically differ from the real WACC relative to CPI because the forecast rates of inflation as measured by RPI and CPI are typically different.

⁴¹¹ Paragraph 13.187, page 13-38, 2014 NIE Determination.

A14.145 We noted that the most recent forecasts as compiled by HM Treasury showed that inflation for 2016/17 was forecast to be greater than that used in the 2013 BCMR Statement of 2.8%. We proposed to reflect the latest available inflation estimates available at the time of our WLR/LLU statement.

Responses to the July 2013 LLU WLR Consultation

A14.146 BT said that “as a matter of clear principle, Ofcom must adjust the RPI inflation assumption of 2.8% used to set the nominal WACC to ensure consistency with RPI inflation assumptions used elsewhere in the charge control (frequent reference is made to a figure of 3.3% as representing a consensus forecast). In particular, Ofcom has to use a consistent RPI figure in deriving the WACC calculation and in determining the final year asset inflation which drives final year holding gains and cost allowances”.⁴¹²

A14.147 TalkTalk said that “BT’s complaint that Ofcom is acting inconsistently is not correct. The figures that BT quotes are different figures: the 2.8% rate reflects the 2016/17 forecast inflation as estimated in the BCMR Report; the 3.3% is the average inflation forecast across the forecast period”.⁴¹³

Our analysis and conclusions

A14.148 In February 2014, HM Treasury published an RPI forecast of 3.2% for 2017⁴¹⁴. This forecast represents the average of a number of independent forecasts from City and non-City forecasters.

A14.149 HM Treasury publishes medium term forecasts every three months. We note that the average forecast of RPI in 2017 has reduced over the last year from the 3.6% forecast in February 2013 to a forecast of 3.2% from the latest report⁴¹⁵.

A14.150 Given this movement, we considered it would be appropriate to assess whether an RPI forecast of 3.2% in 2017 was reasonable. We have therefore additionally considered:

- Implied RPI on forward rates (the difference in yields between 5 and 10 year nominal and indexed-linked gilts taken out in three years’ time); and
- Implied RPI estimated by adding the Bank of England’s long run estimated difference between RPI and CPI to the Bank of England’s CPI target of 2%.

A14.151 Implied inflation on five-year bonds taken out in three years’ time has varied between 3% and 3.4% in the year to date (up to 11 Feb 2014) and for 10 year bonds taken out in three years’ time the implied inflation is 3.2% to 3.6%. The average implied inflation for a five-year bond taken out in three years’ time is around 3.2% based on the last year’s data, and 3.5% for a ten year bond. Figure A14.7 illustrates how these implied inflation rates have changed over the last year.

⁴¹² Paragraph 481, page 99, BT Response to July 2013 LLU WLR Consultation.

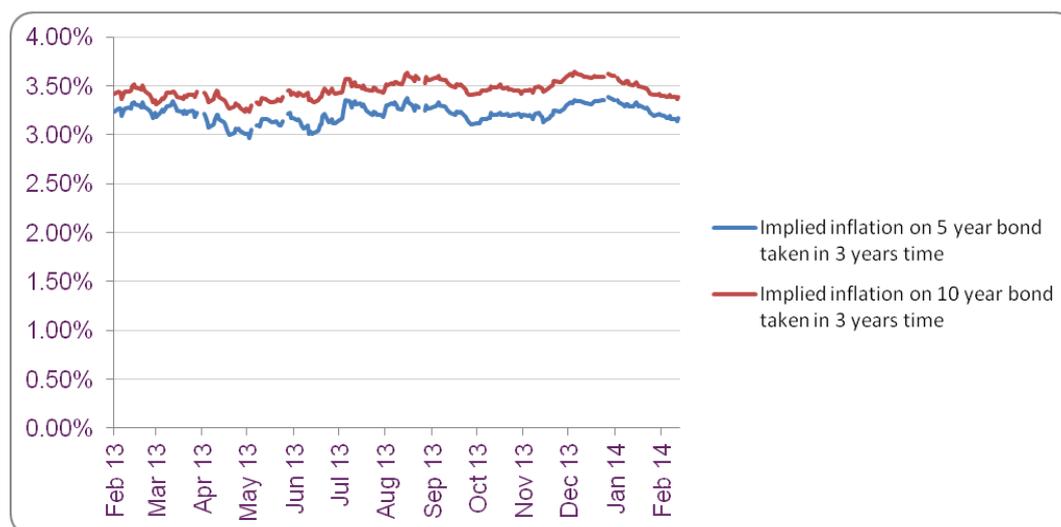
⁴¹³ Paragraph 4.3, page 19, TalkTalk Response to BT’s response to the July 2013 LLU WLR Consultation.

⁴¹⁴ Table M3, page 25, HM Treasury, *Forecasts for the UK Economy: a comparison of independent forecasts*, February 2014,

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283983/201402forecom p.pdf

⁴¹⁵ February 2013: 3.6%; May 2013: 3.6%; August 2013: 3.4%; November 2013: 3.5% and February 2014: 3.2%. Forecasts available here: <https://www.gov.uk/government/collections/data-forecasts>

Figure A14.7: Implied inflation on bonds taken out in three years' time



Source: Ofcom analysis based on Bank of England data.

A14.152 The Bank of England has a long run CPI target of 2% (the most recent HMT average forecast for 2017 is 2.1%). This CPI forecast can be combined with an estimate of the wedge between RPI and CPI to estimate RPI inflation.

A14.153 In its 2014 NIE Determination, the CC said that “We note the historical gap between RPI and CPI measures of inflation of around 0.8 per cent, and the forecast increase in the gap”⁴¹⁶. The historical difference between RPI and CPI might therefore imply a forward looking RPI forecast of around 3%. However, in its 2014 Inflation report the Bank of England published a ‘long run’ estimate of the wedge between RPI and CPI of 1.3%⁴¹⁷. This would imply an RPI forecast of around 3.3% based on long-run expectations. The Bank of England noted that its estimate of the wedge was similar to the Office for Budget Responsibility’s long run estimate of 1.3% to 1.5%⁴¹⁸ (implying a long run RPI forecast of 3.3% to 3.5% when added to the Bank of England’s target of 2%).

A14.154 This information is summarised in Table A14.9 below.

Table A14.9: RPI evidence

Forecast based on:	HMT 2017 (Feb 2014)	Implied inflation on forward rates	RPI-CPI wedge
RPI estimate	3.2%	3.2% to 3.5%	3% to 3.5%

Source: Ofcom analysis

⁴¹⁶ Paragraph 13.126, page 13-24, 2014 NIE Determination.

⁴¹⁷ Page 34, Bank of England, *Inflation Report*, February 2014,

<http://www.bankofengland.co.uk/publications/Documents/inflationreport/2014/ir14feb.pdf>.

⁴¹⁸ Page 31, Office for Budget Responsibility, *The long-run difference between RPI and CPI inflation*, November 2011, <http://cdn.budgetresponsibility.independent.gov.uk/Working-paper-No2-The-long-run-difference-between-RPI-and-CPI-inflation.pdf>. The Office for Budget Responsibility does not define the “long run”.

A14.155 The 2017 HM Treasury RPI forecast of 3.2% is consistent with the level of RPI inflation based on the other comparators we have considered. On this basis, we have adopted an RPI rate of 3.2% in our WACC calculation.

A14.156 BT was concerned that the RPI rate that we used in the WACC calculation should be consistent with the RPI rate used to derive asset inflation in the charge control model. First, it should be noted that not all assets are inflated by RPI in the charge control model. Second, assets to which the RAV applies (i.e. copper and duct) are inflated at RPI, and we can confirm that the RPI inflation used to inflate the value of RAV assets in the final year of the charge control is 3.2%, the same rate assumed in the WACC calculation.⁴¹⁹

Disaggregation of BT Group asset beta

Introduction and summary

A14.157 In the July 2013 LLU WLR Consultation we used a variety of evidence to assess the asset beta of BT Group's copper access services (the 'Openreach' asset beta) and the remainder of BT Group's activities (the 'Rest of BT' – RoBT – asset beta). In particular, we:

- considered that fundamental beta analysis (proposed by Europe Economics) was unlikely to be appropriate to assess the asset beta of each part of BT Group's business;⁴²⁰
- looked at the evidence from comparator companies (UK network utilities, US telecoms operators, Chorus – a vertically separated telecoms network provider in New Zealand – and UK telecoms operators);⁴²¹
- assessed the potential riskiness of BT's investments, in particular, into superfast broadband and TV sports rights;⁴²² and
- discussed the relative weights of each of Openreach and the RoBT in BT Group.⁴²³

A14.158 In the July 2013 LLU WLR Consultation we concluded that some of the evidence on comparator companies could be interpreted as suggesting that the gap in the systematic risk between Openreach and the RoBT may have increased, while other evidence did not support moving Openreach's asset beta closer to that of network utilities. We also noted that it might be appropriate to consider alternative ways to disaggregate the BT Group asset beta, for example, by increasing the weight ascribed to the RoBT. This change in the weights of each part of BT Group could result in asset betas for Openreach and the RoBT that better reflected the evidence we used in our analysis (for example, on comparable UK telecoms operators), while

⁴¹⁹ In any case, the inflation forecast used in a forward looking WACC calculation does not need to be the same as the inflation or indexation used to calculate asset price inflation in the final year of the charge control. For example, if implied inflation on forward rates was significantly different from the RPI anticipated for the final year of a charge control, this might suggest that the inflation assumption used to calculate a forward looking WACC would be different from the inflation assumption used to estimate asset price inflation in the final, single, year of the charge control.

⁴²⁰ Paragraphs A15.166-A15.170, July 2013 LLU WLR Consultation.

⁴²¹ Paragraphs A15.171-A15.193, July 2013 LLU WLR Consultation.

⁴²² Paragraphs A15.194-A15.202, July 2013 LLU WLR Consultation.

⁴²³ Paragraphs A15.205-A15.206, July 2013 LLU WLR Consultation.

at the same time maintaining the BT Group asset beta consistent with empirical estimates based on market data.⁴²⁴

A14.159 We considered that we should exercise caution in changing our analytical approach and placed weight on the stability of our analytical approach to calculating the WACC. We therefore concluded that we should be consistent with our analysis in the 2013 BCMR Statement and continue to assume that Openreach's asset beta was 10% below that of BT Group and that the asset beta of the RoBT was 10% above the level of BT Group. This implied an Openreach asset beta of 0.6 and a RoBT asset beta of 0.74.⁴²⁵

A14.160 In this section we update the analysis presented in the July 2013 LLU WLR Consultation following the same structure used in that Consultation (as discussed above). In summary,

- i) We have concluded that the split of the economic value of BT Group between Openreach and RoBT should be 1/3:2/3 (rather than the 50:50 split proposed in the July 2013 LLU WLR Consultation), based on more satisfactory measures of the economic value of each part of the business.
- ii) We have analysed the asset betas of benchmark companies and the riskiness of BT Group's investments to arrive at our estimates of the Openreach and RoBT asset betas. We believe it would be reasonable to expect a widening of the wedge between Openreach and the RoBT, as the majority of the changes in BT Group's business in recent years have been driven by the RoBT's business (while Openreach has remained fairly unchanged). In fact, the increase in BT's asset beta has been associated with an increase in the market value of its equity, suggesting that the business contributing the incremental value (which we consider is the RoBT) may have a higher asset beta than the other parts of the business.
- iii) Our best estimate of the asset beta for Openreach is 0.5 which implies an asset beta for the RoBT of 0.83 (a wedge of 0.33 points between the two parts of the business). This is based on:
 - o the evidence on benchmark companies for Openreach and/or the RoBT as appropriate (for example, UK network utilities, UK telecoms operators and the New Zealand telecoms network operator Chorus); and
 - o the constraint on the asset beta disaggregation which requires that the sum of the asset betas of Openreach and the RoBT weighted by their economic value must be equal to the BT Group asset beta derived from market data.

Fundamental beta analysis

Proposals in the July 2013 LLU WLR Consultation

A14.161 We noted that Europe Economics had advocated using fundamental beta analysis, which relied on regression analysis using accounting and market information to estimate the equity beta of Openreach.⁴²⁶ We did not consider that this approach would be appropriate as it was unclear that it would be superior to the approach we

⁴²⁴ Paragraphs A15.204-A15.207, July 2013 LLU WLR Consultation.

⁴²⁵ Paragraphs A15.208-A15.210, July 2013 LLU WLR Consultation.

⁴²⁶ Paragraphs A15.166-A15.169, July 2013 LLU WLR Consultation.

had been using to disaggregate BT Group's beta. We also noted it was a relatively complex approach, requiring regression analysis with a large sample of firms and a significant degree of judgment in terms of sample selection and choice of accounting variables.⁴²⁷

Responses to the July 2013 LLU WLR Consultation

A14.162 BT considered that Ofcom had rightly rejected the use of fundamental beta analysis on the basis that it was unclear that it would produce superior outcomes due to the level of judgement that would be required in assessing data.⁴²⁸

Ofcom's analysis and conclusions

A14.163 As we noted in the July 2013 LLU WLR Consultation, we understand that fundamental beta analysis consists of estimating the equity beta of a company using accounting and market information as follows:

- select certain accounting and/or financial variables (e.g. leverage, earnings volatility, etc.);
- identify a suitable pool of comparator companies;
- estimate the relationship between the beta of these companies and the selected accounting/financial variables over a set period of time; and
- apply the estimated equation for beta as a function of the financial variables to estimate the beta of a specific company using the values of the accounting/financial variables for that company.⁴²⁹

A14.164 From our own research at the time of the July 2013 LLU WLR Consultation there does not appear to us to be a large body of academic research on this approach to beta estimation,⁴³⁰ although the references provided by Europe Economics show that there has been some academic research on the relationship between accounting variables and systematic risk.⁴³¹ For example, we are not aware of any academic paper that may have considered whether fundamental analysis could be seen as superior to an approach based on the CAPM (i.e. the approach we are proposing to continue using).⁴³²

A14.165 We also note that other sector regulators (e.g. Ofgem, Ofwat or ORR) or the Competition Commission do not tend to use the type of regression analysis advocated by Europe Economics to estimate equity betas for regulatory purposes. Europe Economics' response to the Civil Aviation Authority (CAA)'s consultation on

⁴²⁷ Paragraph A15.170, July 2013 LLU WLR Consultation.

⁴²⁸ Paragraph 501, BT response to July 2013 LLU WLR Consultation.

⁴²⁹ Paragraph A15.165, July 2013 LLU WLR Consultation.

⁴³⁰ In paragraph A15.166 of the July 2013 LLU WLR Consultation, we referred to several academic articles that had been quoted by Europe Economics in its response to the CAA's consultation on the estimation of Heathrow's cost of capital (pages 61-62, Europe Economics, *Heathrow Airport's Cost of Capital. A report on behalf of Heathrow*, February 2013, <http://www.caa.co.uk/docs/78/HeathrowCostOfCapitalStudy.pdf>).

⁴³¹ Paragraph A15.167, July 2013 LLU WLR Consultation.

⁴³² Fundamental beta analysis also does not appear to be mentioned in a number of standard texts on the subject. For example, fundamental beta analysis is absent from Brealey, R. A., Myers, S. C., and Allen, F., *Principles of Corporate Finance*, 10th Edition, McGraw-Hill (2012) or Copeland, T.E., Weston, J.F. and Shastri, K., *Financial Theory and Corporate Policy*, 4th Edition, Pearson, (2005).

the cost of capital for Heathrow airport quotes a study by Oxera⁴³³ in 2006 on behalf of BAA that purportedly used fundamental beta analysis. However, this analysis was not used by the CAA when setting the price cap at Heathrow at that time. In circumstances similar to those under consideration here (i.e. a regulated firm that is not listed but is part of a wide corporate group), the CAA proposed not to use the fundamental beta analysis advocated by Europe Economics to estimate the WACC for Heathrow in its current review of the airport's regulation.⁴³⁴

A14.166 While the fundamental beta analysis advocated by Europe Economics may have some merit, we remain of the view that it is unlikely to provide a superior basis for disaggregating the BT Group beta. The main reason for this is that it is unclear whether such analysis would be superior to the approach we currently use to disaggregate BT Group's beta and it is a relatively complex approach, requiring further regression analysis with a large sample of firms and a significant degree of judgment in terms of sample selection and choice of accounting variables (many of which may vary for reasons of accounting treatment rather than the fundamental characteristics of the firm). We consider that these factors may also explain the lack of any precedent for the approach advocated by Europe Economics in a regulatory context.

Analysis of benchmark companies

Proposals in the July 2013 LLU WLR Consultation

A14.167 We used the two year asset betas from several companies as benchmarks to assess the risk of each part of BT Group's business, in particular:⁴³⁵

- UK network utilities presented two year asset betas in the 0.28 to 0.33 range;
- US telecoms operators ranged between 0.3 to 0.55;
- Chorus had an asset beta of 0.57; and
- UK telecoms operators ranged between 0.4 and 0.6.⁴³⁶

A14.168 In addition, we looked at financial information from BT, Openreach and UK network utilities, namely:

- Operating leverage: the ratio between 'cash out' and 'cash in' for BT, Openreach and the network utility comparators over the previous five years;
- Variation in turnover: the annual change on the companies' turnover; and
- Volatility of returns: looking at profitability and its volatility over the previous five years.⁴³⁷

⁴³³ Oxera, *Stand-alone costs of capital of Heathrow, Gatwick and Stansted Airports*, 2006.

⁴³⁴ Paragraph 9.107, CAA, *Economic regulation at Heathrow from April 2014: initial proposals*, April 2013, <http://www.caa.co.uk/docs/33/CAP%201027%20Economic%20regulation%20at%20Heathrow%20from%20April%202014%20initial%20proposals.pdf>

⁴³⁵ Paragraphs A15.171-A15.187, July 2013 LLU WLR Consultation.

⁴³⁶ The range we used for the UK telecoms comparators in the July 2013 LLU WLR Consultation was based on the two year rolling asset betas during the year up to March 2013, whereas the figures for the other comparators reflected the two year asset betas as of March 2013. We have corrected this when presenting and comparing the evidence in our consultation to that in this Statement in Figure A14.14 below.

A14.169 Below we update the evidence on the benchmark companies we used in the July 2013 LLU WLR Consultation, although we have replaced the US with European telecoms comparators, as we consider that European incumbent fixed line operators are likely to share greater similarities with BT Group (for example, in terms of their regulatory regime). We also summarise and respond to stakeholder comments relating to our use of this evidence.

Responses to the July 2013 LLU WLR Consultation

A14.170 Several stakeholders commented on our use of benchmark companies to assess the systematic risk of each part of BT Group's business (i.e. Openreach and RoBT). These comments focused mainly on the following three issues:

- the principle of disaggregating the BT Group WACC;
- the use of UK network utilities as comparators for the Openreach copper access services; and
- the use of UK telecoms operators as comparators for the RoBT activities.

A14.171 We summarise these comments in turn below.

The principle of disaggregating the BT Group WACC

A14.172 BT had reservations with the principle of disaggregating the BT Group WACC. It considered that disaggregation placed an unreasonable reliance on indirect data sources, such as utility comparators, when a direct data source (the observed BT Group asset beta) was clearly preferable. In its view, any attempt to alter the asset beta or equity beta that was not based on direct market evidence necessarily weakened the predictive usefulness of the beta factors in question.⁴³⁸

A14.173 TalkTalk disagreed with BT and supported beta disaggregation. It considered that many aspects of the cost of capital estimation using CAPM require regulatory judgement and cannot be based solely on market data. TalkTalk argued that the BT Group beta was becoming an increasingly unreliable basis for deriving the asset beta of Openreach's copper business, as this was becoming a smaller part of the overall BT Group, and the RoBT risk was increasing due to the high risk investments in fibre, BT Global Services and BT Sport.⁴³⁹

The use of UK network utilities as benchmarks for Openreach's copper access activities

A14.174 TalkTalk believed that the natural comparator group for Openreach was similar regulated UK utilities (e.g. water, electricity, gas, etc.) because:

- both Openreach and network utilities are essential utilities facing stable demand;
- all these firms face either no or little competition leading to stable market shares and no cyclical volatility;
- cost levels are predictable, with no relationship to the economic cycle; and

⁴³⁷ Paragraphs A15.188-A15.193, July 2013 LLU WLR Consultation.

⁴³⁸ Paragraph 498-499, BT Response to July 2013 LLU WLR Consultation.

⁴³⁹ Page 23, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

- heavy price regulation sets returns in a predictable manner which is closely related to investments.⁴⁴⁰

The use of UK telecoms operators as benchmarks for the RoBT activities

A14.175 TalkTalk considered that the comparators used by Ofcom for the RoBT were not appropriate and underestimated the risk faced by the RoBT. In particular, it argued that the RoBT included a number of very high risk activities that were not undertaken by the UK telecoms comparators used by Ofcom, namely:

- around half of the RoBT's revenue (47%) is a highly risky consulting and solutions business (BT Global Services) which has seen substantial volatility over recent years and has been generally loss-making;
- BT's NGA business, which requires fibre roll-out, is riskier than Virgin Media's, which only involves software upgrades and is therefore considerably cheaper;
- the BT Sports business is new and therefore riskier than Sky's pay-TV business (which is more mature), and it relies on being cross-subsidised by profits made from BT Consumer/Business's broadband sales, rather than being a stand-alone profit centre; and
- BT has a poorly performing TV business which makes its core BT Consumer/Business business more vulnerable to loss of customers to TalkTalk and Sky's stronger TV offerings.⁴⁴¹

Ofcom's analysis

A14.176 This sub-section is structured as follows:

- the principle of disaggregating BT Group's WACC;
- analysis of UK network utilities;
- comparison with Chorus (New Zealand);
- analysis of UK telecoms operators;
- analysis of EU telecoms operators; and
- assessment of operating leverage and volatility of returns.

A14.177 We present our analysis in turn below. Unless stated otherwise, our analysis is based on a comparison of two year asset betas estimated using daily returns against the FTSE All-Share index. The gearing used to derive unlevered betas is estimated as indicated in the previous section. The majority of the evidence discussed in this section is taken from the March 2014 and April 2013 Brattle Reports.⁴⁴²

⁴⁴⁰ Paragraphs 4.44 to 4.46, TalkTalk Response to July 2013 LLU WLR Consultation.

⁴⁴¹ Paragraph 4.43, TalkTalk Response to July 2013 LLU WLR Consultation.

⁴⁴² See April 2013 Brattle Report and March 2014 Brattle Report.

The principle of disaggregating BT Group's WACC

A14.178 We disagree with BT's criticism of the disaggregation of its WACC into an Openreach and RoBT rate. We first disaggregated BT Group's cost of capital into an Openreach copper access and RoBT WACC in 2005.⁴⁴³ We believe that the justification for disaggregating BT Group's cost of capital, as described in our 2005 Cost of Capital Statement, remains valid. Indeed, it seems to have even more validity now than it did previously. As further described below, BT Group's market capitalisation has experienced a continued increase in the recent years. We believe that this process is more likely to have been driven by BT's investments in areas outside its copper access network (such as superfast broadband and Sports rights), such that the weight of the copper access business is becoming a smaller share of BT Group's enterprise value.

Analysis of UK network utilities

A14.179 To a degree we agree with TalkTalk that a useful comparator group for Openreach is UK network utilities, as both have similar characteristics. We note however that there are also differences between Openreach and these companies. In fact, as we have previously argued,⁴⁴⁴ in terms of systematic risk we do not consider that Openreach is a priori more similar to a network utility than to the rest of BT Group because:

- while demand for telecommunications network services is fairly robust, we do not think it is obvious that this demand is as certain as for the products provided by pure utility operators (e.g. water and electricity networks) which are regarded as "essentials" by consumers; and
- the regulatory framework in the water industry, for example, involves a "duty of finance". No such duty exists for Ofcom in relation to Openreach, which implies that it is likely to be more risky than water utilities on this basis.

A14.180 We therefore remain of the view that it is appropriate to compare BT Group's asset beta against UK network utilities to assess the systematic risk of each part of its business, albeit we should also acknowledge the differences that exist between pure network utilities and Openreach's copper access services. In the latest analysis commissioned from Brattle we have considered it appropriate to include Centrica and Southern & Scottish Energy (SSE) in our analysis, as they were part of the UK network utilities comparator group when we first decided to disaggregate BT Group's asset beta in 2005.⁴⁴⁵ The updated analysis implies an asset beta range for the UK network utilities of 0.27 to 0.46 (the average being 0.34) using a debt beta of 0.1 (compared to 0.28 to 0.33 in the July 2013 LLU WLR Consultation, where we used a debt beta of 0.15 and excluded Centrica and SSE), as shown in Table A14.10 below.

⁴⁴³ Ofcom, *Ofcom's approach to risk in the assessment of the cost of capital*, 18 August 2005, available at http://stakeholders.ofcom.org.uk/binaries/consultations/cost_capital2/statement/final.pdf.

⁴⁴⁴ For example, paragraph 6.222, 2011 WBA Charge Control Statement.

⁴⁴⁵ For example, see Figure 9, Ofcom, *Ofcom's approach to risk in the assessment of the cost of capital - Consultation*, 26 January 2005: http://stakeholders.ofcom.org.uk/binaries/consultations/cost_capital/summary/cost_capital.pdf.

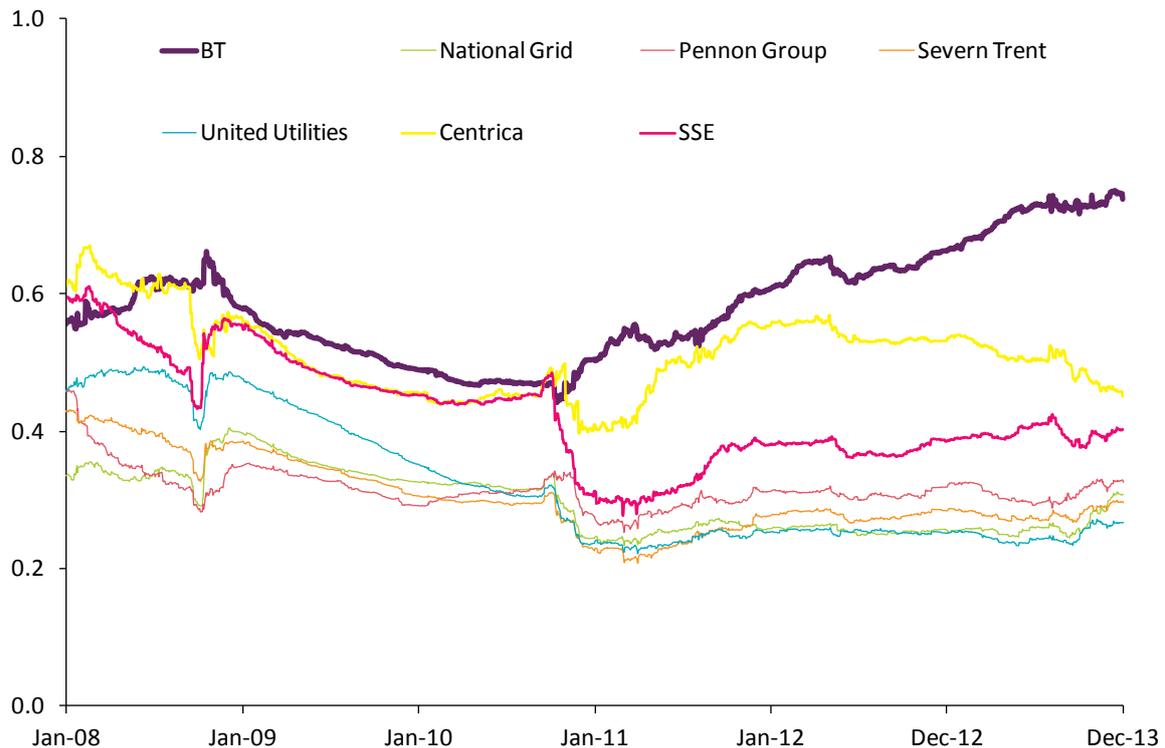
Table A14.10: Comparison of BT Group’s two year asset beta against other UK Utilities

Company	Sector	Asset beta (2 year)	
		July 2013 Consultation	Updated
BT	Telecoms	0.67	0.72
National Grid	Multi utility	0.28	0.30
Pennon Group	Multi utility	0.33	0.32
Severn Trent	Water	0.31	0.30
United Utilities	Multi utility	0.28	0.27
Centrica	Various	N/a	0.46
Scottish & Southern Energy	Multi utility	N/a	0.40
Average comparators	N/a	0.30	0.34

Source: July 2013 Consultation and March 2014 Brattle Report.

A14.181 The evidence shows that the average asset beta of UK network utilities (0.34) is below that for BT Group (0.72). In order to analyse the evolution of the asset beta of BT Group and the UK network utilities, we look at their two-year rolling asset betas in Figure A14.8 below (taken from Figure 10 of the March 2014 Brattle Report).

Figure A14.8: Two year rolling asset betas for BT Group and UK network utilities



Source: Figure 10, March 2014 Brattle Report.

A14.182 In the July 2013 LLU WLR Consultation we noted that BT Group's asset beta had been falling in line with that of the network utilities in the period to the end of 2010, which was consistent with investors treating BT Group a bit more like a utility (because of the presence of Openreach). We argued, however, that this effect may either have been temporary or since dominated by other factors.⁴⁴⁶

A14.183 In fact, we noted that from the end of 2010 up to March 2013 (the latest date covered by the July 2013 Consultation) the BT Group asset beta diverged markedly from that of the network utilities. The latest March 2014 Brattle report (covering the period up to December 2013) shows that this divergence continued after March 2013 but has tended to even out in the second half of 2013, when the asset beta of BT Group stabilised around 0.7.

A14.184 We explained that the increase in BT Group's asset beta after the end of 2010 could be the result of either (i) an increase in both Openreach and the RoBT's systematic risk or (ii) an increase in the systematic risk of the RoBT (while Openreach's systematic risk may have remained relatively stable). We considered that scenario (i) may be less plausible, as it seemed less likely that the systematic risk of BT's copper access activities would have increased since the end of 2010.⁴⁴⁷

A14.185 We considered that there could be factors explaining an increase in the systematic risk of the RoBT (relative to Openreach) but that the extent of this was uncertain.⁴⁴⁸

⁴⁴⁶ Paragraph A15.174, July 2013 LLU WLR Consultation.

⁴⁴⁷ Paragraph A15.175, July 2013 LLU WLR Consultation.

⁴⁴⁸ Paragraph A15.175, July 2013 LLU WLR Consultation.

We discuss the possible causes of the increase in BT Group’s asset beta later in this section when assessing the riskiness of BT’s investments.

Comparison with Chorus (New Zealand)

A14.186 In the July 2013 LLU WLR Consultation we estimated the asset beta of Chorus, New Zealand’s vertically separated telecoms network operator.⁴⁴⁹ We explained that the UK and New Zealand models of separation had been relatively similar, the main differences between Openreach and Chorus being that:

- Chorus does not supply “active” wholesale services such as Openreach’s WLR or ISDN services.⁴⁵⁰ It only supplies unbundled loops and backhaul and controls the network assets needed for those services, while Telecom Wholesale supplies all active services; and
- Chorus shares some information and technology systems with Telecom, whereas Openreach and BT have completely separate systems.^{451,452}

A14.187 In Table A14.11 below we present the updated assessment of Chorus’ asset beta and compare this to the July 2013 LLU WLR Consultation results. In the case of Chorus’ updated asset beta we show its asset beta using a debt beta of 0.1 – consistent with our latest assumptions for BT – and 0.15 – in brackets – consistent with our assumptions in the July 2013 LLU WLR Consultation.

Table A14.11: Equity and asset beta benchmarks – Chorus

Company	2 year equity beta	Market value of equity (£bn)	Book value of debt (£bn)	Gearing D/(D+E)	2 year asset beta
July 2013	1.130	1,209.16	1,590.00	57%	0.57
Updated	1.174	929.71	1,740.00	65%	0.47 (0.51)

Note: Equity betas for Chorus in the July 2013 LLU WLR Consultation were estimated for the period from 22 November 2011 to 15 March 2013 and the updated correspond to the two year period ending on 16 January 2014, both relate to Raw Betas estimated using daily return data against the NZX All-index from *Bloomberg*. Market capitalisation and Net debt data correspond to FY ending 30 June 2012 (July 2013 LLU WLR Consultation) and FY ending 30 June 2013 (updated).

Source: Bloomberg.

⁴⁴⁹ In paragraph A15.180 of the July 2013 LLU WLR Consultation we noted that New Zealand had taken separation further than any other jurisdiction by de-merging the former telecoms incumbent into two separate entities: “Chorus” and “Telecom”. Chorus was separated from Telecom on 1 December 2011, although 2011/12 was a transitional year when Chorus and Telecom operated as a combined entity for the first five months of the 2011/12 financial year and separate entities for the remaining seven months of the year.

⁴⁵⁰ A list of the services offered by Chorus can be found at <http://www.chorus.co.nz/our-products>.

⁴⁵¹ Gilbert Tobin, *Separation regulation of dominant telecommunications operators in today’s legacy networks and tomorrow’s next generation networks*, <http://www.gtlaw.com.au/wp-content/uploads/Separation-regulation.pdf>. For a list of Chorus’ services see <http://www.chorus.co.nz/our-products>.

⁴⁵² July 2013 LLU WLR Consultation, paragraph A15.181.

A14.188 The evidence above suggests that the asset beta of Chorus has reduced since July 2013 (from 0.57 to 0.51, if we continued to use a debt beta of 0.15) while the equity beta has remained fairly stable (moving from 1.130 to 1.174). During this period Chorus has experienced the combination of a decline in the company's market capitalisation and a slight increase in its debt⁴⁵³ which has, in turn, increased the company's gearing over the period from 57% to 65%.

A14.189 If instead we use a debt beta of 0.1 consistent with our assumption for BT Group and Openreach, Chorus' asset beta would be 0.47.

Analysis of UK telecoms operators

A14.190 In the July 2013 LLU WLR Consultation, we presented the 2-year daily rolling asset betas of BT and four UK telecoms operators (TalkTalk, Colt, Virgin Media and Sky). We recognised that these operators were not pure-play comparators to either of Openreach or the RoBT, however, we noted that Virgin Media and Colt were vertically integrated operators controlling both fixed line access infrastructure as well as managing retail operations. We considered therefore that these operators shared characteristics with BT Group – although we recognised that there were differences (e.g. Colt's primary focus on business customers).⁴⁵⁴

A14.191 In particular, we argued that TalkTalk and Sky were involved in very similar activities to BT Consumer/Business and also competed with BT in certain wholesale markets. However, TalkTalk and Sky did not own the underlying fixed line access infrastructure they use (since they rent this from Openreach). Moreover, Sky had also invested in satellite TV broadcasting, although we noted that both BT Consumer/Business and TalkTalk had recently begun to invest in pay-TV operations.⁴⁵⁵

A14.192 TalkTalk has submitted several comments (described above) arguing that the differences between these UK telecoms operators and the RoBT invalidate any comparison between the two. TalkTalk argues that the existence of BT Global Services (BTGS) within the RoBT implies that it should have a higher asset beta than other UK telecoms operators. Although we agree that BTGS has represented around half of RoBT's revenues, we note that these have remained relatively stable (between 48% and 49% of total BT Group revenues during the period 2010-2013) as shown in Table A14.12 below.

⁴⁵³ Some analysts have attributed the decline in Chorus' market capitalisation to the decline in the wholesale prices imposed by the New Zealand Commerce Commission, whereas the increase in the company's debt may have been driven by Chorus' participation in the roll-out of the government-subsidised "Ultra Fast Broadband" network in New Zealand, see page 34, WIK Consult, *Architectures and competitive models in fibre networks*, December 2010, http://teams.loop/kc/elib/br/Fixed%20operators%20UK/BT/BT_Redburn%20120314.pdf.

⁴⁵⁴ Paragraph A15.184, July 2013 LLU WLR Consultation.

⁴⁵⁵ Paragraph A15.185, July 2013 LLU WLR Consultation.

Table A14.12: BT Global Services share of RoBT revenues and EBITDA

	2010	2011	2012	2013
Revenue	8,522	8,059	7,809	7,166
% RoBT Total	48%	48%	49%	48%
EBITDA	457	593	627	626
% RoBT Total	11%	15%	15%	14%

Note: The revenues and EBITDA figures for the RoBT are derived as the difference between the revenues and EBITDA for BT Group from BT's Annual Reports (based on HCA) and Openreach revenues and EBITDA from BT's RFS (using HCA).

Source: BT 2013 Annual Report (p. 116 and 130-131); 2012 Annual Report (p.110-111); 2011 Annual Report (p.88-89); BT's 2012/13 RFS (pp. 130-131) and BT 2011 RFS (pp. 88-89).

A14.193 In addition, we note that BTGS' profits (measured by EBITDA), which are likely to be a more influential driver of BT Group's asset beta than revenues, have remained fairly stable (between 11% to 15% of the RoBT EBITDA) during the period 2010-2013. This is against a background of a steadily increasing asset beta for BT Group over the same period. Thus, we disagree with TalkTalk that the impact of BTGS on the RoBT is sufficient to make the comparison of the RoBT with UK telecoms operators invalid.

A14.194 As discussed above, TalkTalk considered that the differences between Virgin Media and BT in the underlying characteristics of their respective superfast broadband roll-outs implies that both companies were not comparable. We disagree with TalkTalk's characterisation of Virgin Media's investment in its NGA network. In the case of the coaxial cable-TV network used by Virgin Media, deployment of NGA (via an upgrade from DOCSIS2 to DOCSIS3) may incur some fixed costs (e.g. in testing and development and in deploying the supporting systems infrastructure). However, most of the investment can be done in a smooth process of incremental steps for single network segments, for example, on an area-by-area (or even cabinet-by-cabinet) basis.⁴⁵⁶ In this regard, the process is similar to that required for an FTTC VDSL investment (such as BT's superfast broadband network), as the company will have an initial outlay but can then gradually upgrade street cabinets in the areas of its choice to install DSLAMs.

A14.195 In terms of the cost differences between the two types of deployment, we consider that this is likely to depend on the specific characteristics of each network. We are aware that Virgin Media had already deployed fibre to the cabinets and that the extent and scale of the upgrade of its equipment in these cabinets may have been more marginal than in the case of BT. In contrast, the extent and scale of BT's investment is likely to have been more significant as it has had to add new cabinets next to existing ones, as well as providing fibre to these cabinets and installing

⁴⁵⁶ See, for example, page 152, WIK Consult, *Architectures and competitive models in fibre networks*, December 2010, http://teams.loop/kc/elib/br/Fixed%20operators%20UK/BT/BT_Redburn%20120314.pdf.

active equipment in them. Although we are not aware of any study comparing the costs of Virgin Media and BT's fibre roll-outs, some have estimated the CAPEX differences between FTTx and cable (which uses DOCSIS 3.0) to be around 20% lower for cable (DOCSIS 3.0) as compared to upgrading ADSL to VDSL (i.e. via FTTC).⁴⁵⁷

A14.196 In any event, we note that the CC highlighted in the 2010 Leased Lines Charge Control Appeal that, when assessing the appropriate cost of capital, the nature of the underlying assets is a much less relevant consideration than the project's sensitivity to demand fluctuations which determines the project's cash inflows. In fact the CC argued that:

“ whilst the type of assets used would play some part in determining cash outflows and therefore systematic risk, they were unlikely to play any part in the risk associated with the cash inflows and hence the cyclicity of demand was the more important factor.”⁴⁵⁸

A14.197 In summary, we do not expect that the differences between Virgin Media and BT's NGA roll-out in terms of costs is sufficient to invalidate the comparison between the two companies' fibre roll-outs. In addition, we note that the cash outflows of both types of fibre roll-outs (cable and FTTC) have similar characteristics (as described above). For this reason, we consider that the most important factor in determining the systematic risk of both companies' superfast broadband services is likely to be their associated cash inflows. Thus, contrary to TalkTalk's suggestion, we still view Virgin Media as an appropriate benchmark to assess the potential impact of BT's NGA investment on its asset beta.

A14.198 Finally, TalkTalk argued that the poor performance of BT's TV business made it more vulnerable to loss of customers, and consequently was likely to increase its systematic risk. We consider that, with the bundling of different services at the retail level (e.g. internet access, phone calls and TV), it is difficult to separately distinguish the impact of BT's TV strategy on the number of its subscribers. However, contrary to TalkTalk's view, many commentators have recently argued that BT's entry into the provision of pay-TV services (in particular sports), as well as its fibre roll-out have benefited BT to the competitive disadvantage of Sky and TalkTalk.⁴⁵⁹ Thus, we disagree that BT's TV offerings make it less comparable to operators such as Sky and TalkTalk.

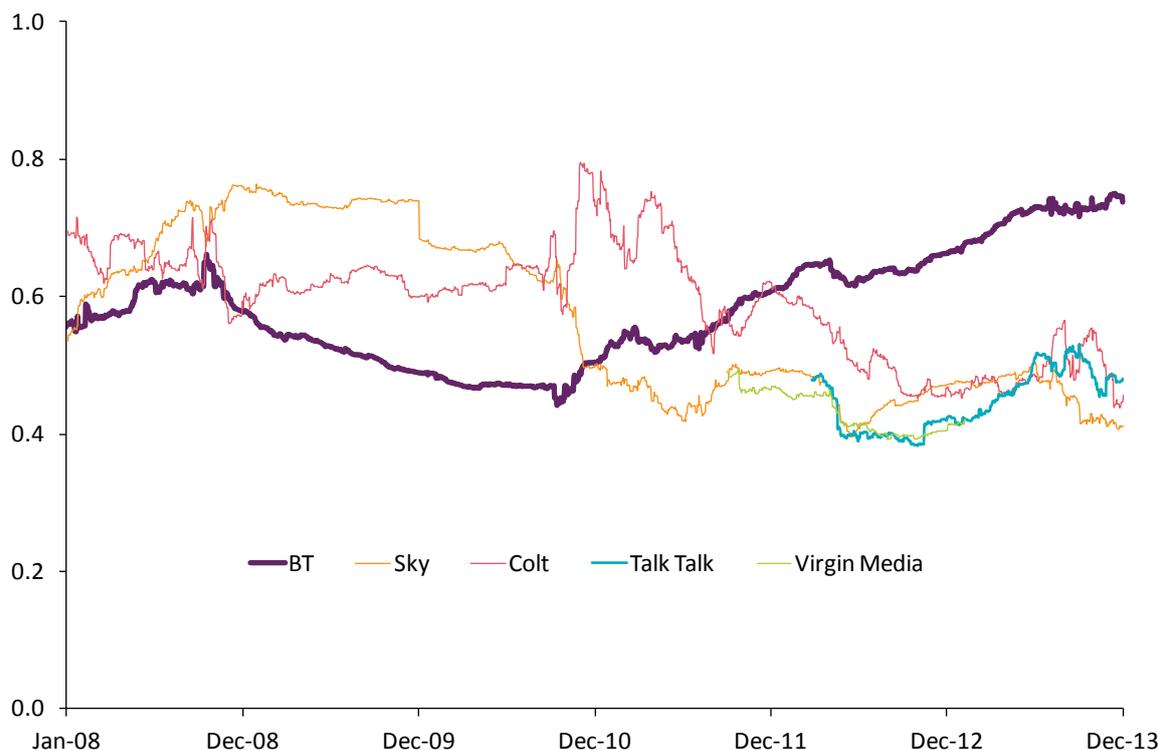
⁴⁵⁷ Figure 2, page 3, Arthur D. Little, *The Moment of Truth. Cable infrastructure as a competitive Next Generation Access (NGA) platform in a financial crunch?*, (2009), http://www.adlittle.com/downloads/tx_adlreports/ADL_The_Moment_of_Truth_02.pdf

⁴⁵⁸ Paragraph, 4.315, Competition Commission, *Cable & Wireless UK v Office of Communications. Case 1112/3/3/09 - Determination*, 30 June 2010, http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/appeals/communications_act/final_determination_excised_version_for_publication.

⁴⁵⁹ See, for example, The Telegraph, *BT's push on sports TV starts to pay off*, 31 January 2014, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/10609033/BTs-push-on-sports-TV-starts-to-pay-off.html>; The Guardian, *BT's push into football and fibre broadband drives up revenues*, 31 January 2014, <http://www.theguardian.com/business/2014/jan/31/bt-sport-football-fibre-broadband-revenues-profits>; The Financial Times, *BT reaps benefits from pay-TV drive*, 31 January 2014, http://www.ft.com/cms/s/047725ba-8a4e-11e3-9c29-00144feab7de.Authorised=false.html?_i_location=http%3A%2F%2Fwww.ft.com%2Fcms%2Fs%2F0%2F047725ba-8a4e-11e3-9c29-00144feab7de.html%3Fsiteedition%3Duk&siteedition=uk&_i_referer=#axzz2tagDY1aA. We have also noted below that the advice from many analysts to buy BT shares after its entry into the Sports TV

A14.199 In light of the above, we continue to believe that although there are differences between these UK telecoms operators and each of Openreach and the RoBT, their use as benchmarks to assess the asset beta of Openreach and the RoBT remains useful, even if it cannot be considered decisive on its own. We present the two-year rolling asset betas of these companies and compare them to BT in Figure A14.9 below (reproducing Figure 13 in the March 2014 Brattle Report).

Figure A14.9: Two year rolling asset betas of benchmark UK telecoms operators



Source: Figure 13, March 2014 Brattle Report.

A14.200 The evidence above suggests that up to the end of 2010 BT Group's asset beta was below or at similar levels to Sky and Colt (the only available comparator companies for this period).⁴⁶⁰ However, due to the upward trend in BT Group's asset beta since the end of 2010, its asset beta has been above that of all comparator companies since the end of 2011, and the divergence between BT and these comparators has continued since this date.

A14.201 The evidence we presented in the July 2013 LLU WLR Consultation showed that the asset betas of the four UK comparator CPs had varied between 0.4 and 0.6 since mid-2011 (all ending within the range 0.5 to 0.6 by March 2013).⁴⁶¹ The latest

market seems to suggest that they expect a positive return from BT's investments, contrary to TalkTalk's view.

⁴⁶⁰ We note that Virgin Media only initiated its listing on the FTSE in late 2009 (see London Stock Exchange, *Welcome stories. The London Stock Exchange welcomes Virgin Media to the Main Market*, 1 October 2009, <http://www.londonstockexchange.com/companies-and-advisors/news-events/welcome/01-10-09-virgin-media.htm>), thus, its two year asset betas only start around the end of 2011 (as shown in Figure A14.9).

⁴⁶¹ Paragraph A15.185, July 2013 LLU WLR Consultation.

evidence shows that the asset beta of benchmark UK telecoms operators has reduced slightly and all were within the 0.4 to 0.5 range by December 2013 (see Table A14.13 below).

Table A14.13: Comparison of BT Group’s asset beta against other UK telecoms operators

Company	Asset beta (two-year)
BT	0.72
TalkTalk	0.48
Virgin Media	0.43
Sky	0.44
Colt	0.45
<i>Average UK comparator CPs</i>	0.45

Source: March 2014 Brattle Report.

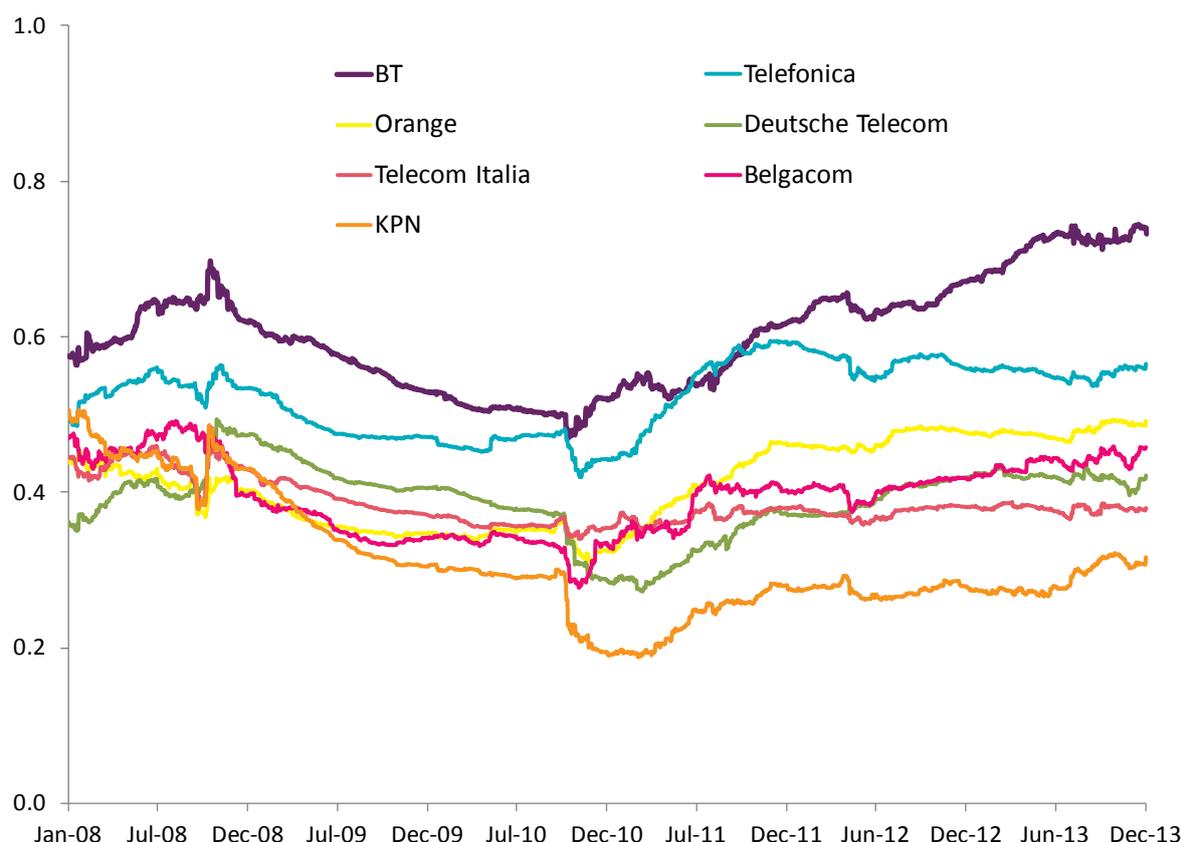
A14.202 We remain of the view expressed in the July 2013 LLU WLR Consultation that, given the demand characteristics of the RoBT (and BT Consumer/Business in particular), we would be uncomfortable attributing an asset beta for the RoBT that is significantly out of line with that of BT Group, given BT Group’s asset beta estimate when compared to that of comparable UK telecoms operators.⁴⁶² Similarly, we expect that, a priori, the systematic risk of Openreach’s copper access business is unlikely to be higher than that of other UK telecoms operators. This is because the latter purchase most of the wholesale inputs they require to supply retail voice and broadband services from Openreach and are also involved in retail activities that are more likely to be subject to higher systematic risk.

Analysis of EU telecoms operators

A14.203 Since the July 2013 LLU WLR Consultation, we have requested Brattle to compare BT Group’s asset beta against that of other EU telecoms operators, as shown in Figure A14.10 below (reproducing Figure 15 of the March 2014 Brattle Report).

⁴⁶² Paragraph A15.186, July 2013 LLU WLR Consultation.

Figure A14.10: Two-year asset beta for selected EU telecoms operators⁴⁶³



Source: Figure 15, March 2014 Brattle Report.

A14.204 The evidence shows that, although BT Group's asset beta has been above that of other EU telecoms operators for most of the period, there are similarities in the movements of the asset betas of these companies (e.g. the downward trend observed from the beginning of the period considered to the end of 2010 and the upward trend from around late 2010/early 2011 onwards). On the other hand, it seems that the asset beta of BT Group and the other EU telecoms operators started to diverge towards the end of the period (from mid-2012), as the asset beta of EU operators has tended to stabilise while that of BT Group has continued to increase.

Assessment of operating leverage and volatility of returns

A14.205 In addition to the comparators above, in the July 2013 LLU WLR Consultation we proposed to consider other determinants of asset beta to assess the appropriate asset betas for Openreach and the RoBT. We looked at:

- Operating leverage: the ratio between 'cash out' and 'cash in'⁴⁶⁴ for BT, Openreach and the network utility comparators over the previous five years;
- Turnover volatility: the change in turnover over the previous five years;

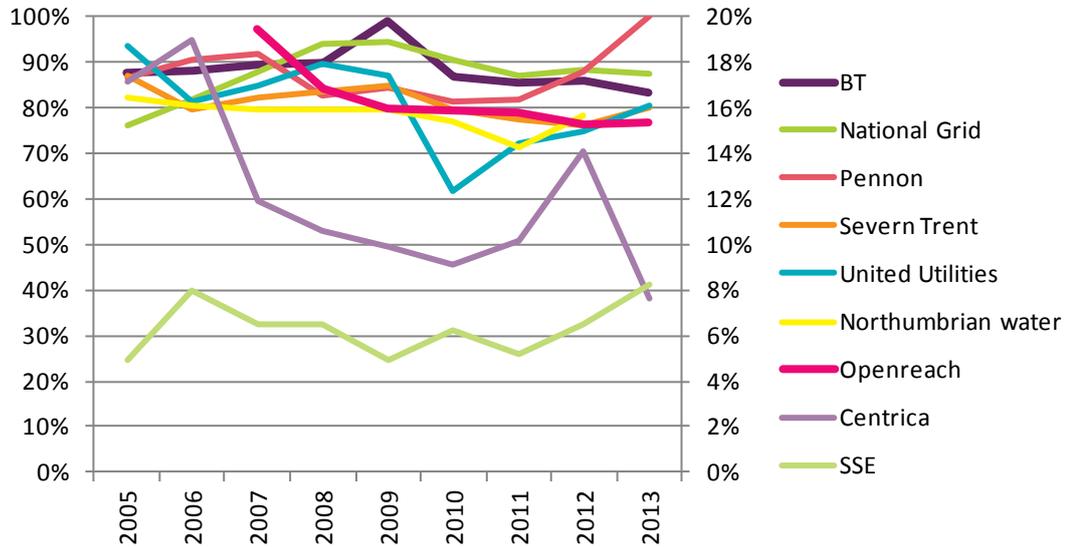
⁴⁶³ The two year asset betas reported relate to daily returns against the FTSE All-Europe index, except in the case of BT which relates to daily returns against the FTSE All-Share. The gearing used to derive unlevered betas was estimated as indicated in the previous section.

⁴⁶⁴ We define operating leverage as $(\text{Operating expenses} - \text{Depreciation} + \text{Capex}) / \text{Turnover}$. We explored other definitions of operating leverage and they did not support a different conclusion than the one presented in this section.

- Volatility of returns: looking at profitability and its volatility over the previous five years.⁴⁶⁵

A14.206 We reproduce below the data we presented in the July 2013 LLU WLR Consultation adding Centrica and SSE to the comparator group. Our analysis of operating leverage is in Figure A14.11 below.

Figure A14.11: Variation in operating leverage



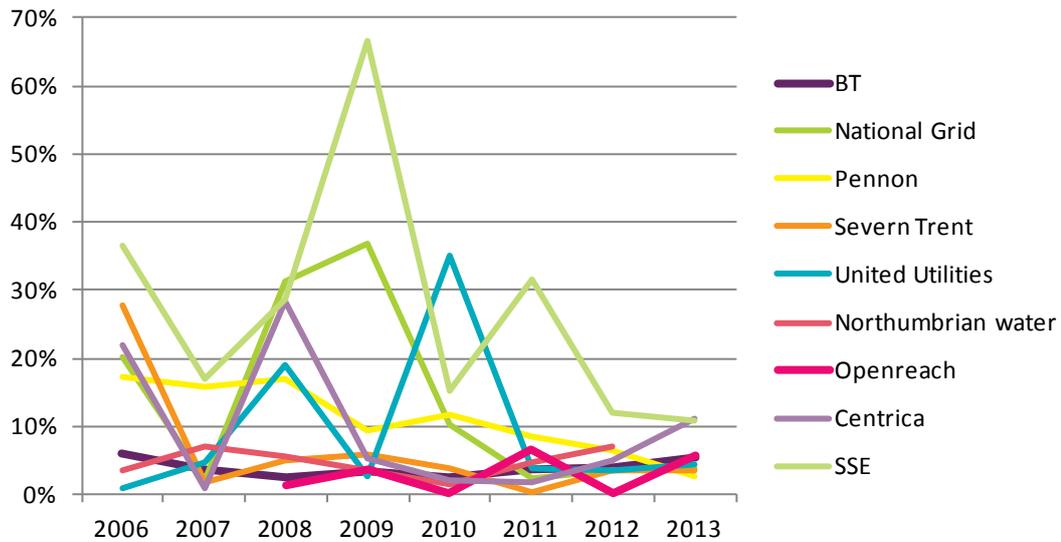
Note: Centrica and SSE are shown against the vertical right axis, all other companies against the vertical left axis. Operating leverage cannot be derived for Openreach's copper access activities alone, as BT's RFS do not report capital expenditure by access market. The figures reported relate to all of Openreach. We define operating leverage as $(\text{Operating expenses} - \text{Depreciation} + \text{Capex}) / \text{Turnover}$.

Source: Bloomberg and BT's Annual Accounts (for Openreach).

A14.207 The variation in turnover is shown in Figure A14.12 below.

⁴⁶⁵ Paragraphs A15.187-A15.192, July 2013 LLU WLR Consultation.

Figure A14.12: Variation in turnover

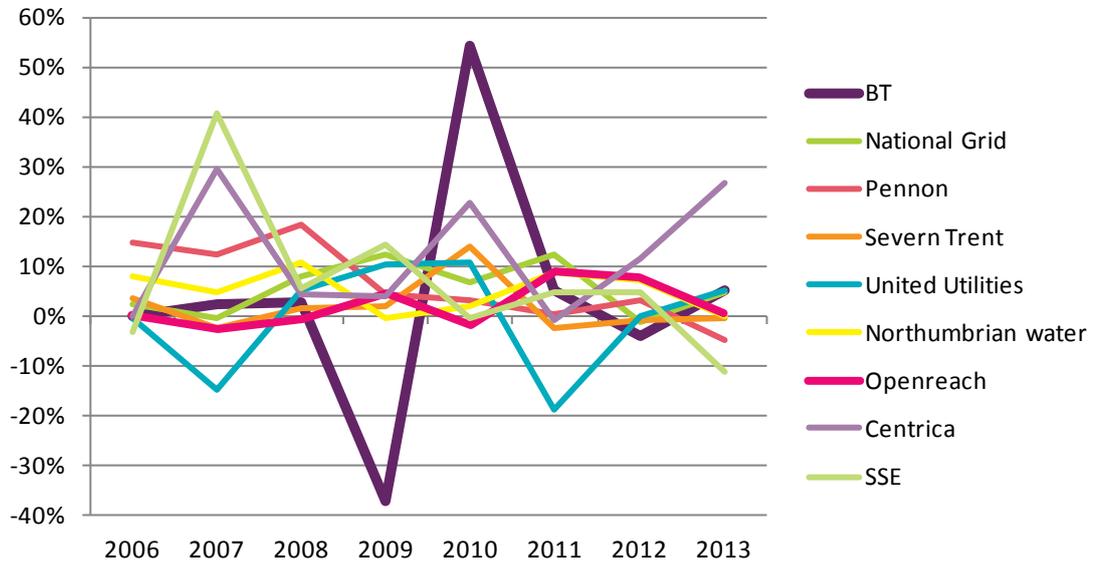


Note: Openreach turnover relates to Openreach’s copper access business.

Source: Bloomberg and BT’s Annual Accounts (for Openreach).

A14.208 The annual variation in the EBITDA of BT, Openreach and the network utilities is shown in Figure A14.13 below.

Figure A14.13: Variation in EBITDA



Note: Openreach’s EBITDA figures relate to all of Openreach, as the information from the RFS is subject to inter-year changes to the methodology used to estimate CCA costs which affect the annual percentage changes shown above.

Source: Bloomberg and BT’s Annual Accounts (for Openreach).

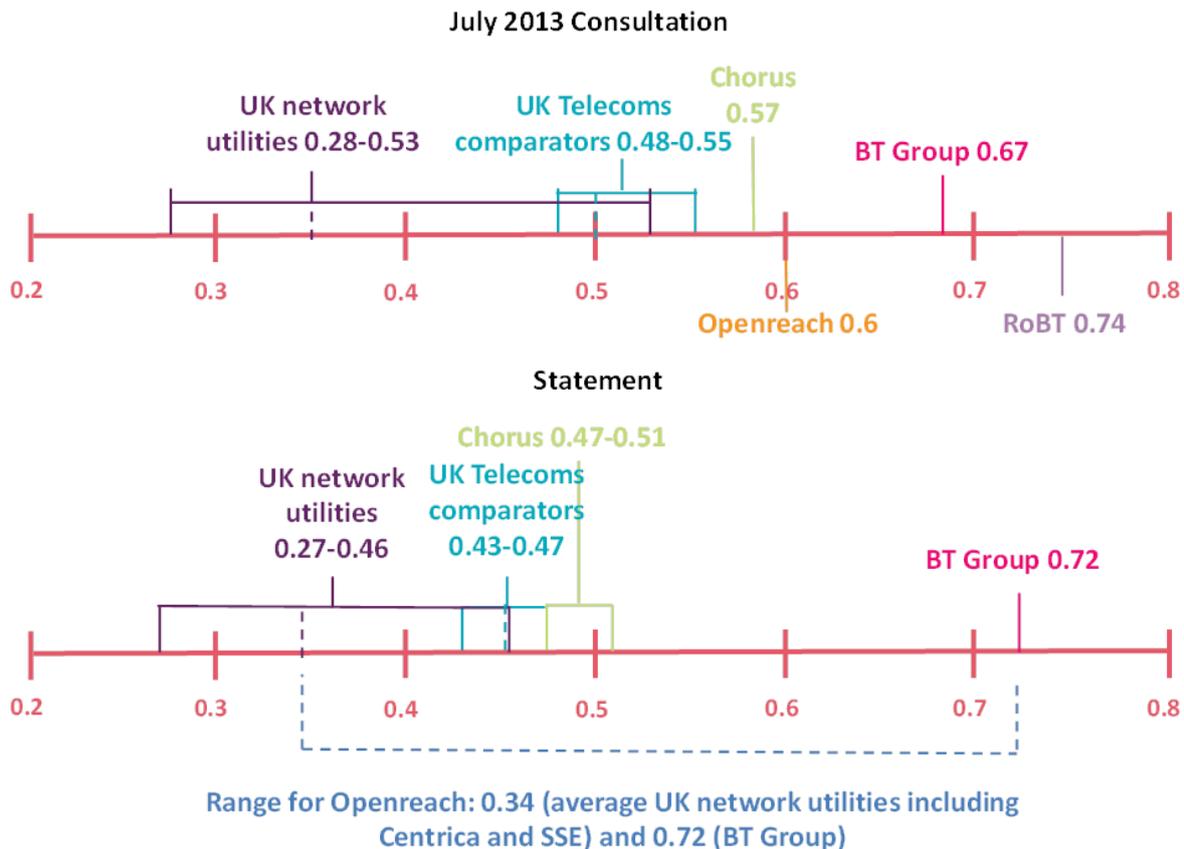
A14.209 While some of the evidence above might suggest that the asset beta of Openreach would be closer to that of a network utility, the evidence on this is mixed. For example,

- over time, Openreach’s operating leverage has declined recently and is comparable to that of a number network utilities (with the exception of Centrica and SSE, which have a much lower operating leverage compared to other utilities), however, this is also the case for BT Group;
- Openreach’s EBITDA volatility seems lower than that of BT Group, but the EBITDA volatility of Openreach has in recent years been towards the upper end of the network utility comparators (and in the last two years has been similar to or somewhat above that of BT Group).

Conclusion on benchmarking

A14.210 We present the two year asset betas of the benchmark companies that we use to assess the asset betas of Openreach and RoBT in the July 2013 LLU WLR Consultation (which related to returns up to March 2013) and compare them against the latest available information (up to December 2013) in Figure A14.14 below (the simple averages of the ranges presented in the diagram are depicted using vertical dashed lines).

Figure A14.14: Asset betas of benchmark companies in the July 2013 LLU WLR Consultation and Statement



Note: we have updated the range of the UK network utilities that we presented in the July 2013 LLU WLR Consultation to include the two year asset beta of Centrica and SSE (up to March 2013). The range we used for the UK telecoms comparators in the July 2013 LLU WLR Consultation was based on the two year rolling asset betas over the year up to March 2013. We have updated this to reflect the two year asset betas as of March 2013, consistent with the methodology used to present the BT asset betas in the figures above.

Source: April 2013 and March 2014 Brattle Report and *Bloomberg*.

A14.211 We consider that the starting point to derive the asset beta for Openreach and RoBT should be BT Group's asset beta, as it is the only asset beta for BT that we can observe from market data.⁴⁶⁶

A14.212 In the case of Openreach, we consider that its asset beta should lie somewhere below the asset beta for the entirety of BT Group, as we would expect that Openreach's copper access business has lower systematic risk than the other parts of BT Group. In addition, we believe Openreach's asset beta should be above the average asset beta of network utilities, recognising that the systematic risk of energy and water utilities is likely to be lower than that for fixed line telephony.⁴⁶⁷ Using the latest available evidence (up to December 2013), the mid-point between this lower bound of 0.34 (the UK network utilities average asset beta) and the upper bound of 0.72 (BT Group's asset beta) is 0.53.

A14.213 In addition to the evidence from UK network utilities, we have looked at the latest evidence on:

- the asset beta range of UK telecoms operators, which is 0.43 to 0.47 (with an average of 0.45) and has declined from the July 2013 LLU WLR Consultation range (0.48 to 0.55, with an average of 0.50); and
- the movement in the asset beta of Chorus which has reduced from 0.57 to around 0.47-0.51 (depending the assumption for its debt beta).

A14.214 We think this evidence suggests that an asset beta below the mid-point of the range indicated above (between BT Group and the UK network utilities), i.e. below 0.53, is likely to be appropriate. Indeed, as noted earlier, a priori it might be argued that the Openreach asset beta should not be higher than that of the UK telecoms operators that are large users of wholesale access services from BT. However, moving to an asset beta for Openreach much below the mid-point of the range between the network utilities and BT Group would represent a large departure from the asset beta of 0.60 we determined early in 2013 (as part of the BCMR statement).

A14.215 In light of the above and the further reasoning in the remaining sub-sections of this annex, we consider that an Openreach asset beta of 0.5 is now appropriate.

⁴⁶⁶ We consider that this view is consistent with the CC's view, articulated in paragraphs 2.360-2.361 of its Case 1111/3/3/09, that "*because Ofcom's approach makes more use of the information contained within the BT Group's beta, which reflects market data from the entire BT Group, including Openreach, we consider there to be strong arguments that the beta analysis should take the form of a disaggregation of the observed BT Group beta*", (Competition Commission, *The Carphone Warehouse Group plc v Office of Communications, Case 1111/3/3/09 - Determination*, 31 August 2010, <http://www.catribunal.org.uk/237-4154/1111-3-3-09-The-Carphone-Warehouse-Group-plc.html>)

⁴⁶⁷ The view that Openreach's asset beta should be between UK network utilities and BT Group was upheld by the CC in paragraphs 2.357-2.363 of its Case 1111/3/3/09 (Competition Commission, *The Carphone Warehouse Group plc v Office of Communications, Case 1111/3/3/09 - Determination*, 31 August 2010, <http://www.catribunal.org.uk/237-4154/1111-3-3-09-The-Carphone-Warehouse-Group-plc.html>).

Assessment of the riskiness of BT Group's investments

Proposals in the July 2013 LLU WLR Consultation

A14.216 We assessed the riskiness of BT Group's latest investments, in particular, superfast broadband and TV sports rights (which correspond to the RoBT part of BT Group). We concluded that:

- it was unclear whether investments in NGA and the cash flows associated with superfast broadband were more correlated with the economy (and therefore subject to more systematic risk) than current generation broadband (or voice). We also noted that Virgin Media had similarly invested in its own superfast broadband network and had a greater number of superfast broadband subscribers than BT, yet it had a lower asset beta than BT;⁴⁶⁸ and
- the increase in BT's asset beta had started around the end of 2010, while BT's acquisition of sports rights (in particular the English Premier League games) was announced in June 2012. We therefore considered that the increase in BT Group's asset beta could not be so clearly attributed to BT Group's activities in the TV sector, as suggested by Europe Economics.

A14.217 Below we summarise and respond to stakeholder comments on the riskiness of BT Group's investments.

Responses to the July 2013 LLU WLR Consultation

A14.218 Several stakeholders provided comments relating to the riskiness of the RoBT's investments in superfast broadband and sports rights and their likely impact on the perceived riskiness of the RoBT, as well as its impact on the differences in risk between the Openreach copper access business and the RoBT.

A14.219 BT agreed with Ofcom that there was no clear evidence to support the assertions made by Europe Economics in relation to the systematic risk associated with BT's "new innovations". It considered that any adjustments to the asset beta of the RoBT and/or Openreach to reflect this would necessarily be subjective in nature. BT argued that any proposal to "increase the wedge" between RoBT and Openreach would need to return to first principles with Ofcom giving full consideration to the basis on which any disaggregation of the WACC is carried out.⁴⁶⁹

A14.220 TalkTalk made several comments relating to:

- the differences in risk profile between Openreach's copper business and the RoBT;
- Openreach's business being unchanged in recent years; and
- the possibility that the wedge between the two parts of BT Group could have increased due to the RoBT's investments in (i) superfast broadband and (ii) BT Sports.

A14.221 We discuss each of these issues in turn below.

⁴⁶⁸ Paragraphs A15.197 to A15.199, July 2013 LLU WLR Consultation.

⁴⁶⁹ Paragraphs 501 to 502, BT Response to July 2013 LLU WLR Consultation.

Differences in risk profile between Openreach's copper business and the RoBT

A14.222 TalkTalk distinguished between the risk and volatility profile of Openreach and the RoBT. TalkTalk considered that Openreach had a low risk/volatility profile because:

- demand and market share were stable, meaning that volumes were similarly stable;
- the cost base was predictable and since there were limited future investments much of its forward-looking cost base was variable;
- regulation implied that profit margins were steady and any new investment had a guaranteed return; and
- high barriers to entry protect returns against increased competition.⁴⁷⁰

A14.223 Instead, TalkTalk considered that the RoBT had a high risk/volatility profile because:

- many of the markets relevant to the RoBT were new and have unpredictable market size;
- the vast majority of the businesses were in fully competitive markets so suffered significant market share risk;
- the cost base was less predictable (since products were new) and required substantial future fixed cost investment; and
- significant competition meant that margins were volatile.⁴⁷¹

A14.224 TalkTalk argued that any upwards review of the Openreach asset beta after the July 2013 Consultation would be wrong. First, it considered that there had not been any meaningful change in the two-year asset beta of BT Group. It disagreed with BT's view that more weight should be placed on the one year beta (in its view BT's position was just driven by the higher one year beta and had no other economic justification). Second, TalkTalk noted that even if it were correct that the BT Group asset beta had increased, it would not be appropriate to associate this increase with the Openreach-copper beta. It considered there was no plausible reason as to why the Openreach-copper beta or its systematic risk would have increased over the last six months.⁴⁷²

Openreach's copper business has remained unchanged over recent years

A14.225 TalkTalk disagreed with Ofcom's view that over the last two years there had been an increase in BT Group's asset beta while at the same time the wedge between Openreach and RoBT had been close to constant. Instead, it argued that a consideration of the different businesses in BT and how they had changed over this period supported the view that the wedge had increased over time.⁴⁷³

⁴⁷⁰ Paragraphs 4.25-4.28 TalkTalk Response to July 2013 LLU WLR Consultation.

⁴⁷¹ Paragraphs 4.25-4.28, TalkTalk Response to July 2013 LLU WLR Consultation.

⁴⁷² Paragraphs 4.14-4.16, TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation.

⁴⁷³ Paragraphs 4.47 to 4.48, TalkTalk Response to July 2013 LLU WLR Consultation.

A14.226 In particular, TalkTalk considered that Openreach's business was in many respects unchanged over the last five years. In this sense, it expected that Openreach's asset beta should show the same profile and stay around the 0.48 it was in 2010.⁴⁷⁴ TalkTalk argued that Ofcom had not shown any evidence to support an increase in Openreach's asset beta. It noted that the evidence presented by Ofcom in the July 2013 LLU WLR Consultation showed a decline in Openreach's operating leverage every year from 2007 to 2011, consistent with a decrease in its asset beta.⁴⁷⁵

Increase in the wedge between Openreach's copper business and RoBT

A14.227 TalkTalk argued that several changes in the RoBT's businesses supported the view that its risk had increased over the past few years, in particular:

- its core retail markets had become steadily more competitive;
- the substantial network investment in NGA, which by BT's own admission was high risk⁴⁷⁶ due to the large fixed investment of £3.5bn⁴⁷⁷ and uncertainty over the demand for the service and consumers' willingness to pay. TalkTalk disagreed with Ofcom that the evidence showing an increase in take up of superfast broadband during the recession implied that it had little systematic risk. It argued that such an increase in take-up was more likely to have been the reflection of demand for superfast broadband that had been suppressed prior to 2010 (when there was almost no fibre roll-out). It considered that the correct counterfactual would be to assess what the demand for fibre would have been if there had been strong economic growth over the 2010 to 2012 period;
- it considered that BT Group's fibre roll-out was likely to increase its financial gearing and that, as depreciation was included in BT's accounts, it would also add to operational gearing⁴⁷⁸;
- the significant investment in its BT Sports channels (£0.5bn a year for three years) with substantial demand and revenue uncertainty, and which was currently underperforming its predecessor ESPN in viewing figures.⁴⁷⁹ It argued that premium sports channels was a line of business with a high operational gearing (as essentially all costs are fixed in the short term), whereas most revenues are variable.⁴⁸⁰

⁴⁷⁴ Note that we concluded on an asset beta of 0.48 for Openreach in 2011, not 2010. Specifically in the WBA Charge Control Statement in July 2011.

⁴⁷⁵ Paragraphs 4.49 to 4.50, TalkTalk Response to July 2013 LLU WLR Consultation.

⁴⁷⁶ TalkTalk quoted BT stating "NGA remains a risky investment with long payback periods" and "Multiple interventions could cause regulatory arbitrage and hence potentially undermine already very risky and long term investment in fibre" in its Response to the FAMR Call for Inputs.

⁴⁷⁷ TalkTalk noted that BT claimed the investment for the commercial roll-out was £2.5bn and BT's funding for the BDUK roll-out another £1.0bn: "At the outset of the process, BT indicated to government that if it were successful in winning the £830 million government announced for the rural broadband programme at the comprehensive spending review in autumn 2010 (£530 million was announced at that time for the period up to 2015 and £300 million for the period 2015 to 17), then it would be able to contribute up to £1 billion of extra funding (on top of the £2.5 billion committed to its commercial area deployment)." Available at:

<http://www.publications.parliament.uk/pa/cm201314/cmselect/cmpublic/474/474vw06.htm>.

⁴⁷⁸ Paragraph 4.17, TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation.

⁴⁷⁹ Paragraphs 4.51 to 4.52, TalkTalk Response to July 2013 LLU WLR Consultation.

⁴⁸⁰ Paragraph 4.17, TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation.

A14.228 TalkTalk concluded that, due to the similarities in risk, Openreach should have an asset beta much closer to the network utility betas and Openreach’s beta should not have increased from 0.48 to 0.60 over the last two years because:

- the underlying risk of Openreach had not increased;
- the asset betas of similar network utilities had not increased; and
- the increase in BT Group’s beta was more likely to be due to an increase in the risk of RoBT activities (investments in NGA and Sports) and/or a reduction in the weight of Openreach as a proportion of BT Group.

Ofcom’s analysis

A14.229 We note that the dynamism of the telecommunications sector in the UK implies that companies are frequently involved in investment projects that may change their underlying businesses. Over time, the changes in the activities and services provided by these companies (including Openreach and the RoBT) may result in changes in their underlying systematic risk. In fact, since our first decision to disaggregate the WACC of Openreach and the RoBT in 2005, and considering the evidence available at each decision, we have specified different asset betas and cost of capital for each part of BT, as well as a different wedge between the two businesses. This is shown in Table A14.14 below.

Table A14.14: Asset betas and WACC (pre-tax nominal) in previous decisions

Decision	Openreach			Rest of BT			Asset beta wedge
	Asset beta	Weight	WACC	Asset beta	Weight	WACC	
August 2005	0.62	40%	10.0%	0.83	60%	11.4%	0.21
May 2009	0.55	50%	10.1%	0.68	50%	11.0%	0.13
July 2011	0.48	50%	8.8%	0.58	50%	9.7%	0.10
March 2013	0.60	50%	8.8%	0.74	50%	9.9%	0.14

Note: Ofcom, *Ofcom’s approach to risk in the assessment of the cost of capital – Final statement*, 18 August 2005⁴⁸¹ Ofcom, *A new pricing framework for Openreach – Annexes*, Statement, 22 May 2009;⁴⁸² 2011 WBA Charge Control Statement; and 2013 BCMR Statement.

Source: Ofcom.

A14.230 We therefore disagree with BT that every time we change the wedge between the asset beta of Openreach and RoBT this should automatically require us to justify the rationale for disaggregating the BT Group WACC.

⁴⁸¹ www.ofcom.org.uk/consult/condocs/cost_capital2/statement/final.pdf

⁴⁸² <http://stakeholders.ofcom.org.uk/binaries/consultations/openreachframework/statement/annexes.pdf>

A14.231 In addition to BT’s comments, TalkTalk made several comments relating to:

- the differences in risk profile between Openreach’s copper business and the RoBT;
- the increase in the wedge between the two parts of BT Group due to the RoBT’s investments in (i) superfast broadband and (ii) BT Sports.

A14.232 We look into each of these comments in turn below.

Differences in risk profile between Openreach’s copper business and the RoBT

A14.233 We agree with TalkTalk that there are differences in the risk profile of Openreach and the RoBT. Indeed, this is the main justification for disaggregating BT Group’s cost of capital. The difficulties arise when determining the magnitude of the difference between the systematic risk of each part of BT Group. TalkTalk contends that this difference may have increased in recent years and that it should therefore be significant. We consider that it would be reasonable to expect a widening of the wedge between Openreach and the RoBT, particularly, as the majority of the changes in BT Group’s business in recent years are likely to have been driven by the RoBT’s business.

A14.234 In fact, as can be seen in Figure A14.15 below, the market capitalisation of BT Group started to increase in 2009 and shortly after in 2010 this was followed by its estimated asset beta. The increase in the estimated asset beta for BT Group has therefore been associated with an increase in the market value of its equity, which suggests that the business contributing the incremental value (which we consider is the RoBT) may have a higher asset beta than the other parts of the business.

Figure A14.15: Evolution of BT’s market capitalisation and asset beta (FY2006-Q42013)



Note: Asset beta is measured on the left vertical axis and market capitalisation against the right vertical axis (in £m). Asset betas reflect values on the 31st of March in every year.

Source: March 2014 Brattle Report and Bloomberg.

A14.235 We consider that it would be reasonable to expect that investments in superfast broadband and pay-TV, with greater growth potential than other parts of BT Group's business, should have a higher asset beta than more stable parts of the business. However, as explained later in this sub-section, we do not consider that the evidence is sufficiently supportive of the view put forward by TalkTalk that the investments in superfast broadband and BT Sports are clearly the main drivers of the widening wedge between the asset betas of Openreach and the RoBT.

Openreach's copper business has remained unchanged in recent years

A14.236 TalkTalk considered that Openreach's business has been unchanged over the last five years and therefore its asset beta should stay around 0.48. While it seems plausible that to a large degree the nature of the services offered and operational gearing might be expected to be little changed for a hypothetical on-going copper access network provider, these are not the only factors that might affect the Openreach asset beta.

A14.237 Instead, movements in asset betas may be driven by external factors affecting investor perceptions of risk. For example, it could be argued that the decline in the asset beta of BT and the network utilities observed from the end of 2008 to the end of 2010 in Figure A14.8 above, as well as for other EU telecoms operators (shown in Figure A14.10 above), is unlikely to have been driven by structural changes in the businesses of these companies happening at the same time. An alternative explanation could be that the similarities observed in the movements of their asset betas is driven by external factors such as investors fleeing into companies that they considered "safe" at the time (such as telecoms and utilities).⁴⁸³ Similarly, the gradual increase observed in the asset betas of all these companies since the end of 2010 may be explained by the market correcting this effect and returning to more "normal" conditions in light of the improvement of economic conditions elsewhere.

The effect of BT's investments in superfast broadband and sports on its asset beta

A14.238 TalkTalk considered that several changes in the RoBT's business, particularly its investments in superfast broadband and BT Sports, could have increased the systematic risk of the RoBT over recent years. We agree that *a priori* the greater growth potential for BT of businesses such as pay-TV or superfast broadband (attributed to the RoBT) could result in an increase in the systematic risk of the RoBT in recent years.

A14.239 TalkTalk argued that the investment in fibre roll-out was likely to have increased BT Group's financial gearing. We consider that the evidence shows that this is unclear, as BT Group has managed to reduce its gearing from approximately 65% around March 2009 to 23% by December 2013 according to BT Group's Q4 2013 results.

A14.240 Furthermore, we disagree with TalkTalk that BT's £3.5bn investment in its fibre roll-out should *necessarily* increase its gearing beyond the level it would had been absent such investment. This is because companies typically have a variety of

⁴⁸³ We note that this was one of the issues included in Europe Economics Submission for the 2012 FAMR CFI, when it asked Ofcom to investigate whether "safe-haven" effects of recent years suggested that Openreach was more like network utilities than previously thought, see p. 21, Europe Economics Submission for the 2012 FAMR CFI.

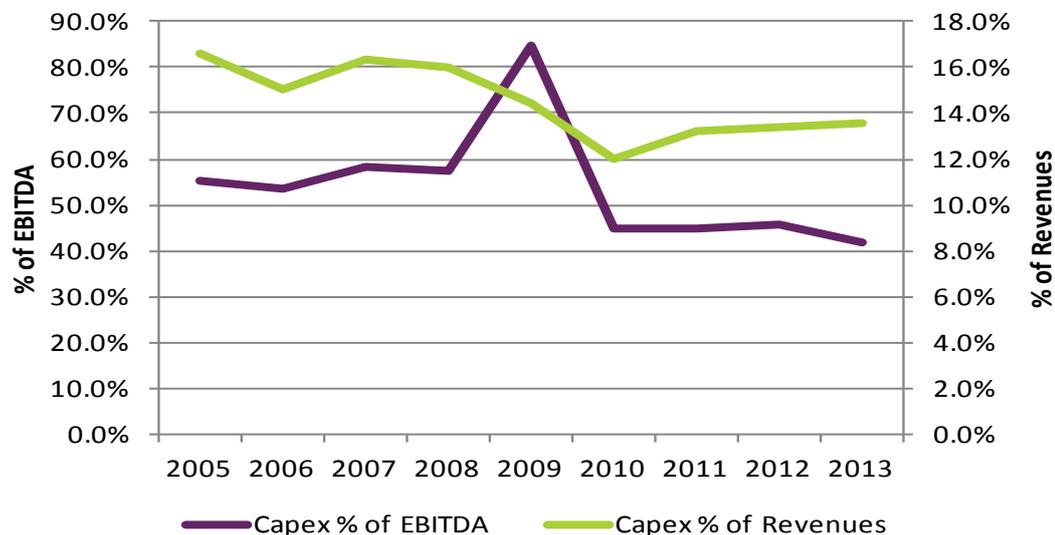
investment opportunities and when choosing investment projects may decide to forego other investments to ensure that the company does not deviate from its target financial gearing. For example, BT suspended its share buyback programme when it announced its initial £1.5bn investment in superfast broadband in July 2008.⁴⁸⁴ This implies that there was a greater proportion of equity in BT's capital structure and thus a lower gearing than would have been the case had the share buyback gone ahead. This is contrary to the proposition from TalkTalk that fibre roll-out should have increased the gearing level.

A14.241 In addition, the market value of a company may increase if investors expect a positive net present value from the investment project, thus potentially reducing the gearing of the company.

A14.242 We similarly disagree that fibre investment should necessarily increase operating leverage. This is because the majority of the investment in fibre can be done gradually (e.g. by choosing to roll-out to different geographic areas at different points in time), with a relatively small share of the investment being a fixed one-off cost (as discussed earlier in paragraph A14.193). This means companies can mitigate the fixed cost element of their investment while at the same time maximising the investment's potential to increase earnings (e.g. by rolling out fibre to those areas with higher demand first). In fact, the evidence in Figure A14.11 above seems supportive of this view as it shows that the operating leverage of both BT and Openreach has declined during the years of BT's investment in fibre.

A14.243 In addition, we present in Figure A14.16 below BT Group's capital expenditures as a share of its EBITDA and revenues over the period 2005 to 2013.

Figure A14.16: BT Group's capex as a share of revenues and EBITDA



Source: Bloomberg and Ofcom calculations.

A14.244 The evidence in Figure A14.16 shows that BT's capital expenditures as a proportion of EBITDA and revenues have remained relatively flat in recent years. This is in particular the case over the period from 2010 to 2013, in which we have observed a steady increase in BT Group's asset beta. Furthermore, BT's total capex has

⁴⁸⁴ Bloomberg, *BT to Suspend Buyback Plan for Fiber-Optic Investment*, 15 July 2008, <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a0Dwzpl8tVM&refer=technology>.

remained fairly flat over this period.⁴⁸⁵ Thus, if BT's investments in fibre and pay-TV have increased BT Group's asset beta, it would not appear to be via an effect on operational gearing..

A14.245 TalkTalk argued that superfast broadband was a premium product and consequently it was likely to be more correlated with the economic cycle than traditional copper services. We continue to believe that this is unclear. In the July 2013 LLU WLR Consultation we showed that since the take-off in superfast broadband in 2010, take-up of both broadband and superfast broadband have steadily increased despite the recent economic recession.⁴⁸⁶ We agree with TalkTalk that this evidence is imperfect because it does not account for what would have happened absent the economic recession. However, TalkTalk's proposition (to assess what the demand for fibre would have been if there had been strong economic growth over the 2010 to 2012 period) would be very difficult to test.

A14.246 Furthermore, if superfast broadband were subject to more systematic risk than current generation broadband⁴⁸⁷, we would expect Virgin Media, which has a greater proportion of its subscriber base on superfast broadband,⁴⁸⁸ to have a higher asset beta than BT Group or other UK telecoms operators with no investments in NGA. In practice, BT Group's asset beta is higher than Virgin Media's and the latter's asset beta was similar to that of other UK telecoms operators with little or no investment in their own infrastructure in fibre loops such as TalkTalk. In addition, we disagree that the differences in the cost of Virgin Media and BT's NGA investments are sufficiently large to invalidate the comparison between the two companies (as discussed in paragraphs A14.193 to A14.196).

A14.247 In order to assess the impact of BT's investments on its asset beta, we plot BT's two year asset beta and its capital expenditures from January 2008 to December 2013 and show a timeline of BT's announcements relating to its NGA and sports rights investments during this period in Figure A14.17 below.

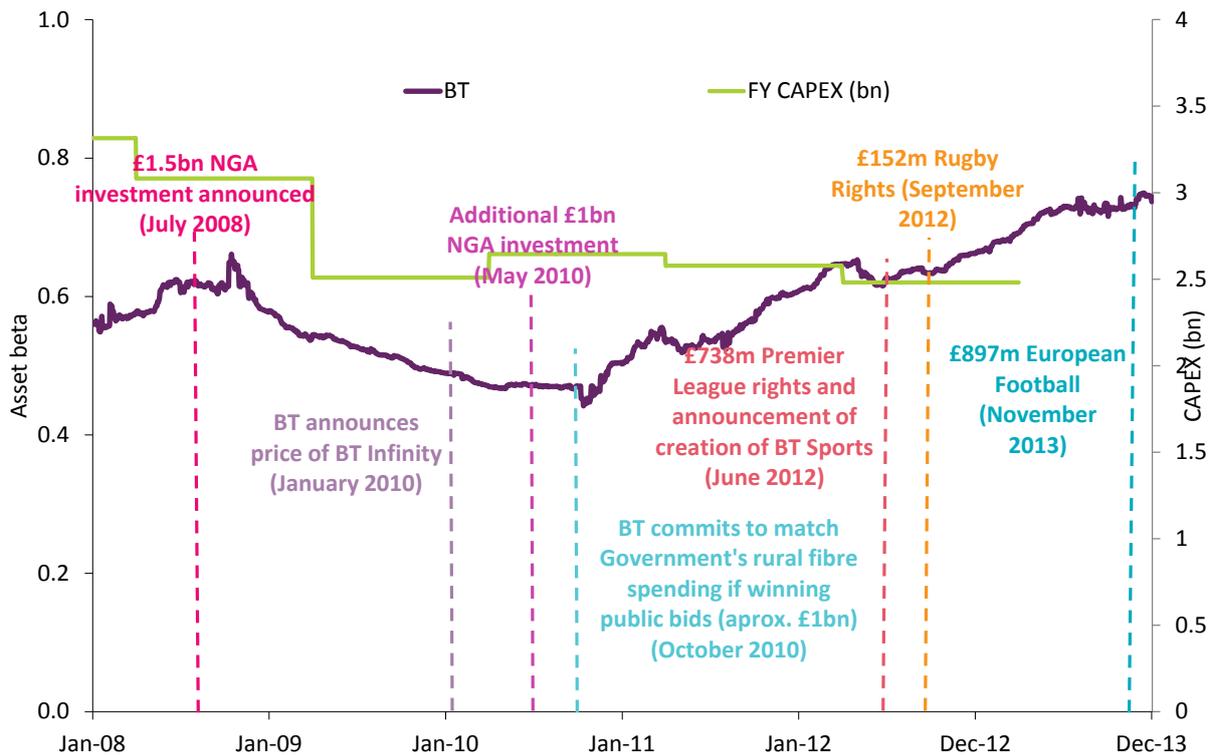
⁴⁸⁵ According to data from *Bloomberg*, it was £2,509m (2010), £2,645m (2011), £2,578 (2012) and £2,481m (2013).

⁴⁸⁶ Paragraph A15.197-A15.198, July 2013 LLU WLR Consultation.

⁴⁸⁷ We note that TalkTalk has not provided evidence supporting the view that superfast broadband is subject to higher systematic risk than current generation broadband.

⁴⁸⁸ Virgin Media had 3.2m superfast broadband subscribers or 74% of all 4.4m subscribers in Q4 2013 – December 2013 (see Virgin, *Virgin Media full year 2013 operational results*, 13 February 2014, <http://investors.virginmedia.com/phoenix.zhtml?c=135485&p=irol-newsarticle&ID=1899958>), compared to BT's 1.9m superfast broadband subscribers equivalent to 27% of its total 7.1m retail fixed broadband subscribers.

Figure A14.17: BT two year asset beta, financial year capex and announcements relating to investments in NGA and sports rights



Source: BT two year asset beta from Figure 10, March 2014 Brattle Report. Capex figures from *Bloomberg*. £1.5bn NGA announcement in July 2008⁴⁸⁹; BT announces price of superfast broadband in January 2010⁴⁹⁰; £1bn additional NGA investment announced in May 2010⁴⁹¹; BT commits to match Government's £830m investment in rural broadband after autumn 2010 spending review⁴⁹²; £738m Premier League rights in June 2012⁴⁹³ and announcement of creation of

⁴⁸⁹ See ZDNet, *BT to roll out fibre to 10m UK homes*, 15 July 2008, <http://www.zdnet.com/bt-to-roll-out-fibre-to-10m-uk-homes-3039447462/> and BT, *Delivering super-fast broadband in the UK*, 5 December 2008,

<https://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Consultativeresponses/Ofcom/2008/Sup-erfastbroadband/>

⁴⁹⁰ See Cable, *BT announces fibre optic broadband pricing*, 21 January 2010, <http://www.cable.co.uk/news/bt-announces-fibre-optic-broadband-pricing-19570774/> and Mobile Business, *BT Launches BT Infinity Super>Fast Broadband*, 21 January 2010, <http://commsbusiness.co.uk/news/bt-launches-bt-infinity-superfast-broadband/>

⁴⁹¹ See Broadband Watchdog, *BT confirm extra £1bn for fibre broadband network*, 14 May 2010, <http://www.broadbandwatchdog.co.uk/story/tag/bt-invest-2-5-billion-in-fibre-optic-network/> and The Guardian, *BT pledges extra £1bn for fibre network after returning to profit*, 13 May 2010, <http://www.theguardian.com/business/marketforceslive/2010/may/13/btgroup-telecoms-fibre-optic-network>

⁴⁹² See BBC, *Government reveals super-fast broadband plans*, 6 December 2010, <http://www.bbc.co.uk/news/technology-11922424> and ISPReview, *UPDATE2 UK Spending Review Confirms GBP530m for Rural Broadband Development*, 20 October 2010, <http://www.ispreview.co.uk/story/2010/10/20/uk-spending-reviews-confirms-gbp530m-for-rural-broadband-development.html> and <http://www.publications.parliament.uk/pa/cm201314/cmselect/cmpubacc/474/474vw06.htm>

⁴⁹³ The Telegraph, *BT makes shock grab for Premier League rights*, 13 June 2012, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/media/9330417/BT-makes-shock-grab-for-Premier-League-rights.html>

BT Sports⁴⁹⁴, £152m Rugby rights in September 2012⁴⁹⁵ and £897m European Football rights in November 2013⁴⁹⁶.

A14.248 Figure A14.17 shows that BT announced its initial £1.5bn investment in superfast broadband in July 2008. It is difficult to ascertain the impact that this announcement may have had on BT's asset beta, given that it peaked shortly thereafter (in October 2008) at 0.70 but then declined until October 2010, when it reached its lowest value (0.47) over the five-year period considered in the chart above. Furthermore, the asset betas of UK network utilities in Figure A14.8 and EU telecoms operators in Figure A14.10 above show a similar pattern to BT (an initial increase around October 2008 followed by a decline up to around October 2010). Therefore, the evidence does not seem to support that BT's announcement in July 2008 may have resulted in an increase in its asset beta (as argued by TalkTalk) and instead suggests that the movements observed in BT's asset beta (as well as UK network utilities and EU telecoms operators) may have been dominated by other (potentially external) factors affecting all these companies at the same time.

A14.249 Similarly, BT announced its pricing strategy for its superfast broadband offering in January 2010. In May 2010 it declared it would invest an additional £1bn in its NGA network and during the autumn of 2010 it committed to match the government's investment in rural broadband (a total of £830m) if public authorities selected it to roll-out fibre in rural areas.⁴⁹⁷ During these announcements BT's two year asset beta continued to decline on the same trend as before, until in October 2010, when it began to increase until the end of the period shown (December 2013). It is unclear whether BT's commitment to invest further in NGA may have influenced such a big increase in BT's two year asset beta after October 2010. This is because the increase in BT's asset beta was similarly matched by EU telecoms operators (see Figure A14.10 above) and, albeit to a lesser extent, by UK utilities (see Figure A14.8 above), implying that the movements in BT's asset beta during this period may have been similarly influenced by external factors. Furthermore, the scale of the investment (£1.5bn in July 2008 and £1bn in May 2010 (totalling £2.5bn) over a period of around four to five years⁴⁹⁸) is relatively modest when compared to BT's annual average capex investment of £2.5bn (i.e. £10bn to £12.5bn over four to five years), which has remained fairly stable over the last four years (as mentioned above in paragraph A14.243). Thus, we consider that the impact of BT's NGA investment on its asset beta over the period up to October 2010 and beyond is unclear, but in so far as there was an effect, is likely to have been modest.

⁴⁹⁴ BBC, *Premier League rights sold to BT and BSkyB for £3bn*, 13 June 2012, <http://www.bbc.co.uk/news/business-18430036>

⁴⁹⁵ The Telegraph, *BT wins rights to broadcast Premiership rugby in £152m deal*, 12 September 2012, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/media/9538070/BT-wins-rights-to-broadcast-Premiership-rugby-in-152m-deal.html>

⁴⁹⁶ BBC, *Champions League: BT Sport wins £897m football rights deal*, 9 November 2013, <http://www.bbc.co.uk/sport/0/football/24879138>

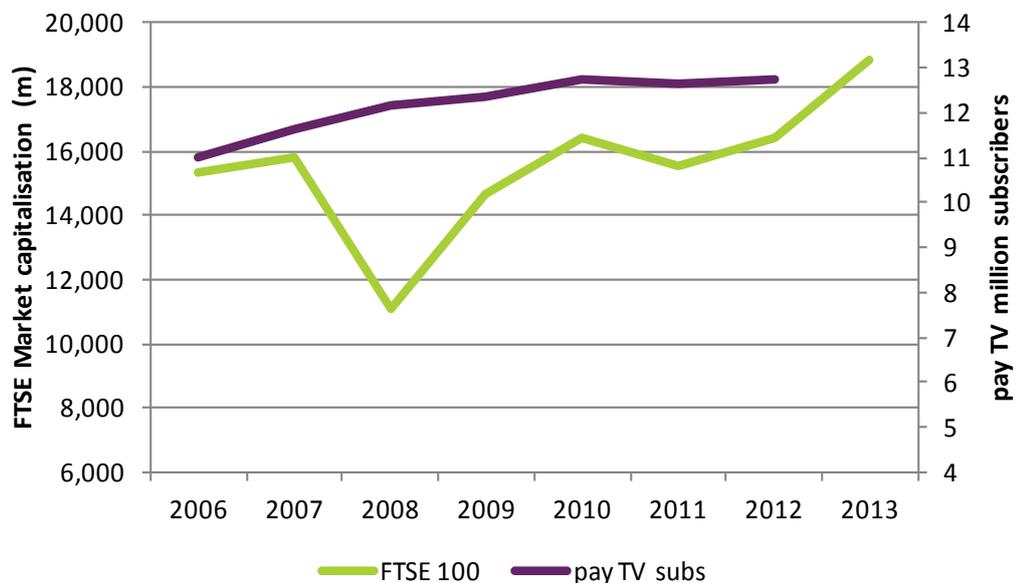
⁴⁹⁷ It should be stressed that BT's commitment to invest in rural broadband was conditional on winning the government's public bids and consequently was subject to uncertainty.

⁴⁹⁸ The announcement in July 2008 of £1.5bn investment was for the period up to 2012 (ZDNet, *BT to roll out fibre to 10m UK homes*, 15 July 2008, <http://www.zdnet.com/bt-to-roll-out-fibre-to-10m-uk-homes-3039447462/>) and the £1bn announcement in May 2010 was to meet the 66% coverage by 2015 (Broadband Watchdog, *BT confirm extra £1bn for fibre broadband network*, 14 May 2010, <http://www.broadbandwatchdog.co.uk/story/tag/bt-invest-2-5-billion-in-fibre-optic-network/> and The Guardian, *BT pledges extra £1bn for fibre network after returning to profit*, 13 May 2010, <http://www.theguardian.com/business/marketforceslive/2010/may/13/btgroup-telecoms-fibre-optic-network>).

A14.250 TalkTalk argued that BT Sport was also likely to have materially increased BT Consumer/Business's (and therefore BT Group's) asset beta. We acknowledge that BT has heavily invested in sports content over the last two years, as it has announced commitments to pay up to £1.8bn⁴⁹⁹ for football and rugby sports rights in the UK.

A14.251 We note, however, that the magnitude of the impact on BT Group's asset beta of its investments in sports rights is likely to be determined by the degree to which these investments may have increased the correlation of BT's returns with those of the wider economy. On the question of whether pay-TV services are likely to be more highly correlated with the wider economy, Figure A14.18 below shows that since 2006 the number of pay-TV subscribers has increased relatively unabated in spite of the variations in the FTSE100 caused by the economic downturn (particularly in the period 2008 to 2011). Thus, the evidence presented above does not clearly support the view that pay-TV is highly correlated with movements in the wider economy and therefore subject to higher systematic risk.

Figure A14.18: Evolution of pay-TV subscribers and the FTSE100 market capitalisation (2006 to 2013)



Source: Bloomberg and Ofcom.

A14.252 In relation to TalkTalk's view that BT's investments in sports rights are likely to have increased its operational gearing, we believe the evidence does not clearly support this view for the same reasons we described in the case of its superfast broadband roll-out in paragraphs A14.238 to A14.243 above. Furthermore, BT's investments in sports will result in approximately £0.5bn of annual spend, which we consider is relatively small expenditure when compared to its annual average £2.5bn capital expenditure which has remained fairly flat over the last four years (as mentioned above in paragraph A14.243).

⁴⁹⁹ Including £738m for three seasons of the English Premier League (announced in June 2012), £152m for four seasons of the Premiership Rugby (announced in September 2012) and £897m for exclusive rights on three seasons of the European Champions and Europa League (announced in November 2013).

A14.253 TalkTalk argued that the maturity of Sky Sports' installed base implied that it could not be compared to BT's investments in sports. In our view a distinction should be made between specific and systematic risks for the purposes of assessing the asset beta of these companies. We agree that Sky and BT may well face different specific risks (i.e. risks that affect an individual firm or sector and that are therefore diversifiable)⁵⁰⁰, however, it is likely that if they provide similar products and face similar demand conditions they would face similar systematic risk (i.e. risks that are correlated with the economy and are thus non-diversifiable). Our view is that Sky Sports and BT Sports offer relatively similar TV services and that it is therefore reasonable to assume that they would face similar systematic risk.

A14.254 It could be argued that Sky's maturity may allow it to benefit from past sunk investments (e.g. in advertising and TV rights) whereas BT, as the new entrant into the market, may need to increase its marketing and advertising expenditure per customer compared to Sky, at least in the short term. We consider that the impact of these differences is likely to be relatively small. Advertising and marketing campaigns need to be reviewed periodically and it is likely that entry into the market by BT will trigger some marketing/advertising response from Sky (which is likely to increase the latter's costs). Moreover, BT is able to sell its pay-TV offering to a large installed customer base which may allow it to mitigate some of the costs that would have been involved in an advertising/marketing campaign aimed at gaining customers from other providers.

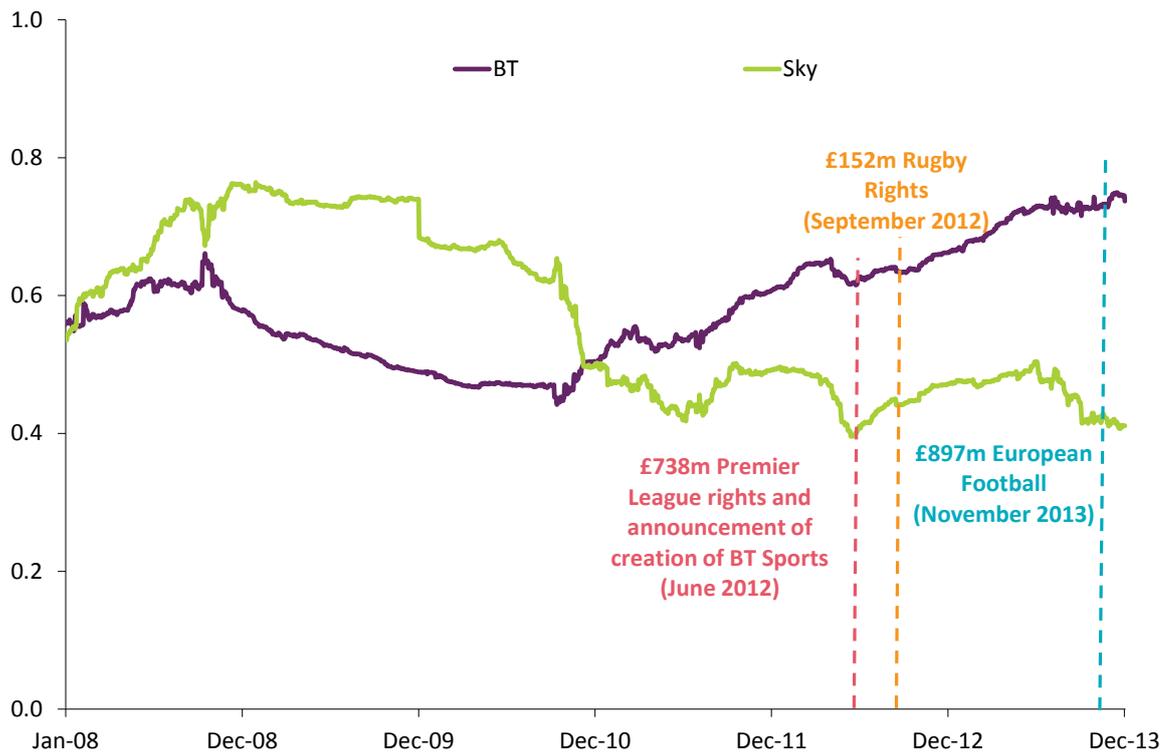
A14.255 Furthermore, we note that BT's entry into the provision of premium sports channels and thus investment in sports rights is likely to have increased the cost of acquiring sports rights for existing broadcasters such as Sky or ITV,⁵⁰¹ potentially increasing their operating leverage and hence systematic risk, other things equal

A14.256 For all the above reasons we consider that it remains appropriate to use Sky as a comparator to assess whether BT's investments in sports rights may have increased its systematic risk. We plot BT and Sky's two year asset betas in Figure A14.19 below.

⁵⁰⁰ We note that specific risks do not influence the cost of capital since in an efficient capital market they can be diversified away by investors, whereas systematic risks create irreducible cash-flow risks and therefore are the only type of risks that affect the cost of capital.

⁵⁰¹ See, for example, The Telegraph, *UK sports rights inflation in six graphs*, 11 November 2013, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/10440715/UK-sports-rights-inflation-in-six-graphs.html> or The Guardian, *Market for TV sport to hit record £16bn in 2014 as broadcasters play hardball*, 3 January 2014, <http://www.theguardian.com/media/2014/jan/03/tv-sport-rights-market-record-growth-2014>.

Figure A14.19: BT and Sky two-year asset betas



Source: Figure 13, March 2014 Brattle Report.

A14.257 Figure A14.19 also shows that the asset beta of both BT and Sky increased from around mid-2012 to mid-2013, during the period when BT announced its purchase of Premier League rights (June 2012) and Rugby rights (September 2012). However, the long term increase in BT Group's asset beta started around the end of 2010, well before BT's investment in sports rights in June 2012. This therefore seems to suggest that the increase in BT Group's asset beta since the end of 2010 cannot be fully attributed to its activities in the TV sector. In addition, from mid-2013 the asset betas of BT and Sky diverge until the end of the period considered.

Conclusion on the assessment of the risk of BT's investments

A14.258 The increase in the asset beta of BT Group observed since 2010 has been associated with an increase in the company's market capitalisation. This suggests that the business contributing the incremental value (which we consider is the RoBT) may have a higher asset beta than the other parts of the business. We consider that there are *a priori* reasons to believe that the investments in superfast broadband and pay-TV could have increased the asset beta of the RoBT (and BT Group), such as the greater growth potential of these businesses when compared to the other more stable parts of BT. However, we consider that the evidence presented in this sub-section is inconclusive as to whether the observed increase in the asset beta of BT Group in recent years can be clearly attributed to its investments in superfast broadband and BT Sports (as suggested by TalkTalk).

Weights of RoBT and Openreach in BT Group

Proposals in the July 2013 LLU WLR Consultation

A14.259 In the July 2013 LLU WLR Consultation we noted that it might be appropriate to consider other ways to disaggregate the BT Group asset beta. Historically, we have determined the weights of Openreach and the RoBT based on the mean capital employed (MCE) of their assets, pointing to a 50/50 split between the two parts of BT Group. We argued that an alternative approach could be to increase the weight ascribed to the RoBT, for example, if we considered that the economic value of the assets for the RoBT were higher than implied by their book value. We considered that this would result in a reduction in the Openreach asset beta without causing the asset beta for the RoBT to move too far away from that for suitable comparators to the RoBT such as other vertically integrated UK fixed CPs.⁵⁰²

Responses to the July 2013 LLU WLR Consultation

A14.260 BT remarked that in 2009 and 2011, when the prior year MCE of Openreach was 48% and 52% respectively, a 50:50 split seemed reasonable, however, in the 2013 LLCC, when the 2011/12 MCE of Openreach had increased to 58%, a 50:50 split looked less reasonable. BT thus advocated using the actual (in year) MCE figures to disaggregate BT Group's asset beta (rather than some average across previous years), as this would support the principle of regulatory consistency. BT disagreed with increasing the weight ascribed to the RoBT and considered that a disaggregation based on the MCE seemed more appropriate.⁵⁰³

A14.261 TalkTalk noted that Openreach's copper business was a subset of the whole of Openreach and consequently it was wrong to use a figure for the whole of Openreach to assess the asset beta of BT's copper business. It argued that most of the investment over the past three years in Openreach had been the roll-out of FTTC infrastructure and BT's investments in sports rights, which were of no relevance for the LLU WLR charge control review.⁵⁰⁴

A14.262 Sky noted the report provided by Europe Economics on its behalf. It considered that the report advocated a weight of 30:70 (if not lower for Openreach) and that this was clearly supported by the evidence. It estimated that keeping the asset beta for BT Group and the RoBT consistent with our July 2013 LLU WLR Consultation proposals, a 40:60 weight would reduce Openreach's estimated asset beta from 0.60 to 0.57. It argued that this asset beta for Openreach was broadly consistent with a cross-check conducted by Europe Economics from observed falls in Openreach's operating leverage relative to BT Group (which produced an Openreach beta of 0.55).⁵⁰⁵

A14.263 TalkTalk and Europe Economics made several comments regarding the weights of Openreach and the RoBT in the beta disaggregation, in particular, they noted that:

- weights should reflect the economic value of each part of the business;
- there were significant limitations to using weights based on accounting asset values in the case of Openreach and the RoBT; and

⁵⁰² Paragraphs A15.205-A15.206, July 2013 LLU WLR Consultation.

⁵⁰³ Paragraphs 503-508, BT response to July 2013 LLU WLR Consultation.

⁵⁰⁴ Page 24, TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation.

⁵⁰⁵ Paragraphs 8.17-8.19, Sky Response to July 2013 LLU WLR Consultation.

- there were several alternative measures to approximate economic value amongst which some measure based on RAV was preferable.

A14.264 We describe each of these issues in more detail below.

Weights should reflect the economic value of each part of the business

A14.265 TalkTalk and Europe Economics noted that economic theory suggested that the weightings to be used in beta disaggregation should be the economic value of the different parts of BT Group. In their view the best proxy for a business' economic value is its enterprise value (EV), which is the sum of the values of all equity (i.e. market capitalisation), debt, and preferred stock less cash and cash equivalents.⁵⁰⁶ In contrast, TalkTalk disagreed with the use of the MCE to determine relative weights since Openreach was highly capital intensive compared to the RoBT.⁵⁰⁷

A14.266 Whereas it was possible to derive the EV for the whole of BT's business (from BT's stock price and balance sheet it was £27.8bn, as shown in Table 3.1 of Europe Economics' report), this was not possible for Openreach as it was not a separately listed company. Instead, TalkTalk argued that Openreach's regulatory asset value (RAV) was a good estimate of its EV, given that prices were set by Ofcom such that the present value of future profit/cash flows equal Ofcom's assessment of the value of the assets or RAV. As Openreach's RAV was approximately £6.4bn, TalkTalk estimated the weight of Openreach to be 18% of the total economic value of BT Group.⁵⁰⁸

Limitations of using accounting asset values for Openreach and the RoBT

A14.267 In its report, Europe Economics argued that there were significant problems with applying asset weights to business lines where physical assets were not the primary means of delivering economic value. In particular, firms often make use of "intangible assets", including:

- brands;
- customer networks; and
- goodwill.⁵⁰⁹

A14.268 Europe Economics considered that branding was likely to be significantly more important in the RoBT – which contained businesses that sell products with close

⁵⁰⁶ The assumption is that an investor could use cash and cash equivalents to fund the acquisition of a company and thus these assets should not be included in the enterprise value.

⁵⁰⁷ Paragraphs 4.36 to 4.37, TalkTalk Response to July 2013 LLU WLR Consultation.

⁵⁰⁸ Paragraph 4.38, TalkTalk Response to July 2013 LLU WLR Consultation and page 3-4, Europe Economics, *Disaggregating the BT Group Asset Beta. Report for Sky and TalkTalk*, October 2013: http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Europe_Economics_report.pdf (Europe Economics, *Disaggregating the BT Group Asset Beta*). We note that using a BT enterprise value of £27.8bn and a RAV value of £6.4bn, as suggested by TalkTalk (which did not indicate the year for these figures), the RAV/EV ratio should be 23% (not 18%). Table 4.1 in the Europe Economics, *Disaggregating the BT Group Asset Beta*, estimates that the RAV/EV ratio was 23% in 2012 and 18% in 2013.

⁵⁰⁹ Page 5, Europe Economics, *Disaggregating the BT Group Asset Beta*.

substitutes – than in the case of Openreach – a business selling products with little or no direct substitutes.⁵¹⁰

A14.269 Europe Economics noted that two key problems associated with the role of intangible assets when considering firms' value were that:

- even when intangible assets were valued and included on firms' balance sheets, such valuations were subject to considerable uncertainty, and could significantly underestimate the true economic value of these assets; and
- many intangible assets were not included in firms' balance sheets.⁵¹¹

A14.270 To demonstrate the difficulties of valuing intangible assets, Europe Economics presented evidence on assets (property, plant and equipment – PPE), book intangibles and enterprise value for multiple companies in different sectors. It noted that the intangibles/PPE ratios suggested that intangible assets made up a larger proportion of the asset base of non-fixed access telecommunications and broadcasting firms which do not control a large asset base of fixed lines (e.g. TalkTalk, Sky, Vodafone) compared with firms with larger network operations (e.g. BT Group or water utilities). In contrast, BT Group had higher PPE/EV ratios than asset-light telecommunications companies such as TalkTalk or Sky. It concluded that BT Group differed from these otherwise-comparable companies due to the capital-intensive Openreach business and that these differences highlighted the problems of using the book value of assets to compare asset-light and capital-intensive businesses.⁵¹²

A14.271 Europe Economics indicated that BT's customer relationships and brands were valued for accounting purposes at only £325m. It considered this was unrealistic (quoting a recent study that had estimated BT's brand to be worth around £5.6bn⁵¹³). Instead, it argued that the correct approach would be to undertake a rigorous analysis that identified then valued BT Group's intangible assets and allocated these across its different lines of business.⁵¹⁴

A14.272 Europe Economics provided a description of the different parts of BT Group, including an analysis of the Capex and revenues, and concluded that Openreach's copper access network business derived most of its economic value from employing physical assets and therefore the accounting value of these assets was a reasonable proxy for the value of capital employed in that business. In contrast, the RoBT appeared to derive more of its value from intangible assets, which might not be captured by the accounting value and which would be subject to uncertainty.⁵¹⁵

Alternative measures to approximate economic value

A14.273 TalkTalk and Europe Economics suggested additional measures that could be used to derive the relative weight of Openreach, including:⁵¹⁶

⁵¹⁰ Pages 5-6, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵¹¹ Page 6, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵¹² Pages 6-7, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵¹³ Page 29, *BrandZ™ Top 100 Most Valuable Global Brands 2013*,

http://www.millwardbrown.com/brandz/2013/Top100/Docs/2013_BrandZ_Top100_Report.pdf.

⁵¹⁴ Page 8, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵¹⁵ Page 9, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵¹⁶ Paragraph 4.40, TalkTalk Response to July 2013 LLU WLR Consultation.

- RAV/EV: the ratio of the regulatory asset value (used as a proxy for Openreach-copper enterprise value) and BT’s enterprise value;
- Adjusted RAV/EV: an adjusted version of the ratio above that allows for the fact that regulation may consciously allow scope for outperformance of opex targets and “aims up” on the cost of capital – meaning that the economic value might be above the RAV. Europe Economics assumed a 10 per cent mark-up on the RAV for disaggregation purposes;
- Revenue: the ratio of Openreach-copper to BT Group’s revenues;
- EBITDA: the ratio of Openreach-copper to BT Group’s EBITDA; and
- Operating income: the ratio of Openreach-copper to BT Group’s EBIT.⁵¹⁷

A14.274 We reproduce Europe Economics’ weights estimates in Table A14.15 below.

Table A14.15: Possible weighting approaches (Openreach % of BT Group value)

	2012	2013
RAV/EV	23%	18%
Adjusted RAV/EV	25%	19%
Revenue	17%	17%
EBITDA	30%	29%
Operating income	32%	30%
Range	17-50%	17-50%

Source: Europe Economics report, Table 4.1.

A14.275 Europe Economics recommended using the “adjusted RAV/EV” (i.e. the RAV/EV ratio increased by a 10% mark-up on the RAV). It indicated that it had analysed the RAV/EV ratio from 2007 to 2013 and had found that the ratio was broadly stable over the period, with a minimum of 18%, a maximum of 30% and an average of 24%.⁵¹⁸

A14.276 On the basis of the evidence above, TalkTalk and Europe Economics supported using the following Openreach/RoBT weights:

- Europe Economics: 40:60, or adjusting further to 35:65 or 30:70. Europe Economics argued that a 40:60 weighting would be more appropriate than 50:50, and that this could be regarded as somewhat conservative because, if current levels of RAV-based and income-based weights persisted, it could be better to adjust the split further to 35:65 or 30:70.⁵¹⁹
- TalkTalk: range between 30:70 and 20:80. TalkTalk considered that any alternative weighting measure was clearly inferior to using EV based on RAV

⁵¹⁷ Page 11, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵¹⁸ Page 15, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵¹⁹ Page 11-12, Europe Economics, Disaggregating the BT Group Asset Beta.

and, on this basis, it considered that a weight for Openreach in the range of 20% to 30% was a conservative and reasonable assumption.⁵²⁰

A14.277 Using Ofcom’s asset beta from the July 2013 LLU WLR Consultation of 0.67 for BT Group and 0.74 for the RoBT as given, Europe Economics estimated that a 40% weighting for Openreach implied an asset beta of 0.57. It considered that such a reduction in beta compared to Ofcom’s proposal was also supported by their analysis of the implications of changes in operating leverage. Europe Economics noted that the analysis of Openreach and the RoBT’s operating leverage suggested that over the last five years the difference in asset betas of Openreach and the other divisions in BT would have increased from 0.13 to 0.19. Europe Economics concluded that this supported an asset beta of 0.55.⁵²¹

A14.278 TalkTalk argued that excluding fibre activities from Openreach was likely to result in an increase in the wedge between the two parts of the business beyond the 0.19 level estimated by Europe Economics to, say, 0.25.⁵²² Based on its response to the July 2013 LLU WLR Consultation, TalkTalk presented three scenarios for betas assuming different wedges and weights which give Openreach asset betas between 0.34 and 0.51, as shown in Table A14.16 below.

Table A14.16: Asset betas estimated by TalkTalk under different scenarios

	Ofcom – July 2013 consultation	Proposal 1	Proposal 2	Proposal 3
BT Group	0.67	0.67	0.67	0.67
Openreach	0.60	0.51	0.46	0.34
RoBT	0.74	0.74	0.74	0.78
Wedge	0.14	0.20	0.28	0.44
Openreach weight	50%	30%	25%	25%
RoBT weight	50%	70%	75%	75%

Source: TalkTalk response to July 2013 LLU WLR Consultation, page 42.

Ofcom’s analysis

A14.279 We received several comments from stakeholders on the weights that we should attribute to each part of BT Group. We agree with TalkTalk, Sky and Europe Economics that, from a theoretical perspective, the weights should reflect the economic value of each part of the business. However, neither Openreach nor the RoBT are publicly traded and thus we need to approximate their economic value using alternative metrics.

A14.280 We agree with Sky, TalkTalk and Europe Economics that, because Openreach is a price regulated company, its economic value is likely to be more closely related to

⁵²⁰ Paragraph 4.41, TalkTalk Response to July 2013 LLU WLR Consultation.

⁵²¹ Page 15, Europe Economics, Disaggregating the BT Group Asset Beta.

⁵²² Paragraph 4.60, TalkTalk Response to July 2013 LLU WLR Consultation.

the regulatory accounting value of its physical assets. This is because Ofcom typically caps Openreach's prices such that they equal its expected costs in the final year of the charge control, where these costs are projected, in part, from the regulator's calculation of the value of the assets used in providing these services.

A14.281 We consider that it is inherently difficult to estimate the value of the intangible assets associated with BT, let alone with other parts of its business. Although we agree that it is likely that the brand value of RoBT is likely to be higher than that of Openreach, we consider that there are also likely to be important intangible assets associated with Openreach such as, for example, the value of Openreach's brand or the technical knowledge of its engineers.

A14.282 Sky, TalkTalk and Europe Economics argued that weights based on accounting asset values were inappropriate and suggested that we use the RAV to derive the economic value of Openreach. In response, we note that both the MCE and the RAV are effectively accounting asset values (i.e. not true measures of forward looking economic value of the underlying assets in their entirety – both tangible and intangible). Moreover, the RAV used by these stakeholders in their submissions only included the value of Openreach's duct and copper assets (i.e. the assets to which we apply the "RAV adjustment"). In contrast, we also take into account other assets that are used to supply WLR/LLU services when setting the charges for these services.

A14.283 TalkTalk, Sky and Europe Economics suggested that we consider additional measures that could be used to approximate the weight of Openreach in BT Group. We do not agree that the following measures presented by these stakeholders (as shown above in Table A14.15) are appropriate:

- RAV (based only on copper and duct assets) to Enterprise Value EV (RAV/EV) or Adjusted RAV/EV: because this RAV only includes duct and copper and therefore excludes the value of other assets used to provide WLR/LLU services;
- Revenue: because it does not capture the costs of providing LLU and WLR services; and
- Operating income: although operating income reflects profitability, we prefer a measure such as EBITDA which does not subtract depreciation and amortization, which may be subject to accounting conventions and therefore not reflective of the scale of forward-looking earnings. In any event, the calculations by Europe Economics suggest that the weights derived using operating income and EBITDA are very similar for Openreach.

A14.284 In Table A14.17 below we present the measures from which we propose to refine our view of the relative weights of Openreach and the RoBT, notably:

- Openreach's copper access MCE as a share of BT Group's total MCE (note that these shares relate to Openreach's copper access business only);
- Openreach's EBITDA as a share of the total BT Group's EBITDA; and
- Regulatory NRC/EV: the value of all assets used to provide WLR/LLU services on a net replacement cost (NRC) basis (including copper and duct on a RAV basis) divided by BT Group's EV.

Table A14.17: Weighting approaches (Openreach copper access as a percentage of BT Group value)

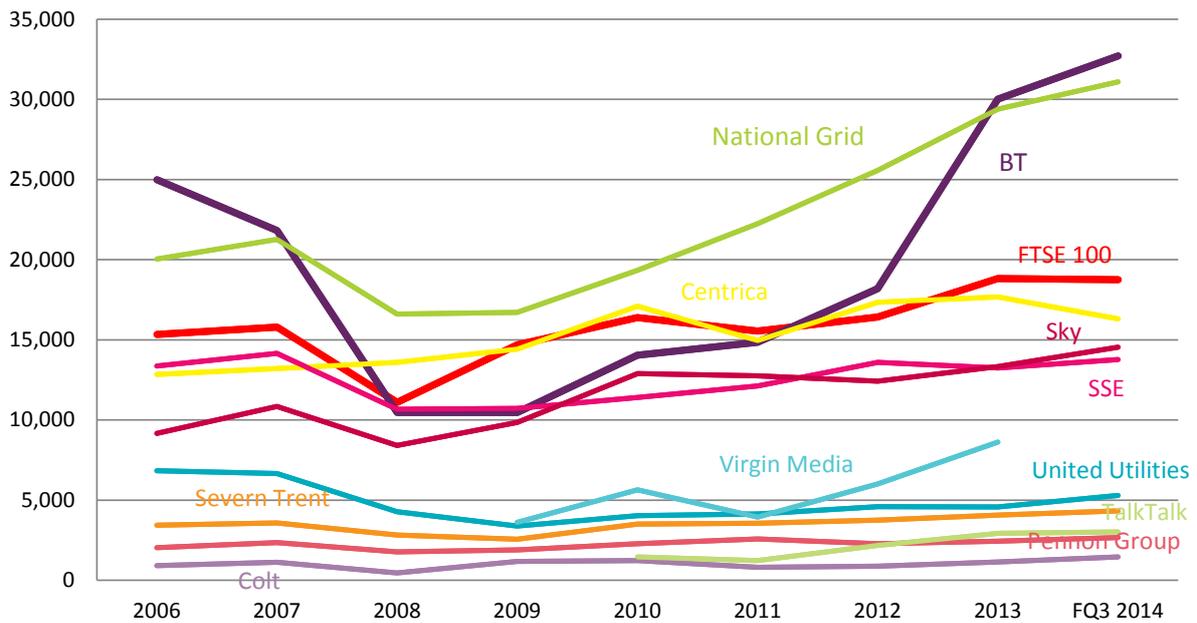
	2010/11	2011/12	2012/13
Mean Capital Employed	56%	61%	61%
EBITDA	18%	30%	28%
Regulatory NRC/EV	39%	33%	29%

Source: Ofcom, BT Annual Reports and RFS and Bloomberg.

A14.285 We consider that the MCE weighting is likely to overstate the economic value of Openreach when compared to the RoBT. This is because Openreach's copper access business is a regulated business with prices capped by reference to a rate of return on a regulatory accounting asset base; it also has more limited growth potential, at least compared to the RoBT. In contrast, a much smaller share of the RoBT is price regulated (only 30% of the RoBT's EBITDA corresponds to BT Wholesale), and the RoBT is likely to have a greater extent of intangible assets. The relative economic value of Openreach implied by measures such as EBITDA or the "Regulatory NRC/EV" is lower than that implied by the MCE.

A14.286 In Figure A14.20 we plot the market capitalisation of the FTSE100 and the companies used as comparators in our analysis above. The evidence shows that BT has experienced a continued increase in its market capitalisation since 2009 (only matched by National Grid amongst the comparator regulated companies). It also shows that BT and the FTSE100 index presented a similar movement in their market capitalisation between 2009 and 2012. This could suggest that the increase in BT's market capitalisation may have been due to external factors affecting the UK economy as a whole (e.g. the economic recession that started in 2008) rather than factors intrinsic to BT. However, since 2012 the relative increase in BT's market capitalisation has not been matched by the FTSE100, supporting the view that factors specific to BT (rather than the economy generally) may explain the increase in the value of BT. We consider that this increase is likely to have been mostly driven by BT businesses other than Openreach's copper access business.

Figure A14.20: FTSE100 and benchmark companies' market capitalisation



Note: Market capitalisation based on final year data from *Bloomberg* (financial year data is not available for the FTSE100 index from *Bloomberg*). The market capitalisation of the FTSE100 is shown divided by 100.

Source: Bloomberg.

Conclusion on the weights of RoBT and Openreach in BT Group

A14.287 We present in Table A14.18 below different combinations of Openreach and RoBT asset betas, as well as weights for each, that are consistent with a BT Group asset beta of 0.72. We have included the following scenarios:

- Openreach asset beta of 0.5.
- Weights of 40:60, 30:70, and a 1/3:2/3 split.

Table A14.18: Openreach and RoBT WACC with different asset betas and weight assumptions

Weight OR/RoBT	Openreach		RoBT		Asset beta wedge
	Asset beta	WACC	Asset beta	WACC	
40/60	0.5	8.6%	0.87	11.0%	0.37
33/67	0.5	8.6%	0.83	10.8%	0.33
30/70	0.5	8.6%	0.81	10.7%	0.31

Source: Ofcom calculations.

A14.288 We consider that a weighting of 1/3 for Openreach and 2/3 for RoBT, placing more weight on the alternative measures presented (rather than the MCE), is consistent with the view that most of the increase in BT Group's market capitalisation in recent years should be attributed to the RoBT. In particular, we do not think that the economic value of the price-regulated copper access business is likely to have increased markedly. We also consider that such a weighting allows for asset betas for the RoBT and Openreach that are more consistent with the evidence on comparator companies described above, as the asset beta of each part of the business weighted by its economic value must equal the asset beta of BT Group derived from market evidence.

Conclusion on disaggregation of BT Group's asset beta

A14.289 In summary, we consider that we should adopt an asset beta of 0.50 for Openreach and a weighting for Openreach within BT Group of 1/3 and the RoBT of 2/3. Given the observed BT Group asset beta of 0.72, these values imply an asset beta for the RoBT of 0.83.

Disaggregating BT Group's debt premium

Proposals in the July 2013 LLU WLR Consultation

A14.290 In the July 2013 LLU WLR Consultation we proposed that Openreach's debt premium should be 1.7% (the lower bound of the debt premium range proposed for BT Group) and that for the RoBT it should be 2.3% (the upper bound of the range). However, we noted that as further data became available, we would review the range for BT Group itself and BT Group relative to suitable comparators (e.g. network utilities and Sky) in our final statement for the LLU WLR charge controls.⁵²³

Responses to the July 2013 LLU WLR Consultation

A14.291 We have addressed Sky's and TalkTalk's comments on the debt premium in general in paragraphs A14.60 to A14.63. There were no additional comments on the disaggregation of BT Group's debt premium.

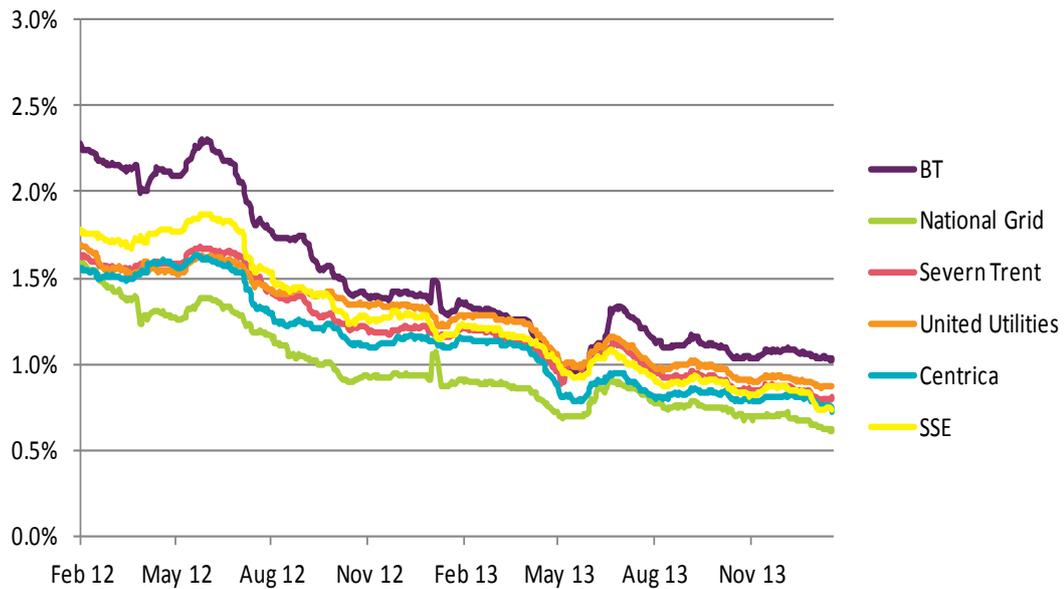
Ofcom's analysis

A14.292 Earlier in this annex we explained that we are proposing to assume a debt premium of 1.0% to 1.5% for BT Group. We have similarly decided to adjust the debt beta downwards (from 0.15 to 0.1).

A14.293 Following our approach in the July 2013 LLU WLR Consultation to estimate an appropriate debt premium for Openreach and the RoBT we have compared BT Group's debt premium to the range observed for the selected UK network utilities, as shown in Figure A14.21 below. In the chart we use BT's 2017 GBP bond.

⁵²³ Paragraphs A15.211-A15.216, July 2013 LLU WLR Consultation.

Figure A14.21: BT and network utilities' corporate bonds spread over benchmark gilt yields (%)



Note: The maturity of the corporate bonds used is: BT 23 June 2017; National Grid 7 June 2017; Severn Trent 22 Jan 2018; United Utilities 14 May 2018; Centrica 24 October 2016; SSE 1 October 2018. There was no corporate bond information available for Pennon Group from Bloomberg.

Source: Bloomberg ('Mid Sprd BM (SRC:BGN)).

A14.294 The evidence in Figure A14.21 above shows that the debt premium for BT Group and UK network utilities has generally declined since the publication of the July 2013 LLU WLR Consultation. Since then BT Group's debt premium has differed slightly from that of UK network utilities, although the gap between the two has remained fairly stable, with BT Group above network utilities by around 0.3 to 0.5 percentage points (depending on which utility of the comparator group is taken as a reference). The range for the network utilities is now 0.6% to 0.9%, although in the last year their minimum and maximum values were within the 0.6% to 1.3% range.

A14.295 As explained earlier in this annex, in light of the continued decline of BT Group's debt premium we consider that we should adopt a lower BT Group debt premium range of 1.0% to 1.5% (compared to 1.7% to 2.3% in the July 2013 LLU WLR Consultation). The evidence comparing the debt premium of BT Group and network utilities shows that a debt premium of 1%, slightly above the debt premium of network utilities by the end of 2013, is more consistent with a stable price regulated business such as Openreach. Consistent with our previous methodology to assessing the debt premium of Openreach and the RoBT, this leaves 1.5% (the upper bound of the debt premium range for BT Group over the last year) for the RoBT.

Ofcom's conclusions

A14.296 We therefore consider that Openreach's debt premium should be 1% (the lower bound of the debt premium range for BT Group) and that for the RoBT it should be 1.5% (the upper bound of the range).

Annex 15

Brattle Group report: Estimate of BT's Equity Beta

A15.1 Please see the separate PDF document published alongside this Statement entitled *Brattle Group report: Estimate of BT's Equity Beta*. This is available here:

http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/15_annex15.pdf

Annex 16

Efficiency

Introduction

A16.1 In this Annex, we set out our assessment of the efficiency gains we have forecast to be delivered by Openreach over the period of the charge control. We also set out how we reflect this in our cost modelling.

A16.2 Based on the analysis below, we believe that Openreach should be capable of achieving an efficiency, as defined below, of 5% per annum, taking into account the costs of implementation.

Definition of efficiency gains

A16.3 The rate we have sought to determine for the purpose of forecasting efficiency gains in the provision of WLR and LLU services is a single rate that:

- is applied to all cash payments (cash costs are defined to be operating costs less depreciation plus capital expenditure);
- is independent of volume effects and input price changes;
- captures the effect of all means of delivering efficiency savings including savings that might be achieved by doing things less often (e.g. through reduced fault visits); more quickly (e.g. through reduced task times) or for less money (e.g. reduced payments for business rates – i.e. cumulo);
- is stated with reference to the overall reduction in cash costs i.e. it takes into account any additional costs incurred, such as redundancies;
- is defined with reference to a constant fault rate i.e. absent any intervention faults are assumed to occur at a constant rate. Efficiency initiatives may lead to a reduction in actual fault visits;
- excludes any financial changes resulting from achievement of different levels of service provision from those in the base year. These are captured separately in our modelling; and
- is the efficiency rate that could be achieved by the operator of an efficient hypothetical on-going copper network, consistent with our anchor pricing approach.

A16.4 Our efficiency estimate includes both “catch up” and “frontier shift”. Catch up is the change in costs required to bring Openreach in line with an efficient operator. Frontier shift is the movement in efficiency expected by an efficient operator over time. We have not separately estimated how much is frontier shift and how much is catch-up efficiency.

July 2013 LLU WLR Consultation proposals

- A16.5 In the July 2013 LLU WLR Consultation we proposed that Openreach should be capable of reducing its cash payments, taking into account the costs of implementation, by between 4% and 6% each year.⁵²⁴
- A16.6 Our cost modelling for that Consultation applied the effect of this reduction by applying a single rate of 5% to all cash costs (including capital expenditure); the rate of 5% reflected the cost of achieving the efficiencies projected.

Stakeholder responses to the July 2013 LLU WLR Consultation

Efficiency rate and incentives

- A16.7 Openreach responded that the overall efficiency rate of 5% was too high. Openreach argued that a range of 2.8% to 5%, with an average of 4.0%, would be consistent with the evidence.⁵²⁵
- A16.8 Openreach stated that Ofcom's policy in setting an efficiency rate should be one which is challenging but that "BT can reasonably be expected to exceed".⁵²⁶ In particular, it noted that Ofcom needed to give proper consideration to the balance between setting a challenging target and allowing BT the opportunity to identify and realise yet further savings. It stated that, in doing so, Ofcom should align its approach with those it has used in the past and take into account the approach used by other UK regulators.
- A16.9 Openreach further questioned the evidence given to support the target; both in terms of the interpretation of data and the sources alleging a "limited reference to external benchmarking" which they argued affected incentives for Openreach to make efficiency savings and set itself challenging targets in the future.⁵²⁷
- A16.10 In support of its arguments Openreach submitted reports by Oxera⁵²⁸, which reviewed our efficiency assessment, and a benchmarking study prepared by Deloitte.⁵²⁹
- A16.11 TalkTalk argued in its response to our July 2013 LLU WLR Consultation that we do not need to set a low efficiency target in order to provide BT with cost minimisation incentives and that the consultation rate of 5%, whilst higher than previous charge controls, was too low.⁵³⁰
- A16.12 Other stakeholders agreed with TalkTalk's position that the rate proposed in the July 2013 LLU WLR Consultation of 5% was too low (Sky⁵³¹, Vodafone⁵³² and

⁵²⁴ Paragraph A7.5, Annex 7, July 2013 LLU WLR Consultation.

⁵²⁵ Paragraphs 15 and 99, Openreach Response to the July 2013 LLU WLR Consultation.

⁵²⁶ Paragraph 76, Openreach Response to the July 2013 LLU WLR Consultation.

⁵²⁷ Paragraphs 87 and 452, Openreach Response to the July 2013 LLU WLR Consultation.

⁵²⁸ Oxera, *Assessment of Ofcom's analysis to set the efficiency target. Is the proposed 4–6% range consistent with the evidence?*, Report prepared for BT/Openreach, 25 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Openreach_Annex_C.pdf

⁵²⁹ Deloitte, *Analysis of the Efficiency of BT's Regulated Operations*, 19 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/responses/BT_Deloitte_Report.pdf

⁵³⁰ Paragraph 3.8, TalkTalk Response to the July 2013 LLU WLR Consultation.

⁵³¹ Paragraph 6.1, Sky Response to the July 2013 LLU WLR Consultation.

Verizon⁵³³), whilst Everything Everywhere⁵³⁴ argued that it was a minimum. Stakeholders' arguments centred on BT having allegedly made excessive returns, having consistently outperformed efficiency targets in previous charge controls and on BT's incentives to understate its future potential efficiencies.

- A16.13 Vodafone further argued that BT's alleged excess profits could be reduced without impacting service quality.⁵³⁵ In support of its views, Vodafone submitted a report by Frontier Economics which analysed BT's regulated profits across the period 2005/06 to 2012/13.⁵³⁶ Sky also argued that improved service levels should not lead to additional costs.⁵³⁷
- A16.14 Virgin Media argued that a base case rate of 4.5%, i.e. a continuation of the rate used in the March 2012 LLU WLR Statement, would be supported by the available evidence. It suggested that historic cost reductions might have been achieved at the expense of service performance and hence caution should be adopted in using historic trend data to inform the target.⁵³⁸

Modelling Efficiency

- A16.15 Openreach argued that Ofcom should assess, set and apply in its modelling, a separate efficiency rate for operating expenditure (opex) and capital expenditure (capex). It argued that a single rate, which applied to opex and capex efficiency, would penalise BT if the capex efficiency underlying that single rate is higher than the opex efficiency. It estimated that using an average rate instead of split rates would lead to an under-recovery over the charge control period of £85m.⁵³⁹
- A16.16 EE also commented on separate opex and capex targets saying that it made sense to set a single target and that Ofcom should not be micro-managing the extent to which such gains could be achieved from different types of costs. However, EE did suggest that Ofcom should apply different efficiency targets to different groups of services and in particular WLR where it cited significant efficiency improvements achieved since the last control.⁵⁴⁰ Other stakeholders⁵⁴¹, including Verizon, supported a single combined target.⁵⁴²
- A16.17 Vodafone argued that we should make an adjustment to our cost base to account for its assessment that BT had inefficient labour practices.⁵⁴³ In support of this position Vodafone submitted a confidential paper.⁵⁴⁴

⁵³² Response to Question A 7.2, Vodafone Response to the FAMR and the July 2013 LLU WLR Consultations.

⁵³³ Paragraph 53, Verizon Response to the July 2013 LLU WLR Consultation.

⁵³⁴ Response to Question A7.2, EE Response to the July 2013 LLU WLR Consultation.

⁵³⁵ Page 5, Section 1, Vodafone Response to the FAMR and the July 2013 LLU WLR Consultations.

⁵³⁶ Frontier Economics, *The Profitability of BT's Regulated Services. A report prepared for Vodafone*, November 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Vodafone_Frontier_Economics_report.pdf.

⁵³⁷ Paragraph 6.3, Sky Response to the July 2013 LLU WLR Consultation.

⁵³⁸ Response to Question 7.2, Virgin Response to the July 2013 LLU WLR Consultation.

⁵³⁹ Paragraph 445, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁴⁰ Page 32, EE Response to the July 2013 LLU WLR Consultation.

⁵⁴¹ ✂ response to question A7.1 of the July 2013 LLU WLR Consultation.

⁵⁴² Response to Question A7.1 Paragraph 51, Verizon Response to the July 2013 LLU WLR Consultation.

⁵⁴³ Page 13, Vodafone Response to the FAMR and the July 2013 LLU WLR Consultations.

⁵⁴⁴ ✂

Updated Information

- A16.18 Following the July 2013 LLU WLR Consultation, we obtained updates from Openreach in relation to data it had previously provided to us, including historical data for 2012/13 and the latest version of its plans.
- A16.19 We also obtained a benchmarking report which we reviewed. We further requested additional information on an international benchmarking report used and referenced in BT's briefings with analysts.
- A16.20 In the following sections we review our original data sources in light of stakeholders' comments, additional information and, where applicable, updated information. We also set out our conclusions based on each data source.

Ofcom's analysis and assessment of responses

Efficiency target and incentives

- A16.21 In the July 2013 LLU WLR Consultation we stated that:

"Once the charge control is set, BT will have an incentive to try to maximise profits and reduce costs regardless of whether the efficiency target has been set too high or too low. Setting the efficiency rate is therefore not about giving BT incentives but about ensuring that future prices are set at an efficient forecast cost level."⁵⁴⁵

- A16.22 In its response to the July 2013 LLU WLR Consultation, Openreach stated that this represented a "radical new claim" explaining that:

"Ofcom's position appears to be that price cap regulation is about incentives but that the setting of the efficiency rate is not. Given that efficiency is one of the key factors that is largely within BT's control (as opposed, for example, to the WACC) the idea that this integral part of the approach can be carved out and positioned differently is clearly misguided."⁵⁴⁶

It went on to state that:

"The problem that Ofcom are seeking to avoid by the claim in A7.18 is that they have not addressed how the basis of the chosen forecast can itself be expected to affect incentives over time."⁵⁴⁷

- A16.23 Openreach's view was that, because Ofcom had relied almost exclusively on historic and projected Openreach data in setting the targets, Openreach was faced with poor incentives to both cut costs and set stretching targets to cut costs in the future. TalkTalk agreed that reliance on historic data in setting the efficiency target would reduce cost minimisation incentives, however, it noted that Ofcom did reference exogenous data sources in the July 2013 LLU WLR Consultation.⁵⁴⁸
- A16.24 More generally than the efficiency target, our view is that the incentives on Openreach to reduce costs would be stronger if charge controls could be set

⁵⁴⁵ Paragraph A7.18, Page 35, Annexes, July 2013 LLU WLR Consultation.

⁵⁴⁶ Paragraph 451, Page 73, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁴⁷ Paragraph 452, Page 73, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁴⁸ Paragraph 3.33-3.35, page 1, TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation.

completely independently of Openreach's actual costs. However, setting charge controls completely independently of Openreach's actual costs is challenging and may raise issues of cost recovery. If independent benchmarks are not closely comparable to the specifics of Openreach's business, there could be a greater risk that the charge control would be set at an inappropriate level. This applies to the setting of charge controls in general, and also specifically to determining the efficiency target, and the degree of reliance on Openreach's past efficiency performance in setting the efficiency target.

A16.25 We do not consider that the sources independent of Openreach are sufficient on their own to set a reliable efficiency target for LLU and WLR services. Our approach has therefore been to consider a wide range of sources to estimate the costs of an efficient operator, and to balance the degree to which each source is based on Openreach's actual business and knowledge of it, and the degree to which they are independent of BT.

A16.26 We use Openreach forecasts in our range of sources on the grounds that they were produced in the context of internal planning and are less likely to be influenced by downward bias.⁵⁴⁹ We also continue to place some weight on historic data. While this means that efficiency gains made by Openreach in the future may be expected to influence the setting of any future efficiency targets for price regulation, we consider the potentially detrimental effect this may have on Openreach's incentives is mitigated by the incentives inherent in price cap regulation (i.e. to outperform the control once set), and by our use of glide paths. Moreover, we have not relied exclusively on Openreach's historic data to determine the efficiency target.

A16.27 Openreach also argued, in its response to the July 2013 LLU WLR Consultation, that Ofcom needed to give proper consideration to the balance between setting a challenging target and allowing BT the opportunity to identify and realise yet further savings.⁵⁵⁰ TalkTalk argued that Ofcom should not need to set a low assumption in order to provide BT cost minimisation incentives because incentives would be provided even with an unachievable target.⁵⁵¹

A16.28 Our view is that we have set a challenging but achievable target. Our intention is not to set a target that will be easy to meet, nor to set a target that would be impossible to outperform. We have drawn from a range of different sources, which we note have been compiled on different bases, and have exercised our regulatory judgment in setting the target based on this information.

Historical Trend Analysis

A16.29 In the July 2013 LLU WLR Consultation, we analysed both historical efficiencies as recorded within Openreach's management accounts and the historical trend of the WLA and WFAEL markets from the Regulatory Financial Statements (RFS). We provisionally concluded that, if past efficiency could be considered to be indicative of savings that might be made in the future, that historical data would imply a range of between 4% and 6%.⁵⁵²

⁵⁴⁹ Since the July 2013 LLU WLR Consultation, adjustments have been made to Openreach's forecasts to align the outputs with our modelling approach. See paragraph A16.44.

⁵⁵⁰ Paragraph 78, page 21, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁵¹ Paragraph 3.8, Page 22, TalkTalk Response to the July 2013 LLU WLR Consultation

⁵⁵² Paragraph A7.27, July 2013 LLU WLR Consultation.

Regulatory Financial Statements

- A16.30 In the July 2013 LLU WLR Consultation, we included an estimate of the average historic operating efficiency costs achieved within the WLA and WFAEL markets, using data from the RFS. This had the advantage of providing an efficiency estimate specific to the market we are interested in. However, it only provided an estimate of operating cost efficiency.
- A16.31 We have repeated our analysis, this time using the Cost Model to derive actual operating cost efficiency for 2010/11 and 2011/12.⁵⁵³ By doing this we ensured that the assumptions used to derive our efficiency estimate were consistent with those adopted in our modelling. We used the Cost Model to estimate cost movements due to volume and input price inflation. We then compared the results with outturn costs, the difference being cost movements due to efficiency.
- A16.32 This approach was similar to that adopted by Oxera in its submissions on behalf of BT, in which the Cost Model was used to estimate the volume impact applicable to the efficiency estimate.
- A16.33 The efficiency estimate derived from the model was then adjusted to account for the recent (April 2014) retrospective reductions in BT's cumulo bill which correspond to this period.⁵⁵⁴ The cumulo adjustment further smoothed the RFS cumulo allocation such that a broadly consistent proportion of the bill was allocated to the WLA and WFAEL markets across the period. This meant that the cumulo estimate included within our efficiency estimate included both the latest changes in BT's bill (applicable to this period) and a smoothed allocation base.⁵⁵⁵
- A16.34 We tested the robustness of our analysis by repeating the calculations for subsets of the total list of cost components (each time including the main cost components e.g. E-side and D-side copper). Our analysis led us to conclude that a reasonable range for past operating cost efficiency from this data source was between 7.5% and 9%. This was based on data between 2009/10 and 2011/12.
- A16.35 In Openreach's response to the July 2013 LLU WLR Consultation, it argued that efficiency estimates at the level of Openreach as a whole were more reliable than market level assessments (such as for the WLA and WFAEL markets).⁵⁵⁶ Openreach considered that estimates at the level of Openreach as a whole were more stable and less likely to be influenced by changes in cost allocation methodologies.
- A16.36 We note that data between 2009/10 and 2011/12 were not restated at either the market or Openreach level and so could be considered to have consistent cost allocation methodologies applied. However market specific data could be influenced by product mix effects across the markets. For example, product growth in markets which share common costs with the WLA and WFAEL markets could cause a shift

⁵⁵³ Our model is based on a base year of 2011/12. See Annex 22.

⁵⁵⁴ These changes are discussed further in Annex 26, paragraphs A26.65 and A26.66.

⁵⁵⁵ A new rating list, the 2010 list, came into force in England, Wales and Scotland on 1st April 2010. BT's allocation methodology meant that the allocation of its cumulo costs in 2010/11, at the start of this new list, was very different to that in 2009/10, at the end of the previous rating list. We do not want to capture this effect as it is the result of differences in cost allocation not cost savings. Hence in our calculations we smooth the effect. This change in BT's allocation of cumulo is discussed in more detail in Annex 26.

⁵⁵⁶ Paragraph 470, Openreach Response to the July LLU WLR Consultation.

in common cost allocations to WLA and WFAEL. This would change the costs in the WLA and WFAEL markets but would not be a result of efficiencies.

- A16.37 We therefore also considered the implicit efficiency from the RFS at an Openreach level. We used the WLA and WFAEL market component volume cost movements as our estimate of the impact of volumes on costs (as in our market level analysis) and applied input price inflation assumptions consistent with our modelling. We also took account of cumulo as described above, this time considering the allocation to Openreach (not just WLA and WFAEL), but excluding NGA.
- A16.38 We estimated that, at the Openreach level, operating cost efficiency for 2010/11 and 2011/12 averaged between 5% and 6.5%. We compared this to Openreach's submissions based on Oxera's analysis⁵⁵⁷ which gave an average of 4.9% for this period. We further removed Oxera's adjustments which excluded cumulo and other savings from the efficiency estimate (i.e. we put these savings back into the estimate) to obtain a figure of 5.9%. We also observed that the declining trend that Openreach highlighted in its response⁵⁵⁸ was a consequence of adjustments made for "other" costs.
- A16.39 We consider that estimates made both at the market level and Openreach level provide valid inputs for our review, however, we accept that there are limitations to both. The market level analysis, whilst theoretically more relevant, may be less reliable due to cost allocation and product mix effects. However, the Openreach level analysis may understate efficiency as it is likely to understate the cost movements due to volumes.⁵⁵⁹ Both estimates (as they rely on the Cost Model) depend on only two data points i.e. the rates of change for 2010/11 and 2011/12.
- A16.40 In conclusion, we believe that if historic efficiencies can be considered indicative of future efficiencies, RFS data implies a range for operating cost efficiencies of 5% to 6.5% (conducting the analysis at an Openreach level) or 7.5% to 9.0% (conducting the analysis at a WLA and WFAEL market level). We place more weight on the analysis conducted at the Openreach level due to concerns of reliability on the WLA and WFAEL market level analysis.⁵⁶⁰

Management Accounts

- A16.41 Openreach's management accounts provided another source of historic data within our July 2013 LLU WLR Consultation. The management accounts record the

⁵⁵⁷ Table 4.1 and Table 4.2 (Oxera historical RFS analysis), Openreach Response to the July LLU WLR Consultation; and Table A1.4 (Openreach (component volume and 'other operating income adjustments)), Oxera, *Assessment of Ofcom's analysis to set the efficiency target. Is the proposed 4–6% range consistent with the evidence?*, Report prepared for BT/Openreach, 25 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Openreach_Annex_C.pdf.

⁵⁵⁸ Paragraph 94, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁵⁹ The WLA and WFAEL markets account for the majority of Openreach's volumes. It also accounts for the majority of Openreach's historic operating costs, although this share has been declining. We therefore consider that whilst the WLA and WFAEL volume effect might be a reasonable proxy for the overall Openreach volume effect, it may understate the level of volume change. The declining cost share would appear to suggest that other volumes are growing at a faster pace. Considering Openreach's product set also supports this view; Ethernet products and NGA products are both going through considerable growth, not all of which will be due to substitution from other products offered by Openreach.

⁵⁶⁰ This estimate is based on operating costs whereas our efficiency estimate is applicable to both operating and capital costs. However as operating costs form the majority of the applicable efficiency cost base we consider this to be useful, if incomplete, information.

annual outturn cash costs incurred by Openreach together with a cost bridge between the years. The bridge accounts for cost movements in terms of “Price” (i.e. inflation) changes, “Volume” effects, “Efficiencies” achieved and “Other” one-off costs. This is referred to as the “PVEO” analysis.

- A16.42 Our analysis, in the 2013 July LLU WLR Consultation, of management account data (for the period 2007/8 to 2011/12) suggested that Openreach had achieved an average annual efficiency rate of 5% if all cost movements were accounted for. When cost movements which BT classified as “one-offs” were excluded the efficiency rate reduced to 4%.⁵⁶¹
- A16.43 In Openreach’s response to that consultation, it argued that efficiency as recorded within the management accounts was “*inconsistent with Ofcom’s modelling approach*”.⁵⁶² Openreach argued that the management accounts efficiency rate should be adjusted to allow for differences in cost movements due to volume differences between the two approaches (i.e. between the management accounts and our modelling). In particular it suggested that the previous 2012/13 efficiency estimate reduced by around 2% when costs were reclassified for these effects.⁵⁶³
- A16.44 We believe that it is appropriate to adjust the management accounts data to align with our modelling: both in terms of volumes, as highlighted by Openreach; but also in terms of inflation. In particular, with regard to volumes, the management accounts record changes in costs due to fault rates as volume driven cost movements. This effect is not captured in the same way in our modelling. Instead, any historic movements in fault rates will be captured in our historic efficiency estimate. This means that, to be consistent with our modelling approach, historic increases in fault rates should be captured as inefficiencies (and decreases captured as efficiencies).
- A16.45 We have obtained under our statutory information gathering powers Openreach’s view of the 2012/13 management account efficiency rate adjusted both for the volume inconsistencies highlighted by Openreach in its response to the July 2013 LLU WLR Consultation, and for differences in inflation between the two approaches. Openreach estimates that, on a consistent basis to our modelling, Openreach’s efficiency in 2012/13 was 4.8%.⁵⁶⁴
- A16.46 Our own analysis of 2012/13 data, accepting Openreach’s volume adjustments, but adjusting for inflation and the April 2013 retrospective changes to BT’s cumulo bill suggests a range between 3.5% and 5.0%, dependent on the treatment of other costs and one-offs. These figures are prepared on the basis of cash costs from Openreach’s management accounts (before the recent re-organisation) which are higher than Openreach’s RFS reported cash costs.
- A16.47 In our July 2012 LLU WLR Consultation we estimated Openreach’s historic efficiency based on a long term trend (from 2007/8 to 2011/12) from management accounts data, adjusted for NGA.⁵⁶⁵ We have extended the data set to 2012/13 on the same basis as the July data, including unsmoothed cumulo within the efficiency estimates. This gives us an historic average estimate (unadjusted for differences in volume, input price inflation and cumulo) of between 5% and 6% dependent on the treatment of other costs. We note that to be consistent with our modelling the data

⁵⁶¹ Paragraph A7.27, July 2013 LLU WLR Consultation.

⁵⁶² Paragraph 80, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁶³ Paragraph 81, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁶⁴ BT’s response dated 21 March 2014 to question 9 of the Nineteenth LLU WLR BT Information Request.

⁵⁶⁵ Paragraph A7.25, July 2013 LLU WLR Consultation.

needs to be adjusted for volumes, inflation and cumulo. In recent years, the differences in volumes (which decrease the efficiency estimate) counter the differences in input price inflation and cumulo (which increase the efficiency estimate). However it is not possible to obtain the data to ascertain on a long term basis what the impact would be to the range. As such we place little weight on this data source.

A16.48 Openreach included Oxera's analysis of BT's management accounts data. We note that they applied the component volume movements and inflation movement as per their RFS analysis. The difference in results between their RFS analysis and Management accounts analysis was a result of comparing different time periods and the different cash costs between the data sources. We consider the RFS data to be most applicable to the efficiency parameter to be used in the Cost Model.

A16.49 In conclusion, we believe that Openreach's management accounts provide a useful data source for understanding Openreach's efficiency. However this data needs to be adjusted to account for differences due to the treatment of volumes and inflation between the management accounts and the Cost Model. Using 2012/13 data we estimate a range of 3.5% and 5.0%, but note that this range is dependent on a number of judgements to align it to our modelling approach.

BT Planning Documents

A16.50 In our July 2013 LLU WLR Consultation we considered both Openreach's short term (2012/13 and 2013/14) and longer term (2014/15 and 2015/16) forecast together with the public statements being made by BT to analysts to provide a view of what BT felt the potential was for future savings. We considered that the sources implied a midpoint of 5% and a range of 4% and 6%.⁵⁶⁶

A16.51 Using our statutory information gathering powers we have obtained an updated forecast (2013/14 to 2016/17) reflecting Openreach's estimate of the efficiencies it can make, consistent with both our inflation and volume assumptions. We have analysed the data to produce our own estimate including adjustments to include efficiencies due to cumulo. We estimate that this data source suggests a range of 4.5% and 6.5%, taking into account the challenging nature of the forecasts and dependent on the treatment of other costs. The longer term forecast (for 2015/16 and 2016/17) is consistent with lower end of this range, and the shorter term with the upper end. However it should be noted that this appears to be, at least in part, a consequence of moving to a different forecasting basis.

A16.52 We believe that BT's forecasts provide a useful input to our efficiency estimate for the Cost Model, and consider that this data source implies a range of 4.5% to 6.5% when adjusted to account for cumulo, input price inflation and volume differences.⁵⁶⁷ We note that these estimates are dependent on adjustments to align with our cost modelling which involves elements of judgement.

⁵⁶⁶ Paragraph A7.36, page 37, July 2013 LLU WLR Consultation.

⁵⁶⁷ The cash costs forecast within the management accounts reflect the new BT organisation structure.

BT Public Statements

- A16.53 In the July 2013 LLU WLR Consultation we set out comments made by BT's Group Finance Director in a presentation to analysts, which described the opportunity for underlying efficiency as material.⁵⁶⁸
- A16.54 In BT's 2012/13 Quarter 4 Results briefing to analysts⁵⁶⁹, BT used an international benchmarking study (in which BT participated in 2011) to identify future cost reduction opportunities of over £1bn for the whole of BT. The £1bn represented the cost gap at that time based on the benchmarking study.
- A16.55 BT further referenced the network business as being an area in which efficiency gains are expected. In particular, the presentation and international benchmarking study recognised cost gaps in the areas of "Technical services" and "Network operations" which were identified as being in the 2nd and 4th quartiles respectively in 2011.⁵⁷⁰ These areas account for the majority of Openreach's costs.
- A16.56 In its response to our July 2013 LLU WLR Consultation, Openreach argued that the BT analyst briefing did not support our proposed baseline efficiency target of 5% because a 5% target implied total savings of £2.8bn over the charge control period (not £1bn).⁵⁷¹ Openreach also noted that the external benchmarks used by BT, to which we refer, give weight to financial measures and are therefore not relevant to Ofcom's review.⁵⁷²
- A16.57 We consider that the international benchmarks are relevant because BT refers to them in its statements on potential cost savings.⁵⁷³ We also consider that £1bn represents only a proportion of the efficiencies that BT identified in its briefing. In particular, BT's Group Finance Director made reference to frontier shift efficiencies⁵⁷⁴, additional efficiencies beyond the £1bn⁵⁷⁵ and said that the benchmark on which the calculation was based was "*not a great benchmark because the industry is not efficient in some of these areas.*"⁵⁷⁶
- A16.58 Interpreting the Group Finance Director's comments, we calculate that the efficiency estimate described equates to an annual efficiency rate for our charge control of

⁵⁶⁸ Paragraph A7.33, Page 37, Annexes, July 2013 LLU WLR Consultation.

⁵⁶⁹ Slide 5, BT, *Q4/full year 2012/13 results and business update – Part 2*, 10 May 2013, www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_slides_update_part2.pdf.

⁵⁷⁰ Slide 5, BT, *Q4/full year 2012/13 results and business update – Part 2*, 10 May 2013, www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_slides_update_part2.pdf.

⁵⁷¹ Footnote 37, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁷² Paragraph 88, page 23, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁷³ Page 1, BT, *Q4 2012/13 Results Presentation Transcript - Part 2*, 10 May 2013, http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_transcript2.pdf.

⁵⁷⁴ Page 9, BT, *Q4 2012/13 Results Presentation Transcript - Part 2*, 10 May 2013, http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_transcript2.pdf: "...I gave you those numbers, that's assuming everyone stands still. Now, I should have made it clear the market moves on, people get more efficient".

⁵⁷⁵ Page 12, BT, *Q4 2012/13 Results Presentation Transcript - Part 2*, 10 May 2013, http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_transcript2.pdf: "... We will swallow the impact of inflation going forward as well, and when we talk about cost savings of a billion, the billion is in relation to where it is now. If inflation comes along, we'll swallow that in terms of further efficiencies."

⁵⁷⁶ Page 2, BT, *Q4 2012/13 Results Presentation Transcript - Part 2*, 10 May 2013, http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_transcript2.pdf

between 4% and 4.5%. (This includes catch-up efficiencies, quantified to be £1bn in 2012/13, achieved over three years⁵⁷⁷, combined with additional efficiencies offsetting inflation; these may consist of both frontier shift and catch-up efficiencies).

- A16.59 BT's Group Finance Director stated that "*when we talk about cost savings of a billion, the billion is in relation to where it is now*" and categorically stated that inflation would also be offset. Volume impacts and costs of achieving efficiencies were not explicitly discussed and it is not clear whether the end result of £1bn had been estimated net of their impact or otherwise. Further, the data presented was BT specific, although we observe that Openreach's costs were identified as areas where cost gaps exist through both the benchmarking and the briefing. The benchmarks were also referred to as not being efficient, which implies that we should also expect some further scope for catch-up.
- A16.60 TalkTalk argued in its response to BT's response to our July 2013 LLU WLR Consultation⁵⁷⁸ that the £1bn of savings identified by BT was in line with a 7% to 9% efficiency improvement per annum. The higher estimate of 7% (compared to our estimate of 4.5%) was a result of TalkTalk interpreting the data such that additional frontier shift efficiencies could be had in addition to BT achieving a £1bn nominal reduction in costs. Our interpretation is that such a frontier shift is included in the nominal cost reduction.
- A16.61 TalkTalk further argued that the applicable figure should be higher than 7% (potentially up to 9%), to take into account that the benchmarking data was based on monopoly incumbents not operating in fully competitive markets and that BT had indicated that greater than average savings were available to Openreach.
- A16.62 Overall, we conclude that BT's public statements and interpretation of an international benchmarking report suggests that there are efficiency savings to be had of between 4% and 4.5%. Of significance to our analysis, and on which we place great weight, is the evidence it provides that there are still significant catch-up efficiencies to be made by BT, and by Openreach in particular. The figure itself is subject to considerable assumptions, is based on BT rather than Openreach data, and may not take into account the costs of achieving efficiencies, volume impacts or limitations in the benchmarked data set. However, due to its use of data external to BT we consider it a useful input to our range, but place less weight on it than other sources.

Analyst Reports

- A16.63 In the July 2013 LLU WLR Consultation we set out statements made by industry analysts concerning BT's future costs. We found that these statements appeared positive about BT's ability to continue to reduce costs but that this might be increasingly difficult to achieve. We noted that this view was consistent with BT's public statements.⁵⁷⁹
- A16.64 Openreach stated that, because the analyst reports used by Ofcom derive largely from BT's public statements, this was not a new separate source of exogenous

⁵⁷⁷ Page 1, BT, Q4 2012/13 Results Presentation Transcript - Part 2, 10 May 2013, http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_transcript2.pdf "*there are plenty more opportunities . . . over the course of the next three years*".

⁵⁷⁸ Paragraph 3.39, pages 15-16, TalkTalk Comments on BT response to the July 2013 LLU WLR Consultation.

⁵⁷⁹ Paragraph A7.42, page 38, Annexes, July 2013 LLU WLR Consultation.

data.⁵⁸⁰ We recognise that these statements are analysts' views and are likely to be based predominantly on BT's public statements. However, these views reveal the level of confidence that external analysts have in BT's public statements and as such we consider them a relevant source of information.

A16.65 Since the July 2013 LLU WLR Consultation, we have also reviewed more recent analyst statements, which we found are consistent with those previously cited. We have also considered the analyst consensus forecasts which Openreach cited in its response.

A16.66 Analyst consensus forecasts are published by BT on a quarterly basis and set out the results of a poll of analysts' views carried out by BT's investor relations team.⁵⁸¹

A16.67 The pre-Q2 2013/14 forecast⁵⁸², cited by Openreach, forecasts a decline in nominal operating costs to 2016/17 of just under 1% over the whole period⁵⁸³ which Openreach interpreted as "aggregate cost savings in line with inflation (c. 2.3% measured against CPI; or c. 3% against RPI)".^{584, 585} We note that the forecast is over a four year period during which costs are forecast to fall in the first two years, rising in the latter two years. For example, over the first two years of the period the annualised change in forecast costs is -1% p.a. (compared to -0.2% p.a. over four years).

A16.68 We consider that shorter term forecasts are likely to be more reliable in general and in particular we note that published analysts' forecasts generally focus on shorter periods.^{586, 587}

A16.69 We also note that analyst consensus forecasts are not directly comparable to our efficiency target because they do not include the effect of volume changes or capex efficiency.

A16.70 Including adjustments for the impact of inflation and volumes consistent with the Cost Model, and considering the most recent consensus forecasts we estimate that analyst⁵⁸⁸ forecasts support an efficiency range of 3.5% to 4.0%.

A16.71 We note that the estimate is based on operating costs and excludes capital costs. Openreach stated in its response to the July 2013 LLU WLR Consultation that its

⁵⁸⁰ Paragraph 90, page 78, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁸¹ ✂

⁵⁸² BT, *BT Pre Q2 2013-14 Consensus*, 25 July 2013, <https://www.btplc.com/Sharesandperformance/Quarterlyresults/Quarterlyresults.htm>.

⁵⁸³ An annualised rate of decline of -0.2%.

⁵⁸⁴ Paragraphs 491 to 492, pages 78 to 79, Openreach Response to the July 2013 LLU WLR Consultation.

⁵⁸⁵ The most recent consensus forecasts shows a nominal increase in operating costs over the same period of just over 1% indicating a lower forecast real terms operating cost efficiency. BT, *BT Pre-Q4 2013-14 Consensus*, 31 January 2014, <https://www.btplc.com/Sharesandperformance/Quarterlyresults/Quarterlyresults.htm>.

⁵⁸⁶ BT Group consensus forecast published by Bloomberg shows that one and two year forecasts are published by 18 analysts but the four year ahead forecast is only published by seven analysts. Based on Bloomberg, Best Consensus Detail, EBITDA, 08 January 2014.

⁵⁸⁷ BT's pre Q2 2013/14 consensus forecast was based on 14 analysts' forecasts in 2013/14 falling to 11 in 2016/17. See BT's response dated 10 February to question 5 of the Fifteenth LLU WLR BT Information Request.

⁵⁸⁸ BT, *BT Pre-Q4 2013-14 Consensus*, 31 January 2014, <https://www.btplc.com/Sharesandperformance/Quarterlyresults/Quarterlyresults.htm>.

opex efficiency was lower than efficiency generated on capex.⁵⁸⁹ This would imply that the combined efficiency would be higher than the opex efficiency. However, more recent submissions of Openreach's forecast management accounts data, adjusted to align with our modelling approach, show higher operating cost efficiencies forecast than capital cost efficiencies (see paragraph A16.91), implying the forecast combined efficiency would be lower. On balance, we consider that information on operating cost efficiency is useful for our efficiency target, while recognising that it does not capture the impact of capex efficiencies.

A16.72 Overall, we conclude that analyst statements support the view that BT will continue to reduce costs. We note that they also suggest that this may be increasingly difficult to achieve. We believe this data source suggests an efficiency range of 3.5% to 4%.⁵⁹⁰

Deloitte benchmarking report

A16.73 As part of its response to our July 2013 LLU WLR Consultation, Openreach submitted a report by Deloitte⁵⁹¹ which analysed the comparative efficiency of BT's Network Business. The report compared BT against a group of seven international operators⁵⁹² over the period 2005 to 2011. It found that BT was the most efficient operator within the sample, in terms of network operations, and that there was no shift in the cost frontier over time in nominal terms. Openreach cited the findings of this report in its response to our July 2013 LLU WLR Consultation stating that the study implied that there was no potential for catch-up efficiency and that the trend rate of efficiency improvement was between 2.5% to 3.5% per annum.^{593 594}

A16.74 We consider this result in the context of BT statements made to analysts (see from paragraph A16.53 above) regarding the efficiency gains which BT expected to realise. These statements appear to contradict the conclusions of the BT commissioned Deloitte Report. We note that although the public statements made relate to BT as a whole, and the Deloitte Report relates to BT's network business, the public statements reference the network business as being an area in which gains are expected.⁵⁹⁵

A16.75 We consider that the Deloitte report has limitations, which relate to the approach and dataset. The approach seeks to improve on a similar study carried out by Deloitte in 2012⁵⁹⁶ by addressing concerns raised by Ofcom.⁵⁹⁷ These concerns

⁵⁸⁹ Paragraph 96, Openreach Response to July 2013 Consultation.

⁵⁹⁰ The consensus forecasts provide analysts' views of Openreach's future cost reductions. The level to which they include reductions in BT's cumulo bill is unclear. The forecasts pre-date the retrospective revisions to BT's cumulo bill which reduced Openreach's cost base but applied to historic costs. We have included these reductions in our estimates of historic data including 2012/13.

⁵⁹¹ Deloitte, *Analysis of the Efficiency of BT's Regulated Operations*, 19 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/responses/BT_Deloitte_Report.pdf.

⁵⁹² BT is compared against BTC/Vivacom, Eircom, Etisalat, France Telecom, Telecom Italia, Telefonica Spain, and Telekom South Africa.

⁵⁹³ Paragraph 481, page 77, Openreach Response to the July 2013 LLU WLR Consultation. Note: BT refer to the upper bound as both 3.5% (paragraph 481) and 3% (paragraph 89 and table 2).

⁵⁹⁴ Using consistent assumptions to the Cost Model we estimate historic inflation for the period 2008/09 to 2011/12 at 3.2% which is at the upper end of the range cited by Openreach.

⁵⁹⁵ <.

⁵⁹⁶ Deloitte, *Analysis of the Efficiency of BT's Regulated Operations. A report for BT*, 16 February 2012.

⁵⁹⁷ Paragraph A5.77, page 32, Ofcom, *Leased Lines Charge Control. Proposals for a new charge control framework for certain leased lines services - Consultation*, 5 July 2012,

were that the number of observations in the original model was low relative to the number of explanatory variables, resulting in a model that could be over-fitted. Ofcom also noted that the structure of the model, which pooled the observations into one dataset, required that any element of an operator's cost which was unique to that operator and fixed over time was unrelated to all the explanatory variables in the equation. We considered that there were a number of reasons why this assumption might not hold.⁵⁹⁸

- A16.76 The updated report uses different techniques on an augmented data set; however, we have similar concerns to those raised with the earlier report. Whilst the sample size has increased, it remains small for the model being estimated. Panel data techniques typically require a large number of observations in either the time series or the cross section; this data set has eight panel observations and six time series observations.
- A16.77 The report uses a panel-based stochastic frontier approach to the econometric estimation. This approach allows for company-specific inefficiency to enter the model and explicitly recognises the panel structure of the data (in contrast to the previous pooled approach). However, it still places a strong requirement on the data for consistent estimation of parameters, namely that the company-specific inefficiency term is uncorrelated with the explanatory variables. As in the previous version of this report we consider that there are a number of reasons why this assumption might not hold; for example, larger firms may be systematically more (or less) efficient in their use of inputs.
- A16.78 Overall, we consider that the Deloitte report has significant limitations, and so place little weight on it in our consideration of an appropriate efficiency target. The updated study does not address the concerns we raised with the earlier Deloitte report and appears to (indirectly) contradict BT public statements that in 2012/13 there were potential catch-up efficiency gains which BT expected to realise.

European Price Trends

- A16.79 As a further exogenous source we have looked at trends in prices over time for LLU and WLR services for Western European countries. This analysis showed that, in real terms, Western European LLU rental charges have fallen by an average of 5% per annum over the last ten years.⁵⁹⁹ Recognising that LLU prices may have been particularly variable in the early part of the period, we have also considered the average change in prices across Europe for the last five years. This shows an average real decline of 3% for LLU prices and 0% for WLR prices, but with high variability between countries.
- A16.80 Though we recognise that prices can only be considered as a broad proxy for costs, we consider that looking at trends in prices may be useful in indicating trends in underlying costs since prices are generally regulated in line with costs. However, we do not regard it as meaningful to compare the absolute price levels between

www.stakeholders.ofcom.org.uk/binaries/consultations/llcc-2012/summary/LLCC_2012.pdf (2012 Leased Lines Charge Control Consultation).

⁵⁹⁸ Paragraph A5.77, Page 32, 2012 Leased Lines Charge Control Consultation.

⁵⁹⁹ Data provided by Cullen International on monthly fees in real terms (calculated using consumer price indices). Average calculated by Ofcom, using the geometric mean. WLR price data not available over a 10 year period.

countries in an efficiency study, as they will be affected by different cost drivers between countries, such as differences in topology and average pay levels.⁶⁰⁰

A16.81 We conclude that, if the price changes exhibited could be considered consistent with cost changes, this would suggest historic average real reductions of 0% to 5% per annum. While we do not place much weight on this figure in informing our range, we observe that the data broadly correlate with the findings from our other data sources.

Other benchmarking ✕

A16.82 ✕⁶⁰¹

A16.83 ✕⁶⁰²

A16.84 ✕⁶⁰³

A16.85 ✕

A16.86 We consider this report provides a useful external source of benchmarking data. The report identifies ✕

Modelling Efficiency

Separate efficiency targets

A16.87 In our July 2013 LLU WLR Consultation, we proposed a single efficiency target based on total cash costs and so incorporating savings in both operating costs (opex) and capital expenditure (capex).

A16.88 Openreach stated in its response to the July 2013 LLU WLR Consultation that Ofcom should set separate opex and capex efficiency targets because it was clear from the evidence provided that Openreach had achieved a lower rate of efficiency on opex and that this would result in a material understatement of efficiently incurred costs.⁶⁰⁴ Openreach attributed this under-recovery to the way Ofcom's model amortised the higher efficiency being generated on capital expenditure over the life of the assets whereas operating cost efficiencies fed directly into forecast unit costs.⁶⁰⁵

A16.89 Openreach illustrated this point through a stylised example and also calculated that applying an average efficiency rate rather than applying a separate opex and capex

⁶⁰⁰ We also note this data relates to prices of monthly rental charges; activations, connections and one-off fees were not included.

⁶⁰¹ ✕

⁶⁰² ✕

⁶⁰³ ✕

⁶⁰⁴ Paragraphs 438 and 446, pages 70 and 72, Openreach Response to the July 2013 LLU WLR Consultation.

⁶⁰⁵ Ofcom's Cost Model forecasts opex and capex (cash costs) taking into account expected cash cost efficiency gains. It then converts post-efficiency cash costs over the charge control period into accounting costs which are used to create the outputs of the model and are the basis of the charge control.

efficiency rate would lead to an under-recovery of c. £85m over the life of the control.⁶⁰⁶

A16.90 EE also commented on separate opex/capex targets saying that it made sense to set a single target and that Ofcom should not be micro-managing the extent to which such gains can be achieved from different types of costs.⁶⁰⁷ Further, other stakeholders, including Verizon, supported a single combined target (see Paragraph A16.16).

A16.91 We recognise that the efficiency rate affects opex and capital costs in different ways and, as a result, a split rate, with different levels of opex and capex efficiency, could lead to a different outcome for prices over the charge control period. However, as noted in the July 2013 LLU WLR Consultation, the application of the efficiency target is consistent with the way it has been derived.⁶⁰⁸ We also continue to believe that setting two separate targets would introduce complexity without giving a more robust outcome. We note that:

- Openreach's own management account data is the only source that provides separate opex and capex efficiencies. Other non-BT data sources do not provide a comparison for Openreach's opex/capex efficiency split. For example, benchmarking data is based on either accounting costs or opex including capitalised labour i.e. including only some capex. As a result, Ofcom would find it difficult to verify the robustness of the split of efficiency between opex and capex stated by Openreach.
- Openreach's forecast management accounts data, adjusted to align with our modelling approach, shows higher operating cost efficiencies forecast than capital cost efficiencies i.e. the opposite effect to that outlined by Openreach in its response.⁶⁰⁹
- Moreover, going forward, BT has some discretion to substitute capex for opex (and vice versa) and our primary objective is that overall costs are minimised, subject to delivering output to at least the minimum level of quality, and not the precise inputs used to deliver the output.

A16.92 In conclusion we believe that our approach of adopting a single efficiency rate is appropriate in the present context. We believe that the adoption of a single rate minimises the complexity of a target which already relies on judgement and avoids the need for Ofcom to specify the precise inputs used to deliver efficiency savings, particularly when those inputs are, to a degree, substitutable.

Other Issues

A16.93 Vodafone argued for a higher efficiency rate on the basis that BT had achieved super-normal profits over the past six years, part of which it alleged was "*attributable to BT beating low efficiency assumptions set in charge controls over that period*".⁶¹⁰ To evidence the alleged super-normal profits Vodafone submitted a

⁶⁰⁶ ✂

⁶⁰⁷ Page 32, EE Response to the July 2013 LLU WLR Consultation.

⁶⁰⁸ Paragraph A7.15, page 35, Annexes, July 2013 LLU WLR Consultation.

⁶⁰⁹ Paragraph 439, Openreach Response to the July 2013 LLU WLR Consultation.

⁶¹⁰ Page 13, Vodafone Response to the July 2013 LLU WLR Consultation.

report by Frontier Economics which calculated that BT had achieved returns significantly above its WACC.⁶¹¹

- A16.94 We consider that there may be many reasons why BT achieved returns above its WACC when analysed in this way. Of key relevance is our approach to regulation which uses price caps rather than rate of return regulation. This approach may lead to returns above the WACC ex-post, but provides incentives on BT to beat charge controls by cutting costs. Further we note that Frontier Economics' calculations do not identify significant returns over the WACC in the WLA / WFAEL markets. Therefore we do not consider that this provides us with evidence to “select the highest efficiency factor” in the range as Vodafone suggested.⁶¹²
- A16.95 Vodafone further argued that a proportion of BT's labour costs were inefficient and should be completely removed from the Cost Model. Vodafone submitted a paper by UKCTA which identified the inefficient labour cost items to be ✂.⁶¹³
- A16.96 We disagree with this proposal. Our approach for these charge controls has been to model BT's existing costs and project efficiency savings, which implicitly includes labour efficiencies. Within the framework of a top-down cost model, we have not made a bottom-up assessment of particular areas of cost savings. Instead we start from aggregate top-down cost information and apply an overall efficiency factor to remove aggregate level inefficiencies but capture sector-wide expected gains in productivity. This fits with the principle that the incentives inherent in price-cap regulation should drive greater efficiencies over time, and avoids the regulator micro-managing how particular efficiencies should be realised, particularly as the regulated firm is typically best placed to decide how to use different inputs most efficiently.
- A16.97 However, we have reviewed the UKCTA paper and consider that it does not provide us with evidence to warrant a change in approach. Our assessment of BT's pay is included in Annex 13 where we conclude that it is not out of line with industry comparators.

Conclusion

- A16.98 We have concluded that a single efficiency rate of 5% p.a. is an appropriate assumption for our cost modelling. We consider that this provides a challenging but achievable target which includes all sources of efficiency savings, including future cumulo cost reductions and also the cost of achieving the savings.
- A16.99 In reaching our conclusion we have relied on the numerous data sources set out in this annex, including data generated by Openreach and external data sources. As set out above, we have drawn a conclusion on the efficiency range implied by each individual data source. In taking account of the range implied by each data source we have considered the extent to which they are applicable to the Cost Model and the level to which they may be considered independent of BT. This has informed the weighting we have placed on each source in formulating our conclusions. We have also considered whether the data source might be interpreted as producing low or high estimates.

⁶¹¹ Frontier Economics, *The Profitability of BT's Regulated Services. A report prepared for Vodafone*, November 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Vodafone_Frontier_Economics_report.pdf

⁶¹² Page 13, Vodafone Response to the July 2013 LLU WLR Consultation.

⁶¹³ ✂

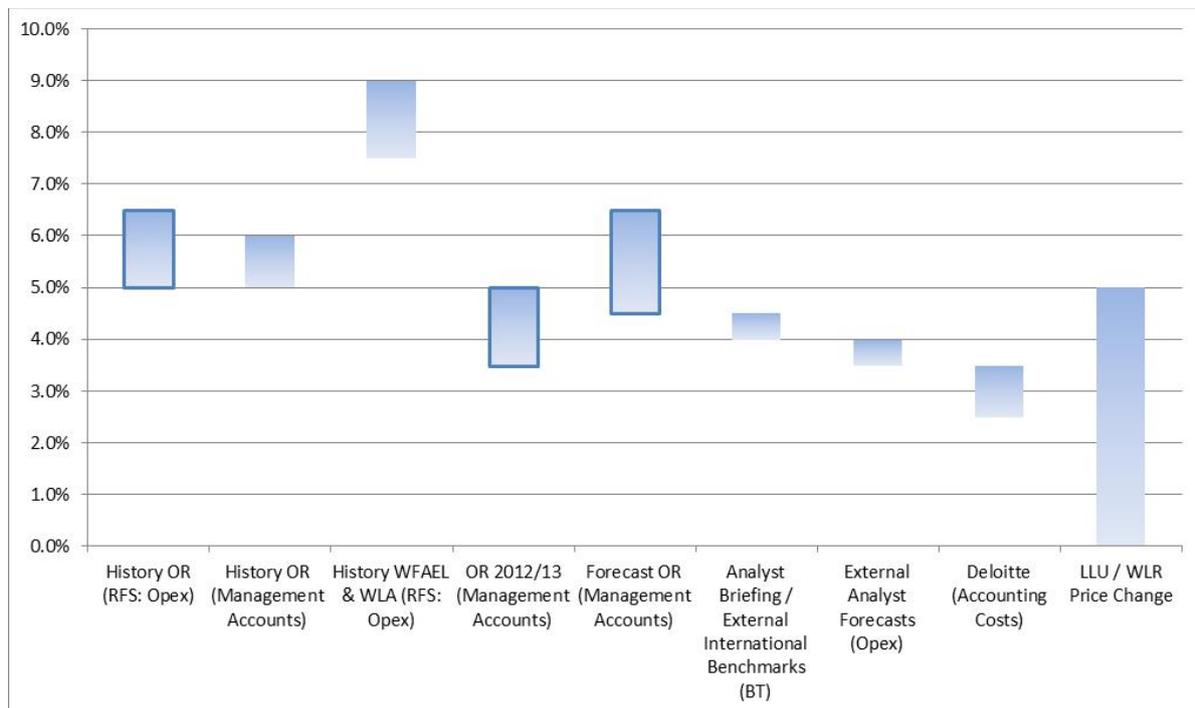
A16.100 We take account of projected changes in cumulo costs through the single weighted average efficiency gain assumption applied to all costs in the Cost Model, including cumulo costs. The data sources used to inform our decision on the appropriate efficiency target treat cumulo costs as follows:

- Historic data sources include past reductions in cumulo costs, adjusted to account for the recent retrospective changes in BT’s Rateable Value. They further smooth for allocation changes relating to timings of changes in ratings lists;
- Forecast data sources include our own projection of future cumulo cost reductions taking into account the recent changes; and,
- Our interpretation of analysts’ briefings, international benchmarks and external analysts’ forecasts is that these are unlikely to include any explicit allowance for future cumulo cost reductions since analysts are concerned with a more high-level view of overall costs and likely cost savings.

We take these different treatments into account when we interpret the ranges of estimates drawn from each source.

A16.101 The data sources which imply ranges are summarised in the chart below. More weighting was placed on the ranges with a border, whilst the other data sources, helped inform our range and interpretation.

Figure A16.1: Summary of Efficiency Data Sources



Source: Ofcom.

A16.102 A figure of 5% is consistent with our key sources: Openreach historic data (from the RFS, consistent with our cost modelling approach), Openreach’s latest outturn data for 2012/13 (from the management accounts, adjusted to be comparable with our cost modelling) and Openreach’s own forecast efficiencies from its management

accounts, again adjusted for consistency. We note that two sources implied a range substantively above the 5% and one below.

- A16.103 Using the other sources to inform our range, whilst we felt the WFAEL/WLA historic RFS estimates were too high, they provided some evidence in support of our view that Openreach estimates (using WLA/WFAEL volume movements) might provide lower estimates than market-specific estimates. Similarly, we were reluctant to place too much weight on the estimates from the analyst briefing utilising international benchmarking. However we placed weight on BT's interpretation of the benchmarking report as highlighting that BT could make considerable catch-up efficiencies, which appeared to contradict the Deloitte study.
- A16.104 We have further considered whether the other data sources imply that we should move from this position. Our conclusion is that 5% represents a reasonable balance. Market specific data appeared to be higher and external data sources lower. In terms of the external sources, we have placed greater weight on the use of the international benchmark report used in the briefing to analysts than the Deloitte study. We have placed limited weight on the LLU / WLR price change data.
- A16.105 We have also considered additional data sources to those shown in the chart, such as the \mathcal{X} benchmarking study, which informed our estimate but did not directly provide a figure. This provided updated information that \mathcal{X} .
- A16.106 We have also given consideration to stakeholders' concerns about BT's incentives to downplay the efficiency estimate. Similarly, we considered BT's arguments that efficiencies will be increasingly difficult to achieve to be reasonable.
- A16.107 Overall, having regard to our interpretation of each of the data sources, we believe that a target of 5% for our charge control reflects these data and sets the right balance of producing a challenging but achievable target.

Annex 17

Service Quality Modelling

Introduction

A17.1 This annex describes our consideration of a model (the Resource Simulation Model) commissioned by Openreach from Ernst and Young (EY) to explore the relationship between QoS and resources for its main services (MPF, analogue and digital WLR, SMPF and GEA). We consider the Resource Simulation Model and the resource estimates for performance improvements produced by the model in light of:

- A review of the model commissioned by Ofcom from consultants Analysys Mason (AM, QoS Model Report). The report was published in conjunction with the December 2013 LLU WLR Consultation at Annex 9.
- Stakeholder responses to the December 2013 LLU WLR Consultation. These included three consultant reports submitted by stakeholders:
 - Frontier Economics, Review of the DES Model – a report commissioned jointly by Sky and TalkTalk;
 - Alix Partners, QoS Report – a report commissioned by Sky; and
 - EY, Response to comments on the DES Model – a report commissioned by Openreach.
- A further report commissioned by Ofcom from Analysys Mason which addresses certain issues arising from the responses to the December 2013 LLU WLR Consultation (AM Comments on QoS Model Consultation Responses). At Annex 18 to this Statement.

A17.2 This annex also describes our further analysis of the relationship between Openreach's performance and resources that we have used to inform our assessment of the Resource Simulation Model and the resource estimates.

Further Ofcom analysis of the relationship between performance and resources

Background

A17.3 In the July 2013 FAMR Consultation we explained that we had undertaken our own analysis of the relationship between engineering resource requirements and service levels and had concluded that the relationship is likely to be non-linear to some extent because Openreach is essentially a queue-based organisation at the operational level.⁶¹⁴

A17.4 We explained that as part of our work we had considered a range of analysis techniques to investigate the relationship between service performance, fault/order volumes and engineering resources in order to derive our own estimate of the

⁶¹⁴ Paragraphs A10.19 to A10.30, *Ofcom, July 2013 FAMR Consultation* - Annex 10.

resource increments associated with service quality improvements. The techniques we considered included:

- simple measures of changes in demand levels and resource volumes;
- using relationships between performance, demand and resource levels derived from theoretical models of queue based organisations;
- simple regression of the performance and resource data (to derive a relationship between them); and
- our own discrete event simulation modelling of Openreach's operations of varying degrees of detail.

A17.5 We obtained information from BT under statutory powers to support these analyses. We found, however, that there were significant limitations in the period of time over which the key performance and related data had been retained by BT. This limited our ability to estimate the resource impacts of service changes for the purposes of the July 2013 Consultation in that we were only able to obtain comprehensive data relating to the last two years. We concluded that even with a more comprehensive dataset, there were limitations to the insights that these analysis techniques could give. Consequently, our view was that a very much more detailed approach to the analysis based on simulation techniques was preferable.

Our further analysis

A17.6 After the July 2013 FAMR Consultation we undertook further analysis to investigate the relationship between service performance, fault/order volumes and engineering resources in order to derive our own estimate of the resource increments associated with service quality improvements. This produced some useful findings which can inform our consideration of the estimates produced by the Resource Simulation Model. In particular:

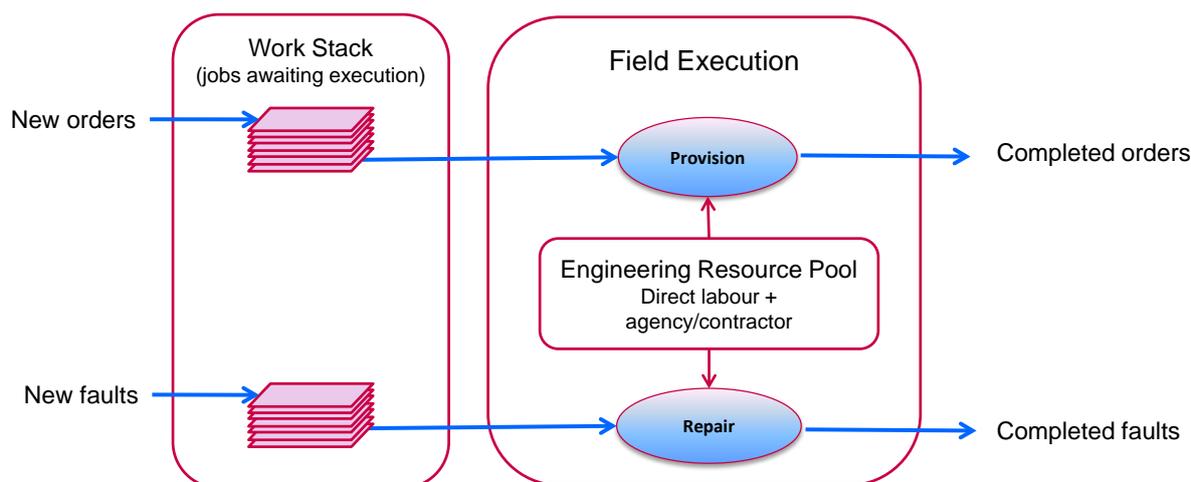
- a further study of the theoretical relationship between resources, demand and performance has provided useful insights about the likely scale of the resource increments required to improve service quality; and
- further analysis of the BT data using simple queuing formulae for the relationship between performance and resourcing has also provided useful insights about the likely scale of resource increments required to improve service quality.

A17.7 We describe our analysis below.

Relationship between demand, resources and performance

A17.8 Figure A17.1 shows a simplified process model of Openreach's field operations.

Figure A17.1: Simplified process model for Openreach



A17.9 As new orders and faults arrive, they are placed in a work stack awaiting execution. Work is undertaken in order of arrival and thus orders and faults are taken from the bottom of the work stack for field execution (subject to necessary prioritisation e.g. by service level).

A17.10 Appointed orders are executed on the appointment date and the work stack is controlled by means of an appointment book which is populated with appointment slots that reflect the volume of field resources that will be made available each day for provisioning work. In normal circumstances sufficient resources are made available to meet provision demand. When fault rates are high, the number of appointment slots can be reduced and resources diverted to repair work and appointment lead times allowed to extend.

A17.11 The primary determinant of the process performance is the balance between the volume of work to be undertaken and the resources available to undertake it.

A17.12 When sufficient resources are available, it should be possible to achieve a high quality of service (i.e. to complete the vast majority of faults and orders successfully within the agreed timescales). In practice, a small minority of faults and orders will not be completed successfully for example because of errors or because some jobs are too large to complete within the agreed timescales. Openreach's past performance suggests that when well resourced, Openreach can complete over 90% of orders and over 80% of faults successfully.⁶¹⁵

A17.13 If work volumes exceed the capacity of the engineering resources available then performance will inevitably suffer. For example faults will not all be repaired within the target time and provisioning lead times will be extended.

A17.14 A particular feature of such processes is that after a period of excess demand, performance will not be fully restored until the backlog of work in the work stack has been cleared. Whilst the backlog exists, all incoming work will spend longer than

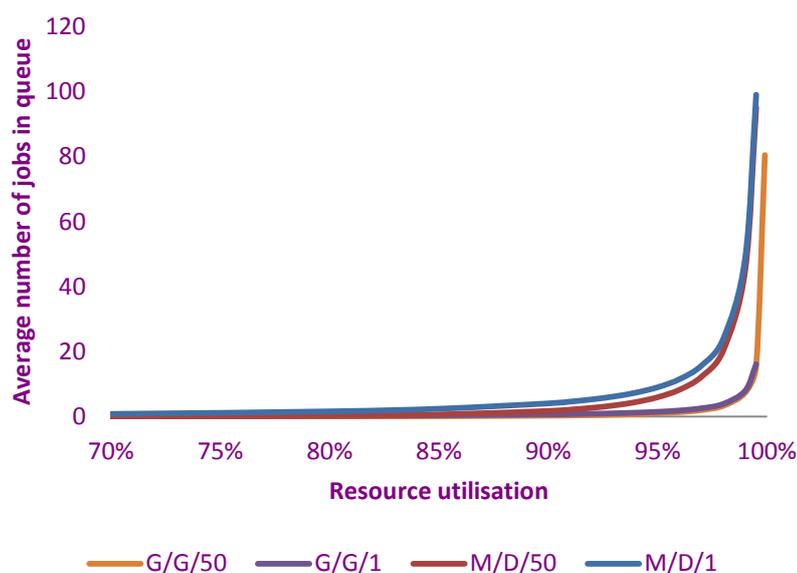
⁶¹⁵ For example, in 2009/10, completion of WLR orders by the appointment date was consistently above 94% and completion of MPF and SMPF orders consistently above 90%. See July 2013 FAMR Consultation paragraphs A9.27 to A9.29. In 2009/10, completion of WLR Service Level 1 faults within the SLA timescales was generally above 80% and completion of MPF and SMPF Service Level 2 faults within the SLA timescales was at or above 80%. See paragraphs A9.33-A9.35, Ofcom, *July 2013 FAMR Consultation - Annex 9*.

normal in the work stack waiting for resources to become available and consequently performance is impaired on an on-going basis until the backlog is cleared. This feature means that performance is highly sensitive to the level of resources available to meet demand. In particular, performance is sensitive in the following ways:

- Sensitivity to peaks in demand: the time taken to clear a backlog of work generated by a short term peak in demand will depend on the amount of spare capacity available once demand has fallen back to normal levels. For example, if an organisation is presented with a peak of work 20% above normal for one week after which volumes return to normal, the backlog could be cleared and performance restored in approximately 1 week if the organisation has 10% spare capacity at normal volumes. However, if it has only 2% spare capacity the backlog would take approximately 5 weeks to clear. In the extreme, if the organisation has no spare capacity, performance would not be restored unless demand falls below normal.
- Cumulative impact of small resource shortfalls: a small shortfall in resources relative to demand that persists over an extended period will cause the work stack to steadily increase and will consequently have a large impact on performance. For example if 10% of provision resources are diverted to repair activities for an extended period, assuming constant provision demand, order lead times would extend by 0.5 day per week and 2 days over a month.

A17.15 Operational processes of this type are known generically as queuing models and have been subject to detailed theoretical study. The sensitivity of performance to the level of resources is also evident in theoretical resource utilisation curves for such queuing models. Figure A17.2 below shows the theoretical relationship between resource utilisation and the average number of jobs queued for a selection of queuing models.

Figure A17.2: Theoretical performance for a sample of queuing models⁶¹⁶



Source: Ofcom

A17.16 Figure A17.2 shows that the number of jobs queued rises sharply as resource utilisation passes a certain threshold (e.g. beyond about 95% in the examples in Figure A17.2). The number of jobs in the queue also has a direct bearing on cycle time (i.e. the overall elapsed time from the arrival of a work item to when it is completed) and therefore performance against cycle time SLAs.⁶¹⁷

A17.17 Clearly, at high levels of resource utilisation the queue length (and therefore performance) will be very sensitive to small variations in resource utilisation that might arise because of variations in work volumes and resource levels.

Practical considerations

A17.18 In practice, Openreach operates a large number of work queues for orders and faults (reflecting the geographic areas normally covered by teams of technicians and a range of differently skilled engineers required for the work) and thus the observed national performance reflects the overall average achievement for the full group of queues rather than an individual queue as in the theoretical example above.

⁶¹⁶ Figure A17.2 portrays the theoretical performance for queuing systems consisting of a single queue served by one or 50 servers ($k=1$ or 50). The G/G/ k curves assume a generalised probability distribution for both inter-arrival time (the time between jobs arriving) and service time (the time taken to execute jobs). In the G/G/ k case the distribution of queue length and associated statistics (mean, variance, etc.) are insensitive to the probability distribution of the inter-arrival time and service time. The curves are theoretical approximations as exact solutions are not available in most cases (see Dennis E. Blumenfeld, *Operations Research Calculations Handbook*, second edition, CRC Press, 2012). The G/G/ k curves are for an arrival coefficient of variation (CV) of 0.4 and a service CV of 0.05, values derived from the resource and volume data obtained under our statutory powers. Coefficient of variation is the standard deviation divided by the mean of the sample data. The M/D/ k curves assume an exponential inter arrival time distribution (Poisson arrival process) and a constant service time.

⁶¹⁷ In a single server scenario a queue length of 16 jobs indicates a cycle time equivalent to the time taken by the server to complete 16 jobs in the queue plus the time taken to service the job in the server (e.g. if the server completes 4 jobs per day, the cycle time would be 4.25 days to complete the 17 jobs).

A17.19 In practice, the demand patterns faced by Openreach are also more complex and vary from day to day as well as seasonally and from region to region.

A17.20 Openreach also has a significant amount of flexibility to manage its resources to meet demand. For example:

- Periods of low demand can be used to reduce or eliminate backlogs built up in periods of high demand provided resources are not reduced in line with the demand reductions. Sustaining resource levels can also be used to keep order and fault lead times low under normal circumstances to make performance more resilient to peaks of demand.
- Preventative maintenance work can be undertaken in periods of low demand to keep staff fully utilised that are not immediately required for provision and repair work. Preventative maintenance should reduce fault volumes.
- The level of resources available for repair can be increased during periods of high demand by:
 - redeploying staff from preventative maintenance activities;
 - using overtime;
 - by moving staff from areas with low demand to areas with high demand;
 - temporarily extending order appointment lead times within the range permitted by the SLA in order to redeploy field staff to repair activities;
 - using contractors; and
 - recruiting additional staff.

A17.21 Given this flexibility we would expect performance to be somewhat more resilient to variations in demand than the theoretical curve presented in Figure A17.2. We would nevertheless expect Openreach's performance to exhibit the generic characteristics of queuing models. In particular, we would expect:

- the balance between demand and resources to be the primary determinant of Openreach's provision and repair performance;
- Openreach's performance to become less resilient to peaks in demand at high levels of resource utilisation;
- a small shortfall of resources compared with demand to lead to a large drop in performance, particularly if the shortfall persisted for an extended period; and
- a small increase in resource (of the order of 5 to 10%) to lead to a significant improvement in performance in cases where performance has been impaired by resource shortages.

Ofcom analysis of cycle times and resource utilisation

A17.22 As explained above, provision and repair job cycle times consist of time spent waiting in the queue and time spent servicing the job. When the volume of orders and faults exceeds Openreach's resource capacity, excess work is placed in

queues thereby increasing provision and repair cycle times. Similarly if the volume of orders and faults is less than the resource capacity then the excess capacity will reduce the number of jobs in the queue and reduce cycle times. If over a period of time the volume of orders and faults matches the resource capacity then the number of jobs in the queue and the cycle time at the end of the period will not change compared to the beginning of the period.⁶¹⁸

A17.23 The Average Time to Install (ATTI) orders and the Average Time to Clear (ATTC) faults provide an average measure of the cycle time over the measurement period. As cycle time is directly related to the number of jobs waiting in the queue, ATTI and ATTC provide direct indications of the volume of work not completed throughout each averaging period, e.g. each week or month. Increasing the resource capacity over some preceding period by an amount equivalent to the resource required to complete the outstanding work should significantly reduce the volume of work not completed and in turn reduce the ATTI and ATTC cycle time measures.⁶¹⁹

A17.24 This relationship allows us to make a simple observation to gauge the potential impact of a small increase in Openreach's field resources on its performance in periods when performance is impaired by resource shortages. We observe that a 5% increase in Openreach's field resources would be equivalent to adding one extra working day per month to field resources.⁶²⁰ These resources would be sufficient to reduce provision and repair cycle times by up to one day per month or up to 12 days per year (i.e. to reduce ATTI by one day per month or 12 days per year and similarly to reduce the ATTC by 14 hours per month⁶²¹). This suggests that an increase of this size could have a significant impact on cycle time performance and therefore performance against the cycle time SLAs.

A17.25 The relationship between demand, resource and cycle times can also be used to derive a useful measure of resource utilisation which can show the resource shortfall or surplus causing an increase or decrease respectively in the cycle time over some period. Hence differences in ATTI or ATTC between an averaging period of interest and the preceding period provide a direct indication of the change in number of jobs not completed (queued) and hence an indication of the difference between demand and resources, i.e. resource utilisation, for the averaging period of interest compared to the preceding period.

A17.26 Assuming the outstanding work (queue length) does not reduce to zero during the period of interest, then the change in queue length (dQ) at the end of the month of interest is the difference between the demand (D) arriving and resource (R) deployed in that month,⁶²² i.e.:

⁶¹⁸ However over time scales shorter than the period of interest there will be some fluctuation in queue length and cycle time due to the irregular arrival of provision and repair requests and the less but still irregular nature of servicing the jobs.

⁶¹⁹ The irregular arrival of provision and repair work may result in short periods when there is no work for the additional resource, resulting in inefficient use of the additional resource. Consequently deploying additional resource equivalent to the volume of work not completed may not always reduce the volume of incomplete work to zero. However this is less likely when the queues are operating in the high resource utilisation regions previously described in connection with Figure A17.2. The preceding period over which additional resources are deployed should be at least one and preferably many ATTI or ATTC averaging periods, i.e. typically many weeks or months.

⁶²⁰ There are approximately 20 week days per month on average less bank holidays.

⁶²¹ There are 14 working hours per day for repair.

⁶²² This is likely to be the case when cycle times are extending.

$$dQ = D - R$$

A17.27 This can be re-arranged to show that resource utilisation (U) can be expressed as:

$$U = D/R = 1 + dQ/R$$

Where dQ is the difference between ATTI (or ATTC) for adjacent averaging periods, i.e. a week or month, and D, R and dQ must be expressed in common units, e.g. KMH (kilo-man hours).

A17.28 We have used this resource utilisation measure to gain an insight into the scale of the resource shortfall relative to demand in 2012/13 when Openreach suffered its most sustained period of reduced performance.

A17.29 In 2012/13 both provision and repair cycle times rose steadily from a low point in April 2012 after the weather deteriorated, peaking in January 2013. Table A17.1 below shows the cycle time changes that occurred over this period.

Table A17.1: Change in Provision and Repair Cycle Times in 2012/13

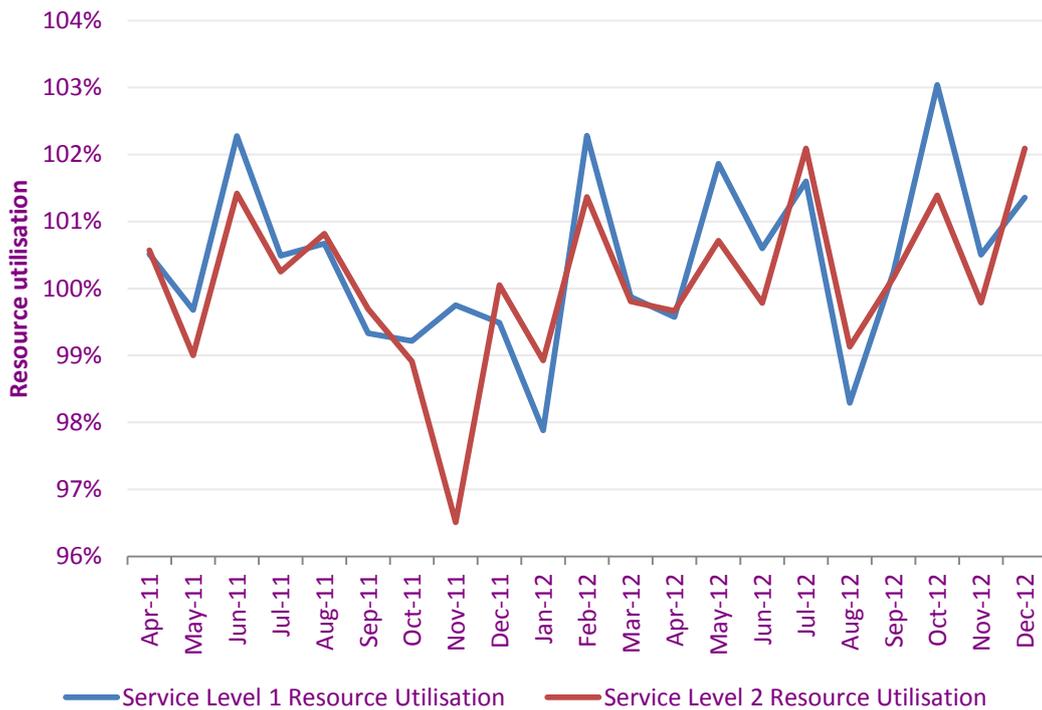
Measure	Service	April 2012 (low point)	January 2013 (peak)	Change
Provision Appointed ATTI (Working Days)	MPF	11.2	21.3	10.1
	WLR3	11.5	25.4	13.9
Repair ATTC (Working Hours)	MPF	19.4	34.5	15.1
	WLR3	23.3	50.8	27.5

Source: Openreach

A17.30 Figure A17.3 and Figure A17.4 below shows respectively for repair and provision, resource utilisation estimates derived from monthly ATTI/ATTC and resource information⁶²³ using the second formula presented above.

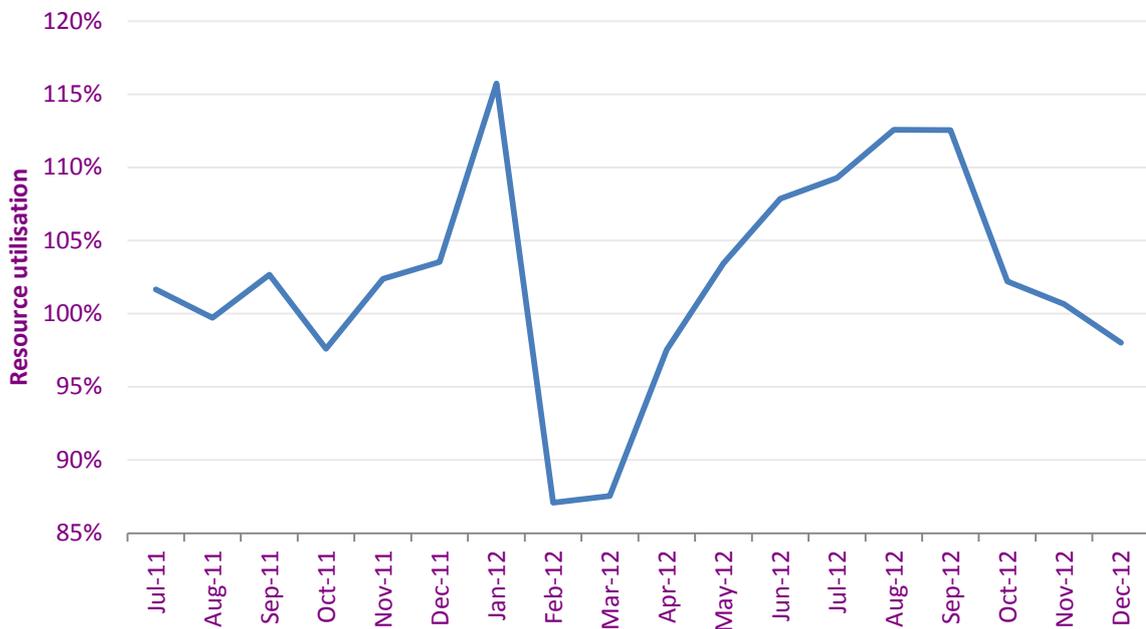
⁶²³ Man hours booked to provision and repair activities.

Figure A17.3: Openreach repair resource utilisation⁶²⁴



Source: Ofcom analysis of Openreach data

Figure A17.4: Openreach provision resource utilisation (appointed orders)



Source: Ofcom analysis of Openreach data

⁶²⁴ Service Level 1 includes WLR3 analogue and BT Classic while Service Level 2 includes WLR analogue, BT Classic, MPF and SMPF products.

A17.31 In Figure A17.3 and Figure A17.4, utilisation above 100% indicates that demand exceeded resources and therefore cycle time extended. Conversely, utilisation below 100% indicates that resources exceeded demand and cycle times reduced.

A17.32 These measures illustrate the balance between resources and demand but do not give any insight into the absolute level of resources deployed. They must therefore be considered in the context of Openreach’s decision to divert resources from provision to repair after the weather deteriorated in 2012. Table A17.2 below shows the overall differences between 2011/12 and 2012/13 field resourcing for copper provision and repair field activities recorded by Openreach.

Table A17.2: Openreach field resourcing⁶²⁵

Man hours (thousands)	2011/12	2012/13	Difference between 2011/12 and 2012/13
Field provision (excluding NGA)	✗	✗	✗
Field Repair (excluding payphones)	✗	✗	✗
Total	✗	✗	✗

Source: Openreach

A17.33 We observe in Table A17.2 that Openreach chose to divert resources from provision to repair in 2012/13. This was consistent with priority given to repair by Openreach and its customers and reflected the increase in repair demand. There was a small overall resource increase in 2012/13 compared with 2011/12 of ✗.

A17.34 Figure A17.3 suggests that after these mitigating actions, between April 2012 and December 2012, the shortfall in repair resources was relatively small, ranging from 1% to 3% per month. Figure A17.4 suggests that for provision the imbalance between demand and resources peaked at about 13% in July and August 2012 and is likely to be mainly a function of the diversion of resources to repair.

A17.35 We consider that these estimates give a reasonable indication of the shortfall in resources that led to the fall in performance in 2012. The steady increase in cycle times indicates that from April onwards, there was a sustained shortfall in resources relative to demand and therefore Openreach was generally operating in the high utilisation region of the theoretical curves in which the cycle time and resource utilisation formulae are valid. However, these estimates treat Openreach as a single queue and use monthly data for the whole of Openreach. They therefore represent a blended average picture for the whole of Openreach and do not show local and regional variations which could be better or worse. They should therefore be regarded as indicative.

Our review of the Resource Simulation Model

A17.36 As we explained above, we have investigated the Resource Simulation Model to determine whether it could provide a sound basis for estimating the resource impacts of service quality improvements that could form an appropriate input to our regulatory cost models.

⁶²⁵ Eleventh LLU WLR information request of 4 October 2013 to British Telecommunications plc.

A17.37 Here we review the Resource Simulation Model specifically in the context of the resource estimates for performance improvements. In Annex 19 we review it in the context of the service level resource differential estimates.

Overview of the model

A17.38 The Resource Simulation Model is a model commissioned by Openreach from Ernst and Young to explore the relationship between QoS and resources for its main services (MPF, analogue and digital WLR, SMPF and GEA). The model was also used to explore the resource differential for fault repairs between Service Level 1 and Service Level 2 services. We discuss this feature further in Annex 19.

A17.39 The model is of a type known as a 'discrete event simulation' that is often used to model the operation of queue-based processes. With this type of model, the arrival, queuing and processing of individual events (in this case faults and orders) is explored using a time sequence simulation in order that the performance characteristics and resource requirements of the process can be assessed.

A17.40 Typically such queuing models are used to estimate the performance that can be achieved by different resource allocations given a specified pattern of inbound work to a queue (known as an 'allocation' approach). The Resource Simulation Model adopts a 'distribution' approach. The performance achieved by Openreach on a weekly basis is taken as an input and the main output is an estimate of the volume of resources required to achieve that performance. The model is first calibrated so that the simulated weekly performance closely matches that actually achieved by Openreach. Performance can then be adjusted by altering the distribution of job completion times and the resource impacts assessed. In effect, this means that performance improvements are simulated by uplifting the baseline performance profile.⁶²⁶

A17.41 The model is built using a combination of Microsoft Excel and the simulation software package Simul8 and follows a three stage process:

- Calculation of input parameters for a given scenario in Excel;
- Simulation of the scenario in the Simul8 package and export of the results to Excel; and
- Post-processing of the simulation results in Excel.

A17.42 The model simulates Openreach's performance for the operational areas of each of Openreach's 9 GM areas for the years 2011/12 and 2012/13. It takes as its main inputs summaries of faults and orders received each half day, weekly performance figures and average job durations.

Independent review of the model

A17.43 We considered it appropriate to seek independent verification of the model and the resource estimates produced by it. We therefore commissioned consultants Analysys Mason (AM) to undertake a thorough review of the model. AM obtained a copy of the model for review and also replicated many of the resource estimates produced by Openreach.

⁶²⁶ See Section 2.2.3, AM, *QoS Model Report* in Annex 29 of the December 2013 LLU WLR Consultation for further details.

A17.44 We published AM's QoS Model Report detailing their findings as Annex 9 to the December 2013 LLU WLR Consultation.

A17.45 We asked AM to consider a number of points raised by respondents to the Ofcom December 2013 LLU WLR Consultation and have published AM's further report as Annex 18 to this statement.

Model disclosure

A17.46 Respondents to the July 2013 FAMR Consultation and the December 2013 LLU WLR Consultation commented on the need for transparency about the Resource Simulation Model if it were to form the basis for our assessment of the resource implications of minimum standards.

A17.47 In order to improve transparency of the Resource Simulation Model we made the following documents available in the December 2013 LLU WLR Consultation:

- a methodology document prepared by Ernst & Young which includes a detailed description and explanation of the Resource Simulation Model.⁶²⁷ The document set out the Resource Simulation Model scope, input data and calculation steps, and provided information on the key modelling assumptions;
- an accompanying document prepared by BT which provided analysis of additional factors impacting service costs in very high performance scenarios. This document provided analysis of certain aspects of the model referred to as the glass ceiling and the task time uplift⁶²⁸;
- an excel spreadsheet extract from the Resource Simulation Model which performs the post-processing of the simulation results, populated with randomised data. This provided stakeholders with visibility of the workings of the redistribution algorithm which generates the model results. We referred to this as the Redistribution Worksheet and published it along with an explanatory note alongside the consultation; and
- Analysys Mason's report on the Resource Simulation Model.⁶²⁹ In addition to Analysys Mason's independent assessment of the model, this report included a description of the model's workings and key assumptions.

A17.48 Following further stakeholder responses to our December 2013 LLU WLR Consultation we are also publishing in Annex 18 a report by Analysys Mason which addresses specific points raised by stakeholders.

⁶²⁷ Ernst & Young (EY), Openreach's Discrete Event Simulation Model: Methodology Document, November 2013 (EY, Model Methodology Document)
<http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex6.pdf>

⁶²⁸ Openreach, Openreach analysis of additional factors impacting service costs in very high performance scenarios, November 2013 (Openreach, Supporting Document on the Model).
<http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex7.pdf>

⁶²⁹ Analysys Mason, *Quality of Service model assessment: Final report for Ofcom*, November 2013. (Analysys Mason, QoS Model Report). <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex9.pdf>

Summary of consultation responses

Responses to the July 2013 FAMR Consultation

A17.49 Sky, TalkTalk and Virgin said that Ofcom should closely scrutinise Openreach's claims for extra costs. All called for Ofcom to provide transparency about the Resource Simulation Model. Sky and Virgin called for Ofcom to subject the model to independent review and Sky said it should be made available to stakeholders for review.^{630 631 632}

Responses to the December 2013 LLU WLR Consultation

A17.50 Sky said that it is particularly undesirable for Ofcom to rely on a complex model produced by BT which has not open to full scrutiny by stakeholders as the basis for assessing higher charges.⁶³³ Sky also expressed concern about the process Ofcom had followed in relation to the use of the model to develop cost estimates for improving Openreach's quality of service. Sky said that stakeholders had not been given adequate opportunity to provide informed comment on the model. The level of detail published in the December 2013 LLU WLR Consultation was inadequate for stakeholders to provide informed comment on it. Sky also considered that the consultation period of 8 weeks was insufficiently long given the need for stakeholders to obtain expert advice.

A17.51 In Sky's view the reports by Frontier Economics (commissioned jointly by Sky and TalkTalk) and Alix Partners (commissioned by Sky) indicated that further more detailed examination would be likely to reinforce their findings about the flaws in the Resource Simulation Model.⁶³⁴

Ofcom's comments on model disclosure

A17.52 We appreciate Stakeholder concerns about the confidentiality restrictions which limit the degree to which we can provide transparency of the resource model. Clearly, it is important that Stakeholders have sufficient information to ensure that they are able to comment meaningfully on matters under consultation.

A17.53 We have set out our approach to model disclosure in paragraphs A17.47 and A17.48 above.

A17.54 We consider that the approach we have undertaken in the course of this review with respect to the Resource Simulation Model ensured that Stakeholders were able to undertake an intelligent consideration of our proposals and provide an intelligent response. We consider, for instance, that our approach contained sufficient information to enable stakeholders to comment on the key elements of the model while preserving BT's legitimate confidentiality. We provided Stakeholders with a highly detailed third party review of the model which highlighted its internal mechanisms and assumptions which were then available for comment.

⁶³⁰ Paragraphs 3.27 to 3.28, *Sky Response to the July 2013 FAMR Consultation - Quality of Service*

⁶³¹ Paragraph 51, *TalkTalk Response to the July 2013 FAMR Consultation - Quality of Service*.

⁶³² Page 15, *Virgin, Response to the July 2013 FAMR Consultation*.

⁶³³ Paragraph 6.3, *Sky Response to the December 2013 LLU WLR*

⁶³⁴ Paragraph 6.5, *Sky Response to the December 2013 LLU WLR Consultation*.

A17.55 It is clear from the depth and sophistication of stakeholder responses that this approach has allowed meaningful Stakeholder comments which has informed our final work.

Openreach’s resource estimates

A17.56 Openreach first ran the model with 2011/12 and 2012/13 data to simulate the week-by-week performance achieved in each year in order to produce the baseline resource estimates against which the resource estimates for performance improvements were assessed.

A17.57 When originally modelled with the 2012/13 input data, the large fall in provisioning performance led to an unrepresentative spike in resource requirements. This was because the backlog in orders became a key driver of the resource estimates particularly towards the end of the year. Openreach considered these results to be unrepresentative and as a result adjusted the input data such that the weekly performance was held constant at the annual average.

A17.58 Table A17.3 below presents the 2011/12 and the re-modelled 2012/13 baseline results together with the overall annual average performance achieved. As we explain later in this section, these figures have a bearing on our conclusions about the model.

Table A17.3: Openreach’s baseline resource estimates

	2011/12	2012/13
Repair performance excluding MBORC faults (% faults completed within SLA timescales)	79%	63%
Provision performance for provisioning appointment SLA of 13 days (% orders completed within 13 days)	65%	42%
Resource estimate Full Time Equivalents	✂	✂
Resource estimate Man hours (thousands)	✂	✂

Source: Openreach Resource Simulation Model outputs submission to Ofcom on 7 November 2013.

A17.59 We asked Openreach to simulate a range of performance improvements as illustrated in Table A17.4 so that the relationship between performance and resources could be assessed.

Table A17.4: Performance scenarios modelled

Base line resource estimates	2011/12 & 2012/13
Performance improvement estimates	As per table below for each base year

Repair Performance excluding MBORC faults (% of faults completed by SLA target)	Provision Performance for Provisioning Appointment SLA of 13 days, 12 days and 11 days (% of orders completed within Appointment Timescale)		
	75%	80%	85%
75%	X	X	X
80%	X	X	X
85%	X	X	X

A17.60 Table A17.5 and Table A17.6 below present Openreach's estimates of the resource impacts of various improvements in provision and repair performance in 2011/12 and 2012/13 respectively. Results are presented for both a 13 day and a 12 day appointment availability SLA. The estimates are expressed as percentage increases in field engineering FTE against the baseline resource estimates shown in Table A17.3 above.

A17.61 The resource estimates reflect average achievement of the performance targets across each of Openreach's 9 General Manager areas (the units used for the simulations). Openreach considered that the estimates would need to be increased if Ofcom were to apply more granular targets such as Openreach's 26 forecast areas or its 58 Senior Operations Manager areas.

A17.62 The simulation includes all faults handled by Openreach including those affected by a force majeure declaration (referred to as Matters Beyond Our Reasonable Control or MBORC by Openreach). However, the performance targets exclude faults affected by MBORC. Thus a repair performance measure based on all faults (including MBORC) would be slightly lower as a small proportion of faults are affected by MBORC declarations.

A17.63 In estimating the resource impact of achieving an 85% target on both provision and repairs, Openreach has applied an uplift to average task times. Openreach's position is that to achieve a performance of 85%, would require technicians to be deployed outside their normal local area of work more frequently and that this would result in increased task times. In Table A17.5 and Table A17.6 we show two sets of figures for additional resources that would be required to achieve an 85% performance standard. The first includes the uplift applied to average task times by Openreach whilst the second set, calculated by AM assumes no uplift. We discuss this further in paragraph A17.127 below.

Table A17.5: Resource Simulation Model outputs for 2011/12 baseline showing additional resources required for specified performance improvements⁶³⁵

Repair Performance excluding MBORC faults (% of faults completed by SLA target)	Provision Performance for Provisioning Appointment SLA of 13 Days (% of orders completed within 13 days)			85% without uplifted task times ⁶³⁶
	75%	80%	85% with uplifted task times	
75%	1.3%	3.7%*	6.3%* - 10.1%*	6.0%
80%	1.6%	3.3%	6.0% - 9.3%	6.0%
85% with uplifted task times	6.7% - 10.0%	9.0% - 12.3%	11.0% - 17.5%	-
85% without uplifted task times ⁶³⁶	3.3%	5.1%	-	7.1%

Repair Performance excluding MBORC faults (% of faults completed by SLA target)	Provision Performance for Provisioning Appointment SLA of 12 Days (% of orders completed within 12 days)			85% without uplifted task times ⁶³⁶
	75%	80%	85% with uplifted task times	
75%	2.2%	3.7%	5.7% - 9.6%	5.5%
80%	2.6%	3.9%	6.3% - 9.7%	6.3%
85% with uplifted task times	8.4% - 11.8%	10.3% - 13.9%	12.4% - 19.0%	-
85% without uplifted task times ⁶³⁶	5.0%	6.5%	-	8.1%

Source: Openreach Resource Simulation Model outputs submission to Ofcom on 7 November 2013 and Ofcom analysis (non uplifted 85% figures).

Note: Empty cells relate to scenarios not modelled.

⁶³⁵ Openreach considers that the model results marked with asterisks have been affected by outlying data points and are likely to be a slight over estimate.

⁶³⁶ The Non-uplifted 85% figures calculated by Analysys Mason, uplifted figures calculated by Openreach.

Table A17.6: Resource Simulation Model outputs for 2012/13 baseline showing additional resources required for specified performance improvements⁶³⁷

Repair Performance excluding MBORC faults (% of faults completed by SLA target)	Provision Performance for Provisioning Appointment SLA of 13 Days (% of orders completed within 13 days)			85% without uplifted task times ⁶³⁸
	75%	80%	85% with uplifted task times	
75%	14.1%	17.2%	20.5% - 24.1%	-
80%	14.9%	18.1%	20.8% - 26.3%	20.7%
85% with uplifted task times	20.4% - 24.5%	22.9% - 27.1%	24.9% - 29.5%	-
85% without uplifted task times ⁶³⁸	-	21.1%	-	23.3%

Repair Performance excluding MBORC faults (% of faults completed by SLA target)	Provision Performance for Provisioning Appointment SLA of 12 Days (% of orders completed within 12 days)			85% without uplifted task times ⁶³⁸
	75%	80%	85% with uplifted task times	
75%	16.3%*	19.25%*	-	-
80%	16.8%	20.0%	22.0% - 24.6%	20.1%
85% with uplifted task times	-	24.3% - 26.6%	26.7% - 31.5%	-
85% without uplifted task times ⁶³⁸	-	22.0%	-	24.9%

Source: Openreach Resource Simulation Model outputs submission to Ofcom on 7 November 2013 and Ofcom analysis (non uplifted 85% figures).

Note: Empty cells relate to scenarios not modelled.

Openreach's revised resource estimates for 2011/12 baseline data

A17.64 In its response to the December 2013 LLU WLR Consultation, Openreach provided a revised resource estimate for the proposed minimum standard using the 2011/12 data. Openreach considered that the 2011/12 results would be likely to underestimate the resource impacts of the proposed minimum standards because

⁶³⁷ Openreach considers that the model results marked with asterisks have been affected by outlying data points. Figures presented are Openreach's estimates based on interpolation of adjacent data points.

⁶³⁸ The Non-uplifted 85% figures calculated by Analysys Mason, uplifted figures calculated by Openreach.

Openreach had not been subject to an appointment availability SLA in 2011/12. Openreach considered that an appointment availability SLA would have reduced Openreach’s flexibility to move provision resources to repair activities. Therefore it is likely that performance would have been lower in 2011/12 had an appointment availability SLA been in place. Openreach said that EY had examined the sensitivity of the Resource Simulation Model to varying the assumed baseline repair performance and had concluded that an appointment availability SLA could be expected to raise the resource delta for the proposed minimum standard by approximately 1.2%.⁶³⁹ Therefore, if Ofcom were to use the 2011/12 resource deltas, in Openreach’s view erroneously, an uplift of 5% or more would be more appropriate, even based on the more benign conditions of 2011/12.⁶⁴⁰

Table A17.7: Revised Resource Simulation Model outputs for 2011/12 baseline showing additional resources required for proposed minimum standards

Repair Performance excluding MBORC faults (% of faults completed by SLA target)	Provision Performance for Provisioning Appointment SLA of 12 Days (% of orders completed within 12 days)	Calculation Methodology
80%	5.1%	Addition of 1.2% to previously reported estimate to account for reduction in resourcing flexibility due to appointment availability SLA.

Openreach’s revised resource estimates for 2012/13 baseline data

A17.65 As noted in paragraph A17.55 above, when originally modelled with the 2012/13 performance data, the large fall in provisioning performance led to an unrepresentative spike in resource requirements and consequently Openreach adjusted the input performance data such that the weekly performance was held constant at the annual average.

A17.66 In the December 2013 LLU WLR Consultation we expressed concerns about the reliability of the 2012/13 resource deltas derived from the adjusted data. In response to these concerns, Openreach and EY presented revised 2012/13 resource estimates for the proposed minimum standards using two alternative methodologies:

- The performance floor methodology – an adjustment to the input performance data that is similar in concept to the ‘glass ceiling’ constraint on high performance. This approach imposes a minimum threshold for weekly performance and adjusts downward performance in weeks where performance is above the threshold to compensate. EY explained that this approach seeks to maintain the variability of performance over time whilst limiting the scope for low performance to generate backlogs that subsequently drive resource

⁶³⁹ Paragraph 148, Openreach *Response to the December 2013 Consultation*.

⁶⁴⁰ Paragraph 138, Openreach *Response to the December 2013 Consultation*.

requirements.⁶⁴¹ EY said that it had identified that at performance levels between 30% and 40% backlogs will begin to accumulate to a point where it begins to be the dominant factor in the resource estimates. EY therefore set the performance floor at 35% for provision activity.⁶⁴²

- First six months – As an additional exercise, EY also modelled the resource delta for the first six months of 2012/13 using unadjusted input data, the period over which the data suggests the backlog accumulated. EY found that the results produced using this method were closely aligned with the results obtained using the performance floor methodology.⁶⁴³

A17.67 Table A17.8 below presents the revised resource estimates using these two methodologies.

Table A17.8: Revised Resource Simulation Model outputs for 2012/13 baseline showing additional resources required for proposed minimum standards

Repair Performance excluding MBORC faults (% of faults completed by SLA target)	Provision Performance for Provisioning Appointment SLA of 12 Days (% of orders completed within 12 days)	Calculation Methodology
80%	80%	
80%	15.5%	Full year results calculated using the performance floor adjustment to the input performance data. Performance floor set at 35%.
80%	15.3%	Results for first six months of 2012/13 calculated using unadjusted input data

Source: Openreach Response to the December 2013 Consultation.

A17.68 Openreach considered this approach may be regarded as a proxy for the extent to which weekly work volumes would depart from the short term resource forecast. This approach produced resource deltas ranging from 15.3% to 20% depending on the view taken on short term resource forecasting accuracy. On the basis that in future years, short term resource forecasting should be expected to be more accurate than was the case in 2012/13, then the appropriate resource delta would be closer to 15.3% than 20%. On this basis Openreach considered that the relevant uplift for the proposed minimum standard should be 15.3%.⁶⁴⁴

Analysys Mason review of the simulation model

A17.69 AM's overall impression was that a useful and productive effort had been made to significantly improve the understanding of the relationship between Openreach's QoS and resources that previously had not been addressable in a systematic way. The model appeared to be well built and to be without significant errors in the

⁶⁴¹ Paragraph 4.19, EY, *Response to Comments on the DES Model*.

⁶⁴² Paragraph 4.21, EY, *Response to Comments on the DES Model*.

⁶⁴³ Paragraphs 4.21-4.22, EY, *Response to Comments on the DES Model*.

⁶⁴⁴ Paragraphs 145 and 146, Openreach *Response to the December 2013 Consultation*.

coding and implementation and not to be biased towards results more favourable to Openreach. The model outputs also appeared to be consistent and replicable. AM did however, consider that there were some material issues with the model which reduced their confidence in the model outputs. We consider these issues in the discussion of the model below.

A17.70 AM also reviewed the methodology used to assess the resource differential between repair Service Levels 1 and 2. We discuss this in Annex 19.

Our assessment of the Resource Simulation Model

A17.71 We share AM's view that a useful attempt has been made to investigate the relationship between performance and Openreach's resources. We do, however, consider that AM's initial review of the model, subsequent responses from stakeholders to the Ofcom December 2013 LLU WLR Consultation and further work we have asked AM to undertake since the Ofcom December 2013 LLU WLR Consultation have identified some significant issues, which need to be taken into account in our consideration of whether the resource estimates can form a suitable input for our regulatory charge control models. These issues are:

- Simulation approach - the suitability of the 'distribution' simulation approach adopted in the Resource Simulation Model for our purposes;
- Gamma distribution – in particular:
 - The fit of the gamma distribution used to represent the distribution of job completion times with the empirical data; and
 - The method used to manipulate the gamma distribution to model performance improvements; and
- The uplift applied to job durations at high levels of performance;
- The resource estimates – in particular:
 - the reliability of the 2012/13 resource estimates calculated with the flattened performance profile;
 - the revised 2012/13 resource estimate submitted by Openreach with its response to the December 2013 LLU WLR Consultation; and
 - the revised 2011/12 resource estimate submitted by Openreach with its response to the December 2013 LLU WLR Consultation.

A17.72 We consider each of these issues in turn below before concluding on the suitability of the resource estimates for our purposes in light of our analysis, including further work we have undertaken since the December 2013 LLU WLR consultation in light of stakeholder responses

Introduction to the consultation responses

A17.73 In the discussion below we make reference to several consultant reports submitted by consultation respondents as part of their consultation responses. These are:

- Frontier Economics, Review of the DES Model – a report commissioned jointly by Sky and TalkTalk;
- Alix Partners, QoS Report – a report commissioned by Sky; and
- EY, Response to comments on the DES Model – a report commissioned by Openreach.

Our consideration of the simulation approach

A17.74 As we explained above, Openreach and EY have adopted the distribution approach to simulating performance rather than the more conventional allocation approach. This means that the model takes the actual performance achieved by Openreach each week as an input and estimates the resources required to achieve this performance. Performance is then uplifted and the resource deltas are derived from the difference in the resource estimates.

A17.75 In the December 2013 LLU WLR Consultation we considered that the distribution simulation approach adopted in the model seemed reasonable and was arguably less theoretical than an allocation approach since the variations in performance could reflect factors impacting performance that are not modelled directly. We did however consider that the simulation approach had certain limitations and would be most likely to produce representative results in years when performance was relatively stable and large backlogs did not occur.

Summary of consultation responses

A17.76 Openreach commissioned EY to review Ofcom and AMs analysis and to consider the concerns about various aspects of the model. Openreach considered that the report showed that there would be little benefit from further adjustments to such parameters as they would be unlikely to improve the robustness of the modelled resource differentials.

A17.77 In its report for Openreach, EY noted that both the distribution approach (as used in the Resource Simulation) model and the allocation approach to discrete event simulation are commonly used in operational resource modelling. The distribution approach allows operational data to be used to define a baseline against which incremental resource estimates can be calculated for scenarios against the baseline. It is less reliant on assumptions (for example about activity prioritisation) than the more theoretical allocation approach. EY considered this to be of benefit given the requirements of this modelling exercise.⁶⁴⁵ An allocation approach would also result in a simulated outcome which departed from Openreach's observed operational model in the years modelled (2011/12 and 2012/13) and is therefore less supportable by empirical data in validating the results.⁶⁴⁶

A17.78 EY understood that Openreach considers that the distribution approach better reflects the operational reality of its business in relation to the questions posed by Ofcom in the FAMR and that the outputs to be more evidence based.⁶⁴⁷ It also noted Ofcom's view⁶⁴⁸ that the distribution approach arguably makes the simulation approach less theoretical than an allocation approach. EY said that it agreed with

⁶⁴⁵ Paragraph 3.10, EY, *Response to Comments on the DES Model*.

⁶⁴⁶ Paragraph 3.11, EY, *Response to Comments on the DES Model*.

⁶⁴⁷ Paragraph 3.12, EY, *Response to Comments on the DES Model*.

⁶⁴⁸ Paragraph A5.56 of the Ofcom *December 2013 LLU WLR Consultation*

Openreach and Ofcom that the modelling approach makes the simulation less theoretical and for this reason considered it to be superior to an allocation based approach.⁶⁴⁹

A17.79 EY also discussed Ofcom's comment that there is a risk with the distribution approach that performance improvements being assessed against an imperfect outcome:

[...] the resource estimates for performance improvements are being assessed against an imperfect outcome that reflects the resourcing decisions that led to performance being below the desired level in the first place. [...] A particular risk is that the resource estimates may be a function of much larger volume of resources required to clear backlogs that have built up over a prolonged period rather than the smaller increases required to prevent them occurring in the first place.⁶⁵⁰

A17.80 EY said that Openreach considers the distribution approach to be preferable to using a theoretical 'perfect' outcome that does not reflect operational reality. Openreach was under strong incentives to allocate resources efficiently and it considers the performance achieved to be optimal given the information available for forecasting/planning and the difficulty forecasting peaks in provision and repair activities which are often caused by matters outside its control.⁶⁵¹

A17.81 Sky and TalkTalk considered the resource estimates produced by the Resource Simulation Model to be unreliable and that the modelling approach was a contributory factor.

A17.82 Frontier Economics considered the Resource Simulation Model to be fundamentally mis-specified because it takes the distribution of the elapsed time between jobs being received and completed as a fixed input. This does not reflect causality, as in practice the waiting time before a task is executed will be a function of the available resources, other jobs already in the queue and the relative priority of the jobs. Frontier considered this approach would lead to unrealistic results, for example in relation to the treatment of idle resources (we discuss this point further below).⁶⁵²

A17.83 One facet of the modelling approach highlighted by EE⁶⁵³, Sky⁶⁵⁴, TalkTalk⁶⁵⁵, Frontier Economics⁶⁵⁶ and Alix Partners⁶⁵⁷ was that the potential of idle resources to be used to improve performance (by taking additional jobs from the queue of outstanding work) is ignored because jobs are executed according to the completion time distribution determined by the gamma distribution. Alix Partners pointed out that the example provided by EY in Figure 9 of the EY Model Methodology Document showed there would be idle resources that could have been allocated work scheduled for execution on following days.⁶⁵⁸

⁶⁴⁹ Paragraphs 3.13 & 3.14, EY, *Response to Comments on the DES Model*.

⁶⁵⁰ Paragraph A5.56 of the Ofcom *December 2013 Consultation*

⁶⁵¹ Paragraphs 3.16 to 3.18, EY, *Response to Comments on the DES Model*.

⁶⁵² Pages 2,5 & 6, Frontier Economics, *Review of Openreach's DES Model*

⁶⁵³ Page 6, EE *Response to the December 2013 LLU WLR Consultation*.

⁶⁵⁴ Paragraph 6.8, Sky *Response to the December 2013 Consultation*.

⁶⁵⁵ Paragraph 10.26, TalkTalk *Response to the December 2013 Consultation*.

⁶⁵⁶ Page 2, Frontier Economics, *Review of Openreach's DES Model*

⁶⁵⁷ Paragraphs 3.2.16 to 3.2.19, Alix Partners, *QoS Report*.

⁶⁵⁸ Paragraphs 3.2.17-3.2.19, Alix Partners, *QoS Report*.

A17.84 Alix Partners considered it unlikely that Openreach would implement performance improvements by evenly uplifting performance in every week as assumed in the Resource Simulation Model. Rather it would target the ‘lowest hanging fruit’. Where there is a modelling choice that in any way corresponds to a commercial choice that Openreach might face, then the modelling should choose the path that gives the lowest delta reflecting the approach that would be taken by a firm seeking to minimise its costs.⁶⁵⁹

Additional analysis of the treatment of idle resources

A17.85 We asked AM to consider Alix Partners’ comments about the treatment of idle resources. AM considered these comments were essentially a comment on the modelling methodology.

A17.86 AM noted that the untapped potential of idle resources to improve performance had been identified in their report. AM agreed with Alix Partners that this is an artefact of the modelling methodology. As the model follows a distribution approach, the execution of jobs is predetermined by historical data leading to a resource requirement. In order for the potential of any idle resources to improve performance to be assessed, the fundamental directionality of the model would need to be reversed such that the model followed an allocation approach. The model is not capable of doing such a calculation and therefore the scale of the effect on the resource estimates cannot be quantified.⁶⁶⁰

Ofcom's assessment of the resource simulation approach

A17.87 The main issue here is whether an allocation or distribution approach to discrete event simulation would be better suited to modelling the resource impacts of improvements in Openreach’s quality of service.

A17.88 We accept that the distribution approach has limitations, particularly in relation to the treatment of idle resources as AM and respondents have pointed out. This is an inherent feature of the distribution approach which simulates the execution of work according to the pattern actually observed. However, taking account of the observed variations in performance arguably makes the simulation less theoretical than the allocation approach to discrete event simulation since the observed variations of performance could reflect factors impacting performance that are not modelled directly such as local variations in demand. Given the complexity of the Openreach’s operations this is an important consideration.

A17.89 The distribution approach does, however, mean that the resource estimates for performance improvements are being assessed against an imperfect outcome that reflects the resourcing decisions that led to performance being below the desired level in the first place. It could therefore be likened to correcting a problem rather than preventing it. A particular risk is that the resource estimates may be a function of much larger volume of resources required to clear backlogs that have built up over a prolonged period rather than the smaller increases required to prevent them occurring in the first place. This appears to be the case with the 2012/13 simulation which, prior to the adjustments made by Openreach, produced an unrealistic peak in the resource estimates towards the end of 2012 to address a backlog of orders. Consequently, we consider this simulation approach is most likely to produce

⁶⁵⁹ Paragraphs 3.2.48-3.2.49, Alix Partners, *QoS Report*.

⁶⁶⁰ Section 4.2.1, *AM Comments on QoS Model Consultation Responses*.

representative results in years when performance was relatively stable and large backlogs did not occur.

Consideration of the resource estimation approach

- A17.90 The Resource Simulation Model uses a two-step process to estimate the resources required in any given performance scenario. Firstly the discrete event simulation is executed and used to determine the resource requirements for each skill group on each day of the year. These initial resource estimates do not take full account of the flexibility within the skill groups to undertake other skill groups' work. Consequently, a further calculation referred to as 'resource re-distribution' is performed to take this flexibility into account.
- A17.91 The model contains two versions of the resource re-distribution calculation referred to as the Maximum Day approach and the Top N approach. Both assess resources by reference to peaks in demand for resources in each skill group. The Maximum Day approach assesses the amount of resources available to work on lower skilled work on off-peak days by reference to the highest peak observed (the 'maximum day'). The Top N approach assesses the amount of resources available to work on lower skilled work on off-peak days by reference to the average of the Top N days where N is a number set by the user.
- A17.92 AM considered the approach to resource estimation adopted in the model implied a level of idle resources which may lead to a systematic overestimate of resource requirements. This is because resources are estimated by reference to peaks in demand and resources are left idle on off-peak days. AM also found that the choice of resource redistribution calculation had a significant impact has a significant impact on the resource estimates.
- A17.93 In the December 2013 LLU WLR Consultation we took the view that the Maximum Day approach may overstate the resource deltas somewhat. However, given the complexity of the model and the sensitivity of the results to the observed patterns in the fault and order data it was difficult to be definitive about the extent of any overstatement.

Summary of consultation responses

- A17.94 Alix Partners considered that the choice of the methodology should have been informed by a comparison of the modelled and actual workforce size or utilisation rates but neither appeared to have been undertaken.⁶⁶¹ Alix Partners agreed with AM's conclusion that the EY Top 10 methodology is inadequate. It also noted that the choice of resource distribution methodology had a significant impact on the resource deltas, in one case resulting in a delta of 0.55% for AM's alternative Top N approach (with N=25) and 8.11% for the Max Day approach. Alix Partners interpretation of this difference was that "extreme peaks" in resource requirements also have a disproportionate effect on resource deltas.
- A17.95 Frontier Economics considered that the method used to derive resource estimates from the number of completed jobs in each shift to be broadly reasonable subject to its concerns about the modelling approach, whereby jobs are assigned start times independently of the available resources.⁶⁶² Frontier Economics also noted that AM's Top N Days approach would in some sense deal with the lack of resource

⁶⁶¹ Paragraphs 1.116-1.118 and 3.2.51, Alix Partners, *QoS Report*.

⁶⁶² Paragraph 3.3, Frontier Economics, *Review of Openreach's DES Model*

flexibility between days. There would be insufficient resources on peak days and therefore some jobs would be held in the queue for execution on later off-peak days.⁶⁶³

A17.96 Sky considered that the methodology adopted understated the flexibility between skill groups.⁶⁶⁴

Further analysis of the resource estimation approach

A17.97 We asked AM to consider Alix Partners comments about resource redistribution approaches. AM agreed with Alix Partners that the Max Day approach had shortcomings, particularly with regards to its focus on “extreme peaks” in resource requirements. However it considered it to be preferable to the original version of the Top N methodology for the reasons set out in the AM QoS Model Report.

Ofcom's assessment of the resource estimation approach

A17.98 AM considered the Top N calculation not to be a useful measure of resources because it had the effect of restricting the amount of spare resources made available to do lower skilled work on off peak days, thereby leading to higher resource estimates. The Top N method is only used to produce the service level differential resource estimates and we therefore discuss its use further in Annex 19.

A17.99 AM concluded that the Maximum Day approach used for all of the baseline resource estimates and the performance improvement resource estimates would systematically overestimate the resource requirements. This is because resource requirements are estimated by reference to the highest peak in demand for each skill group and a significant proportion of resources are assumed to be idle on most days of the year. The potential of these idle resources to be usefully deployed and to improve performance on off-peak days is not taken into account by the model.

A17.100 AM was not however able to determine what impact the overestimates would have on the resource estimates for performance improvements (resource deltas) which are the percentage difference between baseline estimates and a resource estimate for improved performance. For our regulatory models, it is the resource deltas that are of most interest. Therefore the absolute levels of the resource estimates are less important provided the resource deltas are not adversely affected.

A17.101 AM also found that the resource re-distribution methodology used had a strong influence on the resource deltas. AM tested an alternative version of the Top N calculation. AM's methodology used the average resource requirement for the top N days as both the resource to redistribute (to make available for lower skilled work on off-peak days) and the required resource per skill level.⁶⁶⁵ This approach sets resources at a level somewhat below the highest peak in resource requirements (i.e. demand will not be fully resourced on those days). AM used 2011/12 data to model 85% provision performance against a 12 day appointment lead time and 85% performance for repair. AM found that with values of N greater than 1, its method gave lower absolute resource estimates and lower resource deltas than the Max Day method used by Openreach for its estimates. Increasing the value of N gave

⁶⁶³ Paragraph 3.2.51, Frontier Economics, *Review of Openreach's DES Model*

⁶⁶⁴ Paragraph 6.8 *Sky Response to the December 2013 Consultation*.

⁶⁶⁵ For details of the resource redistribution methodologies used by Openreach see Section 2.4, *Analysys Mason, QoS Model Report*. See Section 3.3 for further details of Analysys Mason's alternative methodology.

progressively lower absolute resource estimates and resource deltas. With N set to 25 (the highest value tested) AM's method gave a resource delta of 0.55% compared with 8.11% for the Max Day method used by Openreach.

A17.102 AM did not suggest that its alternative Top N calculation should be adopted but on the basis of its analysis concluded that the Maximum Day calculation may result in an overstatement of resource deltas for improvements in performance or SLA targets.

A17.103 In our view, AM's analysis suggests that the Maximum Day approach may overstate the resource deltas. In particular it suggests that the model may put too much emphasis on uplifting resources on days of peak demand and that performance improvements could more efficiently delivered by improving performance on off peak days. However, given the complexity of the model and the sensitivity of the results to the observed patterns in the fault and order data it is difficult to be definitive as to the extent of any overstatement.

Consideration of the gamma distribution

A17.104 In the Resource Simulation Model, the completion time for each job is determined by means of a random sample of a gamma distribution.⁶⁶⁶ The gamma distribution represents the probability distribution of job completions over time.

A17.105 The shape of the gamma distribution used in the model is set using two parameters, the alpha (shape) parameter and the beta (rate) parameter. For the baseline performance modelling, these parameters are set such that the shape approximates to that of the empirical distribution of jobs and the cumulative probability of job completions by the target is equal to the actual weekly performance achieved. For provision jobs the mode (peak) of the gamma distribution was set at 1 working day before the SLA target and for repair jobs the mode was set at 0.5 working days before the SLA target for Service Level 1 jobs.

A17.106 For performance improvement scenarios the shape of the gamma distribution is altered by adjusting the alpha and beta parameters such that the cumulative probability of job completions by the target rises to the desired performance level. For any given performance level there are an infinite number of combinations of alpha and beta parameter settings. In order to provide a unique solution as performance is increased, the mode (peak) of the gamma distribution is held constant at one working day before the SLA target for provision jobs and 0.5 working days before the SLA target for repair jobs.⁶⁶⁷

A17.107 AM considered that the method used to shape the distribution to simulate different levels of performance was not unreasonable per-se. However, other methods with similar levels of justification could have been chosen which could reasonably have increased or decreased the peak of the distribution and therefore the resource estimates.

A17.108 In the December 2013 LLU WLR Consultation we took the view that whilst the method used to control the gamma distribution does not seem unreasonable, it was unclear whether it is representative of job completions, particularly for provision jobs as performance increases. We noted that the resource estimates are driven by the

⁶⁶⁶ A gamma distribution is a type of probability density function.

⁶⁶⁷ For a more detailed explanation of the gammas distribution and how it is used to adjust performance see Section 3.2, *AM QoS Model Report*.

peaks in the gamma distribution so an unnecessarily ‘peaky’ profile would lead to resources being overestimated. We considered the method used to control the gamma distribution warranted further consideration as a possible refinement to the model.

Summary of consultation responses

Fit of the gamma distribution with the empirical data

A17.109 Alix Partners, Frontier Economics, Sky⁶⁶⁸ and TalkTalk⁶⁶⁹ all considered that the gamma distribution was a poor fit to the empirical distribution of completion times for provision and repair.

A17.110 Frontier Economics considered that the gamma distribution was a very poor fit with the empirical provision distribution, the latter being broadly bi-modal with peaks at around 1 day and 12 days. It considered the gamma distribution to be a better fit with the empirical repair distribution but even so there were systematic differences as the empirical data exhibited peaks at regular one day intervals.⁶⁷⁰ Frontier Economics also questioned whether the use of a fixed gamma distribution each week would be consistent with the empirical data. In its view it would be reasonable to assume that the distribution of completion times would vary depending on the day of the week and would have larger queues on Mondays due to faults reported over the weekend.⁶⁷¹

A17.111 Alix Partners considered the fit of the gamma distribution with the empirical provision distribution to be particularly problematic, firstly because of the lack of similarity between the shapes and secondly because the peak of the gamma distribution was much higher than that of the empirical distribution. Alix Partners considered that it would have been preferable to use the sum of two distributions or a piecewise defined distribution.⁶⁷² Alix Partners noted that AM had found that the difference between the gamma distribution and the empirical distribution introduced a cost uplift of more than 1%. In Alix Partners view this indicated that the gamma distribution leads to artificially high resource estimates and that a correction should be applied to offset this bias.⁶⁷³

A17.112 EY considered that the gamma distribution is an appropriate method to use in the Resource Simulation Model because it produces very similar results to the empirical data. EY accepted that the gamma distribution is not a perfect fit to the empirical provision data for 2011/12, a period before the introduction of the appointment availability SLA. In its response it showed a graph for a more recent period (December 2012 to January 2014), when the provision SLA was in place, which it considered to be a much better fit with the gamma distribution.⁶⁷⁴

Method used to adjust the gamma distribution

⁶⁶⁸ Paragraph 6.8, *Sky Response to the December 2013 Consultation*.

⁶⁶⁹ Paragraph 10.26, *TalkTalk Response to the December 2013 LLU WLR Consultation*.

⁶⁷⁰ Section 2.2, Frontier Economics, *Review of Openreach’s DES Model*.

⁶⁷¹ Section 2.1, Frontier Economics, *Review of Openreach’s DES Model*.

⁶⁷² i.e. a hybrid function comprising two or more separate functions each of which is used to simulate a separate segment of the empirical distribution.

⁶⁷³ Paragraphs 3.2.34-3.2.38, Alix Partners, *QoS Report*.

⁶⁷⁴ Paragraphs 3.33-3.39, EY, *Response to Comments on the DES Model*.

A17.113 Alix Partners, Frontier Economics⁶⁷⁵, Sky⁶⁷⁶ and TalkTalk⁶⁷⁷ also raised concerns about the method used to shape the gamma distribution as performance is increased, specifically that the mode (the peak) of the distribution would remain constant relative to the SLA targets as performance is increased. A number of points were made:

- There is no apparent theoretical or empirical justification for the assumption that the mode should remain constant relative to the SLA targets.
- Keeping the mode constant results in the distribution becoming more concentrated around the mode of the distribution as performance is increased and a smaller proportion of jobs are completed in the ‘tails’ of the distribution away from the mode (i.e. significantly earlier or later than the peak). This problem would be likely to be worse for provision jobs than faults.
- It appears counter-intuitive that as performance rises the proportion of jobs completed the day before the SLA target would increase to such an extent and that the proportion completed earlier would reduce. Frontier Economics suggested that a more intuitively reasonable assumption would be that QoS should be improved by completing jobs more rapidly in general rather than increasing the proportion completed close to the SLA target. One way to achieve this would be to keep the alpha ‘shape’ parameter of the gamma distribution constant whilst varying the beta ‘rate’ parameter. This would result in a lower peak compared with the fixed mode approach.
- The fixed mode would result in high resource deltas for any given performance improvement, compared with other methods that would result in less concentration around the peak. Alix Partners considered the constant mode assumption to be the most extreme assumption that can be maintained in terms of its effect on resource delta.

A17.114 Frontier Economics suggested that to the extent that any constraint is applied to the gamma distribution it should reflect the approach of a hypothetically efficient operator and be set to minimise the peak, and therefore the resources.

A17.115 EY considered the fixed mode assumption to be reasonable and appropriate. The empirical provisioning data for 2012/13 and December 2012 to January 2014, both periods in which the appointment availability SLAs were in force, showed a reasonable approximation to a gamma distribution with a mode approximately one day before the SLA target. It noted that Openreach considered this to be an inherent empirical relationship that would not change if performance targets were changed. Any deviation from this empirical relationship would make the model more arbitrary and represent a change in the assumptions regarding Openreach’s operations and would not reflect how Openreach considers its operations would change under the performance scenarios being modelled. EY also noted that neither AM or Ofcom had suggested an alternative to the approach taken in the model.⁶⁷⁸

⁶⁷⁵ Section 3.2, Frontier Economics, *Review of Openreach’s DES Model*.

⁶⁷⁶ Paragraph 6.7, *Sky Response to the December 2013 Consultation*.

⁶⁷⁷ Paragraph 10.26, *TalkTalk Response to the December 2013 LLU WLR Consultation*.

⁶⁷⁸ Paragraphs 3.40-3.47, EY, *Response to Comments on the DES Model*.

Further analysis

A17.116 We asked AM to review the comments about the impact of the fixed mode assumption on resource requirements, in particular that with increased performance a lower proportion of jobs are completed well before the peak compared with the baseline performance scenario. AM found that this effect was particularly visible for provision jobs but was small for repair jobs.⁶⁷⁹

A17.117 We also asked AM to review Frontier Economics suggestion that a better way to manipulate the gamma distribution would be to fix the alpha (shape) parameter and to alter the beta (rate) parameter. AM found that for repair jobs this approach resulted in only a small change in the overall profile of job completions for the modelled performance improvement scenario, including a small reduction in the peak of the distribution. For provision the impact was much more pronounced, resulting in a much lower peak in the distribution and a significant increase in the proportion of jobs completed earlier.⁶⁸⁰

Ofcom's assessment of the gamma distribution

Fit of the gamma distribution with the empirical data

A17.118 AM found that for repair jobs, the baseline gamma distribution used in the Resource Simulation Model was a reasonable but by no means perfect fit with the empirical data. For provision jobs, the baseline gamma distribution was a very rough approximation for the empirical data, in particular because it did not accurately represent the significant proportion of jobs which are completed with short lead times. However, AM found that in practice, the gamma distribution produced resource estimates that were very closely aligned with the empirical data for the baseline scenarios (with a difference of just over 1%).⁶⁸¹

A17.119 Whilst we accept that it is possible to use an alternative function (such as those suggested by Alix Partners) to create a better fit with the empirical provision data, we consider the gamma distribution to be a reasonable approach for the baseline modelling, on the basis that the modelled results are closely aligned with those of the empirical distribution.

A17.120 A model of this type is necessarily a highly simplified representation of Openreach's operations. On this basis we consider the use of a single gamma distribution for all working days to be reasonable.

Method used to shape the gamma distribution

A17.121 In the December Consultation we reported AM's findings in relation to the method used to control the gamma distribution. AM noted that whilst the mode settings for the gamma distribution may have accurately reflected the empirical data, there was nothing to suggest *a priori* that this should continue to be the case when performance is adjusted. It was therefore less clear that it was appropriate to fix the mode when modelling performance improvement scenarios. In AM's view,

⁶⁷⁹ Section 4.1, *AM Comments on QoS Model Consultation Responses*

⁶⁸⁰ Section 4.1, *AM Comments on QoS Model Consultation Responses*

⁶⁸¹ Section 3.2, *AM QoS Model Report*.

alternative choices with similar levels of justification could reasonably have increased or decreased the resource estimates.⁶⁸²

A17.122 We share this view that whilst the method does not seem unreasonable, it is unclear whether it gives a representative distribution of job completions as performance increases.

A17.123 In relation to provision jobs at least, it is not clear to us that the fixed mode approach is reflective of an empirical relationship (as Openreach suggests) given the longer lead times for provision jobs and Openreach's ability to shape the distribution of work with its appointment books.

A17.124 The additional analysis undertaken by AM suggests that the repair results are relatively insensitive to the method used to control the gamma distribution due to the short lead times for fault repairs. The marked difference between the 'fixed mode' approach and Frontier Economics alternative 'fixed shape' approach indicates that the provision results are much more sensitive to the method used to control the distribution.

A17.125 We share respondents' reservations about the way in which the fixed mode approach concentrates the distribution of provision jobs around the mode of the gamma distribution as performance is increased. This effect seems counter-intuitive to us because the most obvious way to improve performance would be to reduce appointment lead times which would have the effect of increasing the proportion of jobs completed well before the SLA target and possibly also shifting the mode of the distribution backwards.

A17.126 Despite these reservations we do not have any strong basis for selecting an alternative methodology for controlling the gamma distribution in the absence of information about how the empirical distribution varies with performance in practice.

A17.127 Absent a basis for selection simply selecting a method that would minimise the resource delta as Frontier Economics suggests clearly raises a risk that such a hypothetically efficient approach would not be achievable in practice and as a result the resource deltas would be underestimated. Also, as explained in more detail in paragraphs 11.128 to 11.134, we model efficiency improvements separately in our charge control and therefore the resource deltas should reflect the resource increments associated with performance improvements with current processes and procedures.

A17.128 We have therefore decided to use the resource estimates based on the fixed mode method of controlling the gamma distribution whilst noting that may have introduced an upward bias in the resource deltas for performance improvement.

Consideration of the uplift to average job durations

A17.129 In the model, the average task times used for each task type are the monthly averages achieved in each GM area in the base year. Openreach considers that this does not capture the increase in average task times associated with higher levels of performance that would arise because technicians would have to travel outside their normal working area more frequently. Consequently for performance above 80% Openreach has applied an uplift to the average task times as a sensitivity to the resource estimates. For provision the uplift is 0% to 5% and for

⁶⁸² Section 3.2 AM Qos Model Report.

repair 5% to 10%. Openreach has explained the basis for the uplift in the documentation accompanying the Resource Simulation Model.⁶⁸³

A17.130 In the December 2013 LLU WLR Consultation we noted that AM found that the uplift applied to job durations (for performance above 80%) had a significant impact on the resource estimates and lacked justification. In light of AM's analysis and our own analysis we considered that the uplift had not been adequately justified and we therefore proposed not to take it into account in our considerations of the resource estimates.

Summary of consultation responses

A17.131 EE supported our proposal but none of the other consultation respondents commented on the uplift to the resource estimates directly.⁶⁸⁴ This may be because the resource uplifts are not applied at the levels of performance we have proposed for the minimum standards.

Ofcom's assessment of the uplift to average job durations

A17.132 AM recognised that job durations might increase as performance increases but considered the ranges specified by Openreach to be aggressive. They considered the non-uplifted estimates presented in Table A17.5 and Table A17.6 for 85% performance to be most realistic because the information given by Openreach in their view implied an overall uplift of around 1%.

A17.133 We also have concerns about the explanation given. Firstly, Openreach has not provided any empirical evidence that the incidence of out of area working would increase at higher levels of performance and it is not clear to us that this would necessarily be the case. It might equally be the case that the improvement in performance would be enabled by the additional resources estimated by the model rather than more out of area working. Secondly, the uplifts applied by Openreach to average task times implies a very much larger increase in out-of-area working than suggested by Openreach in its explanation. Table A17.9 below summarises Openreach's estimates of the increase in out-of-area working and task times. It also shows our calculation of the implied increase in overall average task times derived from these figures and our calculation of the increase in out of area working implied by the increases in overall average task times proposed by Openreach.

⁶⁸³ Pages 6-10, Openreach, *Openreach analysis of additional factors impacting service costs in very high performance scenarios*, November 2013 (Openreach Supporting Document on the Model).

⁶⁸⁴ Page 7, *EE Response to the December 2013 LLU WLR Consultation*.

Table A17.9: Resource uplift estimates

	Repair	Provision
Openreach estimate of increase in out-of-area working for performance about 80% ⁶⁸⁵	1% to 5%	1% to 5%
Openreach estimate of difference in task times between in-area and out-of-area jobs	At least 16% higher than normal in-area jobs	
Ofcom calculation of the increase in resources implied by the estimates above	1.1% to 5.8%	1.1% to 5.8%
Average task time uplift sensitivities applied by Openreach as a sensitivity to all jobs	5% to 10%	0% to 5%
Ofcom calculation of the increase in out-of-area working implied by the Openreach task uplifts ⁶⁸⁶	31% to 62%	0% to 31%

Source: Openreach Supporting Document on the Model and Ofcom analysis of Openreach data

A17.134 Openreach considers that at high levels of performance around 85% of technicians would be required to work further afield more often and as a result average task times for out-of-area working could rise significantly above their 16% estimates. Even if this was the case and for example the average task time for out-of-area working rose to 40% above the general average task time, the uplifts would still imply a large increase in out-of-area working.

A17.135 Since AM completed their report, Openreach has provided information about two other factors that would be likely to increase average task times at higher levels of performance. Firstly, Openreach has said that it would be necessary to divert technicians more frequently from work in progress to work on other jobs in jeopardy of failing. Secondly, Openreach has said that at higher levels of performance, a greater proportion of particularly complex and labour intensive jobs would need to be completed within SLA timescales and that as a result peak resource levels would need to increase.⁶⁸⁷ We acknowledge that these factors may have a bearing on average task times. However, from the information presented, it has not been possible for us to determine whether they would have a material impact on average task times as performance increases.

A17.136 In light of the above considerations, we consider that the uplift has not been adequately justified and therefore we have decided not to take it into account in our considerations of the resource estimates.

⁶⁸⁵ This increase would be in addition to the level of out-of-area working already allowed for in the average task times for the base years.

⁶⁸⁶ In addition to the level of out-of-area working in the base year.

⁶⁸⁷ Page 9, Openreach, Supporting Document on the Model.

Consideration of the resource estimates

A17.137 In the December 2013 LLU WLR Consultation we considered that the limitations in the simulation and resource estimation approaches were particularly apparent in the modelling of 2012/13.

A17.138 AM noted the actual resource estimates for performance improvements produced using the 2012/13 as a base year were much larger than when using 2011/12 data to achieve the same performance standard. AM said it was not in a position to determine which year would be the most representative of future years, though it noted that Openreach advocated 2012/13. AM did however, find that the adjustment made to the 2012/13 provision input performance data (as discussed in the report cited in the fourth bullet point of paragraph A17.47 above) would have the effect of increasing the resource estimates for performance improvements.

A17.139 We considered that the 2012/13 results had been adversely affected by a combination of the impact of the adjustment to the 2012/13 input data and the limitations of the simulation and resource estimation approaches in dealing with large drops in performance and associated backlogs. We were therefore not persuaded that the 2012/13 resource estimates were sufficiently representative to form the basis for our charge control calculations.

A17.140 We considered that the 2011/12 modelling was likely to provide more representative estimates because they were based on unadjusted baseline data, performance had been more stable and the results were less likely to have been adversely affected by sustained backlogs.

Summary of consultation responses

Openreach and EY comments about the resource estimates

A17.141 Openreach commissioned EY to review the December 2013 LLU WLR Consultation and to consider the concerns raised by Ofcom and AM about various aspects of the model. Openreach considered that the report⁶⁸⁸ showed that there would be little benefit from further adjustments as they would be unlikely to improve the robustness of the modelled resource differentials.⁶⁸⁹

A17.142 Openreach considered that Ofcom should use the 2012/13 results from the Resource Simulation Model to set the cost uplift for the proposed minimum standards.⁶⁹⁰ Openreach considered the 2011/12 model results to be less reliable than 2012/13 and likely to significantly underestimate the costs associated with the proposed minimum standards. This is because the 2011/12 data would not reflect the latest and more demanding position in relation to several exogenous factors:

- the proportion of Care Level 2 jobs;
- fault volumes;
- fault volume volatility;

⁶⁸⁸ EY, *Response to Comments on the DES Model*.

⁶⁸⁹ Paragraph 233, *Openreach Response to the December 2013 LLU WLR Consultation*.

⁶⁹⁰ Paragraph 138, *Openreach Response to the December 2013 LLU WLR Consultation*.

- the operational capabilities of the workforce in relation to jobs that are difficult to diagnose and fix; and
- intermittent faults affecting broadband lines.⁶⁹¹

A17.143 Openreach did not agree with our view that the model had not coped well with the backlogs of work that had built up in 2012/13. The model had been designed to reflect the level of short term (weekly) forecasting accuracy in the base year. In 2012/13 there were longer periods when repair volumes exceeded the resource applied, hence backlogs built up.⁶⁹²

A17.144 EY explained that the 2012/13 baseline data had been adjusted to remove the distortive impact of backlogs of provision orders, which were the primary determinant of resource requirements using the unadjusted data.⁶⁹³ EY understood that the backlogs had arisen as a consequence of an unusually sustained period during which the volume of incoming work exceeded Openreach's short-term forecasts due to an unseasonal and sustained rise in repair activity and a significant increase in demand for provision activities.⁶⁹⁴ The adjustment sought to reflect a "business as usual" level of forecasting accuracy by preventing the accumulation of relatively high volumes of backlogs. Adjustment of a data set should not be considered a disadvantage *per se*, as any modelling exercise requires calibration and testing to ensure the robustness of the results.⁶⁹⁵

A17.145 EY recognised that when choosing the most appropriate base data for the resource uplift estimates, there is a trade-off between using the unadjusted 2011/12 data and the more recent 2012/13 data that had been adjusted to remove distortions relating to forecasting inaccuracies during the year. Given the considerable operational changes since 2011/12, EY considered the 2012/13 data should be used as the basis of the resource deltas.⁶⁹⁶

A17.146 EY disagreed with Ofcom's view that the adjustment to the 2012/13 performance data would have the effect of pushing up the resource requirement deltas for performance improvements relative to a normal peaky performance distribution. EY considered that whilst there is a risk that a flat performance profile may overstate the resource deltas for the reasons given by Ofcom and Analysys Mason, it could understate the performance deltas because the adjustment would raise performance for some weeks and lower it for others so the impact is ambiguous and would depend on the observed variations from the average.⁶⁹⁷

The revised 2012/13 resource estimates proposed by Openreach and EY

A17.147 As discussed in paragraph A17.64 above, in response to Ofcom's concerns, about the reliability of the 2012/13 results calculated using the adjusted data, Openreach and EY developed an alternative adjustment (the performance floor methodology) for the 2012/13 data. Using this methodology, the resource delta modelled by EY for the proposed minimum standard (80% provision, 80% repair, 12 day appointment availability SLA) is 15.5%.⁶⁹⁸ As an additional exercise, EY modelled

⁶⁹¹ Paragraph 147, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁶⁹² Paragraph 144, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁶⁹³ Paragraph 4.9, EY, *Response to Comments on the DES Model*.

⁶⁹⁴ Paragraph 4.11 and 4.12, EY, *Response to Comments on the DES Model*.

⁶⁹⁵ Paragraph 4.14, EY, *Response to Comments on the DES Model*.

⁶⁹⁶ Paragraphs 1.13 and 1.14, EY, *Response to Comments on the DES Model*.

⁶⁹⁷ Paragraph 4.18, EY, *Response to Comments on the DES Model*.

⁶⁹⁸ Paragraph 4.23, EY, *Response to Comments on the DES Model*.

the resource delta for the first 6 months of 2012/13, the period over which the data suggests the backlog accumulated. For the same performance scenario, the resource delta was very close to that modelled using the performance floor methodology at 15.3%.⁶⁹⁹

A17.148 Openreach considered the performance floor methodology may be regarded as a proxy for the extent to which weekly work volumes would depart from the short term resource forecast.⁷⁰⁰ EY explained that this approach sought to maintain the variability of performance over time whilst limiting the scope for low performance to generate backlogs that subsequently drive resource requirements.⁷⁰¹

A17.149 EY considered the Performance Floor Methodology to be a valid alternative to the flat performance profile previously used. It implied that to consistently achieve the proposed minimum standard requires an increase in resources in the range of 15.3% to 20% depending on the approach taken to adjust the 2012/13 data to reflect a business as usual level of forecasting accuracy.⁷⁰²

A17.150 Openreach also considered that the new resource estimates indicated that the proposed minimum standard would require a resource delta ranging from 15.3% to 20% depending on the view taken on short term resource forecasting accuracy. On the basis that in future years short term resource forecasting should be expected to be more accurate than was the case in 2012/13 then the appropriate resource delta would be closer to 15.3% than 20%. On this basis Openreach considered that the relevant uplift for the proposed minimum standard should be 15.3%.⁷⁰³

The revised 2011/12 resource estimates proposed by Openreach

A17.151 As discussed in paragraph A17.62 above, Openreach also considered that the 3.9% resource delta for the proposed minimum standard derived from the 2011/2 data should be regarded as indicative only because Openreach was not subject to a provision appointment availability SLA at the time. The presence of an appointment availability SLA would have reduced Openreach's flexibility to move provision resources to repair activities. Therefore, Openreach submitted that it is likely that repair performance would have been lower in 2011/12 had a provision appointment availability SLA been in place. EY examined the sensitivity of the Resource Simulation Model to varying the assumed baseline repair performance and had concluded that an appointment availability SLA could be expected to raise the resource delta for the proposed minimum standard by approximately 1.2%.⁷⁰⁴ Therefore, if Ofcom were to use the 2011/12 resource deltas, in Openreach's view erroneously, a uplift of 5% or more would be more appropriate, even based on the more benign conditions of 2011/12.⁷⁰⁵

Other stakeholders' comments about the resource estimates

A17.152 EE supported Ofcom's proposal to use the 2011/12 resource estimates given Ofcom's finding that the 2012/13 results had been unduly influenced by the backlogs and manual adjustments to the data. EE also considered that setting the resource deltas so as to allow Openreach the large resource cost associated with

⁶⁹⁹ Paragraphs 4.21-4.22, EY, *Response to Comments on the DES Model*.

⁷⁰⁰ Paragraph 145, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁷⁰¹ Paragraph 4.19, EY, *Response to Comments on the DES Model*.

⁷⁰² Paragraph 4.25, EY, *Response to Comments on the DES Model*.

⁷⁰³ Paragraphs 145 and 146, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁷⁰⁴ Paragraph 148, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁷⁰⁵ Paragraph 138, Openreach *Response to the December 2013 LLU WLR Consultation*.

clearing backlogs, rather when much smaller increases could have prevented them occurring in the first place would not set the right incentive for Openreach. On this basis, EE considered that Ofcom should not make an allowance for the difference in resource levels between 2011/12 and 2012/13. EE considered that the resource estimation approach and the level of idle resources it generated was unrealistic and inefficient. Ofcom should make an adjustment to counteract this effect.⁷⁰⁶

A17.153 The FCS said it was difficult to make an assessment of the resource estimates given the redactions in the Ofcom December 2013 LLU WLR Consultation. However, it considered the 2011/12 resource deltas provided a good starting point to assess resource requirements. The FCS considered it logical to take account of the difference between the 2011/12 and 2012/13 resource levels in order to take account of the more challenging conditions.⁷⁰⁷

A17.154 Prospect considered that Openreach is not adequately resourced to meet existing quality standards and that its members who work in Openreach's engineering workforce are already under considerable pressure. It considered that a much larger increase than the 3.9% proposed by Ofcom would be required to meet higher quality standards.⁷⁰⁸

A17.155 Sky considered that it is readily apparent that the results produced by the Resource Simulation Model are not sufficiently reliable to be used as an input into setting charge controls. The AM report had identified a series of important issues (described as "material issues with the model" by AM) and had stated that the modelling approach "may lead to a systematic overestimate of resource requirements". Ofcom had also accepted that there is "an upward bias" in determining resource requirements associated with higher service quality levels, and uncertainty associated with the specific nature of distribution used to sample the time taken to complete jobs.⁷⁰⁹ Sky considered that these concerns were reinforced by two consultant reports it submitted with its consultation response: a report by Frontier Economics, jointly commissioned by Sky and TalkTalk, and the report by Alix Partners commissioned by Sky. They conclude that both the approach to the modelling and the actual modelling make the results wholly unreliable.⁷¹⁰ Given the unreliability of the model outputs, Sky considered that Ofcom should define a range for the cost estimates and rely on its regulatory judgement to select an appropriate level between those bounds. In Sky's view, the estimates proposed by Openreach are clearly the upper bound, whilst zero would be a reasonable lower bound. Given the undemanding nature of the minimum standards and the scope for Openreach to make efficiency improvements, Ofcom should select a figure towards the bottom of the range.⁷¹¹

A17.156 Drawing on the Frontier Economics report, TalkTalk considered that the estimates produced by the Resource Simulation Model were unreliable and likely to exaggerate the impact of higher quality.⁷¹² A number of Openreach's assumptions unequivocally over-estimate the additional costs and in relation to other points where they were not certain of the direction of any bias, it is legitimate to presume that Openreach has adopted assumptions that would exaggerate costs.⁷¹³ Given

⁷⁰⁶ Pages 6-7, *EE Response to the December 2013 LLU WLR Consultation*.

⁷⁰⁷ Page 3, *The FCS Response to the December 2013 LLU WLR Consultation*.

⁷⁰⁸ Executive Summary, *Prospect Response to the December 2013 LLU WLR Consultation*.

⁷⁰⁹ Paragraph 6.6, *Sky Response to the December 2013 LLU WLR Consultation*.

⁷¹⁰ Paragraph 6.7, *Sky Response to the December 2013 LLU WLR Consultation*.

⁷¹¹ Paragraph 6.11, *Sky Response to the December 2013 LLU WLR Consultation*.

⁷¹² Paragraph 1.11, *TalkTalk Response to the December 2013 LLU WLR Consultation*.

⁷¹³ Paragraph 10.25, *TalkTalk Response to the December 2013 LLU WLR Consultation*.

this, TalkTalk considered that Ofcom should reduce the cost estimates, for instance the 14% increase for the Care Level differential should be reduced to 10%.⁷¹⁴

A17.157 Verizon agreed that the 2011/12 resource deltas provide a reasonable basis to assess the resource and cost increments associated with minimum standards. Verizon considered that an adjustment to the final resource estimate to take account of the difference in resource levels between 2011/12 and 2012/13 would be unwarranted given the proposed MBORC allowance.⁷¹⁵

A17.158 3< considered the analysis to be relatively pragmatic and that the cost increases even at the upper bound were relatively modest. Notwithstanding its objection on principle⁷¹⁶, from the perspective of 3< the costs would not disproportionate to the benefits of better performance.⁷¹⁷

A17.159 Frontier Economics considered that the Resource Simulation Model was fundamentally mis-specified and consequently the results of the model cannot be relied upon.⁷¹⁸ Frontier Economics identified 5 areas of concern which we have discussed earlier in this section:

- The modelling approach;
- The fit of the distribution of completion times (as specified in the gamma distribution) with the observable data;
- The lack of evidence supporting the assumptions about how the distribution of completion times change varies with QoS changes; and
- The changes made about the changes in distribution of completion times with higher QoS seem counter intuitive and appear to lead to increases in peak resources in excess of that required to improve QoS efficiently.
- The assumption that an increase in peak resources as estimated by the model (i.e. the resource deltas) would translate into a proportionate increase in Openreach's costs.⁷¹⁹

A17.160 Alix Partners identified 4 potential issues with the Resource Simulation Model that may lead to a considerable overestimation of the resources required to meet targets. These issues, which we have discussed earlier in this section were:

- Understating Openreach's flexibility between days, essentially to utilise idle resource by bringing jobs forward;
- Understating the impact of flexibility between engineering skill groups;
- The poor fit of the gamma distribution with the profile of actual completion times, particularly for provision activities; and

⁷¹⁴ Paragraph 10.27 TalkTalk *Response to the December 2013 LLU WLR Consultation*.

⁷¹⁵ Page 3, Verizon *Response to the December 2013 LLU WLR Consultation*.

⁷¹⁶ [cross ref to paragraph where the rest of their response covered]

⁷¹⁷ Page 7, 3< response to the December 2013 LLU WLR Consultation.

⁷¹⁸ Page 1, Frontier Economics, *Review of Openreach's DES model*.

⁷¹⁹ Page 1, Frontier Economics, *Review of Openreach's DES model*.

- Assuming that Openreach would seek to enhance performance evenly throughout the year rather than a cost-minimising path to meet targets.⁷²⁰

AM analysis of EY comments about the directional impact of flattening the performance profile

A17.161 We asked AM to consider EY’s comments about the directional impact of flattening the performance profile.

A17.162 AM considered that its analysis clearly indicated that flattening the performance profile of the 2012/13 input data caused the resource deltas to increase. When modelled with the unadjusted 2012/13 performance data, the model produced a resource estimate of 0.6% for the proposed minimum standard⁷²¹, significantly lower than the 20% figure calculated with the flattened performance profile. This is due to the difference in the absolute number of resources estimated in each case. With the unadjusted input data, a backlog of provision work in the latter part of the year caused the model to estimate a very high level of resources and consequently a low resource delta.⁷²²

AM analysis of the performance floor adjustment to the 2012/13 data

A17.163 We asked AM to review the two alternative methodologies for the 2012/13 data as put forward by Openreach and EY.

A17.164 AM applied the performance floor methodology to the 2012/13 data with a 35% performance floor in order to reproduce the results quoted by EY in their consultation response. AM obtained a 12.75% resource delta for the proposed minimum standard (80% provision, 80% repair, 12 day appointment availability SLA). AM considered that the reasons for the difference between their result and the 15.5% obtained by EY were unclear but they were most likely due to small differences in the Simul8 software build or model version.⁷²³

A17.165 AM also explored the sensitivity of the 2012/13 results to the setting of the performance floor. AM found the model to be sensitive to the level of the performance floor setting. Table A17.10 below shows the results of AM’s sensitivity analysis.

Table A17.10: Sensitivity of the revised 2012/13 resource deltas to performance floor settings⁷²⁴

Target: 80% of faults completed within SLA, 80% of provision orders completed within 12 days.	No Floor (unadjusted distribution)	20% Floor	30% floor	35% Floor	Flattened distribution (equivalent to 46% floor)
Resource delta	0.6%	1.5%	6.8%	12.8%	20.0%

Source: Figure 2.2, AM Comments on QoS Model Consultation Responses

⁷²⁰ Paragraph 11.28, Alix Partners, *QoS Report*.

⁷²¹ 80% of faults completed within SLA timescales (excluding MBORC), 80% of provision orders completed within 12 days.

⁷²² Section 2.1, *AM Comments on QoS Model Consultation Responses*.

⁷²³ Section 2.2.2, *AM Comments on QoS Model Consultation Responses*.

⁷²⁴ AM intended to run scenarios with the performance floor set at 40% (the upper end of the range quoted by EY) and 45% (close to the flattened performance level of 46%), however the model was incapable of operating with these settings.

A17.166 AM also calculated the resource deltas for the first six months of 2012/13 for 80% repair performance and 80% provision performance against a 12 day SLA. AM obtained a resource delta of 13.7% compared with 15.3% obtained by EY. AM was unclear about the reason for the difference but considered it likely that differences in the Simul8 software, model build or the precise dates modelled were likely to be responsible.⁷²⁵

A17.167 AM concluded that both the performance floor methodology and the first six months methodology would be likely to be more robust than the flattened performance profile. However it considered that neither were without difficulties. The performance floor result was heavily dependent on the setting of the performance floor setting. Whilst the 35% figure used by EY had some rationale and did not appear unreasonable AM had not seen evidence to suggest that its derivation is rigorous. The first six month methodology ignores the seasonality of the results and the fact that Openreach would be assessed on an annual basis. Whilst AM agreed with EY that adjustments to datasets are not necessarily problematic, in the case of the 2012/13 data, the amount of adjustment and the large impact on the results were a cause for concern.

A17.168 AM also considered EY's comment that the 2011/12 results would be less reliable than the 2012/13 results because Openreach had not been subject to a provision appointment SLA in 2011/12. Although it did not have strong views on the subject, AM observed that:

- Given that a certain level of performance was achieved in the baseline and that the model output is resource deltas for different performance scenarios, it did not seem overly problematic that a provision appointment SLA was not in place.
- Following the adjustments to the 2012/13 data, it is unclear whether the provision appointment availability SLA remains intact from a modelling perspective (i.e. the appointment lead times are significantly altered by the adjustment).⁷²⁶

Ofcom's assessment of the resource estimates

Consideration of the 2012/13 results produced with the flattened performance profile

A17.169 We consider that the limitations in the simulation and resource estimation approaches discussed above are particularly apparent with the modelling of 2012/13.

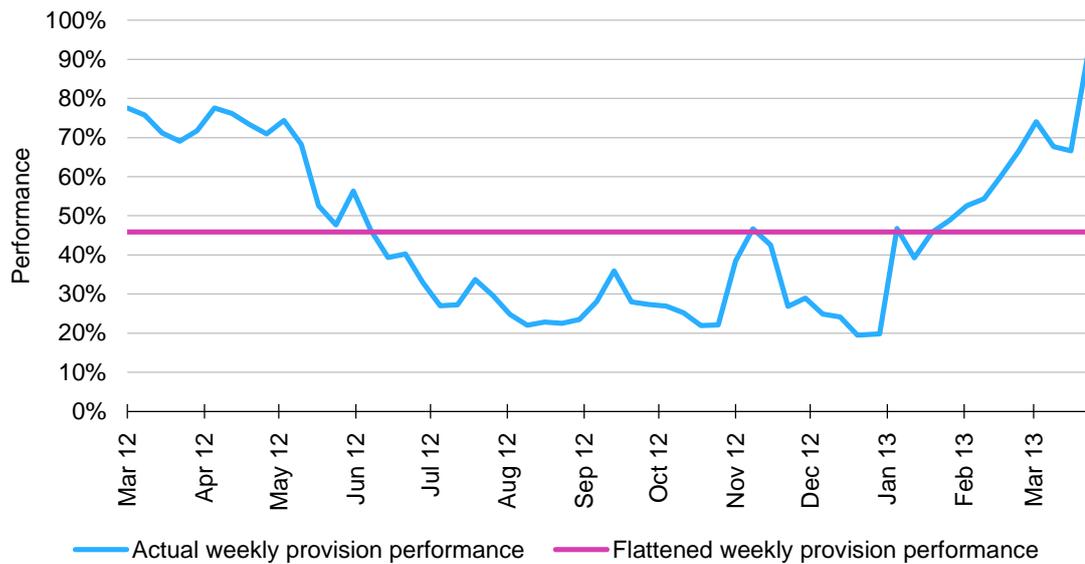
A17.170 When originally modelled the 2012/13 input data produced an unrealistically high peak in the resource estimates towards the end of the year. This was because provisioning performance fell to a very low level in the summer leading to a backlog of orders, which in turn led the model to estimate an unrepresentative spike in resource requirements. As a result, Openreach adjusted the input data by completely flattening the provision performance profile, setting it at the annual average for the whole year.⁷²⁷ Figure A17.5 below reproduces Figure 4.6 from the AM report showing the adjustment.

⁷²⁵ Section 2.2.3, *AM Comments on QoS Model Consultation Responses*.

⁷²⁶ Section 2.3, *AM Comments on QoS Model Consultation Responses*.

⁷²⁷ See Section 4.3.1, *Analysys Mason, QoS Model Report* in Annex 29 of the December 2013 LLU WLR Consultation for Analysys Mason's discussion of this adjustment.

Figure A17.5: 2012/13 provision performance profile and adjustment made by Openreach



Source: Analysys Mason’s QoS Model Assessment

A17.171 AM examined the impact of the adjustment and found that it had the effect of increasing the resource deltas for improvements in performance. This was because performance in the lowest performing weeks had been adjusted upwards with the result that more resources are required to improve performance than with a normal ‘peaky’ performance distribution.

A17.172 Whilst we acknowledge that 2012/13 may have been more challenging for Openreach than 2011/12 we find it difficult to reconcile the differences in the 2011/12 and 2012/13 estimates with the differences in the operational challenges faced by Openreach. In particular:

- We note there is a marked disparity in the movement in the baseline resource estimates produced by the model and Openreach’s recorded resourcing patterns, the former being \times higher in 2012/13 than 2011/12 and the latter \times higher.
- The 2012/13 resource estimates for performance improvements are very high indeed and much higher than the 2011/12 resource estimates particularly when the \times difference in the baseline resource estimates is taken into account. We find these estimates difficult to reconcile with the very much smaller differences in the fault and order volumes between the respective years that we discussed in the July 2013 FAMR Consultation. They are also very much larger than the shortfall indicated by our resource utilisation studies described earlier in this section.
- In light of the above, our judgement is that there is little evidence that the differences in the operational challenges faced by Openreach could be responsible for the very much larger resources estimates in 2012/13 than 2011/12. In our view it is likely the differences have been driven more by a combination of the impact of the adjustment to the provision data as identified by AM and the limitations of the simulation and resource approaches in dealing with large drops in performance and the associated backlogs. We are therefore not persuaded that the original 2012/13 resource estimates (i.e. those produced with

the flat performance profile) are sufficiently representative to form the basis of our charge control calculations.

Consideration of revised 2012/13 results produced using the performance floor methodology

A17.173 The Performance Floor methodology that Openreach has proposed in its consultation response attempts to address our concerns about the reliability of the 2012/13 results with an alternative method of adjusting the input performance data. In some respects the application of a performance floor is more attractive than completely flattening performance because it seeks to retain some of the observed variation in performance which is at the heart of the distribution approach to discrete event simulation.

A17.174 As AM explain in their analysis, all of the results under consideration here may be considered as a series of Performance Floor results with different performance floor settings. At one end of the series there are the flattened performance results (effectively a very high performance floor of 46%) which for the reasons discussed above we consider unreliable. At the other end of the series there are the completely unadjusted results (effectively a performance floor of 0%) that Openreach discarded because backlogs led to unrealistically high baseline resource estimates. As the performance floor is reduced from 46% to 0%, the baseline resource estimates and the resource delta for performance improvement move in opposite directions:

- The baseline resource estimates increase from the flattened performance level (which as discussed above, we consider problematic) to the unrealistic levels observed by Openreach; and
- The resource deltas for performance improvements decrease from a very high level to a very low level as illustrated in Table A17.10 above.⁷²⁸

A17.175 Thus at any point in the series, the combination of the resource deltas for performance improvement and the baseline resource estimates indicate a very much larger resource estimate for 2012/13 than 2011/12.

A17.176 In our view, all of the results in this series suffer from the same underlying issue as the flattened performance results i.e. that it is difficult to reconcile the difference between the 2012/13 results and the 2011/12 results (taking into account the resource deltas and the difference in the baseline resource estimates between 2012/13 and 2011/12) with the differences in the operational challenge faced by Openreach in 2012/13 compared with 2011/12.

A17.177 The new Performance Floor results strengthen our view that the difference between the 2012/13 results and the 2011/12 results are driven more by a combination of the adjustments to the provision data and the limitations of the simulation and resource estimation approach in dealing with large drops in performance and the associated backlogs. Figure 6 of EY's report⁷²⁹ lends support to the view that the adjustments to the performance data have not fully mitigated the impact of the backlogs. This shows that there is a significant accumulation of backlogs across the range of performance floor settings, including flattened performance. We are therefore not

⁷²⁸ This is because as the baseline resource estimate increases, the level of idle resources away from the backlog induced peak also increases and as a result it becomes easier to improve performance with the baseline resources.

⁷²⁹ Figure 6, EY *Response to Comments on the DES Model*.

persuaded that the revised results for 2012/13 produced using the Performance Floor methodology are sufficiently representative to form the basis of our charge control calculations.

A17.178 In light of the above, we consider that the 2011/12 modelling provides a more representative estimate of the resource increments required to improve performance because unlike the 2012/13 estimate it is based on unadjusted input data. Also performance was more stable in 2011/12 and the results are less likely to have been unduly influenced by sustained backlogs which were, in turn influenced by resourcing decisions made by Openreach.

Consideration of the revised 2011/12 resource estimates

A17.179 As we have discussed in paragraph A17.62 above, in its response to the December 2013 LLU WLR Consultation, Openreach proposed that if we base our resource estimate for the proposed minimum standard on the 2011/12 data we should add 1.2% to the estimate produced by the Resource Simulation Model to account for the additional constraint that the appointment availability SLA would have imposed on its resourcing flexibility had it been in force had it been in force in 2011/12. This would raise the resource estimate for the proposed minimum standard from 3.4% to 5.1%.

A17.180 We accept that the addition of an appointment availability SLA reduces Openreach's resourcing flexibility because it reduces flexibility to divert resources from provision work to repair work in times of sustained high demand. However, we do not consider that an adjustment to the resource estimates is necessary since the resource estimates for performance improvements measure the gap between the baseline performance (i.e. the performance actually achieved) and the target level of performance. To the extent to which Openreach made use of the additional resourcing flexibility resulting from the absence of an appointment availability SLA in 2011/12, it would be reflected in lower baseline provision performance and therefore lower baseline resource estimates. Consequently we consider that the absence of an appointment availability SLA in 2011/12 is already taken into account in the resource estimates and no further adjustment of the 2011/12 estimates is justified.

A17.181 We also observe that even if the Resource Simulation Model had produced reliable outputs for 2012/13, the resource estimates would not in our opinion have been particularly representative of Openreach's performance under the appointment availability SLA given the very low performance against this measure for much of the year.

Our conclusions about the resource estimates produced by the Resource Simulation Model

A17.182 Our overall assessment is that the Resource Simulation Model is a reasonable vehicle for understanding variations in Openreach operations, though one with clear limitations. However, a model of this type is necessarily a highly simplified representation of Openreach's operations and consequently there will be an irreducible level of uncertainty about the resource estimates even if the issues discussed above were addressed.

A17.183 We acknowledge Openreach's view that the difference between fault levels in 2011/12 and 2012/13 represents the differences in the demand Openreach experiences and it would be desirable to model resource demands in 2012/13 as well as 2011/12. However, as discussed above, we consider that the Resource

Simulation Model cannot produce reliable results for 2012/13 due to the inability of the simulation approach to cope with the large fall in performance observed in 2012/13. Consequently we consider that the 2012/13 results are not suitable for use as an input to our charge control models.

A17.184 We consider that the 2011/12 results are likely to be more representative because they are based on unadjusted input data and are modelled on a year in which performance was more stable. We have however concluded that two of the modelling assumptions are likely to lead to an upward bias in the resource estimates, suggesting that absent other considerations a downward adjustment would be appropriate.

A17.185 In order to reach a final view about the suitability of the resource estimates for the charge control models there are two other issues that need to be considered:

- Firstly, we have concluded that the resource estimation approach appears likely to have led to an upward bias in determining the resource deltas and that the fixed mode assumption used to shape the gamma distribution may also have resulted in an upward bias in the resource deltas. Absent other considerations this would suggest that a downward adjustment would be appropriate.
- Secondly, we are conscious that using the 2011/12 model results may risk underestimating the resources required to meet the minimum standards in more challenging years. We consider that the risk of underestimating the resources required for more challenging years has been addressed primarily through the adoption of an MBORC allowance based on the more challenging 2012/13 outcomes (see paragraphs xx to xx). However we also need to consider whether it would be appropriate to make a further adjustment to account for the difference in resource levels between 2011/12 and 2012/13 again to account for the additional resources required when conditions are more challenging.

A17.186 On balance we consider that there is a risk of under estimation of the resource requirements of more challenging years though this is very difficult to quantify.

A17.187 Accordingly absent a definitive means of determining the scale of the upward bias in the 2011/12 model results discussed above, we have decided to use the 2011/12 model outputs.

A17.188 In reaching this decision, we have taken account of the irreducible level of uncertainty discussed above and the fact that the 2011/12 model outputs are in line with our own analysis discussed in this Annex which indicates that even the significant fall in performance in 2012/13 stemmed from a relatively small shortfall in resources and also that a relatively small increase in resource would have a significant impact on performance.

A17.189 In summary we conclude that the 2011/12 resource estimates provide us with a reasonable basis to assess the resource increments and therefore the price impacts associated with the imposition of minimum standards.

Annex 18

Analysys Mason Comments on QoS Model Consultation Responses

A18.1 Please see the separate PDF document published alongside this Statement entitled *Analysys Mason Comments on QoS Model Consultation Responses*. This is available here:

http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/18_annex18.pdf

Annex 19

Service Level resource differentials

Introduction

- A19.1 In this Annex we set out our conclusions on the relative difference in costs that result from the WLR and MPF services having different contractual Service Levels.
- A19.2 This issue arises because MPF has a higher contractual repair standard, known as a Service Level. For MPF reported faults must be repaired by the end of the next working day after being reported (including Saturdays) – referred to as Service Level 2. In comparison, WLR faults must be repaired by the end of the second working day after being reported (excluding Saturdays) – referred to as Service Level 1. Openreach also offers Service Levels 3 and 4, which provide for increasingly fast committed repair times. For the purposes of this assessment, however, we have only focused on the cost differential between Service Levels 1 and 2 as it is these standards that are important for modelling the costs of the core services.
- A19.3 We use the term Service Level cost differential to refer more generally to the difference in the costs associated with undertaking repairs between Service Level 1 and 2. The Resource Simulation Model developed by Openreach (with EY support), which is discussed in detail in Annex 17, can be used to attempt to estimate this differential. However, the Resource Simulation Model only considered the engineering *resources* (expressed in FTEs) involved in providing Service Level 1 and 2, while other inputs are also used that go towards the *cost* differential. Therefore, we have used the term Service Level resource differential to refer to the estimates produced by the Resource Simulation Model. In order to understand how the Service Level resource differential impacts on the cost estimates used in the charge controls please refer to Annex 13.
- A19.4 In Annex 17, paragraphs 17.182 – 17.189 we concluded that the Resource Simulation Model was a reasonable vehicle (though one with limitations) for the modelling the resource requirements for service quality. In this Annex we consider a different question: whether a variation of the model first considered in Annex 17 would be suitable for estimating the Service Level resource differential.
- A19.5 In the December 2013 LLU WLR Consultation we explained the basis for our proposal that led us to estimate the Service Level resource differential as being 14.1%. Following careful consideration of stakeholders' responses to this aspect of our proposals, we commissioned Analysys Mason (AM) to prepare a further report addressing this issue (See "AM Comments on QoS Model Consultation Responses" in Annex 18). Having considered those submissions and that further evidence, for the reasons set out in more detail in the remainder of this Annex, our best estimate of the Service Level resource differential is 21%. We have therefore concluded that it is appropriate to set the Service Level resource differential for the purposes of the Cost Model at 21%.
- A19.6 In this Annex we first discuss the general approach to estimating the Service Level cost differential before covering in more detail the main assumptions used in the Resource Simulation Model for the purpose of this estimation. For both sections we:

- 19.6.1 report the proposals in our December 2013 LLU WLR Consultation;
- 19.6.2 summarise the responses received from stakeholders; and
- 19.6.3 provide our response and an explanation of how we reached our conclusions.

December 2013 LLU WLR Consultation proposals

Background: The July 2013 LLU WLR Consultation Proposal

- A19.7 In the July 2013 LLU WLR Consultation, we explained that we considered it appropriate to allocate a higher proportion of repair costs to MPF than to WLR basic on the basis that MPF has a higher repair Service Level.⁷³⁰
- A19.8 BT had proposed that this difference should be 20% and had reflected this in its Regulatory Financial Statements (RFS). This was a significant increase against the allocation in the 2012 charge control, which was 5.4%.
- A19.9 We noted that this issue had been the subject of one of the Competition Commission's findings in the 2012 charge control appeal, where Ofcom's approach had been upheld on appeal. In the absence of further robust evidence, we proposed to estimate the Service Level cost differential using the methodology established in 2009 and used again in the 2012 charge control.
- A19.10 In the July 2013 LLU WLR Consultation we explained that, during the course of our on-going analysis of QoS and fault rates, we intended to give further consideration to the estimation of the Service Level cost differential.

The December 2013 LLU WLR Consultation

- A19.11 After the July 2013 LLU WLR Consultation we continued to engage with BT and stakeholders on this issue with the assistance of AM. In the December 2013 LLU WLR Consultation we set out a revised set of proposals, which were based on a Resource Simulation Model provided by BT (developed by their advisers EY). We provided further details of AM's review in Annex 5 of our December 2013 LLU WLR Consultation as well as on the steps that we have taken to provide transparency to stakeholders about the model.
- A19.12 In the December 2013 LLU WLR Consultation we explained that the modelling task necessary to seek to estimate the difference in the average cost per line incurred by Openreach in undertaking repairs under Service Levels 1 and 2 was highly complex. Our understanding was that engineering activity is the dominant driver of costs when repairing faults. On this basis, the Resource Simulation Model sought to use the Service Level resource differential in engineering activity (expressed in FTEs) between Service Level 1 and 2 as a proxy for the Service Level cost differential.
- A19.13 We also explained our assessment that the engineering activity associated with actually repairing a fault would be the same irrespective of whether that repair is undertaken under Service Level 1 or Service Level 2. However, the higher the Service Level, the less flexibility Openreach has as to the timing of the repair. By way of example, we noted that if a substantial number of faults arose on Monday,

⁷³⁰ Paragraphs A13.122-A13.149, Ofcom, *July 2013 LLU WLR Consultation*

under Service Level 2 Openreach would be obliged to undertake a repair by the end of the following working day to meet its contractual obligations. This means that a substantial peak of resources would occur on the Tuesday. However, if these repairs could be completed under Service Level 1 (which requires repairs to be completed by the end of the second working day), the peak that would otherwise occur on Tuesday could be reduced (or shifted) as some of these repairs could be undertaken on Wednesday. This would reduce the resources that Openreach would need to have available, as these are determined by the level of resources required at peak.⁷³¹ Hence, the less flexibility Openreach has under Service Level 2 relative to Service Level 1, the higher the peak of resources it faces and the greater its resource availability requirements.

A19.14 In seeking to estimate the Service Level resource differential, the conceptual approach that we adopted in the December 2013 LLU WLR Consultation was to consider the incremental resources required to undertake some repair jobs at Service Level 2 rather than at Service Level 1. In order to illustrate how this could be approached conceptually, we argued that the first step would be to estimate the required resources, expressed in Full Time Equivalents (FTEs)⁷³², if all repairs were undertaken at Service Level 1. The second step would then be to estimate the FTEs required, if a proportion of these repairs were instead undertaken at Service Level 2 (while the remainder stayed at Service Level 1). The difference between the two total levels of resources could then be interpreted as the incremental FTEs required by the introduction of the proportion of repairs moving from Service Level 1 to Service Level 2.

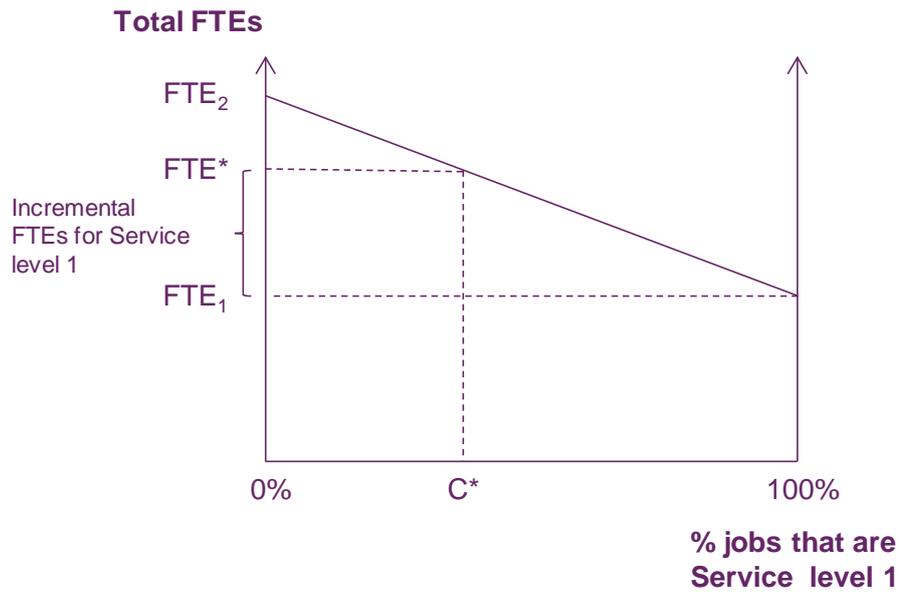
A19.15 This approach is illustrated by Figure A19.1. If all repairs were undertaken at Service Level 1, Openreach would require a level of FTEs equivalent to FTE_1 .⁷³³ However, if the proportion of Service Level 1 repair jobs was only C^* and the remainder of repairs were undertaken at Service Level 2, the FTEs required would be higher and, in this illustration, equivalent to FTE^* . The difference between FTE^* and FTE_1 would indicate the incremental overall FTEs required to undertake a proportion C^* of repairs at Service Level 2 instead of Service Level 1.

⁷³¹ This would be the case if Openreach's resources consisted of full time employees. However, even if Openreach made use of temporary contractual resources to cover peaks in demand, we understand that such resources would be more expensive (i.e. on a hourly basis). Hence, in terms of cost, there may be not much difference in considering whether repairs are undertaken only by Openreach's employees or also by some contractors.

⁷³² A FTE is a measure of resources or work, defined by reference to the capacity of a full time employee. A FTE of 1 is equivalent to one full time employee.

⁷³³ This assumes that to undertake a repair under Service Level 1 would require fewer resources than if the same repair was undertaken at Service Level 2.

Figure A19.1: Impact of undertaking a proportion (C*) of repair jobs at Service Level 2



Source: December 2013 LLU WLR consultation, Figure 4.1.

- A19.16 Given the linear relationship between the total FTEs and the proportion of repairs that are undertaken at Service Level 1 in the illustrative example shown in Figure A19.1, the gradient⁷³⁴ of the line in Figure A19.1 expresses the percentage constant resource differential per job between undertaking repairs at Service Level 2 rather than Service Level 1.⁷³⁵
- A19.17 In the period prior to our December 2013 LLU WLR Consultation, Openreach provided a modified version of the Resource Simulation Model discussed in Annex 5 of our December 2013 LLU WLR Consultation. The Resource Simulation Model incorporated a functionality to vary the mix of Service Level 1 and Service Level 2 services across the full range (i.e. from 0 to 100% of either Service Level) and to assess the impact on resource levels. Our assessment in the December 2013 LLU WLR Consultation was that the adjustments that Openreach made to the Resource Simulation Model were an attempt to implement this conceptual approach.
- A19.18 In the period leading up to our December 2013 LLU WLR Consultation Openreach used its model to estimate the Service Level resource differential for a range of service mixes and for three levels of performance against the repair SLAs. Following a number of discussions with Ofcom, Openreach estimated the resources required under different mixes.⁷³⁶ On the basis of these estimates, the Resource Simulation Model suggested that the difference between the average resources required for repairs under Service Level 1 and 2 did not depend on the Service Level mix. For example, for a given performance target (e.g. 80%) the average resource differential per repair was constant regardless of whether there was a

⁷³⁴ The gradient is defined as the change in the vertical axis and the change in the horizontal axis. Given that the relationship shown in Figure A19.1 is linear the gradient remains constant irrespective of the proportion of repairs at Service Level 1.

⁷³⁵ If the relationship were not linear the average resource difference per job would change as the proportion of Service Level 1 repair jobs changes.

⁷³⁶ For the 2011/12 year Openreach estimated the total FTEs required the proportion of Service Level 1 were 100, 60, 55, 48, 35 and 0 per cent.

single Service Level 2 repair or where 50% of repairs were undertaken at Service Level 2.

- A19.19 According to Openreach, the model results indicated that the Service Level resource difference between Service Level 1 and Service Level 2 repairs was “approximately 20%.”⁷³⁷ For the reasons discussed in Section 3 in our December 2013 LLU WLR Consultation, we considered that the appropriate base year to use for the purposes of this analysis was 2011/12.⁷³⁸ In addition, using an 80% performance target (see also Section 3 in our December 2013 LLU WLR Consultation) the Resource Simulation Model estimated a constant resource differential of 23% between undertaking a Service Level 1 and 2 repair. We understood that this was the Service Level cost differential which Openreach suggested existed between Service Level 1 and Service Level 2 repairs for the chosen performance target.
- A19.20 In the period that led up to our December 2013 LLU WLR Consultation, we commissioned AM to review Openreach’s Service Level resource differential estimates as part of its wider review of the Resource Simulation Model (see Annex 9 in our December 2013 LLU WLR Consultation for more details). AM found that, in relation to the Service Level resource differential estimates, the model operated as described by Openreach and it was able to reproduce Openreach’s estimates. However, AM raised concerns about several changes to the modelling methodology used to derive the Service Level resource differential compared with the model used for the performance improvement resource differentials (discussed in detail below).
- A19.21 Overall we considered that this approach was a substantial improvement on previous submissions by BT Group on the service differential (notably submissions received for the previous charge controls and those made in the context of BT’s appeal of the Service level cost differential adopted in that charge control). Notably, the dataset on which it is based could potentially be used to understand real world cost differentials. However, we noted that the Resource Simulation Model was not originally built for the purpose of estimating the cost differential, but was subsequently adjusted to address this question. We also argued that it was important to bear in mind that the Resource Simulation Model compares overall (engineer) resource levels under different mixes of Service Level. This is an approximation, as several resources are required for repair jobs (technicians’ time, tools, vans, spare parts etc.).⁷³⁹ Furthermore, for the purposes of assessing whether there was a cost differential between Service Level 1 and 2 repairs, we noted that ideally one would need to translate resources into costs. In our December 2013 LLU WLR Consultation we stated that any value obtained from estimating the Service Level resource differential could be interpreted as a proxy for the Service Level cost differential and not a precise estimate.
- A19.22 With the help of AM⁷⁴⁰ we scrutinised the assumptions and workings of the Resource Simulation Model for the purpose of estimating the Service Level cost differential. Having undertaken that assessment and made a few adjustments (the

⁷³⁷ Openreach, *Openreach Service Cost Modelling*, presentation, 4 October 2013. The estimated Service Level resource differential varied depending on the level of the overall performance target and the year, as shown in Table 4.2 of our *December 2013 LLU WLR Consultation*.

⁷³⁸ We note that Openreach’s Resource Simulation Model estimates the resource differential to increase with the performance target in 2012/13 but to decrease in 2011/12.

⁷³⁹ The mix of resources will also depend on the type of repair job.

⁷⁴⁰ Ofcom, *December 2013 LLU WLR Consultation, Annex 9*.

detail of which is set out in next section), we proposed that the Service Level resource differential be set at 14.1%.

Stakeholders' responses to our use of the Resource Simulation Model to estimate the Service Level resource differential

- A19.23 We received a number of responses from stakeholders relating to our proposal to use the Resource Simulation Model for the purposes of estimating the Service Level cost differential. We have grouped these responses into those that refer to the modelling approach in general and those that concern the estimated Service Level resource differential. Submissions on the specific modelling assumptions are discussed in paragraph A19.39 onward.
- A19.24 With respect to the modelling approach, Openreach agreed with our proposals and argued that the Resource Simulation Model provided a legitimate basis for estimating the impact on total costs of varying the proportion of total repair jobs that is at Service Level 1. It argued that this modelling approach was a much improved approach compared to previously used approaches for assessing Service level cost differentials.⁷⁴¹
- A19.25 Virgin Media supported the commissioning of consultants (i.e. AM) to review Openreach's Resource Simulation Model and agreed with Ofcom that the cost of repairs should be reflected in the charges to maintain competitive neutrality between WLR and unbundled CPs.⁷⁴²
- A19.26 As noted in Annex 17 on the Quality of Service aspects of the charge control, Sky and TalkTalk submitted a report prepared on their behalf by Frontier Economics, which contained a critique of the Resource Simulation Model (see paragraph A17.72). Frontier Economics considered that the Resource Simulation Model was mis-specified and its criticisms of the model also applied to the use of the model for estimating the Service Level resource differential.⁷⁴³ TalkTalk, on the basis of Frontier Economics' submissions, considered that the Resource Simulation Model poorly represented the costs, with a risk of producing an overestimate.⁷⁴⁴ Sky stated that, in their view, the model was flawed and unreliable on the basis of AM's, Frontier Economics' comments and the comments in a further report they commissioned from Alix Partners.⁷⁴⁵
- A19.27 Frontier Economics (on behalf of Sky and TalkTalk) also argued that the estimated service level cost differential was heavily influenced by the values of extreme scenarios. It further argued that it would be more appropriate to look at the effects of changes in the Service Level mix starting from the current situation and then assess the impact of small changes to this.⁷⁴⁶
- A19.28 With respect to the Service Level resource differential that we estimated, Openreach argued that its 23% estimate (and not the 14.1% in our December 2013 LLU WLR Consultation) for the 80% performance target remains the correct one. Openreach observed that adopting different scenarios would lead to a range of

⁷⁴¹ Pages 52-53, Openreach Response to the December 2013 LLU WLR Consultation.

⁷⁴² Page 6, Virgin Media Response to the December 2013 LLU WLR Consultation.

⁷⁴³ Page 18, Frontier Economics Response to the December 2013 LLU WLR Consultation.

⁷⁴⁴ Paragraphs 10.25-10.26, TalkTalk Response to the December 2013 LLU WLR Consultation.

⁷⁴⁵ Pages 2, 17-18, Sky Response to the December 2013 LLU WLR Consultation.

⁷⁴⁶ Page 18, Frontier Economics Response to the December 2013 LLU WLR Consultation.

estimates. Overall and across these scenarios, it stated that the Service Level cost differential was in the order of about 20%.⁷⁴⁷

A19.29 TalkTalk considered that our estimates of a 14.1% service differential should be reduced to 10% on the basis of the Frontier Economics' report that had identified a number of concerns that would bias the estimate upward.⁷⁴⁸ One confidential respondent Σ argued that, because of the information asymmetry, it could not comment of the legitimacy of Ofcom's calculations but only on what the underlying process to derive estimates should be. It argued that the only difference between Service Level 1 and 2 should be the incremental costs of having sufficient engineering resources available to rectify faults more quickly and on a Saturday, less any efficiency savings in diagnosis and rectification time and effort from the customer base that more naturally takes Service Level 2. This was based on one confidential respondent's Σ observation that, in its experience, business customers with more competence than residential customers were less likely to take basic packages.⁷⁴⁹

Our response and conclusions

A19.30 In terms of the modelling approach, Frontier Economics argued that the model was mis-specified. According to TalkTalk and Sky, the model was flawed and unreliable. We discuss the specific concerns identified by Frontier Economics in Annex 17 (paragraphs A17.77-A17.79).

A19.31 All stakeholders are in agreement that there is a Service Level cost differential and accept that this should be reflected in setting the charge controls, though they disagree on the level of such differential. As the Competition Commission recognised in the appeal of the 2012 charge control, the modelling approach previously adopted to seek to address this issue had limitations and was not an ideal solution to estimating the resource differential.⁷⁵⁰

A19.32 We have therefore sought to exercise our judgement to determine an appropriate way of estimating the Service Level cost differential. While we accept that the Resource Simulation Model is not immune to criticism (indeed, we have assessed the detailed criticism of the model prepared by AM), in our view it represents a significant improvement over the previous approaches to the estimation of a cost differential. Our view is that, appropriately adjusted, it is capable of forming a reasonable basis for estimating the Service Level cost differential. In the absence of a better alternative, we consider that the Resource Simulation Model offers a reasonable analytical basis for the estimation of the Service Level cost differential.

A19.33 In terms of the submissions regarding the level of the estimated Service Level resource differential, we consider that it is best to assess these in the context of the discussion of the appropriate assumptions on which to base our estimation (see paragraphs A19.39 to A19.91). We note in this regard, however, that we do not agree with TalkTalk's argument that Frontier Economics' comments would lead to an estimate of 10%. No evidence has been provided to suggest that this would be a more reliable and accurate estimate than the one that results from the (adjusted) Resource Simulation Model.

⁷⁴⁷ Pages 52-53, Openreach Response to the December 2013 LLU WLR Consultation.

⁷⁴⁸ Paragraphs 10.25 – 10.26, TalkTalk Response to the December 2013 LLU WLR Consultation.

⁷⁴⁹ Q4.1, Σ Response to the December 2013 LLU WLR Consultation.

⁷⁵⁰ Paragraph 6.65, March 2013 CC Determination.

- A19.34 One confidential respondent \times observed that the Service Level cost differential should not only reflect differences in incremental costs of having sufficient engineering resources but also the difference in efficiency savings that Service Level 2 customers entail by providing a better diagnosis. The argument is based on the observation (in the confidential respondent's \times experience) that Openreach would enjoy savings when dealing with Service Level 2 customers as these would be better at diagnosing the fault type. We agree with this confidential respondent \times that in principle, if we had reliable evidence of this effect, it would be appropriate to reflect it in our estimation. However, our understanding of the process is that Openreach would almost always undertake a (remote) line test before sending out its engineers. It would also consider the fault details as reported by the CP so the CP's dialogue with the customer would also be relevant. However, we consider that the type and location of most faults should be obvious from the line test. Hence, we consider that this is unlikely to materially affect the estimation.
- A19.35 Frontier Economics also argued that the Service Level resource differential estimate in the December 2013 LLU WLR Consultation was heavily influenced by the values estimated for the extreme observations (i.e. Service Level 1 being either 0% or 100% of all repairs) and that it would be appropriate to look at the more realistic narrower ranges around today's mix of services. To investigate this suggestion, we asked AM to undertake further checks and sensitivity on the impact of excluding the values in extreme scenarios. AM reported (See "AM Comments on QoS Model Consultation Responses" in Annex 18, in Section 3.2) that:
- 19.35.1 Estimating the slope of a linear regression through the available point estimates yielded an estimated Service Level resource differential of 23.6% (unadjusted for economies of scope between repairs and provisions). This is very similar to the estimate obtained by only considering the extreme observations;
 - 19.35.2 Results from the Resource Simulation Model are sensitive to small changes in the Service Level mix as exogenous factors can affect the estimation. This effect is minimised over larger ranges; and
 - 19.35.3 When estimating the slope of a linear regression by excluding the extreme observations, AM noted that the effect identified in paragraph 19.35.2 came to play and the slope could be more or less steep depending, for example, whether we included all four or only three of the central observations.
- A19.36 AM concluded that the approach that makes use of the extreme observations would be a more accurate reflection of the underlying Service Level resource differential.
- A19.37 At paragraph A19.21 we noted that the Resource Simulation Model only estimates the Service Level resource differential in terms of (engineer) resource (expressed in FTEs) and that other inputs are also required to undertake repairs. As noted in Annex 13 this has important implications for setting the relevant charge controls (for a detailed discussion see paragraphs A13.30 to A13.34.)
- A19.38 Overall, we have concluded that the Resource Simulation Model (with the adjustments discussed in the next section), though not immune to criticism, can appropriately be used to estimate the Service Level resource differential.

Detailed assessment of each of the adjustments to the Resource Simulation Model

A19.39 In the next sub-sections, we first provide some background on the work undertaken on the specific modelling assumptions. Then, for each assumption Openreach modified for the purposes of calculating the Service Level cost differentials we:

19.39.1 report the proposals of our December 2013 LLU WLR Consultation;

19.39.2 summarise stakeholders' responses to our December 2013 LLU WLR Consultation; and

19.39.3 provide our response and explanation of how we reached our conclusions.

The December 2013 LLU WLR Consultation

A19.40 In the period that led up to our December 2013 LLU WLR Consultation, as mentioned at paragraph A19.20, we asked AM to review several changes to the modelling methodology used to derive the Service Level resource differential compared with the version of the model used for the performance improvement resource differentials.

A19.41 AM considered that these might not be fully justified and in some cases might affect the results. In particular, AM identified the following adjustments made by Openreach to the Resource Simulation Model in order to estimate the Service Level resource differential:

19.41.1 made use of a 'Top 10' resource re-distribution algorithm (instead of the 'Maximum Day' resource re-distribution algorithm used elsewhere in the Resource Simulation Model);

19.41.2 revised the gamma distribution parameters to align the peaks of the gamma distributions used for Service Level 1 and Service Level 2 fault completions;

19.41.3 removed all provision jobs from the input data when running the simulation to assess Service Level cost differentials; and

19.41.4 excluded Saturday working for Service Level 2 faults.

A19.42 On the basis of the concerns it had raised, we asked AM to run the Resource Simulation Model with a different set of assumptions to the ones used by Openreach. In order to limit the number of scenarios required, we asked AM to base its analysis on our proposed base case scenario for the proposed minimum standard, namely using 2011/12 as a base year and an 80% performance target. The adjustments we asked AM to consider were as follows:

19.42.1 estimate the Service Level resource differential under a 'Maximum day' assumption (used in the Resource Simulation Model for the performance target question) and a 'Top 10' assumption (used solely for the resource differential question);

19.42.2 for each of the above assumptions we also asked AM to estimate the results by:

- using the gamma distribution assumptions used in the Resource Simulation Model for performance improvement resource estimates and the adjusted gamma distributions used for the resource differential question;
- including and excluding provisions; and
- including and excluding Saturday working for Service Level 2.⁷⁵¹

A19.43 Openreach expressed a number of “serious concerns” related to the validity of some of the additional scenarios with the changes in assumptions described in paragraph A19.42.^{752, 753} Openreach also observed that when Ofcom asked for these adjustments in the assumptions used in its model, Ofcom was at a very late stage in the process prior to the December 2013 LLU WLR Consultation and had left little scope for debate about the robustness and validity of the results before we decided whether or not to publish them (see paragraphs 4.35.1 to 4.35.4 of the December 2013 LLU WLR Consultation for further details of Openreach’s concerns).

A19.44 We noted Openreach’s concerns and took them into account in reaching our provisional conclusions. We understood that the Resource Simulation Model suffered some limitations as it was not originally designed to address the issue of the Service Level cost differential. However, we considered that to correctly assess the validity of the Resource Simulation Model and understand its reliability we needed to undertake some further testing under different assumptions. We understand that, to the extent that this led to counter-intuitive results as mentioned by Openreach, this was a cause for concern. However, we considered that it was equally inappropriate to modify the assumptions used for other modelling purposes unless such changes can be carefully justified and doing so leads to more credible results. This led us to consider that the fact that this Resource Simulation Model was not designed to address the Service Level cost differential issue was a critical consideration to factor into the weighting we gave its results.

A19.45 We discuss each issue raised by AM in the next sections.

Redistribution method

Proposals in the December 2013 LLU WLR Consultation

A19.46 The Resource Simulation Model uses a two-step approach to estimate resources. The second step, known as ‘resource re-distribution’ adjusts the resource estimates produced by the simulation in order to take further account of the flexibility within a skill group to undertake other skill groups’ work. The Resource Simulation Model contains two versions of the resource re-distribution calculation, referred to as the ‘Maximum Day’ approach and the ‘Top N’ approach (where N is a number that the user can select).⁷⁵⁴

⁷⁵¹ We also asked AM also to provide the estimates for a number of combinations of the above assumptions.

⁷⁵² Email from ☒ Head of NGA Regulatory Affairs, Openreach to ☒, Principal Competition Policy, Ofcom, 22 November 2013.

⁷⁵³ We also asked Openreach to undertake the same exercise.

⁷⁵⁴ Paragraphs A5.62-A5.68, Annex 5, *December 2013 LLU WLR Consultation*. For a more detailed description of the resource distribution calculation see Sections 2.4, 3.3, Analysys Mason, *Quality of Service model assessment: Final Report for Ofcom*, November 2013.

- A19.47 Openreach used the Maximum Day calculation for all of the resource estimates for performance improvements associated with the Quality of Service minimum standards. However, for its submissions on the Service level cost differential, Openreach modified the redistribution approach and adopted a 'Top 10' approach (i.e. the Top N calculation where N is set to 10). The effect of this change was to redistribute idle resources for the Top 10 days rather than the one day under the Maximum Day approach.
- A19.48 In the December 2013 LLU WLR Consultation we said that Openreach had not provided a sufficiently strong justification for departing from the Maximum Day approach for the purpose of estimating the Service Level resource differential, particularly given AM's view that the Top 10 calculation was not a useful measure of resources. For the purpose of our proposals, we therefore considered that it was more appropriate to use the Maximum Day calculation.
- A19.49 We noted Openreach's observation that it had only applied the Top 10 approach to the 75% Service Level scenario.⁷⁵⁵ As all the results obtained by AM were based on the 80% Service Level scenario, there should have been no difference between Openreach's and AM's estimates. However, AM in re-estimating the Service Level resource differential found that there was a substantial difference between its estimated results (17.9%) and Openreach's (23%). We considered it prudent to apply a consistent approach in modelling resource impacts for different performance targets and service differentials, unless there was a clear reason for adopting different assumptions. Therefore, we considered it more appropriate to base any determinations on the Maximum Day approach.

Stakeholder responses to the July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation

- A19.50 EY (on behalf of Openreach) and Openreach agreed in principle that it was preferable to use the Maximum Day approach in all scenarios. However, EY argued that for a specific scenario (2011/12 and 75% performance) the results produced were inconsistent with the linearity result for the Service Level resource differential (i.e. they showed some non-linearity) and it was felt more appropriate to rely on the Top 10 Day estimate.⁷⁵⁶
- A19.51 However, Openreach disagreed with the estimated value used in our December 2013 LLU WLR Consultation (17.9%) for the Maximum Day redistribution approach and suggested that the difference in value was likely to be an error on the part of Ofcom or AM. It maintained that for the relevant scenario the correct estimate remained 23%.⁷⁵⁷

⁷⁵⁵ Openreach subsequently clarified that had it used the Top 10 approach only for the 75% repair scenarios (for both 2011/12 and 2012/13) and had used the Maximum Day approach for the other Service Level resource differential scenarios. It had not fully explained this distinction in the material it had originally provided to Ofcom. Openreach did not consider this point to be as problematic as Ofcom's other queries about the modelling assumptions. It explained that, in this instance, it ran a number of different scenarios using different resource redistribution approaches (e.g. Maximum Day, Top 10 etc.) but some produced less consistent results than others. Openreach argued that, for the 75% repair scenario, the Top 10 approach produced a more consistent set of results than the Maximum Day approach, albeit with slightly lower differentials. It felt that this was more useful output for both Openreach and Ofcom. In Openreach's (and EY's) view, the approach used was a robust way of estimating the resource required to increase the Service Levels.

⁷⁵⁶ Paragraphs 5.29-5.32, EY Response to the December 2013 LLU WLR Consultation.

⁷⁵⁷ Page 52, Openreach Response to the December 2013 LLU WLR Consultation.

Our response and conclusions

- A19.52 We note Openreach's explanation for why it put forward an estimate based on the Top 10 Day approach for a single scenario. We considered that this has no impact as the scenario to which Openreach applied the Top 10 Day approach (2011/12 and 75% performance) was not considered as a relevant scenario for this analysis (i.e. we used 2011/12 and 80% performance).
- A19.53 In the light of Openreach's (and EY's) concern that the difference in the estimated values under the Maximum Day approach by EY and AM, we asked AM to rerun their estimates to check whether their initial estimate was correct. AM (See "AM Comments on QoS Model Consultation Responses" in Annex 18, Section 3.1.1) has rerun the Resource Simulation Model and concluded that an incorrect model setting had been used. It confirmed that the correct estimate under the Maximum Day approach was 23% (without yet considering adjustment for economies of scope between provisions and repairs).

Gamma distribution

Proposals in the December 2013 LLU WLR Consultation

- A19.54 In the Resource Simulation Model a gamma distribution is used to represent the waiting time of jobs in the queue prior to execution.⁷⁵⁸
- A19.55 AM noted that, for the Service Level resource differential, Openreach had made changes to the parameters used to control the shape of the gamma distribution. These changes had the effect of aligning the peak of Service Level 1 and Service Level 2. In essence, while in the Resource Simulation Model used for the performance improvements estimates Openreach assumed that the most likely time to repair a fault was one day for Service Level 2 and two days for Service Level 1, in estimating the Service Level resource differential the changes by Openreach to the gamma distribution implied that the most likely time to repair a fault was the same irrespective of the Service Level (roughly between one and two days).
- A19.56 In its initial assessment, AM observed that the justification given by Openreach for the change in this assumption was that this was necessary to achieve a meaningful comparison of the extreme cases and to take into account what might happen to the profiles if the extremes were realised. AM considered that it was difficult to justify this departure from the original modelling methodology. AM further noted that while some changes in the distribution would be observed in extreme cases in the real world, it is much harder to justify such extreme changes for all scenarios with changes in the Service Level mix. As a result we asked AM to produce Service Level resource differentials under two separate gamma distributions for Service Level 1 and Service Level 2.⁷⁵⁹
- A19.57 AM's further estimations (see paragraph A19.42) showed that starting from the base case (i.e. the current Service Level mix) and moving to all repairs being either Service Level 1 or 2 led to an increase in resource requirements. This was to be expected, according to AM, given that a movement away from the base case Service Level mix is in effect a move towards the peak of one of the two gamma

⁷⁵⁸ For further details and discussion see Sections 2.3, 3.2, AM, QoS Model Report published alongside our December 2013 LLU WLR Consultation.

⁷⁵⁹ Openreach's views on this modelling modification were reported at paragraphs 4.52 to 4.53 to the *December 2013 LLU WLR Consultation*.

distributions, thereby effectively increasing total resource requirements. AM commented that the cause behind the greater increase of resources when the model assumes that all repairs are carried out at Service Level 1 rather than at Service Level 2 was not apparent. AM noted that its additional analysis suggested there was non-linearity in the relationship which was not the case under the assumptions used by Openreach. However, it argued that if one adopted a partial approach and only examined the base case and all repairs at Service Level 2 mix (i.e. this would be valid if we expected the proportion of Service Level 2 repairs to increase over time), the Resource Simulation Model suggested a Service Level resource differential of 5.8%. AM, however, questioned how meaningful this partial approach would be.

A19.58 In the December 2013 LLU WLR Consultation we considered that neither the methodology used by Openreach nor the change we asked AM to undertake were satisfactory ways of modelling the Service Level resource differential. However, we noted that the estimation undertaken by AM led to some counter-intuitive results and this raised concerns. Accordingly, in the absence of a more appropriate alternative approach we did not consider that there was compelling evidence for adopting a different approach from the one suggested by Openreach.

Stakeholder responses

A19.59 Frontier Economics (on behalf of Sky and TalkTalk) argued that Openreach used a gamma distribution of two days for the all Service Level 1 scenarios, of one day for the all Service Level 2 scenarios and between one and two days for the baseline scenario. It concluded that there was no empirical support for the choice of gamma distributions for the different mixes of service levels including the extreme scenarios.⁷⁶⁰

A19.60 EY (on behalf of Openreach) agreed with Ofcom's conclusions on the gamma distribution assumptions for the service level cost differential, although it argued that EY's approach was superior to AM's.⁷⁶¹

Our response and conclusions

A19.61 We consider that Frontier Economics has mischaracterised the assumptions used in the Resource Simulation Model (see paragraph A19.55). We have discussed and provided our assessment of the responses received from stakeholders in relation to the justifications for using a gamma distribution in detail in Annex 17 (see paragraphs A17.95-17.119). Our conclusions apply equally to the use of a gamma distribution for the purposes of estimating the Service Level resource differential. Therefore, in this section we only cover the stakeholders' points (see paragraphs A19.59 to A19.60) that are specific to the Service Level resource differential.

A19.62 We do not agree with EY on the relative superiority of their rather than AM's approach to the gamma distribution. Our view in the December 2013 LLU WLR Consultation, which remains our view, is that there are issues with both approaches and that there is no compelling evidence to adopt a different approach from the one suggested by Openreach in the first place.

A19.63 Given that we received limited responses from stakeholders on this issue specifically for the Service Level resource differential and in the light of our more

⁷⁶⁰ Page 17, Frontier Economics Response to the December 2013 LLU WLR Consultation.

⁷⁶¹ Paragraph 5.13, EY Response to the December 2013 LLU WLR Consultation.

general discussion about the use of gamma distribution at paragraphs A17.95-17.119, we consider that there is no appropriate alternative that has been identified to the assumption initially made by Openreach.

Treatment of provisions

Proposals in the December 2013 LLU WLR Consultation

- A19.64 In addressing the question of the resources required to meet different performance targets, the Resource Simulation Model estimated the resource impact should minimum standards be set for both provisions and repairs. In estimating the Service Level resource differential, however, Openreach departed from this assumption by excluding all provisions from the Resource Simulation Model.
- A19.65 In the December 2013 LLU WLR Consultation we considered that it was desirable to include provisions in estimating the Service Level resource differential to capture the economies of scope in undertaking both repairs and provisions from the same pool of resources. This is particularly the case if the peaks in provisions and repairs are not aligned. This means that, during an off-peak period for provision tasks, resources would become free to undertake repairs, requiring fewer incremental resources for repairs.
- A19.66 In its initial assessment AM noted that Openreach justified removing all provisions from the input data when running the simulation to estimate the Service Level resource differentials by arguing that that this would avoid the possibility of the estimates being affected by the inclusion of provision jobs. AM considered this was a valid argument up to a point, since resource estimates are heavily influenced by the distribution of provisions. However, AM also considered it to be a departure from reality that ignored the potential economies of scope that arise from the same organisation undertaking both provisions and repairs. At that stage AM was unable to estimate the impact of the exclusion of provisions on the estimates. As a result we asked AM to estimate the Resource Simulation Model's results under the assumption that all provisions are included (see paragraph A19.42).⁷⁶²
- A19.67 In its analysis AM found that, when provisions were included, a linear relationship between the resource differential and the Service Level was maintained. However, the Service Level resource differential that AM estimated when adding provisions was of a substantially smaller magnitude (8.3% rather than 17.9% under the Maximum Day redistribution approach). AM noted that adding provisions roughly doubled resource requirements and, hence, a resource differential of about half would be expected.⁷⁶³ This effect was purely due to the fact that including provisions leads to an output from the Resource Simulation Model that measured the Service Level resource differential relative to a much larger resource base. However, if this was the only effect of including provisions in the Resource Simulation Model, it meant that there was no evidence of economies of scope between repairs and provisions.

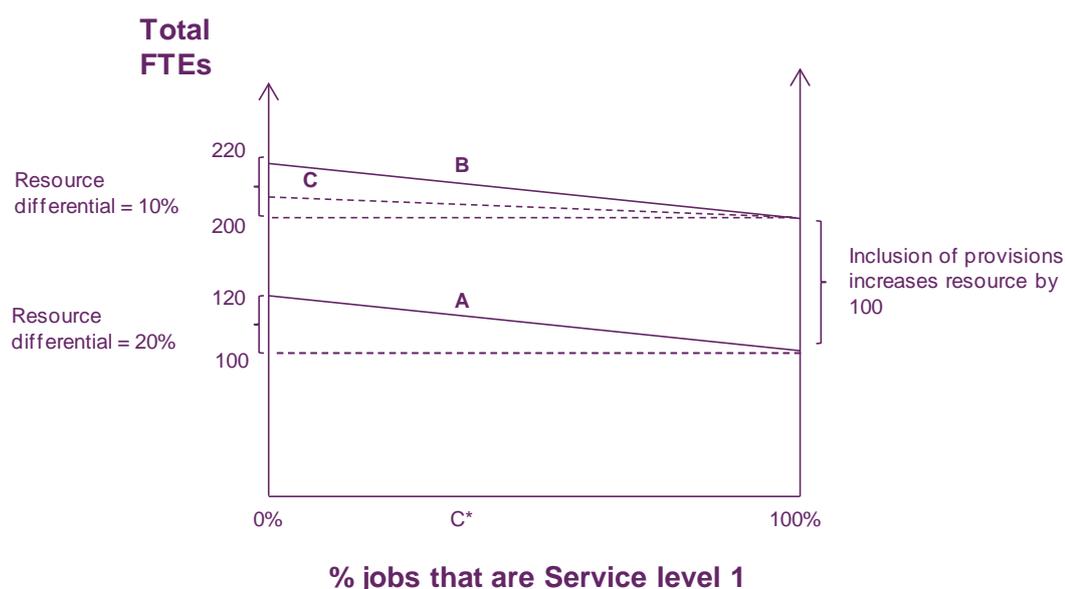
⁷⁶² Openreach's views on this modelling modification were reported at paragraphs 4.61 to 4.63 of the December 2013 LLU WLR Consultation.

⁷⁶³ AM also noted that the scale of the reduction in the resource requirements when all repairs are undertaken at Service Level 1 is difficult to understand. AM concluded that the latter is most likely due to the way in which the historical datasets interact, creating certain peak days.

A19.68 To investigate this further, we asked AM to attempt to disentangle the effect of approximately doubling the resources⁷⁶⁴ from the possible effect driven by economies of scope.

A19.69 We have illustrated the difference between these two effects by the example in Figure A19.2. This reproduces the same relationship as depicted in Figure 4.2 in our December 2013 LLU WLR Consultation. For illustration, suppose that excluding provisions Openreach needed 100 resources if all repairs were at Service Level 1 and 120 if all were at Service Level 2. The resource differential would be 20, or 20%, as shown by line A. Suppose now that we include provisions and that doing so increases the resources required by another 100 for both extreme Service Level mixes. The resource differential would still be 20 but in percentage terms it will be 10%, as shown by line B. This is driven purely by the increase - i.e. doubling - in the denominator by including provisions and not by any difference in the level of resources to undertake repairs at Service Level 2 relative to Service Level 1. However, if the inclusion of provisions also changed the slope or gradient of this relationship, for example as shown by line C, this would indicate that there are economies of scope between repairs and provisions and that their impact differs between Service Level 2 and Service Level 1 repairs.⁷⁶⁵

Figure A19.2: Impact of including provisions in the Resource Simulation Model



Source: Ofcom

A19.70 AM's view was that the evidence suggested that there was an 'economies of scope' effect. AM estimated that, when provisions were excluded, failing to take into account the economies of scope led to an overestimation of the Service Level resource differential of about 21%. AM estimated the total amount of additional resources required by calculating the additional resources required when moving from Service Level 1 being 100% of repairs to being 0%, both including and excluding provisioning. This indicated that excluding provisioning over-estimated the proportion of additional resources by about 21%.

⁷⁶⁴ AM found that provisions consisted of 42% of all jobs (i.e. provisions and repairs).

⁷⁶⁵ Line C in the illustrative example shows that economies of scope would be stronger when repairs are undertaken at Service Level 2 rather than 1.

- A19.71 We agreed with AM that, in the presence of economies of scope, excluding provisions could lead to an overestimation of the resources needed for repairs. We also noted the concern that including provisions was likely to roughly double the resource requirements and hence have an impact on the estimated service level cost differential.
- A19.72 In terms of the ‘doubling effect’, we explained our understanding that the inclusion of provisions would increase the overall resources across all Service Level mixes (i.e. by almost doubling it) and, hence, lead to a reduction of the estimated resource differential. We did not consider that it was appropriate to adjust for this effect as it is purely driven by the way the resource differential is estimated and is not a reflection of an actual resource differential between Service Level 1 and 2.
- A19.73 In terms of the ‘economies of scope’ effect, we were interested in knowing whether the exclusion of provisions (as assumed by Openreach in the Resource Simulation Model) had an impact on the Service Level resource differential. We considered that a possible reason as to why this may be the case is that economies of scope between repairs and provisions may be more important when Openreach has less flexibility in undertaking repairs (i.e. under Service Level 2). This means that when Openreach undertakes a Service Level 2 repair, excluding provisions would fail to consider the economies of scope with provision and overestimate the resource required. As the effect is smaller for Service Level 1, excluding provisions would lead to an overestimate of the resource differential. We considered that we should adjust the Resource Simulation Model estimate for this effect.
- A19.74 Therefore, we considered that it would be appropriate to adjust the Resource Simulation Model’s estimates (using the Maximum Day redistribution method). Adjusting for this led to a differential of approximately 14% (i.e. $17.9\% * (1 - 21\%)$).

Stakeholders’ responses to the December 2013 LLU WLR Consultation

- A19.75 EY (on behalf of Openreach) commented that the December 2013 LLU WLR Consultation did not provide sufficient information for it to understand how we got to the 21% adjustment applied to take into account economies of scope. Nonetheless, EY accepted that running the Resource Simulation Model excluding provisions would potentially overstate the Service Level resource differential as it would not reflect the economies of scope between the two. EY undertook a further run of the Resource Simulation Model (for 2011/12, 80% performance and Maximum Day approach) including provision which resulted in a Service Level resource differential of 12.4%. EY then considered that by 2016/17 repair jobs would account for 58% of all field activity and taking this into account it derived a service level cost differential of 21% (estimated as $12.4\%/58\%$). EY concluded that the relatively immaterial impact of economies of scope reflected Openreach’s expectations because of the substantial difference in provisions and repairs lead times (13 vs. 1 to 3 days) and the fact that provisions were appointed some time in advance. This, according to EY, minimised Openreach’s ability to transfer resources between provisions and repairs.⁷⁶⁶
- A19.76 Openreach similarly referred to EY undertaking more model runs including both provisions and repairs showing that the impact of economies of scope would be much lower than that suggested in our December 2013 LLU WLR consultation as it would reduce the service level cost differential from about 23% to about 20%. Openreach also stated that it was not clear why it would be appropriate to reflect

⁷⁶⁶ Paragraphs 5.20-5.28, EY Response to the December 2013 LLU WLR Consultation.

such potential economies of scope (if they existed) in the Service Level cost differential.⁷⁶⁷

Our response and conclusions

- A19.77 We note that EY agreed that we should take account of economies of scope between provisions and repairs, although they argued that they may be small.
- A19.78 In light of stakeholders' requests for further information, we have described in more detail below how, in our December 2013 LLU WLR Consultation and based on AM's advice, we came to the conclusion that the estimate should be adjusted downwards by a factor of 21%. We also provided to Openreach/EY before publication of our conclusions in this document some additional clarifications on how AM estimated the adjustment for economies of scope between repairs and provisions.⁷⁶⁸ AM (See "AM Comments on QoS Model Consultation Responses" in Annex 18, Section 3.1.2) describes in detail how it originally estimated the required resource adjustment. In the period leading to the December 2013 LLU WLR consultation AM estimated the additional resources (FTEs) to be 1,504 and 1,240 when excluding and including provisions in the Resource Simulation Model, respectively. The degree of over-estimation from excluding provision was estimated at 21% - i.e. $(1,504/1,240) - 1$. We have asked AM to re-estimate their results in the light of the incorrect model setting used (see discussion at paragraph A19.53). Taking the latter into account and using the same methodology as in our December 2013 LLU WLR Consultation, the adjustment factor is now estimated to be 9.3% instead of the 21% used in our December 2013 LLU WLR Consultation (See "AM Comments on QoS Model Consultation Responses" in Annex 18, Section 3.1.2).
- A19.79 In responding to the December 2013 LLU WLR Consultation, EY directly estimated the Service Level resource differential including provisions (instead of estimating the required adjustment as done by AM). In order to correct for a double counting effect, EY adjusted the repair jobs as a proportion of total jobs leading to an estimated Service Level resource differential of 20%. We note that the two estimates are very similar, although AM have identified some important differences (See "AM Comments on QoS Model Consultation Responses" in Annex 18, Section 3.1.3). In particular, AM's methodology estimates the required adjustment to be applied to the Service Level resource differential, while EY's estimates it directly but using the number of jobs/tasks (instead of resources) as the relevant variable. As jobs are likely to vary in terms of the amount resources they require, in our view it would be more appropriate to use AM's methodology.
- A19.80 We remain of the view that it is appropriate to undertake an adjustment to the Resource Simulation Model to account for economies of scope associated with provisioning. We consider that the preferred methodology for doing so is that based on the proportion of resources suggested by AM. Solely as a consequence of correcting the error in estimating the resource differential under the Maximum Day approach (see paragraphs A19.52 to A19.53), AM revised its estimate of the required adjustment factor for economies of scope from 21% to 9.3%.

⁷⁶⁷ Page 52, Openreach Response to the December 2013 LLU WLR Consultation.

⁷⁶⁸ Email from ☒, Competition Policy Advisor, Ofcom to ☒, Head of Major Regulatory Programmes, Openreach, 14/03/14.

Saturday working for Service Level 2

Proposals in the December 2013 LLU WLR Consultation

A19.81 In its resource estimates for performance improvements, Openreach estimated the impact of assuming that Service Level 2 repairs could also be undertaken on Saturdays. In estimating the Service Level resource differential, however, Openreach assumed that Saturdays could not be used to undertake Service Level 2 repairs.

A19.82 In its initial assessment AM noted that Openreach justified excluding Saturday working for Service Level 2 repairs because the number of employees working on Saturdays is much smaller than on weekdays and that, with scenarios with higher proportions of Service Level 2 repairs, the model would assign more jobs for Saturday execution than would be achievable in the real world. AM considered this change to be justified up to a point, but that it was also a departure from reality. This assumption would have the effect of increasing the peak of the busiest weekday and therefore potentially overestimate the resource differentials. Nonetheless, AM considered that Saturday working and any associated additional staffing costs for Saturday working would need to be taken into account to conduct a proper analysis of the Service Level cost (rather than resource) differential. As a result we asked AM to estimate the Resource Simulation Model's results under the assumptions of including Saturday working for Service Level 2.

A19.83 In its subsequent analysis (see paragraph A19.42 of our December 2013 LLU WLR Consultation), AM's results when including Saturday working for Service Level 2 indicated that the same relationship was maintained (i.e. Service Level 2 repairs are more resource intensive than Service Level 1), but the differential was estimated to be lower than in the case where Saturday working is excluded. This, according to AM, was logical as now a portion of repairs would occur on Saturday thereby decreasing the peak that otherwise would have occurred on a weekday. AM also considered the possible impact in costs rather than resources by applying a scalar \times to Saturday repairs, broadly reflecting the relative difference in wages between weekdays and Saturdays.⁷⁶⁹ AM also provided us with the split in resources required at different Service Level mixes for Saturdays and weekdays. At the current Service Level mix the Resource Simulation Model indicated that Saturday resources would amount to 10% of the weekly resources (rather than the 5% mentioned by Openreach).⁷⁷⁰

A19.84 In our December 2013 LLU WLR Consultation we considered that, in principle, excluding Saturday working for Service Level 2 would lead to an increase in the peak of resource requirements for Service Level 2 in the early part of the week (as repairs that could no longer be undertaken on Saturday would have to be undertaken the following Monday). However, we also recognised two factors countering this effect:

19.84.1 An increase in the proportion of Service Level 2 repairs as we change the Service Level mix could lead to an increase in the overall Saturday resource requirements. The extent to which Openreach has an incentive to

⁷⁶⁹ Email from \times , Head of Major Regulatory Programmes, Openreach to \times , Principal Competition Policy, Ofcom, \times , Competition Policy Advisor, Ofcom to and \times , Competition Policy Manager, Ofcom, 24/10/13.

⁷⁷⁰ Openreach's views on this modelling modification were reported at paragraphs 4.77 to 4.78 of the *December 2013 LLU WLR Consultation*.

undertake such repairs on Saturdays also depends on the relative premium of Saturday versus weekday working. Hence, Openreach may have limited incentives to increase repairs on Saturday if the resource cost is much higher than that required for weekday working. This is a valid concern, though we note that the whole assessment is undertaken in terms of resources rather than costs differential; and

19.84.2 Openreach also argued that it would face difficulties in increasing the amount of resources on Saturdays, even if it had an incentive to do so, (See our December 2013 LLU WLR Consultation at paragraphs 4.77 to 4.78). While there is some validity to this argument, we considered that if the change in Service Level mix could be forecasted (and we expect that this is the case for the relevant services) then Openreach could gradually overcome these difficulties.

A19.85 Overall we considered that the way the Resource Simulation Model excluded Saturday working for Service Level 2 was not entirely satisfactory, although we recognised that there might be some factors put forward by Openreach suggesting that inclusion of Saturdays may also not be appropriate. We therefore recognised that the effect of excluding Saturday working for Service Level 2 might not be material. This was because, while exclusion of Saturday working increased the resource peak early on in the week, its inclusion would mean making use of more costly Saturday resources. In the absence of strong evidence suggesting one approach was markedly superior to another, we did not consider it appropriate to include a Saturday working assumption in the model at this stage.

Stakeholders' responses to the December 2013 LLU WLR Consultation

A19.86 Frontier Economics (on behalf of Sky and TalkTalk) noted that the linear relationship assumed between peak resources and costs overstated the cost impact of increasing Service Levels for a number of reasons (see Annex 17 at paragraphs A17.87-89 and A17.98-103). Frontier argued that this was also relevant for the estimating the Service Level resource differential.⁷⁷¹

A19.87 One confidential respondent \mathcal{X} noted that there was a growing trend for employment contracts to treat Saturday as a normal day in a five day working week and, therefore, it would not expect it to be more expensive.⁷⁷²

A19.88 EY (on behalf of Openreach) agreed with Ofcom's conclusions, but further noted that exclusion of Saturday working reduced the risk of any bias in the results.⁷⁷³

Our response and conclusions

A19.89 The main reasons mentioned in our December 2013 LLU WLR Consultation for not including Saturday working within the modelling undertaken were:

19.89.1 Saturday working may be more expensive; and

19.89.2 even if it were not, BT may not find it easy to increase its available resources for Saturday working.

⁷⁷¹ Pages 16-17, Frontier Economics Response to the December 2013 LLU WLR Consultation.

⁷⁷² Q4.1, \mathcal{X} Response to the December 2013 LLU WLR Consultation.

⁷⁷³ Paragraph 5.19, EY Response to the December 2013 LLU WLR Consultation.

- A19.90 We considered that the latter would not be a very strong argument for not including Saturday working as Openreach could overcome these difficulties over time. On the former we noted one confidential respondent's statement that there was a trend not to pay a premium for Saturday working. We considered that if this were the case then it could be argued that Saturday working should be included. Nonetheless, we conclude that we did not have sufficient evidence to dismiss BT's evidence that Saturday working was more expensive (in the case of Openreach's engineers). If in the future there were evidence that any premium on Saturday working had reduced and/or its use had become less widespread, we would need to reconsider this assumption.
- A19.91 Overall, in the light of the stakeholders' responses to our December 2013 LLU WLR Consultation, we concluded that in the current market review there is no evidence to suggest that we should attempt to include Saturday working (as discussed at paragraph A19.89).

Our overall assessment of the Openreach estimates

- A19.92 In Annex 17 (paragraphs 17.182 – 17.187) we concluded that the Resource Simulation Model was a reasonable vehicle (though one with limitations) for the modelling the resource requirements for service quality. Having done so, in this Annex we need to conclude whether or not it would be appropriate to use the variation of the Resource Simulation Model put forward by Openreach (appropriately modified) also for estimating the Service Level resource differential.
- A19.93 Having carefully considered the responses to our December 2013 LLU WLR Consultation and the additional analysis undertaken, our view is that the Resource Simulation Model represents a sophisticated attempt to model Service Level cost differentials and is a marked improvement on evidence reviewed for the purpose of previous LLU WLR charge controls. While the modelling approach proposed by Openreach in assessing Service Level cost differentials has limitations (including those highlighted in Annex 17), we consider that it offers a more meaningful insight into the Service Levels resource differential than the methodology used in the previous charge controls, such that it is appropriate to use it for the purpose of this charge control.
- A19.94 Accordingly, in view of stakeholders' responses to our December 2013 LLU WLR Consultation and subsequent work undertaken by AM, we have reached the following conclusions:
- 19.94.1 Following a re-estimation by AM we agree that, under the Maximum Day approach (unadjusted for economies of scope), the Resource Simulation Model yields an estimate of 23% as argued by Openreach. The previous estimate of 17.9% reflected an estimation error (see discussion at paragraphs A19.52 to A19.53);
- 19.94.2 It is appropriate to adjust for economies of scope that would be overlooked if provisions were not included in the model. As noted at paragraph A19.80, the size of the adjustment is estimated to be 9.3% rather than the 21% estimated in our December 2013 LLU WLR Consultation (this reflected the correction of the error identified at paragraphs A19.52 to A19.53). Therefore, applying a 9.3% adjustment to the unadjusted estimate of 23% we obtain a Service Level resource differential rounded estimate of 21% (i.e. $23\% * (1 - 9.3\%)$). We consider that the approach put forward by AM looking at resources rather than number of jobs (as

suggested by Openreach) is potentially more precise and, hence, more appropriate than the approach put forward by EY (see discussion at paragraphs A19.77 to A19.80);

19.94.3 We do not consider that it is appropriate to modify any other assumptions in the Resource Simulation Model for the purpose of this market review; and

19.94.4 Lastly, we note that the Resource Simulation Model only estimates the Service Level resource differential in terms of resource FTEs and that other inputs are also required to undertake repairs. This has implications for setting the relevant charge controls which are discussed in Annex 13. We also note that when other modelling factors, such as AVEs and CVEs, are applied in the charge control modelling the impact on prices will be less than 21%.

A19.95 On the basis of this analysis, the estimate of the Service Level cost differential that we have used in the cost modelling underpinning the charge controls is 21%.

A19.96 An indication of the scale of the cost impact of the 21% Service Level cost differential can be seen in Annex 9. Here we show that the WLR (Service Level 1) + SMPF (Service Level 2) minus MPF (Service Level 2) LRIC difference for service levels is -£1.91 (see paragraphs A9.32 to A9.35).

Annex 20

Fault Rates

- A20.1 In this Annex we set out our conclusions in respect of the treatment of costs associated with handling/repairing faults on Openreach's network for the purpose of the LLU WLR charge controls. The cost of repairing faults represents a material proportion of the cost of providing the rental services.
- A20.2 Stakeholders have expressed a wide range of views about the level of faults that should be assumed in the cost modelling for the charge controls. Key questions raised are: whether there is evidence to support incorporating an increasing propensity to fault by services through the period of the control; whether prevailing levels of faults that underpin existing cost information could be considered to be reasonable/efficient; how we should model the relative rate of faults between services; and, what year should be used as the basis for cost extrapolation.
- A20.3 For these charge controls we have undertaken a significant amount of analysis on the question of fault rates, which has involved detailed scrutiny of substantial, albeit time limited data sets obtained from BT using our statutory information gathering powers, most notably a "copper line biography" database prepared by Openreach. We have also engaged external consultants Cartesian (formerly CSMG) to undertake an analysis of the information obtained from Openreach. Stakeholders have also engaged consultants to consider the evidence and we have carefully considered those submissions and the evidence presented in the course of making our decision. The detail of this analysis is contained in an appendix to this Annex.
- A20.4 As set out in this Annex, in assessing fault rates, we have taken an approach that seeks as a matter of regulatory policy to ensure that there is competitive neutrality as between MPF and WLR+SMPF wholesale inputs. This means that we would not want to introduce pricing differences as between the products unless they were real, enduring and material. We believe that our approach provides the right incentives to Openreach in terms of the treatment of different services, and is one that best ensures undistorted competition between wholesale services that are used to compete at the retail level of the market. Consistent with this approach, we have taken as our starting point a position that best reflects the technical/engineering aspects of the network underpinning the relevant services and assessed whether this is consistent with the evidence available. What has become clear from our analysis is that while there is a substantial volume of raw data on faults, the nature and duration of the data sets are not of a quality that allows us to rely on this information for the purpose of setting charge controls.
- A20.5 For the reasons set out in more detail in this Annex, we have concluded that:
- 20.5.1 For the base year of our assessment we are relying on the total costs associated with handling/repairing faults as presented in BT's 2011/12 RFS;
 - 20.5.2 We have decided to set the cost allocations related to relative faults levels for the key services in 2016/17 in the Cost Model as set out in Table A20.1; and

Table A20.1: Relative fault cost allocations

Product	Relative fault levels
MPF	1.0
WLR	0.83
SMPF	0.17
WLR + SMPF	1.0

20.5.3 We have concluded that it is appropriate to hold constant the propensity of services to fault throughout the period of the charge control (i.e. the number and type of faults per line for a given service in 2016/17 are assumed to be the same as those in the base year, though, the absolute number of faults will of course vary depending on the mix of services).

A20.6 In this Annex we set out:

- A brief explanation as to the relationship of fault rates and volumes to the charge control;
- The limitations of the data analysis;
- A summary of the December 2013 LLU WLR Consultation proposals on fault rates;
- A summary of consultation responses;
- Our analysis of the level of base year faults;
- Our analysis of relative fault rates;
- Our analysis of any fault rate trends during the charge control period;
- A summary of our main conclusions; and
- A discussion of other issues.

Relationship of faults rates and volumes to the charge control model

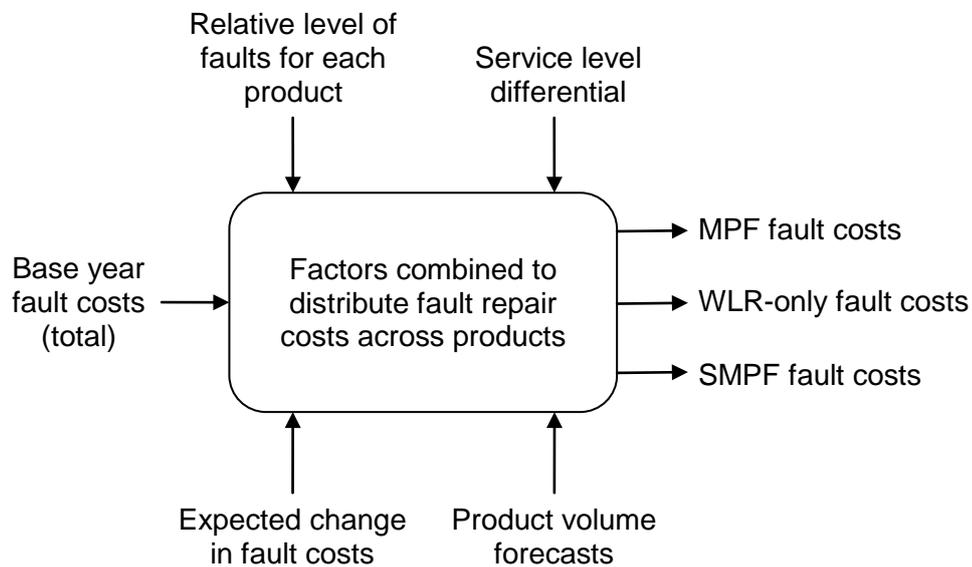
A20.7 The absolute level of faults, in total and for each service, is not a direct input into the charge control Cost Model. Rather, in order to establish the costs associated with faults for each service we determine the following three inputs to the Cost Model:

- 20.7.1 the efficient level of total costs associated with handling/repairing faults in the base year (noting that for a given fault report type cost will vary significantly);
- 20.7.2 the relative level of costs associated with handling/repairing faults for each of the main rental products as we would anticipate it in 2016/17 (MPF, WLR and SMPF); and

20.7.3 how the costs associated with handling/repairing faults are expected to change over the period of the charge control.

A20.8 In addition to the relative level of fault costs (point A20.7.2 above) the service level differential is used to determine the relative level of fault costs across the different products. The service level differential and how it applies to the main rental products is discussed in Annex 19 Service Level resource differentials. Finally, product volume forecasts are used to calculate the absolute level of fault costs for each product, as this allows the total costs associated with faults to be allocated across the different products, whilst maintaining the relativities established by the relative level of faults and the service differential. This is illustrated in Figure A20.1 below.

Figure A20.1 Factors used to distribute the fault repair cost across products



Limitations of the data analysis

A20.9 We have undertaken detailed analysis of the data provided by Openreach in the course of this review. We obtained information on faults, deployed products and product provisions in the form of a “copper line biography” from Openreach using our statutory information gathering powers.⁷⁷⁴ The information obtained is a dataset prepared by Openreach from a more comprehensive database that consolidates, as far as possible, the history of activities (provisioning, fault repair, transfers etc) associated with a specific line to a premise. This consolidation reduces record duplication and supports analysis of trends in faults and their relationship to individual services. While we set out the results of this analysis in the course of this

⁷⁷⁴ The Openreach line biography provides a framework for defining different groups of lines and faults for analysis. The line biography consists of a series of “chapters” for every unique primary line ID (telephone number or MPF line ID). A chapter is created each time there is a significant change to the line, for example a provision, cease or modification activity. Each chapter has a start date and an end date and they cannot overlap (but there can be gaps). A wide range of fault and product information can be associated with each chapter.

Annex, we have set out up front our concerns about the reliability and level of confidence that can be placed on the data in the context of setting charge controls.

Variations in data presented

A20.10 Openreach presented two distinct data sets for analysis at an interval of about four months (both of which we obtained using our statutory information gathering powers). While both were generated from the same line biography database, we have observed differences in the apparent weekly fault rates between the datasets which despite investigation have not been adequately explained.⁷⁷⁵

Impact of “Unknown”, “Unclassified” and “N/A” product classifications on fault rates

A20.11 Frontier Economics, in its response to our December 2013 LLU WLR Consultation on behalf of Sky and TalkTalk, brought to our attention the possible bias effects on the fault rates of excluding faults with product labels unknown, unclassified and n/a (“unknown” faults).

A20.12 We have considered this issue and asked Cartesian to see what effect their inclusion might have on the fault rates produced by the data analysis. Cartesian added the unknown faults to the rental products in proportion to the number of other faults per product in two ways: (i) before the totality of faults are filtered by the fault inclusion criteria; and (ii) after the totality of faults are filtered by the fault inclusion criteria.⁷⁷⁶ The first approach yielded a higher fault rate of 5.8% to 7.4% and the second approach yielded fault rates of 6.2% to 8%. The uplift in the rates were distributed reasonably evenly across the products with WLR+SMPF showing a slightly higher uplift than MPF with the larger uplift generally occurring in the first half of 2013/14.

A20.13 However there are other ways of distributing the faults across the products including:

- allocating them on the basis of the proportion of products deployed, i.e. working system size, but this would have the effect of increasing the fault rates by the same proportion and make no change to the relative fault rates;

⁷⁷⁵ Paragraph 4.8, Cartesian *Updated Fault Rates Report*, about 60,000 SFI, CDTA and CDTNA faults had previously been excluded. This constitutes about 1% of the approximately 6m faults analysed after filtering. Given the random nature of the weekly differences in fault rates (figures 22-24, Cartesian *Updated Fault Rates Report 2014*) most of the difference could be due to the non-chargeable SFI, CDTA and CDTNA faults.

⁷⁷⁶ The totality of faults in the fault report database are filtered by fault inclusion criteria to eliminate faults that are outside the scope of the charge control primarily on the grounds of product type and whether the repair is chargeable or non-chargeable. All faults with product labels “unknown”, “unclassified” and “n/a” (hereinafter known as the unknown product faults) were eliminated from the fault rate analyses. To determine the effect of including the unknown product faults in the analysis on the estimated fault rates the unknown product faults were allocated to each of the known product types in one of two ways. The first way allocated the unknown product faults before the fault inclusion criteria filtering was applied to the totality of faults. In this case the faults were allocated to products both within scope of the charge control and to products that were not within scope of the charge control. Some of these unknown product faults would therefore be excluded when the fault inclusion criteria was applied. The second way allocated the unknown product faults to just the in scope products that remained after the fault inclusion criteria filtering was applied to the totality of fault reports. Consequently there were different numbers of faults allocated to the in scope products for the two cases leading to different fault rate increases.

- allocating them evenly across the three product MPF, WLR-only and WLR+SMPF resulting in uplifts in the fault rates of 12% for MPF, 9% for WLR-only and 5% for WLR+SMPF;
- allocating them all to one product on the basis that there is some systematic reason for the inability to label the fault properly with resultant increases in fault rates of the order of 36% for MPF, 26% for WLR-only and 16% for WLR+SMPF; and
- allocating them on some random or ad-hoc basis to the products, with consequential increases in fault rates somewhere between zero and those for allocating the unknown faults to just one product.

A20.14 We believe there is no obviously superior method for distributing these faults across the products than that used by Ofcom/ Cartesian and that the bias introduced from not including them is likely to be no worse than the possible bias from including them. The unknown labels could originate from field staff failing to complete fault reports properly and / or from data processing and storage issues, so we do not expect further investigation with Openreach to yield a reduction in the unknown labels in the data we have at our disposal. We have therefore concluded that it is appropriate to treat the effect of these unknown, unclassified and n/a labels as yet another example of possible error and uncertainty in the analysis results.

Limited time period

A20.15 One major concern in determining the parameter values for the charge control period is the time period for which Openreach has provided data and analysis. Openreach provided 34 months of data and analysis, which we consider to be inadequate in terms of assessing the impact of cyclic variation in factors affecting fault volumes and rates such as weather and investment. Later in this Annex we set out as an example the extent to which fluctuations in UK rainfall appear to show a six year fluctuation cycle (see Figure A20.2 Annual UK rainfall for financial years later in this annex).

A20.16 We also expect fluctuations in investment and therefore age-related fault volumes to exhibit periods of many years.

A20.17 Further analysis will not correct or compensate for these uncertainties and historical data is not available as it has not been retained by BT. In the context of the volume of analysis already undertaken, we also believe that further analysis to establish what would amount to some small adjustment to the projected fault rates would not be justified given the level of uncertainty in the analysis and resulting estimates.

The December 2013 LLU WLR Consultations

A20.18 We set out below our December 2013 LLU WLR Consultation proposals on (i) the overall level of fault rates in the base year of the charge control, (ii) the relative level of fault rates for the MPF, WLR and SMPF products, and (iii) whether those fault rates are likely to change over the charge control period.⁷⁷⁷

⁷⁷⁷ Paragraphs 5.1-5.166, Section 5, Ofcom, *December 2013 LLU WLR Consultation*.

Level of base year faults⁷⁷⁸

A20.19 The base case year used in the analysis in the December LLU WLR 2013 consultation was 2011/12. At that time we were still considering the submissions from Openreach as to whether 2011/12 should remain the base year for the purposes of this charge control or whether we should update our model to include cost data (modified as necessary) from the 2012/13 RFS.

A20.20 We also proposed not to make any adjustment to the base year cost and fault levels. We did not accept arguments made by stakeholders that that existing levels of faults were inappropriately high and we should assume a lower level. We accepted that there was a variation in the level of investment Openreach had made in the network but there was no evidence that the outcome of investment cost versus fault repair costs was necessarily inefficient.

Relative fault rates⁷⁷⁹

A20.21 We proposed that when allocating the costs associated with faults to the rental services we would assume that lines sold as WLR+SMPF and lines sold as MPF should have the same allocation. That is we would assume that their relative fault rates are equal.

A20.22 The basis for this proposal was that our analysis of the technical characteristics of the lines used to deliver MPF and WLR+SMPF concluded that they are essentially the same and should on average generate the same level of faults. We said that we could not identify from our analysis of faults any explicable and measurable systematic differences in faults to justify an alternative assumption.

A20.23 We also observed that an alternative assumption would have inappropriate incentives:

- if Openreach knew that the price of MPF would rise relative to WLR+SMPF, if it reported or allocated more faults to MPF, then this could influence its decisions as to how it reports/allocates faults; and
- unjustified variation in assumptions of fault rates would give rise to variations in wholesale costs which would lead to inefficient selection of wholesale inputs.

A20.24 We then derived relative fault cost allocation rates for the individual products of 1.0 for MPF, 0.87 for WLR and 0.13 for SMPF.

Fault rate trend during the charge control period⁷⁸⁰

A20.25 We proposed that we would assume that the propensity for the services to fault would remain constant through the charge control period.

A20.26 We did not accept that the evidence presented by Openreach demonstrated that there were upward trends in fault propensity related to changing weather patterns, increased broadband usage or other factors that would clearly impact on fault levels during the charge control period. We similarly did not accept arguments that we should assume a downward trend in fault propensity as proposed by other

⁷⁷⁸ Paragraphs 5.80- 5.96, Ofcom, *December 2013 LLU WLR Consultation*.

⁷⁷⁹ Paragraphs 5.136- 5.156, Ofcom, *December 2013 LLU WLR Consultation*.

⁷⁸⁰ Paragraphs 5.97- 5.137, Ofcom, *December 2013 LLU WLR Consultation*.

stakeholders based on Openreach's historic success prior to 2010 in reducing faults.

Summary of Consultation responses

A20.27 Six of the respondents to the December 2013 LLU WLR Consultation made submissions about fault rates. We summarise these below.

Openreach

Base Year

A20.28 Openreach did not agree with Ofcom's approach to establishing base year costs and said we should use the latest information available and use the 2012/13 outturn data as the base year. Openreach claimed that the 2012/13 outturn was much closer to current and projected fault levels and is therefore more representative than the year 2011/12 for fault levels. Openreach also submitted that Ofcom's data analysis had underestimated the total level of faults by at least 25%.⁷⁸¹

A20.29 Openreach argued that its performance compared favourably with that of other operators noting the average time between faults on a line of 11.8 years.

A20.30 Openreach claimed its capital expenditure and proactive maintenance activities have been maintained at significant levels (oscillating on roughly a 3 year cycle between approximately 3 and 4 per quarter since Q1 2009/10 to Q1 2013/14) but that a significant increase in the level of network and test equipment investment is needed to partially stem the increase in fault rates arising from network deterioration and the effects of weather.⁷⁸²

Relative fault rates

A20.31 Openreach claimed that Ofcom (and its consultants Cartesian) had not included all the relevant fault types that should have been included in the analysis.⁷⁸³

A20.32 Openreach did not agree with the fault rates proposed in the December 2013 Consultation believing that Ofcom had underestimated the absolute fault rates as well as the differential rate between broadband and voice-only lines. It stated that Ofcom had not set the fault premium for broadband services sufficiently high to cover the increased costs arising from the expected change in product mix.⁷⁸⁴

A20.33 Openreach expressed the view that it is wrong to equalise MPF and WLR+SMPF fault rates because the products are used differently by different CPs with different approaches to customer service resulting in different propensities to report faults.⁷⁸⁵

A20.34 Openreach suggested Ofcom should treat frame costs separately from line costs. In its view, the distribution of frame costs across products should be based on the

⁷⁸¹ Paragraph 235, Openreach, *Response to the December 2013 LLU WLR Consultation*

⁷⁸² Paragraphs 279 and 280, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁷⁸³ Paragraphs 240-245, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁷⁸⁴ Paragraphs 300-307, Openreach *Response to the December 2013 LLU WLR Consultation*.

⁷⁸⁵ Paragraphs 281-288 and 300-307, Openreach *Response to the December 2013 LLU WLR Consultation*.

number of jumpers per service^{786 787} as it considered that this must lead to differences in fault costs.

Trends in fault rates

A20.35 Openreach claimed that Ofcom (and its consultants Cartesian) should also have included faults for the period April 2011 to September 2011 in the analysis, as it disagreed with Cartesian's concerns about the integrity of the data for this period. Openreach also said that Ofcom should include faults for the period September 2013 to January 2014 in any further analysis to better reflect prevailing weather conditions.⁷⁸⁸

A20.36 Openreach did not agree with setting fault rates that are constant throughout the charge control period. Openreach believed that fault rates are increasing linearly at about 6.3% per annum (including the effect of NGA/FTTC).⁷⁸⁹

A20.37 Openreach claimed Ofcom's proposals in the December 2013 Consultation would not fund the increased level of fault volumes and Ofcom has not taken account of the key external driving factors, including the effects of:⁷⁹⁰

- new broadband applications including increased duration of use and changing customer behaviour suggesting that customers are much less tolerant of service degradations;
- broadband electronic signalling uses a much wider range of frequencies and lower level signals on the copper line, making it more susceptible to noise and interference;
- uses of more network components by broadband, many of which are outside Openreach's responsibility, which coupled with an inability to reliably identify root causes can drive an increase in fault volumes within Openreach;
- additional jumpers on broadband services, which means that broadband provisioning and repair activities are more prone to jumper faults and the need for jumper repair work;
- more frequent and worsening extreme weather events; and
- natural deterioration of the network, which is increasingly difficult to address proactively.

⁷⁸⁶ Openreach suggested the effect of their proposed change would be to increase the WLR+SMPP fault rate relative to MPF and lower the relative fault rate of WLR-only. Ofcom's 2011/12 fault cost base figure comprises fault related cost components for E-Side Copper Current; D-Side Copper Current; PSTN Dropwire Maintenance; and Local Exchange General Frames Current. Ofcom treats these cost components in exactly the same way by treating the aggregate 2011/12 cost base as a single entity which it then splits and distributes the cost across the products.

⁷⁸⁷ Paragraphs 300-307, *Openreach Response to the December 2013 LLU WLR Consultation*.

⁷⁸⁸ Paragraphs 240-243, *Openreach Response to the December 2013 LLU WLR Consultation*.

⁷⁸⁹ Paragraphs 246-250 and 297, *Openreach Response to the December 2013 LLU WLR Consultation*.

⁷⁹⁰ Paragraph 255 and 274-278 *Openreach Response to the December 2013 LLU WLR Consultation*.

Deloitte analysis for Openreach

A20.38 Openreach commissioned Deloitte to analyse its fault data, and has submitted three reports to Ofcom. We describe each in turn in this section. The reports are:

- the Fault Data Report (submitted September 2013)⁷⁹¹;
- the Addendum to the Fault Data Report (submitted December 2013)⁷⁹²; and
- the Updated Fault Data Report (submitted February 2014)⁷⁹³.

Fault Data Report (submitted September 2013) report

A20.39 Openreach commissioned Deloitte to analyse fault rate levels and trends for WLR, SMPF and MPF services. Deloitte's analysis and findings were described in its report which Openreach submitted with its response to the July 2013 FAMR and July 2013 LLU WLR Consultations.⁷⁹⁴

A20.40 Deloitte analysed Openreach fault data for the period September 2011 to early September 2013 and also analysed order data for the same period to determine whether order activity had any impact on fault rates. Deloitte's conclusion was that WLR, MPF and WLR+SMPF services had different fault rates, most notably in relation to early life failures (ELFs)⁷⁹⁵ as summarised in Table A20.2 below, but there was no obvious trends in the data.

⁷⁹¹ Deloitte, *Openreach fault data: data analysis, report for Openreach, September 2013*, http://stakeholders.ofcom.org.uk/binaries/consultations/fixe-access-market-reviews/responses/Openreach_-_Deloitte_report.pdf.

⁷⁹² Deloitte: *Openreach fault data: data analysis. Addendum to the September 2013 Report, December 2013*, http://stakeholders.ofcom.org.uk/binaries/consultations/fixe-access-market-reviews/responses/Openreach_Deloitte_report_addendum.pdf.

⁷⁹³ Deloitte, *Openreach Faults Data - Data Analysis. Update report covering the period April 2011 to January 2014, report for Openreach, February 2014*, http://stakeholders.ofcom.org.uk/binaries/consultations/fixe-access-market-llu-wlr-charge-controls/responses/Openreach_Annex_B.pdf

⁷⁹⁴ Deloitte, *Fault Data Report*.

⁷⁹⁵ An Early Life Failure (or ELF) is a fault that occurs on a line within 28 days of a provision activity taking place. In contrast an In Life Failure (or ILF) is a fault that occurs on a line after this period of time.

Table A20.2 BT/Deloitte fault rates per product for the period October 2011 to September 2013

Product	Fault rates (faults per week per 1,000 lines)		
	Average ⁷⁹⁶	In-life	Early Life
WLR	1.6	1.5	4.0
WLR+SMPF	2.3	2.1	4.5
MPF	2.0	1.7	13.2

Source: Deloitte, Fault Data Report.

A20.41 Deloitte also reported that the total average fault rates for MPF, WLR+SMPF and WLR/PSTN have remained at broadly the same level over the period September 2011 to September 2013, close to 2.3 weekly faults per thousand lines for WLR+SMPF, 2.0 for MPF and 1.6 for WLR/PSTN.⁷⁹⁷

A20.42 Deloitte found: (i) very little correlation between order activity that involved field engineering and / or frame activity (which it termed 'customer switching' activity) and ILF fault rates (correlation coefficient of 0.07), and (ii) a stronger correlation with ELF fault rates (correlation coefficient of 0.25).⁷⁹⁸ Deloitte said that the latter indicates higher incidence of customer switching order activities can be linked to higher ELF rates.⁷⁹⁹ Deloitte also reviewed the level of customer switching order activity between January 2012 and July 2013. It found that WLR+SMPF services had a lower incidence of such orders than WLR-only services and that MPF services had a much higher incidence than WLR services.⁸⁰⁰

A20.43 Deloitte also examined ELF rates over the period September 2011 to June 2013, concluding that ELF fault rates for MPF services had risen.

Addendum to the Fault Data Report (submitted December 2013)

A20.44 Deloitte reported it had updated its analysis because two changes had been made to the data.⁸⁰¹

- The treatment of Modified Primary Line (MPL)⁸⁰² orders had been corrected, which increased the ELF rate and marginally reduced the ILF rate for WLR and WLR+SMPF; and
- A reconciliation exercise had been undertaken between Openreach internal databases, which reclassified the reporting CP for a number of the lines.⁸⁰³

⁷⁹⁶ Deloitte use the term average to mean the overall or total fault rate. We generally use the term overall fault rate to cover fault rates derived from the totality of early-life and in-life faults in any given period.

⁷⁹⁷ Page 7, Deloitte, *Fault Data Report*.

⁷⁹⁸ Figure 14, Deloitte, *Fault Data Report*.

⁷⁹⁹ Page 12, Deloitte, *Fault Data Report*.

⁸⁰⁰ Figure 9, Deloitte, *Fault Data Report*.

⁸⁰¹ Page 4, Deloitte, *Addendum to the Fault Data Report*.

⁸⁰² Modified Primary Line (MPL) is a transitory service whereby telephone calls intended for one fixed line may be temporarily diverted to another telephone (fixed or mobile) that can be used while a line is being transferred to another CP or in the event of the original line being affected by a fault.

A20.45 Deloitte also added data covering the periods April 2011 to September 2011 and October 2013 to November 2013, thus extending the period of analysis to cover April 2011 to November 2013 (the “Extended Period”).⁸⁰⁴

A20.46 Deloitte’s new analysis yielded the fault rates shown in Table A20.3 below. The ILF and overall fault rates were the same or slightly different to those presented in the September 2013 Report, whereas there was a significant increase in the ELF rates for WLR-only and WLR+SMPF. Deloitte concluded that the ELF rate rise was primarily due to the Modified Primary Line correction.⁸⁰⁵

Table A20.3 BT/Deloitte fault rates per product for the period April 2011 to October 2013

Product	Fault rates (faults per week per 1,000 lines)		
	Average	In-life	Early Life
WLR	1.7	1.5	7.9
WLR+SMPF	2.3	2.1	8.6
MPF	2.1	1.7	12.9

Source: Page 6, Deloitte, Addendum to the Fault Data Report.

A20.47 Figure 7 of the report shows the average faults per quarter. It appears to us that the growth in faults is largely due to an increase in faults categorised as “other”, whilst the product faults shown as WLR PSTN, WLR+SMPF and MPF, in aggregate, have remained broadly level.⁸⁰⁶

A20.48 Deloitte highlighted an uplift in the ILF and overall fault rates for the period September 2013 to November 2013 of approximately +6% (WLR-only), +20% (MPF) and +10% (WLR+SMPF) compared to the two year average fault rate for each product.⁸⁰⁷

A20.49 Deloitte also analysed and removed seasonal variations in the ILF rate data to identify the remaining ILF rate trends over the period of the data and concluded that for the period September 2011 to November 2013 the ILF rates at the end of the period compared to those for the first quarter were 17% higher for MPF, 13% higher for WLR+SMPF and 7% higher for WLR-only. Deloitte highlighted that “two years of data is typically not sufficient to conclude on a repetitive multi-year seasonal trend”.⁸⁰⁸

A20.50 Deloitte estimated an increase in WLR ILF rates of about 14% and in MPF ILF rates of about 1% for the period September 2011 to November 2013 when the voice faults relating to WLR+NGA and MPF+NGA services are included in the WLR and MPF ILF rates. However Deloitte reported that it was not possible to distinguish

⁸⁰³ According to Deloitte this changed the CP some lines were allocated to in the dataset and presumably changed how the faults were allocated to and distributed across the CPs. For further details please refer to Deloitte, *Addendum to the Fault Data Report*.

⁸⁰⁴ Pages 4 and 6, Deloitte, *Addendum to the Fault Data Report*.

⁸⁰⁵ Pages 9 to 15, Deloitte, *Addendum to the Fault Data Report*.

⁸⁰⁶ Figure 7, page 8, Deloitte, *Addendum to the Fault Data Report*.

⁸⁰⁷ Page 11, Deloitte, *Addendum to the Fault Data Report*.

⁸⁰⁸ Pages 12 and 13, Deloitte, *Addendum to the Fault Data Report*.

whether a fault is related to the voice service or the data service and it did not explain how it decided what proportion of faults were applicable to the voice component in WLR+NGA and MPF+NGA.⁸⁰⁹

A20.51 Deloitte also analysed average ILF rates by CP and found that the ILF rates varied significantly by CP.⁸¹⁰

A20.52 We note that whilst Deloitte offers this further analysis suggesting increasing fault rates (both ILFs and ELFs) it did not suggest any underlying causes, other than errors in the original data assignment.⁸¹¹

Updated Fault Data Report (submitted February 2014)

A20.53 Deloitte reported that the following changes were incorporated in this update to its analysis:⁸¹²

- additional data to extend the period covered to January 2014;
- a further set of “chargeable clear codes” were excluded (20.9% for faults were now excluded rather than 19.2% previously), though clear codes 152 (faults that were Right When Tested) and 172 (mostly duplicate reports and non-service affecting external damage to non-Openreach assets) were still included;
- a further set of faults identified by specific clear codes were excluded to align with Ofcom’s initial analysis (about 0.3% extra excluded);
- unclassified faults that were not within the overall set of 490 clear codes were excluded (approximately 10% of faults); and
- exchange faults based on clear codes rather than Main Fault Location (MFL) were excluded⁸¹³ (3.5% of faults now excluded rather than 2.2% previously).

A20.54 Deloitte believed these changes aligned its analysis to the Cartesian’s 2013 analysis, except for non-chargeable faults identified by clear codes 152 (faults that were Right When Tested) and 172 (mostly duplicate reports and non-service affecting external damage to non-Openreach assets). These accounted for approximately 4.7% of the faults.⁸¹⁴

A20.55 Deloitte reported that the changes, particularly the exclusion of the unclassified faults, reduced the faults rates produced by its analysis, as indicated in Table A20.4 below.⁸¹⁵

Table A20.4: BT/Deloitte changes in overall fault rates per product between the February 2014 and the December 2012 reports

Product	Overall fault rates (faults per week per 1,000)
---------	---

⁸⁰⁹ Pages 13 and 14, Deloitte, *Addendum to the Fault Data Report*.

⁸¹⁰ Page 14, Deloitte, *Addendum to the Fault Data Report*.

⁸¹¹ Page 4, Deloitte, *Addendum to the Fault Data Report*.

⁸¹² Pages 3- 5, Deloitte, *Updated Faults Data Report*.

⁸¹³ Main Fault Location (MFL) is the initial estimate of where the fault is located when the fault is first reported. It is one of the information fields in a fault report.

⁸¹⁴ Page 4, Deloitte, *Updated Faults Data Report*.

⁸¹⁵ Page 5, Deloitte, *Updated Faults Data Report*.

	lines)		
	Addendum to September 2013 report	February 2014 report	Percentage reduction
WLR	1.65	1.52	8.1%
WLR+SMPF	2.35	2.21	6.2%
MPF	2.09	2.02	3.5%

Source: Page 5, Deloitte, Updated Faults Data Report.

A20.56 Deloitte’s latest analysis produced the fault rates displayed in Table A20.5 for the period April 2011 to January 2014. All fault rates have reduced slightly compared to those reported in the Addendum to the September 2013 report.⁸¹⁶

Table A20.5: BT/Deloitte fault rates per product for the period April 2011 to January 2014

Product	Fault rates (faults per week per 1,000 lines)		
	Average	In-life	Early Life
WLR	1.5	1.4	7.4
WLR+SMPF	2.2	1.9	8.0
MPF	2.0	1.7	12.2

Source: Page 7, Deloitte, Updated Faults Data Report.

A20.57 Table A20.6 shows the increase in fault rates in the Deloitte analysis for the period November 2013 to January 2014 compared to the average over the period April 2011 to January 2014. Compared to its previous report (addendum to the September 2013 report) there is now some difference between the change in ILF and average (overall ILF and ELF) fault rates.⁸¹⁷

Table A20.6: BT/Deloitte increases in fault rates per product for the period November 2013 to January 2014 compared to the average over the period April 2011 to January 2014

Product	Increase in fault rates
---------	-------------------------

⁸¹⁶ Page 7, Deloitte, *Updated Faults Data Report*.

⁸¹⁷ Pages 10, 12 and 16, Deloitte, *Updated Faults Data Report*.

	Average	In-life	Early Life
WLR	6%	13%	8%
WLR+SMPF	17%	19%	12%
MPF	13%	24%	3%

Source: Pages 10, 12 and 16, Deloitte, Updated Faults Data Report.

A20.58 Deloitte repeated its analysis to remove seasonal variations from the trend in fault rates but restricted the periods of interest for trend analysis to the October to December quarter in the years 2011, 2012 and 2013. Deloitte’s analysis yielded increases in ILF rate for 2013 compared to 2011 of 24% for MPF, 13% for WLR+SMPF and 9% for WLR. Deloitte reported that they took this approach to avoid using the first quarter which had repeatedly low ILF rates.⁸¹⁸

A20.59 Deloitte also repeated its estimates of increases in WLR and MPF ILF rates when the voice faults relating to WLR+NGA and MPF+NGA services are included in the WLR and MPF ILF rates. For the period April 2011 to January 2014 it estimated increases of 0% for MPF and 10% for WLR-only. However, it again reported that it was not possible to distinguish whether a fault is related to the voice service or the data service and it did not explain how it decided what proportion of faults were applicable to the voice component in WLR+NGA and MPF+NGA.⁸¹⁹

A20.60 The analysis of faults by CP presented in the Addendum to the September 2013 report was not repeated.

Frontier Economics review for Sky and TalkTalk

A20.61 Sky and TalkTalk commissioned Frontier Economics to review certain aspects of the December 2013 Consultation. Sky and TalkTalk each submitted the report as part of their respective responses to the December 2013 LLU WLR Consultation.⁸²⁰ All of Frontier Economics’ and Sky’s comments were in relation to base year considerations. TalkTalk also made comments on the question of relative fault rates and trends.

Base Year

A20.62 Frontier provided another estimate for the volume of faults in 2009 of approximately 1.8m faults derived using additional information obtained from BT annual reports.⁸²¹

⁸¹⁸ Pages 13 and 14, Deloitte, *Faults Data Updated Report*. This is the same approach that Cartesian took in their 2013 analysis for similar reasons which Openreach criticised in their response to the December 2013 LLU WLR Consultation on the basis it distorted the trend analysis.

⁸¹⁹ Pages 14 and 15, Deloitte, *Updated Faults Data Report*.

⁸²⁰ Frontier Economics, *Treatment of the level of faults in the LLU and WLR charge controls for 2014-17. A report prepared for BSkyB and TalkTalk*, February 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Sky_and_TalkTalk_-_Frontier_Economics_Fault_Rates_Report.pdf.

⁸²¹ Page 10-12, Frontier Economics, *Faults Report*.

- A20.63 Frontier argued that the rapid deterioration in network quality and increase in fault levels since 2009 is not consistent with an efficient network operator and fault rates being at an efficient level. The rapid increase in fault volumes between 2009 and 2012 is too large to be explained by weather or increases in the number of broadband lines, but the rise does coincide with BTs NGA roll-out and reduction in preventative maintenance. Frontier also argued that Ofcom had not provided a quantitative assessment to explain how this fault increase is consistent with an efficient level of costs in a competitive market.⁸²²
- A20.64 Frontier further argued that if the base year fault volumes and costs are not adjusted to an efficient level and / or the fault volume is not capped, then there could be an incentive for BT to rationally choose to continue to increase fault volumes and costs with implications for downstream CPs and consumers. Frontier argued that the fault levels and associated costs should be adjusted to reflect a hypothetical, efficient, copper-only operator and include the wider costs of fault volumes on downstream CPs and consumers⁸²³ and exclude the effect of extreme weather.⁸²⁴
- A20.65 Frontier claimed there were a number of weaknesses in the Cartesian analysis prepared for Ofcom which made it impossible to determine if the differences in fault rates is due to NGA rollout or other factors.⁸²⁵ They proposed that a “simple fixed effects panel model” should be used and that it should include a mix of endogenous and exogenous factors.⁸²⁶
- A20.66 Frontier also argued that Ofcom’s fault rate analysis contained some “methodological flaws” as it did not address the “Unknown” and “Unclassified” products, the effects of line length and significant differences between in-life and early life fault rates.⁸²⁷

Sky

Base Year

- A20.67 Sky did not agree with our fault rate proposals arguing fault rates and volumes are inefficiently high due to reduced capital expenditure by Openreach on replacing older parts of the copper network without compensating increases in preventative maintenance. Sky expressed its view that it would be appropriate for Ofcom to apply a one-off reduction to base year costs and fault volumes.⁸²⁸
- A20.68 Sky did not agree with Openreach’s argument that increased rainfall and broadband penetration significantly increased fault rates. Sky argued it would be wrong for

⁸²² Pages 1-3 and 13-15, Frontier Economics, *Faults Report*.

⁸²³ Pages 2, 15 and 16, Frontier Economics, *Faults Report*.

⁸²⁴ Pages 19-22, Frontier Economics, *Faults Report*.

⁸²⁵ Pages 25-28, Frontier Economics, *Faults Report*.

⁸²⁶ Endogenous factors might be levels of maintenance and provision whilst exogenous factors might be line length, line age, climate, ducted or aerial line, mix of business and residential lines, etc. Pages 28-31, Frontier Economics, *Faults Report*.

⁸²⁷ Pages 33 and 34, Frontier Economics, *Faults Report*.

⁸²⁸ Paragraphs 5.1-5.11, Sky, *Response to the December 2013 LLU WLR Consultation and January 2014 FAMR Consultation (Charge controls)*.

Ofcom to include in the base year incremental fault costs due to the exceptional rainfall that occurred in 2012.⁸²⁹

A20.69 Sky expressed its view that most of the increase in faults is due to factors within BT's control. Sky provided two graphs showing:⁸³⁰

- a reduction of the order of 50% in Openreach's copper capex between 2008/09 and 2012/13;
- an increase of about 25% in Openreach operational capital maintenance between 2008/09 and 2012/13; and
- Openreach capex varying by about +/-10% around a mean of £1bn between 2006 and 2013 with the copper contribution reducing from about 35% to just less than 20% (from 2009 onwards) whilst the remaining capex, after deduction of copper and duct capex, increases from about 45% in 2010 to about 75% in 2013. Sky assumed that the remaining capex was spent on the rollout of NGA (fibre-to-the cabinet access technology).

A20.70 Sky argued that it is not unreasonable to reduce copper capital expenditure given the possible shortening of the life of e-side copper through FTTC deployment, provided preventative maintenance is increased, which Sky believed is not the case.⁸³¹

A20.71 Sky did not agree that continued investment in copper would not produce continuing reductions in fault rates and volumes and argued that:⁸³²

- more preventative maintenance is required as the life of the copper network is being prolonged;
- benefits arising from preventative maintenance activities such as weatherproofing, field force training and improving frame quality do not last forever and need replenishing;
- changing network conditions will offer new opportunities for continued improvement;
- BT's assertion that the same gains cannot be obtained from preventative maintenance as in the past is fallacious especially as BT's actual efficiency gains in the past have been larger than they claimed possible; and
- BT is inconsistent in arguing that high rainfall causes more faults but there is no more waterproofing to be done.

A20.72 Sky disagreed with Ofcom that there is insufficient data to demonstrate high fault rates are mainly due to under-investment.⁸³³

⁸²⁹ Paragraphs 5.13-5.14, *Sky Response to the December 2013 LLU WLR Consultation (Charge controls)*.

⁸³⁰ Paragraphs 5.16 and 5.17, *Sky Response to the December 2013 LLU WLR Consultation (Charge controls)*.

⁸³¹ Paragraph 5.19, *Sky Response to the December 2013 LLU WLR Consultation (Charge controls)*.

⁸³² Paragraph 5.21, *Sky Response to the December 2013 LLU WLR Consultation (Charge controls)*.

⁸³³ Paragraphs 5.5 and 5.6, *Sky Response to the December 2013 LLU WLR Consultation (Charge controls)*.

A20.73 Drawing on the Frontier analysis Sky considered the Cartesian analysis to be insufficiently robust to draw the conclusion that NGA has no impact on the fault rates of the other services.⁸³⁴

A20.74 Sky argued that BT would have made additional gains due to under-investment during the charge control period which will effectively be protected and rewarded if consequent increases in fault volumes and associated repair costs are adopted as the base cost in future charge controls. It argued that Ofcom should consider making a one-off reduction to the base year fault volumes and costs should it be proven that a reduction in preventative maintenance was the cause of elevated fault levels.⁸³⁵

TalkTalk

Base Year

A20.75 TalkTalk did not agree with Ofcom's adjustment of the single figure of 1.9m faults for 2009 to a range of 1.9m to 2.5m. Drawing on the Frontier report it presented an estimate of 1.8m faults for 2009.⁸³⁶

A20.76 TalkTalk disagreed with our analysis of the effect of rainfall and argued that the increase in faults from 1.8m or 1.9m to 2.9m cannot be explained by (i) rainfall which caused only 0.06m faults or (ii) broadband take up which caused only 0.03m faults. TalkTalk further argued that the likely causes are the known reduction in preventative maintenance, NGA roll-out, and other factors in Openreach's control. TalkTalk based its analysis on the difference between 2009 and 2012.⁸³⁷

A20.77 Also drawing on the Frontier report TalkTalk said that Cartesian's conclusion that NGA has no impact on LLU/WLR faults is not reliable because the statistical method it used is unsound. TalkTalk believed a straightforward panel analysis as suggested by Frontier would provide a more reliable estimate of the impact of NGA. Other factors highlighted by TalkTalk that suggest NGA causes higher faults include:⁸³⁸

- RFS 2013 e-side costs (so presumably fault repair costs and fault rates) fell while the d-side costs rose and

"FTTC deployment and uptake will primarily interfere on the e-side copper these differences in fault rates are consistent with FTTC causing more faults"; and
- evidence revealed during the 2012 LLU Charge Control Appeal regarding faults showed that access faults had risen whilst exchange faults had reduced.

A20.78 TalkTalk argued that even if Ofcom do consider that the 2012 fault level was efficient, it would be incorrect to use this because the level of rain in 2012 was

⁸³⁴ Paragraph 5.23, *Sky Response to the December 2013 LLU WLR Consultation (Charge controls)*.

⁸³⁵ Paragraphs 5.24-5.29, *Sky Response to the December 2013 LLU WLR Consultation (Charge controls)*.

⁸³⁶ Paragraph 4.2-4.5, *TalkTalk, Response to the December 2013 LLU WLR Consultation*.

⁸³⁷ Paragraph 4.6 and Footnote 44, *TalkTalk Response to the December 2013 LLU WLR Consultation*.

⁸³⁸ Paragraph 4.9, *TalkTalk Response to the December 2013 LLU WLR Consultation*.

‘exceptionally’ high and above average levels. Ofcom should base fault rates and cost estimates on average rainfall levels.⁸³⁹

Relative fault rates

A20.79 TalkTalk expressed its view that it would be more appropriate to recover the costs associated with early life faults from the provision activities that caused them as this will lead to greater economic efficiency.⁸⁴⁰

A20.80 TalkTalk also expressed its view that the ILF rate for MPF should be set lower than that for WLR+SMPF in line with the available evidence and also because of different approaches to test access. It said that, CPs’ own testing facilities on MPF are likely to result in fewer false positives (hence unnecessary fault service responses) and that as voice and broadband on MPF are provided by a single provider, there should be fewer points of failure tending to lower fault rates⁸⁴¹

A20.81 TalkTalk argued that by setting the overall fault rate (ILF + ELF) to be flat over the charge control period Ofcom is repeating the approach taken in the 2012 LLU WLR charge control in which the Competition Commission considered Ofcom had erred and incorrectly estimating the level of faults because the proportion of MPF provisions is falling and the ELF rate is much higher than the ILF rate.⁸⁴²

Other respondents

A20.82 In this section we summarise the responses from Verizon, Vodafone and one other respondent ✕ to our December 2013 LLU WLR Consultation.

Base Year

A20.83 ✕ agreed with our approach to establishing base year costs as BT has profit incentive under the charge controls to set its preventative maintenance investment to appropriate levels. The respondent also agreed that NGA faults are outside the scope of the charge control.

A20.84 Vodafone welcomed Ofcom’s proposal to adjust base year costs if Openreach had underinvested and fault levels increased because of the implications for future charge controls and the super normal profits they consider BT has generated. Vodafone also supported Ofcom’s conclusion that there will not be any significant rises in fault levels due to weather during the charge control period.

A20.85 Verizon agreed with Ofcom’s approach to establishing base year costs based on fault levels and costs actually incurred as a reasonable compromise between the varying views of Openreach and the other CPs, none of which advance truly compelling arguments.

Relative fault rates

A20.86 Verizon agreed with Ofcom’s position to equalise MPF and WLR+SMPF fault rates.

⁸³⁹ Paragraph 4.11, TalkTalk *Response to the December 2013 LLU WLR Consultation*.

⁸⁴⁰ Paragraphs 4.14 to 4.16, TalkTalk *Response to the December 2013 LLU WLR Consultation*.

⁸⁴¹ Paragraph 4.17, TalkTalk *Response to the December 2013 LLU WLR Consultation*.

⁸⁴² Paragraph 4.14, TalkTalk *Response to the December 2013 LLU WLR Consultation*.

A20.87 ☒ argued that equalising MPF and WLR+SMPF fault rates would amount to cross-subsidy as the data suggests MPF genuinely attracts more faults, especially early life faults, and should therefore have higher costs. The fault rates should be set in line with the fault data unless there is positive proof that the fault data is incorrect. The respondent also believed but admitted they had no proof that WLR+SMPF services are used more than MPF by business CPs who have better processes in place that may drive fault rates lower on WLR+SMPF.

Trend in fault rates

A20.88 ☒ agreed that fault rates should stay constant as a compromise between their view that the fault rates are inefficiently high and Openreach's view of an upward trend that is hard to understand given the mature nature of the technology which would normally be expected to be more reliable. The respondent believes the profit motive should be a sufficient incentive to reduce fault rates without the need for a glide path.

A20.89 Verizon did not agree with Ofcom's proposal to keep fault rates constant. Verizon argued that as a matter of principle fault rates should decrease due to process efficiency improvements. Verizon also agreed with Sky and TalkTalk's position that existing faults are significantly above an efficient level. However Verizon observed there is very little hard evidence to support a reduction and given the opposing position of Openreach it understands Ofcom's position of no change.

Our analysis: Level of base year faults

A20.90 We consider in this section whether it is appropriate to adjust the fault related costs in our base year in the charge control model (which have been derived from the 2011/12 RFS).

A20.91 We would note that as a matter of principle in cost modelling, as a starting point we believe that using a consistent set of cost data for the base year is a reasonable and desirable approach avoiding the risks of inconsistency in cost allocations.

A20.92 Accordingly, we would only consider making such an adjustment if there was clear evidence that costs included would not form a sound basis to project future cost from and it if was clear how any adjustment could be made that would ensure consistency in both operating and capital investment cost and service volumes.

Our consideration of stakeholder responses for the base year

A20.93 We discuss below: (i) investment and preventative maintenance, (ii) the impact of weather, and (iii) the impact of NGA roll out.

Investment and preventative maintenance

A20.94 We expect fault rates of network components to increase after their expected working life has been reached.⁸⁴³ To ensure this does not have a detrimental effect on the services delivered we anticipate network operators wishing to retain customers and business will invest in the replacement of life expired network components. We do not expect this investment to necessarily be constant as network operators have to decide between competing demands for the available

⁸⁴³ There is further discussion of the expected characteristics of network component fault rates in the section on trends in fault rates.

investment funds. Consequently, we expect fault rates to vary over time as investment levels in network component replacement will naturally vary over time. Such variations are likely to occur over periods of many years and there may always be some residual level of faults due to network component ageing.

- A20.95 There may be situations where network development will eventually replace older network equipment with newer alternative technologies making replacement of the older worn-out network components commercially unattractive. It could also be that the business case drivers for the deployment of the new technology do not align with the need to replace life expired network components, leaving life expired components in the network longer than is desirable and increasing the chances of elevated levels of faults. Such situations could be the sign of genuine structural changes in the market due to technology evolution. If this were the case, then replacing equipment that would not be used for its expected life could lead to increased costs that in the long term could be greater than the costs associated with a short term increase in fault rates and associated repair costs.
- A20.96 The evidence on investment in the copper network is very mixed. In support of our December 2013 Consultation, we gathered data from BT using our statutory information gathering powers to examine the costs of preventative maintenance investment in copper and infrastructure and on preventative maintenance activity. This data showed a reduction in preventative maintenance of about 30% in the years 2011/12 and 2012/13 when compared to the years 2009/10 and 2010/11.
- A20.97 We also reviewed Openreach's overall investment in copper, which again shows a reduction in 2011/12 and 2012/13 when compared to 2007/08 and 2008/09.⁸⁴⁴
- A20.98 In its response to the December 2013 LLU WLR Consultation, Sky included two charts presenting copper capital expenditure. The charts show a significant drop of around 30% from 2008/09 to 2011/12 and a further drop of 30% from 2011/12 to 2012/13.⁸⁴⁵
- A20.99 Openreach's own submission in relation to capital expenditure and proactive maintenance activities does not suggest a reduction in investment over the critical period 2009/10 to 2011/12. However, the actual levels of expenditure are also generally lower than shown in Sky's submission.
- A20.100 It is clear that the submissions represent different perspectives on the investment elements relevant to the sustainability of the copper network. It is also clear that Openreach's priority for investment has changed over the last decade. We would also observe that even constant levels of expenditure are not necessarily consistent with the maintenance of an aging network.
- A20.101 However, it is difficult to derive a clear conclusion as to the relationship between investment levels and fault levels in any given period. Investment levels and associated age-related faults will very likely fluctuate over long time periods and priorities for investment changes. For us to determine whether the level of investment is inefficient we would need to consider whether the capital savings are outweighed by the costs of faults (to Openreach, its customers and end users). There is no evidence that this is the case, given the relatively small change in fault levels over the period and the absence of evidence of a significant increase in

⁸⁴⁴ Ofcom, *FAMR LLU WLR 2013 RAV Model*, July 2013.

⁸⁴⁵ Paragraphs 5.16 and 5.17 *Sky's response to the Charge Control elements of Ofcom's December 2013 and January 2014 Consultations*

consumer harm due to this variation. We would also note that Openreach's customers benefit from lower capital expenditure through the charge control.

A20.102 We therefore conclude that the evidence we have is insufficiently reliable and consistent to enable us to assess a quantitative relationship between investment levels, preventative maintenance expenditure levels and changes in fault volumes.

A20.103 Further, we do not agree with TalkTalk's, Sky's and Verizon's views that a continued reduction in the level of faults is necessarily possible. Clearly if network components, including items such as waterproofing of cable joints, are not replaced before their end of life fault rates will increase. Equally if network components are replaced significantly before their end of life is reached, then investment will effectively be wasted and no reduction in the level of faults achieved (i.e. fault trends will continue at the same historic level). It is also arguable that unnecessary replacement of network components could increase fault rates due to the introduction of unnecessary early life faults. Similar arguments apply to expenditure on training for staff to improve what they do. Consequently we believe there will be limits to the improvement in fault levels that can be obtained from investment in network component replacement and preventative maintenance expenditure.

A20.104 TalkTalk has also argued that Openreach's claims of fault sensitivity to weather are overstated and that a high proportion of faults can be attributed to non-weather related network failure than we or Openreach recognise.

A20.105 We do not accept TalkTalk's estimates of the quantitative relationship between fault levels and rainfall for the period 2009 to 2012. The relationship between rain and faults used by TalkTalk (Figure A10.18, July 2013 FAMR Consultation) represents the level of faults occurring in the month following the month in which the rain fell and is very specific to the circumstances that applied in 2012, that of rainfall accumulating as high levels of ground water.⁸⁴⁶ We believe the rainfall circumstances in 2012 were unusual and were not evident in the other years being considered, where flash flooding and other storm damage were much more likely to be the cause of weather related faults. The relationship between faults and weather is complicated, very likely to be non-linear and in some cases requires the waterproofing in the network to have failed as well for there to be an increase in fault levels due to changes in weather conditions.

A20.106 No stakeholder has submitted any evidence that the current level of faults represents an inefficient level. The mean time between failures we derived from the results of the Cartesian analysis results is 9 years for broadband and 12 years for voice only lines. The consumer survey evidence that we presented in the December 2013 LLU WLR Consultation suggests that the rate of faults is not considered to be a major issue for consumers or businesses (compared to the speed of fault repair which is an issue of concern).

A20.107 Absent such evidence to the contrary we consider BT is best placed to assess the balance between investment, preventative maintenance expenditure and the cost of fixing faults that occur. We therefore do not consider there is a basis for adjusting the fault costs or investment assumptions in the base year.

⁸⁴⁶ No significant relationship was found between rainfall in a given month and the level of faults within that same month.

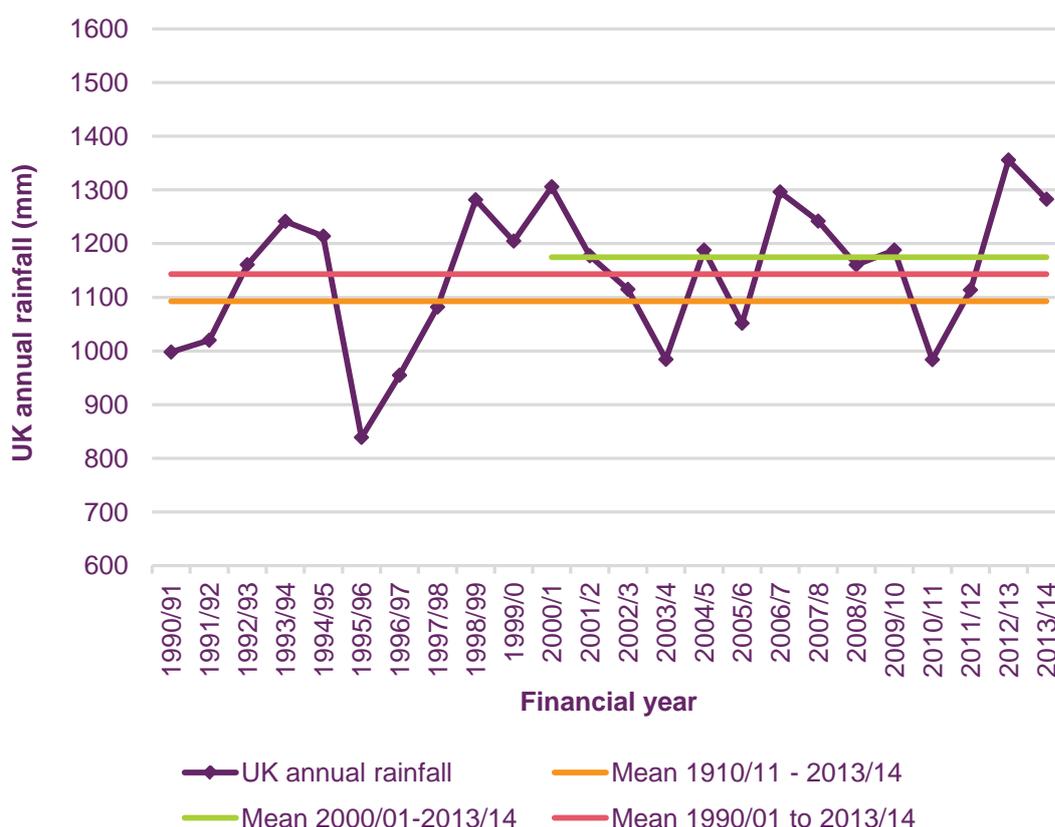
Weather considerations

A20.108 Openreach has argued that 2012/13 was more representative of the expected future average conditions than 2011/12 and that this should form the base year for faults in the Cost Model.

A20.109 On the other hand, Sky, TalkTalk argue that Ofcom should not use 2012 as the base year because the level of rain in 2012 was ‘exceptionally’ high and above average levels. They said Ofcom should base fault rates and cost estimates on average rainfall levels.

A20.110 We discuss weather trend arguments in more detail later in the Annex, but we would observe that absent any other clear evidence as to the likely weather expectations for final year of the control we consider the most appropriate assumption is one linked to historical experience. On that basis it is not clear that 2012/13 offers a more appropriate position than 2011/12, which can be seen from Figure A20.2 sits close to the long term average rainfall level. We note the comments by Sky and TalkTalk on rainfall in 2012 but observe that the higher rainfall in 2012 largely occurred in financial year 2012/13 not financial year 2011/12.

Figure A20.2 UK annual rainfall for financial years



Source: Ofcom analysis of Met Office data.

Impact of rollout and take-up of NGA

A20.111 Central to our approach in the setting of charges in this review is that where services are combined to form an integral service such as WLR+SMPF, any additional costs arising from the addition of SMPF to WLR are borne by the

additional service, i.e. SMPF in this example. If the addition of SMPF causes an increase in WLR faults (as well as there being actual SMPF service faults) then we would allocate these additional WLR faults and the associated cost of repair to SMPF.

A20.112 We have decided that it is appropriate to apply the same policy to the allocation of additional faults and costs in services when they are combined with NGA. In this case, we think it is appropriate to allocate additional faults and costs in WLR and MPF arising from their combined delivery with NGA to form WLR+NGA and MPF+NGA to NGA. Further, as we are not setting a charge control for NGA faults related to NGA, combined services such as WLR+NGA and MPF+NGA are outside the scope of the charge control and are therefore excluded from this fault rates analysis.

A20.113 TalkTalk and Sky have argued that the level of faults in 2012 was affected by the deployment of NGA.⁸⁴⁷

A20.114 Cartesian (2013) specifically investigated whether the rollout of NGA had increased fault rates and found no relationship between overall fault rates and NGA rollout. In some cases Cartesian found that the fault rate was lower in areas where NGA had been deployed.⁸⁴⁸

A20.115 Sky, TalkTalk and Frontier Economics argued in their response to the December 2013 LLU WLR Consultation that Cartesian's (2013) conclusion was not well founded and based on flawed analysis. Frontier suggested a simple panel analysis should have been performed to identify and eliminate potential biases in the analysis. They also suggested that better parameters could have been used in the analysis.

A20.116 TalkTalk also argue that Cartesian's 2013 conclusion that NGA has no impact on LLU/WLR faults is not reliable because:

- RFS 2013 e-side costs (so presumably fault repair costs and fault rates) fell while the d-side costs rose and

“FTTC deployment and uptake will primarily interfere on the e-side copper these differences in fault rates are consistent with FTTC causing more faults”⁸⁴⁹.

- evidence revealed during the 2012 LLU Charge Control Appeal regarding faults showed that access faults had risen whilst exchange faults had reduced.

A20.117 Cartesian performed the analysis (2013) most suited to the timescales, resources and data available. We do not consider that a “simple fixed effects panel model” is proportionate to the aims of the review, which is to determine an appropriate set of inputs to a charge control model. It would require extensive data gathering and we are not convinced after the considerable difficulties we experienced obtaining the fault data we did analyse, that time series data could be made available for all the parameters Frontier suggest should be included, certainly not without introducing an unacceptable period of delay to the setting of these charge controls. We also note that Sky and TalkTalk have not provided any other quantitative evidence to suggest

⁸⁴⁷ Sky's and TalkTalk's responses to the July 2013 LLU WLR Consultation.

⁸⁴⁸ Paragraphs 6.20-6.21, CSMG, *Fault Rates Report*

⁸⁴⁹ Page 28, TalkTalk response to the July 2013 LLU WLR Consultation.

that NGA installation and provisioning is having a negative effect on the fault levels of the products covered by this charge control. On balance, we consider that Cartesian's 2013 conclusions are sufficiently sound for the purpose of deciding whether to adjust for NGA effects in the base year costs.

A20.118 FTTC deployment bypasses e-side copper so we do not agree that NGA primarily interferes on the e-side cable. Also as NGA bypasses the e-side copper we do not agree that increases in access costs are necessarily due to NGA. We also have no other evidence to suggest that d-side costs are increasing due to NGA.

A20.119 We also note that Openreach argued in its response to the December 2013 LLU WLR Consultation that in relation to services combined with NGA Ofcom wished to incorrectly allocate copper costs to fibre services. However this apparent allocation of copper related costs to fibre only arises because of Openreach's labelling of the NGA (GEA) services as fibre when most NGA deployments are a hybrid combination of copper and fibre delivery.

A20.120 We conclude there is no evidence to suggest that NGA rollout is causing any significant increase in the fault levels of the charge control products. Therefore, we have not made any changes to our view of fault rates for the charge control period to take account of the impact of NGA rollout.

Conclusion on base year fault levels

Our use of fault data from 2011/12

A20.121 We do not consider that there is evidence that the existing fault levels as experienced in 2011/12 can be seen to be inefficiently high and more specifically that the balance of fault repair costs and investment incurred by Openreach in 2011/12 was inefficient.

A20.122 Equally, we do not accept the evidence from BT that 2012/13 would be more representative of future years than 2011/12 such that it should be used as the starting point for our assessment. On the basis of the evidence we have, we would consider that the environmental conditions experienced in 2011/12 are closer to recent averages than those experienced in 2012/13.

A20.123 Moreover, we do not accept that there is any evidence that NGA investment has had a material impact that would suggest that the 2011/12 year is not representative of future fault levels.

A20.124 We therefore conclude that it is appropriate to use 2011/12 fault related costs in determining the base year for the charge control.

Our analysis: Relative fault cost allocation

A20.125 We now consider the appropriate allocations of the fault related costs to the different services. In this regard we are only concerned with relative fault allocations for the rental services subject to the charge controls at the end of the charge control period. In the following we present:

- our regulatory policy considerations on fault allocations between products;
- technical considerations on fault allocations between products;

- a summary of our consideration of the analysis of the fault data relevant to fault allocations;
- derivation of the relative fault allocation for WLR-only and SMPF; and
- our decision on relative fault allocations.

Regulatory policy considerations for the allocation of fault costs

A20.126 In considering the appropriate allocations of the fault related costs in the Cost Model, we have sought to adopt an approach consistent with our duties to promote competition, including our principal duty under section 3 of the Act. Specifically, we have taken an approach that seeks as a matter of regulatory policy to ensure that there is competitive neutrality as between MPF and WLR+SMPF wholesale inputs, thus helping ensure that there is no distortion to competition in downstream retail markets⁸⁵⁰. This means that we would not want to introduce pricing differences as between the products unless they were real, enduring and material.

A20.127 Therefore, our starting point in considering the appropriate allocation of fault costs is to consider whether there are any technical considerations that would suggest a particular allocation of fault costs as between MPF and WLR+SMPF. We then consider whether any of the evidence supports making an adjustment to this on the basis that there are real differences observed in the data that justify a different allocation as between the products. Consistent with our regulatory policy position, we would only consider moving away from the position indicated by technical considerations if there was a clearly identified reason for doing so which was unequivocally supported by stable data and was material in its nature. Further, introducing a difference would require accurate and consistent data, otherwise any adjustment runs the risk of being spurious which would cut across our regulatory policy objective as it would risk distorting competitive neutrality as between MPF and WLR+SMPF wholesale inputs.

Technical considerations on fault allocations between products

A20.128 MPF and WLR+SMPF are mainly used to provide consumers with the same set of services, i.e. voice and broadband. Further, between the frame in the BT exchange and the consumer premise, MPF and WLR+SMPF are the same and one can be readily swapped for the other. That is, the E-side network, D-side network, drop wire and all the various connections between them are identical. Therefore, we see no obvious reason why fault rates for each of these segments should be different for MPF compared with WLR+SMPF.

A20.129 Further, while Openreach notes that there may be some minor differences in the provisioning activity on the frame for each of these products (and migrations between them), it is not clear why the fault rate related to frames would be materially different for MPF compared with WLR+SMPF.

A20.130 One area where differences in fault levels may emerge is in the line testing equipment, which is provided differently for MPF than it is WLR+SMPF (and

⁸⁵⁰ This is a different approach to modelling the costs than that taken in the March 2012 Statement where we set fault allocations using BT's fault rates reported at the start of the charge control period to set the final year allocation.

WLR).⁸⁵¹ As such, faults associated with line testing equipment could result in differences between the fault rates on the different products. However, Cartesian's analysis indicates that there were no faults caused by line testing equipment in 2012/13.⁸⁵² We therefore cannot see this being a material factor in the fault rates for the different products.

A20.131 A WLR-only service uses the same E-side network, D-side network and drop wire as MPF and WLR+SMPF. However, it does have fewer frame jumpers. The fact that it has fewer frame jumpers may be expected to result in fewer faults. However, of more significance is the fact that a WLR-only service only supports an analogue voice service whereas both MPF and WLR+SMPF are generally used to support analogue voice and broadband services simultaneously. The need to additionally support broadband could be expected to give rise to increased faults. Accordingly we would expect WLR-only to have a slightly lower fault rate than MPF and WLR+SMPF.

A20.132 We also noted in our previous consultation that Cartesian's analysis showed little correlation between line length or population density and faults so that, even to the extent that the services may be used differently (i.e. MPF lines being in areas with lower proportions of overhead delivery), the data does not suggest this causes a difference in fault rates by network segment.⁸⁵³

A20.133 Consequently we consider that there are no underlying technical reasons to justify different fault rates between WLR+SMPF and MPF. Therefore, given our technical understanding of the products, our strong preference is to assume that MPF and WLR+SMPF have the same fault rates and we consider that the equalisation of the MPF and WLR+SMPF fault allocations in 2016/17 is an optimal starting position.

A20.134 Consistent with our regulatory policy approach described above, we now consider stakeholder contributions and our analysis of the faults data to determine whether there is any basis justifying different relative fault rates, including assessing whether any such explanation is evidenced by sufficiently reliable and stable data.

Summary of fault data analysis relevant to relative fault rates

A20.135 We present in the Appendix at the end of this Annex a summary of Cartesian's analyses on faults and a summary of various investigations into the causes of early life failures.

A20.136 We have considered and Cartesian have analysed on our behalf various combinations of data, covering slightly different periods and incorporating various different fault inclusion criteria (following submissions from Openreach). For clarity,

⁸⁵¹ Test Access Matrix (TAM) equipment is used to test MPF lines but not WLR or WLR+SMPF lines. Faults in MPF service products that are relevant and within scope to the charge control can arise from failures within the drop-wire, d-side, e-side, MDF, TAM equipment and internal exchange wiring components used to deliver the service. Faults in WLR+SMPF service products that are relevant and within scope to the charge control can arise from failures within the drop-wire, d-side, e-side, MDF, and internal exchange wiring components used to deliver the service. Test access equipment for the WLR+SMPF service is an integral part of the electronics used to deliver the WLR voice component of the service and is outside the scope of Openreach and the charge control. Faults within the TAM can introduce a break in the transmission of the service product signals.

⁸⁵² See Figures 3 and 4, CSMG, *WLR and LLU Fault Rates Analysis: Final report, prepared for Ofcom*, November 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex10.pdf>.

⁸⁵³ CSMG, *Fault Rates Report*

the datasets and fault inclusion criteria considered are defined in Table A20.7 below. The combinations analysed include:

- the Original Dataset with the Original Fault Criteria (Cartesian 2013 analysis);
- the Extended Dataset with the Updated Fault Criteria (Cartesian 2014 analysis);
and
- the Extended Dataset with the Modified Fault Criteria (Cartesian 2014 analysis).

Table A20.7 Definition of datasets and fault inclusion criteria used in analyses

Name	Meaning	Cartesian equivalent
Original Dataset	Fault and working system size dataset covering the period April 2011 to September 2013	Original Data
Extended Dataset	Fault and working system size dataset covering the period April 2011 to January 2014	Extended Data
Original Fault Criteria	<p>Fault inclusion criteria (i.e. the fault types considered to be in scope)</p> <p>The set of clear codes (i.e. fault reference codes) defining which fault types should be included in the analysis used in the first Cartesian 2013 Analysis.</p> <p>CDTA faults that were not classified as 'fault not found' were considered in-scope</p>	Previous Filtering
Updated Fault Criteria	<p>Fault inclusion criteria.</p> <p>The set of clear codes defining which fault types should be included suggested by Openreach in February 2014. These were essentially the same as the Original Fault Inclusion Criteria but also included clear codes starting with codes 152 and 172.⁸⁵⁴</p> <p>It also specified the inclusion of all SFI, CDTA and CDTNA faults prior to filtering with the clear code criteria (which should remove the chargeable faults leaving just non-chargeable SFI, CDTA and CDTNA faults).⁸⁵⁵</p>	Updated Filtering
Modified Fault Criteria	<p>Fault inclusion criteria.</p> <p>The Updated Fault Inclusion Criteria without the inclusion of clear codes starting with codes 152 and 172.⁸⁵⁶</p> <p>This set is the same as the Original Fault Inclusion Criteria but also includes the non-chargeable SFI, CDTA and CDTNA faults.⁸⁵⁷</p>	Modified Filtering

⁸⁵⁴ Clear codes starting 152 relate to faults that are Right When Tested (RWT) and clear codes starting 172 relate to fault reports that are duplicate reports or reports of non-service affecting external damage to non-Openreach assets. The addition of these was suggested by Openreach.

⁸⁵⁵ SFI, CDTA and CDTNA are essentially chargeable fault investigation services. However if Openreach finds during one of these investigations a fault with their network they do not make a charge. If they find a fault outside their network then they charge the CP or customer. Consequently there are both chargeable and non-chargeable faults associated with these fault investigation service products.

⁸⁵⁶ Clear codes starting 152 relate to faults that are Right When Tested (RWT) and clear codes starting 172 relate to fault reports that are duplicate reports or reports of non-service affecting external damage to non-Openreach assets.

⁸⁵⁷ SFI, CDTA and CDTNA are essentially chargeable fault investigation services. However if Openreach finds during one of these investigations a fault with their network they do not make a charge. If they find a fault outside their network then they charge the CP or customer. Consequently

- A20.137 We commissioned the Cartesian 2014 analysis in response to stakeholder challenges of the dataset used to support the assessment in the December 2013 LLU WLR Consultation, which in turn was based on the Cartesian 2013 analysis. The Cartesian 2014 analysis considered the Extended Dataset and the Updated Fault Criteria because Openreach suggested that we had omitted a number of relevant fault types in our consideration of the Original Dataset and Original Fault Criteria in the Cartesian 2013 analysis. Openreach argued that the omitted clear codes and non-chargeable SFI, CDTA and CDTNA faults materially affected the fault rates analysis.
- A20.138 As presented in the appendix we found that the WLR-only and WLR+SMPF overall fault rates (derived from the Extended Dataset and Updated Fault Criteria) were uplifted by between approximately 10% and 14% and the overall fault rate for MPF by between approximately 4% and 5%. The Cartesian 2014 analysis of the Extended Dataset and Updated Fault Criteria found that WLR+SMPF had a higher level of faults relative to MPF over the whole period analysed (April 2011 to January 2014) as compared to the Original Dataset and Original Fault Criteria (Cartesian 2013 analysis) where WLR+SMPF showed higher relative faults for approximately the first half of the period analysed (April 2011 to August 2013) whilst MPF showed higher faults for the remainder of the period analysed (April 2011 to August 2013).
- A20.139 Our investigations showed that the change in overall fault rates was predominantly due to the inclusion of the clear codes starting with codes 152 and 172. These clear codes represent faults that are Right When Tested (RWT) (in other words they are not true faults), are duplicate reports and are related to site visits where the damage reported is not to Openreach property.
- A20.140 We consider that these faults do not drive engineering activity costs and would distort the distribution of costs in the charge control Cost Model. Consequently, we based our subsequent analysis on the Extended Dataset and the Modified Fault Criteria.⁸⁵⁸ The analysis considered in the remainder of this section on relative fault rates is over the period April 2011 to January 2014 (the Extended Dataset) unless specified otherwise.
- A20.141 The analysis showed that the fault rates estimated for the Extended Dataset and the Modified Fault Criteria (Cartesian 2014) were essentially the same as those derived from the Original Dataset and the Original Fault Criteria (Cartesian 2013) that were presented in the December 2013 LLU WLR Consultation.
- A20.142 The estimated overall annual fault rates for MPF and WLR+SMPF for the Extended Dataset and Modified Fault Criteria are very similar but neither is consistently larger than the other over the time period as shown in Table A20.8 below. The changing differences over time are due to the different contributions over time from both in-life and early-life fault rates for each product, whereas previously in the Original Dataset and Original Fault Criteria the differences were predominantly due to early life faults.

there are both chargeable and non-chargeable faults associated with these fault investigation service products. The non-chargeable elements will form part of the fault repair cost input to the charge control model.

⁸⁵⁸ Clear codes starting 152 relate to faults that are Right When Tested (RWT) and clear codes starting 172 relate to fault reports that are duplicate reports or reports of non-service affecting external damage to non-Openreach assets.

Table A20.8 Overall annual fault rates for the Extended Dataset and Modified Fault Criteria⁸⁵⁹

	<u>2011/12</u>	<u>2012/13</u>	<u>2013/14 (52 wk. est.)⁸⁶⁰</u>
MPF	10.4%	11.2%	11.4%
WLR-only	8.2%	8.5%	8.6%
WLR + SMPF	10.6%	11.0%	11.1%

Source: Cartesian, *Updated Fault Rates Report*.

A20.143 We separately considered the impact on overall fault rates of the rate of in-life failure and early life failure over time to determine whether this could have any bearing on allocations of costs at the end of the charge control period.

Impact of in-life faults

A20.144 The estimated in-life annual fault rates for MPF and WLR+SMPF for the Extended Dataset and Modified Fault Criteria shown in Table A20.9 below are very similar with WLR+SMPF consistently higher by about 9% at the start of the extended period and about 4% at the end of the extended period. We have not been able to identify any technical or operational reason why this difference should be apparent in the Extended Dataset.

A20.145 These results exhibit an absolute difference of about 0.2% compared to the rates derived from the Original Dataset and fault inclusion criteria (i.e. is about 2% higher as a ratio than the original analysis results).

A20.146 We also further considered the difference in ILF rate between MPF and WLR+SMPF. Given the small differences between the results from the Original Dataset and the results from the Extended Dataset over the period April 2011 to September 2013, we believe that the original findings of no relationship between ILF rates and network segment, line length or population density still stand, at least over the April 2011 to September 2013. To the extent that rainfall seems to have been a significant contributor to ILF rate changes outside the period April 2011 to August 2013, we believe that it is reasonable to assume that the findings of no relationship between ILF rates and network segment, line length or population density apply to the whole period April 2011 to January 2014. We have also not been able to identify any other possible causes for the difference in ILF rate.

⁸⁵⁹ The fault rates are expressed as a percentage and can be interpreted equivalently as: (i) the number of faults per one hundred lines of the product per period of time the fault rate is quoted for; or (ii) the percentage of all lines of the product that will exhibit a fault in the period of time the fault rate is quoted for, i.e. a year in this table.

⁸⁶⁰ 52 week estimate was obtained by prorating actual fault rate for 42 weeks.

Table A20.9 In-life annual fault rates for the Extended Dataset with Modified Fault Criteria

	<u>2011/12</u>	<u>2012/13</u>	<u>2013/14</u> <u>(52wk est.)⁸⁶¹</u>
MPF	8.5%	9.3%	9.4%
WLR-only	7.4%	7.9%	7.9%
WLR + SMPF	9.3%	9.7%	9.8%

Source: Cartesian, *Updated Fault Rates Report*.

Impact of early life faults

A20.147 As we show in Table A20.8 above there is an increase in overall fault rates in the period of analysis (April 2011 to January 2014).

Table A20.10 Proportion of all faults for the given product due to early life faults derived from the Extended Dataset and Modified Fault Criteria

Product	2011/12	2012/13	2013/14 (42 week)
MPF	21%	21%	21%
WLR-only	12%	9%	10%
WLR+SMPF	18%	15%	14%

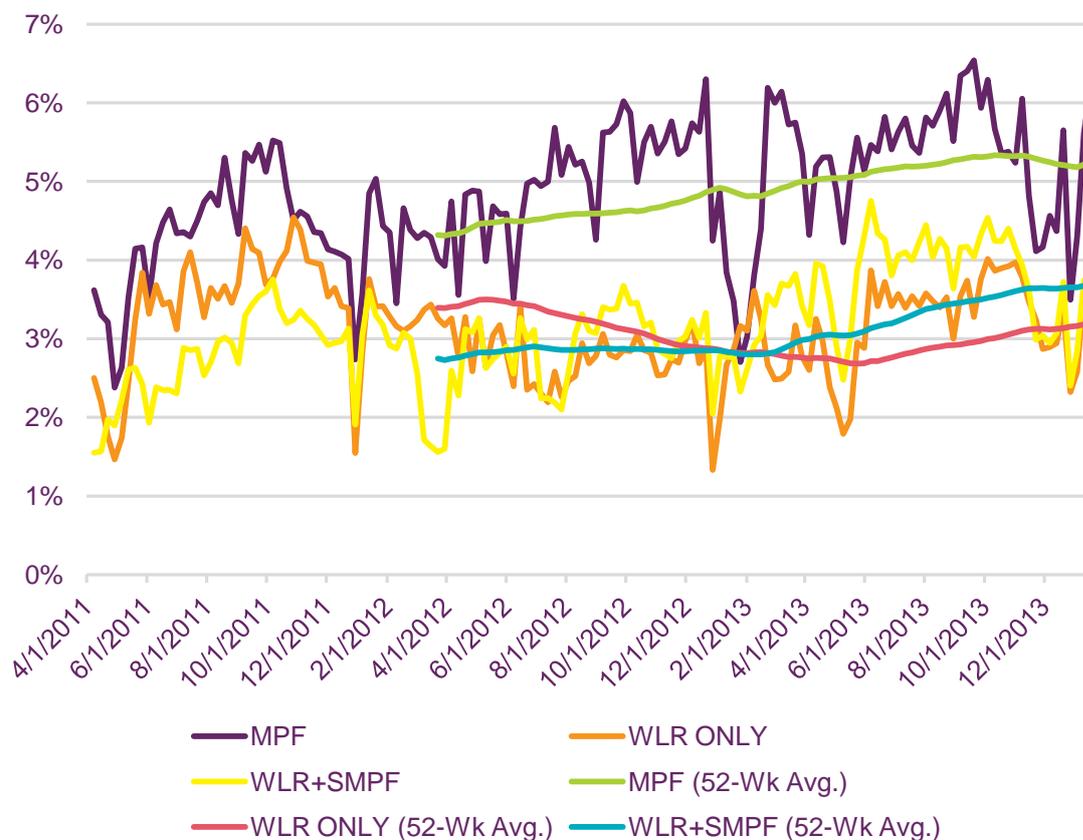
Source: Ofcom analysis of Cartesian 2014 analysis

A20.148 Table A20.10 shows the contribution of ELF's to the total faults for each product for each year as a proportion of the total faults for each year. As can be seen the contribution of ELF appears to be constant for MPF whilst it is declining for the WLR-only and WLR+SMPF.

A20.149 The estimated early-life weekly fault rates, shown in Figure A20.3 below, are very different for each product. MPF is clearly greater than WLR+SMPF and both are increasing whereas WLR-only is similar in value to WLR+SMPF but after a period of decline also exhibits an increase. All three show some indication of flattening towards the end of the period.

⁸⁶¹ 52 week estimate was obtained by prorating actual fault rate for 42 weeks.

Figure A20.3 Early-life weekly fault rate trends for the Extended Dataset and Modified Fault Criteria



Source: Ofcom and Cartesian (2014) analysis of Openreach data⁸⁶²

A20.150 To determine whether the proportion of ELF's will be significantly different at the end of the charge control period (where we are setting the allocation for the Cost Model) we need to consider how the ELF rates and the volume of provisions might evolve over the charge control period.

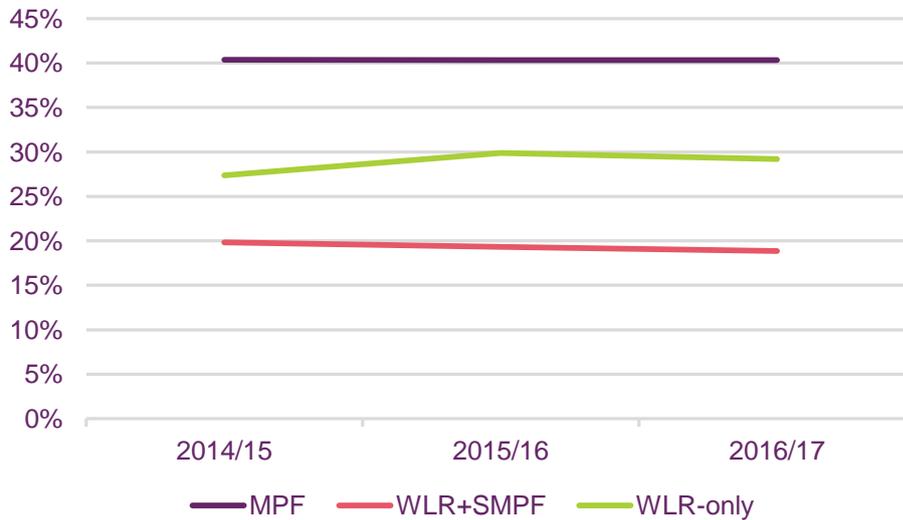
A20.151 Figure A20.3 above shows that the ELF rates have been volatile over the period covered by the data. Consequently, we have further reviewed the investigations into the causes of early life faults to determine if causes and remedies have been identified and whether these will result in a reduction in ELF's in the charge control period. We include in the appendix at the end of this annex a summary of investigations being undertaken by Openreach and a summary of investigations being led by the OTA. Neither, however, provides evidence to indicate that the ELF rates will stabilise over time. Further, the OTA has recently identified some process improvements that have reduced ELF rates⁸⁶³ and the work does suggest that Openreach internal systems have a significant impact on ELF levels, which would suggest that further reductions are possible. Accordingly, the direction of change in ELF is also unclear. On this basis it is not possible to be confident as to the rate of ELF that is likely to be experienced in 2016/17, or the impact of ELF on relative or absolute fault rates.

⁸⁶² BT's responses dated 5 March 2014 and 7 March 2014 to the sixth QoS BT Information Request.

⁸⁶³ ELF rate for the Start of Stopped line provision order type has improved from 9% in August 13 to around 6% in March 2014.

A20.152 We next considered the forecasts of volumes of provisions relative to the working system size (number of lines or rentals). Figure A20.4 indicates that MPF and WLR+SMPF do not change significantly over the charge control period whereas WLR-only increases by about 10% between the first two years and is relatively flat thereafter.

Figure A20.4 Forecast provision volumes relative to volume of rentals



Source: Ofcom analysis of Ofcom product volume forecasts (see Annexes 24 and 25)

A20.153 We therefore conclude that the ELF levels are not stable, there is no means of predicting those rates in 2016/17 and nor is there evidence that there is a consistent difference between the rate of ELF for different products. However, we observe that the volume of young lines (ones in early-life state) relative to the working system size has largely stabilised. Accordingly, given the impact of ELF on overall average fault levels will not be significantly influenced by changes in the mix of young and older lines and there is no basis for a reliable prediction as the differences in the impact of ELF (if any) on the products, we consider that observed levels of ELF in today's data is not helpful in establishing fault cost allocations in 2016/17.

Use of the services

A20.154 Openreach expressed the view that it is wrong to equalise MPF and WLR+SMPF fault rates because the products are used differently by different CPs with different approaches to customer service resulting in different propensities to report faults. Deloitte in their addendum to the September 2013 report also found that average ILF rates varied significantly by CP.

A20.155 Unfortunately Openreach did not expand on these points. It is not obvious to us how different approaches to customer service can affect the underlying fault rates of the copper network which is what we are interested in.

A20.156 One other respondent ✕ to the December 2013 LLU WLR Consultation argued that equalising MPF and WLR+SMPF fault rates would amount to cross-subsidy as the data suggests MPF genuinely attracts more faults, especially early life faults, and should therefore have higher costs. The fault rates should be set in line with the fault data unless there is positive proof that the fault data is incorrect. The

respondent also believed but accepted that they had no proof that WLR+SMPF services are used more than MPF by business CPs who, in its view, have better processes in place that may drive fault rates lower on WLR+SMPF.

A20.157 While it is likely that at any time different practices and types of services used by CPs will give rise to different reporting levels by customers, there is no evidence that this is likely to be a stable set of differences and we believe that it would be inappropriate to be setting relative fault allocations on such a basis. Further our analysis suggests, that to the extent that the data allows, there is no evidence that either WLR+SMPF or MPF exhibit a greater overall fault rate consistently over time.

Determining the separate allocations for WLR and SMPF

A20.158 We set out earlier in this Annex the concerns we have with the underlying data provided by Openreach and we present in the appendix our estimates of the errors in the fault rates due to the factors causing uncertainty. While, it is not clear that there is an alternate approach to establishing an allocation for WLR other than to base it on the fault data provided by Openreach as analysed by Cartesian we need to be cautious about the level of detail we would wish to use in any determination.

A20.159 For example, while Openreach have argued that we should consider separate assumptions for fault rates between the frame and the lines, we do not think that estimating the differences through an analysis of the different network segments used by the different products would provide a more reliable approach than a higher level of aggregation.

A20.160 Cartesian was not able to accurately and reliably disaggregate the faults on WLR+SMPF lines into individual WLR and SMPF faults. Consequently Cartesian was not able to derive reliable and consistent fault rates for SMPF directly from the fault reports. In addition, we remain concerned that faults on lines with WLR and SMPF may not be reported correctly, i.e. determining whether a fault is properly a WLR fault or an SMPF fault at the time of reporting the fault is problematic. The later Cartesian analysis did not attempt to split WLR+SMPF and just derived estimates for MPF, WLR-only and WLR+SMPF.

A20.161 We have used the data presented in Cartesian's 2014 report to calculate the relative fault rate of WLR-only and consequently to derive the relative SMPF rate. A number of different approaches could have been taken. As we have explained above, we have equalised the rates for MPF and WLR+SMPF. We could therefore use MPF rates, WLR+SMPF rates or an average. We could also use the data for one year or average across both years. Finally, we could use overall fault rates, ILF rates or ELF rates.

A20.162 In our December 2013 LLU WLR Consultation we considered the above options and found that the ILF rate data in Cartesian's 2013 report appeared to have been stable for WLR and MPF over the two years. On that basis we calculated the ratio of WLR ILF rates to MPF rates, which equalled 0.87. On the basis that we equalised the fault rates for WLR+SMPF and MPF we set the relative rates for MPF = 1.0 and WLR+SMPF = 1.0. However, our charge control Cost Model allocates costs to WLR and SMPF separately. In line with our approach to allocating additional fault costs to the broadband component in situations such as WLR+SMPF, costs would be allocated to SMPF by subtracting the cost of WLR-

only from the WLR+SMPF cost.⁸⁶⁴ Consequently we adopted the same approach with the relative fault rates so that given the relative fault rates of 1.0 for WLR+SMPF and 0.87 for WLR-only this meant that the SMPF rate was calculated to be 0.13.

A20.163 When we repeated the approach for the latest fault rate estimates derived by Cartesian from the Extended Dataset from Openreach using our Modified Fault Criteria we found that the MPF and WLR ILF rates were no longer stable in an absolute or relative sense. We found the relative rate for WLR-only varied from 0.84 to 0.87.

A20.164 We considered the above options again concentrating on in-life fault rates rather than overall fault rates because we believe the in-life rate to be the most stable fault rate for each product in the long term, as this does not reward, and avoids, the potential distortive effects of early-life faults on downstream competition. We found that using the average of the MPF and WLR+SMPF ILF rates and taking the ratio of WLR-only ILF rate to this average produced the most stable rate, as shown in Table A20.11.

Table A20.11 Derivation of WLR-only relative fault rate

In-Life	2011/12	2012/13	2013/14 (estimated) ⁸⁶⁵	Average across time
MPF	8.5%	9.3%	9.4%	9.05%
WLR-only	7.4%	7.9%	7.9%	7.74%
WLR + SMPF	9.3%	9.7%	9.8%	9.62%
Mean MPF & WLR+SMPF	8.9%	9.5%	9.6%	9.33%
Ratio of WLR-only to the average of MPF and WLR+SMPF	0.83	0.83	0.82	0.83

Source: Ofcom and Cartesian analysis of Openreach data.

A20.165 Consequently by following the same approach as for the December 2013 LLU WLR Consultation we derived the following relative fault allocations:

- MPF = 1.0
- WLR+SMPF = 1.0
- WLR-only = 0.83
- SMPF = 0.17

⁸⁶⁴ Central to our approach in the setting of charges in this review is that where services are combined to form an integral service such as WLR+SMPF any additional costs arising from the addition of SMPF to WLR are borne by the additional service, i.e. SMPF in this example. If the addition of SMPF causes an increase in WLR faults (as well as there being actual SMPF service faults) then we would allocate these additional WLR faults and the associated cost of repair to SMPF.

⁸⁶⁵ The 52 week value is estimated by prorating from the 42 week value calculated from the Extended Dataset by Cartesian.

Conclusion on fault allocations

A20.166 We have determined that the equalisation of the MPF and WLR+SMPF fault allocations at the end of the charge control period is an appropriate position for technical and regulatory policy reasons.

A20.167 In technical terms, we started from the basis that the MPF and WLR+SMPF fault allocations should be equalised as this reflects the underlying network components and costs used to supply the two products. We also established that from a technical perspective the fault rate of WLR-only lines should be less than the fault rate of MPF and WLR+SMPF lines.

A20.168 We also concluded that equalising the fault rates for MPF and WLR+SMPF is beneficial because it avoids inappropriate incentives on Openreach in its treatment of services. Also, we would not wish charges for competing services to be distorted by short term differences in costs.

A20.169 We then carefully considered the submissions made by stakeholders on fault allocations and rates, but found no compelling arguments or evidence to support a different relationship between MPF, WLR+SMPF and WLR-only than we established at the start of our analysis.

A20.170 While we have concerns over the robustness of the dataset presented by Openreach with respect to this question, our analysis suggests that the available data is consistent with the conclusion that the overall rate of faults on MPF and WLR+SMPF rates are broadly aligned, once the data is appropriately filtered to account only for faults that drive the costs of the products relevant to this charge control. The overall annual fault rates for MPF and WLR+SMPF were very similar, with neither consistently greater over the period analysed. We determined that the differences and changes over the period analysed were due to differences and changes in both in-life and early-life faults. WLR-only is consistently lower than either MPF or WLR+SMPF as expected.

A20.171 Further as noted above, given the impact of ELF on overall average fault levels will not be significantly influenced by changes in the mix of young and older lines and there is no basis for a reliable prediction as the differences in the impact of ELF (if any) on the products, we consider that observed levels of ELF in today's data are not helpful in establishing fault cost allocations in 2016/17.

A20.172 Our judgement, therefore, is that the analysis of the fault data has not yielded sufficient evidence to justify a change from our initial assumption of equalised MPF and WLR+SMPF fault rates.

A20.173 We have therefore used the following allocations for fault costs in 2016/17 in the Cost Model:

- MPF = 1.0
- WLR+SMPF = 1.0
- WLR-only = 0.83
- SMPF = 0.17

Our Analysis: Overall trends in the level of faults during the charge control period

A20.174 Having considered the base year level of faults and the appropriate allocation of faults in 2016/17, we now consider the question of whether it would be appropriate to reflect any anticipated change in the level of faults over the charge control period in the Cost Model.

A20.175 We have adopted an approach to assessing the overall trends in the level of faults during the charge control period in a manner that is consistent with the approach we have taken to considering the appropriate allocations of the fault related costs in the Cost Model. That is, our starting point is whether there are any technical considerations which would suggest overall trends in the level of faults during the charge control period and we only depart from this approach if there was a clearly identified reason for doing so which was unequivocally supported by stable data and was material in its nature. Consequently we present in this section:

- our initial technical considerations in relation to such anticipated trends;
- our consideration of relevant stakeholder responses to the December 2013 LLU WLR consultation;
- a summary of our consideration of the analysis of anticipated trends in the fault data; and
- our decision.

Technical considerations of trends in the level of faults

A20.176 From a technical perspective we would expect the various components used in the construction of the Openreach service products to follow a standard engineering “bathtub” fault curve in that:⁸⁶⁶

- during a relatively short “early-life” period (compared to the whole life of the component) immediately following manufacture or installation, the components will exhibit elevated but declining fault rates;
- followed by a relatively long “in-life” period where the component exhibits a relatively constant low fault rate; and
- a final end-of-life period where the components exhibit elevated and increasing fault rates due to various forms of wear and tear.

A20.177 We would expect well run operational businesses to have investment programmes to replace end-of-life components such that unreasonably elevated fault rates do not occur. Competing demands for available capital may mean that components are not always replaced at the ideal time and periods of elevated fault rates could occur. However we would then expect these to be followed by periods of increased investment to bring the situation back under control resulting in a level of fluctuation in the overall fault rates.

⁸⁶⁶ Page 142, *Introduction to Reliability Engineering*, 2nd edition, E. E. Lewis, Wiley, ISBN 0471-01833-3

A20.178 We are not aware of any components or their use in the Openreach networks that would cause the components to diverge from the bathtub fault curve. We also expect components will be replaced in the long term to address faults caused by an ageing network. Consequently, from a technical perspective we do not expect in the long term an increasing or a decreasing trend in the fault rates of individual components or groups of components in the arrangements necessary to deliver the service products (MPF, WLR-only and WLR+SMPF). Therefore, we equally do not expect long term increasing or decreasing trends in service product fault rates arising from the underlying networks of components.

A20.179 However there are other mechanisms that can lead to apparent faults in the service products arising from degradations to the signals and interference that are not necessarily the result of inherent deficiencies or defects in the underlying network components. Some of these can arise from the impact of certain types of weather, the way the service products are used (broadband versus telephony) and various forms of electrical interference. We discuss the effects of weather and broadband use (including briefly on interference) later in this section on trends in fault rates.

Our consideration of stakeholder responses on fault rate trends

A20.180 We consider the stakeholders comments by reference to submissions on trends in fault volumes and fault rates, the effect of weather on fault trends and the effect of broadband on fault trends.

Trends in fault volumes and fault rates

A20.181 Openreach has argued that factors such as extreme weather events, increased usage of broadband (and increasing demands of broadband users), deteriorating copper network despite consistent investment in the past and CP behaviours are driving these increases and that this would continue. It argues therefore that we should increase our assumption on costs accordingly. We discuss these arguments separately below but we first consider Openreach's data submissions.

A20.182 Openreach data evidence with respect to fault trends has varied through the course of this review. The original report by Deloitte from September 2013 set out that the total average fault rates for MPF, WLR+SMPF and WLR/PSTN remained at broadly the same level over the period September 2011 to September 2013.

A20.183 However, the later Deloitte report argued that there was evidence of upward trends in fault rates once a longer time period was included and in particular that there were:

- lower than average fault rates in the period April 2011 to August 2011; and
- higher than average fault rates during the November 2013 to January 2014 period.

A20.184 Openreach itself, in its December 2013 LLU WLR Consultation response, produced a forecast of non-chargeable weekly fault volumes (i.e. faults that should be relevant to the charge controlled products as they are not charged for separately) which suggested a continuous rise from about 48k faults per week in 2011/12 to about 64k faults in 2016/17 (i.e. an increase of about 6.3% per annum).

A20.185 We set out in the Appendix Cartesian's analysis of the data provided by Openreach.

A20.186 What is clear from this analysis is how sensitive any conclusion is to the decision we take on (i) which is the appropriate start and end date of the data set used and (ii) which fault records are appropriate to be included in the analysis.

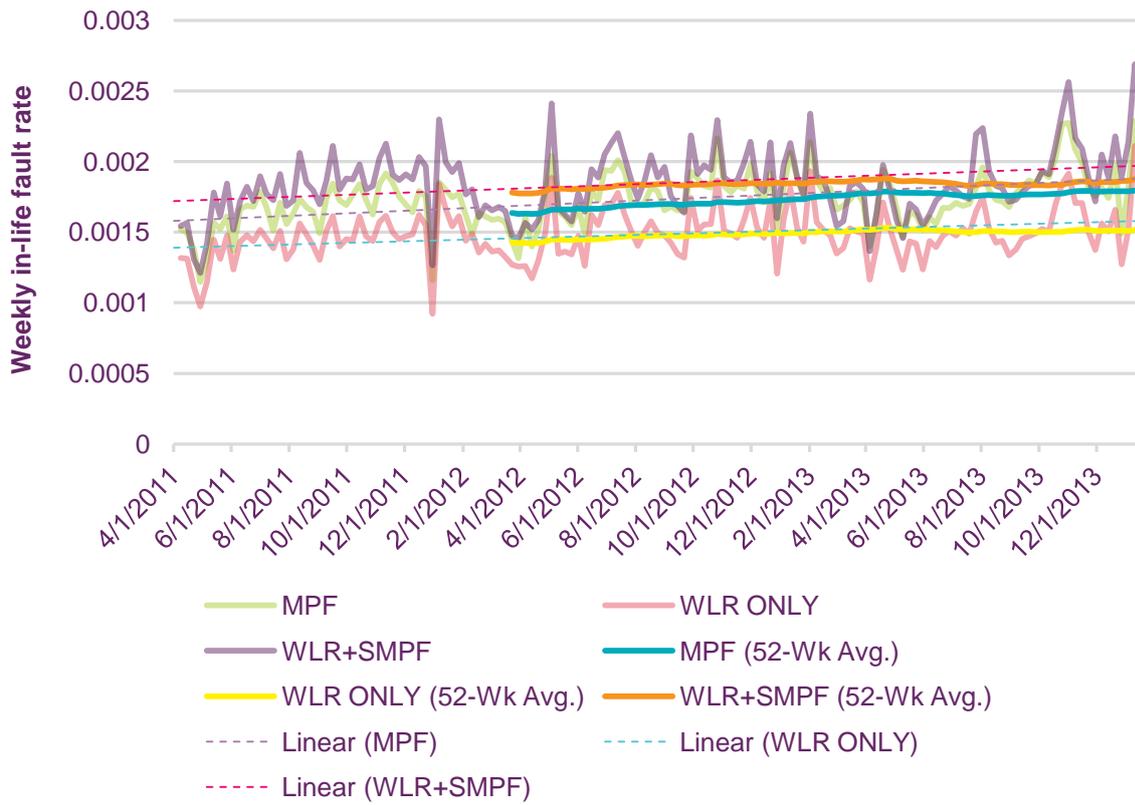
A20.187 We observe that Openreach's submission of an Extended Dataset, which includes non-seasonally balanced additional periods at the beginning and end of the original data submission, clearly impacts on our trend analysis. While the Original Dataset suggested there was no evidence of an upward trend in fault rates (confirmed by Cartesian and Deloitte), the revised set suggests a small upward trend, even when fault records we do not consider pertinent to the analysis are removed.

A20.188 However, the new evidence is not compelling. It is clear that the increasing trend observed in the latest ILF rates, and consequently the overall fault rates, is due to the inclusion of weekly fault rates with values lower than average before September 2011 and values higher than average after August 2013. The changes in trend appear to affect all products similarly so the cause or causes must be related to common underlying factors.

A20.189 One factor could be rainfall. Visually comparing the peaks and troughs, each roughly a few months long, in the weekly in-life fault rates in Figure A20.5 with the available monthly UK rainfall for April 2011 to January 2014 in Figure A20.6 suggests there may be some relationship. To the extent that the network is affected by rainfall and given that the end of 2013 was wetter than average and the early part of 2011 drier than average, then including the data at the beginning and end of the fault rate time series would distort any trend analysis, especially given that outside of the April 2011 to January 2013 period the rainfall levels continue to oscillate.⁸⁶⁷ This confirms our concern that basing decisions about the trend and how it might evolve in the long term on the limited data we have carries a high risk of error.

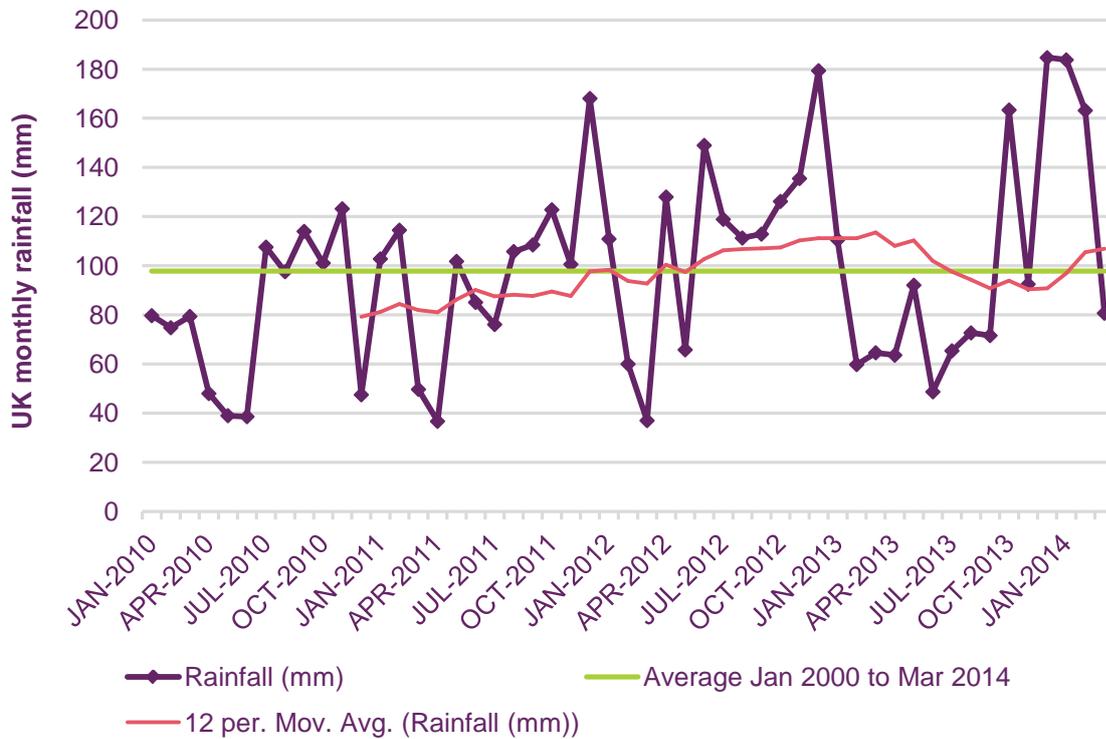
⁸⁶⁷ In the case of the values before April 2011 the values rise above the 2000 to 2014 rainfall average for a period and for the values after January 2014 they eventually drop to below average.

Figure A20.5 Weekly in-life fault rates (Extended Dataset with Modified Fault Criteria)



Source: Ofcom and Cartesian (2014) analysis of Openreach data.⁸⁶⁸

Figure A20.6 UK monthly rainfall January 2011 to June 2013



⁸⁶⁸ BT's responses dated 5 March 2014 and 7 March 2014 to the sixth QoS BT Information Request.

Source: Ofcom analysis of Met Office data

A20.190 In our view the duration of the Extended Dataset (34 months) is not sufficient to reflect the longer term periods of fluctuation in exogenous and endogenous factors known to affect fault rates, e.g. weather and investment. Consequently, a fault dataset covering a longer period could yield a very different trend estimate but this data does not exist.

A20.191 Deloitte highlighted in its report “Addendum to the September 2013 analysis” that “two years of data is typically not sufficient to conclude on a repetitive multi-year seasonal trend”.

A20.192 We also note that Cartesian⁸⁶⁹ highlighted that confidence in the long term fault rate trends estimated by the Cartesian 2013 analysis (and Deloitte⁸⁷⁰) is limited. Cartesian’s 2013 historical trend analysis did not provide sufficient evidence to conclude on the existence or absence of long term trends in fault rates.

A20.193 There was also no evidence from the data analysis to suggest that age-related faults are increasing due to possible reductions in investment.

A20.194 We did not specifically analyse the distribution over time of the Unknown, Unclassified, and n/a labelled faults so we do not know what effect these could have on the trend estimated from the Extended Dataset if their labelling could be corrected. Therefore this introduces a further degree of uncertainty in the estimated fault rate trends.

A20.195 We also observed that ELF rates appear to be changing over time and we found no evidence to suggest this would not continue. However, as we have observed earlier in our discussion on relative fault allocations, ELF rates have been demonstrably erratic over the period. As we have noted above, we consider that observed levels of ELF in today’s data is not helpful in establishing fault cost allocations in 2016/17.

A20.196 We therefore conclude that the Extended Dataset is not sufficiently representative of the wider set of faults over a longer period to be able to reliably use trend estimates derived from it. We also conclude that the Original and Extended Datasets are of insufficient length to be able to draw reliable conclusions about the long term trend behaviour of fault rates.

A20.197 Consequently, we conclude from our analysis that the Extended Dataset does not provide any additional reliable evidence which might lead to a reappraisal of our initial assumption of a flat trend in fault rates, notwithstanding the recent variability in the ELF rates.

A20.198 While we would accept that there may be some volume changes due to service mix over the course of the charge control period (which is reflected in our costing model), the evidence on an increasing propensity to fault is not clear from the data.

Impact of weather patterns on fault trends

A20.199 Notwithstanding the limited evidence from the data, we consider here the possible effect weather (particularly climate change) could have on the fault rate trends

⁸⁶⁹ Paragraph 3.19, CSMG, *Fault Rates Report*.

⁸⁷⁰ Deloitte’s analysis for Openreach covering a slightly different 2 year period produced very similar fault rates to CSMG’s estimates.

during the charge control period and whether it would be appropriate to take any such trends into account.

A20.200 We note that Figure A20.2 shows the UK has already experienced from the mid-1990s a period of turbulent weather with rainfall in particular oscillating between some of the driest and some of the wettest periods recorded since 1910. Openreach claims in its response to the December 2013 LLU WLR Consultation that extreme weather is getting worse and cites the rainfall and storms of the last two years as evidence for this. Whilst the press has noted instances of record-breaking weather, Met Office records show that only four areas of the UK and the UK overall have broken previous winter rainfall records.⁸⁷¹ Out of these areas only south-east and central southern England (6%) and east Scotland (12%) have exceeded previous rainfall records by more than 1%.⁸⁷² All but one of the previous record-breaking years had occurred since 1994.⁸⁷³ Consequently, although there have been recent instances of extreme weather, and it is reasonable to expect that there will be instances of extreme weather during the charge control period, the evidence indicates that this is not likely to be so different to previous bad weather.

A20.201 In its response to the December 2013 LLU WLR Consultation Openreach claimed that to partially stem the increase in fault rates arising from network deterioration and to combat the effects of weather, a significant increase in the level of investment is needed to replace parts of the network and associated test and diagnostic capability.⁸⁷⁴ Given that the weather observed for the period covered by the fault dataset is not significantly different from previous recent record-breaking years, this may indicate the need for continued investment rather than being a new problem due to seriously worsening weather.

A20.202 We have also reviewed the three consultants' reports on climate change and weather submitted by Openreach to try to assess the impact the weather may have on fault volumes during the forthcoming three year charge control period. In summary our view is that these reports suggest:

- Whilst there is some consensus on changes in the UK's climate in the long term, this is likely to have limited short-term effects on Openreach's network. Similarly there are ten-year and shorter-term climate patterns causing increasing variability on the UK's weather but to what extent is still unclear;
- Although statistical observations suggest that the pace of increase in average precipitation may be slow, the spatial (regional) and temporal variability of the weather is gradually increasing, resulting in more frequent, localised extreme events such as floods and wind storms;
- 2012's annual precipitation level was only exceeded or equalled in 1960 and 2000, based on data collected since 1931. 2012's precipitation level is considered to represent an infrequent, high peak given that the high precipitation levels in 1960 and 2000 were not followed by one or more years with such high levels of precipitation; and

⁸⁷¹ Met Office information in "Winter so far – 20th February rainfall update", Met Office News Blog, <https://metofficeneews.wordpress.com/>

⁸⁷² Ofcom analysis of Met Office information in "Winter so far – 20th February rainfall update", Met Office News Blog.

⁸⁷³ Ofcom analysis of Met Office information in "Winter so far – 20th February rainfall update", Met Office News Blog.

⁸⁷⁴ Paragraphs 33 and 280, Openreach Response to the December 2013 LLU WLR Consultation.

- The reports do not support, or provide clear evidence, that short or medium term climate patterns affecting the UK's weather are expected to change within the next 2-3 years.

A20.203 Taking account of this evidence for the specific purposes of the present charge control review, we therefore consider that the available evidence suggests:

- There is little evidence that weather is likely to be materially worse in the forthcoming charge control period, compared to that experienced in the previous three years;
- There is a possibility of a rise in the number of extreme events such as flooding and wind damage, all likely to be declared as MBORC. This covers a very small proportion of total fault volumes and we do not expect it to change significantly;
- Openreach has some control over changes in fault volumes associated with some adverse weather, as explained in the 2009 PFFO Statement⁸⁷⁵; and
- Our analysis for the July 2013 FAMR Consultation, our further consideration explained above and stakeholder submissions suggest that a proportion of changes in fault volumes could be due to changes in the weather but other factors are likely to have played a more significant role in the changes in fault volumes in the past.

A20.204 We acknowledge the body of evidence on climate change and the evidence of the potential impacts on telecommunications systems. In our judgement, however, it would not be appropriate to use this evidence on long term climate effects to support a three year projection of increasing fault levels. There is no clear basis for assuming that average weather conditions over the next three years will be materially different from those experienced over the last three years. We consider that it is appropriate therefore to assume that, on average, the weather over the next three years will be the same as the weather experienced in 2011/12, during which rainfall was close to the long term average.

A20.205 If, as suggested by BT, there is genuinely a systematic shift in the UK's weather that will result in higher costs, then we believe that the only reasonable basis to capture this is by the regular re-setting of the base year costs in future controls.

Impact of broadband usage on fault trends

A20.206 Addressing Openreach's arguments that broadband lines are driving an increase in faults we consider that it is possible that broadband fault rates could be greater than those of traditional voice services and it is possible that there has been a change in fault levels due to the initial use of broadband to stream broadcast content, but we believe there is no evidence that would allow us to determine a long term increasing trend in broadband fault rates.

A20.207 Fault reports arise from a complex mix of actual defects in the network, including unacceptably high levels of interference, and how users perceive and react to the effects on their use of the service. We believe the extent to which a user is likely to perceive and report an issue with their broadband service depends on:

⁸⁷⁵ Paragraph A9.122, Ofcom, *New Pricing Framework for Openreach Statement*.

- the initial line speed as determined by the broadband modems when they synchronise;
- what margin the CP operating the broadband equipment leaves when setting the speed of the broadband service to the line conditions;
- the degradation in the line characteristics and increases in interference (repetitive and intermittent) and their consequent effect on line speed and data error levels;
- how many and which types of broadband application are used concurrently and the bandwidth demands of these applications;
- whether the broadband service incorporates quality of service mechanisms to protect delivery of such applications such as video; and
- what proportion of time the line is being used.

A20.208 Unlike traditional voice services, broadband services are affected by the high frequency line characteristics and high frequency interference because of the much greater bandwidth used by broadband. Broadband access equipment adapts the speed of the service to the line characteristics and repetitive electrical interference levels, with margins set by the CPs' policies, to produce a service that is essentially free from data errors. Intermittent interference will cause data errors but will not trigger a line speed adjustment due to their intermittent nature.

A20.209 The first three points set out in above are not new and have been issues that industry has had to deal with since broadband was first introduced. Given that many of the service products within the charge control will have converted to ADSL2+ and that over 70% of the services within the charge control are already broadband enabled (meaning that crosstalk levels between users will already be high), it is not clear what further technical changes there might be that could cause an increase in apparent broadband faults in the future.

A20.210 Further, many applications are able to adapt to lower speed situations and correct data errors to an extent that is not apparent to users except in extreme cases when responses to a user's actions are very slow, e.g. when browsing. However, breaks and degradation in video picture delivery are generally unacceptable to end users. Users are also generally less tolerant of noticeable degradations and interruptions in broadband applications than they are of background noises experienced on traditional voice telephony services. Consequently there could be a step change increase in broadband fault rates due to the increased use of TV and video applications which expose line conditions that were tolerable with other broadband applications. However it depends on the technical operating margins of the user's broadband service.

A20.211 Ofcom's Infrastructure Report update published in December 2013 highlights that only 8% of broadband users operate at less than 2Mbit/s, a rate which is insufficient to support most TV and video applications, and about 20% at less than 5Mbit/s, a rate that may not be sufficient to some of the higher definition TV and video applications.⁸⁷⁶ We are also aware that some broadband service providers deliver TV and video services via quality of service mechanisms that protect the broadband capacity allocated to the video at the expense of decreasing the broadband

⁸⁷⁶ Infrastructure Report, update, Ofcom, http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/infrastructure-report/IRU_2013.pdf

capacity available to other applications. However, they usually charge a premium for this. Users may also switch to higher bandwidth services where they are available. Consequently we consider it unlikely that increased use of broadband TV and video services over the copper access network will lead to a significant increasing trend in broadband fault reports due to speed and capacity utilisation issues.

A20.212 Broadband TV and video consumption significantly increases the proportion of time copper access lines are used compared to traditional telephony services and may increase the propensity of users to report faults, primarily because of greater awareness and less tolerance of intermittent interference and defects. Whilst we do not believe increased usage can increase the propensity of a line to fail in the first place, there may be a step change rise in the number of broadband-related fault reports arising from previously unreported defects becoming unacceptable when users first use broadband TV and video services (other than low bandwidth YouTube like videos).⁸⁷⁷ However we would expect the proportion of lines experiencing such previously unreported defects to be low given the period in which broadband has been available.

A20.213 Openreach has also previously said in its Consultation response that greater broadband usage, coupled with more demanding applications and the use of multiple devices, is increasing users' expectations of Openreach products and is leading to an increase in customer problems with the services which are not technically copper line faults. This has increased the demand for special investigation products (such as Conscious Decision to Appoint (CDTA), Conscious Decision to not Appoint (CDTnA), Special Fault Investigations (SFI) and Broadband Boost (BBB)). However, Openreach clarified this has not increased the number of copper line faults.⁸⁷⁸ We therefore assume from Openreach's comments that they are able to separately charge for this additional work and it does not increase the costs of repairs included in the charge control.

A20.214 Deloitte's analysis also suggests that there is no relationship between fault rates and broadband usage levels (Figure 29 in its report) although there appeared to be some small relationship between the volume of SFI and BBB products and broadband usage level.⁸⁷⁹

A20.215 We recognise that there may be an increase in the use of SFI and BBB products but these are out-of-scope of the fault rates considered here as they are separate chargeable products and therefore not included within the charge control costs for the main rental services. It would therefore be incorrect to reflect increases in the use of these services in our analysis. Openreach has since indicated that where a special fault investigation does ultimately lead to a line fault being found, then no charge is made.

A20.216 Cartesian in the latest analysis of the Extended Dataset with the Modified Fault Criteria have included the non-chargeable CDTA, CDTNA and SFI faults. This has

⁸⁷⁷ Whether the fault rate remains increased or is transitory depends on the operating margins of the lines after the degradations have been rectified. We would expect only those lines operating near the lines speed capacity limits, i.e. low operating margins, to possibly exhibit continuing elevated fault levels. As explained in earlier the use of video and TV makes line defects more noticeable because when they defeat the error protection mechanisms the effect on the information presented to the user is more noticeable.

⁸⁷⁸ Paragraph 1.3.5 and paragraphs 33-37, Openreach *Response to the FAMR and July 2013 Consultations (Quality of Service)*.

⁸⁷⁹ Figure 29, Deloitte, *Fault Data Report*.

amounted to about 60k additional faults being included in the original time period analysed which constitutes about a 1% difference in the overall volumes of faults to be analysed. It made no significant difference to the estimated fault rates.

A20.217 Accordingly, while, we accept that there is a higher propensity for faults to be reported on broadband enabled lines (MPF and WLR+SMPF), we do not agree, however, with the argument that this propensity for faults will rise consistently over the period of the charge control. We would accept that increasing consumer demand may lead to more demand for other chargeable ‘fault’ services such as broadband boost (“BBB”). However, for the Cost Model we are only considering non-chargeable faults, i.e. faults related to SMPF and MPF and the need to ensure that the copper line is consistent with the contracted standard.

Conclusion on fault rate trends

A20.218 From a technical perspective we have identified no underlying reason why there should be an increasing or decreasing trend in fault rates during the charge control period, provided there is a continuing programme to replace life-expired network components to control the effect of elevated fault rates due to ageing and related wear and tear.

A20.219 We have considered and rejected Openreach’s argument that we need to allow for a linear increase in fault cost.

A20.220 As set out above, we do not consider that this claim is supported by the data provided on recent faults and in any event the duration of data available is not sufficient to derive clear evidence of long term trends without introducing an unacceptable risk of error into the assessment.

A20.221 We reject the argument that there is clear evidence of short term environmental changes that can be used to predict increases in fault rates. While there may be long term trends in environmental conditions short term (2-3 year impacts) cannot be derived from any analysis of these long term trends.

A20.222 Further we also do not consider that there is compelling evidence that changes in the use of broadband will cause an on-going increase in broadband fault rates of the type funded in the charge control.

A20.223 Consequently we conclude that our analysis of the Extended Dataset does not provide sufficiently reliable evidence to determine a trend in fault rates over the charge control period and it does not provide sufficient evidence to justify changing our initial assumption of a flat trend.

Summary of our conclusions on fault rates

A20.224 Over 15 months we have performed an analysis on fault volumes followed by three extensive analyses on fault rates. In the process we have analysed in excess of 20million fault records. The three fault rate analyses all raised new issues, significantly increased the volume of data to be analysed and, except in one instance, did not reduce the underlying uncertainty in the estimated fault rates. Only the third analysis helped reduce some uncertainty when it facilitated more accurate identification of WLR+SMPF faults versus WLR-only faults.

A20.225 Having undertaken this analysis, our judgement is that the level of precision we have been seeking to identify in the estimation of faults rates, in an attempt to

reliably address any small differences and/or potential trends in subcategories of faults (and which stakeholders seek us to take account of) is not supported by the available data from which the fault rates are derived. The data has limited accuracy, which we think is likely to be due to fields not being reliably completed and / or data corruption in the data processing and storage which the data is subject to. The data is only available for a limited and insufficient timespan, at least in relation to the needs of this charge control, due to BT's data retention policies. Additionally, there is some evidence of differences between the datasets provided to us, which we have not been able to fully explain. This creates further uncertainty and limits our confidence in the analyses and outcomes.⁸⁸⁰

A20.226 We believe we have considered and performed all the analyses that we reasonably could have undertaken within the charge control review period. We do not consider that a further stage of analysis of fault reports can address the fundamental limitations in the data and reduce the level of uncertainty.

A20.227 Therefore, on the basis of the available evidence and analysis presented above we have concluded that:

- For the base year of our assessment we are relying on the total costs associated with handling/repairing faults as presented in BT's 2011/12 RFS;
- We have decided to set the cost allocations related to relative faults levels for the key services in 2016/17 in the Cost Model as set out in Table A20.12; and
- It is appropriate to hold constant the propensity of services to fault throughout the period of the charge control (i.e. the number and type of faults per line for a given service in 2016/17 are assumed to be the same as those in the base year, though, the absolute number of faults will of course vary depending on the mix of services)

A20.228 Further detail on fault rate allocation and our cost modelling approach is set out in Annex 13 Detailed cost modelling assumptions

Table A20.12 Relative fault cost allocations

Product	Relative fault levels
MPF	1.0
WLR	0.83
SMPF	0.17
WLR+SMPF	1.0

A20.229 When compared to our approach adopted in the 2012 LLU WLR charge control our decision on relative fault allocations results in a higher proportion of fault costs being allocated to MPF and SMPF and a lower proportion of fault costs allocated to WLR.

⁸⁸⁰ The data set reviewed by Cartesian is not obtained directly from Openreach operational management systems but has been processed for analysis purposes by Openreach so that it allows a 'line biography' to be determined. That is the information has been processed to enable orders and faults relating to individual lines to be associated with each other so that the order/fault history of lines can be examined.

Other issues

ELF and ILF rates

A20.230 TalkTalk argued that by setting the overall fault rate (ILF + ELF) to be flat over the charge control period Ofcom is:

- repeating the approach taken in the 2012 LLU WLR charge control in which the Competition Commission considered Ofcom had erred; and
- incorrectly estimating the level of faults because the proportion of MPF provisions is falling and the ELF rate is much higher than the ILF rate.

A20.231 Frontier also argued in its response to the December 2013 LLU WLR Consultation that Ofcom's fault rate analysis contained some "methodological flaws" one of which was that there are significant differences between in-life and early life fault rates, the latter potentially caused by provisioning work, which was not reflected in the cost modelling.

A20.232 In the 2012 charge controls we set fault allocations using BT's fault rates reported at the start of the charge control period to set the final year allocation. The 2013 LLU and WLR Determinations found that we had erred in not making an adjustment over the course of the period to reflect the young lines effect, which would have had an impact on final year allocations, as well as noting the uncertainty over the ELF levels in the base data and our understanding of if, and why, they may have changed.

A20.233 In this review, for the regulatory policy reasons set out above, we have adopted an approach that takes as our starting point whether there are any technical considerations that would suggest a particular allocation of fault costs as between MPF and WLR+SMPF. We then consider whether any of the evidence supports making an adjustment to this on the basis that there are real differences observed in the data that justify a different allocation as between the products. This is a different approach than that taken in the March 2012 Statement.

A20.234 Our review has included an extensive examination of fault rates and ELF rates, the detailed results of which are set out above and in the Appendix. In our assessment of the evidence we have considered whether the previously observed trend in the mix of newly provisioned versus rental stock was significant for this charge control and have determined that overall average fault levels will not be significantly influenced by changes in the mix of young and older lines (as the volume of provisions has largely stabilised versus the working system size).

A20.235 Further, we consider that, regardless the mix of young or mature lines, the impact of ELF on WLR and MPF is erratic and there is no certainty as to what the likely relative ELF rates are likely to be by the end of the period (or even if they are likely to reflect their current relative size versus ILF). We have therefore given more weight to considerations of ILF in the determination of relative fault rates.

A20.236 While, as we have set out, we have identified in the data some differences in the rate of ILF between MPF and WLR+SMPF we have not identified any material technical reason for such a difference and, as we have also explained, our concerns in relation to Openreach's data is such that we do not consider it is

appropriate to base our fault allocations solely on today's observed fault rates. Instead we place more weight on our engineering analysis and the expected relative fault rates this produces.

A20.237 Accordingly, on the basis of our analysis, our judgement is that the appropriate course of action is to equalise the fault allocations of equivalent products at the end of the charge control period, in this case MPF and WLR+SMPF.

A20.238 We do not consider that the approach we have taken is inconsistent with the 2013 LLU and WLR Determination.

A20.239 TalkTalk also expressed its view that the ILF rate for MPF should be set lower than that for WLR+SMPF in line with the available evidence and also because:

- there are different approaches to test access: MPF uses a Test Access Matrix (TAM) whilst the WLR component of WLR +SMPF is via the line card;
- CPs' own testing facilities on MPF are likely to result in fewer false positives; and
- voice and broadband on MPF are provided by a single provider with fewer points of failure tending to lower fault rates.

A20.240 As we explained earlier we expect the fault rate contribution from the TAM to be sufficiently low so as not to have a significant effect on the difference between the product fault rates and this was corroborated by the Cartesian 2013 analysis. We also believe that in so far as the TAM may make a difference it would be much lower than the errors or uncertainties we identified above that could and probably exist in the fault rate estimates. Also, our analysis of the Openreach components that are within scope of this charge control and are involved in the delivery of the different but equivalent services does not show any significant differences between the equivalent services. We also do not believe that from a competition and regulatory viewpoint that differences in CPs' testing facilities should be allowed to distort the distribution of the fault related costs and we also do not believe it would be appropriate or practical to determine different costs for the same product for each CP (clearly if there are materially and sustained higher rate test equipment faults or false reports arising from test equipment chosen by a CP this is a matter which should be addressed directly by Openreach with that CP).

Usage factors for local exchange frames

A20.241 In its response to the December 2013 LLU WLR Consultation Openreach has said that we should amend the cost allocation to the services for the 'local exchange general frames' cost component (which relates to main distribution frame maintenance) to take account of the fact that MPF has two jumpers while WLR and SMPF each have one, and the number of jumpers will affect repair costs.

A20.242 We do not consider this is appropriate because our view on relative fault rates for MPF, WLR and SMPF is based on an end to end basis for each service which means that the rates already take into account the differences in the number of jumpers for each service. It would therefore not be appropriate to make a further adjustment to the usage factor for the local exchanges general frames cost component.

Appendix

Analysis of fault data

A20.243 In this section we set out:

- A summary of the analyses Cartesian (ex CSMG) has undertaken on our behalf on the various data sets provided by Openreach; and
- An update on the investigations being carried out by Openreach and separately by the OTA into the causes and possible remedies of early life faults.

Overview of Cartesian analyses

A20.244 In order to further examine the fault rates associated with WLR, SMPF and MPF services, we commissioned CSMG, who subsequently changed their trade name to Cartesian, to undertake detailed analysis of evidence obtained from BT using our statutory information gathering powers. Two analyses were performed:

- a) the Cartesian 2013 analysis⁸⁸¹, analysed fault and working system size data⁸⁸² covering the period April 2011 to August 2013. Cartesian's analysis focused on those faults relevant to the charge control and hence filtered out any faults deemed to be out of scope; and
- b) the Cartesian 2014 analysis⁸⁸³, (i) analysed the same datasets as the first analysis but with a revised definition of in-scope faults (referred to as Updated Fault Criteria) suggested by Openreach during February 2014 and (ii) then analysed the Extended Dataset (fault and working system size) for the period April 2011 to January 2014 with the Updated and Modified Fault Criteria.

A20.245 The Cartesian 2014 analysis did not repeat all aspects of the Cartesian 2013 analysis. Outline details are set out below and further details may be found in the reports. We have published the Cartesian's 2014 analysis in Annex 21.

A20.246 Between the two analyses CSMG changed their name to Cartesian. The first report therefore bears the name CSMG. Our December 2013 Consultation documents also refer to CSMG. In this Statement we will refer to Cartesian throughout.

A20.247 We have used various fault and working system size datasets and various fault inclusion criteria (i.e. definitions of in-scope faults) throughout this document. Table A20.7 summarises these datasets and fault inclusion criteria and the names we have used to refer to them in this document. The table also shows the equivalent definitions that Cartesian has used in its report.

A20.248 We present each analysis with their findings in turn below.

⁸⁸¹ CSMG, *WLR and LLU Fault Rates Analysis: Final report, prepared for Ofcom*, November 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex10.pdf>.

⁸⁸² Working system size data includes the number of lines per product actively delivering the service products covered by the charge control and the number of provisions per product (new or modified products). Both are measured over weekly, monthly and annual periods.

⁸⁸³ Cartesian, *Updated WLR and LLU Fault Rates Analysis: Final report, prepared for Ofcom*, April 2014, Annex 21 of this Statement.

Cartesian 2013 analysis⁸⁸⁴

A20.249 We first present an overview of the analysis and then consider in turn; data integrity, in-life faults (ILF), relative ILF rates, historical ILF rates, early-life faults (ELF), relative ELF rates, historical ELF rates and overall fault rates. We then set out a summary of Cartesian's conclusions.

A20.250 Both our analysis and Cartesian's analysis exclude faults that are not related to the charge controlled products (or are accounted for elsewhere in the charge control). Excluded from our analysis are the following:

- faults related to the WLR line card. This is because the costs of repair and maintenance of line cards is included in the line card costs, which are allocated to WLR;
- faults relating to BBB, SFI2 and Conscious Decision To not Appoint (CDTnA) because these are separately charged services;
- faults that were classified as Fault Not Found (FNF) relating to Conscious Decision To Appoint (CDTA) because these are separately charged for;
- faults related to products not in the charge control (i.e. ISDN related faults, NGA related faults); and
- faults where the clear code was not related to the Openreach network (such as faults isolated to Customer Premise Equipment (CPE) and customer wiring beyond the Network Terminating Equipment (NTE)).

A20.251 We commissioned Cartesian to perform an analysis to:

- Determine ELF and ILF rates for WLR, WLR+SMPF and MPF;
- Investigate why WLR+SMPF and MPF fault rates may be different considering at least the following causal factors:
 - line length;
 - urban versus rural locations (overhead line delivery);
 - specific segments of the network;
 - last service transition type experienced by a line, e.g. the provision of a new MPF line or the addition of SMPF to WLR-only to create a WLR+SMPF line or the change of MPF from one CP to another CP (many other transitions are possible);
 - activities relating to the rollout of NGA; and
- Forecast the fault rates to 2016/17.

A20.252 The data set reviewed by Cartesian was not extracted directly from BT operational management systems but has been processed for analysis purposes by Openreach so that it allows a 'line biography' to be determined. This means the information has

⁸⁸⁴ CSMG, *Fault Rates Report*.

been processed to enable orders and faults relating to individual lines to be associated with each other so that the order/fault history of lines can be examined. The Openreach data covers the period 1 April 2011 to 31 August 2013. It also contains information on working systems sizes⁸⁸⁵.

A20.253 We also requested and obtained a copy of the line length disclosure of 10 July 2012 made by BT to Analysys Mason in the Sky-TalkTalk appeal.⁸⁸⁶

A20.254 We have previously published Cartesian's report of this first analysis.⁸⁸⁷ A further description of the dataset is provided in Cartesian's 2013 report, along with Cartesian's analysis and findings. We summarise Cartesian's findings and the issues arising below.

Data integrity

A20.255 Cartesian did not carry out a formal assessment of the quality of the data provided by Openreach, but did make the following two observations concerning potential quality issues:

- The field codes in a small number of records were incompatible with the product, e.g. broadband faults associated with WLR only lines;⁸⁸⁸ and
- The data in the first week was incomplete and the ELF data for the first ten weeks appeared to cause the ELF rates to rise from near zero to values more consistent with the rest of the period.⁸⁸⁹ Consequently trend analysis was limited to a 105 week period from September 2011 to August 2013.

A20.256 In addition:

- Cartesian and Deloitte used similar data sets but there were small differences. The working system size datasets were consistent with differences in Compound Annual Growth Rate (CAGR) of less than 2%. However, the Cartesian fault dataset was larger at approximately 9.5m records compared to the Deloitte dataset of approximately 7.5m records. After removing out-of-scope records, the Cartesian in-scope dataset contained 4.68m records compared to the Deloitte

⁸⁸⁵ This dataset was selected after attempts to use direct extracts from Openreach's management information systems demonstrated that, absent a clear line biography, there was a significant risk of fault mis-categorisation between ELF's and ILF's for each service and also between WLR only, WLR+SMPF and the WLR and SMPF component services in WLR+SMPF. The information in the existing datasets was also insufficient to perform some of the analysis we had requested, e.g. impact of last service transition on fault rates.

⁸⁸⁶ Fourth QoS information request of 20 September 2013 addressed to and received from British Telecommunications plc.

⁸⁸⁷ CSMG, WLR and LLU Fault Rates Analysis: Final report, prepared for Ofcom, November 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex10.pdf>.

⁸⁸⁸ Cartesian used the term 'incompatible field codes' to describe the unreliable or inconsistent data fields that they found in the data. For example, the 'Fault Product' field contained data suggesting broadband faults on a WLR-only line, or GEA faults on non-GEA products. This was likely the result of incorrect data entry by technical staff when updating and or closing trouble tickets.

⁸⁸⁹ The weekly ELF rates calculated from this data started at almost zero for the first week of April 2011 and increased over the next ten weeks such that by the tenth week the ELF rate was at a level more consistent with the level seen for the rest of the period. This apparent growth in ELF rate was not expected and could not be explained and was clearly a consequence of corrupt data due to incomplete data collection or retention.

dataset of approximately 4.55m records. Cartesian was not able to reconcile the differences;

- Cartesian found that it was not possible to accurately and reliably disaggregate the faults on WLR+SMPF lines into individual WLR and SMPF faults. Two different approaches were tried but the results were found to be inconsistent with other results. Consequently, whilst Cartesian was able to provide fault rate estimates for MPF, WLR-only and WLR+SMPF based on the product category labelling of the fault reports and the line biography information provided, it was not able to provide reliable fault rate estimates for SMPF directly from the fault report labelling and line biography information; and
- The data covered the period April 2011 to August 2013. Cartesian observed that confidence in long-run trend analysis was limited by the relatively short period covered by this data.

In-Life Faults (ILFs)

A20.257 Cartesian investigated the differences in relative ILF rates, and historical ILF rates.

A20.258 It considered annual ILF rates and the weekly ILF rate (based on a four week moving average). The annual ILF rates estimated by Cartesian for the datasets provided are presented below in Table A20.13.

Table A20.13: In-life overall fault (ILF) rates as proportion of working lines⁸⁹⁰

Line Type	2011/12	2012/13
MPF	8.5%	9.1%
WLR-only	7.4%	7.9%
WLR + SMPF	9.1%	9.6%

Source: CSMG, Fault Rates Report.

Relative ILF rates

A20.259 Cartesian's estimates indicate that the WLR+SMPF ILF rate is slightly higher than the MPF ILF rate for both years. The WLR+SMPF ILF rate is also slightly higher than the MPF ILF rate when the 4-week moving average ILF rates are considered, except for a short period around March-April 2013. Variations in the ILF rate over the time period for each product are greater than the difference between the WLR+SMPF and MPF ILF rates. WLR ILF rates are always consistently lower than those of WLR+SMPF and MPF.

A20.260 To attempt to understand why WLR+SMPF ILF rates are higher than MPF ILF rates, Cartesian tested whether:

- line length was a factor in the different fault rates;
- there is a relationship between population density and fault rates; and
- faults in certain network segments were responsible for any differences.

⁸⁹⁰ For the product of interest, the ILF rate is the number of faults per year divided by the average number of working lines. For example, in the year 2011/12, the number of MPF ILFs per year will be 8.5% of the average number of working MPF lines during the year.

A20.261 Cartesian found that MPF lines are on average shorter than WLR+SMPF lines by about 1.7%. However, it found that the correlation between line length and ILF rate is low (R^2 of 0.0185).

A20.262 Cartesian suggested that if there was a correlation between population density and fault rates, this could provide a possible reason for lower MPF ILF rates because exchanges where MPF has been deployed are more likely to be in more densely populated areas than exchanges with WLR+SMPF. Whilst Cartesian found some clustering of high ILF rates in rural locations, it found only a weak inverse relationship (R^2 of 0.0014) between fault rate and densely populated areas.

A20.263 Finally, Cartesian investigated whether a particular network segment may be responsible for the differences in ILF rates. However no particular network segment was found to be the cause of the differences and changes in ILF rates.

Historical ILF rates

A20.264 Cartesian’s annual ILF rate estimates were higher for 2012/13 than those for 2011/12 (see Table A20.13 above). However, its weekly ILF rates appeared to show a relatively flat trend.⁸⁹¹ Therefore, Cartesian investigated the trends in ILFs by comparing two years of data⁸⁹² and found that:

- there was no clear trend of higher ILFs in Year 2 relative to Year 1; and
- for some intervals, the Year 1 ILF rates were higher whilst for others Year 2 ILF rates were higher, for all three products.⁸⁹³

Early life faults (ELFs)

A20.265 Table A20.14 and Table A20.15 show two annual ELF rates calculated by Cartesian, one relative to the number of new provisions for each period of interest and a second relative to the average weekly working system size of early life lines.⁸⁹⁴

Table A20.14: Early life fault (ELF) rates as proportion of number of provisions⁸⁹⁵

Line Type	2011/12	2012/13
MPF	4.2%	4.8%
WLR-only	3.1%	2.7%
WLR + SMPF	2.4%	2.8%

Source: CSMG, Fault Rates Report.

⁸⁹¹ Figure 11, Cartesian, *Fault Rates Report 2013*.

⁸⁹² Paragraph 6.7, *Ibid*.

⁸⁹³ Paragraph 6.10, *Ibid*.

⁸⁹⁴ Here early life is defined as a 28 day period following activation of a service product or changes to the physical provision of that product.

⁸⁹⁵ For the product of interest, this ELF rate is the number of ELFs in a period of time divided by the number of lines provisioned in the same period of time. For example, in the year 2011/12, the number of MPF ELFs in a month is equal to 4.2% of the number of MPF lines provisioned during the month.

Table A20.15: Annual ELF rates as proportion of early life working system size⁸⁹⁶

Line Type	2011/12	2012/13
MPF	56%	63%
WLR-only	42%	35%
WLR + SMPF	32%	37%

Source: CSMG, Fault Rates Report.

Relative ELF rates

A20.266 Tables A20.14 and A20.15 indicate the ELF rates for MPF are significantly higher than for WLR+SMPF and WLR.

A20.267 Cartesian investigated whether a particular network segment may be responsible for the differences and apparent changes in ELF rates over the period analysed. However no particular network segment was found to drive the differences and changes in ELF rates.

Historical ELF rates

A20.268 Cartesian's trend analysis indicates that:

- the MPF ELF rate is consistently higher than the WLR+SMPF ELF rate; but
- the WLR+SMPF ELF rate is not always greater than the WLR ELF rate.

A20.269 However, its historical trend and 12 month interval analysis did not provide sufficient evidence to conclude the existence or absence of a long term trend in ELF rates.

A20.270 Cartesian also investigated whether the last change in service product⁸⁹⁷ (i.e. whether the line was migrated from one CP to another, or upgraded to broadband by the CP providing voice, etc.) could be responsible for the differences and changes in ELF rates. If so, this could indicate what the future trend may be dependent on the relative volume of each change in service product. Cartesian said its analysis demonstrated that transition type is not a significant driver of ELFs.

Overall fault rates

A20.271 Table A20.16 presents the overall annual fault rates estimated by Cartesian.

Table A20.16 Overall annual fault rates expressed as faults per annum as proportion of working lines

Line Type	2011/12	2012/13
MPF	10.3%	11.1%

⁸⁹⁶ For the product of interest, this ELF rate is the number of ELFs per year divided by the average number of lines per week classified as being in early life. For example, in the year 2011/12 the number of MPF ELFs per year will be 56% of the average number of new MPF lines each week that are within the early life period for that year.

⁸⁹⁷ This relates to the process used when the new product was provided (e.g. single migration, new provide, activate broadband, etc.)

WLR-only	8.1%	8.4%
WLR + SMPF	10.5%	10.8%

Source: CSMG, Fault Rates Report.

A20.272 Cartesian found overall fault rates for MPF and WLR+SMPF were very similar with WLR+SMPF slightly higher for 2011/12 and MPF slightly higher for 2012/13. 4-week moving average overall fault rates were found to vary much more over time than the difference between MPF and WLR+SMPF fault rates, with neither being consistently higher over the two year period. Cartesian also examined weekly fault rates which indicated that the overall fault rates are broadly flat.⁸⁹⁸

A20.273 In addition to the analysis examining differences in ILFs and ELFs (as discussed above), Cartesian considered whether NGA activities may lead to differences in fault rates. TalkTalk suggested NGA activities may lead to increases in WLR/LLU faults (but that these costs should be recovered from NGA activities). Cartesian tested the hypothesis that NGA activity may be a driver of faults but found no meaningful correlation between overall fault rates and NGA activity.

Summary of the Cartesian 2013 report

A20.274 The key findings presented in the Cartesian 2013 report are:

- i) The WLR+SMPF overall fault rate (ILF + ELF) is very similar to the MPF overall fault rate (WLR+SMPF is slightly higher in the first year whilst MPF is slightly higher in the second);
- ii) WLR+SMPF has a slightly higher ILF rate than MPF over most the period analysed (April 2011 to August 2013) though the difference is lower than the variation in the fault rate over the period;
- iii) ILF rates are flat for all products throughout the period analysed;
- iv) MPF has a significantly higher ELF rate than WLR+SMPF over the period analysed;
- v) MPF and WLR+SMPF ELF rates exhibit an increasing trend through the period whilst the WLR ELF rate shows a slight fall; and
- vi) Whilst the annual figures calculated by Cartesian may suggest increasing fault rates, this is not the case with its analysis of weekly fault rates or its trend analysis. It is not clear from the evidence available that there is an underlying upward trend in fault rates in 2011/12 and 2012/13.

Cartesian 2014 analysis

A20.275 The second analysis covered the following:

- i) a comparison of the fault volumes and rates estimated from the Original Dataset using the Updated and the Original Fault Criteria;

⁸⁹⁸ Figure 9, Cartesian, *Fault Rates Report*.

- ii) a comparison of fault rates, estimated from the Original Dataset and Original Fault Criteria, derived from two alternative treatment of Unknown, Unclassified or N/A product classifications: i.e. between:
 - o excluding the products classified as “Unknown”, “Unclassified”, and “N/A” as in previous analyses (Cartesian 2013); and
 - o including the products classified as “Unknown”, “Unclassified”, and “N/A” by allocating them in two different ways to the charge control products;
- iii) an estimate of the fault volumes and rates for the complete Extended Dataset with the Updated Fault Criteria including comparison with similar estimates derived from the Original Dataset adjusted to also include the Updated Fault Criteria; and
- iv) an estimate of the fault volumes and rates for the complete Extended Dataset with Modified Fault Criteria consisting of the Updated Fault Criteria but excluding clear codes that do not drive engineering activity costs (and hence have a significantly lower impact on the charge controlled products).

A20.276 The Cartesian 2014 analysis also included an analysis of the impact of Matters Beyond Reasonable Control (MBORC) and on Openreach’s ability to repair faults to its contractual SLA obligations. This analysis and associated results are covered in Section 11, Volume 1.

A20.277 We requested the analysis based on the Updated Fault Criteria in response to Openreach’s criticism of Cartesian’s 2013 analysis where it argued that Cartesian had not included all the fault types that Deloitte had included in its “Addendum to the September 2013 analysis” for Openreach. Following a challenge from Ofcom as to whether all the faults included by Deloitte were relevant to the charge control products and whether in particular the repair costs associated with the faults included by Deloitte in its analysis were included in the RFS cost elements relevant to the charge control products, BT presented on 25 February 2014 its updated view of which fault types should be included in the fault rate analysis for the charge control. BT’s criteria for including a particular fault type in the analysis were:

- i) the fault must be relevant to the charge control products; and
- ii) the repair costs associated with fault must be non-chargeable to an Openreach customer; and
- iii) the repair costs associated with the fault must be included within one or more of the RFS cost elements for the charge control products.

A20.278 The faults Openreach considered should be included in addition to those included in Cartesian’s first analysis were:

- i) faults labelled CDTA, CDTNA, and SFI2 and filtered in the same way as all other fault types by the clear code inclusion criteria;
- ii) faults with high level clear code 152 relating to administrative work covering Right When Tested (RWT) situations where no visit to customer’s premise was incurred; and

- iii) faults with high level clear code 172 relating to administrative work on duplicate reports and site visits where the damage reported is not to Openreach property.

A20.279 We observed that faults with high level clear codes 152 and 172⁸⁹⁹ would probably incur lower repair costs than the engineering based repair costs incurred by other faults and that their inclusion could distort the fault rates and the distribution of the fault related base cost across the products in the Cost Model. Consequently we requested Cartesian to investigate the effect on the fault rates of including and excluding faults with high level clear codes 152 and 172.⁹⁰⁰

A20.280 The Extended Dataset (fault and working system size) covering the extended period April 2011 to January 2014 were newly prepared by BT and included the complete period not just the additional period from September 2013 to January 2014.

A20.281 Cartesian carried out checks to determine if there were material differences between the Original and Extended Datasets for the period of time for which they overlap. This included applying the Updated Fault Criteria to the Original Dataset and the overlapping portion of the Extended Dataset.

Effect of the Updated versus Original Fault Criteria on annual fault rates estimated for the Original Dataset

A20.282 This part of the analysis considered the effect of the Updated Fault Criteria on the fault rates.

A20.283 Approximately 0.5m fewer faults were excluded by the Updated Fault Criteria, increasing the number of faults to be analysed by 9.7% to just over 6m faults.

A20.284 The effect of the Updated Fault Criteria on the fault rates estimated from the Original Dataset is shown in Tables A20.17 to A20.19 for the ELF, ILF and overall fault rates respectively. Early, in-life and overall fault rates for MPF were uplifted by about 4% whilst the fault rates for WLR-only and WLR+SMPF was uplifted by approximately 10% to 16% depending on which product and which year is considered. This has created a noticeable difference of 0.6% to 0.8% (in absolute fault rate measure) across the period April 2011 to August 2013 between the overall fault rate for WLR+SMPF and MPF.

A20.285 Most of the uplift in the fault rates is due to the inclusion of clear codes 152 and 172⁹⁰¹ which contributed about 11% of the faults to be analysed after filtering compared to the inclusion of CDTA, CDTNA and SFI2 faults which contributed about 1% of the faults to be analysed after filtering.

⁸⁹⁹ Clear codes starting 152 relate to faults that are Right When Tested (RWT) and clear codes starting 172 relate to fault reports that are duplicate reports or reports of non-service affecting external damage to non-Openreach assets.

⁹⁰⁰ We recognize that clear code 172 includes site visit activities relating to the clearance of non-service affecting fault reports related to damage to non-Openreach assets. However we do not consider this will incur the same level of cost as fault repairs involving engineering repair activity.

⁹⁰¹ Clear codes starting 152 relate to faults that are Right When Tested (RWT) and clear codes starting 172 relate to fault reports that are duplicate reports or reports of non-service affecting external damage to non-Openreach assets.

Table A20.17 Early-life annual fault rates for the Original Dataset using Updated Fault Criteria

Line type	Early-life annual rates			Percent increase compared to Original Fault Criteria		
	2011	2012	1H2013	2011	2012	1H2013
MPF	4.4%	5.0%	5.5%	3.6%	4.2%	4.6%
WLR-only	3.5%	3.0%	3.2%	10.1%	11.4%	10.5%
WLR+SMPF	2.7%	3.2%	4.1%	11.9%	13.1%	11.9%

Source: Cartesian, *Updated Fault Rates Report*.

Table A20.18 In-life annual fault rates for the Original Dataset using Updated Fault Criteria

Line type	In-life annual rates			Percent increase compared to Original Fault Criteria		
	2011	2012	1H2013	2011	2012	1H2013
MPF	8.8%	9.5%	3.8%	4.0%	3.9%	4.1%
WLR-only	8.1%	8.9%	3.7%	10.6%	13.5%	16.1%
WLR+SMPF	10.0%	10.8%	4.3%	9.8%	12.1%	14.3%

Source: Cartesian, *Updated Fault Rates Report*.

Table A20.19 Overall annual fault rates from Original Dataset using Updated Fault Criteria

Line type	Overall annual fault rates			Percent increase compared to Original Fault Criteria		
	2011	2012	1H2013	2011	2012	1H2013
MPF	10.7%	11.5%	4.6%	3.9%	3.9%	4.2%
WLR-only	9.0%	9.6%	4.0%	10.5%	13.3%	15.5%
WLR+SMPF	11.5%	12.1%	4.9%	10.1%	12.2%	13.9%

Source: Cartesian, *Updated Fault Rates Report*.

Impact of the “Unknown”, “Unclassified”, and “N/A” product classifications of the estimated annual fault rates for the Original Dataset and Updated Fault Criteria

A20.286 This part of the analysis estimated the change in fault rates from including faults with products classified as “Unknown”, “Unclassified”, and “N/A” (referred to as unknown product faults hereafter). These faults had previously been excluded.

A20.287 Cartesian analysed the effect of including the unknown product faults in two different ways:⁹⁰²

- a) it first added the unknown product faults to all products before applying the Updated Fault Criteria filtering to the dataset (low-impact case); and
- b) in its second iteration Cartesian added the unknown product faults only to MPF, WLR-only and WLR+SMPF after applying the Updated Fault Criteria filtering (high-impact case).

A20.288 When adding the unknown product faults, Cartesian distributed them across the products in proportion to the fault volumes for each product. Distributing the faults before applying the inclusion criteria allocated a small proportion to the WLR+NGA and MPF+NGA products which were then excluded.

A20.289 Adding the “Unknown”, “Unclassified”, and “N/A” faults increased the early life faults rates by approximately 2% to 3% and the in-life fault rates by approximately 6% to 9% for each of the time periods considered. Tables A20.20 and A20.21 show in more detail the increases in the overall fault rates which increased proportionately between 5.5% and 8.3%.

Table A20.20 Overall annual fault rates for the Original Dataset using Updated Fault Criteria and including “Unknown”, “Unclassified”, and “N/A” faults (low-impact case)

Period	Overall annual fault rates			Percent increase from adding “Unknown”, “Unclassified”, and “N/A” faults		
	2011	2012	1H2013	2011	2012	1H2013
MPF	11.3%	12.2%	5.0%	5.8%	5.5%	6.7%
WLR-only	9.5%	10.1%	4.3%	6.1%	5.7%	7.0%
WLR+SMPF	12.3%	12.9%	5.3%	6.4%	6.0%	7.4%

Source: Cartesian, *Updated Fault Rates Report*.

Table A20.21 Overall annual fault rates for the Original Dataset using Updated Fault Criteria and including “Unknown”, “Unclassified”, and “N/A” faults (high-impact case)

Period	Overall annual fault rates			Percent increase from adding “Unknown”, “Unclassified”, and “N/A” faults		
	2011	2012	1H2013	2011	2012	1H2013

⁹⁰² The Updated Criteria exclude faults with product labels that do not match the charge control relevant products MPF, WLR-only and WLR+SMPF (as well as filtering out excluded clear codes etc.). The fault dataset contains faults for products other than the relevant charge control products. The unknown product faults are allocated to each product type in proportion to the number of faults for that product. Allocating the unknown product faults before applying the fault inclusion filtering distributes the unknown product faults across a larger number of products than if allocated after the application of the fault inclusion filter, where they can only be distributed across the three remaining products. Consequently there will be fewer unknown product faults allocated to the three charge control products when allocated before the application of the inclusion filter compared to being allocated after the application of the inclusion filter. For further details please refer to the Cartesian 2014 Report.

MPF	11.4%	12.2%	5.0%		6.2%	5.9%	7.6%
WLR-only	9.6%	10.2%	4.3%		6.7%	6.4%	8.3%
WLR+SMPF	12.3%	12.9%	5.3%		6.4%	6.2%	8.0%

Source: Cartesian, *Updated Fault Rates Report*.

Fault rate estimates for the Extended Dataset and Updated Fault Criteria

A20.290 This part of the analysis considered the effect of both the Extended Datasets (faults and working systems size) and the Updated Fault Criteria on the fault rates.

A20.291 We were informed by BT that the Extended Datasets had been created afresh from its master databases and were not the Original Dataset complemented by additional data covering a longer time period. Consequently, the contents of the Extended Dataset were compared with the relevant contents of the Original Dataset for the period covered by the Original Datasets. For the period of overlap between the two datasets of 2011/12 to the first half of 2013/14 the overall, in-life and early-life fault volumes for the two datasets differed by 0.0% to 1.9% whilst the working system sizes for the two dataset for the same period of overlap differed by -0.1% to 1.0%.⁹⁰³

A20.292 Cartesian compared the weekly fault rates derived from the Extended and Original Datasets with the Updated Fault Criteria through plots of 4 week rolling averages and ratios of the fault rates for each week. The 4 week rolling averages showed that for each of the fault rate types the derived estimates were generally indistinguishable with the comparison of the weekly faults rates showing the fault rates are within +/- 2% of each other. However the comparison of weekly fault rates showed an increasing difference in fault rates between the Extended and Original Datasets after April 2013, increasing to 5% or more during August 2013.⁹⁰⁴

A20.293 The fault rates estimated from the Extended Datasets with the Updated Fault Criteria are shown in Table A20.22 to Table A20.24. Also shown in the tables are the increases in fault rates for the Extended Dataset with the Updated Fault Criteria compared to the fault rates estimated from the Original Dataset with the Original Fault Criteria for the two complete years for which they overlap. Cartesian estimated the overall annual fault rates for the whole of the 2013/14 year by pro-rating the annual fault rates derived from the data for the April to January part of 2013/14.

A20.294 The fault rates for MPF increased by 3.5% to 5.8% compared to the original fault rates whereas WLR-only increased by 10.8% to 15.6% and WLR+SMPF increased by 10.5% to 16.3%.

A20.295 The fault rates derived from the Extended Dataset with the Updated Fault Criteria mostly show an increasing trend from year to year as shown in Table A20.25.

⁹⁰³ Cartesian, *Updated Fault Rates Report*

⁹⁰⁴ For further details please refer to graphs 22 to 24 in the Cartesian 2014 report (Cartesian, *Updated Fault Rates Report*).

Table A20.22 Early-life annual fault rates for the Extended Dataset and Updated Fault Criteria

	Early-life annual fault rates (Extended Dataset and Updated Fault Criteria)			Percentage increase compared to original fault rates (Original Dataset and Original Fault Criteria)	
Period	2011/12	2012/13	2013/14 (52 wk. est.) ⁹⁰⁵	2011/12	2012/13
MPF	4.4%	5.0%	5.5%	4.8	4.2
WLR-only	3.5%	3.0%	3.5%	12.9	11.1
WLR + SMPF	2.7%	3.2%	4.1%	12.5	14.3

Source: Cartesian, *Updated Fault Rates Report*.

Table A20.23 In-life annual fault rates for the Extended Dataset and with Updated Fault Criteria

	In-life annual fault rates (Extended Dataset and Updated Fault Criteria)			Percentage increase compared to original fault rates (Original Dataset and Original Fault Criteria)	
Period	2011/12	2012/13	2013/14 (52 wk. est.) ⁹⁰⁶	2011/12	2012/13
MPF	8.8%	9.5%	9.7%	3.5	4.4
WLR-only	8.2%	8.9%	9.3%	10.8	12.7
WLR + SMPF	10.1%	10.8%	11.3%	11.0	12.5

Source: Cartesian, *Updated Fault Rates Report*.

Table A20.24 Overall annual fault rates for the Extended Dataset and Updated Fault Criteria

	Overall annual fault rates (Extended Dataset and Updated Fault Criteria)			Percentage increase compared to original fault rates (Original Dataset and Original Fault Criteria)	
Period	2011/12	2012/13	2013/14 (52 wk. est.) ⁹⁰⁷	2011/12	2012/13
MPF	10.7%	11.5%	11.8%	3.9	3.6
WLR-only	9.0%	9.6%	10.0%	11.1	14.3
WLR + SMPF	11.6%	12.2%	12.7%	10.5	13.0

Source: Cartesian, *Updated Fault Rates Report*.

⁹⁰⁵ 52 week estimate was obtained by prorating actual fault rate for 42 weeks. In the case of this ELF rate it does not change.

⁹⁰⁶ 52 week estimate was obtained by prorating actual fault rate for 42 weeks.

⁹⁰⁷ 52 week estimate was obtained by prorating actual fault rate for 42 weeks.

Table A20.25 Year on year increase in annual fault rates

Period	ELF rates		ILF rates		Overall fault rates	
	2011/12 to 2012/13	2012/13 to 2013/14	2011/12 to 2012/13	2012/13 to 2013/14	2011/12 to 2012/13	2012/13 to 2013/14
MPF	15.3%	8.8%	7.8%	2.4%	7.8%	2.6%
WLR-only	-12.5%	14.9%	9.6%	3.5%	6.3%	4.0%
WLR+SMPF	18.6%	28.5%	7.8%	4.3%	5.6%	4.1%

Source: Cartesian, *Updated Fault Rates Report*.

Fault rate estimates for the Extended Dataset with Modified Fault Criteria

A20.296 One of the aims of this fault analysis is to determine the impact of any fault trends on Openreach's cost base. Accordingly, we have considered the extent to which the additional clear codes submitted by Openreach for inclusion subsequent to our consultation are relevant to our analysis of cost drivers.

A20.297 As we have noted above clear codes 152 and 172 mostly cover administrative activity in the service centres (i.e. not engineering activity) related to fault reports which are:

- Right When Tested situations where no visit to the customers' premise was required; and
- duplicate reports and site visits where the damage reported is not to Openreach property.⁹⁰⁸

A20.298 Accordingly, we consider that the inclusion of these codes distorts the analysis of fault rates and trends directly related to the distribution of engineering activity based fault repair costs. We, therefore, requested Cartesian undertake analysis of the Extended Dataset with the Updated Fault Criteria but excluding clear codes that Ofcom consider do not drive engineering activity costs, specifically clear codes 152 and 172.⁹⁰⁹ We describe this set of inclusion criteria as the Modified Fault Criteria which are equivalent to the Original Fault Criteria used in the Cartesian 2013 analysis with the addition of the non-chargeable CDTA, CDTNA and SF12 faults.

A20.299 Table A20.26 presents the annual overall fault rates derived from an analysis of the Extended Dataset with the Modified Fault Criteria. This shows that the MPF and WLR+SMPF fault rates are again very similar with WLR-only consistently lower, very similar to the Cartesian 2013 analysis results. The results also show that all rates increase over time but by different amounts. However, in all cases most of the increase is from 2011/12 to 2012/13.

⁹⁰⁸ We recognize that clear code 172 includes site visit activities relating to the clearance of non-service affecting fault reports related to damage to non-Openreach assets. However we do not consider this will incur the same level of cost as fault repairs involving engineering repair activity.

⁹⁰⁹ Clear codes starting 152 relate to faults that are Right When Tested (RWT) and clear codes starting 172 relate to fault reports that are duplicate reports or reports of non-service affecting external damage to non-Openreach assets.

Table A20.26 Overall annual fault rates for the Extended Dataset with Modified Fault Criteria

	<u>2011/12</u>	<u>2012/13</u>	<u>2013/14</u> <u>(52 wk. est.)⁹¹⁰</u>
MPF	10.4%	11.2%	11.4%
WLR-only	8.2%	8.5%	8.6%
WLR + SMPF	10.6%	11.0%	11.1%

Source: Cartesian, *Updated Fault Rates Report*.

A20.300 Table A20.27 presents the annual in-life fault rates derived from an analysis of the Extended Dataset with the Modified Fault Criteria. The results show all rates increase over time but by different amounts. However, in all cases most of the increase is from 2011/12 to 2012/13.

Table A20.27 In-life annual fault rates for the Extended Dataset with Modified Fault Criteria

	<u>2011/12</u>	<u>2012/13</u>	<u>2013/14</u> <u>(52 wk. est.)⁹¹¹</u>
MPF	8.5%	9.3%	9.4%
WLR-only	7.4%	7.9%	7.9%
WLR + SMPF	9.3%	9.7%	9.8%

Source: Cartesian, *Updated Fault Rates Report*.

A20.301 Table A20.28 presents the annual early-life fault rates derived from an analysis of the Extended Dataset with the Modified Fault Criteria. The results show the early-life fault rates for MPF and WLR+SMPF increasing whereas the WLR-only early life fault rate initially decreases and then increases from around May 2013. However, unlike the overall and in-life fault rates, the early-life fault rates are spread more evenly across the years.

⁹¹⁰ 52 week estimate was obtained by prorating actual fault rate for 42 weeks.

⁹¹¹ 52 week estimate was obtained by prorating actual fault rate for 42 weeks.

Table A20.28 Early-life fault rates by provision for the Extended Dataset with Modified Fault Criteria

	<u>2011/12</u>	<u>2012/13</u>	<u>2013/14</u> <u>(52 wk. est.)</u> ⁹¹²
MPF	4.2%	4.9%	5.3%
WLR-only	3.2%	2.7%	3.1%
WLR + SMPF	2.5%	2.9%	3.7%

Source: Cartesian, *Updated Fault Rates Report*.

Summary and conclusions of Cartesian 2014 analysis

A20.302 As we set out above, the Extended Datasets (fault and working systems size) were recreated by Openreach and were not simply the original data supplemented with new data covering the additional period. However, the contents of the new Extended Dataset for the period overlapping the Original Dataset did not differ by more than 2% by volume compared to the contents of the Original Dataset. The effect of these differences on weekly fault rates was also small. Comparing the fault rates derived from the new Extended Dataset with those derived from the Original Dataset, for the period for which the two datasets overlapped (April 2013 to August 2013), the differences in fault rate were found to be generally less than 2% over the period April 2011 to June 2013. However, we observed larger more erratic differences for the remainder of the overlapping period covering July 2011 to August 2013. Overall, the differences were most apparent in the data covering the 2013/2014 financial year.

A20.303 It is clear that the Updated Fault Criteria applied to the Original and Extended Datasets led to an increase in estimated fault rates for the Extended Dataset though by different amounts for the different products, creating a clear difference between WLR+SMPF and MPF fault rates (in-life and overall). However, it was also clear that the main cause of the difference in the fault levels between WLR+SMPF and MPF was due to the inclusion of the 152 and 172 clear codes.⁹¹³

A20.304 Early-life faults rates for the Extended Dataset and Updated Fault Criteria were erratic with large fluctuations but (i) MPF was found to be higher than WLR-only and WLR+SMPF and (ii) WLR-only and WLR+SMPF were found to be similar in fault rate but crossed over a few times during the period April 2011 to January 2014.

A20.305 All estimated annual fault rates for the Extended Dataset exhibit an increasing trend over time except for WLR-only which decreased between 2011/12 and 2012/13 and then increased by a slightly larger amount between 2012/13 and 2013/14.

A20.306 The Extended Dataset adds a further 20 weeks of data for analysis. Based on the 42 weeks of data now available for 2013/14, it appears likely that the fault rates for this year will be higher than those for 2012/13.

⁹¹² 52 week estimate was obtained by prorating actual fault rate for 42 weeks.

⁹¹³ Clear codes starting 152 relate to faults that are Right When Tested (RWT) and clear codes starting 172 relate to fault reports that are duplicate reports or reports of non-service affecting external damage to non-Openreach assets.

A20.307 Cartesian argued that should the fault rates in 2013/14 be higher than those of 2012/13, then the annual fault rates will have increased each year from 2011/12 to 2013/14. However, given the relatively short-run nature of the data available for analysis, it is not possible to say with any confidence that this trend will continue into 2014/15 and beyond.

A20.308 We also note that Openreach argued in its response to our December 2013 LLU WLR Consultation that Ofcom has underestimated the total level of faults by at least 25% and that the fault levels in 2012/13 were 5% higher than 2011/12.

A20.309 It is clear from Cartesian’s analysis that this is not the case. Table A20.29 shows the volumes of faults for the calendar years 2011/12 and 2012/13 and a prorated volume for 2013/14 derived from the Cartesian 2014 analysis, described below, and based on the latest and Extended Dataset of faults that we received from Openreach in February 2014. These faults only included those relevant to the charge control. The data does not show 5% and 25% increases as claimed by Openreach.

Table A20.29 Total fault volumes derived from Cartesian analysis of the Extended Dataset with the Modified Fault Criteria

Year (calendar)	Total faults (millions)	Percent annual increase
2011/12	2.31	
2012/13	2.38	3.0%
2013/14 ⁹¹⁴	2.35	-1.3%

Source: Ofcom and Cartesian analysis of Openreach data

Investigations of early life failures

A20.310 This section presents an overview of two sets of investigations being undertaken to determine the causes of early life faults and identify actions to reduce the level of early life faults. The first we present is an investigation undertaken by Openreach and the second one led by the OTA.

Openreach investigation into ELFs

A20.311 We sought information from BT using our statutory information gathering powers on all external analysis commissioned by BT and all internally commissioned analyses in the last 3 years which analyse ELF rates.⁹¹⁵ Openreach’s response included 15 reports covering a number of investigations into ELF

⁹¹⁴ Value for 2013/14 prorated for the year of 52 weeks from actual data for 42 weeks from April 2013 to January 2014.

⁹¹⁵ BT’s responses dated 5 November 2013 and 12 November 2013 to the Fifth QoS BT Information Request.

2010 to October 2013. Of the fifteen reports, one report was from December 2010 and one was from November 2011 whilst all the other reports were from 2012 or 2013. These reports highlight several potential causes of ELF and potential reasons for changes in ELF rates. These reports provide some evidence that Openreach processes may have contributed to increases in ELF rates, although other factors were also identified as having an impact.

A20.312 The two reports from 2010 and 2011 focused on specific issues and did not present data on the number of faults, or the likely impact on fault volumes or rates that may result from the investigation. All the other reports used 2012 and/or 2013 data. The reports collectively highlight a wide range of issues concerning the possible causes of ELFs though most relate to Openreach's internal processes and testing issues. These issues include:

- issues relating to frame work;
- the fact that Openreach's testing had not picked up some faults on the Openreach network which other CPs using different testing approaches had identified;
- MPF use of the start of a stopped line process (i.e. when a line which has not had service for a given time period is activated for MPF) where there appear to be data recording issues which include accuracy of information on which lines have jumpers left in place when use of the line is stopped, and how these are handled when these jumpers, or the equipment ports they were ultimately connected to, are re-used when use of the line or another line is started;⁹¹⁶
- The fact that for the period July 2012 to July 2013, LLU start of a stopped line and new provide, SMPF basic provide and WLR3 new provide were the largest contributors to ELFs; and
- As indicated by some reports, non-visited orders also exhibit a higher ELF rate irrespective of product type and that appointed WLR orders irrespective of whether they are visited or "visit saved" also have a higher ELF rate than MPF.

A20.313 Openreach indicated that further analysis of faults, including ELFs is currently underway within Openreach (in addition to work involving the OTA and other CPs) and that the reports should not be taken as offering final conclusions on the subject.

A20.314 The internal investigations by Openreach have provided some evidence that factors relating to processes within Openreach and between Openreach and CPs may have contributed to increases in the ELF rate, but the impact of these issues, compared to other issues outside Openreach's control is uncertain. Investigations are continuing.

OTA review of Early Life Faults on MPF lines

A20.315 As highlighted in the December 2013 LLU WLR Consultation, the OTA is undertaking a review of ELFs on MPF and WLR lines in order to understand what is driving the apparent increase in ELFs and to identify what mitigating actions can be

⁹¹⁶ Start of Stopped" is the supply of a new line or service using a previously stopped line, i.e. a line where the service it carried has been stopped.

taken.⁹¹⁷ The review is being undertaken with assistance from Openreach, Sky (as lead CP) and two other CPs.

A20.316 The OTA's initial investigations appear to suggest that issues endogenous to Openreach (e.g. process issues) may play a part in at least some of the increase in ELF rates, although it is difficult to quantify the scale and effect of such issues. Following an initial top level analysis, a programme of work has been developed between the OTA and Openreach. This plan consists of three work streams:

- a) frame-only order issues (i.e. start of a stopped line ('start of stop'))⁹¹⁸;
- b) reduce overall ELF rate (all order types); and
- c) eliminate ELFs by provision redesign (root cause correction).

A20.317 Following detailed work with Openreach a number of issues were found around Openreach systems incorrectly labelling lines as working when they were faulty with the fault therefore not being apparent until the line was used again. These issues were the result of data integrity issues in Openreach's systems. A number of tactical fixes were implemented to improve the quality of records held in Openreach's systems which has seen the ELF rate for the Start of Stopped provision⁹¹⁹ order type improve from just under 9% in August 2013 to about 6% in March 2014.⁹²⁰ A final strategic solution is due soon. Attention has now turned to how the interpretation of routine test results of lines not in service can be improved to better indicate the likelihood of an early life fault when the line is put back into active service. Openreach are conducting some trials to prove or disprove this approach. A number of other initiatives have also been identified and will be executed during 2014 which should lead to a reduction in ELFs.

A20.318 We recognise fault rates are an important issue as they directly impact the service experienced by the end user and to that end we see value in continuing to develop an understanding of the factors that drive fault rates. In this context we welcome the work currently being undertaken by the OTA and will consider what, if any, further work we could undertake in this area to provide useful insights into fault rates.

⁹¹⁷ Paragraph 5.50, Ofcom, December 2013 LLU WLR Consultation.

⁹¹⁸ "Start of Stopped" is the supply of a new line or service using a previously stopped line, i.e. a line where the service it carried has been stopped.

⁹¹⁹ "Start of Stopped" is the supply of a new line or service using a previously stopped line, i.e. a line where the service it carried has been stopped.

⁹²⁰ Source: Openreach data via the OTA.

Annex 21

Cartesian Updated Fault Rates Report

A21.1 Please see the separate PDF document published alongside this Statement entitled *Cartesian Updated Fault Rates Report*. This is available here:

http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/21_annex21.pdf

Annex 22

Choice of base year data for cost modelling

Summary of our decision

- A22.1 We have decided, for the reasons set out below (A22.27 onwards), to use data based on and underpinning BT's published 2011/12 RFS to form the base year of the Cost Model for the LLU WLR charge controls.
- A22.2 When creating top-down cost models, we seek to use the best available information to forecast BT's relevant costs. In practice, over the course of several different market reviews the most recent RFS data has formed the starting point for this task. In this instance, following a careful review and detailed assessment, our judgement is that BT's 2011/12 RFS are not appropriate for use as the base year data. This is because the 2012/13 RFS contain material cost allocation methodology changes when compared to the 2011/12 RFS which, our analysis demonstrates, would result in significant over-recovery of costs for BT. Our analysis also raised concerns regarding the balance of the review leading to the changes in allocation methodology.
- A22.3 We sought to use the cost information contained in the 2012/13 RFS using the allocation methodologies from the 2011/12 RFS. However, due to the identification of errors in the 2012/13 RFS, which were not discovered until towards the end of the review process, we determined that we were not able to do so with sufficient confidence without introducing an unacceptable period of delay in the imposition of the charge controls, which would be contrary to legal and regulatory certainty. The 2011/12 RFS data are not affected by these issues so we consider, in the context of a need to introduce controls in a timely manner to protect competition in the market to the benefit of consumers and citizens, that it represents the best available data on which to forecast BT's relevant costs. The Cost Model therefore starts with 2011/12 as the base year and forecasts forward from there.

Proposals in July 2013 and December 2013 LLU WLR Consultations

- A22.4 In the July 2013 LLU WLR Consultation, we used BT's 2011/12 RFS to establish the base year cost data for the purposes of the Cost Model. In doing so, we noted that it might be appropriate to update the Cost Model to use BT's 2012/13 RFS to form the base year, once BT had published this. We also noted that, to the extent that changes in the 2012/13 RFS reflected changes in accounting methodologies (such as cost allocation rules) rather than changes in the underlying costs, we would need to consider whether it would be appropriate, and if so how, to reflect these changes in the base year costs within the Cost Model.
- A22.5 On 31 July 2013, after the publication of the July 2013 LLU WLR Consultation, BT published its 2012/13 RFS.⁹²¹ We therefore considered the extent to which it would be appropriate to use the 2012/13 RFS for cost modelling purposes when finalising the charge controls.

⁹²¹ BT Group Regulatory Financial Statements 2013:
<https://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/index.htm>

- A22.6 In its 2012/13 RFS BT changed several of the methodologies that it uses to prepare its RFS. We found that these changes had a material effect on BT's costs for these markets when compared to the methodologies used by BT in 2011/12. We required BT to prepare a separate report setting out the reasons for and effect of these changes. BT published this report on 3 October 2013 (the October RFS Report).⁹²² BT also commissioned a further report from Deloitte which sought to appraise the changes in allocations between the 2011/12 RFS and the 2012/13 RFS (the Deloitte RFS report) and BT submitted this report to Ofcom on 16 October 2013. On 12 December 2013 BT also published a non-confidential version of the Deloitte RFS report.⁹²³
- A22.7 For the purposes of the December 2013 LLU WLR Consultation, we continued to use the information contained in BT's 2011/12 RFS. We said, however, that for our final decisions on the proposed charge controls we intended to proceed by updating the base year cost data in our modelling by using the cost data in BT's 2012/13 RFS (where this was appropriate following further scrutiny) but use the allocation methodologies presented in BT's 2011/12 RFS (i.e. the allocation bases upon which we consulted in July 2013). We noted, however, that should this approach not be feasible (for as-then-unanticipated reasons), we would consider reverting to using BT's 2011/12 RFS as the base year data for the Cost Model.

Stakeholder responses to July 2013 and December 2013 LLU WLR Consultations

Responses to July 2013 LLU WLR Consultation

- A22.8 In response to the July 2013 LLU WLR Consultation, some stakeholders⁹²⁴ made submissions to Ofcom regarding BT's 2012/13 RFS and its suitability to be used to update the base year cost data.
- A22.9 BT said *"...it would not be fair, logical or coherent for Ofcom to use an out of date set of RFS data as the base year for the WLR and LLU charge controls."*⁹²⁵ According to BT *"...an approach which uses superseded rather than most recent data cannot give proper effect to Ofcom's statutory duties, nor will it achieve the benefits which Ofcom seeks to achieve by moving to a new RFS-based cost model."*⁹²⁶ Openreach, in its separate response, supported BT's view.⁹²⁷

⁹²² BT, *Report requested by Ofcom describing certain changes to the Accounting Documents for the year ended 31 March 2013 and illustrating the resulting differences to the Current Cost Financial Statements had those changes not applied*, 3 October 2013
<https://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/Reportrequest edbyOfcomfortheyearended31March2013.pdf>.

⁹²³ Deloitte, *BT RFS Attribution Methodology Changes*, 15 October 2013,
http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/BT_Group_-_Deloitte_Report_on_BT_RFS_Attribution_Methodology_Changes.pdf.

⁹²⁴ BT (section 5.1, pages 92-93, BT response to July 2013 LLU WLR Consultation), Openreach (section 3, pages 17-18, Openreach Response to July 2013 LLU WLR Consultation), Sky (paragraphs 3.5-3.7, page 5, Sky Response to July 2013 LLU WLR Consultation), TalkTalk (paragraph 2.73, page 21, TalkTalk Response to July 2013 LLU WLR Consultation) and Virgin Media (page 3, Virgin Media Response to July 2013 LLU WLR Consultation). See:
<http://stakeholders.ofcom.org.uk/consultations/llu-wlr-cc-13/?showResponses=true>.

⁹²⁵ Paragraph 445, page 92, BT Response to July 2013 LLU WLR Consultation.

⁹²⁶ Paragraph 453, page 93, BT Response to July 2013 LLU WLR Consultation.

⁹²⁷ Page 17-18, Section 3, Openreach response to July 2013 Consultation.

- A22.10 TalkTalk noted that “...initial review indicates that many of the changes made by BT [in its 2012/13 RFS] appear prima facie to be inappropriate, and that the main aim of BT’s submissions in this area (both in substance and timing) appears to be to game the regulatory system.”⁹²⁸
- A22.11 Virgin Media said that “...it will be vital for stakeholders to be offered an opportunity to comment on any material changes to proposals and to understand how Ofcom is treating the restatement in advance of any final decision being taken to set controls for the next three years.”⁹²⁹

Responses to the December 2013 LLU WLR Consultation

- A22.12 The majority of stakeholders who responded to the December 2013 LLU WLR Consultation made submissions to Ofcom regarding BT’s 2012/13 RFS and its suitability for use as the base year cost data (when reported using the allocation methodologies presented in BT’s 2011/12 RFS).
- A22.13 BT disagreed with Ofcom’s proposal to use adjusted 2012/13 RFS cost information as the base year data for cost modelling, where those adjustments removed all the methodology changes made in 2012/13 without reference to the underlying appropriateness of the changes themselves.⁹³⁰ It argued that Ofcom should use the published FAC data within the 2012/13 RFS as the base year within the model, with any adjustments limited to areas where clear economic efficiency issues had been identified or other adjustments, specific to these controls, were appropriate.
- A22.14 BT provided several reasons in support of this:
- 22.14.1 Ofcom should ideally use the latest available FAC information in its cost forecasting model and the latest audited RFS would normally be accepted as the best source of up to date FAC data for use in a charge control cost model.⁹³¹
 - 22.14.2 When setting the methodologies in its 2012/13 RFS, BT carried out a fair process and followed clear criteria,⁹³²
 - 22.14.3 “...BT has the flexibility to, and in certain circumstances should, change cost allocations over time where those changes result in cost being more accurately allocated in accordance with the cause of those costs;”⁹³³
 - 22.14.4 “Despite explaining the reason for each of the methodology changes to Ofcom, Ofcom has not provided any views on the robustness and appropriateness of individual changes made;”⁹³⁴ and
 - 22.14.5 “Ofcom’s reasons for rejecting the use of the published data is not that it is based on methodologies that are considered inconsistent with the [Regulatory Accounting Principles] or are not superior to previous methodologies. Instead, Ofcom raises a more general concern around consistency of treatment over time and the potential for this to allow BT to

⁹²⁸ Paragraph 2.73, page 21, TalkTalk Response to July 2013 LLU WLR Consultation

⁹²⁹ Page 3, Virgin Media Response to July 2013 LLU WLR Consultation

⁹³⁰ Section 5, BT Response to December 2013 LLU WLR Consultation;

⁹³¹ Section 5.1, BT Response to December 2013 LLU WLR Consultation

⁹³² Section 5.2, BT Response to December 2013 LLU WLR Consultation

⁹³³ Paragraph 16, page 39, BT Response to December 2013 LLU WLR Consultation

⁹³⁴ Paragraph 24, page 40, BT Response to December 2013 LLU WLR Consultation

*set prices across different markets and different charge controls which would then allow it to over-recover certain common costs.*⁹³⁵

A22.15 BT noted that, due to Ofcom’s approach of using the 2011/12 RFS methodologies, some of its costs would not be recovered until the next round of LLU WLR charge controls. BT gave as an example the BT Technology, Service and Operations (BT TSO) cost. It said that Ofcom should consider the methodology changes relating to allocation of costs incurred by BT TSO because:

22.15.1 *“the changes were triggered by a clear organisational change and issues of “balance” cannot be relevant;*

22.15.2 the changes do not raise “interdependence” concerns with the other methodology changes; and

22.15.3 the changes do not raise any concerns about double recovery of costs from leased line services to WLR/LLU services.”⁹³⁶

A22.16 BT also submitted three reports related to its 2012/13 RFS:

22.16.1 another copy of the Deloitte RFS report;

22.16.2 FTI Report on the Regulatory Reporting Framework;⁹³⁷ and

22.16.3 BT report “Illustrative attribution of Wholesale Current Cost 2013 restated on basis of 2011-12 methodologies except for the BT TSO methodologies”.⁹³⁸

A22.17 In a letter to Ofcom in December 2013⁹³⁹, BT also asserted that:

22.17.1 “Ofcom must consider these methodology changes at some point. ... Ofcom’s approach will lead to cost under recovery... as:

- a) The next LLCC will start in April 2016 from a lower cost base, but the WLR/LLU higher cost base will not start until April 2017, meaning that there will be one year where costs are not recovered; and
- b) There is approximately £90m of higher costs relevant to the WLR/LLU markets outside the LLCC markets that is also being excluded ...”

A22.18 Openreach said that “*Regardless of Ofcom’s decision regarding the cost allocation methodology changes in 2012/13 Ofcom should still use the cost base from 2012/13 rather than from 2011/12 in setting the Charge Control.*”⁹⁴⁰ For its specific arguments Openreach referred to BT’s response.

⁹³⁵ Paragraph 26, page 41, BT Response to December 2013 LLU WLR Consultation.

⁹³⁶ Paragraph 34, BT Response to December 2013 LLU WLR Consultation.

⁹³⁷ FTI Consulting, *Ofcom’s consultation on BT’s Regulatory Financial Reporting*, 14 February 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/BT_Group_-_FTI_Consulting_report_on_BT_RFS.pdf.

⁹³⁸ BT report *Illustrative attribution of Wholesale Current Cost 2013 restated on basis of 2011-12 methodologies except for the BT TSO methodologies*.

⁹³⁹ Letter dated 18 December 2013 from Deputy Group CFF at BT to Group Director, Competition at Ofcom, published at Annex 23.

⁹⁴⁰ Paragraph 331, page 75, Openreach Response to December 2013 LLU WLR Consultation.

- A22.19 EE supported Ofcom’s proposed approach of using 2012/13 cost data presented using the cost allocation methodologies in the 2011/12 RFS for its base year, for the reasons set out in the December 2013 LLU WLR Consultation. It said that “*EE considers it highly inappropriate that BT should be allowed to significantly over-recover its costs (§7.92) and also agrees that timely implementation of the new charge controls is critical to stimulating efficient, sustainable and technology neutral competition and maximising consumer welfare (§§7.94-7.96). In the event that Ofcom’s proposed approach proves not feasible for any reason, EE supports Ofcom’s proposed fall-back option of reverting to the 2011/12 RFS as the base year data for the charge controls.*”⁹⁴¹
- A22.20 Sky broadly agreed with Ofcom’s proposed approach and said that “*Ofcom is correct to reject the new cost allocations made by BT as they are clearly inappropriate...*”⁹⁴² However, Sky also said that it “*...remains concerned that LLU and WLR prices will be too high because the base year costs will still include unjustified 2013 costs and cost allocations from 2012.*”⁹⁴³ Sky submitted particular concerns in relation to costs associated with: deafness claims, BT’s Career Transition Centre, Openreach computing, Openreach overheads, vacant exchange space and Technology, Service & Operations.⁹⁴⁴
- A22.21 Verizon agreed with Ofcom’s proposal to retain the 2011/12 RFS allocation methodologies as the basis for the Cost Model. In addition, it said that “*due to significant concerns over the accuracy and reliability of the 2013 RFS, Verizon considers Ofcom should base its judgements by reference to the 2012 RFS.*”⁹⁴⁵ Verizon argued that “*the most appropriate option which best safeguards against over-recovery by BT is to use the 2012 RFS as the base year data and source of allocation methodologies for the Charge Controls.*”⁹⁴⁶
- A22.22 Vodafone agreed with Ofcom’s concerns around the large majority of methodological alterations in the 2012/13 RFS and considered it appropriate not to adopt them for the charge control cost base.⁹⁴⁷
- A22.23 Vodafone, Sky, TalkTalk, Verizon and Colt also submitted the executive summary of a report by Berkeley Research Group (BRG) which examines the 2012/13 RFS changes.⁹⁴⁸ According to this report, the current regulatory financial reporting framework and the level of discretion afforded to BT within it did not provide a sufficiently clear and documented cost base for Ofcom to make decisions on cost-oriented charges and charge controls for access to BT regulated services. BRG gave a list of methodology changes that it considered were not supported by the principle of cost-causality and a list of methodology changes that might not be supported by the principle of cost-causality. It concluded that the changes undertaken by BT in its 2012/13 RFS had caused significant redistribution of costs between markets.

⁹⁴¹ Page 15, EE Response to December 2013 LLU WLR Consultation.

⁹⁴² Paragraph 3.5, page 4, Sky Response to December 2013 LLU WLR Consultation.

⁹⁴³ *Ibid.*

⁹⁴⁴ Paragraphs 3.8-3.21 Sky Response to December 2013 LLU WLR Consultation.

⁹⁴⁵ Paragraph 68, page 11, Verizon Response to December 2013 LLU WLR Consultation.

⁹⁴⁶ Paragraph 71, page 12, Verizon Response to December 2013 LLU WLR Consultation.

⁹⁴⁷ Page 9, Vodafone’s response to December 2013 LLU WLR Consultation.

⁹⁴⁸ Berkeley Research Group, *BT’s Regulatory Financial Statements 2012/13. Executive Summary*, December 2013, [http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Colt_and_Vodafone - BRG Report on BT RFS.pdf](http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Colt_and_Vodafone_-_BRG_Report_on_BT_RFS.pdf) (BRG Report).

A22.24 One confidential respondent \times said that Ofcom’s proposal on the base year for charge control cost modelling in the December 2013 LLU WLR Consultation “*strikes the appropriate balance between regulatory certainty (retaining the cost allocation methodologies where they are deemed to be fair and reasonable and producing a result that does not distort competition) and jurisprudence requiring the most up to date information being used prior to a charge control*”.⁹⁴⁹

A22.25 Following the December 2013 LLU WLR Consultation, TalkTalk submitted a response to Openreach’s submissions regarding QoS and LLU WLR charge control.⁹⁵⁰ In this response, TalkTalk said that BT had presented no evidence that demonstrated that the revised 2012/13 cost allocations were appropriate. It said that “...as set out in both TalkTalk’s earlier submissions and the BRG report dated December 2013, the majority of the changes made to the allocations either do not improve cost causality, or BT has provided so little data into the public domain that it is unclear whether the revised allocation is more cost causal or not.”⁹⁵¹

A22.26 Further, TalkTalk submitted that:

22.26.1 using 2012/13 RFS allocations would not increase economic efficiency;⁹⁵²

22.26.2 BT had made changes to 2012/13 RFS which were not related to cost causality⁹⁵³ and were inappropriate⁹⁵⁴ (including, for example, the BT TSO costs),⁹⁵⁵ and

22.26.3 The change control process was not robust.⁹⁵⁶

Our analysis

A22.27 In charge control reviews, we seek to use the best available information to forecast BT’s relevant costs over the charge control period. In practice, over the course of several different market reviews, we have often used BT’s most recently published RFS as a starting position, appropriately scrutinised and adjusted where necessary, as the basis of our assessment of BT’s relevant costs.⁹⁵⁷ A key reason for this is that the RFS has typically formed a sensible check point for the consistent allocation of costs across different markets and services subject to *ex ante* review as well as to unregulated services. BT has asserted that we should only depart from the use of published RFS data in charge control models where scrutiny of the

⁹⁴⁹ Page 16. \times response to the December 2013 LLU WLR Consultation.

⁹⁵⁰ TalkTalk Group, *FAMR/LLU Charge Control. TalkTalk response to Openreach’s submissions regarding QoS and LLU charge control*, March 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk_response_to_Openreach_submissions_regarding_QoS_and_LLU_charge_control.pdf.

⁹⁵¹ Paragraph 2.2, page 1, TalkTalk Response to Openreach submissions

⁹⁵² Section 2.2, TalkTalk Response to Openreach submissions

⁹⁵³ Section 2.3, TalkTalk Response to Openreach submissions

⁹⁵⁴ Section 2.5, TalkTalk Response to Openreach submissions

⁹⁵⁵ Section 2.6, TalkTalk Response to Openreach submissions

⁹⁵⁶ Section 2.4, TalkTalk Response to Openreach submissions

⁹⁵⁷ We have sometimes used older data where we considered that it was the most robust data available, for example in the 2009 Review of BT’s Network Charge Control, we used 03/04 information as the base year from which to model forward looking costs rather than 07/08 data which was the most recent available. As discussed in Annex 2 of the 2009 Network Charge Statement, we did not consider that data available after 2003/04 appropriately reflected the cost faced by an on-going network. http://stakeholders.ofcom.org.uk/consultations/review_bt_ncc/.

financial information raises clearly identified concerns with regulatory accounting principles, economic efficiency considerations and/or with other specific aspects relating to Ofcom's duties and responsibilities.

Our general policy and duties

A22.28 In the specific context of each charge control review, Ofcom is required to exercise its judgement, based on its experience and expertise, to adopt an appropriate, proportionate and timely means to model BT's relevant costs in light of the specific circumstances applying at the time so as to address the competition concerns identified.

A22.29 Our duties require us to achieve an outcome which both furthers the interests of citizens in relation to communications matters and those of consumers in relevant markets, where appropriate by promoting competition. Any charge control remedy must be one that promotes efficiency, sustainable competition and be in the best interests of citizens and consumers as the end-users of those services.

Changes in 2012/13 RFS allocations and consistency across charge controls

A22.30 As noted in paragraph A22.5 above, BT published its 2012/13 RFS on 31 July 2013. The 2012/13 RFS contained a number of material changes in allocation methodology when compared to the 2011/12 RFS.

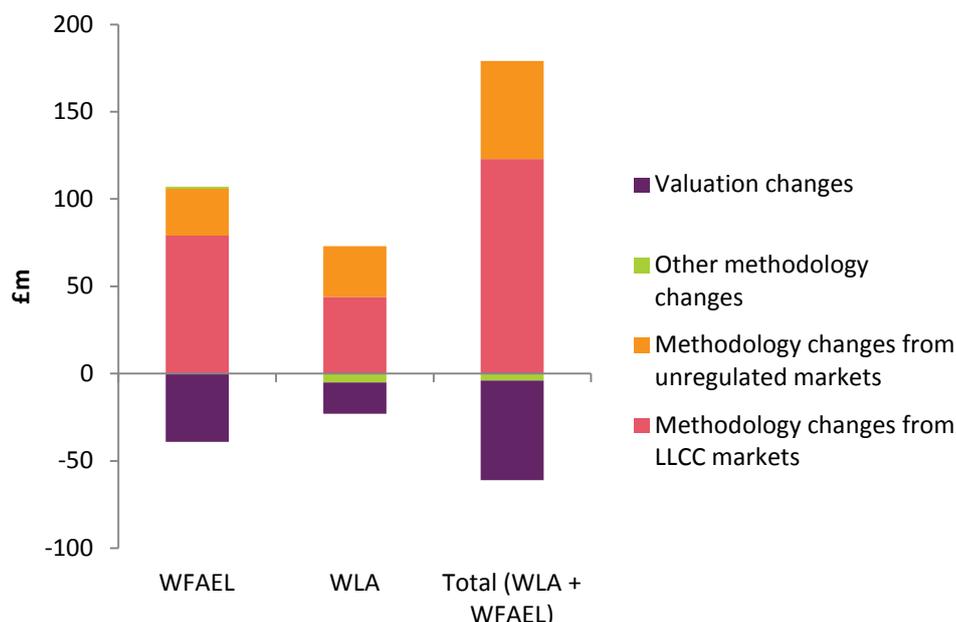
A22.31 Having regard to our objectives when setting charge controls and our duties set out above, and having reviewed the 2012/13 RFS alongside the October RFS Report and the Deloitte RFS Report, in the December 2013 LLU WLR Consultation we carefully considered whether it would be appropriate to use the information contained in the 2012/13 RFS to update the cost models used for the proposed charge controls.

A22.32 We included in the December 2013 LLU WLR Consultation Figure A22.1 below which we considered illustrates:

22.32.1 the effect of the allocation changes (in terms of the scale and direction) which move costs from markets in which Ofcom set charge controls in 2013 (the leased lines charge controls in the AISBO and TISBO markets) into those we are setting in this Statement; and

22.32.2 the net impact of the remainder of the allocation changes, which shows that, overall, costs are moving into the markets covered by this review.

Figure A22.1: Illustrative impact of methodological changes; moving costs into and out of the WLA and WFAEL markets⁹⁵⁸



Source: Ofcom calculations based on BT's October RFS Report

A22.33 As explained in the December 2013 LLU WLR Consultation, as a general matter, it may be appropriate for BT to alter its cost allocation bases from time to time. However, where those changes are material and have significant implications for charge controls and competition across both regulated and unregulated services, they need to be carefully considered to ensure that they are objectively justified and balanced. Although illustrative, Figure A22.1 shows that the predominant effect of the changes in allocation methodology implemented in the 2012/13 RFS would be to the benefit of BT if they were reflected in the charge controls we are setting in 2014. For this reason, we remain concerned regarding (i) the potential for material over-recovery from other regulated markets and (ii) the other material reallocations between the WLA and WFAEL markets and to those markets from unregulated services.

A22.34 In its response to the December 2013 LLU WLR Consultation, BT submitted that Ofcom had not provided any views on the robustness and appropriateness of individual changes to the cost allocations. It argued that, absent “*a clear and specific reason for rejecting each change, on a case by case basis, Ofcom should*

⁹⁵⁸ For each allocation change where costs to WLA and WFAEL markets increase and costs to AISBO or TISBO markets decrease, we have assumed that the allocation moves costs from LLCC markets to WLA and WFAEL markets. We have captured the total increase in WLA and WFAEL markets, although in some cases part of the cost is from LLCC markets and part is from elsewhere, including unregulated markets. For each allocation change which is not assumed to move costs from LLCC markets to WFAEL and WLA markets, where costs for WLA and WFAEL have increased and costs allocated to unregulated markets have decreased, we have captured the total increase in WLA and WFAEL markets as methodology changes from unregulated markets. The valuation changes relate to a CCA valuation of dropwire and CCA valuation of exchange power and specialised accommodation and plant. In BT's 2012/13 RFS there is also a revaluation of copper and duct. However, as we propose to use the RAV model in calculating 2016/17 prices for the purpose of these charge controls, the impact of copper and duct revaluations are excluded from the October RFS report and from the analysis above. Figures based on the data presented on page 18 of BT's October RFS Report

*include that change, it being the most appropriate and up to date information on the costs of providing the set of services relevant to these charge controls. Ofcom's more general concerns with consistency with other controls, the interdependence of the methodology changes, the overall balance of the changes and timing are, in themselves, an insufficient basis to reject the totality of the changes...".*⁹⁵⁹ Thus, BT supported its previous submission that Ofcom should make amendments to only correct for individual errors or to dis-apply specific methodological changes not considered to be 'superior' to those previously in use. In essence, this would involve an item-by-item assessment of each of the changes in the allocation methodology applied in the 2012/13 RFS.

A22.35 Having reviewed all available evidence and all responses to the July 2013 and December 2013 LLU WLR Consultations, our concerns with such an approach remain:

22.35.1 that the suite of methodological changes made by BT in its 2012/13 RFS (and their effects) are potentially interdependent; and

22.35.2 that the changes do not represent a balanced approach to the review of allocations (particularly given our findings in the December 2013 LLU WLR Consultation, as highlighted in Figure A22.1 above). For example, the October RFS Report identified 12 changes to allocation methodologies that affected the WLA market, with a combined effect of increasing costs allocated to this market by £73m. Of these 12 changes, only one had the effect of reducing costs allocated to this market (by £1m). This is similar for WFAEL, where 13 allocation methodologies were changed with a combined effect of increasing the costs allocated to this market by £103m. Three of the 13 had the effect of reducing the costs allocated to this market, by a total of £10m.

A22.36 In response to our concern on interdependence, BT argued that a full review would clarify the extent to which the changes were linked and whether it might be appropriate to accept some of the changes but not others in setting the base year data. It added that, on balance, Ofcom should take a consistent approach here and consider each change on its merits as it does in cases where CPs argue for other adjustments to be made.

A22.37 We do not accept that Ofcom is required to undertake an item-by-item assessment of the methodological changes contained in BT's 2012/13 RFS. We have, however, considered whether we should do so in the context of this review. Our view is still that we would not be confident that applying and dis-applying methodological changes on an item-by-item basis would produce a sufficiently accurate or suitable assessment of BT's relevant costs that could properly be used as the basis for the charge controls.⁹⁶⁰ Such an analysis would create the possibility of material delays in the setting of the new charge controls. Such a regulatory lacuna would be undesirable given the competition concerns we have identified in these market reviews. We have not therefore undertaken a full review or considered the methodological changes relating to the allocation of costs incurred by BT TSO as

⁹⁵⁹ Section 5, Paragraph 5, BT Response to December 2013 LLU WLR Consultation

⁹⁶⁰ The way in which BT's accounting systems operates may mean that the order in which a given allocation change is applied or removed as part of a set may affect the system outputs.

BT argued⁹⁶¹ or indeed any of the other methodological changes on a standalone basis.⁹⁶²

A22.38 In response to this, BT argued that it had provided Ofcom with the necessary information on a timescale that would have allowed Ofcom to carry out a detailed assessment. We do not accept this. Ofcom was not in a position to scrutinise the market-level effects of the methodological changes applied to the 2012/13 RFS prior to the publication of the October RFS Report. Our assessment was that to have undertaken such an assessment after this date would have led to a material delay in the implementation of the revised controls. Moreover, having regard to the alternative approaches available to address the base year issue, we do not consider that undertaking such an assessment would necessarily produce a better outcome in terms of cost allocation.

A22.39 After careful consideration of all available evidence and all responses to the July and December 2013 LLU WLR Consultations, our judgement continues to be that it would not be appropriate to use the new cost allocations used by BT in its 2012/13 RFS for the purpose of the charge controls. In addition, we do not consider that our duties would be best achieved in the context of these charge controls by undertaking a detailed evaluation of each of these allocations.⁹⁶³

Error in 2012/13 RFS cost data

A22.40 We proposed in our December 2013 LLU WLR Consultation to update the base year information to take account of 2012/13 RFS costs (where appropriate), and retain the 2011/12 RFS allocation methodologies. We also said that should we find that this approach is not feasible (for an unanticipated reason), we would need to consider reverting to using the 2011/12 RFS as the base year data for the charge controls.

A22.41 After careful consideration of all responses to the December 2013 LLU WLR Consultation, and in line with our proposals therein, we sought to use the 2012/13 cost data with 2011/12 allocations as the base year data in our modelling of the proposed LLU WLR charge controls. To do this, we undertook a significant amount of work to scrutinise, interrogate and reconcile the data provided by BT in the October RFS Report and, subsequently, in responses to statutory information requests for the purposes of establishing that the 2012/13 cost data on a 2011/12 basis were sufficiently robust for use as the base year data for our charge control cost modelling. In the course of that work BT discovered a material error in the 2012/13 RFS data that had been propagated in the October RFS Report and throughout many of the financial data templates provided by BT in response to statutory information requests. Specifically, BT identified that it had incorrectly allocated some costs associated with engineering time not directly attributable to

⁹⁶¹ BT has asserted that the TSO allocation changes do not affect allocation of costs between markets, are balanced and not interdependent on other changes. However, we would need to conduct an analysis of these changes in the same depth as for any of the others in order to be satisfied that this is the case.

⁹⁶² We note also that the information supplied to us in BT's *Illustrative attribution of Wholesale Current Cost 2013 restated on basis of 2011-12 methodologies except for the BT TSO methodologies* was affected by the error BT found in its 2012/13 RFS (referred to at paragraphs A22.41 to A22.46) and was restated in its submission on 4 March 2014.

⁹⁶³ This does not preclude us carrying out an assessment of BT's RFS allocation methodologies in future, if we consider this appropriate in the context of our review of BT's regulatory reporting framework or the next review of business connectivity markets and associated charge controls on leased lines services.

jobs.⁹⁶⁴ The effect of this was that the 2012/13 RFS had understated costs attributable to the WLA and WFAEL markets, which was estimated at the time to be (c. ⌘ [£15m to £30m]).⁹⁶⁵

A22.42 On 26 February 2014, we informed BT that, to have any possibility of using the 2012/13 cost data (on a 2011/12 basis) as the base year for our cost modelling for the LLU WLR charge controls, we required BT to provide corrected cost data in the required format by 3 March 2014.⁹⁶⁶ BT acknowledged this and agreed that the data would be submitted in a form and to a level of quality that Ofcom could immediately use in its modelling. BT provided the new data on 3 and 4 March 2014.⁹⁶⁷

A22.43 However, although much of this data was provided on the necessary timescale, it was not in a form that could be immediately used. Specifically, there were significant changes to data supplied by BT since October 2013, including changes to other responses to statutory information requests that had not previously been anticipated. We also identified in the information provided issues that would have required further investigation in order to be understood and the omission of data that we believe should have been included in BT's response to our Fifteenth LLU WLR BT Information Request, and which was required in order to assist us in verifying the robustness of the data.⁹⁶⁸

A22.44 Given that these data issues would have necessitated further extensive engagement with BT in order for Ofcom to have confidence that the 2012/13 costs data could form a sufficiently robust basis for our cost modelling, and given the late stage of the process at which these issues arose, we considered that seeking to update the Cost Model using 2012/13 cost data (as now restated) on the basis of 2011/12 allocation methodologies would have introduced an unacceptable risk of error into the charge control modelling and would have resulted in further material delays to the setting of revised charge controls to the detriment of legal and regulatory certainty.

A22.45 Therefore, given that the timely implementation of the charge controls is of central importance to Ofcom (given the competition concerns identified in the Fixed Access Market Reviews) and the fact that new controls are already delayed beyond the expiry of the existing controls, we consider that our statutory duties are best served by using the most robust data available on BT's relevant costs to set the charge controls in a timely manner which is the 2011/12 RFS data.

A22.46 As discussed in Annex 11, we considered whether it would be appropriate for us to try to reconcile the forecast of 2012/13 costs that the Cost Model produces when using a base year of 2011/12 against the 2012/13 cost data provided by BT.

⁹⁶⁴ 20:52 18 February 2014 email from ⌘, Regulatory Affairs, BT to ⌘, Competition Policy Manager, and ⌘, Competition Policy Adviser, Ofcom

⁹⁶⁵ Conversation between ⌘, Head of Finance, BT and David Brown, Director of Competition Finance, Ofcom on Friday 21 February 2014.

⁹⁶⁶ See Annex 23, Letter from David Clarkson, Ofcom to Alan Lazarus, Director of Regulatory Affairs, BT, 26 February 2014.

⁹⁶⁷ See Annex 23, Letter from Alan Lazarus, Director of Regulatory Affairs, BT to David Clarkson, Competition Policy Director, Ofcom, dated 3 March 2014; and Letter from Alan Lazarus, Director of Regulatory Affairs, BT to David Clarkson, Competition Policy Director, Ofcom, 4 March 2014.

⁹⁶⁸ We were not able to immediately reconcile service unit costs between data provided to go into the model and the revised BT October RFS Report data. We also identified a material omission in the data that we believe should have been included in BT's response to the Fifteenth LLU WLR BT Information Request which meant we could not able to perform adequate cross-checks on BT's data.

- A22.47 We do not believe that a reconciliation would be appropriate or informative because, as discussed above, we do not have confidence in either the 2012/13 RFS data or the 2012/13 cost data on a 2011/12 basis.
- A22.48 Further, the changes to the RFS mean that it is not clear that we would be able to identify a comparable set of cost data with which to perform a reconciliation check. In order to be able to compare the outputs of the model with the 2012/13 cost data provided by BT, we would first have to remove costs from the data in order to make it consistent with the Cost Model (e.g. the removal of costs associated with the deafness provision). Even once we had done this, we would need to fully review the 2012/13 data and engage extensively with BT to assure ourselves that the cost data was robust for comparison with the Cost Model. This exercise may not result in us having data that we can compare to the Cost Model and would require a considerable amount of time and resource.
- A22.49 Consequently, we believe a reconciliation to the 2012/13 cost data provided by BT would not be an appropriate exercise.

Conclusions

- A22.50 We have decided that it would not be appropriate to use the allocation methodology used in the 2012/13 RFS for the purpose of the charge controls.
- A22.51 Having undertaken significant further analysis, we determined that we could not use the 2012/13 RFS cost data using the 2011/12 allocation methodologies for the purpose of the charge controls.
- A22.52 Based on the above conclusions, we have decided to revert to using BT's 2011/12 RFS as the base year data for the charge controls (with appropriate adjustments where required).⁹⁶⁹

⁹⁶⁹ We discuss the adjustments made in Section 5, Volume 2 and Annexes 11, 13, 14, 17, 19 and 20

Annex 23

Correspondence on base year data

A23.1 Correspondence on base year data between Ofcom and BT includes the following letters:

- Letter from Stuart McIntosh, Ofcom to Mark Shurmer, BT, 19 November 2013;
- Letter from Mark Shurmer, BT to Stuart McIntosh, Ofcom, 26 November 2013;
- Letter from Stuart McIntosh, Ofcom to Mark Shurmer, BT, 6 December 2013;
- Letter from Richard Cameron, BT to Stuart McIntosh, Ofcom, 18 December 2013;
- Email from Stuart McIntosh, Ofcom to Richard Cameron, BT, 19 December 2013;
- Letter from David Clarkson, Ofcom to Alan Lazarus, BT, 26 February 2014;
- Letter from Alan Lazarus, BT to David Clarkson, Ofcom, 28 February 2014;
- Letter from Alan Lazarus, BT to David Clarkson, Ofcom, 3 March 2014;
- Letter from Alan Lazarus, BT to David Clarkson, Ofcom, 4 March 2014;
- Letter from Stuart McIntosh, Ofcom to Alan Lazarus, BT, 5 March 2014;
- Letter from Alan Lazarus, BT to Stuart McIntosh, Ofcom, 6 March 2014;
- Letter from David Clarkson, Ofcom to Alan Lazarus, BT, 10 March 2014;
- Letter from Alan Lazarus, BT to David Clarkson, Ofcom, 14 April 2014; and
- Letter from David Clarkson, Ofcom to Alan Lazarus, BT, 16 April 2014.

These are available here:

http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/23_annex23.pdf

Annex 24

Volumes forecasting

Introduction

A24.1 This Annex explains the approach we have taken to forecasting volumes for the services within the scope of this review and sets out the outputs of our volumes modelling. In particular we identify the primary drivers of volumes for different services.

A24.2 Volume forecasts are important for the purpose of setting charge controls because they impact costs in the following ways:

- the existence of fixed and common costs means that unit costs will fall if volumes increase and, conversely, increase if volumes fall. These fixed and common cost effects (i.e. economies of scale and scope) are reflected in cost- and asset-volume elasticities which are less than 1; and
- shifts in demand (e.g. from WLR to MPF) will result in changes to the balance of cost recovery between the individual services.

A24.3 In line with the anchor pricing approach we have adopted for these charge controls, this forecast considers BT's copper network as if there were no deployment and take up of Next Generation Access (NGA) services. This is necessary as the charge control applies only to charges for BT's copper access services.⁹⁷⁰ In the rest of this Annex we refer to copper lines as the sum of service rentals, some of which may include an optical fibre element. For this reason, these volume forecasts have been prepared solely for the purpose of inputting into the Cost Model.

Summary of the volume forecasting model and results

A24.4 For these charge controls we have built a model to project volumes of MPF, WLR and SMPF rental, connection and ancillary services over the charge control period.

A24.5 The main outputs of the model are summarised in Table A24.1 below. A more detailed breakdown of the volume projections for the services covered by the charge controls is set out in Table A24.3.

⁹⁷⁰ Anchor pricing is discussed in detail in Section 3, Volume 2 of this document, paragraphs 3.40 to 3.66.

Table A24.1: Forecast results summary^{971, 972}

	2011/12 Actuals		2016/17 Forecasts	
	Number of lines (millions)	Share (%)	Number of lines (millions)	Share (%)
WLR (voice only)	8.2	34%	4.5	18%
WLR +SMPF	11.2	46%	10.6	43%
MPF	5.0	20%	9.7	39%
Totals	24.4	100%	24.8	100%
Broadband lines	16.1	66%	20.3	82%

Source: BT's response dated 25 February 2013 to question 3 of the First LLU WLR BT Information; Ofcom calculations.

A24.6 In the model, changes in the projected number of copper lines are driven by changes in five primary parameters which in turn depend on a larger number of underlying factors. These are listed below in paragraphs A24.16 and A24.17. Where possible, we have based our projections on publicly available input data, with the aim of improving the transparency of our analysis. We have relied on data from BT's regulatory financial statements (RFS),⁹⁷³ from the 2013 Communications Market Report (2013 CMR)⁹⁷⁴, from the Department for Communities and Local Government (DCLG),⁹⁷⁵ from the Office of National Statistics (ONS),⁹⁷⁶ from the Department for Business, Innovation and Skills (BIS)⁹⁷⁷ and from the Office of Budget Responsibility (OBR).⁹⁷⁸

A24.7 We also requested volume data from BT for the financial years 2009/10 through to 2016/17 using our statutory information gathering powers, of which the final four years are forecast data.⁹⁷⁹ In particular we requested BT to provide volumes consumed internally by BT Wholesale which are not published in the RFS.⁹⁸⁰

⁹⁷¹ All volumes data presented in this annex have been calculated by Ofcom.

⁹⁷² Openreach lines only, including fibre (see A24.3 and A24.110 for more detail). Excludes cable.

⁹⁷³ BT's RFS is published at:

<http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/index.htm>

⁹⁷⁴ Ofcom, *Communications Market Report 2013*, 1 August 2013,

http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr13/2013_UK_CMR.pdf (2013 CMR).

⁹⁷⁵ DCLG, *Live tables on household projections*, <https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections>

⁹⁷⁶ ONS, *National population estimates and projections*, <http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-315018> and <http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-318453>

⁹⁷⁷ BIS, *Business population estimates*, <https://www.gov.uk/government/organisations/department-for-business-innovation-skills/series/business-population-estimates>

⁹⁷⁸ Chart 3.17 (Forecasts of the level of GDP), OBR, *December 2013 Economic and fiscal outlook: Charts & Tables*, December 2013, <http://budgetresponsibility.org.uk/pubs/December-2013-EFO-Charts-and-Tables2.xls>

⁹⁷⁹ BT's response dated 25 February 2013 to question 3 of the first LLU WLR BT Information Request; BT's response dated 25 October 2013 to the question 12 of the eleventh LLU WLR BT Information

- A24.8 We consulted on our approach to volume forecasts in the July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation, which included publication of versions of the volumes forecasting model.⁹⁸¹ We have updated our forecasts (where appropriate) in the light of new data that has become available since those consultations and in the light of our consideration of those responses.
- A24.9 A copy of our final model will be provided as Annex 25 to the final statement.
- A24.10 The modelling approach can be explained in the following steps:
- i) After excluding mobile-only households from the total number of households in the UK, we calculate both the number of residential households and the number of businesses expected throughout the period we are modelling, and both the number of lines per household and the number of lines per business;⁹⁸²
 - ii) BT's volume data does not differentiate between business and residential lines. We therefore split them into business and residential lines using data held by Ofcom on the proportions of business and residential lines.⁹⁸³ From this we derive voice lines per business site and voice lines per residential household. This provides a starting point for our forecasts which is consistent with BT's historical data, but is calibrated with externally sourced assumptions. We can then forecast the number of voice lines combining both BT and external data,⁹⁸⁴
 - iii) Using assumptions on lines per household or per business site, market share, churn, LLU roll-out, penetration and the migration between SMPF and MPF, we then forecast the total volume of broadband lines, and the split between MPF⁹⁸⁵, WLR and SMPF; and
 - iv) Finally, we forecast the volume of ancillary services, for example migrations.
- A24.11 Unless otherwise stated we extrapolated forwards from 2012/13 using a three-year moving average growth rate with a dampening factor.⁹⁸⁶ Over the longer term, continuous growth or decline at a constant rate will often be implausible. The dampening factors are used to slow down the three-year trends to ensure that they are consistent with plausible and stable long-run levels for the key forecast variables. At the same time, the use of a three-year moving average means that our forecasts are also a reasonable reflection of shorter-term trends over the forecast

Request; BT's response dated 4 March 2014 to question 6 of the twelfth LLU WLR BT Information Request.

⁹⁸⁰ In our volumes forecast model we have used data provided directly by BT using our statutory information gathering powers and from the RFS. The scope of the data captured is different from that published in Ofcom's telecommunications market data update tables as the telecoms tables include alternative network infrastructure available in the UK (for example Virgin Media). Therefore as alternative infrastructure is not considered in this charge control it is appropriate to base our volumes forecast model on the data provided by BT.

⁹⁸¹ Annexes 8 & 9, July 2013 LLU WLR Consultation and December 2013 LLU WLR Consultation.

⁹⁸² This is for the period 2008/09 to 2016/17.

⁹⁸³ Data on numbers of business and residential fixed lines are published in Ofcom's annual Communications Market Reports, available at: <http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/>

⁹⁸⁴ Voice lines consist of WLR and MPF lines.

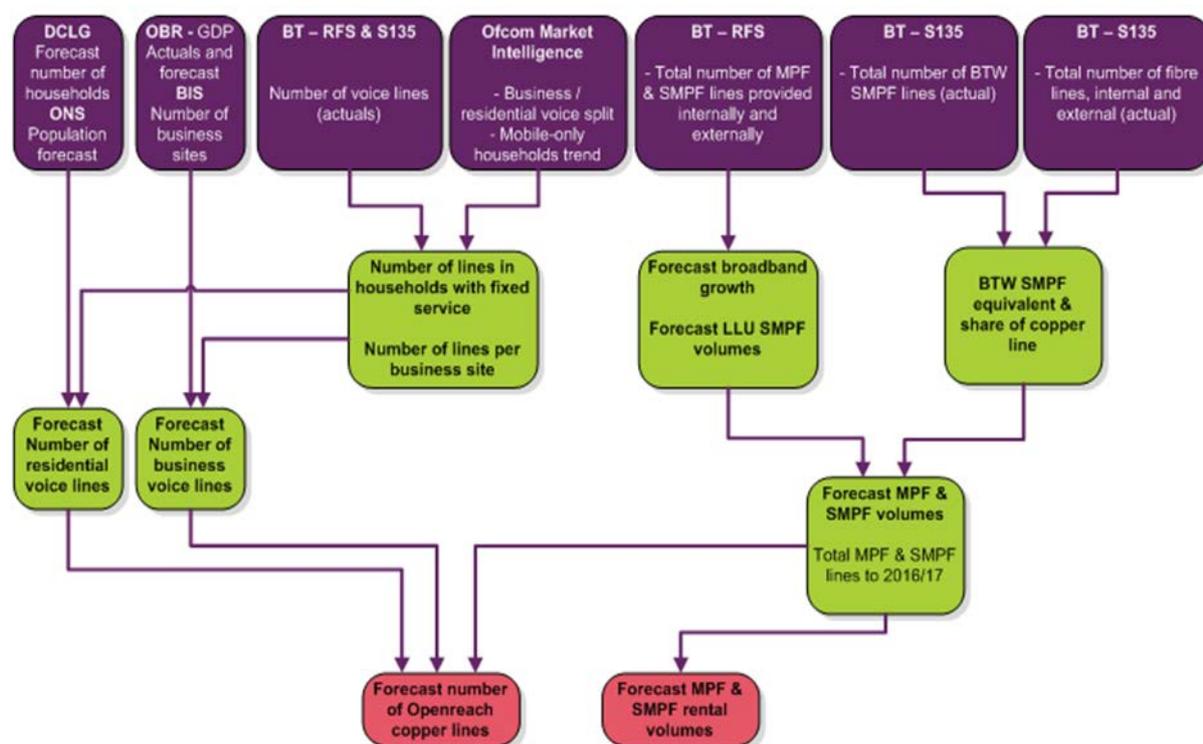
⁹⁸⁵ MPF volumes are calculated as the remainder of total broadband lines less both BT Wholesale and LLU SMPF lines.

⁹⁸⁶ A dampening factor is a divisor applied to the growth rate in order to reduce growth year-on-year.

period. This is a similar approach to that taken in the most recent Network Charge Control (NCC) volume forecasts.⁹⁸⁷

A24.12 Figure A24.1 summarises the method we follow for the main volume forecasts, identifying the data sources and major calculations performed.

Figure A24.1: Forecasting methodology⁹⁸⁸



Source: Ofcom

Structure of this Annex

A24.13 The remainder of this annex is structured as follows:

- first, we summarise the proposals in the July 2013 LLU WLR Consultation and stakeholder responses;
- second, we summarise the proposals in the December 2013 LLU WLR Consultation and stakeholder responses;
- third, we set out our analysis of and replies to stakeholder responses together with our final position on our approach to volumes modelling;
- fourth, we explain a number of additional changes made to our approach to volumes modelling since the publication of the December 2013 LLU WLR Consultation; and

⁹⁸⁷ Ofcom, *Review of the fixed narrowband services markets. Statement on the proposed markets, market power determinations and remedies – Statement*, 26 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/nmr-2013/statement/Final_Statement.pdf

⁹⁸⁸ Voice lines include all voice lines provided via Openreach

- finally, we describe the detailed methods used to produce each individual service forecast.

Summary of our proposals in the July 2013 LLU WLR Consultation and stakeholder responses

A24.14 In the July 2013 LLU WLR Consultation we presented our proposed approach to forecasting volumes and provided a version of the volume forecasting model for stakeholders to review. We received responses to this aspect of our consultation from EE, Openreach, BT, TalkTalk and one confidential respondent ⁹⁸⁹.

A24.15 Table A24.2 summarises our volume forecasts from the July 2013 LLU WLR Consultation.

Table A24.2: Volume forecasts summary from the July 2013 LLU WLR Consultation

	2011/12 Actuals		2016/17 Forecasts	
	Number of lines (millions)	Share (%)	Number of lines (millions)	Share (%)
WLR (voice only)	8.2	34%	5.6	22%
WLR +SMPF	11.2	46%	10.3	41%
MPF	5.0	20%	9.1	36%
Totals	24.4	100%	25.0	100%
Broadband lines	16.1	66%	19.4	78%

Source: BT's response dated 25 February 2013 to question 3 of the First LLU WLR BT Information Request; Ofcom calculations.

A24.16 We identified five primary parameters driving the number of copper lines (these were the drivers taken from the 2012 LLU WLR charge control).⁹⁹⁰ These were:

- the change in the number of mobile-only households;
- the change in the number of households;
- the change in the number of business sites and lines;
- competition from cable; and
- the roll-out of fibre-based access networks (NGA).

A24.17 We considered these factors to be the primary parameters driving copper volumes, but we also explicitly identified a number of underlying factors, in order to attempt to

⁹⁸⁹ Non-confidential responses to the July 2013 LLU WLR Consultation have been published on the Ofcom website, <http://stakeholders.ofcom.org.uk/consultations/llu-wlr-cc-13/?showResponses=true>

⁹⁹⁰ Paragraphs A8.29 to A8.43, July 2013 LLU WLR Consultation

more accurately forecast the primary parameters and therefore more accurately forecast volumes. The additional parameters we considered were:⁹⁹¹

- i) the change in the number of lines per household with a fixed service;
- ii) broadband market shares;
- iii) the potential for further LLU roll-out;
- iv) customer churn between broadband providers;
- v) recent consolidation among LLU operators;
- vi) Openreach broadband penetration; and,
- vii) the split of volumes between MPF and WLR+SMPF.

A24.18 A summary of our proposals for each of these parameters is given below, together with stakeholder responses, where applicable

Mobile-only households

Proposals

A24.19 We proposed to forecast numbers of mobile-only households using data from our 2013 CMR. Our assumption was that the share of households that is mobile-only would remain flat, at 15% of all households, for the duration of the review period. We based this forecast on the fact that the past two years of data had shown that the proportion of households which are mobile-only was constant at 15%, after a prior period of slowing growth in this proportion. We attributed this levelling off to falling usage of mobile broadband ‘dongles’. We stated that we did not expect the introduction of LTE (4G) mobile services to affect the proportion of households which are mobile-only for the purpose of our forecasts.

Stakeholder responses

A24.20 EE and TalkTalk were largely supportive of our analysis but argued that it was likely that the number of mobile-only households could fall as consumers used smart devices over WiFi (which relies on a fixed connection).

A24.21 Openreach argued that, while LTE technology may not become a ‘mass market substitute’ for fixed line services, it had the potential to impact fixed line volumes in specific segments of the overall market. It quoted a report from Plum Consulting (commissioned for BT) and made arguments on a number of factors (which we summarise in more detail below).⁹⁹²

- i) 4G mobile offerings are comparable to fixed for voice quality and broadband speeds;
- ii) 4G could be a better option for consumers on low speed fixed broadband connections;

⁹⁹¹ Paragraphs A8.45 to A8.65, July 2013 LLU WLR Consultation.

⁹⁹² Plum Consulting, *Future evolution of fibre regulation. A report for BT*, September 2013, http://www.plumconsulting.co.uk/pdfs/Plum_Sept2013_Future_evolution_of_fibre_regulation.pdf

- iii) smart phone take-up and technological developments facilitate substitution;
- iv) international data show a negative trend for fixed line household penetration since 4G introduction; and
- v) market research shows that the percentage of mobile-only households in the UK may increase by three percentage points.

A24.22 In December 2013, prior to the publication of the December 2013 LLU WLR Consultation, TalkTalk made a submission noting that Openreach's claims were contradicted by a public statement by Openreach's CEO in May 2013, which discussed the fixed line "renaissance" that the company was enjoying and stated that mobile was "complementary to fixed and not substitutional".⁹⁹³

4G mobile offerings are comparable to fixed for voice quality and broadband speeds

A24.23 Openreach argued that the average download speeds currently achieved on EE's LTE network are comparable with average fixed line broadband speeds of 14.7Mbit/s as measured in the UK fixed broadband performance report. While Openreach recognised that EE's 4G network is currently only lightly loaded with subscribers, it argued that MNOs have outlined a clear plan to upgrade capacity in future, mitigating any degradation in performance.

A24.24 Furthermore, Openreach argued that mobile data costs are forecast to decline significantly, thanks to new spectrum available to mobile networks. Openreach noted that Plum Consulting predicted the incremental cost of mobile networks per GB for mobile broadband might fall to less than £1/GB and potentially to around £0.20/GB. Openreach argued that, if these costs were reflected in prices, a consumer could buy significant amounts of mobile data for the cost of a fixed line contract.

Smart phones and technological advances may facilitate substitution

A24.25 Openreach argued that the take up of smartphone and tablet devices has led service providers to target mobile devices first when rolling out new services and may lead to changes in consumers' preferences. It suggested that new mobile devices allow users to share a single data subscription between multiple devices, through mobile tethering⁹⁹⁴, or the use of specialised devices (MiFi).⁹⁹⁵ It further said that mobile operators have started marketing special packages which allow multiple users (such as the members of a family) to share a common mobile data allowance.

A24.26 Openreach said it expects that, by 2017, smartphone data will be a "near ubiquitous default", with fixed broadband being perceived as an "incremental add on, depending on capacity needs at home". It argued that smartphones and tablets allow large downloads, such as multimedia content and software updates, to be managed without a broadband connection at home and outside any mobile data allowance, for example, "via public WiFi or at work". Furthermore, it said that some

⁹⁹³ BT, Q4 2012/13 Results Presentation Transcript Part 2, 10 May 2013,

http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_transcript2.pdf

⁹⁹⁴ "Mobile Tethering" is the process by which a mobile or tablet device can be used as a modem and offer data access to other connected devices such as laptop or desktop computers.

⁹⁹⁵ "Mobile Fidelity" (MiFi), refers to mobile devices that allow sharing a mobile data connection between several devices that are connected to the MiFi using a WiFi connection.

devices offer the ability to transfer content from one device to another on a peer-to-peer basis, without consuming a mobile (or fixed) data allowance.

A24.27 Furthermore, Openreach argued that the take up of mobile and tablet devices would also lead to improvements in compression and what it called “smart connectivity management”. Openreach referred particularly to a new High Efficiency Video Compression standard (‘HEVC’ or ‘H.265’) which offers similar video quality at half the bit-rate, when compared to the current de-facto compression algorithm, H.264. Adoption of this standard would effectively double the amount of content that could be downloaded with a certain data allowance, making for a stronger case that some consumers could meet their data demands using only mobile connectivity.

Consumers on low speed broadband connections

A24.28 Openreach referred to BT Group’s response to Ofcom’s consultation on the review of the wholesale broadband access markets⁹⁹⁶ in which it argued that customers using broadband lines, who were getting much less than 8Mbps and who were price sensitive/low usage customers were most open to substitution away from their fixed service. It produced a figure showing that, for these consumers, mobile-only voice and data may be cheaper than a combination of fixed and mobile voice and data below certain data limits.

International comparisons

A24.29 Openreach recognised that there might be differences in market conditions between nations but argued that “the learning from real world market data provides valuable insight”.

A24.30 Openreach presented international evidence from Analysys Mason’s trends and forecasts report.⁹⁹⁷ According to Openreach, the evidence in Analysys Mason’s report showed a negative trend for fixed line household penetration in some EU countries, since LTE was introduced. Openreach referred in particular to Germany where it claimed that in the two years following the introduction of LTE (between December 2010 and December 2012) fixed line penetration dropped by 3% to 77%. Openreach said that the rate at which fixed line penetration was declining accelerated to 1.5% per annum, from 1% per annum between December 2008 and December 2010.

Survey research data

A24.31 Openreach submitted a market research survey which it had commissioned from Sweeney Pinedo. The survey aimed to quantify the likelihood of consumers substituting their fixed voice line in favour of LTE. According to Openreach, the survey showed that between 3% and 10% of the sample was likely to take up a mobile broadband service for in-home use and substitute their fixed broadband connection. The responses were conditional on the mobile broadband connection delivering a range of broadly equivalent speeds at broadly similar prices to the existing fixed broadband line.

⁹⁹⁶ Paragraph 9, Annex 1, BT, *BT’s response to Ofcom’s consultation document, “Review of Wholesale Broadband Access Markets”*, 25 September 2013,

<http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/responses/BT.pdf>

⁹⁹⁷ Analysys Mason, *Western European telecoms market: trends and forecasts 2013 – 2018*, 27 June 2013, <http://www.analysismason.com/Research/Content/Regional-forecasts-/Western-Europe-forecast-2013-2018-Jun2013-RDDF0-RDDG0/#27%20June%202013>.

A24.32 TalkTalk provided a supplementary submission that commented on the Sweeney Pinedo survey evidence.⁹⁹⁸ In that, TalkTalk argued that the propositions put to the interviewees were unrealistic as 4G packages are substantially more expensive for much less data.⁹⁹⁹ It further said it was unclear whether 4G would have sufficient capacity to offer comparable quality and speeds as network usage grew. TalkTalk argued that the survey report presented “(inadequate) evidence” consistent with a reduction in the number of households solely using mobile phones to access the internet.¹⁰⁰⁰ Finally, in TalkTalk’s view the survey failed to meet some of the criteria of the OFT & CC’s “Good practice in the design and presentation of consumer survey evidence in merger inquiries”.¹⁰⁰¹

Number of residential households

Proposals

A24.33 We proposed to use forecasts of the number of UK households prepared by the Department for Communities and Local Government (DCLG).¹⁰⁰² It forecast UK households to increase from 26.5 million households in 2011/12 to 27.9 million households in 2016/17. We assumed that new households would have the same propensity to use an Openreach line as existing households.

Stakeholder responses

A24.34 EE stated that the increase in the total number of households forecast could be a “significant under-estimate”.¹⁰⁰³ It argued that the DCLG projection of households was based on a lower net migration figure than had been seen in recent statistics and that the projections took no account of conversions or re-instatement of existing housing stock.

A24.35 Openreach stated in its response that households should be forecast to grow at an average of 178,000 per annum rather than 272,000 per annum.¹⁰⁰⁴ Openreach based this claim on two lines of argument:

- The DCLG household projections are based on an extrapolation of UK population trends, which are inherently uncertain and difficult to predict; and
- Neither the DCLG households projections, nor the population projections on which they are based, reflected limits on the future supply of residential properties.

A24.36 Openreach quoted an article¹⁰⁰⁵ which stated that population-based forecasts involve forecasting migration, lifespan and fertility – all of which have repeatedly

⁹⁹⁸ Section 3, TalkTalk Comments on BT Response to the July 2013 LLU WLR Consultation.

⁹⁹⁹ TalkTalk referred in particular to the proposition in Sweeney Pinedo’s survey that 4G will provide a similar service to fixed broadband at the same price or £5 more.

¹⁰⁰⁰ TalkTalk pointed out that slide 14 of the survey report suggested that while 4% of respondents said they were likely to drop their fixed line internet connection, 5% said they were likely to take up a fixed internet connection.

¹⁰⁰¹ Competition Commission, *Good practice in the design and presentation of consumer survey evidence in merger inquiries*, March 2011, http://www.of.gov.uk/shared_of/consultations/merger-inquiries/Good-practice-guide.pdf

¹⁰⁰² DCLG, *Live tables on household projections*, <https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections>

¹⁰⁰³ Page 34, EE Response to the July 2013 LLU WLR Consultation.

¹⁰⁰⁴ Annex A, paragraph 25, Openreach Response to the July 2013 LLU WLR Consultation.

proven inaccurate. Openreach pointed particularly at migration as an element of great uncertainty. It also argued that the household projections did not account for government policy to reduce net migration to below 100,000 by 2015, and that net migration was already lower than that used in the DCLG projections.

A24.37 Openreach argued that it was incorrect to base the forecast of households on a projection that was unconstrained by housing supply. It argued that “the supply of residential properties is likely to be a constraining factor on the growth in demand for fixed lines”¹⁰⁰⁶ and that “it is clear that a housing constraint is likely to bite”.¹⁰⁰⁷ It argued that only households that form in permanent new homes or dwellings would be in a position to acquire new fixed lines. Openreach disagreed with our assumption that new households had the same propensity to use an Openreach line as existing households.¹⁰⁰⁸ Openreach provided its own forecast of permanent new dwellings¹⁰⁰⁹ on which, it argued, we should base our forecast of households.¹⁰¹⁰

A24.38 Openreach acknowledged that in the appeal of the 2012 LLU WLR charge controls the Competition Commission considered households to be a better predictor of growth in demand for fixed lines than dwellings. Openreach argued, however, that it had adjusted its forecast of dwellings for excluded factors (such as conversions and use of vacant stock) and that this difference no longer applied.

Number of business sites and lines per business site

Proposals

A24.39 We set out our view that business sites were in long-term decline and that this would continue at a decreasing pace into the future, levelling off after 2014/15. In our base case, we proposed that, as the overall economic climate improved (represented by changes in GDP¹⁰¹¹), the decline in the number of businesses would slow. We proposed to use a dampening factor to slow down the rate of decline, as explained in paragraph A24.11 above. We also proposed an alternative scenario that did not take account of GDP growth and which did not include a dampening factor.

A24.40 We proposed to continue the trend of the past three years in the number of voice lines per business site, from 3.55 lines per business site in 2011/12 to 3.48 in 2016/17. We attributed this decline to business users being more likely than

¹⁰⁰⁵ BBC, *How can a graph be so very wrong?*, 20 April 2009, available at

<http://news.bbc.co.uk/1/hi/8000402.stm>

¹⁰⁰⁶ Annex A, paragraph 38, Openreach Response to the July 2013 LLU WLR Consultation.

¹⁰⁰⁷ Paragraph 103, Openreach Response to the July 2013 LLU WLR Consultation.

¹⁰⁰⁸ Annex A, paragraph 39, Openreach Response to the July 2013 LLU WLR Consultation.

¹⁰⁰⁹ DCLG defines households and dwellings in DCLG, *Definitions of general housing terms*, 14 November 2012, <https://www.gov.uk/definitions-of-general-housing-terms>. In summary, a dwelling is defined as a “self-contained unit of accommodation”. A household is defined as “one person or a group of people who have the accommodation as their only or main residence [...]”. Therefore “a dwelling can consist of one household space (an unshared dwelling) or two or more household spaces (a shared dwelling).”

¹⁰¹⁰ Openreach’s forecast of net new dwellings is based on the following sources: a forecast of housing completions from *Leading Edge*, a consultancy in the construction industry; historic data on conversions, change of use and demolitions, trended forward; and an annual reintroduction of vacant housing stock back into the stock of used housing, based on historic data.

¹⁰¹¹ Our model included a forecast of GDP to 2016/17 from the OBR which forecast GDP to grow by 7.8% over the 5-year review period (representing a compounding average growth rate of 1.5%).

residential household users to substitute away from multiple fixed lines to mobiles and VoIP over a single connection.

Stakeholder responses

A24.41 Openreach disagreed with our forecast rate of decline in business lines.¹⁰¹² It argued that, given historic trends, the decline in business lines should be greater in forecast years than we proposed. It disagreed with our approach of modifying the forecast to account for changes in GDP growth, as it disagreed with the degree to which GDP growth was likely to affect the decline in business lines. It further stated that it believed increasing pressure on business line numbers would come from the adoption of VoIP technology by businesses for their telephony, which it claimed would further decrease the number of business lines.

A24.42 In its response, one confidential respondent \times disagreed¹⁰¹³ with our implied assumption that businesses would consolidate to VoIP with just one form of access, claiming that in its experience, many businesses recognised the need for resilience. One confidential respondent \times argued that this would mean that at least two BT copper assets would be deployed per business site instead of just one, increasing demand for business lines.

Cable

A24.43 We proposed that Virgin Media's customer base would change in line with the forecast growth rate for UK residential households so that the relative share of fixed connections on Openreach's and Virgin Media's networks would remain constant. Further, we proposed that the net churn between copper and cable would be zero.

NGA rollout

A24.44 We proposed to forecast the number of copper lines as if there were no deployment and take up of NGA, as the Cost Model is based on a hypothetical on-going copper network. We proposed to allocate a copper equivalent line for every FTTx connection, specifically to WLR and SMPF volumes for FTTx purchased by BT Wholesale and to MPF volumes for FTTx purchased by CPs which use MPF.

Lines per household with a fixed service

Proposals

A24.45 We proposed to continue the trend of the past three years in the number of Openreach voice lines per residential household with a fixed service, from 0.90 lines per residential household with a fixed service in 2011/12 to 0.89 in 2016/17. We attributed this decline to households discontinuing second lines.¹⁰¹⁴

¹⁰¹² Annex A, section 2.3, Openreach Response to the July 2013 LLU WLR Consultation.

¹⁰¹³ Page 53, \times , response to the July 2013 LLU WLR Consultation.

¹⁰¹⁴ There is less than 1 Openreach voice line per household with access to a fixed service due to some households having access to fixed lines using other infrastructure, such as cable.

Stakeholder responses

A24.46 EE disagreed¹⁰¹⁵ with our forecast decline in fixed lines per household being the only set of scenarios, citing the 2013 CMR which stated that the proportion of fixed and fixed & mobile households had been flat for the past two years.

Market shares during the forecast period

A24.47 We assumed that over the review period the broadband market shares of BT (at the wholesale level), Sky and TalkTalk would remain at their current levels. We proposed this because market shares depend on a number of factors that are difficult to predict. We also proposed low and high scenarios in which BT Wholesale's market share would decrease or increase by 1% per annum to reflect this uncertainty.

LLU rollout

A24.48 We assumed that LLU rollout had already peaked and that there would be very limited further rollout over the review period. We set out our view that even if the uncommitted rollout plans were implemented, they would have a small effect on the volume forecasts.

Churn rate

A24.49 We proposed to use a common churn rate for all CPs of 14% per annum. A common churn rate assumption was proposed in order to maintain consistency with our assumption of stable market shares over the review period. The churn rate used was intended to be a representative average across all operators and was informed by data from financial reports and presentations. Furthermore, we proposed that the probability of a churning customer switching to a particular service provider was determined by the relative market share of that provider.

Sky's purchase of O2 Broadband

A24.50 We assumed for the purpose of our forecasts that, following its announcement that it had reached an agreement to purchase O2's broadband and fixed-line telephony business in the UK, Sky would integrate O2's customers with its own SMPF base and would gradually migrate them to MPF. We did not propose to explicitly model each individual LLU operator's number of SMPF customers.

Broadband penetration

Proposals

A24.51 We assumed that the historic trend of increasing numbers of broadband lines would continue. We proposed to extrapolate this trend with a dampening factor applied to the growth rate (as discussed above), resulting in a forecast rise in the proportion of Openreach lines used for broadband from 66% in 2011/12 to approximately 78% in 2016/17. This forecast was based solely on broadband access provided by Openreach and was derived from our forecasts of line volumes. We also forecast low and high scenarios by flexing the dampening factor.

¹⁰¹⁵ Page 34, EE Response to the July 2013 LLU WLR Consultation.

Stakeholder responses

A24.52 EE disagreed with our forecast for the percentage of households taking a broadband line, which it described as “broadly flat”.¹⁰¹⁶ It argued that it was government policy for higher penetration over time, and cited ONS Internet Access Quarterly Updates 2011-13 that showed that this policy had had some success.

Split between MPF and WLR+SMPF

A24.53 We proposed a base case scenario in which the recent historic decline in the number of LLU SMPF lines continued at a steady rate, falling from 2.9m lines in 2011/12 to 0.4m lines in 2016/17.¹⁰¹⁷ We proposed to calculate the number of MPF lines by subtracting the number of BT Wholesale broadband lines and LLU SMPF lines from the total number of broadband lines on the Openreach network. In our proposed base case forecast, total MPF lines were projected to increase to 9.1m lines, with low and high scenarios of 6.7m and 11.0m lines, respectively. These scenarios were based on combining all low case and all high case assumptions respectively, resulting in a large range between them.

Ancillary services

Proposals

A24.54 We proposed to forecast ancillary non-rental services on an individual basis, using one of a selection of methods based on which was most appropriate to each of these non-rental services. For example, for a number of services (such as WLR transfers) we extrapolated current trends; for others, we forecast services based on the historic average ratio of the volume of that service to the volume of the relevant line rental service.¹⁰¹⁸ Where possible we attempted to ensure that our methods were computationally simple, and the method used for each service was explained in full in Annex 8 of the July 2013 LLU WLR Consultation.

Stakeholder responses

A24.55 EE disagreed¹⁰¹⁹ with our forecasts of non-rental services. EE believed that Ofcom’s approach was based on extrapolation of past changes which it argued would be unduly influenced by one-off factors such as migrations from WLR+SMPF to MPF.

A24.56 Openreach disagreed with our approach to forecasting MPF hostel rental volumes.¹⁰²⁰ It claimed that we should forecast MPF hostel rentals using MPF plus external SMPF rental volumes, as it claimed hostel rental costs increase in line with the demand for MPF and external SMPF lines.

¹⁰¹⁶ Page 34, EE Response to the July 2013 LLU WLR Consultation.

¹⁰¹⁷ LLU SMPF lines are SMPF lines provided by non-BT LLU CPs for example Sky or TalkTalk.

¹⁰¹⁸ In some cases, such as for MPF new provides and migrations, we used the most recent year’s ratio rather than the historic average, as the shift from SMPF to MPF rentals means that we believe older data to be less representative of likely future trends.

¹⁰¹⁹ Page 35, EE Response to the July 2013 LLU WLR Consultation.

¹⁰²⁰ Page 9 paragraph 20, Openreach Response to the July 2013 LLU WLR Consultation.

Other responses to the July 2013 LLU WLR Consultation

Base year

A24.57 BT¹⁰²¹ and TalkTalk¹⁰²² stated that we should ensure that we updated our consultation proposals to use volumes data up to 2012/13, rather than data up to 2011/12.

Model error

A24.58 Openreach claimed that it had found a modelling error, which meant that when forecast household numbers were changed, the resulting change in line volumes was not correctly calculated. It claimed that this was caused by historic household numbers being derived from an estimate of the average number of people per household which was calculated from the forecasts of population and household numbers. It said that, as a result, changing the household forecast also changed the numbers of historic households, which changed historic lines per household which in turn drove forecast lines per household. This, it claimed, was effectively a circularity in the way the model worked as the two constituents of the forecast number were not working independently.

Consistency with Single Jumpered MPF Dispute

A24.59 Sky noted that MPF forecasts were included in the Single Jumpered MPF Dispute and that our forecasts should be consistent with those in the dispute.¹⁰²³

Summary of the December 2013 LLU WLR Consultation

Additional proposals

A24.60 In the December 2013 LLU WLR Consultation we published an updated version of the volumes forecast model.¹⁰²⁴ This model was identical to the volume forecasting model published as part of the July 2013 LLU WLR Consultation, with the following exceptions:

- The churn rate used was increased from 14% to 15% in order to align with the Single Jumpered MPF Dispute;
- Data on hard ceases were included; and
- We forecast volumes of WLR Start of Stopped MPF Lines, WLR + SMPF Simultaneous Connections and Hard Ceases (in order to reflect other proposals in the December 2013 LLU WLR Consultation).¹⁰²⁵

Stakeholder responses

A24.61 We received responses to the December 2013 LLU WLR Consultation related to volume forecasting from Openreach and TalkTalk.¹⁰²⁶

¹⁰²¹ Page 92, BT Response to the July 2013 LLU WLR Consultation.

¹⁰²² Page 12, EE Response to the July 2013 LLU WLR Consultation.

¹⁰²³ Page 4 footnote 7, Sky Response to the July 2013 LLU WLR Consultation.

¹⁰²⁴ Annex 13, December 2013 LLU WLR Consultation.

¹⁰²⁵ Paragraphs A11.35 to A11.43, December 2013 LLU WLR Consultation.

A24.62 Openreach reiterated its arguments with regard to total residential households and mobile-only households from its response to the July 2013 LLU WLR Consultation. In particular, Openreach:

- i) provided quotes from Ed Milliband and the BBC stating that building levels of new homes were lagging behind demand, which was leading to increasing house prices and difficulty for first-time buyers;¹⁰²⁷
- ii) said that the Sweeny Pinedo report was the only piece of independent market research put forward and so Ofcom should use it for its decisions;¹⁰²⁸
- iii) stated that there was analyst agreement about 4G's ability to increase the propensity for consumers to abandon their fixed lines in favour of mobile;¹⁰²⁹
- iv) stated that 4G operators would have an opportunity to replace fixed broadband in rural areas, quoting that EE's 4G footprint would be similar to its 2G footprint. This, combined with the speed it claimed for 4G would support rural broadband switching;¹⁰³⁰
- v) stated that there was analyst expectation that 4G adoption would be faster in the UK than in other countries. It quoted a report from Deloitte which stated that one in five mobile users planned to upgrade to 4G in the next 12 months;¹⁰³¹ and
- vi) quoted Ofcom's Director of Research as stating "Smartphones have not been a substitute for fixed broadband yet, but with 4G coming in, we will start to see this happen."¹⁰³²

A24.63 TalkTalk noted in its response that MPF+WLR line volumes had increased in the last quarter by what amounted to an annualised growth rate of 1.1%. It stated that these figures should be reflected in Ofcom's volume estimates rather than our proposed growth rate which amounted to 0.6% per annum.¹⁰³³

Our analysis and conclusions

Drivers of our volume forecasts and using the latest information as a starting point for our forecasts

A24.64 Our proposals in the July 2013 LLU WLR Consultation were based on data up to 2011/12 as these were the most recent data available at the time of publication. We

¹⁰²⁶ Non-confidential responses to the December 2013 LLU WLR Consultation have been published on the Ofcom website, <http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-llu-wlr-charge-controls/?showResponses=true>

¹⁰²⁷ Paragraphs 314 and 315, Openreach Response to the December 2013 LLU WLR Consultation.

¹⁰²⁸ Paragraph 317, Openreach Response to the December 2013 LLU WLR Consultation.

¹⁰²⁹ Paragraph 318, Openreach Response to the December 2013 LLU WLR Consultation.

¹⁰³⁰ Paragraph 318, Openreach Response to the December 2013 LLU WLR Consultation.

¹⁰³¹ Deloitte, *Deloitte report demonstrates strong outlook for 4G*, 18 September 2013,

http://www.deloitte.com/view/en_GB/uk/industries/tmt/b0aa8cf61c131410VgnVCM2000003356f70aR/CRD.htm

¹⁰³² Mobile News, *Customers to replace fixed lines with 4G, claims Ofcom*, 13 August 2013,

<http://www.mobilenewscwp.co.uk/2013/08/13/customers-to-replace-fixed-lines-with-4g-claims-ofcom/>

¹⁰³³ Paragraph 9.7, TalkTalk Response to the December 2013 LLU WLR Consultation.

have updated our volume forecasting model to reflect volumes for the 2012/13 financial year.¹⁰³⁴

A24.65 In the year 2012/13 there were 18.3 million WLR lines, out of which 11.1 million lines were SMPF-enabled. There were also 6.2 million MPF lines.¹⁰³⁵ This forms the starting point for our forecasts.

A24.66 We continue to use the five primary and seven additional parameters identified in the July 2013 LLU WLR Consultation to drive the forecast number of copper lines (set out at paragraphs A24.16 and A24.17 above).

Mobile-only households

A24.67 Openreach has submitted that the roll out of 4G mobile services will have an effect on the number of fixed lines during this charge control period and that this should be factored into our forecasts of volumes. In assessing this claim we have considered the extent to which 4G is likely to become a substitute for fixed access services over the charge control period and whether, in conjunction with the rollout of super-fast broadband (SFBB), there is likely to be a net change in the trends of the percentage of mobile-only households.

A24.68 In our view it is unlikely that 4G rollout will have any material effect on the current net trends in the percentage of mobile-only households during this control period. In this regard we note, in particular, that:

- i) Although 4G can offer speeds that are higher than some fixed broadband connections, there is no evidence that those speeds are consistently comparable to SFBB fixed connections based on NGA networks;¹⁰³⁶
- ii) While it is possible that there may be strong 4G take-up during this charge control period, it does not mean that it will lead to substitution of fixed lines. Strong 4G take-up alone is not evidence of fixed to mobile substitution;
- iii) At present, 4G mobile connections are priced at a significant premium relative to fixed broadband offers with comparable data allowances. 4G connections are typically (but not exclusively) charged on the basis of the monthly data allowance, whereas fixed connections are more likely to be 'unlimited' in terms of data allowance and charged on the basis of headline speeds. Furthermore, the few "unlimited" mobile packages available either do not allow tethering or impose a limit in the amount of data that can be consumed using tethering.¹⁰³⁷ This may

¹⁰³⁴ Eleventh LLU WLR BT Information Request, 4 October 2013, and Twelfth LLU WLR BT Information Request, 11 October 2013

¹⁰³⁵ Combining data published in BT's 2012/13 RFS and data provided by BT in response to the First, Eleventh and Twelfth LLU WLR BT Information Requests. These are year-average figures.

¹⁰³⁶ In paragraph 4.54, Ofcom, *Infrastructure Report. 2013 Update*, 24 October 2013, updated on 6 December 2013, http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/infrastructure-report/IRU_2013.pdf (IRU 2013) we noted that EE reported to have achieved peak speeds of 100Mbit/s, and that it has reported a typical average speed for 4G services above 16Mbit/s. In comparison, we reported that the average speed of SFBB connections in 2013 was 50Mbit/s (paragraph 3.34, *ibid*).

¹⁰³⁷ Three UK's "One Plan" was the last unlimited data plan that allowed tethering in the UK. Since 18 March 2014 Three has capped to 2GB the amount of data that can be used with 'tethering' on this plan, for new customers (PCPro, *Three scraps UK's last unlimited tethering package*, 18 March 2014, <http://www.pcpro.co.uk/news/broadband/387355/three-scraps-uks-last-unlimited-tethering-package>).

tend to make 4G services unsuitable for use with data heavy applications such as video streaming;¹⁰³⁸

- iv) It is plausible that the retail prices per GB of mobile data could fall.¹⁰³⁹ However, the scale of any decline in mobile data prices (and the price per data unit) is still uncertain. Cell capacity in mobile networks is shared between users. As more consumers obtain 4G capable devices, the contention between users will increase in ‘macro’ cells which will tend to reduce the available capacity per user. We expect material price differentials to persist between fixed and mobile broadband in the next three years as “[...] the incremental cost of data transport on LTE is much higher than on fixed”.¹⁰⁴⁰ The difference in the underlying cost per unit of data between mobile and fixed networks is manifested by the different pricing approaches described in (iii) above. This was also recognised by Deloitte which said that “*While 4G does make watching streamed TV possible, it is likely to be prohibitively expensive for most consumers. A gigabyte of data costs several pounds, and would only enable between two to four hours of video*”.¹⁰⁴¹ It is therefore likely that the cheaper way to connect devices to the internet could be by using a combination of fixed and mobile broadband access; this would allow the use of fixed broadband for data intensive applications and mobile data for lighter usage when on the move.
- v) It is unlikely that the coverage increase of LTE using 800MHz will lead to substitution. The coverage obligation sets the minimum speed requirements to 2Mbps, under certain traffic conditions.¹⁰⁴² It is therefore likely that fixed broadband will still be a better option for accessing internet services¹⁰⁴³, particularly as SFBB services based on NGA are rolled out;¹⁰⁴⁴
- vi) Whilst smart phone and tablet usage has increased, research conducted for the 2013 CMR indicates that consumers still consider laptop and desktop computers

An additional data allowance can be purchased at £5 per 1GB

(http://www.three.co.uk/Three_price_guide).

¹⁰³⁸ The latest Ofcom Infrastructure Report (IRU 2013) estimates that average usage of fixed broadband households has increased to 30GB per month (an increase of 30% over the previous year). This growth does not show any sign of slowing in the next few years. Indeed, a recent report by Analysys Mason suggests that average monthly usage will be close to 80GB by 2015.

¹⁰³⁹ Equipment and backhaul costs are decreasing; operators have entered network sharing arrangements; 4G technology will likely see improvements; and there are expected economies of scale generated from further increases in traffic volumes.

¹⁰⁴⁰ The on-going cost of mobile data versus fixed broadband was recognised in a recent Analysys Mason presentation (ISP review, *Fixed Wireless 4G LTE Broadband Networks Face Challenges in Rural Areas*, 24 October 2013, <http://www.ispreview.co.uk/index.php/2013/10/fixed-wireless-4g-lte-broadband-networks-face-challenges-rural-areas.html>)

¹⁰⁴¹ Deloitte, *Deloitte report demonstrates strong outlook for 4G*, 18 September 2013, http://www.deloitte.com/view/en_GB/uk/industries/tmt/b0aa8cf61c131410VgnVCM2000003356f70aRCRD.htm

¹⁰⁴² One of the 800MHz LTE licenses came with a coverage obligation that “*users in an area within which 98% of the UK population lives should be able to receive a 2Mbps mobile broadband service both outdoors and at some indoor locations within the vast majority of premises, provided that there are few other users using the service simultaneously in the vicinity*”.

¹⁰⁴³ According to IRU 2013, only 3% of premises in the UK with speeds below 2Mbit/s do not have SFBB currently available in their area (paragraph 1.20).

¹⁰⁴⁴ The number of households with access to SFBB will likely increase further as BDUK fibre is rolled-out. It is expected that SFBB will reach 95% of the population by 2017 with the remaining 5% of population having access to more than 2Mbit/s data connection (including a plan from the Government to invest £250m). Further increases in SFBB availability could lead to some mobile-only households to take up a fixed line.

as the most important devices for connecting to the internet.¹⁰⁴⁵ These devices are primarily connected to the internet using fixed broadband (via WiFi). Furthermore we understand that, despite the portability of the tablet and the fact that portability is one of the key reasons to buy it, most users (85%) use them mainly in the home, and are likely to do so via a fixed connection;¹⁰⁴⁶

- vii) Openreach argued that the improvement in video compression algorithms could make the case for sharing a single mobile data subscription between several devices and/or people stronger so that it could replace the home broadband connection. Our view is that such technological changes in compression protocols do not often come as step changes. Instead, the benefits of the new compression algorithms are typically gradually introduced over a period of time. In our view it is unlikely that any improvement in compression algorithms would reduce the demand for data to such an extent as to allow households to replace a fixed broadband connection by 4G over the period of the charge controls;
- viii) Increasingly more content is likely to become available over 'online' channels, which could further increase the demand for data. Services such as Netflix are changing from simply providing the same content that is available over other media, such as movies, to generating their own content.¹⁰⁴⁷ Similarly, more sport events than before will be available over online channels. For example, BT Sport recently won the rights to broadcast live Champions League and Europa League for three seasons from 2015.¹⁰⁴⁸ This deal could incentivise sport fans to take up a home broadband subscription. Mobile data allowances are unlikely to allow regular consumption of video content such as TV series and sports events;
- ix) In relation to Openreach's submissions regarding the effect of 4G roll-out in other countries on fixed line penetration, we are reluctant to draw strong conclusions from this as market conditions may be different to those in the UK. For example, the 800MHz LTE licenses awarded in Germany required all mobile operators to first deploy LTE networks in rural areas that are insufficiently covered by fixed broadband.¹⁰⁴⁹ In contrast, only one LTE license awarded in the UK had coverage obligations, which nevertheless do not require build out in rural areas first.¹⁰⁵⁰ Indeed, we understand that MNOs have started rolling out LTE primarily

¹⁰⁴⁵ Figure 1.6, 2013 CMR; 74% of all internet users identified a Laptop or a Desktop as their most important device for connecting to the internet.

¹⁰⁴⁶ Page 53, 2013 CMR. This is further supported by the fact that three-quarters (76%) of tablet owners who connect to the internet say they only use WiFi, while one-fifth (22%) use both WiFi and 3G connections. Although some of these may be using public WiFi connections, the data suggest that most internet connectivity is via a home WiFi connection. In total just under half (46%) of tablet owners claim to have a 3G-enabled device but less than half of these (20% of tablet owners) have a mobile subscription enabling their 3G connection.

¹⁰⁴⁷ For example, the TV series 'House of Cards' is available only to Netflix customers over broadband connections.

¹⁰⁴⁸ BBC, *Champions League: BT Sport wins £897m football rights deal*, 9 November 2013, <http://www.bbc.co.uk/sport/0/football/24879138>

¹⁰⁴⁹ GSMA Intelligence, *Germany rolls-out LTE to rural areas*, 2 June 2011, <https://gsmaintelligence.com/analysis/2011/06/germany-rolls-out-lte-to-rural-areas/283/>

¹⁰⁵⁰ One of the 800MHz LTE licences came with a coverage obligation that "users in an area within which 98% of the UK population lives should be able to receive a 2Mbps mobile broadband service both outdoors and at some indoor locations within the vast majority of premises, provided that there are few other users using the service simultaneously in the vicinity" (Ofcom, *Assessment of future mobile competition and award of 800 MHz and 2.6 GHz - Statement*, 24 July 2012, <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/statement.pdf>)

in urban and sub-urban areas, first.¹⁰⁵¹ Potential differences between EU countries are also evident in Analysys Mason's 'Western European telecoms market: trends and forecasts 2013–2018', referred to by BT. While fixed voice penetration in most EU countries, including Germany, is forecast to continue declining until 2017, Analysys Mason forecasts fixed voice penetration in the UK to increase by 2.5% between 2013 and 2017; and

- x) Differences in consumer behaviour across EU countries have also been recognised in empirical evidence. L. Grzybowski and F. Verboven have analysed data from 133,825 households in 27 EU countries to study the substitution and complementarity between Fixed-line and Mobile Access (the 'Verboven paper').¹⁰⁵² Their study highlighted that there is substantial heterogeneity across countries. In particular, their analysis supports the conclusion that "In the UK, Luxembourg and Slovenia, both technologies are independent from each other", that is, in these countries mobile and fixed services are not substitutes. In the same paper, they recognise that while mobile and fixed voice services are generally substitutes, the same is not true for fixed and mobile broadband internet access.¹⁰⁵³

Evidence from survey reports

A24.69 We have also considered the survey evidence contained in the Sweeney Pinedo report submitted by Openreach. As noted above, Openreach claimed that this survey evidence suggested a potential three percentage point increase in mobile-only households over the next three years.

A24.70 Our initial analysis of the survey report revealed that, while the data sample and initial take-up figures are broadly comparable to those in the Ofcom 2013 CMR data, there were some points where we thought clarification from Openreach was required.¹⁰⁵⁴

A24.71 In order to further inform our analysis we submitted clarification questions to Openreach, based on our concerns. We further requested the list of survey

¹⁰⁵¹ While it is not easy to clearly map urban, suburban, and rural areas, looking at LTE coverage maps (for example <http://ee.co.uk/ee-and-me/network/4gee/coverage-checker>) it appears that current LTE deployments cover primarily cities, towns, and their surrounding areas.

¹⁰⁵² Grzybowski, L. and Verboven, F., *Substitution and Complementarity between Fixed-line and Mobile Access*, Net Institute, September 2013,

http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2335696 (the 'Verboven paper').

¹⁰⁵³ Page 19 of the Verboven Paper mentions that "while households consider that fixed-line and mobile voice services are intrinsically substitutes, they become complements once they are combined with the adoption of fixed broadband internet access".

¹⁰⁵⁴ More particularly: it was not clear whether the data referred to household or individual take-up of services; it was not clear whether interviewees understood that fixed broadband requires a fixed line connection, an issue recognised also by Sweeney Pinedo; we were unable to derive some intermediate results and the final results from the information that was available in the report; we felt that questions on "likelihood to purchase, switch, or cancel" do not give reliable results as they reveal stated, rather than actual, behaviour and therefore that only strongly positive responses should have been considered; an assessment of the likelihood that the price/quality propositions on which the survey was based would be available in the market was missing from the analysis and we felt that it was likely to be very low, reducing the relevance of the end results; we felt that analysis on the net change in mobile-only households, considering also those households that are currently "mobile-only" and are likely to adopt fixed line services, was missing; and, we felt that there was value in seeing the exact questions asked to the interviewees to better understand if they were sufficiently clear.

questions. Our questions and BT's responses are published on our website, along with the survey questionnaire.¹⁰⁵⁵ ✂.

A24.72 Of particular concern is that there has been no attempt to assess the likelihood of the scenarios presented to consumers actually occurring. It is not clear that the scenarios presented are realistic or whether they are unlikely to actually happen – the scenario with the lowest propensity for consumers to switch involved a £5 price premium for 4G services, which may be smaller than the actual price premium in the forecast period.

A24.73 While the survey results presented attempted to measure the likelihood for households to drop their fixed line due to the availability of 4G, we understand that there also exists an opposite trend where households that rely solely on mobiles may decide to adopt fixed line services. For the purposes of our forecasts it is the net change between these two categories of households that is of interest.

A24.74 We asked Openreach to clarify whether the survey measured the likelihood that current mobile-only households might adopt a fixed line service in the future. Openreach confirmed that the survey asked a relevant question and presented us the results showing that 17% of those respondents who were identified as "mobile-only" said they are very or fairly likely to get a landline at home "in the next year or so". Given that 15% of respondents were identified as "mobile-only", Openreach's results suggest that there is likelihood that approximately 2.6% of the UK population may take up fixed line services in the next year or so.¹⁰⁵⁶ This is very similar to the percentage of the UK population that Openreach claims are likely to drop their fixed services during this control period. Responses to this question therefore suggest that new fixed subscriptions could offset reductions due to mobile substitution, which does not support Openreach's arguments for a net increase in the percentage of mobile-only households.

Definition of "mobile-only" households

A24.75 By "mobile-only" households we are referring to those households that do not use a fixed line either for voice, or for internet access purposes.

A24.76 In the July 2013 LLU WLR Consultation we used data on mobile-only households reported in the 2013 CMR for the period 2008-2013. The results presented in the 2013 CMR are based on an annual survey of households, where the presence of a fixed line is determined by asking respondents to indicate if there is "*a landline phone in [their] home that can be used to make and receive calls*" (emphasis added). Sweeney Pinedo used the same question to identify mobile-only households. We had previously assumed that all consumers who have a fixed line (landline) in their home would have responded positively to this question, since such connections can generally be used for voice services, even if the interviewees do not have a phone connected. However, in the course of analysing the raw survey data submitted by BT we identified that a proportion of those who were identified as "mobile-only" had also said that they have access to fixed internet at

¹⁰⁵⁵ Ofcom, *BT's response to the clarification questions on Sweeney Pinedo's Fixed and Mobile Research report*, <http://stakeholders.ofcom.org.uk/consultations/llu-wlr-cc-13/bt-response/>

¹⁰⁵⁶ The estimated percentage of UK households that may take up a fixed line (15% of respondents identified as mobile-only * 17% which said they are likely to get a landline at home = 2.6%) is presented at higher level of accuracy than would normally be reported as a survey result. Typically this number would be rounded to the nearest integer (3%) to avoid false accuracy. We understand that the figures presented in Openreach's report are also subject to sampling error margins.

home which is not through a dongle or mobile device.¹⁰⁵⁷ In particular, of the 257 respondents who were identified as “mobile-only”, 8 did not have fixed internet or said they only had mobile internet at home.¹⁰⁵⁸ We consider this latter group to constitute a “mobile-only” household for the purposes of our analysis.

- A24.77 Having identified this discrepancy, we performed similar analysis on the raw survey data used for the CMRs for the years 2009 to 2013. This identified similar inconsistencies, in that a number of respondents who were identified as “mobile-only” had indicated that they have a fixed internet connection at home.¹⁰⁵⁹ The amended analysis shows that the percentage of households that do not have a fixed line either for voice or internet access has declined at a steady rate over the last three years. These results suggest that the percentage of households with a fixed line has actually increased, driven by fixed broadband take up.
- A24.78 Our findings are consistent with other survey data available. We analysed data from the Target Group Index survey (‘TGI’) looking at the percentage of respondents who said they do not have a fixed landline, excluding those who said they access the internet regularly at home and identified fixed ISPs as their service providers. The results are similar to the CMR data in that this percentage of households has been declining in the last three years. Similarly, Analysys Mason reports broadly stable fixed voice penetration in the UK between 2011 and 2013 but a strong increase in fixed broadband penetration over the same period.¹⁰⁶⁰ In the same report Analysys Mason forecasts a steady increase of 0.3% per annum in fixed voice penetration in the period to 2018, while it forecasts fixed broadband penetration to increase by 8% in the same period and to overtake fixed voice penetration after 2016.
- A24.79 Figure A24.2 compares the percentage of households that are identified as “mobile-only” in table 5.52 of the 2013 CMR (those households that use only mobile for voice services) against our updated estimations which counts only those households that rely on mobile for both voice and data. We also present the percentage of mobile-only households estimated using the TGI data, for comparison.

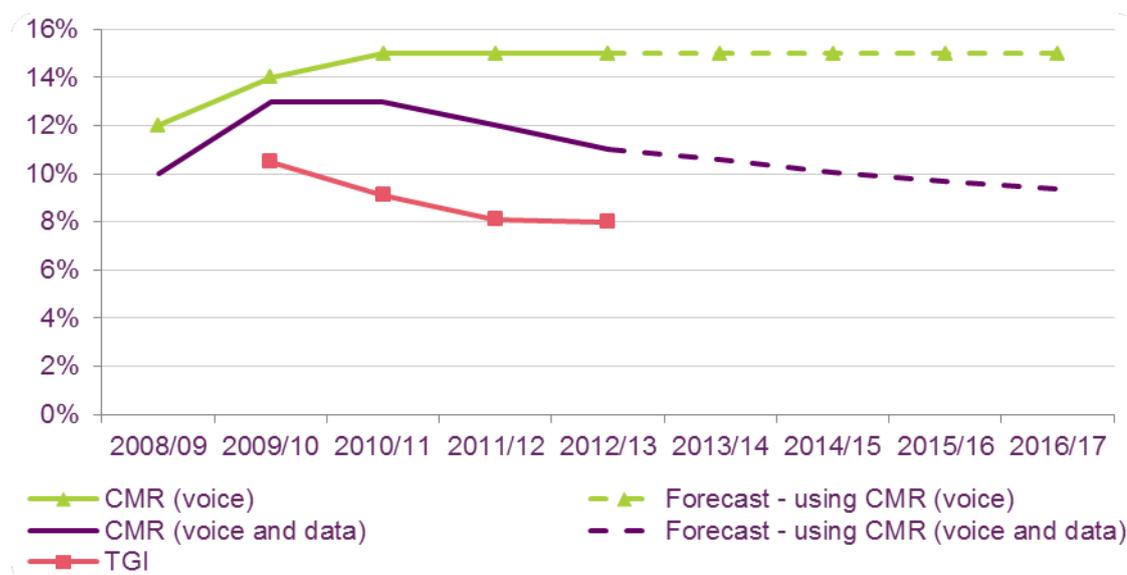
¹⁰⁵⁷ Question Q12 in the Sweeney Pinedo survey asked “Do you have internet at home that is not through a dongle or mobile?”

¹⁰⁵⁸ We counted respondents identified as types 1,4 or 1,6 or 1,6,8 as listed in the Openreach questionnaire key document (http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/sweeney/Attachment_2_Openreach_questionnaire_key.pdf).

¹⁰⁵⁹ We cross checked those identified as “mobile-only” against their response to the question “QE1. Which of these methods does your household use to connect to the internet at home? (Multicode)”

¹⁰⁶⁰ Analysys Mason, *Fixed voice and broadband in Europe: forecasts 2013–2018*, as updated on 10 February 2014, reports that fixed voice penetration changed from 84.3% to 84.8% between 2011 and 2013. In the same period fixed broadband penetration increased from 72.7% to 79.9%.

Figure A24.2: Comparison in the estimate of the percentage of mobile-only households



Source: Table 5.52, Ofcom 2013 CMR; Kantar Media, Target Group Index survey; Ofcom calculations

A24.80 In light of the above, we now base our forecasts on the trend in the proportion of mobile-only households excluding those with fixed internet access. We extrapolate recent trends to 2016/17, in a way that is consistent with reaching steady state fixed line penetration by 2025/26. We continue to use data collected for the 2013 CMR, though now count only those households that rely solely on mobile connectivity for both voice and data services. We chose to use the CMR data instead of TGI as the questions asked for the CMR are more closely aligned with our definition of “mobile-only households” than the questions asked in the TGI.¹⁰⁶¹

A24.81 In its response, TalkTalk requested that we provide the percentages on mobile-only households with accuracy of one decimal point. We have not done so as the survey results published in the CMR have an error margin in the region of plus or minus two percentage points.¹⁰⁶² Using survey data rounded to one decimal point for our calculations, as suggested by TalkTalk, would therefore not lead to more accurate forecasts, but rather would be more likely to lead to false precision.

A24.82 Finally, the point made by our Director of Research in the quote attributed to him was in the context that due to connectivity speeds smartphones have not been able, so far, to replicate the broad range of functions that fixed broadband can provide. He suggested that we may start seeing smartphones, connected via 4G, being used instead of devices connected via fixed broadband *for some uses and applications*, such as social networking and transactions. He was not suggesting that 4G will be an alternative to a fixed access line as a broadband delivery system, more broadly.

¹⁰⁶¹ Question QE1 of the Technology Tracker, as reported in the 2013 CMR, distinguishes specifically between fixed and mobile internet access.

¹⁰⁶² All statistics drawn from sample surveys have a level of uncertainty, defined by the sample error margin. The error margin is affected by several parameters, including the size of the sample used in the survey and the weighting applied.

Conclusions

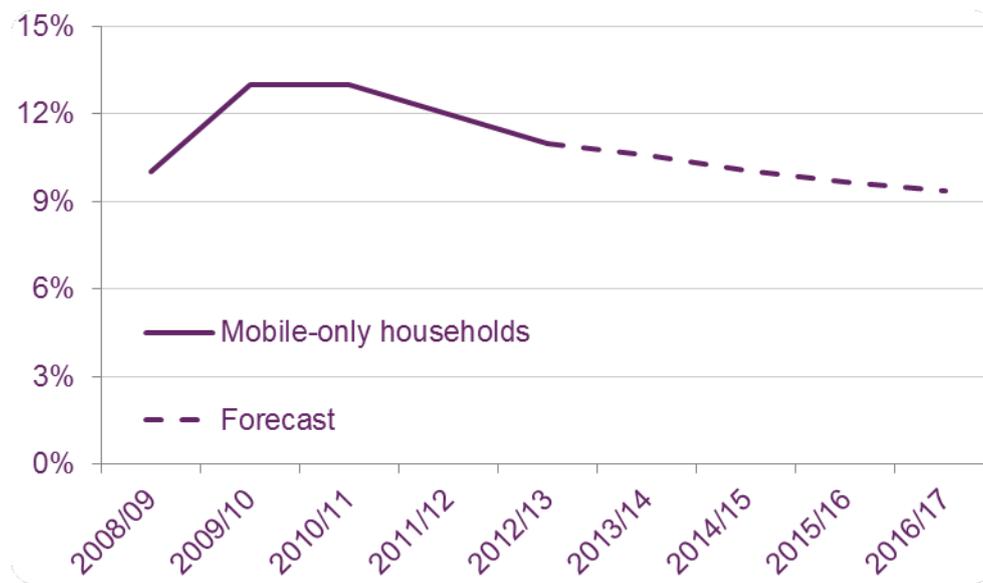
A24.83 In the light of the above, we consider that we should continue to project the share of households which are mobile-only on the basis of past trends, and we do not assume that this trend will change as a result of LTE roll-out. We consider that this is broadly consistent with analysts’ forecasts, as discussed in paragraph A24.78. In addition, closer analysis of the survey results reported by BT revealed that they are consistent with our view that switching from fixed to mobile is likely to be offset by mobile-only users getting a fixed broadband line, with no net effect on the trend of the percentage of mobile-only households.

A24.84 However, as noted above, we have revised our forecast of mobile-only households to take account of those respondents (in the CMR survey data) that claim not to have a landline but who claim to have access to fixed broadband. We believe these are not truly mobile-only households. When these are allowed for correctly, the data show that there has been a steady decline in mobile-only households over the past three years, driven by increased broadband take-up.

A24.85 We forecast this decline to continue over the review period and, for consistency with the forecasting approach followed generally in the model, we do so using a three year moving average growth rate with a dampening factor.

A24.86 Figure A24.3 below shows our forecast of the share of mobile-only households.

Figure A24.3: Forecast of the share of mobile-only UK households



Source: Ofcom calculation

Number of residential households

A24.87 In relation to EE’s comments on the DCLG forecasts, we believe that EE has misunderstood the 100,000 target for net immigration by 2015 to be the level of immigration assumed for the production of the DCLG’s projections. We discussed this issue further with the DCLG. DCLG told us that this is not the estimate of net immigration used in its projections. The DCLG has confirmed that it has based its projections solely upon ONS population projections.

- A24.88 We do not agree with EE's proposal that the DCLG projections of household numbers should be adjusted to include conversions and re-instatement of existing dwelling stock. The DCLG projections are based on long-term demographic trends, and are not adjusted to reflect supposed limits on the available housing stock. They are based on trends of household formation, and so will indirectly account for any restrictions on household formation from dwelling stock only in as much as this has been seen in the outturn data. The proposed modification would only be appropriate if we believed that the DCLG's projection had been incorrectly (and excessively) reduced to account for the number of available dwellings. The data has not been adjusted in this way, and so we consider that the proposed modification would be inappropriate to the method used by the DCLG to create its household projections.
- A24.89 We agree with Openreach that the DCLG projections of households used to generate the forecasts in the July 2013 LLU WLR Consultation document were based on an overestimate of net migration, as shown in the most recent data published by the ONS.¹⁰⁶³ As the DCLG projections are directly based on (earlier) ONS population projections¹⁰⁶⁴, we have made an adjustment to our forecast to account for the slower projected rate of growth.¹⁰⁶⁵ This is explained in more detail in paragraph A24.99.
- A24.90 We do not agree, however, with Openreach's submission that the uncertainties involved in forecasting household growth mean that our forecasts should instead be based on dwellings, even after adjusting for conversions, demolitions and vacant properties. Whilst Openreach has responded to the objections to a forecast based on dwellings identified by the Competition Commission in the 2012 appeal, to do this Openreach has brought together data and forecasts from different sources which are of uncertain robustness and consistency.¹⁰⁶⁶ We would be concerned that each of these adjustments could introduce additional complexity, uncertainty and scope for inconsistency and error. We therefore prefer the DCLG forecasts.
- A24.91 In addition, we consider that an approach like Openreach's, which remains in essence a projection of dwellings supply, could only be used if this were done in an internally consistent way. The approach we proposed to adopt is internally consistent in that we calculate historic lines per household, trend that forwards, and multiply the forecast of lines per household by our forecast of household numbers. All households are included in the historical data, whether or not they are formed in permanent homes (for example those formed as a second household within an existing property are included). Hence, even if it were true that certain households (such as those not able to form in new, permanent homes, or those in communal housing) had a low propensity to take fixed lines, this would already be reflected in

¹⁰⁶³ ONS, *National Population Projections, 2012-based Statistical Bulletin*, 06 November 2013, <http://www.ons.gov.uk/ons/rel/npp/national-population-projections/2012-based-projections/stb-2012-based-npp-principal-and-key-variants.html>

¹⁰⁶⁴ ONS, *Interim 2011-based subnational population projections for England*, 28 September 2012, www.ons.gov.uk/ons/rel/snpp/sub-national-population-projections/Interim-2011-based/index.html

¹⁰⁶⁵ We have taken the interim 2011-based (published 28 September 2012) and 2012-based (published 6 November 2013) subnational population projections and applied the difference between the two on a pro-rated basis to the DCLG's households projection. Given that the 2011-based population projections are not available for all nations, we have based this adjustment only on the projections for England.

¹⁰⁶⁶ BT based its forecast on a forecast of Great Britain housing completions from *Leading Edge*, a consultancy in the construction industry, historic data from the DCLG's 'Net supply of housing, 2011-12' trended forward and marked up from England to UK and historic data from the DCLG's council tax records used to estimate the reintroduction of vacant housing, marked up from England to UK and held constant for the forecast period.

the calculated average number of lines per household. It would then be appropriate to combine this average with the forecast growth in residential households.

- A24.92 In principle, an internally consistent forecast of total line numbers could also be generated by combining a forecast of dwellings growth with a base year figure for lines per dwelling (rather than per household). However, combining a forecast of *dwellings* growth with a forecast of lines per *household*, as Openreach does, appears likely to produce an inconsistent result.
- A24.93 Moreover, the evidence from historical data does not support the case for adjusting the projection of households downwards to allow for a constraint on the supply of dwellings. In a paper on the DCLG projections of households, Holmans states that “The argument has been advanced from time to time that the number of households formed is governed by the number of dwellings there are for them to live in. Historical evidence – inter-Census increases in the dwelling stock and households – is against this hypothesis, from 1951 to 2001.”¹⁰⁶⁷
- A24.94 Holmans also suggests that growth in household numbers in the period up to 2011 may have been below the long-term trend partly “due to housing market causes and the state of the economy”. However, he assumes “that with time the housing market and the economy will recover” with household formation rates slowly recovering to trend, and rising above the DCLG projection, from 2016 onwards. This is consistent with the view that constraints, to the extent they exist, are likely to ease in future.
- A24.95 We have met with the DCLG in order to discuss their projections.¹⁰⁶⁸ It told us that adjusting from the long term forecast in order to account for short term restrictions or effects has historically proven not to be as accurate as the long term forecast has been. As such, it does not consider that including restrictions such as dwellings growth will improve the accuracy in forecasting households.
- A24.96 The DCLG also stated that its households projections are extensively used in Local Authority planning. As such, the future supply of dwellings is not independent of the DCLG’s projection of households, as a projection of excess demand for households may, for example, lead to the release of more land for development.

Conclusions

- A24.97 Having considered the alternative approaches suggested by stakeholders and having regard to further information received from the DCLG, we have concluded that the approach proposed in the July 2013 LLU WLR Consultation remains appropriate for the purpose of forecasting the volume of lines.
- A24.98 We have, however, updated the DCLG forecasts to take account of the most up to date ONS population projections.¹⁰⁶⁹ This is because the DCLG projection of total UK households is based upon the projection of total UK population produced by the

¹⁰⁶⁷ Page 14, A. Holmans, *New Estimates of Housing Demand and Need in England, 2011 to 2031*, T&CP Tomorrow Series Paper 16, September 2013,

http://www.cchpr.landecon.cam.ac.uk/Downloads/HousingDemandNeed_TCPA2013.pdf

Openreach also notes that “in the long-term households and dwellings move in broad correlation”.

¹⁰⁶⁸ Meeting with DCLG, 7 November 2013.

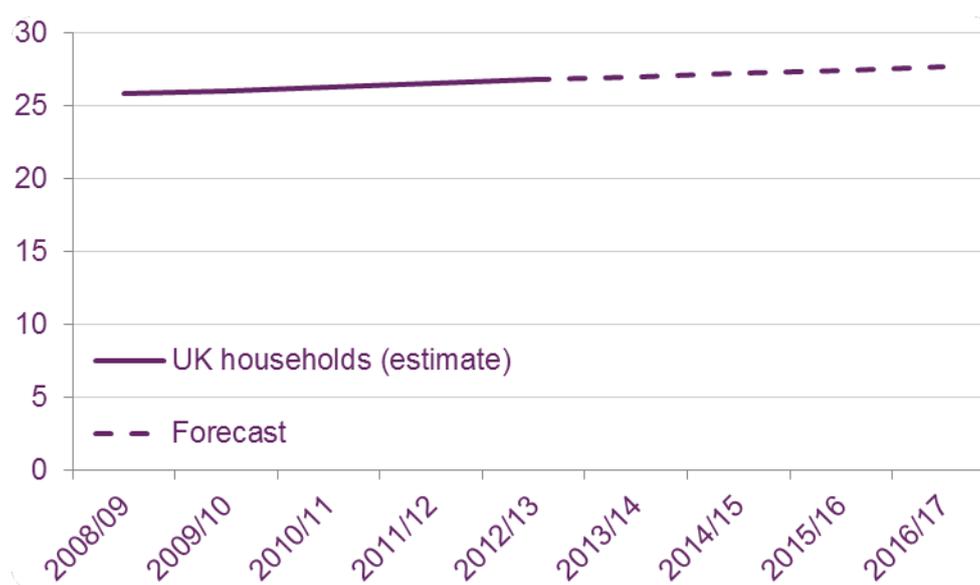
¹⁰⁶⁹ ONS, *National Population Projections, 2012-based Statistical Bulletin*, 06 November 2013, <http://www.ons.gov.uk/ons/rel/npp/national-population-projections/2012-based-projections/stb-2012-based-npp-principal-and-key-variants.html>

ONS.¹⁰⁷⁰ The latest ONS projections forecast a slower growth in total population over the forecast period. This reduction is primarily due to lower estimates of net migration and fertility in the near term.

A24.99 To do this we have taken the difference between the interim 2011-based population projection and the 2012-based population projection and applied it on a pro-rated basis to the DCLG's households projection. That is, we have taken the proportional decrease in projected population as a result of moving to the updated population projection and applied this proportion to the projection of total households in each of the forecast years.¹⁰⁷¹ The 2011-based population projections are not available for all nations of the UK, so we have taken the difference between the respective projections of population for England only, and applied this difference to the DCLG's projection of total households.¹⁰⁷² This has resulted in a reduction of total households in 2016/17 of 0.23 million (0.8%) as compared to the original forecast. The adjusted forecast is that total households will increase to 27.6 million by 2016/17.

A24.100 We expect the overall increase in households to flow through to an increase in the number of fixed lines.¹⁰⁷³ Our forecast of UK residential households is given in Figure A24.5, below.

Figure A24.5: Forecast of UK residential households



Source: Ofcom calculations

¹⁰⁷⁰ ONS, *Subnational population projections – interim 2011-based*,

<http://www.ons.gov.uk/rel/snpp/sub-national-population-projections/Interim-2011-based/index.html>

¹⁰⁷¹ We believe that a pro rata adjustment is consistent with the method used by the DCLG to generate the original projections.

¹⁰⁷² This implicitly assumes that the same changes in population for England apply proportionally to the rest of the UK.

¹⁰⁷³ We assume new households have the same propensity to use an Openreach line as existing households.

Number of business sites and lines

A24.101 In relation to Openreach’s point regarding forecasting the number of business sites, we do not consider that it would be appropriate to forecast business sites based solely on the trend from the past three years, given the evidence that the economic climate is improving. In its response, Openreach “... recognises that the consensus view is for GDP growth to return and improve over time...”¹⁰⁷⁴, although it disagrees with our approach to reflecting this growth in our forecasts. However, it does not suggest an alternative approach. As some positive effect is to be expected from the return of the economy to growth, we consider that an approach that includes some effect for economic growth is superior to one of not allowing for any effect.

A24.102 In relation to the submissions regarding the importance of VoIP over the charge control period, we consider that it is difficult to forecast with accuracy what effect businesses adopting VoIP technology may have on the total number of business lines. This was reflected in the submissions of stakeholders: BT argued that it would reduce the number of business lines while one confidential respondent ☒ argued that businesses would maintain a copper line for resilience.

A24.103 Notwithstanding one confidential respondent’s ☒ experience, the evidence suggests that sufficient businesses are switching to VoIP for a declining overall trend in fixed lines for businesses to be observed. Our projection is consistent with observed trends, and one confidential respondent ☒ has not provided any evidence to suggest that there will be a reversal of this trend. The decline is however fairly modest as an annual rate, so is not necessarily inconsistent with one confidential respondent ☒ experience of “many businesses” in any case.

Conclusions

A24.104 We remain of the view that the evidence indicates that business lines appear to be in long term decline. This decline is likely to be driven by both a change in the number of sites¹⁰⁷⁵ and a trend to fewer lines per site as, for example, fax machines are removed, or as businesses now use IP solutions over a broadband connection rather than multiple telephone lines. In order to try to separate these two factors in our forecasts we have considered separately the trend in the number of business sites and the trend in the number of lines per business site.

A24.105 We believe it would be wrong to forecast the number of business sites based solely on the trend from the past three years, as the number of business sites is likely to be linked to changes in the economic climate. It seems reasonable to expect some positive effect from the economy returning to growth, and so to inform our projection, we have used the most recently available externally produced and published GDP forecast from the OBR.¹⁰⁷⁶ We have used historic data on the number of registered SME business sites published by BIS¹⁰⁷⁷ to inform the starting point for our forecasts.

¹⁰⁷⁴ Paragraph 56, Openreach Response to the July 2013 LLU WLR Consultation.

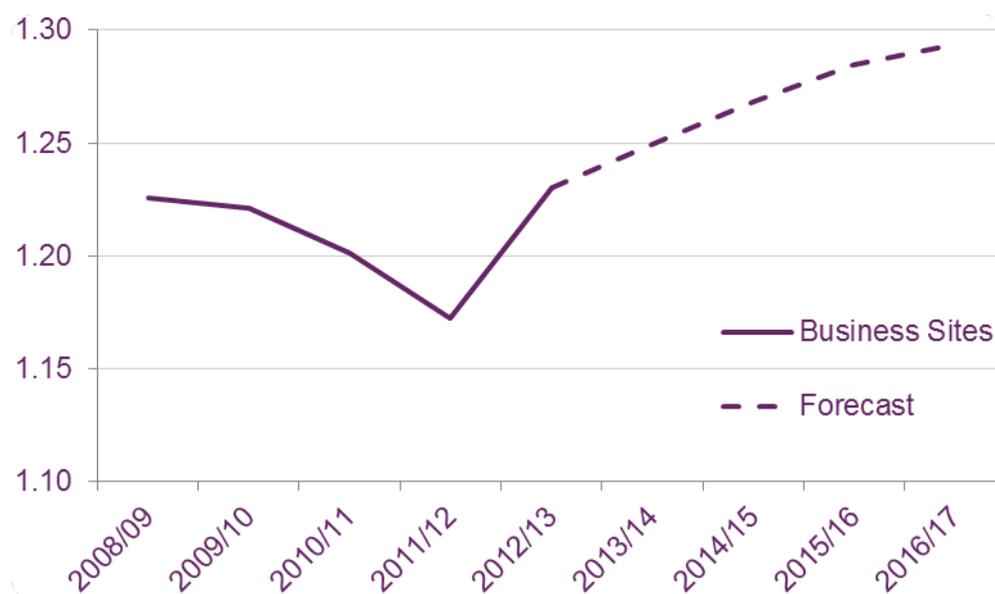
¹⁰⁷⁵ BIS, *Business population estimates*, <https://www.gov.uk/government/organisations/department-for-business-innovation-skills/series/business-population-estimates>

¹⁰⁷⁶ Chart 3.17 (Forecasts of the level of GDP), OBR, *December 2013 Economic and fiscal outlook: Charts & Tables*, December 2013, <http://budgetresponsibility.org.uk/pubs/December-2013-EFO-Charts-and-Tables2.xls>, which forecasts GDP to grow by 10.6% over the review period, which represents a compound average growth rate of 2.6%.

¹⁰⁷⁷ BIS, *Business population estimates*, <https://www.gov.uk/government/organisations/department-for-business-innovation-skills/series/business-population-estimates>

A24.106 Figure A24.6 shows our business sites forecast. New data which have become available since the July 2013 LLU WLR Consultation show that the historic decline in the number of business sites has been reversed, and we now predict business sites to grow over the forecast period, though at a slowing rate. This reflects, firstly, the effect of the GDP forecasts referred to above and, secondly, the dampening factor as discussed in paragraph A24.11, above.¹⁰⁷⁸ The assumed change in GDP is smaller in later years and this, combined with the dampening factor, means that the change in business sites tends to level off.

Figure A24.6: Forecast number of business sites (Millions)



Source: BIS business population estimates; Ofcom calculations

A24.107 The number of lines per business site has been in decline, and research has suggested that business users are more likely (than households) to substitute away from multiple fixed lines to mobiles and VoIP (over a single connection).¹⁰⁷⁹ As we consider that the underlying causes of the trend in business line numbers are likely to remain relevant over the period of this charge control, we base our forecasts on extrapolating the trend. We use a three-year moving average to capture recent movements without being unduly influenced by very short-term fluctuations. We have therefore forecast the number of copper lines per business to reduce by 12.1%, from 3.16 lines per business site in 2012/13 to 2.78 in 2016/17.

A24.108 This decline is steeper than the forecast in the July 2013 LLU WLR Consultation. This is due to the additional year of data included in our forecasts, which showed a rise in business sites against a continued fall in business lines. Because of this, there was a drop in lines per business site which has been included in our forecast. Figure A24.7 shows our business lines forecast.

¹⁰⁷⁸ An assumption of a constant rate of increase in business site numbers would not be plausible over the longer term.

¹⁰⁷⁹ Page 278, Ofcom, *Communications Market Report: UK*, 4 August 2011, http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr11/UK_CMV_2011_FINAL.pdf

Figure A24.7: Forecast number of business lines (Millions)



Source: Ofcom calculations

Cable

A24.109 Stakeholders did not comment on our proposed approach to competition from cable. We have maintained our approach from the July 2013 LLU WLR Consultation. We continue to forecast that Virgin Media's customer base will change in line with the forecast growth rate for UK residential households. We also continue to assume that competition from cable will not impact the number of Openreach provided lines we project, and thus that the net churn between copper and cable will be zero.

NGA rollout

A24.110 Stakeholders did not specifically comment on this aspect of our proposals. We have maintained our approach from the July 2013 LLU WLR Consultation, which is to forecast the number of copper lines as if there is no deployment and take up of NGA, as the Cost Model is based on a hypothetical on-going copper network. We allocate a copper equivalent line for every FTTx connection, specifically to WLR and SMPF volumes for FTTx purchased by BT Wholesale and to MPF volumes for FTTx purchased by CPs which use MPF.

Fixed lines per household

A24.111 EE argued that the fact that the proportion of fixed and fixed-and-mobile households has been flat for two years means that we should have included a scenario representing a higher projection of fixed lines per household.¹⁰⁸⁰ However, fixed lines per household may be falling while fixed line penetration remains flat if the fall in fixed lines per household is caused by households disconnecting second lines, as we proposed in the July 2013 LLU WLR Consultation.¹⁰⁸¹ We continue to believe that this is the cause of the decline and reflect it in our volume projections.

¹⁰⁸⁰ Page 34, EE Response to the July 2013 LLU WLR Consultation.

¹⁰⁸¹ Paragraph A8.45, July 2013 LLU WLR Consultation.

A24.112 In principle, we agree that some upside and downside sensitivities could have been devised for the number of fixed lines per household. However, it was necessary to keep the total number of scenarios manageable and to limit the range of volume forecasts to a level which would be helpful to respondents, and give them a reasonably precise guide to our proposals. For this reason, we did not run every possible sensitivity in the July 2013 LLU WLR Consultation.

Conclusions

A24.113 We have based our forecast of fixed lines per household on past trends using the method set out in both the July 2013 LLU WLR Consultation and the December 2013 LLU WLR Consultation. Having considered stakeholder responses, we believe this approach to be the most appropriate.

A24.114 The changes we have made in how we measure mobile-only households (see paragraphs A24.75 to A24.79) have had an impact on our forecast of fixed lines per household, as we now believe there to be more households with access to a fixed service than we believed at the time of the July 2013 LLU WLR Consultation.

A24.115 As discussed above, we have disaggregated total households into mobile-only households and households with a fixed line. This approach allows us to predict the number of copper lines per household that receive a fixed service. Continuing the current three-year trend we forecast the number of Openreach lines per household with a fixed service to decline by 1.9% over the forecast period, from 0.86 lines per household in 2012/13 to 0.85 in 2016/17.

A24.116 We believe this trend to be driven by households disconnecting second lines, as IP-based services over a fixed broadband connection substitute for dedicated dial-up access lines or fax lines. We have also cross-checked the implied number of fixed lines per household with a fixed service (including both Openreach lines as well as lines from cable) to make sure that this does not fall below one in our forecast.¹⁰⁸² In the review period, total fixed lines per household with a fixed service remains above one, and if extrapolated into the long term it reaches a steady state value just above one line per household with a fixed service, which is consistent with our view that households will continue to remove second lines.

Market shares during the forecast period

A24.117 Stakeholders did not comment on this aspect of our proposals. We have maintained our approach from the July 2013 LLU WLR Consultation. We continue to assume that in the period covered by this review the broadband market shares of BT (at the wholesale level), Sky and TalkTalk will remain at their current levels.¹⁰⁸³ In other words, growth in broadband penetration is captured according to current wholesale market shares. We consider that this is a reasonable assumption since market shares depend on a number of factors which are difficult to predict. Furthermore,

¹⁰⁸² Clearly, the average number of fixed lines per household *with a fixed line* cannot be less than one.

¹⁰⁸³ At the upstream level, we consider that there are very high entry barriers to constructing on a significant scale a local access network independent of BT's network. Entry on a significant scale would be extremely risky and deployment would require a considerable period of time. Hence we would not expect entry into the wholesale local access market during the charge control period to result in significant changes to BT's market share. However, market shares cannot be predicted with precision, and the threat of entry and changes in market shares due to competition are part of the normal commercial risk faced by BT and are consistent with the principles on which the charge control is set. Due to the inherent uncertainty we continue to assume stable market shares as the most reasonable position for this charge control period.

recent market share trends may not be a good guide to the future. One reason is that, although the roll-out of LLU by some CPs has previously helped these LLU operators to gain market share, for the period covered by this forecast further market share changes due to LLU roll-out are unlikely to be material as the LLU roll-out programme is mostly complete.

LLU rollout

A24.118 Stakeholders did not comment on this aspect of our proposals. Since 2006 there has been significant LLU unbundling and take up. However the pace of unbundling has slowed as larger exchanges, where economies of scale are strong, have already been unbundled. Our data shows that in July 2006 Principal LLU operators (POs) had unbundled 720 exchanges in total covering 46 per cent of UK premises¹⁰⁸⁴, while in December 2010 POs had unbundled in total 2,141 exchanges, covering 87.1 per cent of UK premises.¹⁰⁸⁵ Our recent data shows that in December 2012 \times exchanges were unbundled by at least one PO, covering 93 per cent of UK premises.¹⁰⁸⁶ We understand that POs have committed plans to roll out services to an additional \times exchanges where BT is currently the only provider, increasing their total coverage by less than \times . POs also have uncommitted roll out plans for an additional \times exchanges which would only increase their coverage by \times of UK premises.

A24.119 The evidence presented above suggests that LLU rollout has peaked and we expect very limited rollout to take place in the period of this charge control. Even if the uncommitted roll out plans are implemented, they will have a small effect on our volume forecasts.

Churn rate

A24.120 Stakeholders did not comment on this aspect of our proposals. Some of the forecast service volumes are driven by customers switching between service providers, described by the churn rate. For example, this factor is a driver of the volume of migration services.

A24.121 In line with our assumption of stable market shares we assume that the average churn rate over the period of this charge control is the same for all providers. Different churn rates would suggest that market shares gradually change over time as CPs with higher churn lose more customers than they gain.

A24.122 We have maintained our approach from the December 2013 LLU WLR Consultation. In our analysis we use a common churn rate for all CPs of 15% per annum, over the forecast period. This is intended to be representative of average

¹⁰⁸⁴Table A3.4, Ofcom, *Review of the wholesale broadband access markets 2006/07. Identification of relevant markets, assessment of market power and proposed remedies - Consultation*, 21 November 2006, <http://stakeholders.ofcom.org.uk/binaries/consultations/wbamr/summary/wbamr.pdf>

¹⁰⁸⁵Paragraph A3.25, Ofcom, *Review of the wholesale broadband access markets. Statement on market definition, market power determinations and remedies*, 3 December 2010, <http://stakeholders.ofcom.org.uk/binaries/consultations/wba/statement/wbastatement.pdf>

¹⁰⁸⁶Section 4, Ofcom, *Review of the wholesale broadband access markets. Consultation on market definition, market power determinations and remedies - Consultation*, 11 July 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/summary/WBA_July_2013.pdf.

churn rates across operators and is intended to align our estimate of customer churn with that used in the Single Jumpered MPF Dispute.¹⁰⁸⁷

A24.123 We further assume that the probability that a churning customer switches to a particular service provider is determined by the relative market share of that provider. This process ensures market shares remain consistent during the forecast period (as the CP with the higher market share will have more churners leaving and also gain more churners from other CPs).

Sky's purchase of O2 Broadband

A24.124 On 1 March 2013, Sky announced that it had reached an agreement to purchase O2's broadband and fixed-line telephony business in the UK.¹⁰⁸⁸ Following the acquisition, O2's customers are to be gradually transferred to Sky's own network. O2 was the third largest LLU operator, having approximately 0.5 million customers on its SMPF platform.¹⁰⁸⁹

A24.125 We have maintained our approach from the July 2013 LLU WLR Consultation. In the volume forecasting model we assume that Sky will integrate O2's customers with its own SMPF base and will gradually migrate them to MPF. We do not explicitly model each individual LLU operator's number of SMPF customers. The forecast number of LLU SMPF customers remaining at the end of the forecast period represents customers of smaller LLU providers (those other than Sky and TalkTalk) who do not currently use MPF.

Openreach broadband penetration

A24.126 In relation to EE's comments, we disagree with the description of our forecast as being "broadly flat". In the July 2013 LLU WLR Consultation, the percentage of households taking a broadband line increased by around two percentage points per year in our base case. The same is true of our final volume forecasting model.

A24.127 Broadband penetration is an output derived from our forecasts of households and lines, rather than an input assumption of our model. EE has provided arguments that suggest that broadband penetration will rise over the forecast period, with which we agree. However, this rise is already reflected in our forecast at an appropriate level.

Conclusions

A24.128 We have forecast broadband penetration by forecasting Openreach broadband lines and total Openreach lines as set out in the July 2013 LLU WLR Consultation. Extrapolating the current trend using the three-year moving average with a dampening factor applied (as discussed above), we forecast in our base case scenario that the proportion of Openreach lines which are used for broadband will increase from 71% in 2012/13 to approximately 82% in 2016/17. This is higher than

¹⁰⁸⁷ See paragraphs 4.71-4.74, A1.83, Single Jumpered MPF Dispute Determination.

See also TalkTalk, *Preliminary Results*, presentation, 16 May 2013,:

<http://www.talktalkgroup.com/~media/Files/T/TalkTalk/pdfs/presentations/2013/preliminary-results-presentation-2013.pdf>

¹⁰⁸⁸ Sky, *Sky to acquire Telefónica UK's broadband and fixed-line telephony business*, 1 March 2013, http://corporate.sky.com/media/press_releases/2013/sky_to_acquire_telefonicas_uk_broadband_and_fixed_line_telephony_business#

¹⁰⁸⁹ According to Telefónica's quarterly results

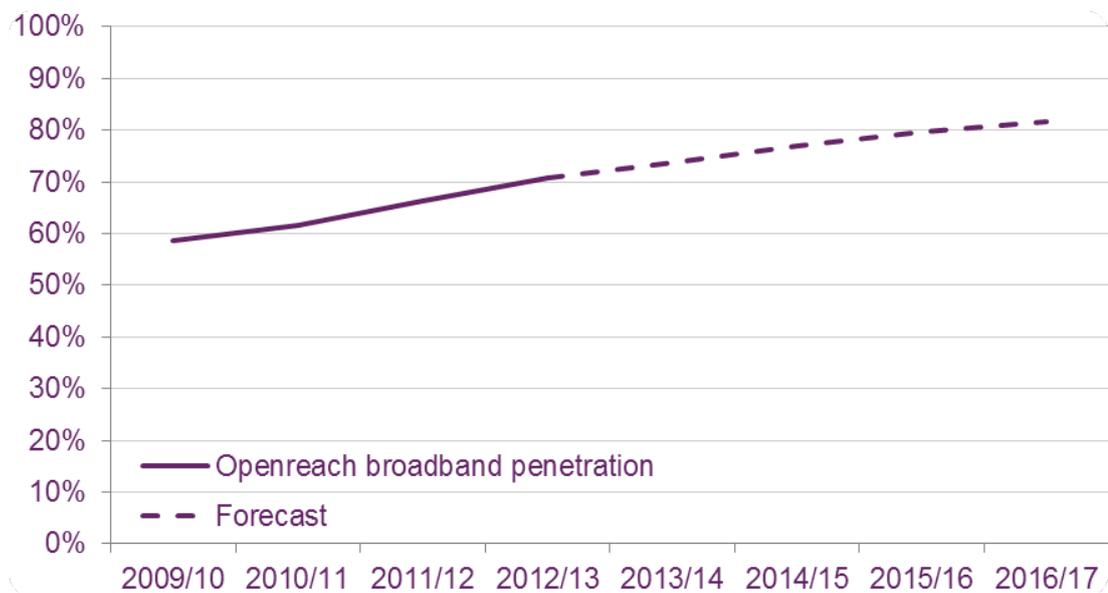
(http://www.telefonica.com/en/shareholders_investors/html/financyreg/resultados2013.shtml)

we forecast in the July 2013 LLU WLR Consultation, due to there being more MPF rentals in 2012/13 than we had forecast.

A24.129 In our calculations we have only considered broadband access provided by Openreach. As such, although not directly calculated, we implicitly forecast that Virgin Media’s broadband market share declines as it has fewer voice-only customers to upgrade to broadband.¹⁰⁹⁰ This is consistent with historical data, which shows a continuous increase in the number of fixed broadband lines over the past three years.¹⁰⁹¹

A24.130 Figure A24.8 shows our forecasts for the increase in broadband penetration on Openreach’s copper network.

Figure A24.8: Forecast Openreach broadband penetration



Source: Ofcom calculations

Split between MPF and WLR+SMPF

A24.131 DSL Broadband lines can be deployed on either MPF or SMPF.¹⁰⁹² SMPF was the platform of choice during the first few years of DSL. However, commercial and technical developments led the larger CPs to gradually adopt MPF.

A24.132 Currently, Sky and TalkTalk have customers on both MPF and SMPF but during the last two years they have been migrating their SMPF customers to MPF. BT, on the other hand, uses WLR+SMPF for both its wholesale and retail offerings.

A24.133 We have maintained our approach to the split between MPF and WLR+SMPF connections from the July 2013 LLU WLR Consultation. There are two key factors which determine this split:

¹⁰⁹⁰ But as discussed above in paragraph A24.109, it should be noted that Virgin Media’s share of total lines remains constant.

¹⁰⁹¹ For example, see Figure 4.17 of the 2013 CMR which shows that fixed broadband penetration has increased from 52% in 2006/07 to 72% in 2012/13.

¹⁰⁹² MPF allows the CP to offer both data and voice services, using a Multi-Service Access Node (MSAN) at the exchange. However when a CP uses SMPF, data services are provided by a Digital Subscriber Line Access Multiplexer (DSLAM) and voice services are provided separately via WLR

- a) the broadband market share of BT wholesale; and
- b) the rate at which LLU providers migrate their SMPF customers to MPF.

A24.134 In this Statement we explain that we have adopted revised proposals for bringing differences between the charges for MPF, WLR and SMPF into line with differences between their long run incremental costs. The differentials at the end of the control period will now be significantly smaller than proposed in the July 2013 LLU WLR Consultation. Other things equal, a change in the charge differential would be expected to affect CPs' choices between MPF, WLR and SMPF and hence projected volumes. In practice, we do not expect the change in the price differentials to materially affect forecast take-up of MPF and SMPF. Firstly, efficient migration to MPF will remain viable – and we estimate that existing decisions are likely to remain viable in the large majority of cases. Second, there are non-price advantages to using MPF. In light of the reasoning and analysis in Section 6, Volume 2, we have concluded that regulatory stability and predictability will not be undermined and the convergence in charges to the incremental cost difference is being phased in over the control period. We consider it unlikely that providers who already use MPF will substantially revise their plans for migrating their remaining SMPF subscribers to MPF. We assume that BT Wholesale's broadband market share remains static, at 50%, during the charge control period.

A24.135 Our data for the last three years show that the number of LLU SMPF lines has declined linearly.¹⁰⁹³ We expect this trend to continue, down from 2.5m in 2012/13 to 0.5m LLU SMPF lines in 2016/17. Finally, we estimate the number of MPF lines as the residual of the total number of broadband lines on the Openreach network less BT's wholesale broadband lines and LLU SMPF lines. Our forecast of the number of MPF lines in 2016/17 is 9.7m lines.

Ancillary services

A24.136 In relation to EE's criticisms of our forecasts of non-rental services, we note that, in fact, our approach was less simplistic than EE suggests. For each non-rental service we have attempted to identify the most appropriate drivers to use in our forecasts. Where it has not been possible to identify drivers accurately enough for the purposes of forecasting, and in the absence of other information, we have forecast these services by taking either the average or most recent proportion of a relevant rental service volume. EE has not suggested any specific improvements that could be made to individual non-rental forecasts.

A24.137 We have made updates to our volume forecasts of WLR conversions¹⁰⁹⁴, MPF bulk migrations¹⁰⁹⁵ and SMPF new provides¹⁰⁹⁶ as a result of further consideration of these services. These updates are explained below. Furthermore, we have now confirmed the robustness of our forecasts by ensuring that projections of rental, connection, migration and cease volumes are consistent with each other.

A24.138 We have reviewed our approach to forecasting MPF hostel rentals¹⁰⁹⁷ in light of Openreach's response. We agree that total MPF + external SMPF rentals is a

¹⁰⁹³ LLU SMPF lines are SMPF lines provided by non-BT LLU CPs for example Sky or TalkTalk.

¹⁰⁹⁴ See paragraphs A24.165 - A24.166.

¹⁰⁹⁵ See paragraphs A24.170 - A24.173.

¹⁰⁹⁶ See paragraphs A24.184 - A24.191.

¹⁰⁹⁷ The term "MPF hostel rentals" is used although LLU operators use the service for both MPF and SMPF lines. See paragraph A24.179 for further details.

superior driver of these volumes. Historically, hostel rental volumes have moved in quite close correlation with these line volumes, and intuitively it would make sense that hostel rentals increased if we forecast MPF room builds to be positive in the review period (as we do). See paragraph A24.179 for further detail on how we have produced our forecast volumes for this service.

Model error

A24.139 Openreach stated that changing forecast household numbers in the Ofcom volume model did not affect line volumes as it would have expected and suggested that this was due to a “modelling error”. However, the property of the model described by Openreach is not the result of an error but rather is intentional and reflects the fact that a change in household numbers affects the forecast of line volumes in two logically distinct ways, as we explain below. We have now increased the transparency of the model, so that the two effects are more clearly distinct within the model itself. However, we do not believe that this was in principle an error that required correcting.

A24.140 Openreach’s claim that reducing forecast households by 100,000 per annum should reduce forecast lines by c.76,500 lines per annum seems to be a straightforward application of an assumed constant number of lines per household to the change in the number of households. However, Openreach’s assumption of a constant number of lines per household was not valid because of the second effect in the Ofcom model.

A24.141 The logic flow in the model is as follows:

- i) Start with an estimate of historic numbers of households;
- ii) Combine this estimate with historic total residential lines to derive an estimate of historic lines per household, and calculate the trend;
- iii) Forecast lines per household based on this estimated historic trend; and
- iv) Finally, combine this forecast with forecast households to create a forecast of total residential lines.

A24.142 However, because we do not have a complete dataset of historic household numbers, data on household numbers for years immediately prior to the forecast period have necessarily been constructed by Ofcom. This part of the calculation proceeds as follows:

- i) Using the exogenous forecasts of population and household numbers, create a forecast of people per household;
- ii) Use this to create an estimate of historic people per household that is consistent with the forecast of people per household for years after 2011 and with the older past data which are available (for 2001);
- iii) Combine this with historic data on population to derive an estimate of historic household numbers.

A24.143 This results in the “feedback” effect noted by Openreach, and described by it as an “error”.

A24.144 To illustrate this, suppose the forecast of households is decreased by Openreach's hypothetical 100,000 households per year. There would be a "first round" effect on the projected number of lines, assuming a given number of lines per household. However, the decrease in the forecast number of households means we may also need to revise our view of the recent past trend in people per household, which we have to estimate. If our estimate of this trend is revised, there will be a "second round" effect on the projected number of lines, in addition to the first round effect.¹⁰⁹⁸

A24.145 In earlier versions of the model, this "second round" calculation was carried out automatically within the model. However, to improve the transparency of this part of our calculation we have revised the model slightly so that it now performs the calculations in two distinct stages which more clearly maintain the distinction between the forecast and the estimation of data for periods in the past. Hence we have now included people per household as an explicit input of our model. Where possible, these data are calculated from actual households and population data. Where data on UK households are not available, we have estimated people per household based on interpolating between 2001/02 and 2011/12.¹⁰⁹⁹ We have done so in a way that produces a smooth trend in people per household from its level in 2001/02 into the forecast from 2011/12.¹¹⁰⁰ It is important to note that this input, and as such the number of households that it implies, remains an estimate based on the forecast number of households.

A24.146 In addition, this revision to the model means that any given estimate of past data may only be consistent with the forecast of households on which it is based. In the event of a change, a second adjustment may then be required to ensure that the output of the model is a consistent projection of household and line numbers. It is for this reason that, when changing forecasts of households as part of our sensitivity testing (as explained in further detail in Annex 28, paragraph A28.8) we have associated estimates of historic people per household for each households forecast. These have been estimated such that they are consistent both with forecast people per household implied by the households forecast, and with the level of people per household in 2001/02.

Consistency with the Single Jumpered MPF Dispute

A24.147 The forecasts in the Single Jumpered MPF Dispute were produced to be consistent with the forecasting method proposed in the July 2013 LLU WLR Consultation, updated to take account of new data available at the time of the dispute determination and not including the assumption of a hypothetical copper-only network (as this assumption would not be appropriate to the circumstances of the dispute). Since the publication of the final determination of the dispute, further changes have been made to the volume forecasts for the LLU WLR charge control modelling based on new data and responses to the July 2013 LLU WLR

¹⁰⁹⁸ It is worth noting that Openreach's hypothetical reduction of 100,000 households per year, without a reduction in population forecasts, leads to a forecast of people per household that contradicts long-term historic trends. Were households and population to be changed simultaneously, the "second round" effects would be minimal as historic people per household would not change by as significant a margin (or at all, depending on the exact adjustment made to forecast population).

¹⁰⁹⁹ These are the closest years for which we have household data from the DCLG.

¹¹⁰⁰ Specifically, we have trended the fall in people per household backward from the forecast period in such a way that it reaches the same value in 2001/02 as can be calculated from historic data in that year (of around 2.407 people per household). Thus, our estimates of people per household are consistent both with historic data and with our forecasts.

Consultation and December 2013 LLU WLR Consultation. For these reasons, the two forecasts will not be identical and we would not expect them to be.

2012/13 volumes data from BT

A24.148 As discussed above, we have used our statutory information-gathering powers to obtain updated volumes data from Openreach.¹¹⁰¹ In some cases, the updated data has affected our forecasts despite the forecast method remaining the same. In summary, the affected forecasts are:

- i) WLR connections were lower in 2012/13 than we had forecast, by around 19%. This flows through in all forecast years.
- ii) WLR transfers were higher than we had forecast, counteracting a trend of strong decline. As such, using the same method we are now forecasting a slower decline in internal transfers and a mostly flat forecast in external transfers.
- iii) MPF new provides were higher in 2012/13 than we had forecast, by around 23%. This flows through in all forecast years.
- iv) MPF single migrations were lower in 2012/13 than we had forecast, by around 22%. This flows through in all forecast years.
- v) MPF room builds were higher in 2012/13 than we had forecast, by around 19%. This flows through in all forecast years.
- vi) SMPF migrations were lower in 2012/13 than we had forecast, by around 40%. This flows through in all forecast years.
- vii) MPF and SMPF hard ceases were higher in 2012/13 than we had forecast, by around 39%. This flows through in all forecast years.

Volume forecasts for specific services

A24.149 In this section we explain how we have prepared the volumes forecasts for the other (non-rental) services covered by the charge controls. Forecasting specific services is often difficult as these volumes can be affected by the complex interaction of various factors. Where possible we have forecast service volumes using computationally simple methods. For example where appropriate we extrapolate current trends. Alternatively, we forecast some ancillary service volumes using the historic average ratio of the volume of that service to the volume of the relevant line rental service.

A24.150 We have performed consistency checks to ensure that forecast connections, migrations and ceases ('flow' services) are consistent with changes in rentals ('stock') forecasts.

A24.151 Our forecasts are presented in table A24.3, together with the historic volumes information available.

¹¹⁰¹ Eleventh LLU WLR BT Information Request, 4 October 2013, and Twelfth LLU WLR BT Information Request, 11 October 2013

Table A24.3: Actual and forecast volumes for LLU and WLR services (millions)¹¹⁰²

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
WLR Rentals Total	22.20	20.69	19.40	18.29	17.44	16.57	15.81	15.12
WLR Basic Rentals Internal	13.73	12.25	11.42	10.61	10.24	9.73	9.28	8.88
WLR Basic Rentals External	3.18	3.13	3.19	3.20	2.85	2.71	2.58	2.47
WLR Premium Rentals Internal	3.61	3.49	3.03	2.81	2.78	2.64	2.52	2.41
WLR Premium Rentals External	1.68	1.83	1.76	1.66	1.57	1.49	1.42	1.36
WLR Basic Connections Internal	0.56	0.56	0.57	0.48	0.48	0.45	0.43	0.42
WLR Premium Connections Internal	0.41	0.33	0.32	0.25	0.27	0.25	0.24	0.23
Wholesale premium and basic analogue external service connections	0.72	0.74	0.53	0.42	0.51	0.48	0.46	0.44
WLR Start of Stopped MPF line	-	-	-	0.24	0.51	0.45	0.44	0.43
WLR Basic and Premium Transfers Internal	2.59	1.52	1.12	1.21	1.02	0.93	0.88	0.82
WLR Basic and Premium Transfers External	2.16	1.39	0.61	1.15	1.00	0.92	1.02	0.99
WLR Conversions	-	-	0.14	0.17	0.19	0.22	0.24	0.26
MPF Rentals	2.22	3.75	4.96	6.18	7.09	7.99	8.86	9.65
MPF New provides	0.04	0.63	1.20	1.75	2.01	2.27	2.51	2.74
MPF Single Migrations	0.96	1.22	0.77	0.64	0.67	0.70	0.73	0.75
MPF Bulk Migrations	0.62	0.10	0.41	0.17	0.21	0.26	0.34	0.41
MPF Ceases	0.45	0.65	1.16	1.25	1.44	1.62	1.80	1.96
MPF Hard Ceases	0.13	0.15	0.36	0.41	0.42	0.47	0.52	0.57
MPF Soft Ceases	0.32	0.50	0.79	0.84	1.02	1.15	1.27	1.39
MPF room build	6	15	15	20	19	7	6	4
MPF hostel rentals	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02
MPF Tie cables	-	-	1.26	1.28	1.31	1.34	1.37	1.39
SMPF Rentals	12.09	11.28	11.17	11.12	11.01	10.93	10.81	10.63
SMPF New Provides	3.00	2.72	2.57	2.03	2.01	2.00	1.98	1.94
WLR + SMPF Simultaneous	-	-	-	0.81	0.92	0.92	0.90	0.89

¹¹⁰² MPF room build is shown in units of hundreds.

	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16	2016/17
Connections								
WLR + SMPF Simultaneous Migration	-	-	-	0.62	0.71	0.80	0.89	0.97
SMPF New Provide on Existing WLR Line	3.00	2.72	2.57	0.61	0.38	0.28	0.19	0.09
SMPF Single Migrations	0.32	0.39	0.31	0.16	0.20	0.15	0.10	0.05
SMPF Bulk Migrations	0.10	0.20	0.40	0.03	0.02	0.02	0.01	0.01
SMPF Ceases	2.68	2.12	2.09	2.21	2.19	2.17	2.15	2.11
SMPF Hard Ceases	0.63	0.41	0.48	0.63	0.52	0.51	0.51	0.50
SMPF Soft Ceases	2.04	1.71	1.61	1.57	1.67	1.66	1.64	1.61

Source: BT's response dated 25 February 2013 to question 3 of the First LLU WLR BT Information Request; BT's response dated 25 October 2013 to question 12 of the Eleventh LLU WLR BT Information Request; BT's response dated 12 November 2013 to questions 1 and 2 of the Twelfth LLU WLR BT Information Request; BT's response dated 21 March 2014 to questions 1 and 2 of the Nineteenth LLU WLR BT Information Request; Ofcom calculations.

WLR Volumes

A24.152 WLR rental volumes have been declining steadily over recent years and we forecast they will continue to do so. This is primarily driven by migration from SMPF to MPF.¹¹⁰³

WLR Basic Rentals Internal and External

A24.153 WLR Basic rentals are voice line rentals primarily used by residential customers. In the last three years WLR Basic rental volumes maintained a stable ratio to the total number of WLR rentals. We expect this trend to continue and apply the average ratio between WLR Basic rentals and total WLR rentals to estimate the number of WLR Basic rentals in the period of this charge control.

A24.154 Similarly, we carry forward the average share of internal and external WLR Basic rentals in the last three years to estimate how the total WLR Basic rentals are distributed between internal and external volumes.

WLR Premium Rentals Internal and External

A24.155 WLR Premium rentals are voice line rentals primarily used by business customers. In the last three years WLR Premium rental volumes maintained a stable ratio to the total number of WLR rentals.¹¹⁰⁴ As such we expect this trend to continue and apply

¹¹⁰³ See paragraphs A24.131 and A24.132.

¹¹⁰⁴ Although WLR premium is mainly used by businesses and we forecast business lines to decline whilst household lines rise, we project premium WLR lines to decline at the same rate as basic WLR lines. This is because WLR basic users have a greater propensity to migrate to MPF than WLR premium users and this offsets the faster decline in business lines.

the average ratio between WLR Premium rentals and total WLR rentals to estimate the number of WLR Premium rentals in the period of this charge control.

A24.156 Similarly, we carry forward the average share of internal and external WLR Premium rentals in the last three years to estimate how the total WLR Premium rentals are distributed between internal and external volumes.

WLR Connections

A24.157 Gross WLR Connection volumes are primarily driven by numbers of home movers, migrations from cable, and new household formation. In light of this, we consider that a reasonable assumption is that the number of WLR Connections is a stable proportion of the number of WLR rentals.¹¹⁰⁵

A24.158 We forecast the number of WLR connections by carrying forward the average ratio between WLR connections and WLR rentals in the last three years.

WLR Basic and Premium connections internal and external

A24.159 We forecast the distribution of connection services for WLR Basic and Premium, internal and external, by carrying forward the average ratios of each of these services to the total number of WLR rentals in the last three years.

WLR Start of Stopped MPF Lines

A24.160 WLR Start of Stopped MPF Line is a service used when two events happen sequentially: an MPF line has been stopped (via a soft cease) and a WLR line is ordered. We expect that these series of events will mainly occur when there is a change in the tenants of a household (home movers), where the old tenants used MPF and the new tenants order a WLR connection.¹¹⁰⁶

A24.161 We first proposed to forecast volumes of WLR Start of Stopped MPF Lines in the December 2013 LLU WLR Consultation in which we proposed to require that the price of this service (and WLR Standard Connection) should be discounted when provided simultaneously with an SMPF New Provide.

A24.162 We have forecast the volume of WLR Start of Stopped MPF Line volumes based on the number of home movers.¹¹⁰⁷ As we have no readily available data on home

¹¹⁰⁵ We note that TalkTalk, in its response to our CFI, suggested that we forecast installations, migrations and disconnections on the basis of churn rates and net migration. However, basing our forecasts on churn rates would not necessarily account for home movers and new households. In addition, attempting to forecast each driver separately may add complexity without necessarily increasing accuracy. The approach we are proposing captures the effect of these drivers while maintaining simplicity and transparency.

¹¹⁰⁶ We recognise, however, that this will not always be the case. For example, in home mover scenarios there may be instances where the CP may decide to fully disconnect the MPF line (i.e. a hard cease) rather than simply stop it (e.g. if the property is unoccupied for a long period of time).

¹¹⁰⁷ We believe that for customers switching from MPF to cable and then to WLR, WLR Start of Stopped MPF Line would not be used. This is because a customer switching to cable is likely to remain on cable for a long period of time. Virgin Media's annual churn rate of 15% implies that customers remain on cable for on average almost seven years. This means that while the customer is on cable the LLU CP is likely to completely disconnect the line (via a hard cease) and that a customer switching back from cable to WLR is more likely to require a WLR Standard Connection (rather than a WLR Start of Stopped MPF Line). Virgin Media's annual churn rate has been calculated using the data from p.44, in Virgin, *Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange*

movers, we have derived these from our estimate of WLR Connections. As stated in paragraph A24.157, WLR Connections are driven by new households, churn from cable and home movers. Therefore, we can derive an estimate of home movers as the residual of WLR Connections less WLR lines due to new households and WLR lines due to churn from cable. This is taken as our estimate of WLR Start of Stopped MPF Lines.

WLR Transfers

A24.163 WLR Transfers are used when end customers change their WLR provider.

Therefore, WLR Transfers are driven by churn between CPs using WLR. Since 2009/10, there has been a trend reduction in the number of these transfers and, although the most recent year's data have shown a slight increase, counter to this trend, we expect the number of WLR transfers to continue to decline slowly during the charge control period. We forecast the volume of WLR transfers by trending forwards the three year moving average growth factor with a dampening factor as explained above. This same method is used for both WLR Basic and Premium Transfers sold internally and WLR Basic and Premium Transfers sold externally.

A24.164 In the light of the new 2012/13 data on WLR Transfers, we have changed the dampening factor used in forecasting this service. In the December 2013 LLU WLR Consultation, we used a dampening factor of 1.5 rather than the factor used for other forecasts of 1.4 because the steepness of the decline in WLR Transfers meant that a dampening factor of 1.4 would have implied a lower steady state value than we believed was reasonable. With the updated data, this is no longer the case and so the dampening factor has been changed to 1.4 in order to maintain consistency with other forecasts.

WLR Conversion

A24.165 WLR Conversion is a service used to migrate from MPF to voice-only WLR.¹¹⁰⁸ In the December 2013 LLU WLR Consultation we did not have historic data on which to base a forecast of WLR Conversions. We now have data for 2011/12 and 2012/13 and so have updated our model to include them, and so forecast WLR Conversions using that data.

A24.166 As the number of MPF customers increases we expect the volume of WLR Conversions to increase as there are more customers churning from MPF each year. We now forecast this service by carrying forward the average proportion of WLR Conversions to MPF rentals. This is broadly consistent with the forecast that BT has provided for this service.

MPF Volumes

A24.167 MPF Rental volumes have increased significantly over recent years and we forecast they will continue to do so. This is primarily driven by migration from SMPF to MPF¹¹⁰⁹ and the increase in broadband penetration.

Act of 1934. For the fiscal year ended December 31, 2012, <http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MTcxMTYzfENoaWxkSUQ9LTF8VHlwZT0z&t=1>

¹¹⁰⁸ Where a migration is from MPF to WLR and SMPF this is instead captured in our model as a WLR + SMPF simultaneous provide service as explained later in this annex.

¹¹⁰⁹ See paragraphs A24.131 and A24.132.

MPF New Provides

A24.168 MPF New Provides are used by home movers and end users taking an MPF-based service without previously having a WLR connection. These can be either new users, or users churning from cable services. There has been a significant increase in the usage of MPF New Provides over the previous four years, triggered by the take-up of MPF. We expect that the number of MPF New Provides over the forecast period will continue to be the same, as a proportion of MPF rentals, as in 2012/13. As such we forecast that the MPF New provides will increase in line with MPF rentals.

MPF Single Migrations

A24.169 MPF Single Migrations are caused by churn to MPF from either WLR or a different MPF provider. The increase in broadband penetration is a large driver of this. As such our forecast assumes that the percentage of MPF Single Migrations compared to total Openreach broadband lines¹¹¹⁰ remains constant from 2012/13 onwards. This results in our forecast of MPF single migrations increasing over the forecast period.

MPF Bulk Migrations

A24.170 MPF Bulk Migrations are driven by CPs moving large quantities of customers from WLR/SMPF to MPF. This primarily occurs in exchanges where a CP has added MPF capability, or increased the number of its MPF lines.

A24.171 In the December 2013 LLU WLR Consultation we forecast these volumes by assuming that the decrease in the SMPF usage of MPF providers was all due to MPF bulk migration. Since the publication of the December 2013 LLU WLR Consultation, we have noticed an inconsistency in the way we forecast MPF bulk migrations. Previously, we forecast them as the net change in LLU SMPF lines, on the basis that LLU SMPF customers will be migrated using bulk migrations onto MPF.

We have noticed that this implicitly assumes that there is zero net churn from LLU SMPF lines. However, while there will be churn away from this platform there will be no countervailing churn onto the platform from other providers as any new customers that these CPs receive will be on MPF, not SMPF.¹¹¹¹ Therefore, some of the reduction in LLU SMPF rentals will be due to customers churning to other operators before they have been migrated by their CP.

A24.172 We forecast MPF Bulk Migrations as the change in LLU SMPF rentals from the previous year to the current year, less those customers that churned to other providers during the current year.

A24.173 This produces a forecast of MPF Bulk Migrations that rises from around 210,000 in 2013/14 to around 412,000 in 2016/17.

¹¹¹⁰ Total Openreach broadband lines is taken as MPF + SMPF.

¹¹¹¹ We explain in paragraph A24.134 that it is unlikely that providers who already use MPF will substantially revise their plans for migrating their remaining SMPF subscribers to MPF. Similarly, it is unlikely that providers which already use MPF will choose to use SMPF for new customers. For example, we understand that TalkTalk and Sky do not allow new customers to keep their voice services with BT, which is consistent with a choice to use MPF for new customers.

MPF Ceases

A24.174 MPF ceases are primarily used by home movers and people churning away from MPF. We expect MPF cease volumes to rise as MPF rentals rise and as such we peg our forecast to MPF rentals. To this end, the average percentage of MPF ceases over the three years from 2009/10 to 2011/12 relative to MPF rentals is applied to the forecast period.¹¹¹²

MPF Hard and Soft Ceases

A24.175 When a MPF line is ceased, it can either be done in a way that involves fully disconnecting the line (a 'hard cease') or in a way that leaves the line connected but stops the service to that line, via software (a 'soft cease'). Most ceases will initially be soft ceases as this involves minimal cost. Hard ceases are often performed in bulk to clear left-in jumpers from equipment when additional port space is required, rather than purchasing new equipment entirely. Hard ceases may well be performed on lines that have already been soft ceased.

A24.176 We forecast the distribution of MPF Hard and Soft Ceases by carrying forward the average ratios of each of these services to the total number of MPF Ceases.

MPF room build

A24.177 Demand for MPF room builds is caused by unbundling and capacity expansion. At a detailed level, the volumes of MPF room build services are driven by parameters which are difficult to predict, such as the spare capacity CPs have in already installed racks and in each exchange, and market share fluctuations in different geographies. However, the number of room builds in the forecast period is expected to decrease as the level of new unbundling of exchanges decreases.

A24.178 To produce our forecast for this service we have considered data gathered using our statutory information gathering powers. Given the difference between our forecast for 2012/13 from the December 2013 LLU WLR Consultation and the outturn figures, we have applied an uplift of 20% relative to our previous forecasts. We have done this because we believe that potential future MPF room build will be driven at least in part by demand for MPF lines. As our forecasts of MPF lines are higher across the review period than they were in the December 2013 LLU WLR Consultation, and due to the higher number of MPF room builds in 2012/13 than were previously forecast, we believe that this uplift is appropriate.

MPF hostel rentals

A24.179 MPF hostel rentals are a collection of products relating to the running costs of building space used for unbundled lines used by CPs other than BT. This building space is used for both MPF and SMPF equipment, depending on the exchange and CP in question. Hostel rentals can increase due to further unbundling and capacity expansion, and can decrease due to decommissioning of old or underutilised equipment and consolidation of MPF and SMPF providers. In the past three years the volume of MPF hostel rentals has increased, driven by the increase in broadband penetration and unbundling of exchanges.

¹¹¹² This period is used as the data for 2012/13 is not comparable with historic data. Soft cease volumes are no longer recorded by Openreach and therefore cease data for 2012/13 contain only hard ceases. As such, we have forecast volumes for 2012/13 rather than using input data from Openreach.

A24.180 We have investigated the relationship between MPF hostel rentals and the sum of MPF and external SMPF lines. We have found that this relationship is stable over the past three years. We believe that capacity expansion will be driven by MPF and external SMPF demand, which we forecast to increase over the review period. We also believe that an increase in MPF room build should result in an increase in MPF hostel rentals. We expect MPF hostel rentals to increase, but at a decreasing rate over the forecast period in line with the decreasing rate of growth in total MPF and external SMPF lines.

A24.181 We forecast the number of MPF hostel rentals by carrying forward the average ratio between MPF hostel rentals and the sum of MPF and external SMPF rentals in the last three years. This produced a forecast which is consistent with our expectation of increasing MPF hostel rentals over time.

MPF Tie Cables

A24.182 As explained in Annex 10, paragraph A10.5, MPF tie cables connect from the MDF to equipment within the exchange. Both MPF and WLR+SMPF require three tie cables. However, rental of an MPF product includes two tie cables, while WLR+SMPF rental includes only one. As such, SMPF connections require two additional tie cables to be purchased whereas MPF connections require only one additional tie cable. For this reason we have pegged the change in tie cables to MPF rentals and 2 x SMPF rentals. As such the tie cable volume increases slightly over the forecast period. The increase is due to the overall increase in lines and broadband penetration.

SMPF volumes

A24.183 The SMPF rental volumes have been declining over recent years and we forecast they will continue to do so. This is primarily driven by migration from SMPF to MPF.¹¹¹³

SMPF New Provides

A24.184 SMPF new provide services are used when a CP requires a new SMPF connection to a previously WLR-connected line. A SMPF new provide has also been used historically when a customer moves from an MPF-based provider or cable, to a provider using WLR+SMPF.

A24.185 We understand that the volume of SMPF new provides per annum is primarily driven by new broadband customers, home movers, and churn from MPF-based service providers and cable.

A24.186 We do not expect the effect of home movers to change with time and we believe that SMPF New Provides can be effectively modelled as a percentage of the total SMPF rentals.

A24.187 We understand, however, that migrations from MPF have been implemented since 2012/13 and will be implemented in future using what we refer to as a SMPF Simultaneous Migration (that is, the combination of the discounted price applied to WLR Conversions when it is provided simultaneously alongside SMPF New Provide), which will allow significant cost savings.

¹¹¹³ See paragraphs A24.131 and A24.132.

A24.188 A similar cost saving will be available for simultaneous provision of both WLR Connection and SMPF New Provide. Thus, SMPF new provides may take three different forms:

- WLR + SMPF Simultaneous Connection;¹¹¹⁴
- WLR + SMPF Simultaneous Migration;¹¹¹⁵ and
- SMPF New Provide on Existing WLR Line.¹¹¹⁶

A24.189 We forecast the number of SMPF new provides on the assumption that the ratio of new provides to SMPF rentals is constant at its 2012/13 level. In the December 2013 LLU WLR Consultation, we attempted to avoid double counting by splitting out WLR + SMPF Simultaneous Migrations from SMPF New Provides (which implicitly included both WLR + SMPF Simultaneous Connections and SMPF New Provide on Existing WLR Lines, though the latter was not explicitly forecast).

A24.190 Since the publication of the December 2013 LLU WLR Consultation, we have noticed an inconsistency between how SMPF New Provides are used in the Cost Model and how they are calculated in the volumes forecast model. In the December 2013 LLU WLR Consultation, WLR + SMPF simultaneous migrations were excluded from the projected SMPF New Provide volumes in order to avoid double-counting of these services. However, in the Cost Model they were not re-aggregated in order to determine the correct volume growth driver for external SMPF New Provides.

A24.191 In order to avoid this error, we no longer exclude WLR + SMPF simultaneous migrations from total SMPF New Provides. We now forecast three services – WLR + SMPF simultaneous migrations, WLR + SMPF simultaneous connections and SMPF New Provides on existing WLR lines – which summed together equal total SMPF New Provides.

WLR & SMPF Simultaneous Connection

A24.192 We have decided to impose a cost-based charge control which discounts WLR Connection where there is a simultaneous provision of SMPF New Provide, to reflect the reduction in effort if the provision of SMPF is done at the same time as a WLR connection.¹¹¹⁷ For the purposes of our model we therefore expect this combination of services to be used in all the cases where a new customer purchases both a WLR and a SMPF line.

A24.193 We have assumed that the proportion of customers purchasing WLR Connections that will simultaneously request an SMPF New Provide is likely to be driven by the number of households that would order a broadband connection together with their voice connection. We have therefore approximated this using the rate of broadband penetration on Openreach lines.¹¹¹⁸

¹¹¹⁴ This service is described in paragraph A24.192.

¹¹¹⁵ This service is described in paragraph A24.194.

¹¹¹⁶ These are SMPF new provides not purchased simultaneously with a WLR component. We call this SMPF new provide on existing WLR line to distinguish the total of SMPF New Provides from each of its component parts.

¹¹¹⁷ This is discussed in Section 4, Volume 2.

¹¹¹⁸ We calculate broadband penetration on Openreach lines as the ratio of the total number of SMPF and MPF rentals over the total number of WLR and MPF rentals.

SMPF Simultaneous Migration

A24.194 We have decided to impose a cost-based charge control which discounts WLR Conversion where there is a simultaneous provision of SMPF New Provide, to reflect the reduction in effort if the provision of SMPF is done at the same time as a WLR conversion.¹¹¹⁹ For the purposes of our model we therefore expect this combination of services to be used in all the cases where an MPF customer moves to a WLR+SMPF provider.

A24.195 We use our assumed churn rate of 15%¹¹²⁰ per annum to estimate the number of customers moving from an MPF LLU provider to an SMPF provider. To account for the probability that a customer may choose to move to a different MPF LLU provider we assume that two thirds of the customers leaving their MPF provider will go to a SMPF platform.¹¹²¹

SMPF Single Migrations

A24.196 SMPF single migrations are driven by intra-SMPF customer migration. We expect SMPF single migrations to reduce as the number of external LLU SMPF lines reduces.

SMPF Bulk Migrations

A24.197 We have identified three main drivers for the Bulk SMPF migration volumes in the last three years. These are:

- a) LLU operators migrating their WBA customer base onto their on-net SMPF platform;
- b) migration of EE's LLU customers to BT Wholesale's SMPF platform;¹¹²² and
- c) migration of customer lines from IP-Stream to BT's 21CN Wholesale Broadband Connect platform.

A24.198 We expect all the above drivers to become less important over the period of this charge control. This is because:

- a) LLU rollout is expected to slow down, while the customer base in exchanges that are not yet unbundled is small;
- b) we assume all EE customers have been moved to BT Wholesale's network; and
- c) we expect IP-Stream to WBC migration to slow down, or stop.

A24.199 To calculate our forecast we assume a 30% year-on-year reduction in SMPF bulk migration volumes from their 2012/13 levels to reflect the declining factors.¹¹²³ We estimate approximately 60,000 bulk migrations within our forecasting period.

¹¹¹⁹ This is discussed in Section 4, Volume 2.

¹¹²⁰ See paragraphs A24.120 - A24.123.

¹¹²¹ We assume that BT Wholesale SMPF accounts for half of the broadband market whilst two MPF providers account for 25% of the market each. As such if a customer from an MPF provider churns to another provider we assume there is a two thirds chance of moving to SMPF.

¹¹²² In April 2010, Orange (now EE) signed a deal with BT to switch its customers from LLU to BT Wholesale's network.

SMPF Ceases

A24.200 SMPF Cease volumes are primarily driven by the number of home movers and people churning away from SMPF. We expect SMPF cease volumes to drop as SMPF rentals reduce and as such we peg our forecast to SMPF rentals. To this end the average percentage over the three years from 2009/10 to 2011/12 relative to SMPF rentals is applied to the forecast period.¹¹²⁴

SMPF Hard and Soft Ceases

A24.201 When a SMPF line is ceased, it can either be done in a way that involves fully disconnecting the line (a 'hard cease') or in a way that leaves the line connected but stops the service to that line, via software (a 'soft cease').

A24.202 We forecast the distribution of SMPF Hard and Soft Ceases by carrying forward the average ratios of each of these services to the total number of SMPF Ceases.

¹¹²³ The use of the 30% year on year reduction in SMPF bulk migration volumes is an estimate. We received no comment from stakeholders on its appropriateness and so continue to use it as we do not have better information on which to base this rate of reduction.

¹¹²⁴ This period is used as the data for 2012/13 is not comparable with historic data. Soft cease volumes are no longer recorded by Openreach and therefore cease data for 2012/13 contains only hard ceases. As such, we have forecast volumes for 2012/13 rather than using input data from Openreach.

Annex 25

Volumes forecasting model

A25.1 The Volumes forecasting model will be published with the final statement.

Annex 26

Treatment of cumulo rates within the charge control

Summary of our decisions and introduction

- A26.1 Cumulo rates are the non-domestic (business) rates that BT pays on the rateable assets within its UK network. The rateable assets consist primarily of duct, fibre, copper and exchange buildings.
- A26.2 In this Annex we explain the treatment of cumulo rates within the LLU WLR charge controls. In summary we have decided that:
- the proportion of BT's cumulo costs that it is reasonable to recover from the MPF and WLR services is lower than the amount allocated to these services in BT's 2011/12 RFS (i.e. the base year data).
 - the reduction in cumulo costs recovered from the MPF and WLR services, to allow for both this revised allocation and also the recent retrospective reductions to BT's rateable value, will be made through the efficiency rate that we have applied in the Cost Model (see Annex 16 for our assessment of efficiency).
 - there should be an equal (per line) allocation of cumulo costs to MPF and WLR services. This is implemented through our assessment of the LRIC differentials (see Annex 9 for our estimation of LRIC differentials).

Principles for recovering cumulo costs

- A26.3 We have concluded that the following principles are appropriate for allocating cumulo costs to MPF and WLR services. We consider that the allocation method should:
- result in equal (per line) allocations of cumulo costs to MPF and WLR lines. This is necessary so that relative charges for MPF and WLR promote economic efficiency, but it is also consistent with our understanding of the rating methodology used by the VOA at an aggregate (BT Group) level;
 - result in allocations which are broadly stable over time;
 - be based primarily on the use of rateable assets, again for consistency with the rating methodology and cost causality and to avoid counterintuitive results;
 - be transparent, logical, and not unduly reliant on confidential data; and
 - pass the benefits of projected reductions in cumulo costs to customers through the charge control, in a way which does not rely on a spuriously precise forecast of cumulo costs.
- A26.4 We have considered the following alternative allocation methods:

- the “Profit weighted net replacement cost” (PWNRC) method, with base-year allocations determined according to BT’s RFS. This was the method proposed in the July 2013 LLU WLR Consultation and was supported by BT, with indications of agreement in broad terms from some other respondents;
- a variant of the PWNRC method with equal base-year allocations determined by Ofcom. Two respondents who did not comment in detail noted that cumulo costs should be equally apportioned between MPF and WLR services;
- an approach which attempts to mimic, at a service level, the method used by the Valuation Office Agency (VOA) to determine BT’s cumulo bill at an aggregate level. This was suggested by TalkTalk and Sky; and
- an alternative method proposed by TalkTalk and Sky and described as an “observed effects” method.

A26.5 We have concluded that we should use the PWNRC method, but with allocations determined by Ofcom rather than derived from BT’s RFS (i.e. the second approach identified above). This method is the most consistent with the principles set out earlier. It is the only method of those listed above which is consistent with equal allocations and with stability over time.

A26.6 Having concluded that we should use the PWNRC method, we then considered how to implement this in our modelling. Two alternative approaches for taking account of projected reductions in cumulo costs over the charge control period have been suggested:

- by means of a separate forecast of cumulo costs outside the main Cost Model, favoured by TalkTalk and Sky; and
- by embedding cumulo costs within the component costs in the main Cost Model, the approach proposed by Ofcom in the July 2013 LLU WLR Consultation.

A26.7 The latter approach was described by Openreach as “reasonable” in its response, with other respondents not explicitly commenting on this aspect of Ofcom’s proposal. With this approach, the Cost Model then projects component costs including cumulo costs using consistent assumptions about efficiency and other key parameters.

A26.8 We consider that the latter approach is the most appropriate. This is because it is only possible to make a forecast of cumulo costs within a broad range and, in these circumstances, making a separate forecast of cumulo costs would require spurious precision for a small component of the cost stack of WLR and LLU services.

A26.9 Instead we take account of projected changes in cumulo costs through a single weighted-average efficiency gain assumption of 5% per annum applied to all costs in the main Cost Model, including cumulo costs. These changes in cumulo costs have been estimated taking account of the recent changes to BT’s rateable values in England, Wales and Scotland that were announced in April 2014, our projections of future volumes of MPF and NGA lines and the cumulo cost allocations we have determined. This means that we capture reductions in cumulo costs and allow them to be passed to users in lower charges and avoid spurious precision.

Setting cumulo rates

A26.10 The rateable value (RV) of BT's cumulo rates is assessed by the relevant rating authority, for example, the Valuation Office Agency (VOA) in England and Wales. The VOA assesses the RV of BT's assets using the "receipts and expenditure" (R&E) method, an approach which:

"estimates the profits of a business that uses the rateable assets and seeks to allocate these profits between a notional tenant (i.e. user of the assets) and a notional landlord (i.e. owner of the assets). The notional landlord, for the purposes of the charge control, is the public authority which levies cumulo rates. The notional tenant is BT".¹¹²⁵

A26.11 In broad terms, the rates bill is then calculated by multiplying the RV by a centrally set rate in the pound that is the same for all ratepayers.¹¹²⁶

July 2013 LLU WLR Consultation proposals

A26.12 We held discussions with the VOA to inform the July 2013 LLU WLR Consultation. The VOA told us that the BT valuation model was created for the specific purpose of informing a rating valuation and was not constructed to allocate costs between different services or asset types. The VOA confirmed that the calculations were generally done at an aggregate level and said that it did not consider that a disaggregation of the existing valuation model by product was possible.¹¹²⁷

A26.13 Therefore, in our July 2013 LLU WLR Consultation we proposed to use the PWNRC method to allocate cumulo costs for the purposes of setting the MPF and WLR charge controls to apply from 1 April 2014.

A26.14 In the July 2013 LLU WLR Consultation, we also looked at the results obtained using this method to make sure that the allocation remained reasonable, and considered two issues in detail. These were the treatment of incremental rates on BT's NGA assets, and the allocation of any reductions in liabilities as a result of increasing MPF volumes. MPF volumes were expected to increase over the new charge control period which, under the current rating framework, would lead to lower liabilities for BT. We therefore reconsidered the treatment of these reductions, which we referred to as "rebates", for the proposed charge controls.

A26.15 We noted that BT allocates any incremental rates associated with NGA assets directly to NGA products and services.¹¹²⁸ As these incremental liabilities were not

¹¹²⁵ Paragraph 11.7, Competition Commission, *References under section 193 of the Communications Act 2003: British Telecommunications Plc v Office of Communications, Case 1193/3/3/12; British Sky Broadcasting Limited and TalkTalk Telecom Group Plc v Office of Communications, Case 1192/3/3/12 – Determinations*, 27 March 2013, http://catribunal.org/files/1192-93_BSkyB_CC_Determination_270313.pdf (March 2013 CC Determination).

¹¹²⁶ The rate in the pound (sometimes called the ratepoundage) for England and Scotland, including the supplementary ratepoundage to fund small business relief, was 43.3p in 2011/12, 45.8p in 2012/13 47.1p in 2013/14 and will be 48.2p in 2014/15. The equivalent numbers for Wales are 42.8p, 45.2p, 46.4p and 47.3p. For an introduction to how rates liabilities are calculated see: <http://www.voa.gov.uk/corporate/Publications/businessRatesAnIntro.html>

¹¹²⁷ Ofcom, *File note of meeting with VOA on Cumulo*, 16 May 2013.

¹¹²⁸ See for example page 79 BT, *Detailed Attribution Methods (DAM) 2013*, 31 July 2013, <https://www.btplc.com/Thegroup/RegulatoryandPublicAffairs/Financialstatements/2013/DAM2013.pdf> (BT's 2013 DAM); or page 57 BT, *Detailed Attribution Methods (DAM) 2012*, 31 July 2012,

included within the base year costs (2011/12) of the Cost Model,¹¹²⁹ this was consistent with our modelling approach, which assumed a copper-only network.

- A26.16 We also noted that BT allocates reductions arising from migration of WLR lines to MPF only across those rateable assets which it classifies as part of its core network. BT's justification for this is that the loss of RV from increasing MPF is due to reduced profits from downstream services – notably wholesale calls and wholesale broadband access. We confirmed with the VOA that changes to BT's RV aim to capture this effect.
- A26.17 We observed that, as a result, the proportion of such rebates which BT allocates to Openreach was significantly less than Openreach's share of cumulo costs before rebates, and the rebates left BT's allocations of cumulo costs to WLR and MPF rentals largely unaffected. Our estimates also suggested that, if the allocation procedures were unchanged, Openreach's share of BT's non NGA cumulo liabilities would increase to between 92% and 94% in 2012/13 with further increases expected in future. In addition, there would be a discontinuity in the way BT's cumulo costs were allocated when there was a new rating list. This was because, in the first year of any new list, the allocation would effectively revert to the main PWNRC allocation on all rateable assets.
- A26.18 To assess the reasonableness of BT's approach, we considered whether it was consistent with an economically efficient allocation of cumulo costs and rebates between MPF and WLR, as well as between access products (i.e. MPF and WLR taken together) and the rest of BT.
- A26.19 We considered that any allocation of cumulo costs should result in the per line charges for MPF and WLR being similar because any difference in usage of rateable assets between MPF and WLR would be minimal. This would also be consistent with our proposal to align charge differentials and incremental cost differentials in order to give CPs an incentive to make the input choice (between MPF and WLR) which minimises overall costs and maximises efficiency.
- A26.20 We then considered whether BT's allocation of cumulo costs between access products and the rest of BT was likely to be consistent with economically efficient charges, treating cumulo costs first as a fixed cost and then as part of the long run incremental costs of an access line. We considered these two alternative approaches because, if BT's allocation appeared likely to lead to inefficient charges both when cumulo costs were treated as fixed and when they were treated as variable, this would be a strong indication that an alternative allocation method was needed.
- A26.21 We noted that, in theory, the most efficient way to recover a fixed cost would be by means of Ramsey pricing. Treating cumulo costs as fixed would then mean that the allocation of cumulo costs between services would be inversely related to their price elasticities of demand.¹¹³⁰ As demand for basic access services is likely to be

http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/DAM_2012.pdf (BT's 2012 DAM). The treatment of NGA is referred to in the description of the CUMNORM base.

¹¹²⁹ BT's responses dated 5 April and 9 April 2013 to question 4 of the Third LLU WLR BT Information Request.

¹¹³⁰ Ramsey pricing is not relevant to the allocation of cumulo costs between MPF and WLR since these are substitute services, either of which can be used to provide the same downstream services. The main concern here is therefore with productive rather than allocative efficiency. In these circumstances, productive efficiency is promoted by setting the charge differential equal to the LRIC differential and recovering similar amounts of common costs from each service.

relatively insensitive to price changes and because such services also account for a significant share of BT's total asset base, we considered it reasonable for access services to bear a significant share of cumulo cost. However, it seemed to us much less likely that applying efficient pricing principles would lead to a sharply rising share of cumulo costs being allocated to Openreach above an already high level. Further increases above the 2012/13 level could mean that the share allocated to Openreach would approach 100%, which we considered unlikely to be appropriate.¹¹³¹

A26.22 We also considered that such increases were unlikely to be justified by treating the cumulo liability as part of the long-run incremental costs of an access line. A forward-looking long run view of cumulo costs which took account of expected changes in BT's cumulo bill at future revaluations, when cumulo costs would be allocated according to the main PWNRC allocation on all rateable assets, would not imply a rapid increase in the Openreach share of cumulo costs.¹¹³² It is BT's practice of allocating rebates primarily to the core network which causes the increase in Openreach's share between revaluations. Finally, in the light of this, we said that the most appropriate approach to rebates would be to assess and allocate cumulo costs in a consistent way over time after any rebates had been deducted.

A26.23 We considered that it was unlikely to be possible to forecast rebates accurately and that a less complex method was therefore needed to arrive at final year costs. In the July 2013 LLU WLR Consultation, we noted that the 2011/12 allocations to WLR and MPF within the RFS were £3.31¹¹³³ and £3.16¹¹³⁴ per line respectively, which implied WLR contributing £0.15 more per line to the recovery of cumulo costs (i.e. less than 5% of the allocated amounts).¹¹³⁵ We concluded that this was a sufficiently small difference to be consistent with our view that MPF and WLR should make similar contributions to the recovery of common costs and therefore did not propose a further adjustment to equalise allocations more precisely.

A26.24 We also carried out a high-level calculation using PWNRC at the WFAEL and WLA market level, with ROCEs set equal to the cost of capital. For example, the allocation to the WFAEL and WLA markets was the WFAEL and WLA WACC x NRC (of WFAEL and WLA) divided by the sum of similar calculations (WACC x NRC) for all wholesale markets. We used this as a cross-check on the base year allocation.¹¹³⁶

¹¹³¹ Our calculations, based on our estimates of the changes in rateable value due to increasing MPF volumes, suggested that the Openreach share could rise above 100% before the end of the charge control period.

¹¹³² The discontinuity caused by reversion to the main PWNRC allocation base at each revaluation (see paragraph A26.17 above) would also then be avoided.

¹¹³³ BT's responses dated 5 April and 9 April 2013 to question 4 of the Third LLU WLR BT Information Request. Product volumes from BT response dated 25 February 2013 to question 3 of the First LLU WLR BT Information Request.

¹¹³⁴ BT's responses dated 5 April and 9 April 2013 to question 4 of the Third LLU WLR BT Information Request. Product volumes from BT response dated 25 February 2013 to question 3 of the First LLU WLR BT Information Request.

¹¹³⁵ Paragraph A14.48, Annex 14, July 2013 LLU WLR Consultation. Clearly a difference of £0.15 is very small in relation to the MPF and WLR rental charges themselves.

¹¹³⁶ We used the following pre-tax nominal WACCs: 8.8% for WFAEL and WLA markets, 9.9% for the rest of BT. We extracted estimates of NRC from page 25 of BT's 2011/12 RFS and defined rateable assets as comprising Land and Buildings, Access-Copper, Access- Fibre and Access –Duct.

A26.25 This calculation resulted in shares for the WFAEL and WLA markets of around 68% compared to the 74%¹¹³⁷ that emerged from the contemporaneous BT allocations. Given the degree of uncertainty over future cumulo costs, we considered that this cross-check provided a reasonable assurance that the base year allocation was at an appropriate level.

A26.26 Hence, given the uncertainties noted and the cross-checks undertaken, we proposed not to make adjustments to the base year (2011/12) allocation of cumulo costs in the Cost Model. In addition, we considered that the most appropriate way to project cumulo costs forward was to do so within the overall component cost projections produced by the Cost Model. The component cost projections reflect expected cost reductions due to efficiency gains over the charge control period and projected reductions in cumulo costs are captured in the efficiency gains assumed. We considered that this approach was more likely to keep the proportion of the cumulo bill allocated to MPF and WLR services stable through time, and consistent in the long-run with changes in total line volumes, than the increasing allocation over time that we might expect to see from the continued use of BT's allocation method.

A26.27 We considered the advantages of this simple approach to be:

- it would continue to allocate a similar amount of cumulo cost to each of WLR and MPF which we believed to be a desirable outcome of any allocation procedure; and
- the amount of cumulo costs which would be recovered from the regulated access services would follow an appropriate time path and be consistent with the regulated services earning their cost of capital over the control period.

Stakeholder responses to the July 2013 LLU WLR Consultation

A26.28 Openreach agreed with our approach to cumulo costs. However, in its submissions in relation to efficiency, it argued that past rates of efficiency growth should be calculated excluding what it described as the “one-off” effects of reductions in its cumulo liability.¹¹³⁸

A26.29 EE argued that cumulo costs were a common cost and, like other common costs, should be equally apportioned between MPF and WLR services.¹¹³⁹ Virgin Media also commented that our approach was consistent with our proposal that MPF and WLR should make similar contributions to common cost recovery, and noted that it took account of the March 2013 CC Determination.¹¹⁴⁰

A26.30 ☒ noted that Ofcom's proposed approach was consistent with previous statements and hence with regulatory certainty but stated that BT “deals” with the VOA or Treasury should be accurately represented in charge controls.

A26.31 The most substantive responses on the cumulo issue were from Sky and TalkTalk, both of whom disagreed with our proposed approach. They advanced similar arguments, although they were developed in more depth by TalkTalk.

¹¹³⁷ The 74% was lower than the 84% given in paragraph A14.29 of the July 2013 LLU WLR Consultation as the latter included other Openreach supplied products, for example AISBO services.

¹¹³⁸ Paragraph 465, Openreach Response to the July 2013 LLU WLR Consultation.

¹¹³⁹ Page 36, EE Response to the July 2013 LLU WLR Consultation.

¹¹⁴⁰ Page 17, Virgin Response to the July 2013 LLU WLR Consultation.

- A26.32 Sky and TalkTalk argued that Ofcom’s MPF and WLR cost estimates were incorrect. TalkTalk did not agree that Ofcom’s “cross-check” calculation of the cumulo allocation “*provides a reasonable assurance that the base year allocation is at an appropriate level.*”¹¹⁴¹ It argued that we “*should investigate [the] discrepancy*”¹¹⁴² between the cumulo allocation calculated by the cross-check method and that implied by the current BT allocations.¹¹⁴³ Sky and TalkTalk also argued that the allocation of cumulo costs should reflect expected future reductions in these costs as lines switch to MPF over the charge control period, and alleged that Ofcom’s method did not do so correctly.¹¹⁴⁴
- A26.33 Although TalkTalk and Sky agreed with the principle of setting charge differentials equal to LRIC differences, they argued that the reduction in cumulo costs associated with switching to MPF should form part of the LRIC differential.
- A26.34 TalkTalk claimed that “*Ofcom has chosen not to properly assess whether the RV and cumulo cost for MPF and WLR are different.*”¹¹⁴⁵ It said that one way that this could be done would be by using the VOA formula, which it claimed was “*shown [to be] entirely practicable*” in its appeal of the 2012 charge control.¹¹⁴⁶
- A26.35 TalkTalk also proposed an alternative which it referred to as an “observed-effects” approach.¹¹⁴⁷ This method starts with the observation that the VOA adjusts BT’s aggregate RV downwards as a result of increasing MPF volumes. In TalkTalk’s view, it then follows that the RV for MPF is less than the RV for WLR. TalkTalk drew an analogy with taxes levied on a business selling apples and oranges to illustrate its view that the RV of MPF must be lower than the RV of WLR.
- A26.36 TalkTalk used an assumption about the change in BT’s cumulo costs between 2011/12 and 2016/17 to infer the difference between the cumulo costs of an MPF line and those of a WLR line which it said were implicit in BT’s total cumulo bill.¹¹⁴⁸ It then followed, TalkTalk argued, that the calculated differences in cumulo costs should be reflected in the MPF/WLR charge differential.

¹¹⁴¹ Paragraph A14.51, July 2013 LLU WLR Consultation.

¹¹⁴² Page 10, footnote 10, TalkTalk Response to the July 2013 LLU WLR Consultation.

¹¹⁴³ The cross-check calculation resulted in shares for the WFAEL and WLA markets of around 68% compared to the 74% that emerged from the current BT allocations.

¹¹⁴⁴ TalkTalk repeated this point in summary form in paragraph 3.60 of its response to the December 2013 LLU WLR Consultation. Ofcom did not discuss cumulo costs in the December 2013 LLU WLR Consultation. In paragraphs 26 to 27 of its 26 March 2014 supplementary submission Openreach said that it “*does not believe there is any merit in TalkTalk’s proposals*” on the grounds that these would remove any “*link between the allocation methodology and the Net Replacement Cost of the assets*”. It also repeated its earlier argument that cumulo rebates reflect reductions in downstream activity. (See Openreach, *Openreach supplementary submission relating to Ofcom’s fixed access market reviews and charge controls*, 26 March 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Openreach_Supplementary_submission.pdf (Openreach 26 March 2013 supplementary submission)).

¹¹⁴⁵ Paragraph 2.32, TalkTalk Response to the July 2013 LLU WLR Consultation.

¹¹⁴⁶ *Ibid.*

¹¹⁴⁷ *Ibid.*

¹¹⁴⁸ TalkTalk relied on Ofcom estimates from paragraph A14.33 of the July 2013 LLU WLR Consultation in this calculation, despite the fact that we stated in the same paragraph that “*we have not found a robust correlation between the changes to BT’s rateable value and the number of MPF lines*”. The absence of such a relationship is also apparent from Figure 14.1 in Annex 14 (which shows BT’s rateable value sometimes falling, sometimes flat and sometimes increasing between April 2010 and April 2013) and Table A8.2 in Annex 8 where it can be seen that MPF rental volumes increased in every year over the same period.

A26.37 Finally TalkTalk responded to a number of arguments which it said Ofcom had previously advanced as reasons for not assuming a lower RV for MPF.¹¹⁴⁹ TalkTalk argued that:

- the fact that assuming a lower RV for MPF would be counter-intuitive should be disregarded, as “intuition should [not] displace an evidence based approach”.
- cumulo rates are a tax on profits, not assets;
- the possibility that cumulo costs could be allocated to products which make no use of rateable assets is irrelevant or does not arise using the “observed effects” approach;
- the fact that MPF and WLR “make similar regulatory returns and make similar use of the asset” should be disregarded as “there is no reason as to why what Ofcom thinks should happen, expect should happen, or even would like to happen should supersede what actually happens and can be observed”;
- the PWNRC method is not consistent with the VOA’s method;
- the VOA’s view that its method cannot be applied at a disaggregated level is irrelevant;
- Ofcom wrongly stated (in paragraph A14.42 of the July 2013 LLU WLR Consultation) that “the cumulo cost is a fixed cost”;
- the observed effects approach is not subject to volatility; and
- the observed effects approach is simple and transparent whereas the PWNRC approach is not.

Our analysis

A26.38 We do not agree with BT that cumulo reductions are likely to be one-off. This is because the main reason for historic reductions to BT's cumulo bill is switching to MPF, and we are projecting significant further switching to MPF over the charge control period. Hence our choice of assumption about future efficiency gains has been informed by the rate of efficiency gains achieved in the past, including reductions in cumulo costs.

A26.39 We have also reviewed the allocation of cumulo costs to WLA and WFAEL products over the charge control period, and confirmed that our assumption about future efficiency gains (i.e. the reduction in real component unit costs) is consistent with a reasonable range of projected cumulo cost reductions.

A26.40 In our charge control model, cumulo costs are included within component costs. We capture the VOA’s most recent assessments of BT’s rates liability within our assessment of future changes to unit costs via our assumption about future improvements in efficiency. This assumption is a weighted average of efficiency gains across a number of cost categories including cumulo. TalkTalk’s calculation that *“the combined effect of these factors [inflation, scale and efficiency] is to reduce total cumulo costs by about 6% over the five years between 2011/12 and 2016/17”*

¹¹⁴⁹ Paragraph 2.45, TalkTalk Response to the July 2013 LLU WLR Consultation.

is misleading, since it assumes that the reduction in cumulo costs is the same as the weighted average rate of cost reduction we have assumed.^{1150, 1151}

- A26.41 There is no dispute that one of the main reasons for changes to BT's RV is switching to MPF (the other is growth in NGA). We again use the term rebates to refer to reductions in BT's rateable value in response to increasing MPF volumes. For the reasons set out above at paragraphs A26.16 – A26.22, we believe that these rebates should be taken into account in assessing the amount of cumulo costs to be recovered from WLR and MPF, and our approach does this.
- A26.42 We do not however accept Sky's contention that "*MPF lines must have a lower RV than WLR and...should attract a lower allocation of cumulo costs*".¹¹⁵² Indeed the RV of an MPF or WLR line, or even of Openreach's copper access business as a whole is undefined and, as noted above, the VOA has confirmed to us that it regards the "rebates" BT receives as relating to changes at a more downstream level.
- A26.43 Whilst the CC suggested that recovery of a greater share of cumulo costs from WLR was not necessarily inconsistent with our approach in the March 2012 Statement, it did not imply that this was a necessary or even a desirable feature of any allocation. Indeed, at paragraph 11.107 of the March 2013 CC Determination, the CC said:
- "we shared with Ofcom the view that broadly equal allocations between LLU and WLR should be expected given the similarity of these products in their use of the rateable assets and their regulated returns (see paragraph 11.15). We agreed with Ofcom that an allocation that was not primarily based on the products' use of assets could lead to counterintuitive results".
- A26.44 On the "discrepancy" alleged by TalkTalk, our view is that, given its role as a cross-check, the calculation described in the July 2013 LLU WLR Consultation did not indicate the existence of a major discrepancy to be investigated. In any case, we have since reviewed and refined our calculations for 2011/12 and confirmed their stability using data for a number of years using the methodology described in paragraph A14.50 of the July 2013 LLU WLR Consultation. In the light of this, we have now revised our approach, and have used the results of the cross-check to calculate an appropriate allocation to MPF and WLR rather than relying on BT's allocation, as we describe later in this annex.
- A26.45 We do not agree that there is a practical version of the VOA method which could be used for deriving the RV for individual products. The method proposed by Sky/TalkTalk in their appeal of the 2012 charge control, which purported to be such a method, was rejected by the Competition Commission. The Competition Commission preferred Ofcom's approach, as set out in paragraphs A14.19 to

¹¹⁵⁰ Paragraph 2.30, TalkTalk Response to the July 2013 LLU WLR Consultation.

¹¹⁵¹ An illustrative example may help to explain the point. For example, the efficiency assumption is that real unit costs should fall by 5% per annum in real terms. Suppose this 5% is a weighted average of reductions in cumulo and other costs and could be made up as follows. Cumulo might account for say 3% of costs and suppose further that the required rate of reduction in cumulo unit costs should be 8.5% per annum, with the remaining 97% of costs requiring a reduction of 4.9% per annum. By applying a weighted average efficiency gain of 5% per annum to all costs, the higher rate of reduction in cumulo costs is in effect spread over all cost components, but it is still taken into account nonetheless.

¹¹⁵² Paragraph 10.56, Sky Response to the July 2013 LLU WLR Consultation.

- A14.20 of the July 2013 LLU WLR Consultation.¹¹⁵³ In any case, TalkTalk now seems to place more emphasis on its alternative “observed effects” approach.
- A26.46 The observed effects approach set out by TalkTalk has two key features. Firstly, it relies on observations of past changes in BT’s RV to project the change in BT’s cumulo liabilities to the end of the charge control period. Secondly, the projected change in cumulo costs is combined with projections of switching from WLR to MPF over the same period in order to derive different cumulo costs for MPF and WLR lines respectively.
- A26.47 We have considered again whether we could make a reliable forecast of the change in BT’s RV due to switching to MPF. In short, our view remains that aggregate data cannot be used to derive a robust relationship between changes to BT’s RV and the number of MPF lines. However, we have reviewed our projection of cumulo costs in the light of BT payments on cumulo rates in 2012/13. We have also confirmed that the rate of efficiency improvement which we apply to component costs in the model is consistent with the range of our projections for cumulo costs. This review is described later in this annex.
- A26.48 TalkTalk’s seller of apples and oranges, the analogy which it uses to explain the observed effects approach, is a simple business providing only two services. TalkTalk’s analogy therefore omits a key effect, the loss of downstream profits which is reflected in the reduction in RV when WLR lines switch to MPF. If we were to increase the realism of TalkTalk’s example slightly, by replacing “apples” with a package of apples and, say, lemons, it would not be possible to solve TalkTalk’s two equations in the three unknowns of the tax charges for each of oranges, lemons and apples. The same of course is true of TalkTalk’s attempts to apply this method to calculate individual cumulo costs for WLR and MPF. TalkTalk is therefore forced to rely on an assumption about the proportion of the change in the RV which is due to changes to downstream activities.¹¹⁵⁴
- A26.49 However, the more fundamental reason why we consider that similar amounts of cumulo costs should be recovered from WLR and MPF charges is that this is consistent with charge differentials which reflect the differences in incremental costs. Relative charges that reflect differences in the amount of resources consumed to produce each service give CPs correct incentives to minimise the overall (end-to-end) costs of serving their customers. As such, only differences in resource costs should influence the charge differential. Cumulo costs – i.e. business rates – are not a resource cost but a form of taxation.¹¹⁵⁵ That is, cumulo costs are a transfer from BT to the government. Accordingly, the charge differential should not reflect any alleged differences in cumulo costs. Doing as Sky and TalkTalk proposed would create a distortion that would result in inefficient choices.
- A26.50 We have also considered the points made by TalkTalk which we summarise at paragraph A26.37 above. Some repeat arguments which were addressed in the 2012 appeal. We note that the CC found that:

¹¹⁵³ Paragraph 11.106, March 2013 CC Determination. See also paragraphs 11.114 to 11.115.

¹¹⁵⁴ The assumption “that 15% of this cumulo cost reduction is due to a reduction in MPF/WLR cumulo cost” used by TalkTalk appears to be illustrative (paragraph 2.41 and footnote 24, TalkTalk Response to the July 2013 LLU WLR Consultation). TalkTalk suggests that “Ofcom can source an estimate of the assumption on this proportion from BT”. However, the VOA does not identify an “RV for MPF/WLR” or “MPF/WLR cumulo cost”.

¹¹⁵⁵ Indeed, TalkTalk appears to recognise this since it draws an analogy with a tax on fruit (paragraph 2.40, TalkTalk Response to the July 2013 LLU WLR Consultation).

- the PWNRC approach was, to a sufficient degree, consistent with cost causality;¹¹⁵⁶
- it was relatively easy to understand, logical, and not unduly reliant on confidential data;¹¹⁵⁷
- the alternative method then proposed by Sky/TalkTalk gave results which could not be reconciled to the VOA's aggregate valuation and "did not offer a simple or transparent approach" in important respects;¹¹⁵⁸
- broadly equal allocations between LLU and WLR should be expected given the similarity of these products in their use of the rateable assets and their regulated returns;
- an allocation that was not primarily based on products' use of rateable assets could lead to counterintuitive results;¹¹⁵⁹ and
- allocations should be stable.¹¹⁶⁰

A26.51 Even if the "observed effects" method could be shown to be, in some respects, an improvement on the method proposed by Sky/TalkTalk in the appeal of the March 2012 Statement, we do not consider that it would be superior to the method we use here. In particular, we consider that reflecting the cost allocations TalkTalk calculates in MPF and WLR charges would lead to economic inefficiency because it would result in a charge for MPF which differed from the charge for WLR by more than would be implied by the underlying resource cost differences (since cumulo costs do not represent an economic cost but a transfer).

A26.52 Finally, TalkTalk has misunderstood the point made in paragraphs A14.42 to A14.45 of the July 2013 LLU WLR Consultation. Our purpose was to show that, whether cumulo costs were regarded as a fixed cost or as a variable cost, the rising share of cumulo rates allocated to Openreach by BT's method of allocating rebates was unlikely to be justified. The assumption that cumulo costs can be viewed as fixed was adopted in paragraphs A14.42 to A14.43 primarily for the purpose of illustration. In paragraphs A14.44 to A14.45 we considered the alternative view that cumulo costs might be considered as variable in the long run.

Revisions in the light of more recent data

The Base Year Allocation

A26.53 We have reviewed our approach to cumulo costs in the light of the 2012/13 cost data received from BT and further data we received from BT on 2011/12 costs. We have used the PWNRC method at the market level to perform cross-checks of BT's 2011/12 cumulo cost allocation to MPF and WLR and to check the stability of these calculations by undertaking similar analysis on 2010/11 and 2012/13 data. These

¹¹⁵⁶ Paragraphs 11.96 to 11.97, March 2013 CC Determination.

¹¹⁵⁷ Paragraphs 11.97 to 11.98 and 11.112, March 2013 CC Determination. The CC noted some departure from the principles of the VOA's method but seems to have regarded this as inevitable given the impracticality of using the latter as an allocation methodology.

¹¹⁵⁸ Paragraph 11.106, March 2013 CC Determination. See also paragraphs 11.114 to 11.115

¹¹⁵⁹ Paragraph 11.107, March 2013 CC Determination.

¹¹⁶⁰ Paragraph 11.111, March 2013 CC Determination.

cross-checks are similar to the ones carried out on 2011/12 allocations which we reported in the July 2013 LLU WLR Consultation.

- A26.54 We have not used BT's 2012/13 RFS cost allocations within the Cost Model. We have, however, undertaken some analysis of the way BT's cumulo costs were allocated by BT in its 2012/13 RFS to confirm some of the points we had made in the July 2013 LLU WLR Consultation. Allocations of BT's cumulo rates bill were very similar under both BT's published 2012/13 RFS and those supporting the October RFS Report that BT published.¹¹⁶¹ The amount of cumulo costs that BT allocated to MPF and WLR services in the 2012/13 RFS was static in nominal terms compared to the 2011/12 allocation. As BT Group's cumulo payments fell by more than 11%, the result was an increase in the share of cumulo costs which BT allocated to MPF and WLR services. The net result was that BT allocated 84% of its cumulo bill to services in the WFAEL and WLA markets, higher than the 74% share it allocated to these services in the 2011/12 RFS.
- A26.55 This is as we expected in the July 2013 LLU WLR Consultation based on our understanding of BT's allocation methodology. As we noted in that consultation, BT allocates a proportion of rate "rebates" to Openreach which is less than Openreach's share of the total cumulo bill and the result is that Openreach's share inevitably rises between revaluations.
- A26.56 We have also updated our cross-check calculations to reflect the revised WACC presented in this charge control: 8.6% pre-tax nominal for Openreach and 10.8% pre-tax nominal for the rest of BT. These calculations suggest that the share should be around 67% in 2011/12, i.e. very similar to the share of 68% that we reported in our July 2013 LLU WLR Consultation.¹¹⁶² Calculations using data for 2010/11 and 2012/13 as reported in BT's RFS resulted in very similar shares¹¹⁶³.
- A26.57 As a further cross-check, we have also carried out a PWNRC calculation using data on BT's assets which are more detailed than those published in the RFS. Using the more detailed data avoids the need to rely on assumptions about proportions of rateable and non-rateable assets, and permits a more accurate treatment of duct and core fibre. This calculation suggests that an appropriate share of cumulo costs for MPF and WLR in 2011/12 would be slightly lower at 63%.^{1164,1165} We have

¹¹⁶¹ BT, *Report requested by Ofcom describing certain changes to the Accounting Documents for the year ended 31 March 2013 and illustrating the resulting differences to the Current Cost Financial Statements had those changes not applied*, 3 October 2013, <https://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/Reportrequest edbyOfcomfortheyearended31March2013.pdf> (October RFS Report).

¹¹⁶² Using the method described in the July 2013 LLU WLR Consultation applied to publicly available RFS data for 2012/13, excluding current assets and provisions, we calculate the share of cumulo costs attributable to WLR and MPF to be 65.7%. The equivalent figure when the 2012/13 RFS are restated to reflect 2011/12 cost allocations is 66.6%.

¹¹⁶³ We have also undertaken similar cross check calculations for Openreach rather than the WFAEL and WLA markets but again based on publicly available information published in the RFS. See for example page 88 of BT's 2011/12 RFS. This suggested that Openreach's share should be around 90% of total BT liabilities. The figures were 92% for 2010/11 and 89% in 2011/12. When we undertake the smoothing calculation referred to in Annex 16, we make two small adjustments to this share. Firstly we adjust it so that it reflects the Openreach share of our estimates of non NGA cumulo liabilities. Then we adjust it for what a more detailed asset breakdown would produce, notably the inclusion of specialised accommodation assets, based on the effect that we have observed on the WFAEL and WLA markets. See paragraph A26.57 and also its footnote 1164 below.

¹¹⁶⁴ BT's response dated 22 November 2013 to question 7 of the Thirteenth LLU WLR BT Information Request. Apart from a more accurate assessment of duct and fibre this revised set of data has

undertaken similar calculations using 2012/13 data and the results are slightly higher at around 64%.

A26.58 In the light of this, we do not now consider that BT's 2011/12 allocation of cumulo costs to MPF and WLR services is reasonable. An allocation which is in line with the results of the calculations above (in the range 63% to 67%) would be reasonable, and would result in a reduction in the cumulo costs attributed to WLR rentals from £3.31 to between £2.80 and £2.98 in 2012/13 and a reduction in the cumulo costs attributed to MPF rentals from £3.16 to between £2.68 and £2.85 in 2012/13. We have reflected this reduced allocation in our charge controls. To do this, we have adjusted our projected rate of cumulo cost reduction so that, by the end of the charge control period, the amount of cumulo costs to be recovered from MPF and WLR services reflects both the correction of the overstatement of base year costs and further reductions in BT's cumulo costs expected over the period. We discuss these calculations again in the light of the recent revisions to BT's rateable value – see paragraph A26.66 below.

Equalising allocations in the final year of the control

A26.59 As we are now not relying on BT's allocation we have also considered whether to make an adjustment to the charge controls on MPF and WLR to achieve full parity of contribution in the final year of the control. This is more consistent with our view that MPF and WLR should make similar contributions to the recovery of common costs than BT's allocation of different amounts to each. Therefore, we have assessed how much of the difference between the LRICs of MPF and WLR derived from RFS data could be due to differences in cumulo cost allocations.

A26.60 In Annex 9, we explain how we have estimated the difference between the LRICs of MPF and WLR. We identify four main cost components which contribute to the differential. These are:

- line cards (including reallocation of certain costs previously recovered from Caller Display);
- TAMs;
- Service Level and faults (which affect the components of: D-side and E-side copper current, drop wire maintenance, frame maintenance and service centre assurance); and
- local exchange general frames capital.

A26.61 The fault and service centre differences relate largely to current costs, not capital costs. They are caused by differences in fault rates and also because MPF is delivered to a higher service level than WLR.

A26.62 We have considered whether the other components (line cards, TAMs and local exchange general frames capital) would be likely to attract a material allocation of cumulo costs by reviewing BT's allocation of cumulo costs to plant groups in

allowed us to include exchange buildings subject to the Telereal agreement in BT's rateable assets. These exchange buildings are part of BT's cumulo hereditament.

¹¹⁶⁵ When we undertake the smoothing calculation referred to in Annex 16, we make a small adjustment so that it reflects the shares of our estimates of non NGA cumulo liabilities.

2011/12¹¹⁶⁶ together with information in BT’s Additional Financial Information (AFI) submissions to translate this to component costs. We have then estimated a cumulo component unit cost and applied the usage factors published in the RFS to estimate cumulo contributions to each of WLR, MPF and SMPF rental FAC unit costs in 2011/12. The results are shown in the table below.¹¹⁶⁷

Table A26.1: Cumulo contributions to 2011/12 Component costs

	WLR rental	MPF Rental	SMPF rental
Local exchanges general frames capital	✂	✂	✂
Local exchanges general frames current	✂	✂	✂
PSTN line cards	✂	-	-
Broadband line testing systems	✂	✂	✂

Source: BT’s AFI submissions, and BT’s responses to the Fourth and Eleventh LLU WLR BT Information Requests.

A26.63 It is clear from the table that the contributions from general frames current and TAMs, which are in the broadband line testing component, are negligible. In addition, the contribution to the *forward-looking* cost differential from local exchange general frames capital, is significantly smaller than the figure shown in the table above, for reasons set out in Annex 9.¹¹⁶⁸ The only possibly material contribution from cumulo costs is through line card costs, and we have therefore taken this into account when estimating the LRIC of line cards in 2016/17 for the purposes of calculating appropriate charge differentials. As explained in Annex 9, our LRIC estimate for line cards is £7.40 after deducting estimated cumulo costs.

A26.64 Therefore we do not propose any other explicit adjustment to final year costs or charges to reflect equalisation of cumulo cost allocations to MPF and WLR.

Changes in cumulo costs over the charge control period

A26.65 We have also reviewed our projections of cumulo costs over the charge control period and in particular have reflected the changes made to BT’s cumulo rateable value by the rating authorities in England, Wales and Scotland in April 2014.¹¹⁶⁹ As we noted in paragraphs A14.31 of the July 2013 LLU WLR Consultation even

¹¹⁶⁶ From BT’s response dated 1 May 2013 to question 5 of the Fourth LLU WLR BT Information request and BT’s response dated 8 November 2013 question 10a of the Eleventh LLU WLR BT Information request.

¹¹⁶⁷ The net difference of about ✂ is consistent with the difference in cumulo unit costs between MPF and WLR that we reported in the July 2013 LLU WLR consultation (see paragraph A26.23 above).

¹¹⁶⁸ As explained in Annex 9, the difference in forward-looking costs is relevant for determining the appropriate charge differential.

¹¹⁶⁹ The changes in England and Wales can be found on the VOA web-site here:

http://www.voa.gov.uk/rli/static/HelpPages/English/help/help153-central_rating_list.html. The changes in Scotland they can be found on the Scottish Assessors Association (SAA) web-site here: http://www.saa.gov.uk/renfrewshire/search.php?SEARCHED=1&ST=advanced&SEARCH_TABLE=valuation_roll&TYPE_FLAG=C&STREET=&TPTLA=&POSTCODE=&ASSESSOR_ID=&CLASS=0020&EFFECTIVE_DATE=&TEFFECTIVE_DATE=&MIN_RV=&MAX_RV=&AS_UARN=&DISPLAY_COUNT=100&x=5&y=9&ORDER_BY=SET+DESC&SEARCH_TERM=&PT=1&UARN=Z99655%2F0067&PPRN=67173845&ASSESSOR_IDX=12&DISPLAY_MODE=FULL_HISTORY#results

through BT’s RVs in England, Wales and Scotland had been changed since the start of the 2010 Rating list all of these changes remained under appeal or “subject to proposals”. We understand from the VOA that these latest changes now resolve all outstanding BT Central List assessment issues for the 2010 Rating List in respect of “material changes in circumstances” (MCCs) between 1/10/2010 and 1/10/2013.

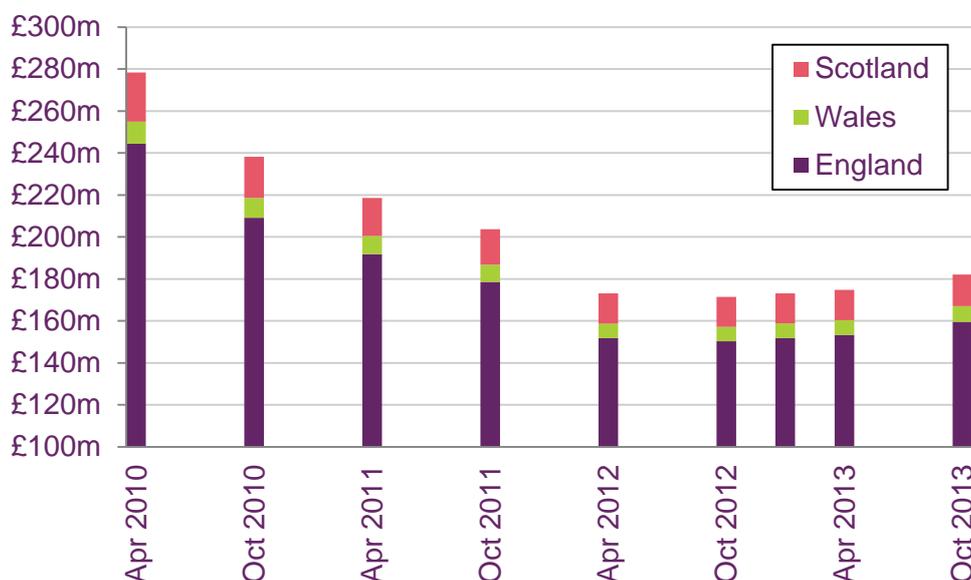
A26.66 Table A26.2 below summarises the changes that have been made. Figure A26.1 below updates Figure 14.1 from the July 2013 LLU WLR Consultation and shows how BT’s cumulo rateable value has changed since April 2010.

Table A26.2: Changes to BT’s RV in Great Britain since April 2010

With effect from	England		Wales		Scotland	
	Prior to April 2014	April 2014 Revision	Prior to April 2014	April 2014 Revision	Prior to April 2014	April 2014 Revision
1/4/2010	£244.46m	-	£10.50m	-	£23.36m	-
1/10/2010	£216.17m	£209.10m	£9.31m	£9.42m	£23.36m	£19.71m
1/4/2011	£209.73m	£191.79m	£9.03m	£8.68m	£20.09m	£18.08m
1/10/2011	£208.19m	£178.66m	£8.97m	£8.13m	£19.94m	£16.84m
1/4/2012	£169.24m	£151.77m	£7.73m	£6.99m	£15.95m	£14.31m
1/10/2012	£168.34m	£150.30m	£7.69m	£6.93m	£15.87m	£14.17m
1/1/2013	£172.15m	£151.84m	£7.85m	£6.99m	£16.23m	£14.31m
1/4/2013	-	£153.35m	-	£7.06m	-	£14.45m
1/10/2013	-	£159.66m	-	£7.32m	-	£15.05m

Source: VOA and Scottish Assessors Association (SAA) websites

Figure A26.1: BT rateable value in Great Britain since April 2010



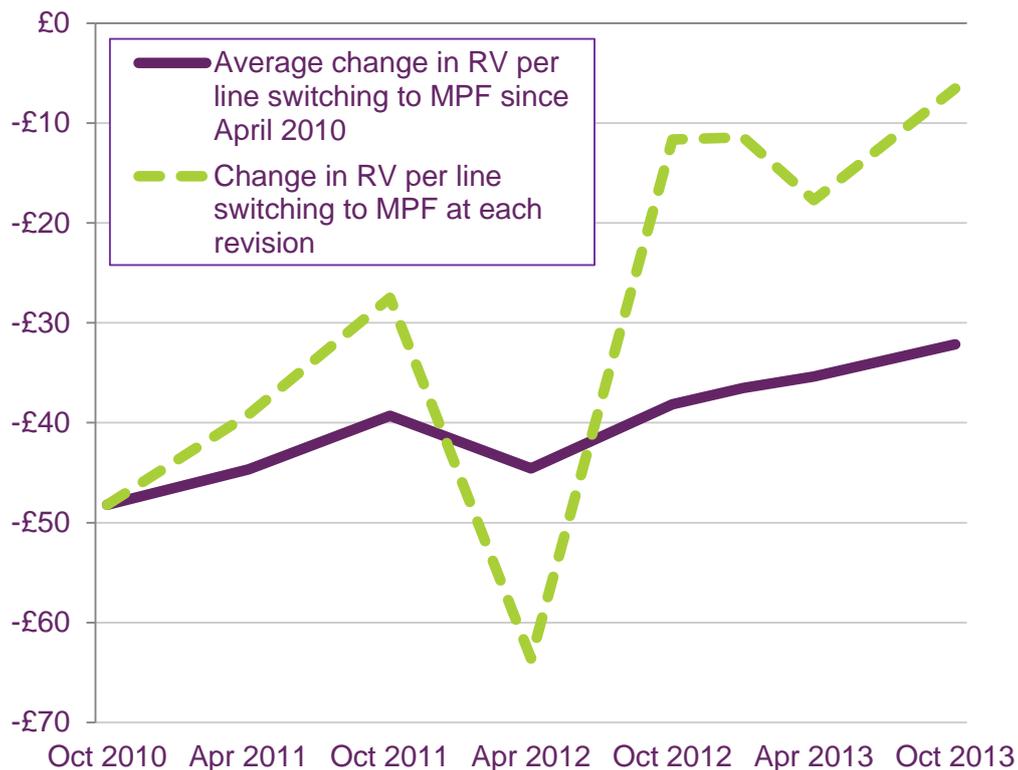
Source: VOA and SAA websites

- A26.67 We have first used the above rateable values to estimate what BT's cumulo bill would have been if these changes had been made in the years to which they referred. We estimate that this would have reduced BT's non-NGA cumulo liabilities by £4m to £5m in 2010/11 and 2011/12 and around £10m in 2012/13. We have also estimated the effect of these reduced payments on the allocations to WLR and WFAEL services that we referred to in paragraph A26.54 above. The great majority of these RV changes are likely to have been associated with updated estimates of the effects of MPF rebates (as opposed to other MCC effects). Assuming that this would not have prompted BT to change the way it allocated these rebates then we estimate that the 74% share of cumulo allocated to WFAEL and WLA services in 2011/12 would have increased to c. 78%. Further, the 84% share of Cumulo allocated to WFAEL and WLA services in 2012/13 would have increased to c. 96%. This casts further doubt on the appropriateness of BT's current allocation methods.
- A26.68 We have then revised our projections of changes in cumulo costs over the remainder of the charge control period. The rateable values that applied in 2013/14 have been published, so forecasts are only required for 2014/15 to 2016/17.
- A26.69 Our projections are derived from analysis of the way BT's RV appears to have changed as a result of MCCs. The two main MCCs are increases in the number of NGA lines, which increase BT's RV, and switching from WLR to MPF lines, which reduces it. We assume that each new NGA line increases BT's RV by £18 if it is supplied using FTTC and by £20 if it is supplied using FTTP.¹¹⁷⁰ Combined with data on the volume of NGA lines¹¹⁷¹, we use these figures to calculate BT's RV in the absence of NGA. The change in this figure between revaluations is then assumed to be due to switching to MPF. We can combine this with data on the change in the number of MPF lines to estimate the change in RV per line switching to MPF. We do not know the line volume figures actually used by the VOA.
- A26.70 We have calculated two measures of the change in RV per line switching to MPF. Firstly we calculate the average change in RV per line switching to MPF since the start of the rating list in April 2010, i.e. since the first revision in October 2010. We also calculate the average change between each subsequent revision to BT's RV. This latter series is particularly volatile as Figure A26.2 below shows.

¹¹⁷⁰ These figures are taken from the Valuation Office Agency, *Rating Manual Volume 5 Section 873: Practice Note 2010: Next Generation Access Telecommunications Networks (NGA)*, http://www.voa.gov.uk/corporate/publications/Manuals/RatingManual/RatingManualVolume5/sect873/1Rat-man%20Vol%205%20Sec873%20PN%202010a.html#P175_2834. Lower figures will apply in BDUK areas but the effect is likely to be small given the greater extent of NGA volumes outside BDUK areas compared to those in BDUK areas over the charge control period. We have updated future rates in the pound to take account of expected inflation.

¹¹⁷¹ Actual and forecast volumes of NGA connections from BT's response dated 25 October 2013 to questions 12 and 15 of the Eleventh LLU WLR BT Information Request.

Figure A26.2: Change in BT rateable value from changes in MPF volumes



Source: Ofcom analysis

A26.71 The change in RV per line switching to MPF that we have calculated appears to have been much lower over the last four revisions, i.e. those since 1st October 2012, than those before that. We discussed this briefly with the VOA who noted:

- i) There are other factors that may have affected revisions to BT's RVs as a result of MCCs apart from NGA and MPF volumes. These other factors may have had a greater effect over the period in question.
- ii) The VOA's discussions with ratepayers focus on the rateable value of the hereditament in question not with how it may or may not be possible to break down that RV. The VOA does not break down BT's valuation or indeed analyse the RV in the way that we, Ofcom, have attempted to do.
- iii) While the VOA understands our desire to analyse changes in BT's valuation in order to understand how BT's cumulo costs might change in the future that is not something that the VOA was willing to speculate on.
- iv) The VOA did, however, note that the impact of different factors will change through time and it may be that recent changes in BT's RV will not necessarily be a good guide to what may happen in the future.

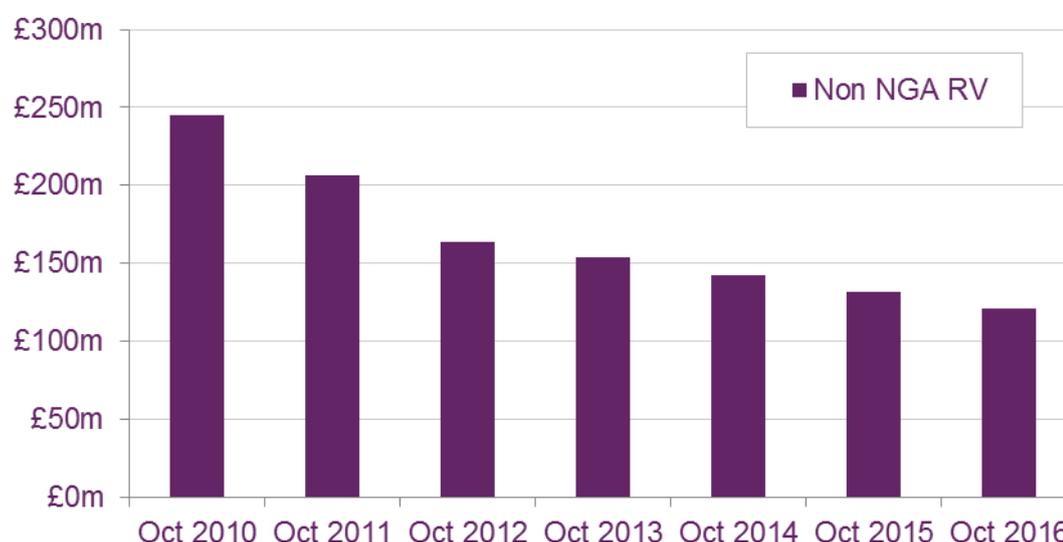
A26.72 The average change in RV per line switching to MPF from April 2010 to April 2012 was around £45. Since then it has decreased reasonably linearly and at 1 October 2013 it was just over £30. A simple extrapolation suggests this average might reach £20 to £25 by 2016/17.

A26.73 We are also conscious of the VOA’s caution that the past may not be a reliable guide to the future. However, if we are to estimate BT’s future non-NGA cumulo payments, we have to take a view on BT’s future RV. We have therefore decided to assume as a central estimate that the average change in RV per line switching to MPF since April 2010 will be £25 by the end of 2016/17. We also consider that figures of £20 and £30 provide reasonable lower and upper bounds respectively.

A26.74 Combining these assumptions about the future change in BT’s RV per line switching to MPF with our projections of the number of such lines, produces forecasts of BT’s RV which we can then translate into projections of cumulo payments attributable to non-NGA services over the charge control period. These forecasts generally imply reductions greater than the 15% to 25% referred to in the July 2013 LLU WLR Consultation, though some of these reductions are the result of the recent retrospective changes in BT’s rateable value.

A26.75 We estimate that non-NGA payments will be 15% to 50% (with a central case of 32%) lower in 2016/17 than the payments BT made in 2012/13 and 30% to 55%¹¹⁷² (with a central case of 42%) lower than the payments BT made in 2011/12. The reductions are greater than we estimated in the July 2013 LLU WLR Consultation because we have assumed a higher loss of RV per line switching to MPF. The forecasts also reflect the recent changes to BT’s rateable value up to 1 October 2013, revised forecasts of MPF and NGA volumes and updated rates in the pound. The charts below show the resulting projection of BT’s RV and cumulo payments, assuming that the average change in BT’s RV per line switching to MPF is £25 by the end of the charge control period. Reductions in BT’s non-NGA cumulo payments are forecast to be smaller from 2014/15 onwards.

Figure A26.3: Forecasts of BT Rateable Value in the UK¹¹⁷³

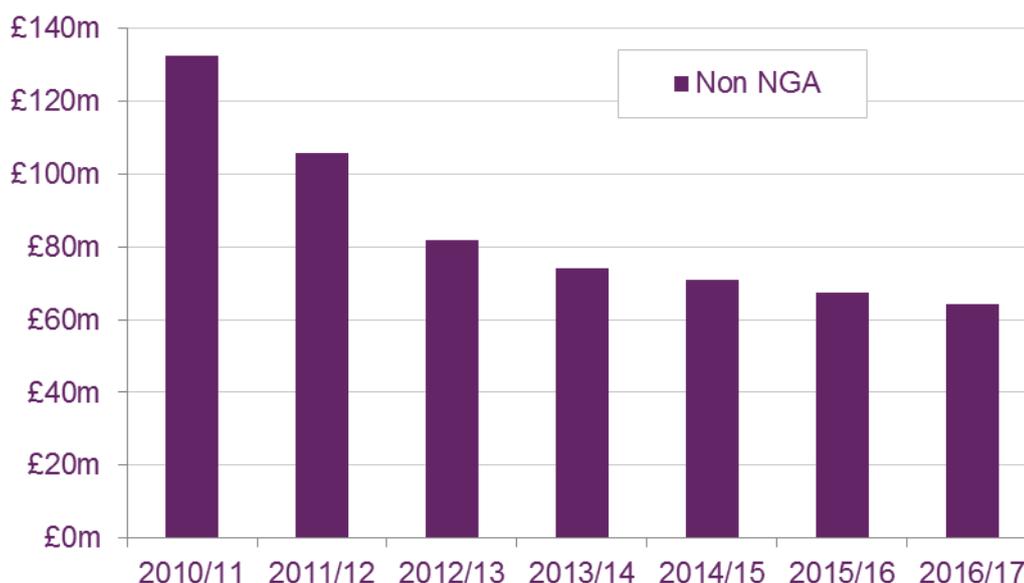


Source: Ofcom analysis

¹¹⁷² The ranges have been rounded to the nearest 5%.

¹¹⁷³ The forecasts include BT’s cumulo RV (or more correctly NAV, Net Annual Value) in Northern Ireland. This has been static since late 2010/11. We have therefore assumed that no element of BT’s NAV in Northern Ireland can be attributed to NGA. Rateable values are due to be reassessed in Northern Ireland with effect from 1 April 2015.

Figure A26.4: Forecasts of BT payables in the UK¹¹⁷⁴



Source: Ofcom analysis

A26.76 There are some caveats surrounding these forecasts:

- The projections rely heavily on the past relationship between BT's RV and the numbers of NGA and MPF lines. These relationships may not hold in the future.
- We do not have detailed knowledge of the way the VOA calculates BT's RV, though we do know this is done at an aggregate level and the VOA has told us that its method cannot be used to derive costs for individual services.
- We are setting the charge controls using a model of a hypothetical all-copper network, but this is not the network that is actually valued by the VOA or will be in the future. We do not know what RV the VOA would ascribe to BT if it possessed such a copper-only network.

A26.77 These caveats suggest that we should be cautious and avoid the spurious accuracy which could arise from making an overly precise projection of RVs and the resulting liabilities.

A26.78 Therefore, rather than make a specific adjustment to projected MPF and WLR costs, our approach is to reflect cumulo cost reductions in our overall efficiency gain assumption. It is a benefit of this approach that the efficiency assumption is not very sensitive to uncertainty about projected cumulo costs because of the relatively low weight of cumulo costs in Openreach's total costs.

A26.79 In Annex 16 we explain that we propose to apply a single rate of annual efficiency gain equal to 5% to all cash costs (including capital expenditure). This single efficiency assumption effectively represents a weighted average of the rates of reduction of several different costs, of which cumulo is one.

A26.80 Our efficiency estimate is informed by data from a number of sources, some of which explicitly capture the effects due to cumulo, others of which have not explicitly

¹¹⁷⁴ The 2010/11, 2011/12 and 2012/13 figures in this graph are different to those reported by BT. The figures in the graph reflect what BT would have paid if the recent retrospective changes to BT's RV had been made in the relevant year. They also ignore any prior year refunds or provision movements.

captured cumulo. For example, it may be unclear what, if any, allowance for future cumulo cost reductions sources such as analysts' briefings and reports include. We take these different treatments into account when we interpret the ranges of estimates drawn from each source.

- A26.81 Annex 16 describes in more detail the historic and forecast analysis of BT's efficiency that we have undertaken. Here we clarify how we have treated cumulo within these calculations.
- A26.82 Our analysis of Openreach's historic efficiency reflects past changes in cumulo costs. But within these calculations we restate cumulo amounts paid over the period 2009/10 to 2012/13 in the light of the above recent retrospective revisions to BT's RV (which affect payments over the period 2010/11 to 2012/13) and our revised allocations of BT's cumulo costs¹¹⁷⁵. Our forecasts of Openreach's efficiency gains include our projections of future cumulo cost reductions based on the above assumptions and again a similar adjustment to reflect our revised allocations. The changes in future payments are consistent with the changes to cumulo payments in 2011/12 and 2012/13.
- A26.83 Our efficiency estimate therefore embeds our analysis of cumulo charges within both the forecast and historic assessments. Removing cumulo rates payments from our efficiency estimates would affect our assessment of Openreach's historic and future performance. We consider that the efficiency assumption used in our charge control model is consistent with the plausible range of cumulo cost reductions.

¹¹⁷⁵ We could alternatively have attributed reductions as a result of the recent retrospective revisions to BT's rateable value and revised allocations to the period post 2012/13. We believe that attributing the changes to the year in which they relate is a more satisfactory approach. See paragraphs A26.56 and A26.57 and footnotes 1162 and 1164 for further details of the adjustments we make to reflect our revised allocations.

Annex 27

Single Jumpered MPF

Introduction and Summary

A27.1 In this Annex we set out our conclusions on whether we should set MPF charges based on the assumption that Openreach provides LLU MPF services on a ‘single jumpering’ basis or the current ‘double jumpering’ basis.

A27.2 We conclude that it is appropriate to continue to set MPF charges assuming the current double jumpering basis.

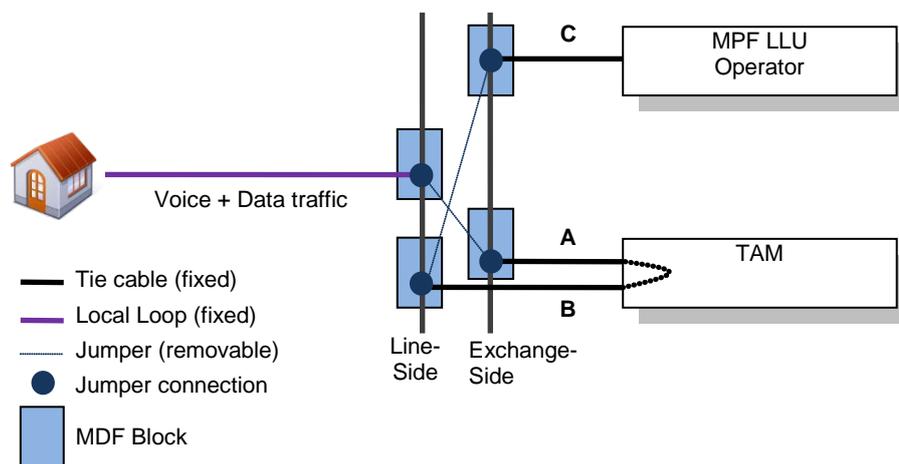
Description of double jumpered and single jumpered MPF

A27.3 This annex considers two possible configurations of MPF, namely the Double Jumpered MPF (“DJ-MPF”), which is currently used, and the Single Jumpered MPF (“SJ-MPF”). Below we show the wiring arrangements in the local exchange for DJ-MPF and SJ-MPF.¹¹⁷⁶

Double Jumpered Metallic Path Facility (DJ-MPF)

A27.4 The current configuration for DJ-MPF is illustrated in Figure A27.1. As can be seen, it involves two jumpers on the Main Distribution Frame (“MDF”) and three tie cables (A, B and C).

Figure A27.1: Standard (Double Jumpered) MPF Configuration



A27.5 With this approach, Openreach is responsible for the full management of: the telephone line from the exchange to the end user, the TAM, tie cables A and B and both of the MDF jumpers. By fully managing these assets Openreach is able to

¹¹⁷⁶ For a fuller discussion of the equipment and activities involved in providing MPF under both the existing Double Jumpering and potential Single Jumpering configurations see Annex 2 of the Single Jumpered MPF Dispute Determination.

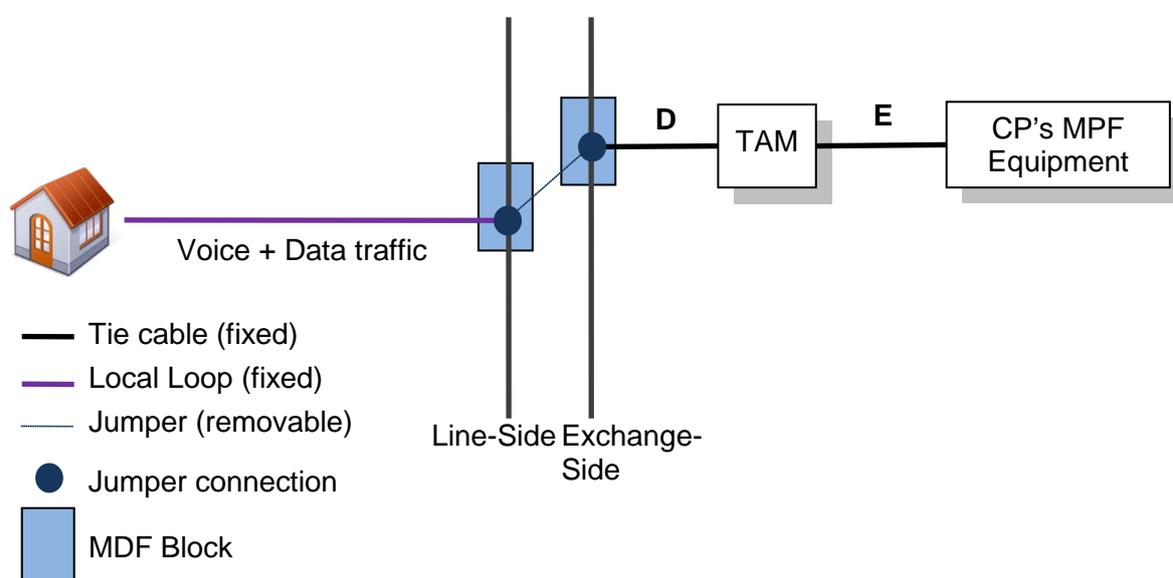
decide how to share and re-use these assets across the various LLU operators and this means that it has control over the utilisation and therefore the unit cost of these assets. Because of this, all of these assets are included in the current MPF product.

A27.6 Conversely, tie cable C is dedicated to a specific LLU operator and whilst Openreach installs this tie cable, the LLU operator is responsible for its usage/utilisation. Because of this, tie cable C is a separate product and is thus not part of the current MPF product.

Single Jumpered Metallic Path Facility (SJ-MPF)

A27.7 Figure A27.2 shows one possible approach to providing SJ-MPF. This arrangement is also known as ‘in-line TAM’. As can be seen, it involves one jumper on MDF and two tie cables (D and E).

Figure A27.2: Single Jumpered MPF Configuration; ‘In-line solution’



A27.8 This approach has not been deployed in the UK. However, if it were implemented, the MPF product would likely only include the telephone line from the exchange to the end user and the jumper across the MDF. This is because these are the only assets fully managed by Openreach. In this approach tie cables D and E and the TAM are dedicated to a specific LLU operator and therefore would need to be separate products. Therefore, with this approach each LLU operator would most likely be responsible for the usage/utilisation of tie cables D and E and the TAM.

Regulatory and Commercial History

A27.9 The MPF product was originally designed based on the DJ-MPF approach. This approach allowed the shared use of TAMs and tie cables (A and B) and therefore promoted efficient use of assets even when individual LLU operators had low levels of demand.

A27.10 In the early stages of LLU development, MPF was not the most commonly used product. Rather SMPF was the most commonly used product. SMPF does not

require a TAM (see Figure A10.2), but it does require a tie cable from the exchange side of the MDF to the LLU operator – in fact exactly the same tie cable as tie cable C shown in Figure A27.1. Thus tie cable C could be used for both SMPF and MPF and in practice many LLU operators who started out using SMPF migrated to MPF by parallel using and re-using their existing tie cables.

A27.11 In the early stages of LLU there were therefore sound economic and commercial reasons for adopting the double jumpering approach to MPF. It is therefore no surprise that industry collectively adopted the DJ-MPF approach in these early stages.

2007: Single Jumpered MPF Discussions

A27.12 In 2007, Openreach had discussions with some CPs about the use of SJ-MPF.¹¹⁷⁷ Openreach said that these were preliminary technical discussions and that the single jumpered approach that was presented would not have been available in all cases or locations and was presented as an option to resolve issues relating to the potential exhaustion of MDF capacity. This approach was not implemented.¹¹⁷⁸

A27.13 BT had also planned to use a single jumpered approach in the implementation of a major network upgrade programme (known as 21st century network, or 21CN). 21CN implementation involved a mass migration of lines onto 21CN and therefore would have put considerable strain on the available MDF capacity. However, because it was going to be a coordinated mass migration it could, in its own right, achieve a high utilisation of TAMs under the single jumpered approach. However, in early 2009 BT revised its 21CN plans and accordingly never migrated its lines to MPF – SJ-MPF nor DJ-MPF.¹¹⁷⁹

2009: Single Jumpered MPF in the LLU and WLR Appeals

A27.14 Ofcom consulted on a new set of charge controls for WLR and LLU in December 2008 and published a Statement in May 2009. TalkTalk argued that Ofcom did not properly consult on the costs of DJ-MPF and/or whether they should be included in the MPF product cost in this charge control.¹¹⁸⁰

A27.15 Subsequently, TalkTalk appealed these charge controls on, among other things, the assumption of the use of DJ-MPF.

A27.16 In this appeal, TalkTalk argued that MPF costs would be lower with SJ-MPF and that Ofcom should use these lower costs to inform the LRIC differential between WLR and MPF costs. The Competition Commission found that Ofcom did not err in estimating the LRIC differentials by assuming DJ-MPF rather SJ-MPF. The reasons it cited were that no Statement of Requirements ("SOR") had been made for a single jumpered solution, that SJ-MPF might not be a more cost-effective

¹¹⁷⁷ Paragraph A9.3, March 2012 Statement.

¹¹⁷⁸ Paragraph A9.50-52, March 2012 Statement.

¹¹⁷⁹ See paragraphs 3.119, Competition Commission, *The Carphone Warehouse Group plc v Office of Communications. Case 1149/3/3/09 - Determination*, 31 August 2010, http://webarchive.nationalarchives.gov.uk/+http://www.competition-commission.org.uk/appeals/communications_act/wlr_determination.pdf

¹¹⁸⁰ Annex 2, TalkTalk, *Charge Control for LLU/WLR Services*, July 2011,

<http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/responses/ttg.pdf>

solution and that TalkTalk had not provided any reason for not making an SOR given that an industry process is in place for this purpose.¹¹⁸¹

2010: First SJ-MPF Statement of Requirements

A27.17 In October 2010, TalkTalk submitted an SOR for TAM-less MPF. Following discussions between Openreach, TalkTalk and the OTA, the scope of the requirement was extended to include an SJ MPF product which provided an ‘in line’ TAM. In December 2010, Openreach rejected the SOR for both TAM-less MPF and in-line SJ-MPF.

A27.18 Following Openreach’s decision, the Copper Products Commercial Group (CPCG)¹¹⁸² requested that Openreach re-visit the SOR and carry out additional analysis. This process was never completed, in part due to the discussion of SJ-MPF within the review leading to the March 2012 Statement.

2012: March 2012 Statement

A27.19 In the March 2012 Statement we concluded that it would not be appropriate to set MPF charges by assuming the use of SJ-MPF.

A27.20 We noted that SJ-MPF had the potential to be more efficient in certain specific circumstances for some operators. But we did not consider that it was clearly the most efficient way to provide MPF because the structure of the cost base was different in the two approaches (in particular because the responsibility for making decisions relating to efficient delivery reside with the LLU operator rather than Openreach in SJ-MPF).¹¹⁸³

A27.21 We also noted that:

- MPF provided via the single jumpering approach should be considered a different product to the current MPF jumpering approach;
- charging for the current MPF jumpering approach based on a different product would be inappropriate;
- expecting Openreach to introduce a new single jumpering product without industry support for the development of such a product would be unreasonable; and
- when assessing the benefits of moving to single jumpering, it would be appropriate to include the costs of migrating existing lines from the current jumpering approach to the single jumpering approach.

¹¹⁸¹ See Paragraph 3.120 onwards, from page 3-23, Competition Commission, *References under section 193 of the Communications Act 2003: The Carphone Warehouse Group plc v Office of Communications, Case 1111/3/3/09 – Determination, 31 August 2010*, http://www.catribunal.org.uk/files/1.1111_Carphone_Warehouse_CC_Determination_310810.pdf

¹¹⁸² The Copper Products Commercial Group (CPCG) is an industry forum involving Openreach and its customers.

¹¹⁸³ Paragraph A9.3, March 2012 Statement.

2012: Second SJ-MPF Statement of Requirements

A27.22 Despite finding that it would not be appropriate to set MPF charges based on SJ-MPF, the March 2012 Statement indicated that Ofcom was supportive of discussions being progressed by the CPCG into the costs and benefits and potential demand for a new SJ-MPF product.

A27.23 Following this, TalkTalk submitted a second SOR for SJ-MPF (“May 2012 SOR”), this time specifying it should be deployed using the ‘in-line’ solution. In December 2012, Openreach made a presentation to the CPCG where it stated that it was rejecting the SOR. Openreach said “*the case is highly sensitive to future volumes and TAM utilisation*” and that “*considerable systems development would be required to create a new product – the earliest release anticipated 13/14*”.¹¹⁸⁴

2013: Single Jumpered MPF Dispute

A27.24 On 25 June 2013, TalkTalk submitted a dispute against BT relating to the decision by Openreach not to offer SJ-MPF having been requested to do so by TalkTalk in the May 2012 SOR.¹¹⁸⁵ TalkTalk recognised that it would not be efficient to move existing customers on DJ-MPF to a new SJ-MPF product. Rather the new SJ-MPF product would be used to support new customers going forwards and the dispute was about whether the project should be developed for this.

A27.25 Ofcom found that whilst there were on-going operational cost savings from SJ-MPF, the quantifiable benefits would not outweigh the quantifiable costs over a reasonable time horizon. This was due to the additional capital costs, development costs, and falling volumes of annual net adds that could make use of the new SJ-MPF.¹¹⁸⁶

July 2013 LLU WLR Consultation Proposal

A27.26 The July 2013 LLU WLR Consultation was published before Ofcom’s determination of the Single Jumpered MPF Dispute. In the July 2013 LLU WLR Consultation, we proposed to retain the same approach as in our March 2012 Statement, and so to forecast costs based on DJ-MPF rather than SJ-MPF.

Responses to the July 2013 LLU WLR Consultation Proposal

A27.27 TalkTalk¹¹⁸⁷ and Sky¹¹⁸⁸ both commented on the approach to setting MPF charges based on DJ-MPF costs¹¹⁸⁹ arguing that Ofcom should base MPF charges on a single jumpered approach. Sky noted that, it has been apparent for several years that single jumper MPF was more efficient but BT had failed to develop it and therefore when modelling the efficient level of MPF costs Ofcom should assume that SJ-MPF was available at an earlier date.¹¹⁹⁰

¹¹⁸⁴ SOR 8333 Evaluation for Single Jumper MPF (CPCG presentation), December 2012 (Annex 3 to Openreach comments on TalkTalk’s dispute submission, 26 July 2013).

¹¹⁸⁵ Single Jumpered MPF Dispute Determination.

¹¹⁸⁶ Tables 6 and 7, page 68 and 69, Single Jumpered MPF Dispute Determination.

¹¹⁸⁷ TalkTalk Response to the July 2013 LLU WLR Consultation.

¹¹⁸⁸ Sky Response to the July 2013 LLU WLR Consultation.

¹¹⁸⁹ TalkTalk did not comment in its initial response to our consultation but submitted a further response in December 2013 following the Final Determination of the Single Jumpered MPF Dispute.

¹¹⁹⁰ Paragraph 10.25, Page 32-3, Sky Response to the July 2013 LLU WLR Consultation.

A27.28 TalkTalk also argued that prices should be based on an SJ-MPF product as if it had been introduced, because this would represent ‘efficient costs’. It argued that the test should be based on whether Openreach could reasonably have known SJ-MPF was lower cost than DJ-MPF and whether SJ-MPF could reasonably have been implemented and used.

A27.29 TalkTalk proposed a number of options for setting the MPF price¹¹⁹¹ noting that the ideal approach (Option 1) would be to remove the ‘inefficient’ costs of DJ-MPF from the MPF charge. TalkTalk also suggested simply correcting the frame costs assumptions in line with the Single Jumpered MPF Dispute Determination (Option 2) or equalising the frame Single Jumpered MPF Dispute cost between MPF and WLR (Option 3).¹¹⁹²

A27.30 TalkTalk also considered there were two other implications of the Single Jumpered MPF Dispute:

- It argued that the same incremental frame cost assumption should be used for the charge control as was used in the Single Jumpered MPF Dispute. We consider this in Annex 9 (Estimation of LRIC differentials); and
- That Openreach had harmed consumers’ interests by delaying the development of SJ-MPF to the degree that it was no longer viable and that this raised a question of whether the regulatory framework around product development could be improved.

A27.31 TalkTalk also responded to our December 2013 LLU WLR Consultation providing an assessment on the circumstances under which SJ-MPF would have been lower cost than DJ-MPF.¹¹⁹³ TalkTalk’s submissions in this regard were that in the 2,000 largest exchanges the number of lines required on SJ-MPF for it to be more efficient was 0% to 7% of total lines, depending on the number of CPs using MPF and whether there was an existing DJ-MPF estate.¹¹⁹⁴

Assessment

A27.32 In the light of Ofcom’s determination of the Single Jumpered MPF Dispute, we consider that it is unlikely that a SJ-MPF product will be introduced. We have therefore considered whether, for the purposes of setting the present charge controls, the costs of the DJ-MPF product should be assessed on the hypothetical assumption that SJ-MPF had been introduced in the past.

A27.33 TalkTalk argued that the Single Jumpered MPF Dispute Determination showed that net cost savings from SJ-MPF are critically dependent on when the product is assumed to start (with an earlier start resulting in higher savings) and that had SJ MPF been introduced in 2007 it would have resulted in a significant positive NPV and cost saving. To support this TalkTalk estimated the NPV of an SJ-MPF product

¹¹⁹¹ Paragraph 3.34. Page 13, TalkTalk, *Implications of SJ-MPF dispute determination*, December 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk_comments_regarding_SJ-MPF_noncon.pdf

¹¹⁹² TalkTalk estimated that the MPF-WLR differential would be the same under Option 1 and Option 3.

¹¹⁹³ Paragraph 3.21, Page 14, TalkTalk Response to the December 2013 LLU WLR Consultation.

¹¹⁹⁴ Paragraph 11.13, Page 60, TalkTalk Response to the December 2013 LLU WLR Consultation.

based on start dates ranging from 2006/07 to 2016/17 and found that if SJ-MPF had been introduced in 2007 it would have resulted in significant net cost savings.¹¹⁹⁵

A27.34 We agree that the assessment of SJ-MPF in the Single Jumpered MPF Dispute indicates that an earlier introduction of SJ-MPF could have resulted in a different impact on efficient costs relative to the double jumpered solution. This reflects the fact that a later start date results in lower line volumes for the SJ-MPF product as net adds fall overall, and indicates that an earlier introduction of SJ-MPF could have resulted in a different impact on efficient costs relative to DJ-MPF.¹¹⁹⁶ However, such a retrospective assessment is made with the benefit of outturn volumes and costs. A prior evaluation of the case for SJ-MPF would not have had such information, it would have required forecasts. A prior evaluation would therefore be sensitive to forecast volumes and projections of costs at the time of that evaluation. By contrast, the evaluation made in the Single Jumpered MPF Dispute Determination used a forwarding looking model based on costs and information from 2013/14 (including projections made thereafter, but conditional on the outturn costs and volumes as at 2013).¹¹⁹⁷

A27.35 In general, we agree with TalkTalk that it is not necessary for CPs to suggest the most efficient ways of providing services through SORs, rather Openreach should be aiming to provide services at lowest cost. However, in the case of MPF, we consider that it was reasonable for Openreach to continue using DJ-MPF until there was industry support for SJ-MPF for the following reasons:

- The MPF product was originally developed through industry-wide discussions, involving BT and other CPs and overseen by the OTA, which agreed the DJ-MPF approach;
- SJ-MPF would be sufficiently different that it should be considered a different product to DJ-MPF. DJ-MPF includes the TAM, but with SJ-MPF, the TAM would not be included in the MPF product, but would be included separately in other products (e.g. a tie cable product). This is because single jumpering would put the responsibility for managing utilisation of the TAM on the LLU operator. The nature and pricing structure of the two MPF products would therefore need to be different.
- Given the differences between DJ-MPF and SJ-MPF, we do not consider it reasonable to have expected Openreach to unilaterally change from DJ-MPF to SJ-MPF without industry support. Changing the MPF product from DJ-MPF to SJ-MPF would result in LLU operators purchasing different products to those that they originally agreed, and those LLU operators with lower volumes and utilisation of their tie cables could be worse off.
- It is therefore the case that SJ-MPF is unlikely to have replaced DJ-MPF, rather the two products would have needed to coexist. Further, if SJ-MPF was introduced alongside DJ-MPF then Openreach's ability to control the utilisation of the DJ-MPF assets (tie cables and TAMs) would be reduced, as volumes are

¹¹⁹⁵ Paragraph 3.9, Page 7, TalkTalk, *Implications of SJ-MPF dispute determination*, December 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk_comments_regarding_SJ-MPF_noncon.pdf

¹¹⁹⁶ Sensitivity analysis shows that a delay to the start date of one quarter would result in a £1.7m decrease in the NPV of SJ-MPF. Table 6, Single Jumpered MPF Dispute Determination.

¹¹⁹⁷ The model used in the Single Jumpered MPF Dispute Determination is forward-looking and does not estimate the impact of earlier start dates, as this was not relevant for the resolution of the dispute.

diverted to SJ-MPF. This would accordingly put upward pressure on the unit cost of DJ-MPF.

- A27.36 We therefore consider that it would not have been reasonable for Openreach to introduce SJ-MPF before assessing TalkTalk's first SOR in October 2010. Openreach rejected this first SOR in December 2010.
- A27.37 We have not undertaken a detailed investigation of whether SJ-MPF would have been likely to reduce costs overall if it had been developed immediately after December 2010. This is because, even if we were to assess now (with hindsight) that it could have reduced costs, such certainty would not have been possible at the time.
- A27.38 As noted earlier, in the March 2012 Statement, we considered that SJ-MPF had the potential to be more efficient in certain specific circumstances for some operators. We did not, however, consider that it was clearly the most efficient way to provide MPF.¹¹⁹⁸ We consider that it would only have become clear whether or not it was lower cost after additional investigation involving discussions between CPs and Openreach. When that detailed investigation was carried out (some time later), our assessment (in the Single Jumpered MPF Dispute Determination) was that it did not support the introduction of SJ-MPF.
- A27.39 Given that we do not consider it was clear that SJ-MPF was lower cost at the end of 2010, we consider it would not be appropriate now to price DJ-MPF on the basis of SJ-MPF.
- A27.40 Moreover, even if we thought that there was a time in the past when SJ-MPF was clearly lower cost, we would not necessarily conclude we should now set a lower charge for DJ-MPF. We determined in the Single Jumpered MPF Dispute Determination that it would not be efficient to introduce SJ-MPF now. A charge for DJ-MPF that was adjusted downwards because SJ-MPF was not introduced in the past would therefore be below the efficient level of providing DJ-MPF today (and most likely in the future). Setting a charge below what is now the efficient level of forward looking costs could lead to inefficient use of MPF. It would also be complex to determine the size of any adjustment. SJ-MPF and DJ-MPF would effectively have been different products, and different ancillary services would have been purchased to support them. When it was economic to use SJ-MPF may have depended on the CP, on whether it was for existing or new subscribers and possibly by exchange.
- A27.41 Finally, turning to the issue of the SOR process, we recognise that this process might not be working as well as it might. As discussed further in Volume 1, paragraphs 10.116 to 10.118, we have decided to closely monitor the SoR process over the next 12 months. At the end of that period, we will decide whether it is appropriate to initiate a separate SoR project.

¹¹⁹⁸ Paragraph A9.3, March 2012 Statement.

Annex 28

Model results and sensitivities

Introduction

A28.1 We have used the Cost Model to calculate the unit costs of services that will be controlled as part of this market review. The detailed description of the Cost Model design and assumptions can be found in Annexes 11, 13, 14, 16, 19, 20, 24 and 26. This annex summarises the results and sensitivities produced by the Cost Model.

Model outputs and sensitivities

A28.2 This section deals with the model outputs under the base case scenario, and shows the sensitivity of the model to changes in certain assumptions. We present the results of the sensitivities and cost breakdown for MPF rentals, SMPF rentals and WLR. The remainder of this section is laid out as follows:

- i) we first show the cost component breakdown for the base case for each of the main rental services;
- ii) we then describe the assumptions used in the base case that we flex as part of the sensitivity analysis;
- iii) we have used the model to analyse the sensitivity of the unit cost of rental services under a range of assumptions; and
- iv) finally, we show the base case results for non-rental services.

A28.3 The unit cost estimates that we use for the sensitivity analysis are the 2016/17 FAC outputs before any common costs reallocating and before the SMPF rental charge has been set to its LRIC of £2.61. For the cost component breakdown we show the FAC outputs before common costs have been reallocated.

Base case cost stacks for Rental services

A28.4 We set out the forecast 2016/17 cost stacks for WLR, MPF and SMPF rental services below, using our base case set out in this document.

Table A28.1: 2016/17 cost stack (FAC) of WLR and LLU Rental services (nominal terms)

Cost component (£)	MPF Rental	WLR Rental	SMPF Rental
E-side copper capital	7.05	7.05	0.00
E-side copper current	2.39	1.64	0.41
D-side copper capital	38.21	38.21	0.00
D-side copper current	7.64	5.24	1.30

Cost component (£)	MPF Rental	WLR Rental	SMPF Rental
Local exchanges general frames capital	3.17	1.58	1.58
Local exchanges general frames current	2.01	1.38	0.34
PSTN line test equipment	0.15	0.15	0.00
Dropwire capital & PSTN NTE	17.06	17.06	0.00
PSTN drop maintenance	4.68	3.21	0.80
PSTN linecards	0.00	10.02	0.00
Pair Gain	0.00	0.02	0.00
Broadband line testing systems	5.15	0.00	0.00
Combi card voice	0.00	0.00	0.00
Service centre – assurance	1.31	0.90	0.24
Sales and product management	0.21	0.20	0.06
LLU systems developments	0.14	0.00	0.14
DSLAM capital/maintenance	0.15	0.11	0.03
NCA mark-up	-0.09	-0.08	-0.05
Fully Allocated Cost	89.23	86.68	4.83

Source: Ofcom

A28.5 Having estimated the 2016/17 FAC for each service, we then make a number of pricing adjustments which are explained in Section 4, Volume 2. As part of these pricing adjustments we:

- set migration charges at LRIC and shift common costs to rentals;¹¹⁹⁹
- set caller display prices at LRIC and shift common costs to rentals;
- align the charge differential between the main rentals to reflect LRIC and reallocate common costs accordingly.

¹¹⁹⁹ Before the common costs of migration services are reallocated, an additional mark-up is added to them to reflect the costs not recovered from simultaneous migrations and connection as described in Section 4, Volume 2 and Annex 8.

A28.6 The results of these adjustments are shown in Table A28.2.

Table A28.2: 2016/17 Charges for WLR and LLU Rental services (nominal terms)

(£)	MPF Rental	WLR Rental	SMPF Rental
Fully Allocated Cost	89.23	86.68	4.83
FAC after common cost reallocation and caller ID mark-up	89.11	88.93	4.20
LRIC differential adjusted prices	90.21	89.39	2.61

Source: Ofcom

Sensitivity analysis

A28.7 We have performed a sensitivity analysis on the key assumptions used when forecasting costs for WLR, MPF and SMPF rentals. We perform this sensitivity analysis in order to test how the model behaves when its input parameters are flexed. In the base case we assume:

- i) 5% efficiency saving on capex and opex (see Annex 16);
- ii) 8.6% nominal pre-tax WACC (see Annex 14);
- iii) Pay inflation of 2.8% and non-pay inflation of 2.3% (see Annex 13);
- iv) Forecasts of WLR lines and MPF lines as set out in Annex 24;
- v) Service level allocation set at 1.21:1.00:1.21 (MPF:WLR:SMPF) (see Annex 19);
and
- vi) Fault rate allocation set at 1.00:0.83:0.17 (MPF:WLR:SMPF) (see Annex 20).

Values changed as part of the sensitivity analysis

A28.8 We have altered the above parameters in order to carry out a sensitivity analysis. When setting values for the sensitivity analysis, we have sought to use values that are different enough from the base case to test the Cost Model, but not so different that we believe they would fall outside what could be considered to be a reasonable range for each parameter. The sensitivities that we have used are:

- i) **Efficiency**: the high and low sensitivities are 6% and 4% respectively;
- ii) **WACC**: the high and low sensitivities are 9.6% and 7.6% respectively;
- iii) **Input operating costs trend**: the high and low sensitivities set the pay and non-pay input price trend as +1 percentage point and -1 percentage point of the base case values.
- iv) **Service level differential**: in order to test the sensitivity of the service differential, we use an alternative value of 1.22:1.00:1.22 (MPF:WLR:SMPF);

- v) **High volume scenario:** we include a high volume sensitivity in which total line volumes are increased by around 1.8% (compared to the base case) and there is a greater shift to MPF, with 11.0m MPF lines in 2016/17;
- vi) **Low volume scenario:** we use a low volume forecast sensitivity in which total line volumes are decreased by around 1.7% (compared to the base case) and there is a smaller shift to MPF, with 7.6m MPF lines in 2016/17; and
- vii) **Alternative Faults ratio:** we use an alternative sensitivity of the faults allocation of 1.10:0.83:0.17 (MPF:WLR:SMPF).

A28.9 The results of these sensitivities are shown in Table A28.3 below. We present the base case FAC for each of the rental services in the top row of their respective columns.

Table A28.3: Sensitivity analysis for Rental services (2016/17 impact on FAC in nominal terms)

Unit cost impact (£)	MPF Rental: 16/17 FAC: 89.23	WLR Rental: 16/17 FAC: 86.68	SMPF Rental: 16/17 FAC: 4.83
Efficiency: 1% higher	-2.12	-2.03	-0.22
Efficiency 1% lower	2.21	2.12	0.23
WACC: 1% higher	2.80	3.18	0.01
WACC: 1% lower	-2.80	-3.18	-0.01
Input operating cost inflation:1% higher	1.73	1.64	0.20
Input operating cost inflation: 1% lower	-1.66	-1.58	-0.19
Alternative Service level allocation (1.22:1.00:1.22)	0.08	-0.05	0.01
High service volumes	-0.78	-0.81	-0.04
Low service volumes	0.80	0.82	0.05
Fault rates set on the basis of 1.10:0.83:0.17	1.18	-0.34	-0.08

Source: Ofcom

A28.10 In all cases the model behaves as we would expect when the input assumption is changed, both in terms of the direction and the size of the change in model output.

2016/17 FAC and charges for charge controlled services

A28.11 We present the FAC outputs and charges for 2016/17 in Table A28.4 (excluding WLR, MPF and SMPF rentals which are shown in Table A28.2). This table shows the impact of the common cost reallocations and simultaneous provide mark-ups on final charges. As with the sensitivities presented above, the FAC values are those produced before the common costs have been reallocated and before costs are reallocated to set the differential between MPF rentals and WLR+SMPF rentals to £1.79.

Table A28.4: Nominal FAC and charges (after all reallocations and LRIC differential adjustments) for non-rental services (nominal £)¹²⁰⁰

	FAC 2016/17	Estimated charge 2016/17
WLR Connections	33.87	Various
WLR Transfers	10.03	8.61
MPF New provides	34.92	Various
MPF Single Migrations	29.76	31.01
MPF Bulk Migrations	20.30	21.55
SMPF New Provides	25.07	31.01
SMPF Single Migrations	29.11	31.01
SMPF Bulk Migrations	20.20	21.55
WLR+SMPF Simultaneous Connection	39.57	Various
WLR+SMPF Simultaneous migrations	31.01	31.01
WLR Conversions	31.01	31.01

Source: Ofcom

A28.12 In order to clearly show the impact on charges from the charge control, we have set out in Tables A28.5 and A28.6:

- The LLU and WLR charges applicable prior to this statement and in the first year of the charge control; and

¹²⁰⁰ Please see Section 4 and Annex 8 for our approach to calculating the cost of simultaneously provided services.

- Our forecasts of the charge controls for the second and third years (where relevant) following implementation of the CPI+/-X caps (based on our forecast of CPI inflation – the outturn will of course depend on outturn CPI inflation applicable to the second and third years).

Table A28.5: LLU charge controls

Basket/ Service	Charges at 31 March 2014 (£)	Charge during the first year of the charge control, nominal (£)	Forecast charges, nominal (£)		The value of 'X'
			2015/16	2016/17	
MPF Rental	83.92	86.10	88.13	90.21	0.3%
SMPF Rental	9.89	5.54	3.80	2.61	-33.4%
MPF Single Migration	30.65	30.77	30.88	31.01	-1.7%
MPF Bulk Migration	28.42	25.92	23.62	21.55	-10.9%
MPF New Provides basket	N.A.	Various	Various	Various	-2.9%
SMPF Single Migration	30.65	30.77	30.88	31.01	-1.7%
SMPF Bulk Migration	28.42	25.92	23.62	21.55	-10.9%
SMPF New Provide	30.65	30.77	30.88	31.01	-1.7%
MPF Cease	0.00	N.A.	N.A.	N.A.	N.A.
SMPF Cease	0.00	N.A.	N.A.	N.A.	N.A.
Hard Ceases basket	N.A.	Various	Various	Various	0.4%
Other LLU ancillaries basket	N.A.	Various	Various	Various	-5.0%
Co-Mingling New Provides and Rentals basket	N.A.	Various	Various	Various	-3.4%
Tie Cables basket	N.A.	Various	Various	Various	-11.8%

Source: Ofcom

Table A28.6: WLR charge controls

Basket/Service	Charges at 31 March 2014 (£)	Charge during the first year of the charge control, nominal (£)	Forecast charges, nominal (£)		The value of 'X'
			2015/16	2016/17	
WLR Rental	93.32	91.04	90.21	89.39	-3.0%
WLR Transfer	3.39	4.63	6.31	8.61	+34.4%
WLR New Connections basket	Various	Various	Various	Various	-8.4%
WLR+SMPF Simultaneous Connections	Various	Various	Various	Various	Various ¹²⁰¹
WLR + SMPF Simultaneous migrations	65.51	30.77	30.88	31.01	N/A ¹²⁰²
WLR Conversion	34.86	30.77	30.88	31.01	-1.7%

Source: Ofcom

¹²⁰¹ We impose a charge discount on WLR Connections + SMPF New Provide of £12.82 in the first year of the charge control. In subsequent years, we apply a CPI+X% annual change to the charge discount value in the previous year, with the Xs being +74.7% in 2015/16 and +31.1% in 2016/17.

¹²⁰² The charge control on WLR+SMPF Simultaneous Migrations will be aligned with the charge control on single migrations (i.e. MPF Single Migrations, SMPF Single Migrations, SMPF New Provide and WLR Conversions).

Annex 29

Proposed Legal Instruments

A29.1 Please see the separate PDF documents published alongside this Statement entitled *Proposed Legal Instruments* and *Schedule 3 to Part I of Annex 29: General Manager Areas*. These are available here:

29.1.1 Proposed legal instruments:

http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/29_annex29.pdf

29.1.2 Schedule 3 to Part I of Annex 29: General Manager Areas:

<http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/fixed-access-market-reviews-2014/draftstatement/Schedule 3 to Annex 29 .pdf>

Annex 30

Quality of service: Current performance, impact of poor delivery and establishing a reasonable level of performance

Introduction

A30.1 This Annex reproduces the material presented in Annex 9 of the July 2013 FAMR Consultation. Our further analysis, including our consideration of stakeholder responses, is set out in Section 11 of Volume 1. We explained in Section 11 of Volume 1 that we initiated a review of Openreach's Quality of Service (QoS) prompted by evidence of a relative decline in performance in 2012 and late 2010 as well as concerns from CPs about the effectiveness of the current regulatory and contractual framework in incentivising Openreach to deliver a good performance on a consistent basis.

A30.2 This annex, together with Annex 31 sets out evidence and analysis we have carried out as part of the QoS review and which led us to developing the SMP service conditions set out in detail in Section 11 of Volume 1.

A30.3 In this annex in particular we assess and provide evidence relating to the following areas:

- Openreach's recent performance;
- the impact of poor service performance; and
- the views of consumers and small and medium enterprises (SMEs) on what constitutes a good or reasonable service quality.

A30.4 We first, however, set out the existing SLAs and SLGs to which Openreach operate.

Current applicable SLAs/SLGs

A30.5 The current Service Level Agreements (SLAs) and Service Level Guarantees (SLGs) have been established mostly by industry negotiation and agreement building on the measures implemented by Ofcom in our previous review of QoS in 2008.¹²⁰³

A30.6 Table A30.1 below summarises the agreed SLAs/SLGs for the main products covered by the FAMR, as well as indicating the process by which they were established.

¹²⁰³ Ofcom, *Service Level Guarantees: Incentivising Performance, Statement, March 2008*
<http://stakeholders.ofcom.org.uk/consultations/slg/?a=0>.

Table A30.1: Current SLA/SLG arrangements for the main product types

Product	Process	SLA	SLG	Process by which SLA/SLG was set
WLR (includes analogue, ISDN2 and ISDN 30)	Installation appointment availability	12 days for installation appointment availability (13 days prior to 1 November 2013)	£2 per day if actual performance is >SLA but ≤ SLA + 3 days £4 per day if actual performance is >SLA+ 3 days	Industry/CEO level discussions
	Fulfilment of appointment	Engineer to arrive during appointment period	£40 per missed appointment	Set by industry on the basis of reciprocity reflecting a charge if the CP causes a missed appointment
	Completion to CDD ¹²⁰⁴	Completion by midnight on CDD	1 month line rental per day (capped at 60 days)	Industry agreement
	Repair	SLA dependent on Care Level selected by CP. Most used Care Level is for repair within next working day +1	1 month line rental per day (capped at 60 days)	Industry agreement
SMPF and MPF	Installation appointment availability	12 days for installation appointment availability (13 days prior to 1 November 2013)	£2 per day if actual performance is >SLA but ≤ SLA + 3 days £4 per day if actual performance is >SLA+ 3 days	Industry/CEO level discussions
	Fulfilment of appointment	Engineer to arrive during appointment period	£40 per missed appointment	Set by industry on the basis of reciprocity reflecting a charge if the CP causes a missed appointment
	Completion to CDD	Completion by midnight on CDD	1 month line rental per day (capped at 60 days)	Industry agreement
	Repair	SLA dependent on Care Level selected by CP. Most used Care Level is for fix by the end of next working day (includes Sat)	1 month line rental per day (capped at 60 days)	Industry agreement
GEA (FTTC)	Installation appointment availability	n/a	n/a	Not part of the recent CEO negotiations
	Fulfilment of appointment	Engineer to arrive during appointment period	£40 per missed appointment	Set by industry on the basis of reciprocity reflecting a charge if the CP causes a missed appointment
	Completion to CDD	Completion by midnight on CDD	1 month line rental per day (capped at 60 days)	Set by Openreach
	Repair	SLA dependent on Care Level selected by CP. Most used Care Level is for fix by the end of next working day (includes Sat)	1 month line rental per day (capped at 60 days)	Set by Openreach

Source: Ofcom research

¹²⁰⁴ The “Contracted Delivery Date” is the date by which Openreach has committed to completing the customer’s order.

Recent performance

- A30.7 We obtained information from Openreach using our statutory information gathering powers for the period from April 2009 to April 2013 to allow us to examine longer term performance trends since the 2008 SLG Review¹²⁰⁵ as well performance in 2012 when there were particular problems. We have also supplemented this information with data from weekly service performance updates provided by Openreach to Ofcom for the period November 2012 to May 2013.
- A30.8 In order to obtain a comprehensive picture of Openreach's performance we asked Openreach to provide:
- its Key Performance Indicators (KPI) that support its installation order and fault repair SLAs (i.e. those measures summarised above in Table A30.1). We also obtained the KPIs that Openreach reports to the OTA which differ slightly from the SLA measures as a much longer time series was available for these measures;
 - its installation order and fault repair processing times (i.e. measures of the elapsed time to complete orders and faults repairs) since these would be likely to extend when performance declines; and
 - the number of SLG claims and the value of SLG payments.
- A30.9 The discussion below is structured as follows:
- first, we give an overview of the KPIs used by Openreach to record its performance;
 - second, we summarise Openreach's installation order performance. We review installation order lead times and performance against the SLA target for order completion by agreed completion dates;
 - third, we summarise Openreach's fault repair performance. We review fault repair lead times and performance against the SLA target for completion of faults within contractual timescales; and
 - finally, we summarise the number of SLG payments paid to CPs by Openreach and the total value of these payments for all products for the provision of new lines and repairs.

Overview of the KPIs used by Openreach to record service performance

A30.10 Below we provide a brief description of the KPIs discussed in the text by way of introduction.

A30.11 Installation orders relate to requests for the installation of new lines, alterations to existing lines and migration activities (i.e. transfer of a service from one CP to another). There are two main types of installation order:

- non-appointed order – an order that only requires exchange jumpering and/or exchange configuration activities (i.e. does not require an appointment for a site

¹²⁰⁵ Ofcom, *Service Level Guarantees: Incentivising Performance*.

visit to a customer) and which can generally be completed with very short lead times (in some cases the same day¹²⁰⁶); and

- appointed order – an order that requires a visit to the customer’s premises. Timescales for these orders are dictated mainly by the availability of field engineering resources and as a consequence are generally longer than for non-appointed orders.

A30.12 Appointed order performance is generally reported separately to non-appointed order performance because of the additional field engineering activities involved.

A30.13 Fault repair activities relate to the repair of customer specific faults. Fault repairs are generally only appointed when the fault report or initial diagnostic tests indicate that the fault is at the customer’s premises.

A30.14 The following are the main KPIs discussed below:

- **Order completion by CDD** – the primary performance measure used by Openreach is a measure of the proportion of orders completed by midnight on the Contracted Delivery Date (CDD). The CDD is the completion date given by Openreach when it accepts the order after validation checks¹²⁰⁷ and where applicable an appointment has been made by the CP. In the case of appointed orders, the CDD is the appointment date. In the case of non-appointed orders, the CDD is a date specified by Openreach unless the CP specifies a date (which would generally be a later date). As noted in Table A30.1, this metric is subject to an SLA and orders not completed by midnight on the CDD are liable for SLG payments.¹²⁰⁸
- **Fulfilment of Appointment** – a measure of appointments missed by Openreach (i.e. when Openreach do not arrive at the customer’s premises within the agreed appointment time-slot). As noted in Table A30.1 above, this metric is subject to an SLA and SLG payments are due for missed appointments.¹²⁰⁹ This SLG operates concurrently with the SLA for Order Completion by CDD. Therefore in cases where a missed appointment results in the order not being completed on the CDD, both SLG payments are due.
- **Installation Appointment Availability** – a measure of the earliest appointment available to a CP when it appoints each installation order, known as First Appointment Date (FAD). As noted in Table A30.1, this metric is subject to an SLA and an SLG payment is due when the earliest available appointment is not within the specified lead time.
- **Repairs completed within contractual timescales** – the primary performance measure used by Openreach for fault repair is a measure of the proportion of fault repairs completed within the contractual timescales as specified for the relevant maintenance Care Levels. As noted in Table A30.1 this metric is subject

¹²⁰⁶ For example, Openreach currently complete the working line takeover (WLTO) process for the same CP with an open stop order within the same day.

¹²⁰⁷ The KC12 order stage in Openreach’s EMP operational support system.

¹²⁰⁸ SLG payments would not be due when completion is delayed by the customer e.g. the customer was not present on the agreed appointment date.

¹²⁰⁹ There is also a reciprocal arrangement for cases when CPs and their customers miss appointments.

to a SLA and a SLG payment is due when repairs are not completed within the contractual timescale.

- **Average Time to Install (ATTI)** – the elapsed time (in days) between the acceptance of a valid installation order by Openreach and when Openreach advises the CP of its completion.
- **Average Time to Clear (ATTC)** – the elapsed time between acceptance of a fault by Openreach and when Openreach advises the CP that the fault has been cleared.
- **Payable volumes** – the number of events for which an SLG payment is due.
- **SLG Payments** – the amount that was paid to CPs under the terms of their SLA/SLG contract.

A30.15 Average lead times as measured by the ATTI measure will be influenced by several factors:

- minimum lead times built into some Openreach processes (for example the 10 day minimum lead time for migration orders);
- the availability of Openreach resources to execute orders which will in turn be affected by a range of factors including:
 - variations in installation order and fault repair volumes;
 - Openreach's resource management decisions (i.e. the level and deployment of resources); and
 - the accuracy of the order volume forecasts submitted by CPs, upon which Openreach makes resource deployment decisions;
- the availability of appointment slots for appointed orders which effectively sets a minimum lead time for appointed orders (determined by the amount of resources that Openreach allocates to provision activities);
- customer choices about lead times (customers may sometimes request an appointment later than the first available appointment and therefore average lead times are likely to be longer than Installation Appointment Availability Measurements would suggest); and
- exceptionally, periods of severe weather which may hamper travel and external engineering activities.

A30.16 We would not expect customer choices about lead times to vary significantly over time and might therefore expect that deterioration in the ATTI would point to more systemic failures in Openreach's service provision.

A30.17 Similarly average fault clearance times as measured by the ATTC measure will be affected by several factors:

- the maintenance Care Levels applicable to services which specify the fault clearance timescales;

- the availability of Openreach resources to repair faults which will in turn be affected by the factors listed above;
- customer availability in cases where site access is required; and
- exceptionally, severe weather that may hampers travel and external engineering activities and as we discuss in Annex 31 may generate faults that are more time consuming to repair.

A30.18 We would not expect customer availability to vary significantly over time and might therefore expect that deterioration in the ATTC would point to more systemic failures in Openreach’s service provision.

Installation order performance

A30.19 We have set out below, using the data provided by Openreach, our analysis of Openreach’s installation order performance with respect to:

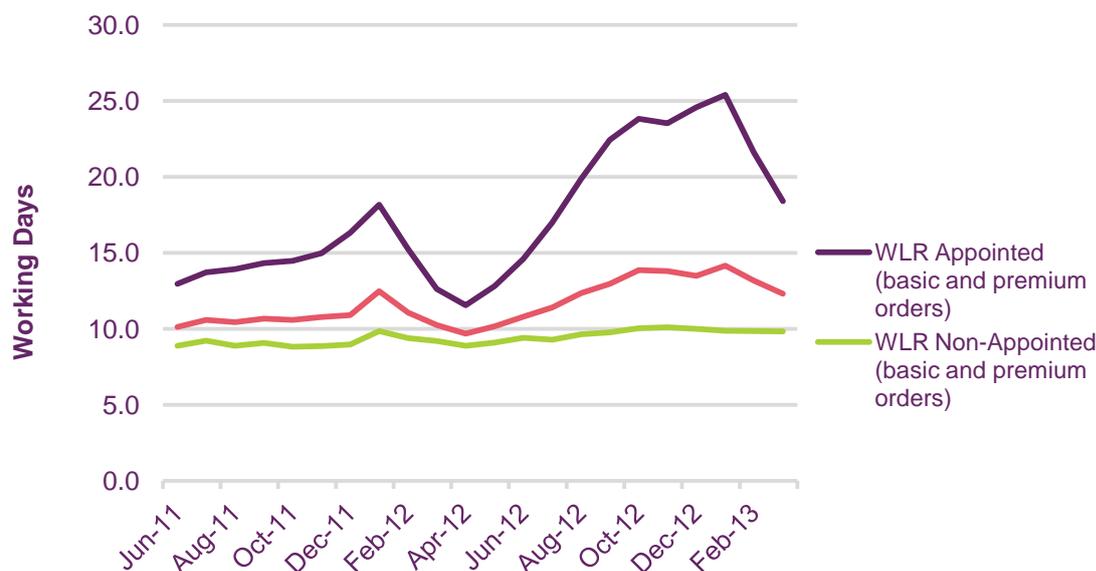
- installation order lead-times. We first look at the ATTI measure and then at the recently introduced measures for installation appointment availability; and
- the completion by CDD performance for WLR PSTN, LLU (MPF and SMPF) and ISDN services.

Installation order lead times – ATTI and Installation Appointment Availability

A30.20 Figures A30.2 and A30.3 below shows Openreach’s ATTI measure for WLR PSTN, SMPF and MPF services for the period June 2011 to February 2013.

A30.21 Figure A30.2 shows that ATTI for non-appointed WLR PSTN orders have been fairly stable. In contrast, ATTI for appointed WLR PSTN orders extended significantly in the second half of 2012 reaching a peak of 25 working days in January 2013.

Figure A30.2: Average Time to Install - Installation orders for WLR3 Services (working days)

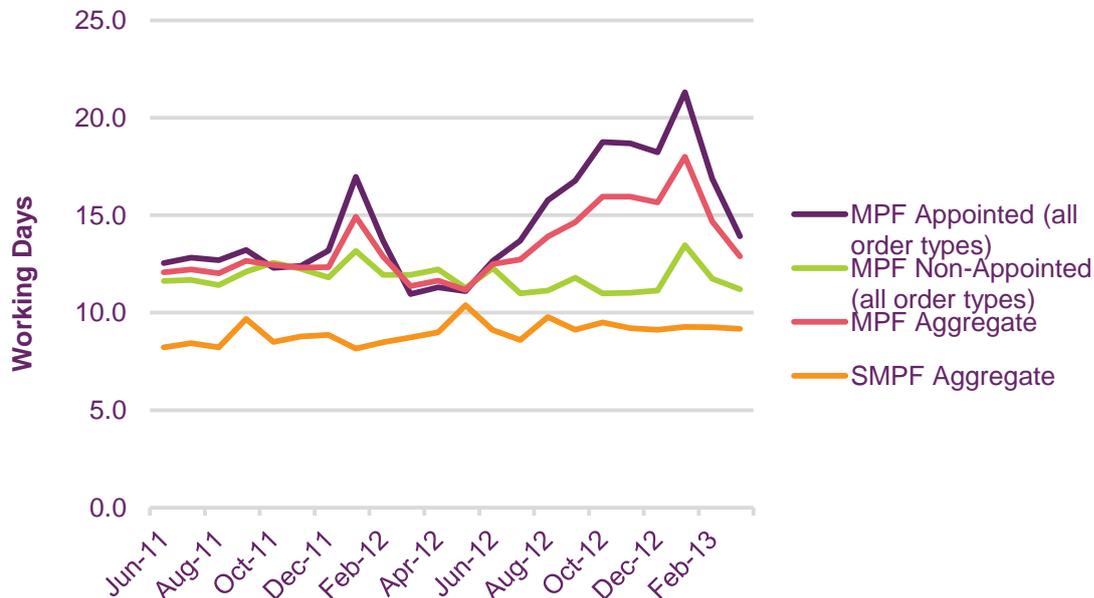


Source: Ofcom analysis of BT's response dated 27 February and updated response dated 31 May 2013 to question 1.12 of the First QoS BT Information Request. Includes basic and premium orders relating to new provide, start of stop, working line takeover, migration and other provide orders, Note that the "aggregate" is a weighted average of sub-products within each product category.

A30.22 Figure A30.3 shows a similar pattern for LLU services. ATTI for appointed MPF orders increased significantly in the second half of 2012 reaching a peak of 21 days in December 2012 before falling in January and February 2013.

A30.23 We understand that these increases in ATTI for WLR PSTN and LLU orders resulted from the diversion of field engineering resources to repair activities due to poor weather. With fewer resources allocated to installation orders, demand exceeded supply and as a result appointment lead-times extended.

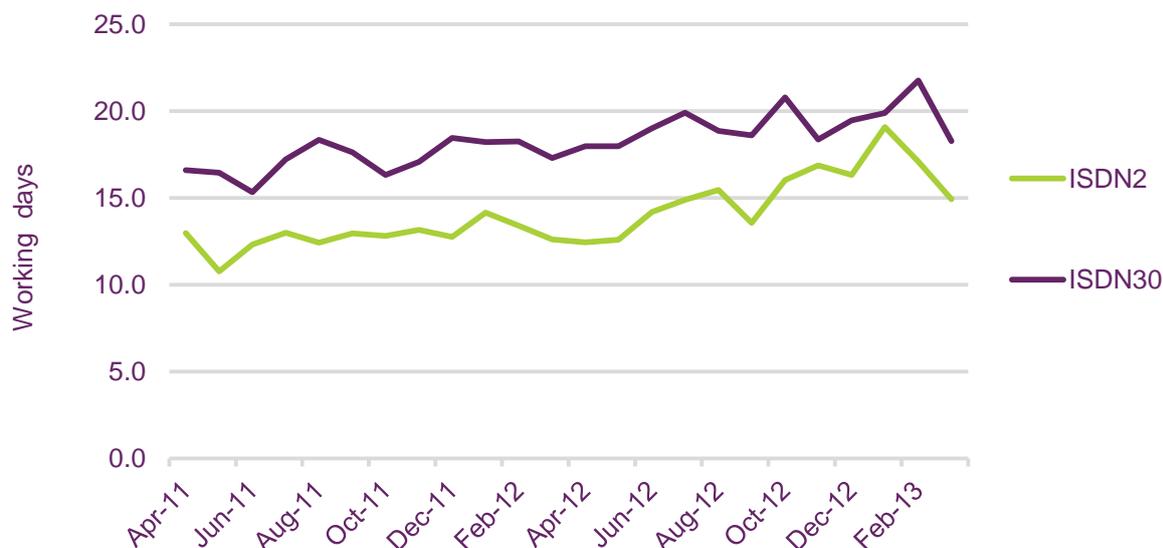
Figure A30.3: Average Time to Install - Installation orders for LLU Services (working days)



Source: Ofcom analysis of BT's response dated 27 February and updated response dated 31 May 2013 to question 1.12 of the First QoS BT Information Request. Includes new provide, start of stop, working line takeover, migration and other provide orders. Note that the "aggregate" is a weighted average of sub-products within each product category.

A30.24 Figure A30.4 shows Openreach's ATTI's measure for ISDN services. ATTI for these services increased steadily over this period.

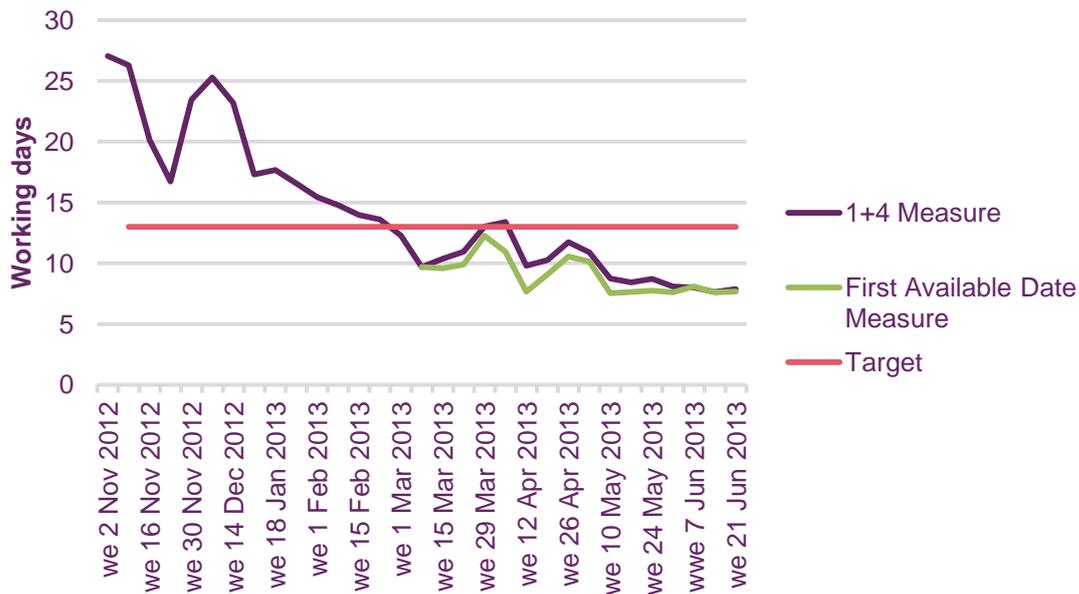
Figure A30.4: Average Time to Install - Installation orders for ISDN services (working days)



Source: Ofcom analysis of BT's response dated 27 February and updated response dated 31 May 2013 to question 1.12 of the First QoS BT Information Request. Includes new provide, working line takeover, migration and other provide orders.

- A30.25 We have also reviewed Openreach's Installation Appointment Availability measure for WLR and MPF that was introduced in conjunction with the copper appointment availability SLA in 2012. The initial measure called the "1+4 Measure" indicated that an appointment slot was available on at least four out of five consecutive days. More recently, a different measure has been used for the SLA. This is known as the First Available Date (FAD) measure and measures the earliest available appointments offered.
- A30.26 Figure A30.5 shows both appointment availability measures and the associated SLA target. It echoes the ATTI trend discussed above and shows a steady improvement in appointment availability between November 2012 and June 2013. During this period, appointment availability reduced from 27 days to less than 8 days.

Figure A30.5: Openreach Installation Appointment Availability Measures for WLR and MPF



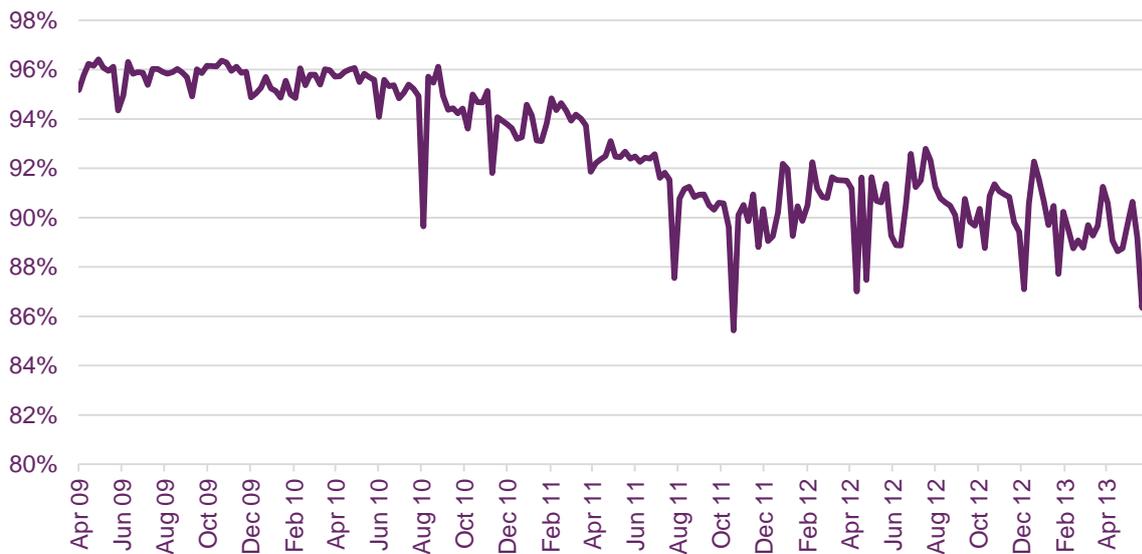
Source: Ofcom weekly service updates provided by Openreach from November 2012 to June 2013. Note: FAD measure added in March 2013.

Installation order completion rates against CDD

A30.27 Figures A30.6 to A30.8 below show Openreach’s performance for WLR PSTN, LLU and ISDN services against the Right First Time measures that Openreach reports to the OTA. We present this measure as a proxy for the SLA measure of “installation orders completed by CDD” as a much longer time series was available than the SLA measure and we are particularly interested in longer term trends here. Both are measures of orders completed by the CDD, but the Right First Time measure additionally classifies orders that develop a fault within 8 days of completion as failures.

A30.28 Figure A30.6 below shows a decline in performance for WLR services. Prior to April 2010 performance was consistently between 94% and 96%. It then declined until June 2011 and subsequently ranged between 85% and 92%.

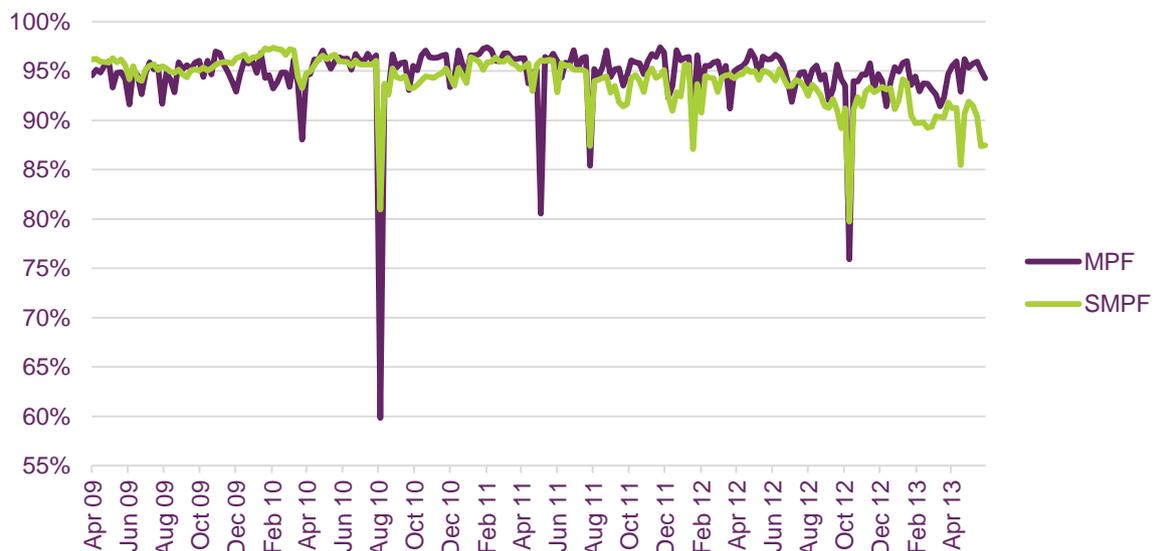
Figure A30.6: WLR Installation order completion by CDD (Right First Time measure)



Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT’s updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request. Includes all WLR2 and WLR3 provide and start order types.

A30.29 Figure A30.7 below shows that with the exception of isolated months, performance for MPF services has been fairly consistent, ranging between 90% and 96%. The same can be said for SMPF performance, apart from deterioration over the six months to April 2013.

Figure A30.7: LLU Installation order completion by CDD (Right First Time measure)

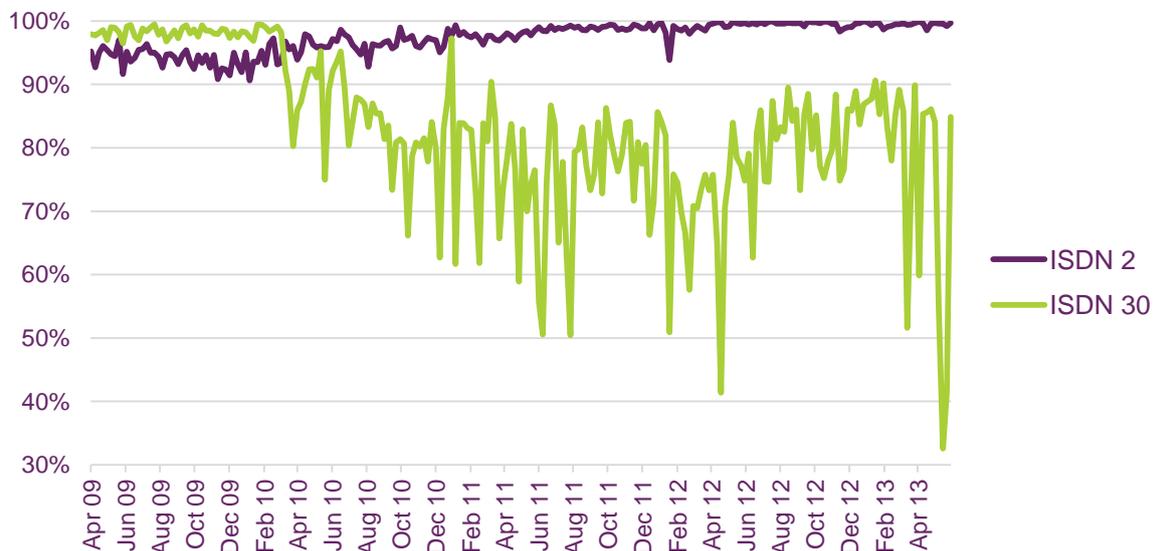


Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT’s updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request. Includes all provision order types.

A30.30 Figure A30.8 below shows an improvement in performance for ISDN2 services from around 95% to 100% over the period. Performance for ISDN30 services declined

significantly from close to 100% to around 80% between December 2009 and September 2010. There has subsequently been significant volatility around a median of about 80%. The volatility may in part be due to the low order volumes for these services.¹²¹⁰

Figure A30.8: ISDN30 Installation order completion by CDD (Right First Time measure)



Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT’s updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request.

Fault repair performance

A30.31 We have set out below, using the data provided by Openreach, our analysis of Openreach’s fault repair performance with respect to:

- fault repair performance against contractual timescales for WLR PSTN, LLU (MPF and SMPF) and ISDN services; and
- fault repair lead times using the ATTC measure for WLR PSTN, LLU (MPF and SMPF) and ISDN services.

Repair performance against contractual timescales

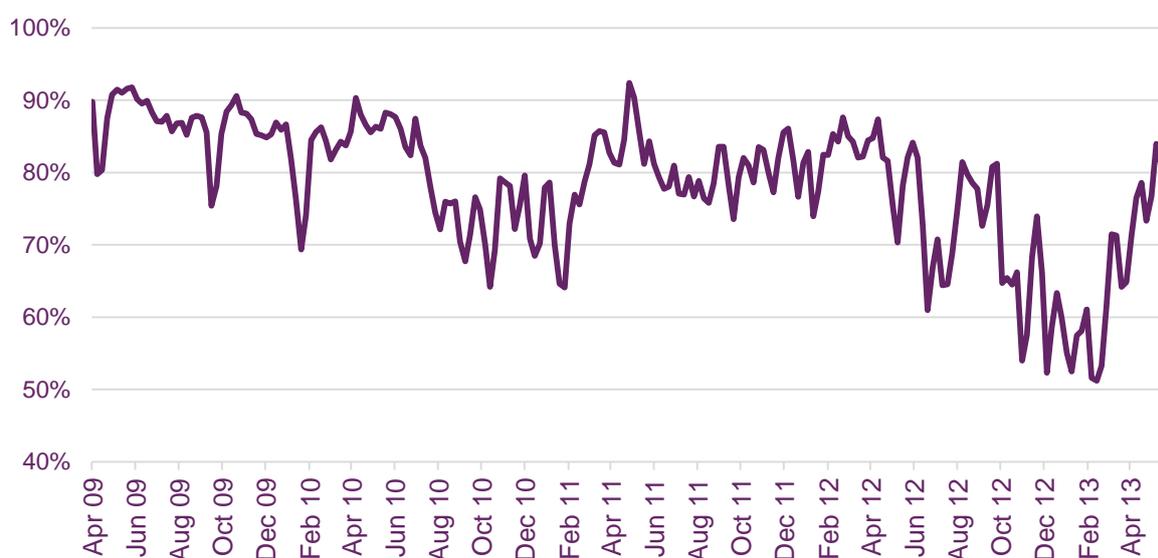
A30.32 Figures A30.9 to A30.11 below shows Openreach’s performance for WLR PSTN, LLU and ISDN services against the First Touch, Last Touch repair measures that Openreach reports to the OTA. We present these measures as a proxy for the SLA measures of repairs against contractual timescales as a much longer time series was available than the SLA measures and we are particularly interested in longer term trends here. Both are measures of faults completed within contractual timescales but the First Touch, Last Touch measure additionally counts Faults that lead to repeat faults within 8 days as failures.

A30.33 Figure A30.9 below shows Openreach’s performance for maintenance Care Level 1 WLR PSTN services which is the default for WLR PSTN Services. This graph

¹²¹⁰ For example, there were on average less than 3 ISDN30 orders per month between June 2011 and March 2013 and less than 3 ISDN2 orders over the same period.

shows the two periods of low performance that were of particular concern to CPs, firstly the period between July 2010 and February 2011 that some CPs have referred to as the first service crisis and secondly the latter half of 2012 when performance fell. Although there is significant volatility from month to month, performance outside these exceptional periods also appears to have declined by around 5-10% from 85-90% to 80-85%.

Figure A30.9: WLR PSTN (Care Level 1) repair performance (First Touch, Last Touch measure)

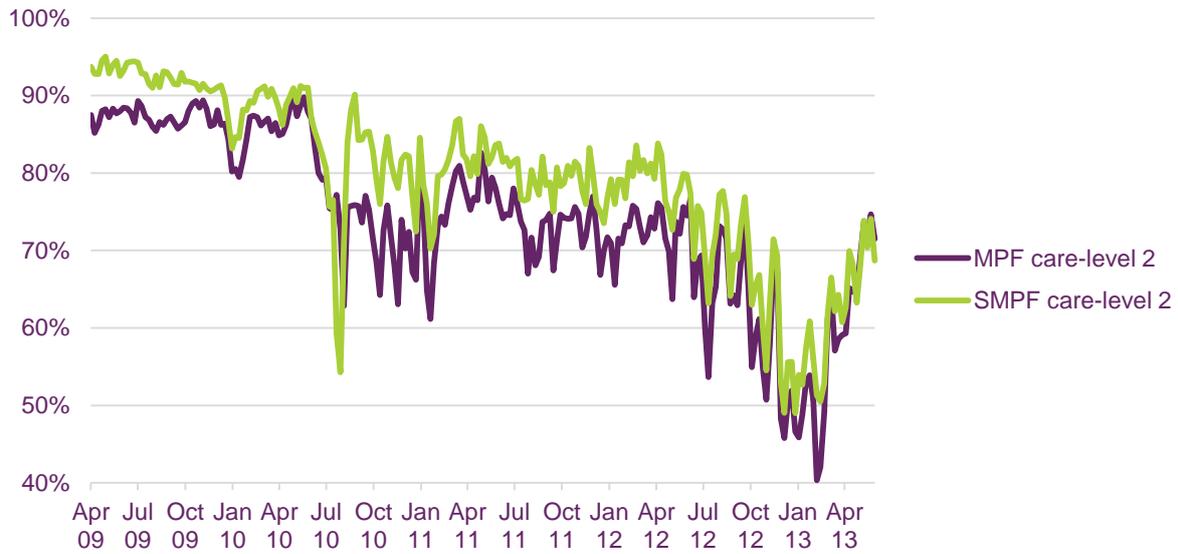


Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT's updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request.

A30.34 Figure A30.10 below shows Openreach's repair performance for MPF and SMPF with maintenance Care Level 2 (the standard offering for such services). Care Level 2 is a more demanding target than Care Level 1, requiring that faults be cleared by the end of the next working day compared with the next working day +1 for Care Level 1.

A30.35 Here again there is significant volatility from month to month, but Openreach's performance exhibits a similar pattern to the WLR services discussed above. The two periods of particularly low performance are again apparent as is an overall decline in performance across the period. The main difference is that the overall fall in performance since April 2009 appears somewhat larger, at a little over 10%, possibly reflecting the more demanding repair targets.

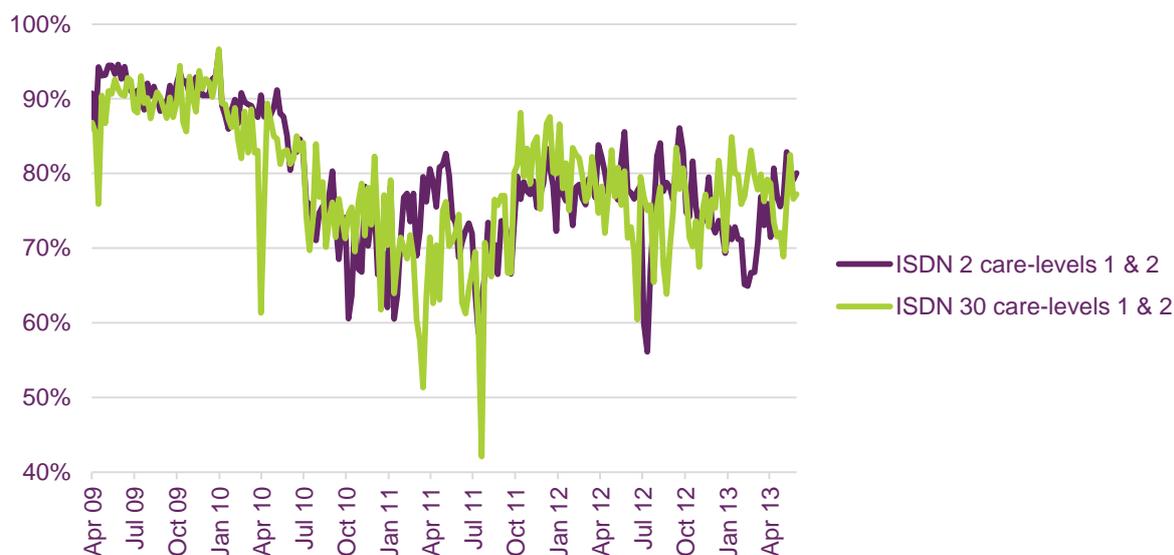
Figure A30.10: MPF and SMPF (Care Level 2) repair performance (First Touch, Last Touch measure)



Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT's updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request.

A30.36 Table A30.11 below shows Openreach's repair performance for ISDN services with both maintenance Care Levels 1 and 2. Here again there is significant volatility from month to month and Openreach's performance exhibits a similar pattern to the other services. There has been an overall fall in performance of about 12% over the period from an average of around 90% to an average of around 78%. The two periods of lower performance are also visible, although performance for ISDN30 services was largely unaffected by the severe weather in 2012.

Figure A30.11: ISDN2 and ISDN30 (care-levels 1 & 2) repair performance (First Touch, Last Touch measure)



Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT's updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request.

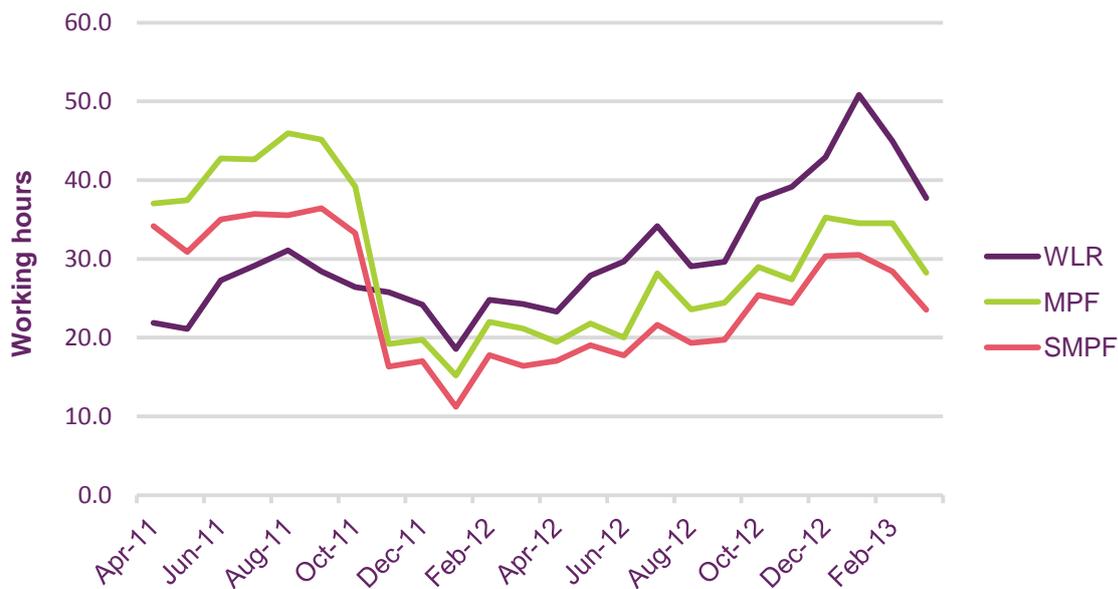
Average time to repair faults

A30.37 We have also analysed Openreach's performance in terms of the average time it takes to complete a repair (using the ATTC measure). Openreach was only able to provide this measure for the period April 2011 to March 2013.

A30.38 Figure A30.12 below shows Openreach's ATTC performance for WLR PSTN, SMPF, and MPF. Average clear times are measured in working hours which vary according to the maintenance Care Level and consequently these figures do not directly equate to performance against specific SLAs.¹²¹¹ Between August 2011 and January 2012, average clear times for all services halved roughly before rising steadily through 2012, peaking again at the end of 2012.

¹²¹¹ Working hours for Care Level 1 are 0700-2100 Monday to Friday. Working hours for Care Level 2 are 0700-2100 Monday to Saturday. Working hours for Care Levels 3 and 4 are all hours (i.e. 24x7x365).

Figure A30.12: Average time to clear WLR3 PSTN and LLU faults (working hours)



Source: Ofcom analysis of BT's response dated 27 February and updated response dated 31 May 2013 to question 1.12 of the First QoS BT Information Request. Includes all maintenance Care Levels.

SLG payments by Openreach

A30.39 Openreach pays compensation to CPs in the form of SLG payments when it fails to meet its performance targets set out in the SLAs with the exception of instances where force majeure applies. To date, Openreach has not tended to apply any force majeure exclusions, known as MBROC to the payment of SLGs related to appointed lead times / installations although it has told us it may well do so in future. In the case of repairs, Openreach has typically not paid SLGs in areas where force majeure has been declared.

A30.40 To the extent that the impact of force majeure remains limited, we would expect the number of payments and the amount paid by Openreach to CPs to increase in line with deteriorating performance.

A30.41 As can be seen from the data presented in this sub-section, the number of SLG payments and the amount paid by Openreach to CPs was particularly high in the second half of 2012, mirroring the fall in Openreach's performance for installation orders and fault repairs. The data in this sub-section begins in mid-2008 and shows that SLG payments have been fairly steadily increasing since then.

A30.42 We first look at Openreach's SLG payments with respect to installation orders for WLR, LLU and ISDN lines. We then look at Openreach's respective SLG payments for fault repair.

Installation order SLG payments

A30.43 Figures A30.13 and A30.14 present the number and value of SLG payments relating to installation orders for WLR PSTN, SMPF and MPF over the last 5 years. They include payments for orders not completed by the CDD but exclude other installation related SLGs such as missed installation appointments and Installation

Appointment Availability. The total number and value of ISDN payments has been very small in relative terms and therefore they are not included in the figures below.¹²¹² The information presented in these figures needs to be treated with care since there was a period during 2012 (April to October) when some of Openreach's MPF CP customers were not receiving SLGs against installation appointments.¹²¹³

A30.44 The relative growth of MPF payments and decline of WLR and SMPF payments is likely to have been driven by the transition of major CPs from WLR/SMPF to MPF services. Consequently, the aggregate numbers of SLG payments and values is the most informative of the overall trend.

A30.45 Although there is significant volatility from month to month, the aggregate volume of SLG payments has increased steadily over this period. The volume of payments peaked in August 2010 at £ and in September 2012 at £ payments per month, roughly twice the level observed at the start of the period. The total value of SLG payments has followed a similar pattern and has increased from around £ per month in September 2008, peaking at nearly £ per month in July 2011 before falling back somewhat.

A30.46 We have reviewed order volumes over time to understand whether an increase in orders has driven the increase in SLG payments. During this period, the volume of non-appointed orders for WLR and LLU services has decreased significantly and the volume of appointed orders has been fairly static. We therefore consider that the increase in SLG payments has been driven mainly by the decline in installation order performance discussed above. However, it is possible that the volatility observed in order volumes may have been a contributory factor.

Figure A30.13: Number of SLG payments associated with installation order completion by CDD SLA

£

Source: BT's response dated 31 January 2013 to Q1.11 of the First QoS BT Information Request.

Figure A30.14: Total value of SLG payments per month associated with installation order completion by CDD measure

£

Source: BT's response dated 31 January 2013 to Q1.11 of the First QoS BT Information Request.

¹²¹² On average, there were around £ claims per month for SLG payments associated with the provision of ISDN2 and ISDN30 lines between July 2008 and the end of 2012. The total value of these payments on average less than £ per month over the same period.

¹²¹³ Between April and December 2012 no SLG payments were made by BT Openreach to Sky and TalkTalk in respect of installations for LLU products. Issues relating to this were investigated by Ofcom during the: "Dispute between TalkTalk Telecom Group PLC and Openreach relating to whether Openreach offered MPF New Provide to TalkTalk on fair and reasonable terms and conditions", http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01098/.

Repair SLG payments

A30.47 Figures A30.15 and A30.16 present the aggregate number and value of SLG payments relating to fault repairs for WLR PSTN, SMPF and MPF over the last 5 years. The total number and value of payments associated with ISDN repairs was relatively low compared to the total and are therefore not included in the figures below.¹²¹⁴

A30.48 As with the installation order SLGs, the transition of major CPs from WLR/SMPF services to MPF will have influenced the patterns observed.

A30.49 The repair SLG payments shown here relate to faults not completed within contractual timescales and consequently the number of payments and value of payments exhibit a pattern similar to the repair performance measures discussed. The volume and value of the SLG payments has risen fairly steadily over the period and there are two peaks in claims, corresponding to the fall in performance in 2010 and the problems in the second half of 2012. The value of SLG payments made each month has risen from a low of around ₤ in April 2009 and peaked at ₤ in October 2012.

Figure A30.15: Total number of SLG payments associated with repairs

✂

Source: BT's response dated 31 January 2013 to Q1.11 of the First QoS BT Information Request.

Figure A30.16: Total value of SLG payments associated with repairs

✂

Source: BT's response dated 31 January 2013 to Q1.11 of the First QoS BT Information Request.

Summary of current and recent performance

A30.50 Our analysis indicates that Openreach's installation order and fault repair performance deteriorated between April 2008 and May 2013. There was a gradual decline in repair performance and some aspects of provision performance during this period and there were also two periods when performance was much lower. The first from July 2010 to February 2011 and the second in the latter half of 2012. At the end of our period of analysis (May 2013), performance had been improving steadily for several months and improved further in June 2013. In summary:

- Openreach's performance against its main installation order measure (orders completed by CDD) has deteriorated somewhat over the past two years. Whilst performance has been maintained at around 95% for MPF orders, performance for WLR orders which was maintained at around 95% until mid-2010 subsequently deteriorated and has since been maintained at around 90%. SMPF performance also deteriorated in late 2012, falling from around 95% to around 90%;

¹²¹⁴ On average, there were around ₤ claims per month for SLG payments associated with the repair of ISDN2 and ISDN30 lines between July 2008 and the end of 2012. The total value of these SLG payments was on average just over ₤ per month during this period.

- installation order lead times increased significantly during the second half of 2012 when Openreach diverted resources to deal with the effects of poor weather. At times, lead times were exceptionally high, reaching a peak of 25 working days for WLR orders in January 2013;
- Openreach's fault repair performance against contractual timescales also declined during this period. Performance for WLR services fell about 5% from around 90% in spring 2009 to around 85% in May 2013. Performance for MPF services declined from around 98% to around 75% during this period. As noted above there were also two periods of much lower performance when performance for WLR services fell to around 50% and performance for MPF services fell to 40%;
- with respect to ISDN services, installation order performance for ISDN30 services declined in early 2010 from around 98%, settling at around 80% (although there is considerable volatility). Installation order performance for ISDN2 services improved from around 95% to close to 100%. Installation order lead times have also increased somewhat for both ISDN2 and ISDN30. However, as discussed above, we place less weight on ISDN due to relatively low order numbers; and
- the number and value of Openreach's SLG payments have increased in line with degrading performance on both installation orders and fault repair of WLR and LLU services. The total value of claims rose from about ₤ per month in April 2009 to around ₤ in October 2012.

Assessing the impact of service quality

A30.51 We now turn to our assessment of the potential impact that poor quality of service delivery by Openreach has on CPs, consumers and businesses. We also consider the potential impact on competition in the retail telephony market more broadly from poor quality of service.

A30.52 In undertaking this assessment we have relied upon evidence received from CPs in response to the 2012 FAMR Call for Inputs and statutory information requests. We also commissioned some market research to understand the value residential consumers and SMEs place on those elements of service performance which are directly attributable to Openreach's service quality.¹²¹⁵ From this we have assessed the impact that long lead times for both provisioning and repair can have on the market.

A30.53 In particular, as outlined in further detail under the relevant headings below, the responses to the 2012 FAMR Call for Inputs provided a clear consensus from wholesale purchasers of Openreach's fixed access services (including from BT Retail) that poor quality of service has a significant negative impact on their operations. Respondents to the FAMR Call for Inputs highlighted that poor QoS has a negative impact for:

- CPs who provide services using Openreach's wholesale fixed access services;

¹²¹⁵ Ofcom *Fixed line installation and fault repair summary report April 2013*
<http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/telecoms-market-data/fault-repair-research.pdf>.

- end-users (both consumers and businesses¹²¹⁶); and
- competition and the market more generally.

A30.54 Although these issues are often interrelated, we have set out our assessment of each of these impacts in turn below, drawing on evidence provided by CPs directly (through formal information requests and comments in response to the FAMR Call for Inputs), our market research and other relevant evidence.

Impact on CPs

A30.55 In the 2008 SLG Review¹²¹⁷, as part of the calculation of the loss to CPs of different failures used to inform the assessment of the level of SLG, we identified the following potential impacts on CPs from poor QoS from Openreach:

- **lost/delayed revenue as a result of failure** – losses associated with anticipated income that is not realised during the period of delay between an anticipated connection and actual connection of a customer’s service;
- **lost customers** – losses and costs associated with potential customers that do not place an order, as well as existing customers that cancel an order;
- **compensation paid by CPs to their end-users;**
- **additional costs of customer service relating to the failure** - costs associated with additional customer care provided to address delayed connections, or
- **operational costs to the CP of dealing with Openreach as a result of the failure;** and
- **reputational damage.**

A30.56 More recently, we have looked at this in our determination of a dispute between TalkTalk and Openreach relating to whether Openreach offered MPF New Provide to TalkTalk on fair and reasonable terms and conditions (the MPF Dispute).¹²¹⁸ In this dispute, we set out four categories we would expect an SLG to cover, which broadly corresponded with the categories identified by TalkTalk and Openreach. These were:

- “Lost revenues” - the daily profit losses associated with customers that experience delays after they have placed an order, but that did not cancel their order because of the delay;
- “Cancellations” – profit losses associated with customers that experience delays after they have placed an order and cancel their order because of the delay;

¹²¹⁶ As explained in Section 11, Volume 1, we have focussed on the LLU and WLR products in this stage of the QoS review, and the users of these products tend to be smaller businesses. Larger businesses usually opt for Ethernet/leased line products which are not in scope of this phase of the QoS review.

¹²¹⁷ Page 20, Ofcom, *Service level guarantees: incentivising performance*.

¹²¹⁸ Ofcom, *Dispute between TalkTalk Telecom Group PLC and Openreach relating to whether Openreach offered MPF New Provide to TalkTalk on fair and reasonable terms and conditions*, http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01098/.

- “Potential Sales” – the profit margin losses associated with customers that would have placed an order with a CP but were deterred from doing so because of their expectation that there would be delays in provision (which in turn was caused by extended lead times); and
- “Customer care” - the additional costs that a CP is likely to incur when handling its customers that have suffered a delay as a result of extended lead times.

A30.57 We consider that both sets of cost categories broadly align:

- “Lost/delayed revenue as a result of failure” from the 2008 SLG Review is the same as “Lost revenues” from the MPF Dispute;
- “Lost customers” in the 2008 SLG Review included “Cancellations” from the MPF Dispute because Cancellations refers to costs as a result of customers ultimately not ordering a new line from a CP due to extended lead times;
- “Compensation paid by CPs to their end-users”, “additional costs of customer service relating to the failure” and “operational costs to the CP of dealing with Openreach as a result of the failure” from the 2008 SLG Review can all be categorised as “Customer care costs” from the MPF Dispute. In the context of the MPF Dispute we did not consider appropriate to include CPs’ costs of missing appointments and goodwill credits that CPs pay out to their customers as a result of extended lead times. Nonetheless, we consider that it is plausible for these costs to be incurred by CPs; and
- “Reputational damage” from the 2008 SLG review is linked to “Potential sales” from the dispute. Although in the MPF Dispute, reputational damage was not explicitly identified we consider that the description of “Potential Sales” is very closely aligned with that of “reputational damage”.

A30.58 Below, we present the evidence we have collected by reference to the cost category headings set out in the MPF Dispute. In our second provisional conclusions in that dispute, we stated that we were mindful that the purpose of an SLG is to provide a pre-estimate of an average CP’s loss and is not designed to calculate the actual loss suffered by a party.¹²¹⁹ Accordingly in this sub-section, we do not attempt to set out a prescriptive methodology for how the impact of poor quality of service should be calculated in financial terms. Rather, for the purposes of the present assessment, we are seeking to identify the categories of the potential impacts on CPs.

Lost revenues

A30.59 This component, which is primarily attributable to delays in provisioning, refers to the daily profit losses associated with customers that experience delays after they have placed an order, but that did not cancel their order because of the delay. When a CP signs up a new customer it will not start to charge that customer until the service is installed and operational. As highlighted in paragraph A30.50 above, during 2012 there were times when provisioning times were as long as 25 working days. These delays therefore raise the potential for significant amounts of lost revenues for CPs, who could otherwise begin charging customers earlier for the provision of the service.

¹²¹⁹ Page 20, paragraph 3.32, *The MPF Dispute, provisional conclusions*.

Cancellations

- A30.60 These are costs associated with customers that experience delays after they have placed an order and cancel their order because of the delay. As CPs set out in their FAMR Call for Inputs responses, examples of this include customers that cancel initial orders because of long provisioning wait times or after having an engineer not turning up for a scheduled appointment. CPs also reported that customers may also cancel their service because of problems with getting repairs completed.¹²²⁰
- A30.61 One CP, ☒, provided evidence showing that there was a positive correlation between the average lead/install times and broadband customer cancellation rates, where the reason for the customer cancellation was BT delays. Another CP ☒ also provided evidence indicating a positive correlation between the number of new line orders requiring an engineer visit and cancellation rates.¹²²¹ It is not clear from the data provided whether BT delays were the main reason for the cancellation and it is likely that other factors also have an influence on customer cancellations (particularly given that the level of cancellations did not decrease when Openreach's provisioning lead times improved). Nevertheless, we consider that a positive correlation is likely.
- A30.62 Data from our market research provides further support for this. In particular, the data available indicates that customers do start considering switching away from their provider when the service they receive for either provisioning or repair is not what they would consider to be reasonable. As indicated in Figures A30.21 and A30.22 below, up to a third of customers (both consumers and SMEs) indicated that they would consider switching away from their provider in these scenarios. The market research indicated that the mean length of time for provisioning that is likely to lead to consumers and SMEs considering a switch is only around 6 working days¹²²², whereas, as indicated earlier, provisioning times in 2012 were up to 25 working days for some products. The effect is not as strong for fault repair - the mean length of time for fault repair which is likely to lead to SMEs considering a switch was just over 4 working days (the evidence suggests that consumers were more tolerant and would accept a lead time of up to 7 working days before considering a switch).¹²²³ In comparison lead times for fault repair were a maximum of 44 working hours (but on average much lower) in 2012.
- A30.63 When we asked about the relative importance of different aspects of provisioning (in the research we referred to this as "installation") scenarios, the time taken to get an appointment contributed to 67% of SMEs' views of whether a particular scenario would cause them to switch supplier and 57% of the same view for consumers.¹²²⁴ This indicates that provisioning times can be an important factor in switching decisions for some end-users.
- A30.64 Research provided by ☒ also provides some indication that consumers are more likely to cancel their orders if they are offered a longer time for provisioning. That

¹²²⁰ TalkTalk and Sky for example referred to these impacts. In addition, ☒

¹²²¹ Note, however, that the data provided in both instances only represented a six month period so may not be representative. ☒, ☒.

¹²²² Q9b 2013 QoS research, "What level of wait for a fixed line phone and/ or internet installation for you/your business would lead you to consider switching to an alternate supplier? The mean response was 6.5 days for SMEs and 6.4 days for consumers.

¹²²³ Q9c 2013 QoS research, "What level of wait for a fixed line phone and/ or internet repair for you/your business would lead you to consider switching to an alternate supplier?" The mean response was 4.3 days for SMEs and 7.1 days for consumers.

¹²²⁴ Q7a 2013 QoS research.

research found that if consumers were offered an installation time of up to two weeks, 40% of respondents were likely to cancel the order. This rose to 58% for a lead time of three weeks, and 74% for over a month. While there are some limitations to this research¹²²⁵, it does provide further support for the likely correlation between likelihood to switching elsewhere and installation times.¹²²⁶ The same research found that around 22% of respondents were likely to switch providers if they had to wait three working days for an engineer to repair their fixed line or broadband service (rising to 37% for 4-5 working days and 51% for 6-7 working days).¹²²⁷

A30.65 We do not consider that it is straightforward to accurately pre-estimate the percentage of customers that will cancel their orders purely because of issues related to Openreach's service. However, the evidence we have described above is suggestive of a positive correlation between a decline in QoS and the loss of orders. We therefore consider for the purposes of this assessment that cancellations could represent a cost to CPs.

Potential sales

A30.66 These are profit losses caused by customers that would have placed an order with a CP but were deterred from doing so because of their expectation that there would be delays in provision (which in turn was caused by extended lead times). CPs lose the profit margins that they otherwise would have made if the customers signed up with them. In the MPF Dispute we considered that there were significant difficulties and uncertainty in pre-estimating the value of the "Potential Sales" component.

A30.67 In effect, lost potential sales can be viewed as reputational damage – one of the impacts listed in the 2008 SLG Review. If a CP was performing particularly badly (as a result of a decline in Openreach's QoS) and the CP's poor performance was public knowledge, it is plausible that consumers' expectations of the service they would expect to receive would be lowered to the point that they would be deterred from placing an order.

A30.68 A number of CPs referred to the damage to their reputations resulting from the decline in QoS provided by Openreach in their responses to the 2012 FAMR Call for Inputs. Vodafone, for example, said that Openreach's service issues damaged its relationships with its end user customers, who considered that it was Vodafone at fault for being unable to effectively manage BT's part in the provisioning process.¹²²⁸ KCOM said that all aspects of Openreach service delivery had a direct impact on its customer relationships and where issues occurred relating to quality and/or timeliness, it was not acceptable for it to suggest in correspondence with customers that the fault lies with another party e.g. Openreach.¹²²⁹ Similarly, FCS said that customers saw quality of service as the responsibility of their service

¹²²⁵ The survey was carried out on a sample of 400 users via an online panel. We note that participants in online panel research tend to have a more favourable than average attitude to technology. In this case the attitudinal bias could potentially have led to an over-statement of the propensity to cancel.

¹²²⁶ ✂.

¹²²⁷ ✂.

¹²²⁸ Page 23, Vodafone's response to the 2012 FAMR Call for Inputs, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/Cable_Wireless_Worldwide.pdf.

¹²²⁹ Page 7, KCOM's response to the 2012 FAMR Call for inputs, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/KCOM_Group_PLC.pdf

provider and therefore a poor level of service from Openreach was damaging to that service provider's business and reputation.¹²³⁰

A30.69 We recognise that the many end-users may not appreciate (or indeed care about) the delineation between that part of the service provided by their CP and that provided by Openreach. We agree, therefore, that where there are issues, it is likely to be the individual CP that the customer holds responsible, rather than a third party. There is some limited evidence from surveys provided by CPs (in response to an information request under section 135 of the Act), which indicate that there may be a correlation between their customers' perceptions of the CP and the service performance issues. For example, 3< provided evidence to show that its scores indicating how likely a customer was to recommend its service to a friend fell the longer customers had to wait for their broadband to be activated.¹²³¹ Similarly another CP 3< provided survey evidence showing a correlation between its scores indicating how likely customers were to recommend its service and changes in service dissatisfaction (particularly for local enterprise customers).¹²³²

A30.70 This reputational impact does appear likely to be greater in the case of business users than consumers, particularly with regards to repairs. Our market research found that SMEs placed significant weight on performance issues and reliability when selecting their CP. In particular SMEs ranked "responsiveness to faults" and "performance" as the most important factors when they were selecting their CP.¹²³³ In comparison, "speed of installation" was given relatively low priority, by both SMEs and consumers. Therefore, where an SME experiences issues with fault repair from their CP, it seems likely that this could impact on that customer's perception of their CP. The fact that the issue with the responsiveness to faults may not be the responsibility of the individual CP (but rather with the service provided by Openreach) does not alleviate this damage to the customer's perception of the CP.

A30.71 It is very difficult to pre-estimate accurately the number of "potential sales" that would be lost as a result of delays. However, we consider there to be a plausible link between poor quality of service and lost potential sales, which in turn represents a potential impact on CPs.

Customer care costs

A30.72 In the 2008 SLG Review and the MPF Dispute, we discussed a number of different types of customer care costs. Below, we set out the three main categories of customer care costs that we consider are likely to be incurred by CPs.

Compensation paid by CPs to end-users

A30.73 A number of CPs highlighted in response to the 2012 FAMR Call for Inputs that they had to provide credits and/or goodwill payments (e.g. free rental months and engineer charges reversed) where there were problems with Openreach's service performance. As highlighted in Figures A30.21 and A30.22 below, a number of end-users (10% of SMEs and 13% of consumers) are likely to request compensation from their provider if the provisioning or fault repair service they receive is not what

¹²³⁰ Page 6, FCS' response to the 2012 FAMR Call for Inputs,
<http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/fcs.pdf>.

¹²³¹ 3<.

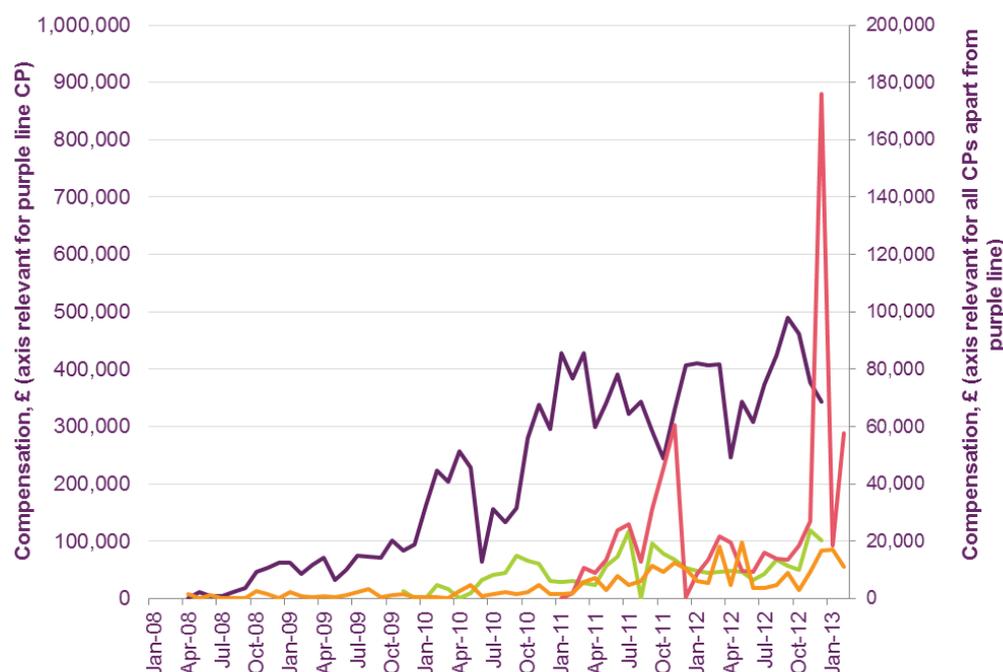
¹²³² 3<.

¹²³³ Q1A 2013 QoS research.

they would consider to be reasonable.¹²³⁴ Consumers in particular indicated that how quickly an appointment could be made was the most important factor (with 45% importance) in their decision to request compensation (if the installation scenario was not what they considered to be reasonable). Whether or not the installation was completed in a single visit was also important (with 39% importance attributed) and to a lesser extent (16%) whether or not the engineer turned up as scheduled.¹²³⁵ In addition, as discussed further below (paragraph A30.75), a significant proportion of consumers and SMEs indicated that they would be likely to complain to their provider if the installation scenario is not what they consider to be reasonable, and this may also result in the provider offering compensation to the customer.

A30.74 We asked CPs about the amount of compensation they have paid out to end-users because of problems with Openreach’s service performance. Figure A30.17 below shows that compensation payments increased for a number of major CPs (X) during the period when Openreach’s service performance deteriorated, particularly in the latter half of 2012. The extent of this impact on CPs depends on their particular approach to providing compensation payments to end-users but where they are issuing these payments, and the cause is Openreach delays, it can represent a direct cost to CPs.¹²³⁶

Figure A30.17: Compensation payments paid by four CPs to their customers¹²³⁷



Source: Ofcom analysis of four CP’s responses received between 28 February 2013 and 6 March 2013 to question 1.11 of the QoS CP Information Request.

¹²³⁴ For further discussion of what consumers and business consider to be “reasonable” see paragraphs A30.117 to A30.121 below.

¹²³⁵ Q7a 2013 QoS research.

¹²³⁶ We did not take these costs into account as part of the MPF Dispute because any compensation payments are discretionary and depend on the particular policy adopted by the CP.

¹²³⁷ Note that there are some limitations to this data because in some cases it was not clear whether the compensation payments could be linked directly to issues with Openreach’s service.

Additional costs of customer service

- A30.75 The results of our market research found that both SMEs and consumers said they were most likely to complain to their providers if a fault repair or provisioning service did not meet their expectations.¹²³⁸ In particular, as demonstrated in Figures A30.21 and A30.22 below, the evidence shows that 67% of consumers and 58% of SMEs would complain to their provider in the event of a provisioning service that they did not consider to be reasonable. In the case of repair this increases to over 70% for both consumers and SMEs.
- A30.76 A number of CPs noted in their responses to the FAMR Call for Inputs that this increased need for end-users to contact CPs to complain about poor service results in increased costs. In particular, the costs of handling those customer service calls (e.g. staff time, as well as opportunity costs because those customer service agents could have been spending time on other issues which the CP has greater control over). BT Retail noted, for example, that the long lead times for repair and provisioning had increased the propensity for its customers to contact them.¹²³⁹
- A30.77 Further, the additional time spent liaising with customers to rearrange appointment times if an engineer does not turn up or the issue is not resolved on the first appointment will also result in additional customer service costs for CPs. There may also be other costs for example if the CP has to provide the customer with an alternative service in order to ensure the customer has internet access where they are experiencing a loss of service (e.g. a mobile broadband dongle). Again, it is difficult to estimate the scale of these costs, in particular which of these costs are incremental to those normally incurred by CPs. However, we consider that the Openreach service issues during late 2012, particularly where provisioning times and fault repairs were significantly below what customers considered to be acceptable are likely to have led to material costs of this nature for CPs.

Operational costs

- A30.78 As well as the more direct costs to CPs resulting from compensation payouts, there are also on-going costs involved in dealing with Openreach as a result of a failure. Vodafone, FCS and TalkTalk all noted in their responses to the FAMR Call for Inputs that poor service quality increased their operational costs, for example the increased resource required to manage failures. In particular CPs need to liaise with Openreach to resolve any issues and manage receipt of SLG payments where appropriate. Clearly where QoS is poor, those issues are likely to be more frequent and thereby create additional costs. It would be a complex process to isolate the exact costs to CPs resulting from these particular issues, but given the numbers of repairs and provisioning of lines which have not been meeting the existing SLA targets (particularly during late 2012), we consider that it is plausible that CPs had to incur additional costs.

¹²³⁸ Q7C 2013 QoS research, (asked to all finding installation scenario not reasonable) “In the event of this scenario happening to you what action or actions, if any, would you be likely to take?” and Q9a “In the event that a fault repair to your [business] fixed line or broadband service was taking longer than you felt was reasonable, what actions, if any would you take?”

¹²³⁹ Pages 3-4, BT Retail’s response to the 2012 FAMR Call For Inputs, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/BT_Retail_response_on_Openr1.pdf.

Impact on end-users (businesses and consumers)

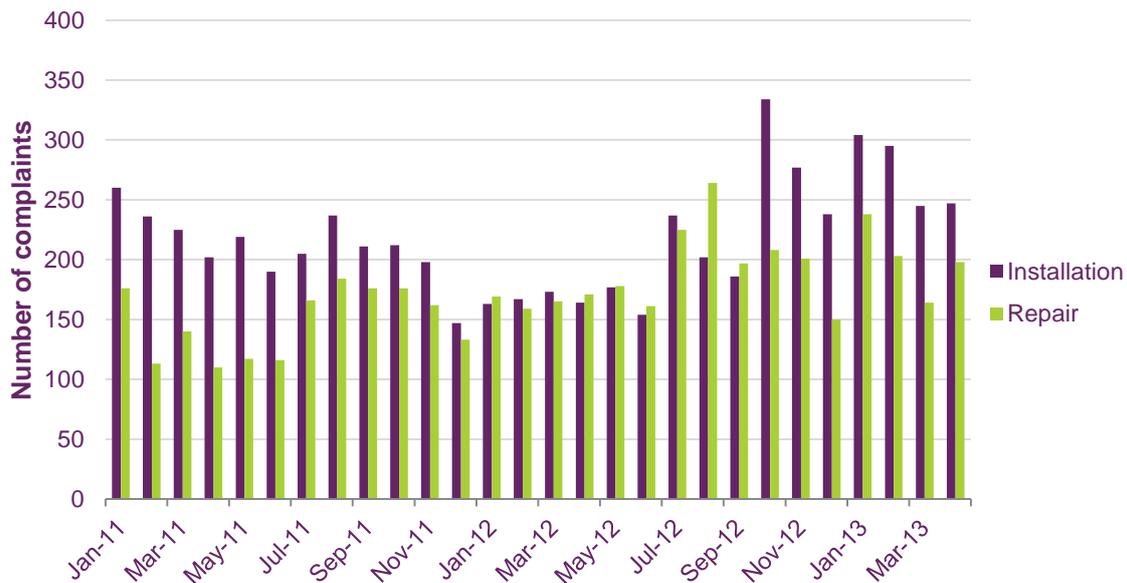
- A30.79 We have outlined above the impact that poor QoS can have on CPs in the form of increased costs, lost margins and reputational damage. This of itself is cause for concern. However, we are also concerned about how this then, in turn, has the potential to lead to particular negative impacts on end-users of the services. Ofcom's principal duty is to further the interests of consumers and citizens in relation to communications matters and these impacts are therefore of central importance in this review. Moreover, any negative impact that poor quality of service has on the consumer/business experience could then in turn be impacting competition within the sector by acting as a barrier to switching.
- A30.80 In response to the FAMR Call for Inputs, a number of CPs commented on the harm to consumers/businesses that could result from poor QoS provided by Openreach. In particular, CPs mentioned the unavailability of service (particularly for home/premise mover customers), as well as the inconvenience to consumers as a result of having to be available for multiple appointments and the frustration they experienced as a result. BT Retail, for example, noted that with the increasing importance of broadband to daily domestic life (and particularly now that significant numbers of its customers had TV over broadband) speedy repair was much more important than it used to be. BT Retail said that for businesses long lead times had been especially frustrating as a provision was often part of a bigger project and service outage was business-disrupting.¹²⁴⁰ KCOM also noted that often the customer installations it was undertaking were complex and could have significant financial implications if they were not completed on time.¹²⁴¹ FCS also noted that the "unacceptable timeframes" for rectifying problems were particularly acute and damaging for business customers, where the cost of failure was much higher than for residential customers.¹²⁴²
- A30.81 The fact that problems with Openreach's service may be impacting consumers negatively more generally is potentially indicated in the increase in complaints to Ofcom's Advisory Team (OAT). Although these complaints relate to delays or problems with provisioning and repairs more generally (i.e. they are not necessarily Openreach specific), there was a noticeable increase in complaints during the latter half of 2012, which coincides with Openreach QoS problems as outlined earlier in this annex. Figure A30.18 below shows that complaints about provisioning in particular increased noticeably in September 2012 (up to a peak of nearly 350 in October 2012) but more recently have started to decrease.

¹²⁴⁰ Pages 3-4, BT Retail's *response to the 2012 FAMR Call for Inputs*.

¹²⁴¹ Page 7, KCOM's *response to the 2012 FAMR Call for inputs*.

¹²⁴² Page 6, FCS' *response to the 2012 FAMR Call for Inputs*.

Figure A30.18: Complaints to OAT about provision/repair



Source: Ofcom OAT complaints data.

A30.82 Based on the evidence available to us in this review, we are particularly concerned that long lead times for provisioning and repair can lead to the following negative impacts on end-users:

- loss of service: long waiting times for provisioning a line and/or for getting faults repaired (where the fault means a loss in service) means that end-users are without fixed line and/or broadband often for extended periods;
- end-user time costs: for example if consumers are left waiting for engineers to turn up, having to make multiple appointments and rearrange appointments with CPs and in general suffering inconvenience as a result of Openreach service performance issues; and
- general reduction in welfare as a result of negative impact on competition.

A30.83 We set out our assessment of the first two impacts below. We discuss the third as part of our assessment of the impact on competition in general under the relevant heading below.

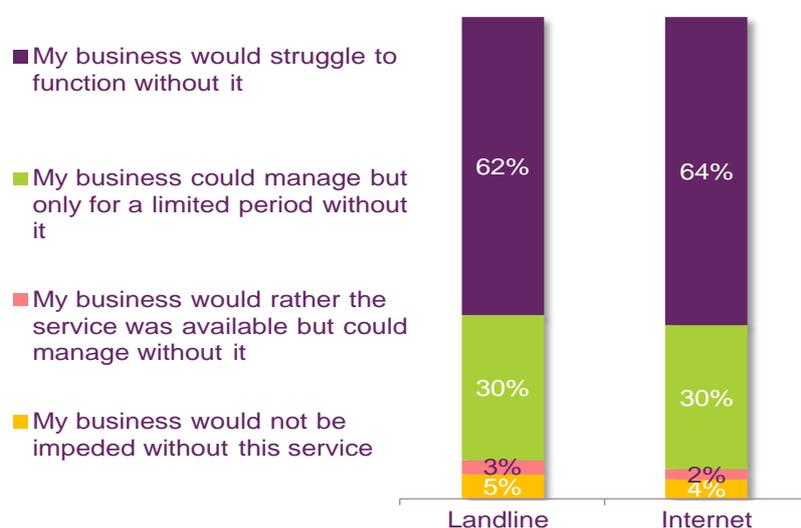
Loss of service

A30.84 Both consumers and businesses are heavily reliant on their fixed line and broadband services, increasingly so in the case of broadband. Therefore any loss in either service can have a particularly significant negative impact, and in some instances the impact could be especially severe, for example if the end-user has a disability or is elderly and is reliant on their landline for contacting emergency services.

A30.85 As indicated in Figure A30.19 below, four in five SMEs said they would struggle to function without at least either their landline or broadband service. When asked about the reasons for this a number of SMEs pointed to the importance of their landline in communicating with customers, particularly for sales. A loss of service

for these SMEs therefore has a significant negative impact because they could be losing customer sales and damaging their revenues, as well as potentially suffering reputational damage associated with being unable to communicate with their customers.

Figure A30.19: SME reliance on landline and broadband



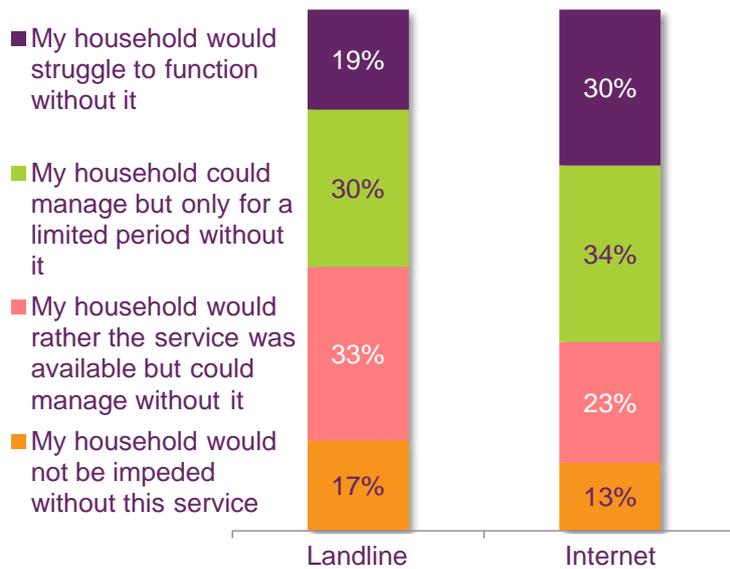
Source: 2013 QoS research, Q8: “Thinking about your landline/ internet connection, how much does your business rely on your landline telephone/ broadband/ internet connection?” Base: All businesses (500).

A30.86 The importance of service reliability and performance to SMEs is also reflected in the higher proportion that say they would consider paying extra for a premium service (where, for example, they received a priority service for fault repair) – 30% of SMEs said they would consider such a service.¹²⁴³

A30.87 In comparison, consumers are less likely to say that their household would “struggle to function” without either a landline or broadband service. However, there is still a significant proportion of consumers (30%) who say they would struggle to function without their broadband service and similarly high proportions who claim that they could only manage for a limited period without either their landline or broadband service.

¹²⁴³ Q15 2013 QoS research.

Figure A30.20: Consumer reliance on landline and broadband services



Source: 2013 QoS research, Q8: “Thinking about your landline/ internet connection, how much do you rely on your landline telephone/ broadband/ internet connection?” Base: All consumers (2011) / Base: All consumers with each service (1989/1604).

A30.88 Within the 19% of consumers who said they would struggle to function without their landline, there was a specific group (17% of that 19% group) that said this was because either they, or a family member, was elderly and/or had disability issues which made landline contact particularly important in case of an emergency.¹²⁴⁴ This particular group of consumers are already protected under existing regulatory requirements – in particular, under General Condition 15, CPs are required to provide a priority fault repair service to any subscribers with disabilities who have a genuine need for an urgent repair and CPs generally meet this requirement through purchasing higher fault repair Care Levels from Openreach.¹²⁴⁵ However, this serves to highlight a specific instance where a loss of service could have a particularly severe impact on a significant group of vulnerable consumers.

A30.89 Research carried out for Ofcom’s switching project in 2011 indicated that around a quarter of consumers who went through the switching process (and did not just cease one service and restart separately with another provider) experienced an unwanted break in service.¹²⁴⁶ The average length of that break in service was 12 days. This is therefore a significant period for consumers to be without a service which they rely on and creates significant inconvenience and costs to those consumers. More recent research (in 2012) provided further evidence of this concern, with the major issues experienced by consumers who switched their landline and broadband services (as a bundles) “being without service during the switch” (21%) “arranging services to start and stop at the same time” (17%), and

¹²⁴⁴ Q8c 2013 QoS research.

¹²⁴⁵ In particular GC15.6. The General Conditions are available at:

<http://stakeholders.ofcom.org.uk/binaries/telecoms/ga/general-conditions22nov12.pdf>.

¹²⁴⁶ Page 20 Q1 Ofcom, *Fixed Broadband Switching research, 2011*,

http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/Fixed-broadband-switching/Final_fixed_broadband_onlin1.pdf.

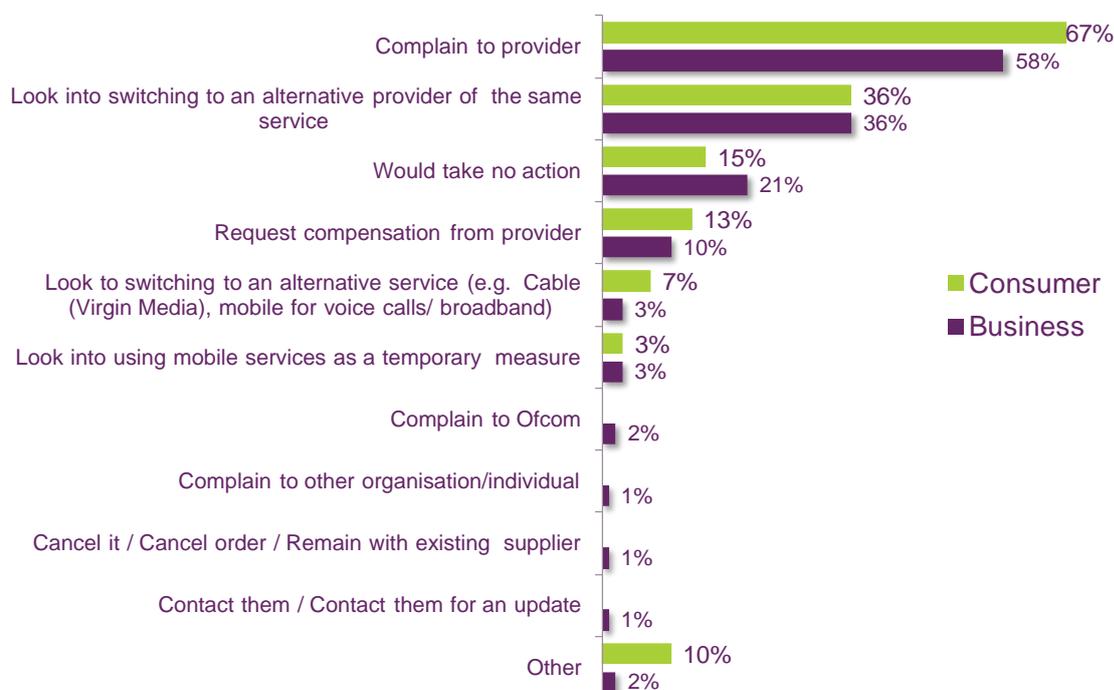
“installation of the new service” (13%) being the most common “main” issue during the switching process.¹²⁴⁷

End-user time costs

A30.90 It is not only a loss in service which creates issues and negative impacts on consumers and businesses. Even where there is no loss in service, consumers and businesses can still be negatively impacted by the additional time they need to spend on arranging to be at home/having someone on the premises available for engineer appointments, rearranging appointments, in general liaising with their CP to get the issue resolved and often complaining to their CP where problems occur. Whilst this may be difficult to quantify, in general this creates a poor customer service experience, with increased inconvenience and hassle for end-users.

A30.91 As highlighted in the figures below, the evidence from our market research is that the most common response when either repair or provisioning arrangements are not considered reasonable is for the customer to complain to their provider.

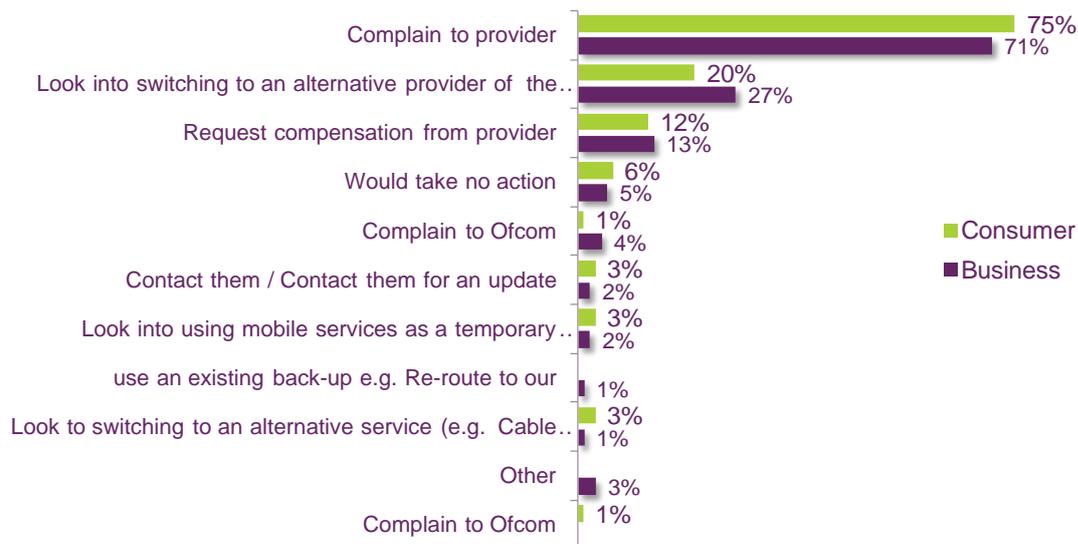
Figure A30.21: Actions users would take if installation arrangements are not considered “reasonable”



Source: Q7C (All finding installation scenario not reasonable) In the event of this scenario happening to you what action or actions, if any, would you be likely to take? UNPROMPTED Base: All not finding at least one installation scenario reasonable (businesses - 353) (consumers – 793).

¹²⁴⁷ Page 55, Figure 45, QE1/2 Ofcom *Customer retention and interoperability research, June 2013*
http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/customer-retention/CRI_Report_Final.pdf.

Figure A30.22: Actions customers would take if repair arrangements are not considered “reasonable”



Source: Q9a In the event that a fault repair to your [business] fixed line or broadband service was taking longer than you felt was reasonable, what actions, if any would you take? UNPROMPTED
Base: All consumers (2011) and all businesses (500).

A30.92 Our market research also found that the most important attribute in a service installation in order for it to be considered “reasonable” by both consumers and SMEs was that the work was completed on a single visit.¹²⁴⁸ This reinforces the view that having to wait for multiple appointments/rearrange appointments is a significant inconvenience to end-users.

A30.93 There is also a concern, which we discuss further below and is indicated in paragraph A30.89 above, that this additional hassle and inconvenience for end-users reduces the likelihood of switching.

A30.94 The questions from the 2013 QoS research which asked about the level of compensation end-users would expect if there was a failure (with either a promised installation or repair) provide some indication of the value consumers and SMEs attribute to the additional hassle/inconvenience such failures create. In terms of SMEs, a third were unable to name a figure for compensation but of those that were, the median amount quoted was £91 per day. The mean amount was a lot higher (at £758) indicating that there are a significant number of SMEs which place a much higher value on compensation – particularly the larger companies which quoted much higher values. In line with the discussion earlier about the importance of fixed line/internet for SMEs compared to consumers, consumers quoted noticeably lower, although not insignificant, amounts. The average (using the median) was £9 per day but the mean amount was also higher at £24 per day (again around a third were unable to name a specific amount).¹²⁴⁹ However, these results need to be considered alongside consumer and SME willingness to pay for a better service which avoids these negative impacts. As we note in paragraphs A30.129 to A30.130 below there was relatively limited willingness to pay for faster installation times or repairs, particularly amongst consumers.

¹²⁴⁸ Q7a, 2013 QoS research. 51% of consumers and 52% of SMEs reported the “completion of the work in a single visit” as the key component in the scenario being considered “reasonable”.

¹²⁴⁹ Q24b, 2013 QoS research.

Impact on competition

A30.95 In response to the 2012 FAMR Call for Inputs a number of CPs referred to the impact that poor quality of service from Openreach has on competition in the market. FCS said customers were less likely to change providers or take-up new services where there were extended lead times for provisioning, or where the process appeared to be unreliable and uncertain.¹²⁵⁰ TalkTalk said that the current level of service provided by Openreach was creating delayed market entry, making switching more difficult and distorting competition.¹²⁵¹ Sky, similarly said that the current level of service was an impediment to competition in the telecommunications industry and was harmful to the economy as a whole.¹²⁵² Sky also argued that the impact of poor QoS was likely to be greater on other CPs compared to BT Retail because, for example, consumers might become concerned about the disruption or delay in switching between operators, resulting in a stabilisation of market shares and/or a “flight to brand” which benefits BT.¹²⁵³

A30.96 We agree with this concern that a decline in QoS may have a negative impact on competition. In particular end-users may not be getting the best deals/packages to meet their communication needs either because:

- they do not have the incentive to switch to a better deal – i.e. they remain with their current provider (despite the availability of better/more attractive packages with other providers) because of concerns about the provisioning process and/or the issues with handling fault repairs. Or, they cancel initial orders when they are advised of the provisioning times and/or they experience delays in the provisioning process (for example an engineer not turning up for an appointment); or
- they are not incentivised to stay with the cheapest provider – i.e. they switch away from their existing provider due to either problems with the provisioning process (when it involves Openreach delays) when they move house/premises or problems with fault repair (again when this involves Openreach delays) taking too long to resolve.

A30.97 As indicated in Figures A30.21 and A30.22 above, a significant proportion of both consumers and businesses (36%) are likely to consider switching to an alternative provider if the service they receive for provisioning (referred to as “installation” in the research) is not what they would consider to be reasonable. For repair this response was less likely, but still up to a quarter of consumers (27% for businesses) indicated they would consider switching. In addition, when asked about different scenarios for installation, both consumers and SMEs attributed significant importance (57% for consumers, 67% for SMEs) to how soon the appointment for installation was in any decision to switch supplier if the installation scenario was not what they considered “reasonable”.¹²⁵⁴ In fact when we asked consumers about the level of wait for installation and repair that was likely to make them consider switching supplier, the mean average for installation was only 6.3 working days for installation and 7.1 working days for repair. For SME’s the average was 6.4 working

¹²⁵⁰ Page 6, FCS’ response to the 2012 FAMR Call for Inputs.

¹²⁵¹ Pages 19-20, TalkTalk’s response to the 2012 FAMR Call for Inputs.

¹²⁵² Page 10, Sky, Sky’s submission dated October 2012, “Regulating for quality: delivering service performance in UK telecoms”, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/BSkyb_Additional_Paper_1.pdf.

¹²⁵³ Page 5, Sky Regulating for quality submission.

¹²⁵⁴ Q7a, 2013 QoS research.

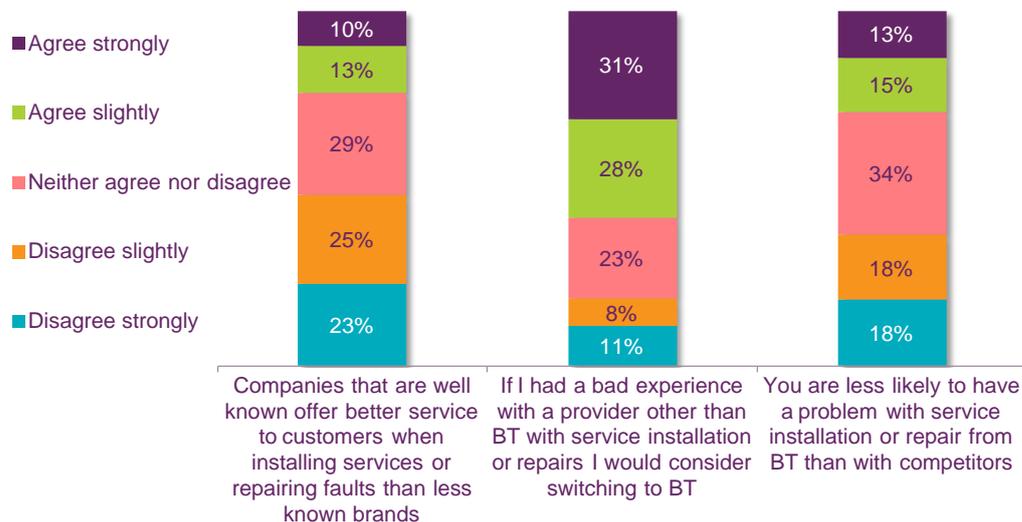
days for installation and 4.3 working days for repair.¹²⁵⁵ Whilst this only reflects those that would consider switching, and many may not actually have switched where there was a delay, it does indicate that even where there is only a short delay over what end-users consider reasonable, they will either be dissuaded from switching to other CPs or start to look elsewhere for their service.

A30.98 This effect was also emphasised in market research provided by \times where provisioning times of more than a week led to a significant proportion of respondents (up to 40%) stating that they would cancel an order. For repair, around a two-fifths (37%) of respondents said they would consider switching if repair took four to five working days or more.¹²⁵⁶

A30.99 Similarly, the consumer switching research discussed above highlighted that there are some indications that issues with the installation process, and loss of service, could be preventing some consumers from switching (see paragraph A30.89 above). In particular, that research found that amongst those consumers that considered switching providers but decided against it, “being without service during the switch” (44%) and “installation of new service” (38%) were reported as a major issue or difficulty for a significant proportion of consumers during the process, and as being a factor which contributed to them deciding against switching.

A30.100 With respect to the “flight to brand” argument put forward by Sky (i.e. consumers may return to a provider they are more familiar with if their experience with smaller brands has been less successful), we also asked about end-users’ views of BT/larger companies with respect to service installation and repair to ascertain whether there was any evidence of this point. The responses from SMEs are indicated in Figure A30.23 below and they indicated a range of views.

Figure A30.23: SME attitudes to larger providers and provisioning/fault repair



Source: 2013 QoS research, Q24b Base: All businesses (500).

A30.101 There was more disagreement than agreement with the statement that “companies that are well known offer better service to customers when installing services or repairing faults than less well known brands”.¹²⁵⁷ There was slightly more

¹²⁵⁵ Q9b, 2013 QoS research.

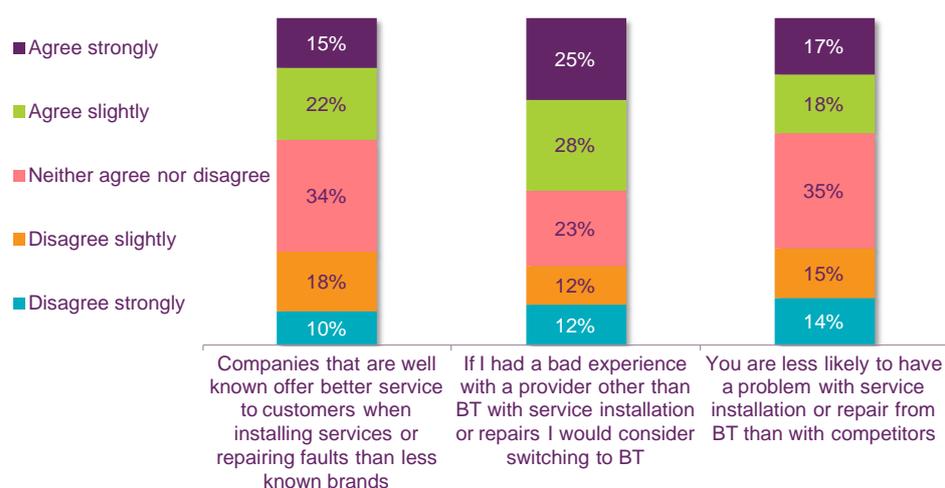
¹²⁵⁶ \times .

¹²⁵⁷ Q24b, 23% of SMEs agreed with that statement and 48% disagreed.

agreement from SMEs with the statement “you are less likely to have a problem with service installation or repair from BT than competitors” but still a greater proportion of disagreement.¹²⁵⁸ A significant proportion of respondents agreed that they would consider moving to BT if they experienced an issue with a service installation or repair (59% in total agreed with that statement), however a material proportion still disagreed with that statement and in a separate question in the research which asked about which supplier SMEs would consider moving to, only 9-11% named BT as the provider they would consider moving to (which is likely to be largely a reflection of BT’s market share).¹²⁵⁹ In addition, this result is likely to have been influenced by those who are already BT customers.

A30.102 With respect to consumers, there appears to be a slightly more favourable attitude to larger brands (including BT). A greater proportion (37% compared to 23% of SMEs) agreed that more well-known brands were likely to offer a better service and similarly a greater proportion agreed that they were less likely to have repair/installation problems with BT compared to its competitors (35% of consumers agreed in total). Again this result has been influenced by those who are already BT customers (49% of BT customers agreed compared to 22% of non BT-customers). Nevertheless, as with the SME responses there appears to be a material minority of end-users who have a view that BT is less likely to have service problems compared to its competitors.

Figure A30.24: Consumer attitudes to larger providers and installations/fault repair



Source: 2013 QoS research, Q24b.Base: All consumers (2011).

A30.103 In summary, this evidence indicates that lead times have a significant impact on SMEs and consumers’ choice of supplier. Whether they are considering switching away from their current provider to a potentially better deal or they are considering staying with their current provider because other potentially better offers do not seem very attractive, the length of time taken to install the new service is an important influence. It seems likely that a decline in Openreach’s quality of service could distort SMEs and consumers’ propensity to select the best value offers and this is likely to be detrimental to competition in the market. There is also some evidence to suggest that this could favour BT as a group in that a material minority of SMEs and consumers have more confidence in the BT brand.

¹²⁵⁸ Q24b, 28% of SMEs agreed and 36% disagreed.

¹²⁵⁹ Q10 2013 QoS research.

A30.104 Therefore the evidence suggests that poor QoS is likely to lead to a negative impact on competition within the sector by firstly reducing the inclination to switch providers (due to the risk of service outages) and by distorting the choice of supplies – that it supporting a slight bias to larger CPs and in particular BT.

Summary of impact of service performance assessment

A30.105 Based on the evidence set out above, it is clear that poor QoS by Openreach for provisioning and repairs of fixed access services has the potential to generate a negative impact on both CPs and end-users, as well as potentially on competition in the market more generally. CPs suffer lost and/or delayed revenues, increased compensation to their customers, customer care and operational costs. Consumers and businesses are harmed by loss of service and increased hassle and inconvenience (often causing increased expense for them). We also consider that poor QoS has the potential to lead to a weakening and distortion of competition, potentially favouring BT over other CPs where there are problems with QoS.

Considering what constitutes a reasonable level of service

A30.106 In order to inform our assessment of whether the current level of service which Openreach offers is appropriate, and what, if any, changes might be needed to the regulations, we discuss below what might constitute a reasonable level of service.

A30.107 We focus in particular on the timescales for provisioning and fault repair for WLR and LLU services – i.e. how many working days it takes Openreach to install a line (where an engineer appointment is required) and repair a fault on a line.

A30.108 We have looked at a number of different evidence sources to inform this assessment, including:

- responses from CPs to the 2012 FAMR Call for Inputs;
- the views of consumers and SMEs demonstrated by our market research; and
- a review of comparable benchmarks from other countries, products and industries.

Stakeholder comments in response to the 2012 FAMR Call for Inputs

A30.109 A number of stakeholders commented on specific details relating to the existing SLAs and how Ofcom should review those SLAs. Some of these comments are also relevant to considering what would constitute a reasonable level of service by Openreach. TalkTalk and Sky, for example, suggested that Ofcom should use benchmarking to assess the appropriate quality targets for Openreach.¹²⁶⁰ In particular, they suggested we review quality target levels for other incumbent telecommunications providers and also other similar businesses, products and service experiences within the UK, as well as in comparable overseas markets.¹²⁶¹ Both emphasised that using current performance would not be sufficient, although TalkTalk suggested that it might act as a minimum quality benchmark.¹²⁶²

¹²⁶⁰ Page 7, Sky *Regulating for quality submission*.

¹²⁶¹ Page 2, Sky *Regulating for quality submission*.

¹²⁶² Pages 7-8, TalkTalk's *response to the 2012 FAMR Call for Inputs*.

A30.110 BT Retail noted that its customer research indicated that customers expected 1-2 weeks for provisioning (under 10 working days) and 2 day repair performance. It said business customers could be equally or more demanding, although it said it was generally a firm commitment within a reasonable timeline that business customers required.¹²⁶³ BT Retail also commented that process improvements are needed to meet customer expectations, in particular relating to Openreach's CP and customer engagement (i.e. a more proactive approach to keeping customers informed), appointment availability and flexibility (e.g. having shorter appointment slots and the ability to give certain customers priority) and allowing innovation to meet business customer needs, such as developing premium services for those willing to pay extra.¹²⁶⁴

Timescales for provisioning – research results

A30.111 In order to put the evidence from our market research in context, it is important to be clear about which provisioning processes we are making comparisons with. Openreach's installation order processes cover a range of activities, relating to the installation, reconfiguration and cessation of telephony and broadband services. These include new line provisioning (for example installing a new WLR or MPF service into a home/office), changes (e.g. adding SMPF to an existing WLR line or adding a feature such as call barring to an existing WLR service), switching a line to a different provider and moving a service to a new location (e.g. in connection with a house move).

A30.112 The actual process, and timing, involved with provisioning can vary significantly depending on the nature of the order. In particular the timescale depends on whether it is a non-appointed or appointed order (as defined earlier, see paragraph A30.11). Appointed orders have been the main cause for concern during the recent service problems when lead times extended considerably when Openreach (with industry agreement) prioritised its resources on repair work. Our market research has consequently focused on these types of orders.

A30.113 Another factor relevant to the provisioning timescale is whether or not the requirement relates to a switching order (i.e. switching a line to a different provider). An additional consumer protection measure is built into the WLR and LLU switching processes, known as the "Notification of Transfer" or NoT process.¹²⁶⁵ This specifies a mandated period of 10 days before a switchover to a new CP, this 10 day period allows the existing CP to write to the customer to confirm that they have requested a switch and it provides the opportunity for the customer to prevent the switch if necessary (e.g. if they have been slammed).¹²⁶⁶ Therefore when a consumer is switching CP there will always be a ten day minimum period for provisioning the line because of these consumer protection measures.

¹²⁶³ Page 4, BT Retail's response to the 2012 FAMR Call for Inputs.

¹²⁶⁴ Pages 4-6, BT Retail's response to the 2012 FAMR Call for Inputs.

¹²⁶⁵ Ofcom, *Consumer switching: A consultation on proposals to change the processes for switching fixed voice and broadband providers on the Openreach copper network*, February 2012, <http://stakeholders.ofcom.org.uk/binaries/consultations/switching-fixed-voice-broadband/summary/condoc.pdf>.

¹²⁶⁶ "Slamming" involves a customer being switched from one company to another without the customer's knowledge or consent. In 2009 we introduced General Condition 24 which set out specific requirements designed to prevent customer's being slammed or mis-sold fixed line services: Ofcom, *Protecting consumers from mis-selling of fixed-line telecommunications services*, December 2009, http://stakeholders.ofcom.org.uk/binaries/consultations/protecting_consumers_misselling/statement/statement.pdf.

A30.114 As set out in Table A30.1 earlier, the current SLA for the first available appointment for LLU and WLR is now 12 working days. In our market research we specifically asked consumers and SMEs about their attitudes towards how long they should wait for an appointment for provisioning when an engineer was required. There is, nevertheless, a risk that the responses we received indicate SME and consumer attitudes to how long any provisioning should take (i.e. they would not necessarily have taken into account in their responses that where an engineer appointment is required, provisioning will require more time than a non-appointed provisioning).

A30.115 In comparing the attitudes of consumers and SMEs to the current situation we have considered not just the SLAs for appointed provisioning but also the average experience those end-users are likely to have (i.e. the ATTI which we defined above – see paragraph A30.11). As set out earlier, following the service problems in 2012 lead times were as high as 25 working days (and even higher in some locations) in late 2012. However, more recent evidence suggests that average lead times have fallen and in May this year the average time for the FAD was just over 8 days.¹²⁶⁷

A30.116 We have divided the discussion of the market research results into the following areas below:

- “reasonable” and “expected” provisioning timescales;
- provisioning timescales leading to consideration of switching;
- relative importance of provisioning timescale; and
- value placed on provisioning timescales.

“Reasonable” and “expected” provisioning timescales

A30.117 We asked participants what they considered was a “reasonable” timescale to wait for an appointment for an engineer to complete an installation either when they were moving home/premises or when switching supplier. We also asked participants about what they “expected” these timescales to be (rather than what they considered to be “reasonable”).¹²⁶⁸ Respondents were not presented with any information on the prices associated with provisioning timescales (e.g. that faster lead times might be more expensive) and therefore the results should be viewed in that context.

A30.118 The full results, including bar charts for each result are set out in the final report (which we have published separately today).¹²⁶⁹ There was a wide range of responses from both consumers and SMEs on the number of working days they either considered “reasonable” or “expected” for the two different provisioning scenarios. Table A30.25 below summarises the results – including the mean average number of working days from the responses as well as the proportions for

¹²⁶⁷ Note that FAD is a different measure to ATTI - see paragraph A30.25 above for an explanation of FAD. Figure A30.5 sets out the number of working days for the FAD.

¹²⁶⁸ In the research we specifically noted that where respondents were indicating what was “reasonable” this did not have to be “their ideal situation but one that would be generally satisfactory”. For what they “expected”, we noted that this “did not necessarily have to reflect their “ideal” or “satisfactory” situation, but the time that you feel would be likely to be offered in these circumstances”. The aim of asking about both “reasonable” and “expected” timescales was to compare whether there was any differences between respondents views.

¹²⁶⁹ Ofcom *Fixed line installation and fault repair summary report*.

up to 3 and 5 working days, as well as the proportion that indicated up to 10 working days or over.

Table A30.25: Summary of QoS research on timescales considered reasonable and expected for provisioning

		Mean average working days		% up to 3 working days		% up to 5 working days		% 10 working days or over	
		Consumer	SME	Consumer	SME	Consumer	SME	Consumer	SME
Reasonable	Moving	4.2	5.2	57%	53%	76%	75%	7%	12%
	Switching	4.9	5.4	53%	53%	73%	73%	14%	14%
Expected	Moving	4.0	5.7	66%	56%	80%	72%	7%	17%
	Switching	4.3	5.4	62%	56%	77%	70%	8%	18%

Source: Q1/Q2/Q3 2013 QoS research. Base: All businesses (500), all consumers (2011).

A30.119 As the table indicates, amongst consumers there was on average no significant difference between the time considered “reasonable” for home moving and switching. Most consumers (73-76%) express the view that it is reasonable for an appointment for an installation (for either home moving or switching CP) to take place in 5 working days or less. In fact a majority of consumers (53-57%) considered that an installation should take place in 3 working days or fewer.¹²⁷⁰ Only a small minority (7% for moving home and 14% for switching CP) considered that 10 or more working days was a reasonable timescale.

A30.120 These results were largely consistent with what they considered to be “reasonable”, although many expected a shorter timescale (for example the average expected timescale for switching CP was 4.3 working days).¹²⁷¹ Breaking down the results further indicated that consumers who had recently had a new line connected were more likely to consider a longer timescale was reasonable (as well as expecting a longer timescale) – the average number of working days considered reasonable by these consumers was 5.9 working days for moving home and 10.5 for switching CP.¹²⁷²

¹²⁷⁰ Q1 2013 QoS research: “You have moved into new home/premises and call a communications provider to set up your fixed telephone line and/or internet connection. They advise you that an engineer will need to come out to your house in order to activate the line. How long do you think it is reasonable for the maximum wait until the first suitable appointment for an engineer to visit and activate your service?” and Q3 “You have decided to change communications provider for your household telephone line and/or internet connection. Your new provider advises that it is necessary for an engineer to visit to perform the switch over. How long do you think it is reasonable for the maximum wait for a suitable appointment for the engineer to attend and the change to occur?”

¹²⁷¹ Q2 and Q4 2013 QoS research: “And how long would you expect it to take?”

¹²⁷² Q1-Q4 2013 QoS research: In relation to expected timescales, consumers who had recently had a new line connected expected provisioning to take 7 days when moving home and 10.2 days when switching CP.

A30.121 As might be expected, given the likely additional complexity of installations for SME customers, SMEs had expectations of slightly longer timescales for installation involving an engineer appointment. In general, SMEs' expected installation times were in line with what they considered to be reasonable (although for moving premise the average expected time was slightly longer at 5.7 working days). For larger SMEs (with over 100 employees) the timescale considered reasonable increased to nearly seven days for either moving premises or switching CP.¹²⁷³ Again, however, the market research indicated that most businesses (73-75%) consider that installation (either for moving premises or switching CP) in less than five working days is reasonable, and a majority (53%) consider that within three working days is reasonable.¹²⁷⁴ The proportion of SMEs that consider 10 or more working days to be reasonable was also small, with only 12/14% selecting this time period.

Installation timescales leading to consideration of switching

A30.122 We also asked respondents to indicate what level of wait for an installation would lead them to start considering switching to an alternative supplier. Again there was a wide range in the responses provided – the average working days and proportions are summarised in the Table below. It is important to bear in mind that this question was asked only of those respondents who indicated they would start considering switching supplier where the installation time was deemed “unreasonable” and therefore the results may be overstated compared to the whole sample.

Table A30.26: Level of installation timescale likely to trigger consideration of switching

	Mean average number of working days	% up to 3 working days	% up to 5 working days	% up to 7 working days
Consumers	6.5	33%	59%	77%
SMEs	6.4	45%	61%	67%

Source: Q9b 2013 QoS research. Base: All consumers would consider switching if installation seemed unreasonable (483) and all business would consider switching if installation seemed unreasonable (128).

A30.123 In general the responses indicated that both consumers and SMEs would start considering a switch to a different supplier even where installation times were only slightly above (e.g. around 2 days over) what they considered reasonable. A greater proportion of SMEs (45% compared to 33% of consumers) said they would start considering switching even if installation was up to three working days.

Relative importance of installation timing

A30.124 We also asked respondents to rate the importance of different components of service installation in order to understand how important the timing of installation is

¹²⁷³ Q1/2 2013 QoS research.

¹²⁷⁴ Q1/2 2013 QoS research.

relative to other aspects of the installation (for example the availability of different appointment slots).¹²⁷⁵

A30.125 In relation to consumers, the responses supported the finding outlined above that most consumers view a five day period for an appointment for installation as reasonable. A five day wait for an appointment (and to a lesser extent a 10 day period) was more likely to lead to a scenario being considered reasonable by consumers – in particular, consumers attributed 36% importance to the time taken to get an appointment for installation in their decision about whether an installation scenario was reasonable and a period of five working days was more likely to make that factor more important to their decision. Where respondents felt that a particular scenario was not reasonable and that it would push them to consider switching to a different provider, a majority (57%) said that it was the installation time in particular that was the important factor driving that decision.¹²⁷⁶

A30.126 The results for SMEs to this question were similar – SMEs attributed 34% importance to the time taken to get an appointment. However, for SMEs, the time taken to get an appointment was more important in their switching decisions, in particular this contributed to 67% of a SMEs decision as to whether they would switch supplier if a particular installation scenario was not what they considered to be reasonable (compared 57% for consumers).

A30.127 For both consumer and SME respondents, however, the key factor in their views of whether a particular installation scenario was reasonable was that the work was completed in a single visit (rather than multiple visits being required) – this had 52% importance for SMEs and 51% for consumers, compared to 34% and 36% importance respectively for the timing of the appointment.¹²⁷⁷

Value placed on installation timescales

A30.128 Our market research also provides some indication of the value that consumers and SMEs place on installation timescales. We asked respondents about their willingness to pay extra for faster installation times. Amongst consumers there was little willingness to pay - only 13% of consumers said they would be likely to consider taking up a premium service which offered faster installation. When asked specifically about how much they would consider reasonable to pay for an appointment sooner than the one they were originally offered only 18% of consumers indicated a willingness to pay – 73% said they would not be willing to pay anything.¹²⁷⁸

A30.129 Amongst SMEs there was slightly more willingness to pay for faster installation but still not a significant amount – 24% indicated a willingness to pay for an appointment slot sooner than the one initially offered but 55% were not willing to pay anything. However when asked about willingness to pay for a “premium service” (which included both faster installation and priority fault repair) a greater proportion of SMEs (35%) indicated a willingness to pay, with the median amount indicated at £24.¹²⁷⁹

¹²⁷⁵ In particular the research asked about five different aspects: “how soon the appointment is”, “appointment confirmation”, “appointment offered”, “engineer turns up as scheduled” and “work complete on a single visit”.

¹²⁷⁶ Q7A, 2013 QoS research.

¹²⁷⁷ Q7a, 2013 QoS research.

¹²⁷⁸ Q12ai and Q15, 2013 QoS research.

¹²⁷⁹ Q13 2013 QoS research.

A30.130 The value of provisioning times is also indicated through the results of the research question which asked about the factors consumers and SMEs considered important when selecting their CP. For consumers, “speed of installation” was ranked very low as a factor. As might be expected, “price” was the most important factor for consumers.¹²⁸⁰ For SMEs, “speed of installation” was also ranked as one of the lowest factors when selecting their CP. Unlike consumers, however, price was not the key factor and instead (as we will discuss further below) “responsiveness to faults” was the main factor.¹²⁸¹

Summary of results on provisioning timescales and comparison to current performance/existing SLAs

A30.131 Table A30.27 below summarises the conclusions that we draw from our market research on the timescales that consumers and SMEs consider reasonable for installation.

Table A30.27: Summary of time considered reasonable for provisioning

	Optimal provisioning timescales - likely to maximise consumer satisfaction (including switching or moving home/premises)	Upper end of acceptable timescales (including switching or moving home/premises)
Consumers	3 to 5 working days	10 working days
SMEs	5 to 6 working days	10 working days

Source: Ofcom

A30.132 Taken at face value, this research indicates that satisfaction with installation service is likely to be maximised if timescales for consumer installations are around three to five working days and SME installations are around five to six working days. There was also a lower stated propensity to consider switching to other suppliers with these timescales. At the other end of the scale, only a small minority of consumers and SMEs considered installation timescales of ten days or more to be acceptable.

A30.133 In considering these results we recognise that what consumers and SMEs consider reasonable may be unrealistic and/or disproportionate for a range of other reasons and that respondents would not necessarily have taken into account all the different factors involved when choosing a number of days for their response. For example, the 10 day period involved as part of the NoT process when switching CP is unlikely to have been a factor in these responses but this process is designed to protect consumers from potential harm and therefore is an important factor which restricts the timescale available for those specific installation scenarios.

A30.134 We also consider it is important to balance these views on installation times against the value which consumers and SMEs place on these timescales. It is clear that speed of installation is not the most important factor in either consumers’ or SMEs’ decision when choosing a CP. SMEs in particular place considerably more weight on responsiveness to faults. When considering the actual installation scenario, both

¹²⁸⁰ Q1A 2013 QoS research “When selecting your CP we would like to know what factors are important to you”.

¹²⁸¹ Q1A, 2013 QoS research.

consumers and SMEs place more importance on the installation being carried out successfully on the first appointment. Therefore, it seems likely that they would be more willing to accept a longer lead time beyond five days provided that that installation can be guaranteed and delays are reduced.

A30.135 In comparing the “reasonable” provisioning timescales set out above to the current situation in terms of the level of SLAs and the actual level of performance, it is important to bear in mind the various factors outlined in paragraphs A30.111 to A30.115 above. In particular, it is not necessarily appropriate to compare the timescales above with the current SLAs, because the SLAs represent the maximum target for installation, rather than the average experience a customer will have when getting a line installed. In addition, as noted earlier, the questions in the market research were specifically about appointed provisioning, however, participants responses may reflect attitudes to how long any type of provisioning should take (i.e. they would not necessarily have taken into account in their responses that where an engineer appointment is required, the installation will require more time than a non-appointed installation). Currently Openreach’s overall transaction lead times for provisioning (for both non-appointed and appointed) are several days lower than the 8 days for appointed only set out in Figure A30.5 above, and therefore are likely to be more closely in line with the consumer and SME expectations set out above. Nevertheless, it is clear that the lead times being experienced in 2012 in relation to provisioning and repair were considerably out of line with both consumer and SME expectations.

Timescales for repair – research results

A30.136 Openreach provides a number of Care Levels, which offer differing committed timescales to fix faults. The SLA for repairs depends (in the majority of cases) on the Care Level selected by the particular CP with whom the consumer or SME has contracted. The most commonly used Care Levels result in an SLA of either next working day plus one day (for WLR) or next working day (for SMPF and MPF). Therefore consumers or SMEs should normally have repairs completed within one or two working days depending on the underlying wholesale access product on which their retail service is based. However, as indicated earlier, in 2012 there was a marked decrease (to as low as 55%) in the number of repairs which were completed within the SLA (see Figure A30.9 above).

A30.137 The discussion below is divided into the following areas:

- “reasonable” and “expected” timescales for repair;
- repair timescales leading to consideration of switching; and
- value placed on repair timescales.

“Reasonable” and “expected” timescales for repair

A30.138 The evidence provided by our market research indicates that consumer views on the timescale for repair are in line with that offered by the current SLAs. The Figure below sets out consumer views on both the reasonable timescale for repair, and the timescale they expect:

Table A30.28: Consumer and SME views on repair timescales

		Mean average number of working days	% up to 1 working day	% up to 2 working days	% up to 3 working days
Reasonable	Consumers	2.6	39%	70%	84%
	SMEs	1.6	83%	89%	91%
Expected	Consumers	2.5	47%	70%	82%
	SMEs	1.6	77%	82%	87%

Source: Q5/Q6 2013 QoS research. Base: All consumers (2011) and all businesses (500).

A30.139 As the Table indicates, there was a noticeable difference in timescales indicated by consumers compared to SMEs – in fact on average there was a one day difference between the average reasonable and expected timescales. Most consumers (84%) considered that a repair within three working days was reasonable, whereas the vast majority (80%) of SME respondents considered it reasonable for faults to be repaired within one working day.

A30.140 Separately we also prompted respondents with different repair timescales and asked them how “reasonable” they considered those timescales to be. The results are summarised in the table below.

Table A30.29: Consumer and SME views on repair timescales (prompted)

		1 working day	2 working days	3 working days	5 working days
Consumers	“Reasonable” ¹²⁸²	95%	76%	43%	16%
	“Only just reasonable”	2%	12%	23%	17%
	“Unreasonable” ¹²⁸³	3%	11%	34%	68%
SMEs	“Reasonable”	79%	38%	16%	7%
	“Only just reasonable”	11%	21%	17%	7%
	“Unreasonable”	10%	42%	67%	87%

Source: Q7D 2013 QoS research. Base: All consumers (2011) and all businesses (500).

A30.141 These results further emphasise that SMEs consider a one day timescale (or shorter) to be reasonable, whereas a greater proportion of consumers are more likely to consider a two day period to be acceptable (76% of consumers considered 2 working days to be reasonable in this instance).

Installation timescales leading to consideration of switching

A30.142 This difference between consumer and SME expectations of fault repair timescales was also evidenced in the responses on consideration of switching. We specifically asked consumers and SMEs what level of fault repair would lead them to consider switching to an alternative supplier – again there was quite a wide range of responses provided but Table A30.30 below provides a summary.

¹²⁸² For these (and the equivalent SME) results we have combined the ‘very reasonable’ and ‘quite reasonable’ responses.

¹²⁸³ For these (and the equivalent SME) results we have combined the ‘very unreasonable’ and ‘quite unreasonable’ responses.

Table A30.30: Level of wait for fault repair likely to trigger consideration of switching

	Mean average number of working days	% up to 2 days	% up to 3 days	% up to 5 days
Consumers	7.1	33%	55%	70%
SMEs	4.3	46%	65%	83%

Source: Q9b 2013 QoS research. Base: All consumers would consider switching if fault repair seemed unreasonable (409) and all businesses would consider switching if fault repair seemed unreasonable (133).

A30.143 As the Table indicates, the mean average number of days which would trigger consideration of switching supplier was significantly lower for SMEs compared to consumers – 4.3 working days for SMEs compared to 7.1 working days for consumers. Nearly half of SME respondents (46%) indicated that even if a repair took up to two working days they would consider switching supplier compared to around a third of consumers (33%). Interestingly those consumers who had previously had an engineer visit to repair a fault indicated slightly more tolerance, with a mean average of 8.6 working days before they would consider switching supplier.¹²⁸⁴

Value placed on installation timescales

A30.144 SMEs also appear to place greater value on their fixed line/broadband connection compared to consumers. For example, as indicated earlier (see paragraphs 30.85) four in five business said they would struggle to function without either their landline or internet and this was primarily because they relied on it for communicating with their customers (for their landline) and for sales (for internet).¹²⁸⁵ Therefore any loss in service resulting from a fault is more likely to create difficulties for SMEs, including lost revenues, and as a consequence they expect, and consider it reasonable, for repairs to be carried out more quickly than consumers.

A30.145 The greater weight that SMEs place on reliability and speed of fault repair is also reflected in the factors they consider when selecting their CP. Our research found that “responsiveness to faults” was rated as the most important factor by SMEs when considering which CP to select, with “performance” ranked as second.¹²⁸⁶ This is notably different from consumer responses to the same question where “price” was by far the most important factor. Consumers do appear, however, to place more weight on a CP’s responsiveness to faults compared to installation times when they are choosing their CP, although it is still less important to consumers than other factors such as price.¹²⁸⁷ SMEs with the highest spend on their telephony package ranked “responsiveness to faults” even higher on average than other SMEs.¹²⁸⁸

¹²⁸⁴ Page 53, 2013 QoS research.

¹²⁸⁵ Q8 2013 QoS research. 62% said they would struggle to function without their landline and 64% would struggle to function without the internet.

¹²⁸⁶ Q1A 2013 QoS research. “Responsiveness to faults” received a score of 29.6 and performance 26.6, compared to 15.07 for price. In contrast, consumer respondents scored price at 30.4 and responsiveness to faults was given 11.66.

¹²⁸⁷ Q1A, 2013 QoS research.

¹²⁸⁸ P30, QoS research report.

A30.146 In terms of willingness to pay for faster fault repair, despite the increased importance of fault repair, the research did not indicate that SMEs are willing to pay extra for faster appointments. Only 17% of SMEs indicated any willingness to pay extra for an earlier appointment for a fault repair and 63% said they were unwilling to pay anything.¹²⁸⁹ This was actually a lower proportion than that willing to pay for faster installation appointments, despite the greater weight that SMEs place on fault repair. In contrast as indicated earlier, when SMEs were asked more generally about paying extra for a “premium service” which offered a “fast-track” or “priority service” on any installation or fault repair, a much greater proportion (35%) indicated that they would be willing to pay for such a service.¹²⁹⁰ Consumers were also unwilling to pay any extra for quicker fault repair with only 15% of consumers indicating any willingness to pay extra.¹²⁹¹

Summary of consumer and SME views on repair timescales

A30.147 In summary, the conclusions that we draw from our market research on the timescales that consumers and SMEs consider reasonable for repairs are:

- for consumers a timescale of up to 2 working days is likely to be considered reasonable; and
- for SMEs a timescale of no more than 1 working day is likely to be considered reasonable.

A30.148 The current SLAs for repairs are therefore, unlike the installation timescales, much more clearly in line with the customer’s expectations, particularly for consumers who are more tolerant towards a slightly longer repair time. For SMEs, the current SLA appears broadly in line with expectations.

Other potentially relevant benchmarks

Comparison with other European countries

A30.149 We contacted other European national regulatory authorities (NRAs) in order to find out what SLAs are in place in those countries, how operators are performing against those SLAs, and how they compare to the Openreach SLAs. The Tables A30.31 to A30.33 below show the different SLAs in place for each product in a number of European jurisdictions, and where the data was available, the average performance against that SLA in 2012.

Installation

A30.150 With regards to SLAs for installation, there are quite a lot of similarities between the countries. As Table A30.31 below demonstrate, SLAs for shared LLU (SMPF) new provide, full LLU (MPF) new provide, and WLR migration are all quite similar with each other; an SLA of seven to eight working days appears to be the average for SMPF and MPF new provides, and five or six working days is a common SLA for WLR migration. MPF migration and WLR new provide is where more variation can be seen, with most SLAs ranging from three to 11 working days and two to eight working days respectively. It is important to note, however, that some countries do take the complexity of the order into consideration, and as such, Italy extends its

¹²⁸⁹ Q12ai, QoS 2013 research.

¹²⁹⁰ Q13, QoS 2013 research.

¹²⁹¹ Q12ai, 2013 QoS research.

SLAs for WLR new provide and WLR migration to 45 working days in complex cases, whilst Switzerland's SLA for general installations is up to 90 working days for cases where a physical change is required.

A30.151 Overall, the majority of installation SLAs range from three working days up to 11 working days. Most operators tend to have provision targets of between five and eight working days, however three or four working days does appear to be a relatively common target in situations where there is a pre-existing access network connection to the property.

A30.152 Where the information has been provided, it can be seen that only in Austria, France, Portugal and Switzerland was the average time to provide often below or equal to the SLA in those Member States. In cases where the average time to provide was above the SLA, this was often by quite a significant amount.

Table A30.31: Shared/full LLU Installation SLAs¹²⁹²

Country	SLA	Average/median time to provide in 2012
Austria	11 days	9.2 days
Cyprus	5 days (shared LLU) 6 days (full LLU)	not provided
France	7 to 8 days depending on whether appointment required	3 days (shared LLU) 3 days (full LLU) without appointment 8.6 days (full LLU) with appointment
Greece	8 days	not provided
Italy	8 days	not provided
Poland	7 days	not provided
Portugal	5 days (migration) 7 days (new provide)	9.2 days in Q4 (new provide)
Romania	3 or 8 days depending on the work required	10 days (Shared LLU new provide) 10 days (Full LLU migration)
Slovenia	8 days	14.24 days (Shared LLU new provide) 18.79 days (full LLU migration)
Switzerland	4 days for 95% of cases (no physical change) 90 days for 95% cases (physical change required)	4 days in 95% of cases (no physical change) 54 days in 95% of cases (physical change required)
Turkey	3 to 4 days	not provided
UK ¹²⁹³	12 days for installation appointment availability (13 days prior to 1 November 2013) for installation appointment availability	[MPF: appointed - 15.0 working days (mean), non-appointed – 11.7 working days (mean) SMPF: 9.0 working days (mean)]

Source: Ofcom research

¹²⁹² Results are stated in working days/hours unless indicated otherwise.

¹²⁹³ Based on data provided by BT in response to First QoS BT Information Request.

Table A30.32: WLR Installation SLAs¹²⁹⁴

Country	SLA	Average/median time to provide in 2012
Cyprus	6 days (migration) 8 days (new provide)	not provided
France	7 days without appointment (new provide) 8 days with appointment (new provide) 6 weeks (WLR migration)	3 days without appointment 10 days with appointment
Greece	5 to 10 days depending on whether the end user is the incumbent's subscriber or not	not provided
Italy	6 to 8 days for a standard line, then up to 45 days for more complex orders	not provided
Poland	7 days	not provided
Portugal	5 days	0.8 days in Q4 (migration)
Romania	3 days	not provided
Switzerland	4 days for 95% of cases (no physical change) 90 days for 95% cases (physical change required)	4 days in 95% of cases (no physical change) 54 days in 95% of cases (physical change required)
Turkey	2 to 4 days (new provide) 5 days (migration)	not provided
UK	13 days (moving to 12 by November 2013) for installation appointment availability	[Appointed - 17.6 working days (mean), Non-appointed – 9.6 working days (mean)]

Source: Ofcom research

Repairs

A30.153 A greater level of variation can be seen across the countries with regards to the SLAs they have in place for repairs. All three products have differing SLAs by country, with some stating that repairs must be carried out within one day, others giving up to five days, and Switzerland giving the longest SLA period of 168 hours (seven days). Both Romania and Switzerland specifically attach performance targets to their SLAs, i.e. a requirement for the target to be met in 95% of cases.

A30.154 Taking into consideration the different metrics that have been used for repair SLAs (working hours and days), it would appear that the average SLA is around two to three working days. This is similar to Openreach's current repair SLAs: WLR repairs should be completed within the next working day plus one day (for Care Level 1),

¹²⁹⁴ Results are stated in working days/hours unless indicated otherwise.

and LLU repairs (Care Level 2) should be completed within the next working day (including Saturdays).

A30.155 Five countries were able to provide information of the average time to repair for certain products. On average, Cyprus, Switzerland and Turkey’s operators were able to repair faults within the target SLA, whereas Romania and Slovenia’s were not.

Table A30.33: Repair SLAs¹²⁹⁵

Country	SLA		Average/median time to provide in 2012
	LLU	WLR	
Austria	24 hours	not provided	not provided
Cyprus	2 days	3 days	1.71 days (Full LLU line)
France	2 days	2 days	not provided
Greece	1 day	3 days	not provided
Italy	2 days in 95% of cases or 12 hours (premium service)	Consumers: 3 hours after second day Business: 1 hour after first day in 95% of cases or 12 hours (premium service)	not provided
Poland	24 hours	26 hours	not provided
Portugal	8 hours on average	48 consecutive hours	not provided
Romania	19 hours	not provided	37 hours (Full LLU line)
Slovenia	3-5 days	not provided	74 hours (Full LLU line)
Switzerland	168 hours for 95% of cases (General line repair)		96.11%
Turkey	18 hours	48 hours	not provided
UK	SLA dependent on Care Level selected by CP. Most used Care Level is for repair within next working day .	SLA dependent on Care Level selected by CP. Most used Care Level is for repair within next working day + 1 .	[28 hours (for WLR and LLU services combined)]

Source: Ofcom research

¹²⁹⁵ Results are stated in working hours/days.

Other international comparisons

A30.156 We have also looked into the types of SLAs in place outside of Europe, in particular those in Australia and New Zealand. Whilst Australia does not have any SLAs in place between the incumbent provider and other CPs, it does have SLAs for end customers, known as customer service guarantees. These are similar to the types of SLAs in place across Europe, ranging between two and 15 working days for installation (depending on whether there is already a connection in place and on the location of the premises) and one and three working days for repairs (depending on the location of the premises).¹²⁹⁶ In situations where the service provider does not reach these agreements, the customer is entitled to compensation.

A30.157 In New Zealand, there are SLAs in place between the incumbent and the CPs with the provision of its unbundled copper local loop (UCLL) services, where the incumbent is required to being expected to be completed within five consecutive working days in 90% of cases.¹²⁹⁷ Repair SLAs, on the other hand, are less specific, although the incumbent is required to notify the expected time for repair to the access operator within six working hours and is required to meet the repair time they have notified within 90% of cases.

Other related services

A30.158 We have also looked at other installation targets for other communication services and other industries. However, we consider that the comparisons that can be drawn between these services are limited, given that the nature of the installation can be very different to that required for LLU and WLR products. Nevertheless, they provide an illustration of the type of targets that can be in place, as well as illustrating the type of timescales end-users may have experienced when using other services (and these experiences may influence their expectations in relation to Openreach services).

SLAs in other industries

A30.159 In terms of other industries we have found limited comparable benchmarks. Ofgem publishes a list of standards for electricity and gas distribution networks which it monitors and enforces.¹²⁹⁸ These include SLAs such as a requirement for electricity supply to be restored within 18 hours if there is an interruption to supply under normal conditions, and within 48 hours when there are severe weather conditions, keeping to timed appointments, as well as a requirement to provide two days notice for a planned interruption of an electricity supply and five working days for gas supply. If the networks do not meet these conditions they are required to pay penalties to the customer.

A30.160 Ofwat also sets out guaranteed service standards for water supply companies and where the suppliers do not meet these service levels they are required to pay

¹²⁹⁶ ACMA, *The Customer Service Guarantee*.

http://www.acma.gov.au/WEB/STANDARD/pc=PC_1712.

¹²⁹⁷ ComCom, *Standard Terms Determination For Telecom's Unbundled Copper Local Loop Network, November 2007*, <http://www.comcom.govt.nz/assets/Telecommunications/STD/UCLL/Final/Final-UCLL-Standard-Terms-Determination-Service-Level-Terms.pdf>.

¹²⁹⁸ Ofgem, *Quality of service Guaranteed Standards*, <http://www.ofgem.gov.uk/Networks/ElecDist/QualofServ/GuarStandds/Pages/GuarStandds.aspx> and <http://www.ofgem.gov.uk/Networks/GasDistr/QoS/Pages/QoS.aspx>.

compensation to their customers.¹²⁹⁹ These standards include making and keeping appointments, notification of any interruption to supply at least 48 hours in advance, restoring service within 48 hours if it is due to a leak or burst pipe.

A30.161 The most meaningful comparison between these types of service and the service offered by Openreach is possibly around timescales for restoring service (where a comparison could be drawn to timescales for repair) and the timescales here are therefore similar to consumer’s expectations of repair timescales, i.e. one to two days. However, as mentioned above the value of this comparison is limited given the different types of infrastructure involved.

Historical Oftel Comparable performance indicators

A30.162 Oftel previously published a set of comparable performance indicators for telecoms services during the 1990s and early 2000’s. This included information on service provision and fault repairs for BT and the cable companies operating at that time. The aim of this information was to allow consumers to compare the performance of different telephone companies.

A30.163 The Table below gives a snapshot of the service BT was providing at that time in relation to service provision and fault repairs for both residential and business consumers as well as a comparison with the service provided by Kingston (now known as KCom).

Table A30.34: Oftel comparable performance indicator data 1996

		Service provision - % of orders completed by date committed to the customer	Fault repair target	% of faults repaired in target time
BT	Residential	98%	9 working hours	92%*
	Business	98%	5 working hours	89%*
Kingston	Residential	99%	End of next working day	99%
	Business	98%	End of next working day	98%

Source: Oftel Comparable Performance indicator data January-June 1996 – Q4.

*These BT results only include those cases where no appointment was made.

A30.164 This information does not indicate the specific targets for installation given that it only refers to the “date committed to the customer”. However, in relation to fault repairs it is notable that the BT targets for fault repair were significantly lower than current targets, with a fault repair service offering of five working hours for business customers (albeit the data does not indicate whether BT was meeting this target for appointed repairs).

¹²⁹⁹ Ofwat, *Standards of Service*, <http://www.ofwat.gov.uk/consumerissues/rightsresponsibilities/standards/>.

Other Openreach services

A30.165 The SLAs / SLGs applying to GEA are similar to those applying to WLR and LLU. The one exception is that there is no SLA/SLG for appointed lead times for GEA.

Table A30.35: Provision for GEA

SLA	SLG
For provision orders completion of work by midnight on CDD	£8 per day (or part thereof) for each line late versus SLA. Capped at 60 days per line
For orders requiring an end user engineering visit, requirement for engineer to arrive during the appointment period (AM/PM)	£40 per missed appointment
Disconnection in error	<p>If Openreach is notified in writing within 6 working days of disconnection in error 1 month rental per day (or part thereof) from time of disconnection to service restoration. Capped at 60 days per line</p> <p>If Openreach is not notified in writing within 6 working days then SLG applies from date Openreach receives notification</p>

Source: Openreach contracts¹³⁰⁰

Table A30.36: Repair for GEA

SLA	SLG
Completion of repair work within contractual the timescales set out in the relevant service maintenance level the CP has specified for the service	1 month line rental per day (or part thereof) for each line late versus the SLA. Capped at 60 days per line

Source: Openreach contracts¹³⁰¹

A30.166 Openreach also have SLAs in place for a range of other connectivity services, which provide a further benchmark.¹³⁰² For example, Openreach's Ethernet

¹³⁰⁰ Openreach GEA Contracts - http://www.openreach.co.uk/org/home/products/super-fastfibreaccess/downloads/GEA_ContractSch4_NotificationIssue319May2013.pdf

¹³⁰¹ Openreach GEA Contracts - http://www.openreach.co.uk/org/home/products/super-fastfibreaccess/downloads/GEA_ContractSch4_NotificationIssue319May2013.pdf

¹³⁰² Openreach, *Contract for Connectivity Services Schedule 4 – Service Level Agreement, December 2012*, http://www.openreach.co.uk/org/home/products/ethernet-services/contracts/contracts/notification_connectivity_services_schedule4_issue9.pdf.

products have a repair SLA of five hours from receipt of a fault. SLGs are payable for each hour of delay in repairing the fault: 15% of the monthly line rental per hour (or part thereof) for each circuit delivered late versus the SLA. Openreach's SLG exposure is capped at 200 hours.

A30.167 There is no equivalent SLA for appointment lead times in Ethernet as there is more variability in the types of installations required (e.g. there is typically a need for a survey to identify how much work would be required to install a new service and there may then be a need to extend fibre to a customer which requires construction work). As is the case for LLU and WLR there is an SLA for completion or work against CDD but lead times are typically over 30 working days due to the fact that these are more complex installations than standard services such as WLR and LLU.

A30.168 Whilst the repair SLA for Ethernet is superior to the standard Care Levels for WLR and LLU, it is worth noting that Ethernet products are priced at a significant premium and typically support a variety of business critical downstream applications such as banking transaction systems and datacentre applications hosting e-commerce and other clients for whom outage tolerance is very low and hence willingness to pay a premium is higher. We note also that CPs can purchase higher Care Level packages for WLR and LLU (for example Care Level 4 has an SLA of 6 hour repair, 365 days a year).

A30.169 Where Openreach does not meet these SLAs it will pay compensation to CPs. For example if the target installation date is 1 to 5 days late it will pay out 5% of the total connection charge whereas if the delay is more than 20 days it will pay 20% of the connection charge.

A30.170 In conclusion, we do not consider Ethernet to be a relevant benchmark. GEA is a more relevant benchmark as it is a product targeted for the mass market although we note that with the exception of appointed lead times, SLAs / SLGs for GEA are broadly similar to WLR/LLU.

Summary of assessment of what constitutes a reasonable service

A30.171 Taking the above analysis together, we consider that a number of conclusions can be drawn about what consumers and SMEs consider constitutes reasonable quality of service.

A30.172 Specifically, in relation to provisioning timescales it seems that, absent a price benchmark (i.e. how much more expensive shorter provisioning timescales might be) both consumers and SMEs were of the view that a period of five days would be reasonable. As explained in paragraphs A30.133 to A30.135 above, this five day period would relate to the average experience for end-users, there will always be some provisioning which necessarily takes longer and in the case of switching scenarios the extra time needed for consumer protection measures has also to be taken into account. It is interesting, nevertheless, that a five day period is in line with some of the more challenging SLAs set in other countries, albeit a slightly longer 7-8 day period is also quite common.

A30.173 As already noted, the expectations and preferences for shorter installation timescales have to be balanced against the value that consumers and SMEs place on provisioning timescales compared to other factors involved with either moving home/premises or switching supplier and the fact that there appears to be little willingness to pay extra for faster provisioning times. In particular, consumers and SMEs appear to place more importance on provisioning work being completed in a

single visit compared to how soon the appointment for provisioning is – the frequency with which this is achieved could also therefore form an important factor in the overall quality of service provided. In contrast to some of the views expressed by stakeholders in response to the FAMR Call for Inputs, the availability of an appointment slots seems less important, particularly for SMEs and therefore this does not appear to be a driving factor in considering what constitutes a reasonable level of service albeit we recognise it may remain important for some consumers.

A30.174 However, it is nonetheless clear that where provisioning times go beyond 10 days there is a significant drop in the number of consumers and SMEs that consider the timescale to be reasonable. Therefore, where provisioning times have been significantly above this (for example during the second half of 2012), end-user expectations were likely to be met and, by this measure, the level of service being provided was not meeting end-user needs.

A30.175 In relation to repair, there is a distinction between what is considered to be reasonable for consumers compared to SMEs. Consumers are slightly more tolerant of longer repair times and therefore the evidence indicates that a timescale of two days is reasonable. This is also consistent with consumers' likely experience with repair timescales for other industries, for example gas and electricity repair timescales, although we recognise that these benchmarks are of limited assistance in our assessment. In addition, the current SLAs appear largely consistent with those operating in other countries as well. This further supports the view that the current repair SLAs for consumers are set at the appropriate level, provided that they are met consistently.

A30.176 For SMEs, responsiveness to repair is the most important factor in selecting their CP and they therefore expect more immediate response to a fault, with a one day timescale being the maximum considered to be reasonable. The fact that BT has in the past operated to targets which were a matter of hours rather than days may have been a function of that demand, and expectation, of SMEs in relation to repair timescales.

Annex 31

Quality of service: Analysis of recent Openreach performance

Introduction

- A31.1 This Annex reproduces the material presented in Annex 10 of the July 2013 FAMR Consultation. Our further analysis, including our consideration of stakeholder responses, is set out in Section 11 of Volume 1 and Annex 20 of Volume 2. In Annex 30 we set out our analysis of Openreach's recent installation order and fault repair performance. In this annex, we set out our analysis and conclusions on the reasons for the recent service performance problems.
- A31.2 We first summarise the FAMR Call for Inputs responses relating to the potential causes of the service problems and then summarise our own analysis.

FAMR Call for Inputs responses relating to the quality of service problems

- A31.3 Most of the respondents to the FAMR Call for Inputs commented on the reasons for the QoS problems.

Openreach

- A31.4 Openreach said that the recent QoS problems had been driven by the extreme weather in 2012. It emphasised that the weather had been wholly exceptional. In 2012 England and Wales had the wettest April and June since records began in 1766 and rainfall in the autumn and December remained well above average. In 2012 rainfall had been above average across a large part of England and Wales and many locations in the south-west and north-east had rainfall over 135% of the average of the last 30 years.
- A31.5 Openreach said that at the beginning of April 2012, before the bad weather started, it had a repair work stack consistently below 16,000 faults¹³⁰³, a very low level that allowed provisions to be completed with short lead times of 4 to 6 days. Although bad weather in April nearly doubled the overall work stack it was able to recover to near normal by the end of May. Further bad weather from June onwards maintained fault volumes throughout the summer and autumn at levels previously only encountered as occasional spikes during periods of severe winter weather. In all, Openreach received 200,000 more faults than expected in the summer period and autumn (equating to between 3 and 4 additional engineer working days) making it impossible to recover quickly.
- A31.6 Openreach also noted that storm damage to overhead networks and water damage to underground networks is more complex to repair than normal faults, requiring specialist staff and typically taking twice as long as normal faults. Underground fault levels peaked at 25% of faults compared with 15% normally and stayed high for months because underground water levels remained high.

¹³⁰³ The repair work stack is the number of repair jobs outstanding at any given time.

A31.7 Openreach said that it had responded to the bad weather by prioritising fault repair over provision (with industry agreement) and also by expanding its engineering capacity by about 20% from circa 120,000 provision and repair completions per week in December 2011 to circa 145,000 completions per week by December 2012. This had been achieved by overtime, productivity improvements and by deploying additional resources (both full time and contractor), ☒. In the preceding three years to December 2011 it had also increased its capacity from ☒ to ☒ provision and repair completions per week. It had also made a number of productivity improvements such as its R15k programme¹³⁰⁴, which was estimated to have delivered in excess of 600,000 fault visit savings in 2012/13.

A31.8 Openreach also noted that in addition to poor weather, other factors are driving up demand on its engineering resources. These are:

- The growth of MPF, which is offered at Care Level 2 and therefore has a significantly more demanding repair target than WLR which is offered at Care Level 1 as standard (repair by end of next working day rather than end of next working day + 1). Between April 2010 and January 2013, volumes had risen from 3 million to 6.5 million placing a considerable additional demand on Openreach and also reducing its flexibility to cope with demand fluctuations. With volumes forecast to reach 10 million by March 2017 this pressure would continue to increase.
- Broadband premium – consumer expectations of broadband services are higher than for telephony services, for example in relation to outages and speed variations, leading to higher incidence of fault reports.

A31.9 Openreach also said that it would be better able to manage performance if the largest CPs could provide accurate regional demand forecasts. It suggested that as a minimum, CPs should work with Openreach to provide medium term demand for the size of their installed base (split by product) and short term forecasts if they are planning activities likely to cause a demand spike (such as marketing activity). It cited the Copper Appointment Availability SLA/SLG as a positive template. With this scheme, the largest CPs agreed to provide accurate demand forecasts in exchange for enhanced SLA/SLGs.

Other respondents

A31.10 Sky, BT Retail and another respondent ☒ acknowledged that exceptional rainfall had been the immediate cause of poor QoS in 2012. Openreach had struggled to cope with exceptional fault volumes and provision performance had also suffered because Openreach had prioritised repair activities.

A31.11 TalkTalk and FCS considered that the QoS problems were caused by workforce reductions in previous years. FCS argued that the experience and skills lost had proved difficult to replace when needed. It also considered that the problems had been compounded by poor jeopardy management and escalation procedures. TalkTalk argued that Openreach should have been able to cope with the additional volumes in 2012 (which it estimated at about 20%) through efficient resource management but had found itself unable to cope due to workforce reductions in the preceding 2-3 years. TalkTalk also noted that when lead times for copper services were at 20-25 days, Openreach had focused its resources on GEA provision for which lead times were kept at 5-10 days.

¹³⁰⁴ An improvement programme to reduce repeat faults by 15,000 per week by end of 2012/13.

- A31.12 Vodafone considered that Openreach had failed to invest in quality systems and processes to deliver good QoS and KCOM considered there were serious problems with Openreach’s service delivery organisation and processes.
- A31.13 BT Retail considered that recruitment of new and inexperienced permanent and temporary staff had led to further problems such as more “dead on arrival” orders, missed appointments and long lead times for re-appointments.
- A31.14 Several respondents argued that the recent QoS problems were a symptom of a more deep-seated problem. One respondent ¹³⁰⁵ described Openreach performance \llcorner . Vodafone noted that Openreach had suffered two separate service crises in recent years and Sky noted that Openreach had failed to meet its performance targets since it was created.
- A31.15 Respondents considered that the current arrangements do not give Openreach sufficient incentives to offer good QoS. A number of related points were made:
- some services have no SLA/SLGs so Openreach is not incentivised to maintain QoS;
 - SLG payments are not large enough to incentivise good performance, so poor service is a profit maximising strategy;
 - the MBORC process further reduces Openreach’s incentives to take preventative measures to maintain QoS; and
 - the charge controls give Openreach an incentive to cut costs at the expense of QoS in order to maximise profits. Conversely, service improvement incentives such as hiring more staff cannot be recovered, nor can longer term investments.

Our approach to the analysis

- A31.16 In this section we describe our approach to the analysis. In the light of the issues raised by stakeholders, we sought to understand the reasons for the levels of service observed.

We have focused our analysis on activities involving a field engineering activity as these appear to be the main problem

- A31.17 Although some of the activities that Openreach undertakes are automated, most faults and a significant proportion of orders require an engineering activity in the access network, at customer premises or in an exchange.¹³⁰⁵ Openreach therefore employs a large engineering workforce across Great Britain.
- A31.18 It is clear from the analysis presented in Annex 30 that the primary focus of the service problems are the activities that require field engineering activities such as a site visit for an installation or repair rather than those that require only exchange activity. We have therefore focused our analysis on these activities.

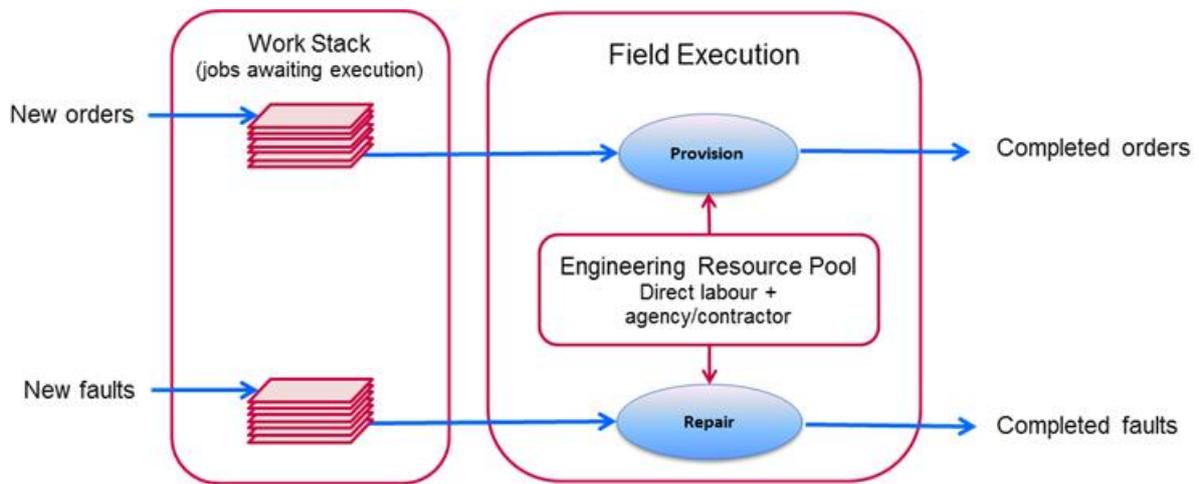
¹³⁰⁵ For example, installation of a new line might require an exchange jumpering activity, jumpering at a cabinet (PCP) and a visit to the customer’s premises to install a drop-wire, lead-in and Network Terminating Equipment (NTE).

We obtained information from Openreach to enable us to examine key aspects of Openreach’s operational processes

A31.19 The primary determinant of the process performance of field service operations of organisations such as Openreach is the balance between the volume of work to be undertaken and the resources available to undertake it. If work volumes exceed the capacity of the engineering resources available then performance will inevitably suffer. For example faults may not all be repaired within the target time or provisioning lead times may be extended.

A31.20 Figure A31.1 shows a simplified process model for Openreach.

Figure A31.1: Simplified process model for Openreach



Source: Ofcom

A31.21 A particular feature of such processes is that after a period of excess demand, performance will not be fully restored until the backlog of work in the work stack has been cleared. Whilst the backlog exists all incoming work will spend longer than normal in the work stack waiting for field resources to become available. This means that even a relatively short period of excess demand can have a more persistent impact on service delivery lead times.

A31.22 If demand falls below capacity, a backlog may be cleared with existing resources, otherwise a temporary increase in resource capacity is necessary.

A31.23 As noted above, Openreach’s position is that the service problems in the second half of 2012 were caused by exceptional fault volumes as a result of bad weather, which had an impact on provisioning because of the pooled engineering workforce, whereas some other respondents consider that the primary cause was insufficient resources due to reductions in Openreach’s workforce.

A31.24 We have therefore focused our analysis on order, fault and resourcing trends in order to seek to understand the reasons for the recent service problems. We have also examined potential underlying drivers of demand cited by respondents such as weather patterns and broadband usage.

A31.25 We obtained information from Openreach using our formal information gathering powers that would allow us to examine each of the key process variables discussed above. In particular, we obtained a time series for each of the following:

- volume of new faults and orders received each month – this enabled us to examine the underlying demand for Openreach’s provision and repair services;
- volume of faults and orders completed each month – this enabled us to examine Openreach’s throughput and trends affecting the volume and mix of orders and faults processed;
- engineering resource data by activity (e.g. man hours by order types and by field repair activity) – this enabled us to examine the resources deployed by Openreach and also efficiency trends; and
- preventative maintenance activity – this enabled us to examine trends in preventative maintenance activity.

A31.26 We sought information from Openreach for the period April 2008 to December 2012 to allow us to examine trends since the 2008 SLG Review¹³⁰⁶ and to allow us to compare installation/repair volumes and resources in 2012 with previous years. Openreach was able to provide order volume and resource data for this period but was not able to provide fault volume data prior to April 2009.

A31.27 Some of the Openreach performance data we obtained was previously supplied to the OTA which, compared to the data prepared specifically for us, has less granular product content, contains consideration of repeat faults and early life failures and covers a longer time period typically 2009-2012 with slightly different reporting periods. Consequently we have restricted use of the OTA data to analysing trends rather than mixing it with other data to derive relationships.

A31.28 We also obtained financial information from Openreach (again using our formal information gathering powers) about costs and profitability in view of the concerns that Openreach had degraded performance in order to increase or maintain profitability.

A31.29 We also obtained detailed information on weather patterns and water tables from the Met Office and the Environment Agency.

A31.30 In the following sub-sections we describe the findings of our analysis of the information supplied by Openreach as listed above. In the analysis below we include WLR (PSTN), SMPF, MPF and GEA. ISDN2 and ISDN30 are excluded.

Openreach’s throughput

A31.31 We first review Openreach’s throughput i.e. the volume of activities completed.

Volume of installation orders completed

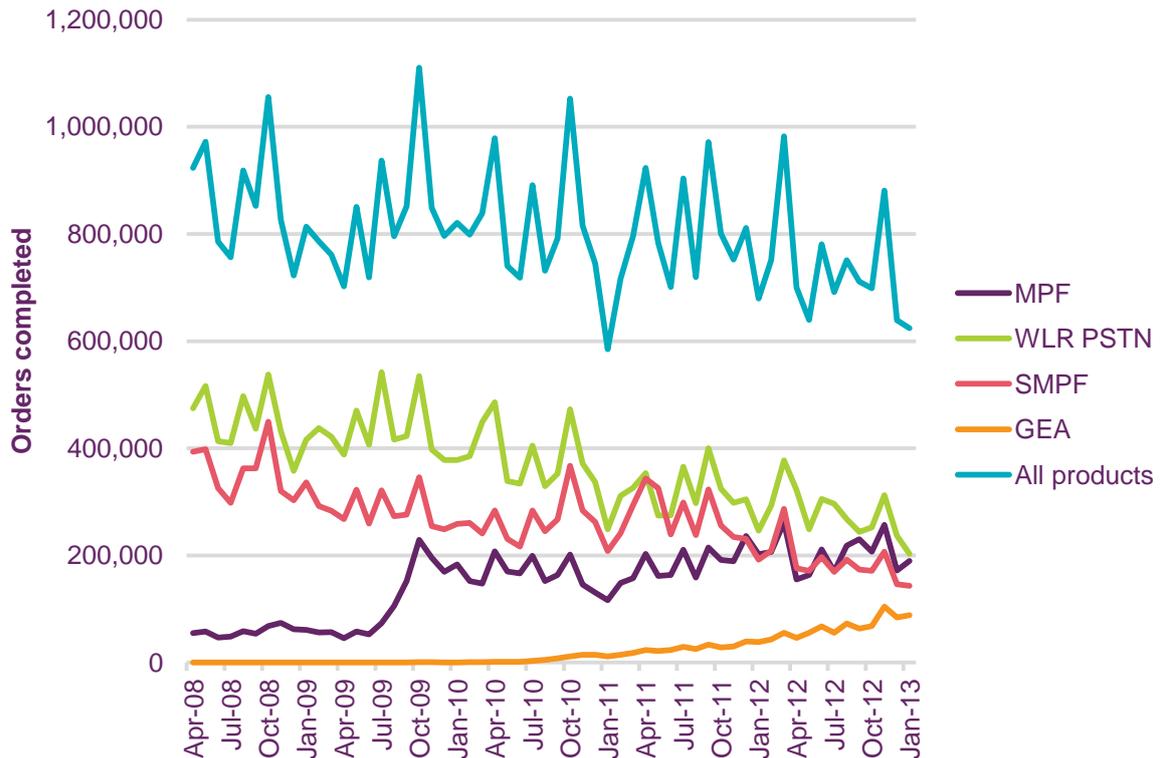
A31.32 Figure A31.2 below shows the volume of provision orders completed each month by Openreach. This shows that whilst there is volatility in the volume of orders completed from month to month, overall there has been a steady decline in the volume of orders that Openreach completes each month over the last 5 years. Order volumes have fallen by 17% from a peak of 2.7 million in Quarter 1 2007/8 to 2.2 million in Quarter 3 2012/13.

¹³⁰⁶ Ofcom, *Service Level Guarantees: Incentivising Performance*.

A31.33 Although volumes in the second half of 2012 are likely to have been reduced by the diversion of resources to repair activities, this downward trend appears to have been driven mainly by the transition of major CPs from WLR PSTN & SMPF to MPF. MPF volumes have increased to about 200k per month during this period and WLR PSTN and SMPF volumes have each fallen by a roughly corresponding amount.

A31.34 The other notable trend in figure A31.2 is that GEA volumes have increased to about 85k per month or about 14% of orders.

Figure A31.2: Order completion volumes by product



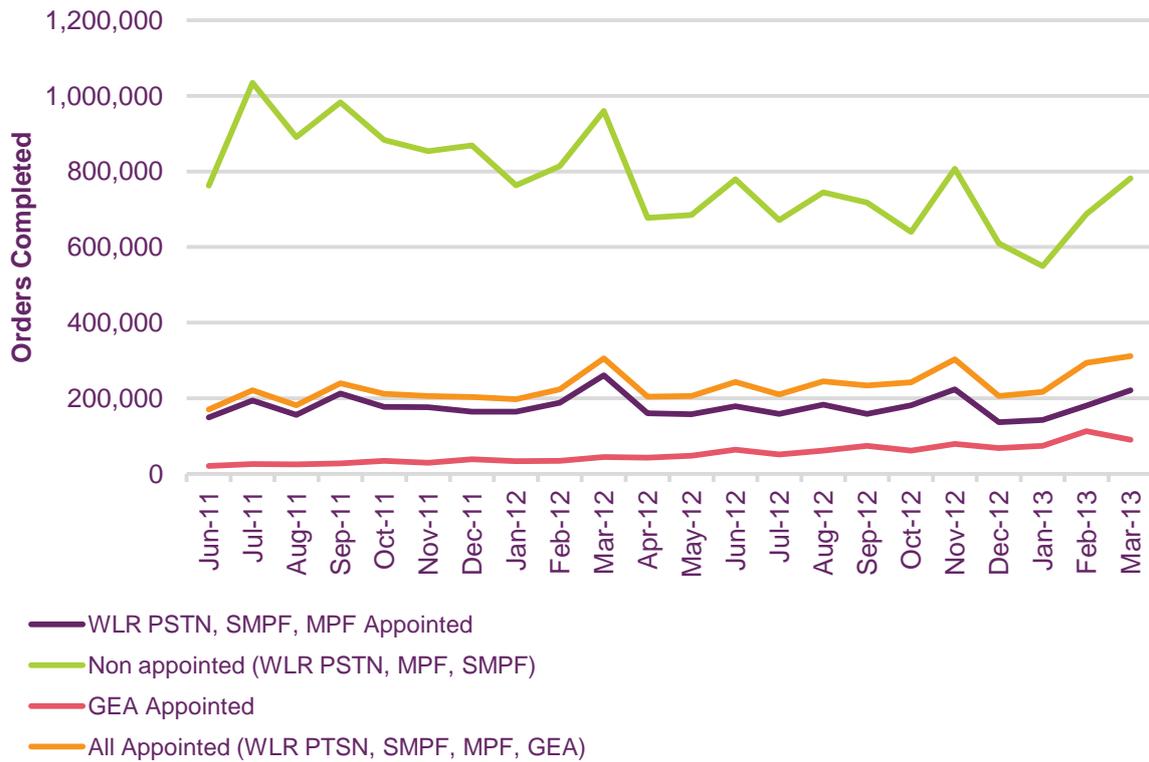
Source: Ofcom analysis of BT's response dated 27 February 2013 to question 1.10 of the First QoS BT Information Request.

A31.35 Figure A31.3 shows the volume of appointed orders and non appointed orders completed from February 2011 to December 2012. It shows:

- Strong growth of about 80% in the volume of appointed orders driven by the increase in the volume of GEA orders. Appointments for copper products (WLR PSTN, SMPF and MPF) by comparison are approximately stable.
- A steady decline in the volume of non-appointed orders.

A31.36 The increase in the volume of appointed orders is significant because appointed orders require a field engineering activity (i.e. a customer site visit) rather than just exchange activities. This trend therefore indicates an increase in the workload on Openreach's field engineering resources.

Figure A31.3: Volume of appointed and non-appointed WLR PSTN, SMPF, MPF and GEA orders completed

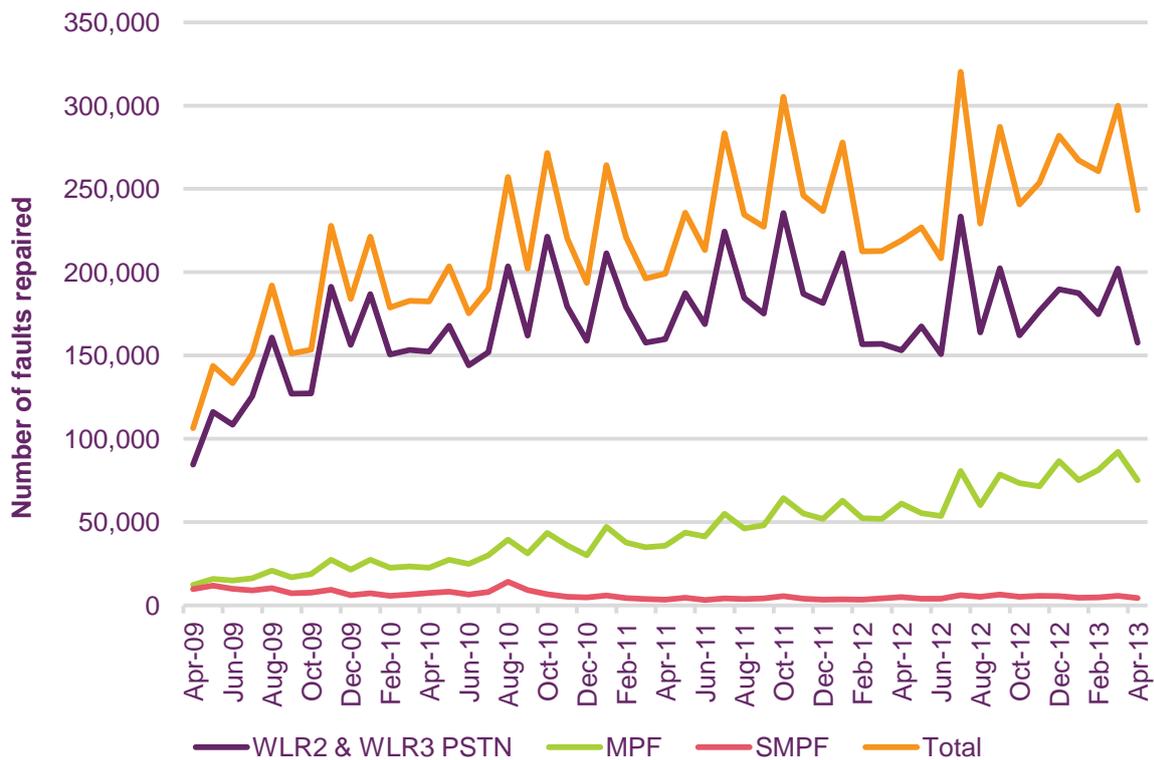


Source: Ofcom analysis of BT's updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request.

Volume of fault repairs completed

A31.37 Figure A31.4 shows the volumes of faults completed by Openreach each month between April 2009 and April 2013. This shows the volume has approximately doubled over the period predominantly due to (i) a continuous steady increase in MPF fault repairs and (ii) an increase in WLR PSTN repairs in the first third of the period. SMPF volumes reduced very slightly throughout the period.

Figure A31.4: Volume of fault repairs completed



Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT’s updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request.

A31.38 Table A31.1 below shows the volume of faults completed by Openreach in each of the last 4 years. This shows that Openreach completed about 107,000 or about 4% more faults in 2012 than in 2011.¹³⁰⁷

Table A31.1: Volume of faults completed

Year (millions)	WLR PSTN	SMPF	MPF	GEA	Total
2009 ¹³⁰⁸	1.6	0.1	0.2		1.9
2010	2.0	0.09	0.4		2.5
2011	2.3	0.05	0.6	0.1	2.9
2012	2.1	0.06	0.8	0.1	3.0

Source: Ofcom analysis of BT data submitted to the OTA and received by Ofcom on 14 June 2013. Data considered supplementary to BT’s updated response dated 23 May 2013 to question 1.12 of the First QoS BT Information Request.

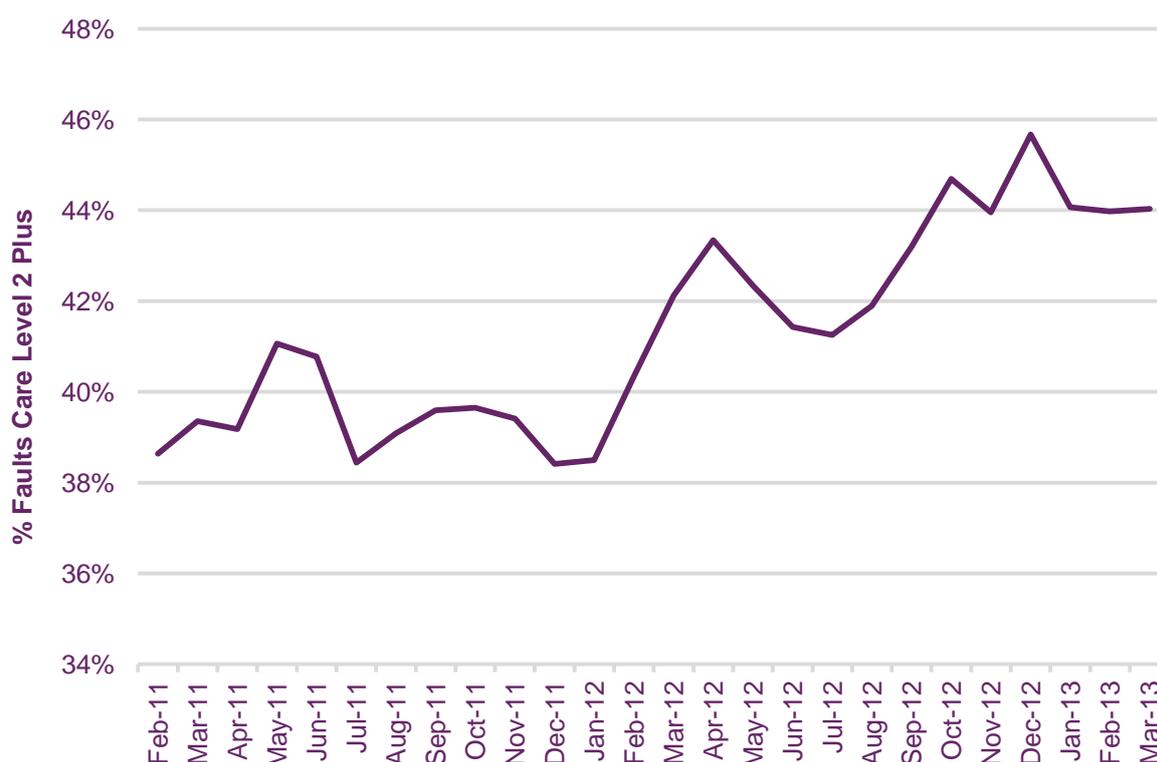
¹³⁰⁷ This does not mean that there were only 4% more faults in 2012 – Openreach built up a backlog of uncompleted faults over that year.

¹³⁰⁸ Jan 2009 to March 2009 pro-rated.

A31.39 Figure A31.5 below shows that from February 2011 to March 2013 the proportion of faults with Care Level 2 and above rose from 39% to 44% of faults. This change was driven mainly by the growth in the installed base of MPF services, which are offered with Care Level 2 as standard and the decline in WLR PSTN volumes, which are offered at Care Level 1 as standard.

A31.40 This trend is potentially significant because Care Level 2 services have a more demanding repair target than Care Level 1 services.¹³⁰⁹ This limits Openreach’s flexibility in the deployment of its field resources and consequently Openreach may require more resources to complete a comparable volume of faults.

Figure A31.5: Proportion of WLR PSTN, MPF, SMPF and GEA faults at Care Level 2 and above



Source: Ofcom analysis of BT’s response dated 27 February 2013 to question 1.12 of the First QoS BT Information Request.

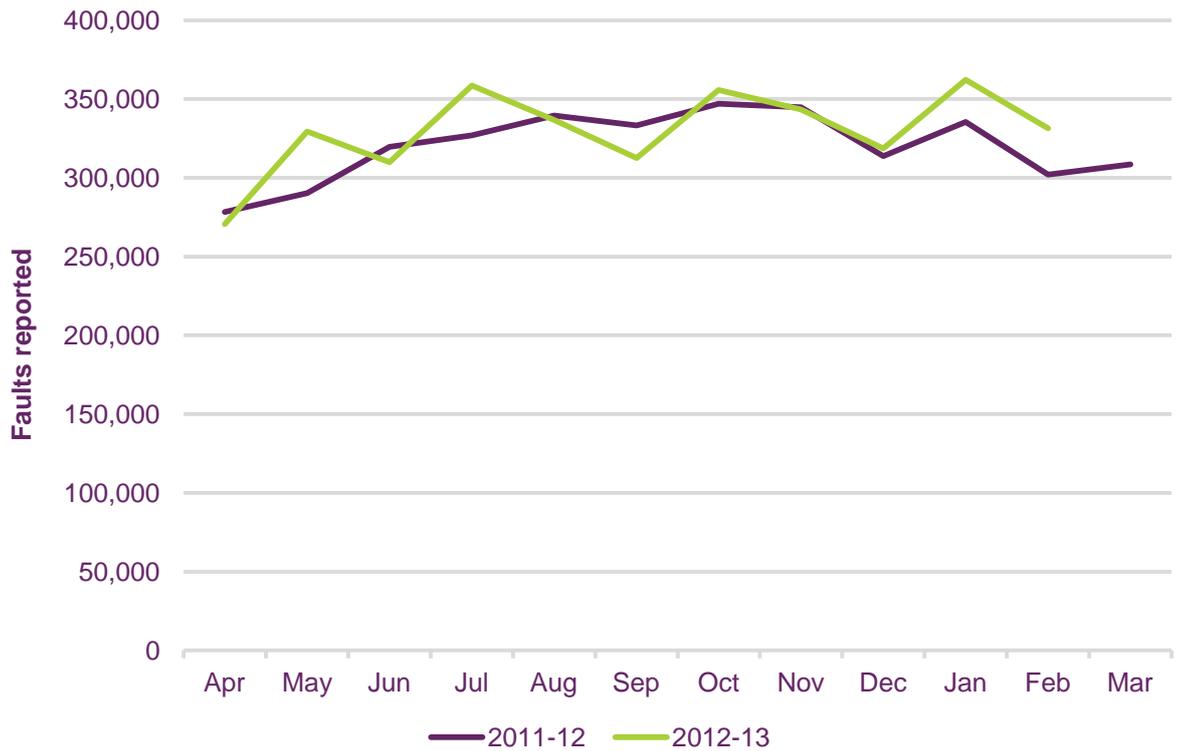
Demand for Openreach services

New fault report volumes

A31.41 Figure A31.6 below, which shows the volume of new faults reported to Openreach each month from April 2011 to April 2013, gives a more direct view of the repair demand faced by Openreach and the difference between the years commencing April 2011 and April 2012.

¹³⁰⁹ The target for repair of Care Level 2 services is the end of the next working day. The target for Care Level 1 services is the end of the next working day + 1 day.

Figure A31.6: Volume of new faults reported to Openreach



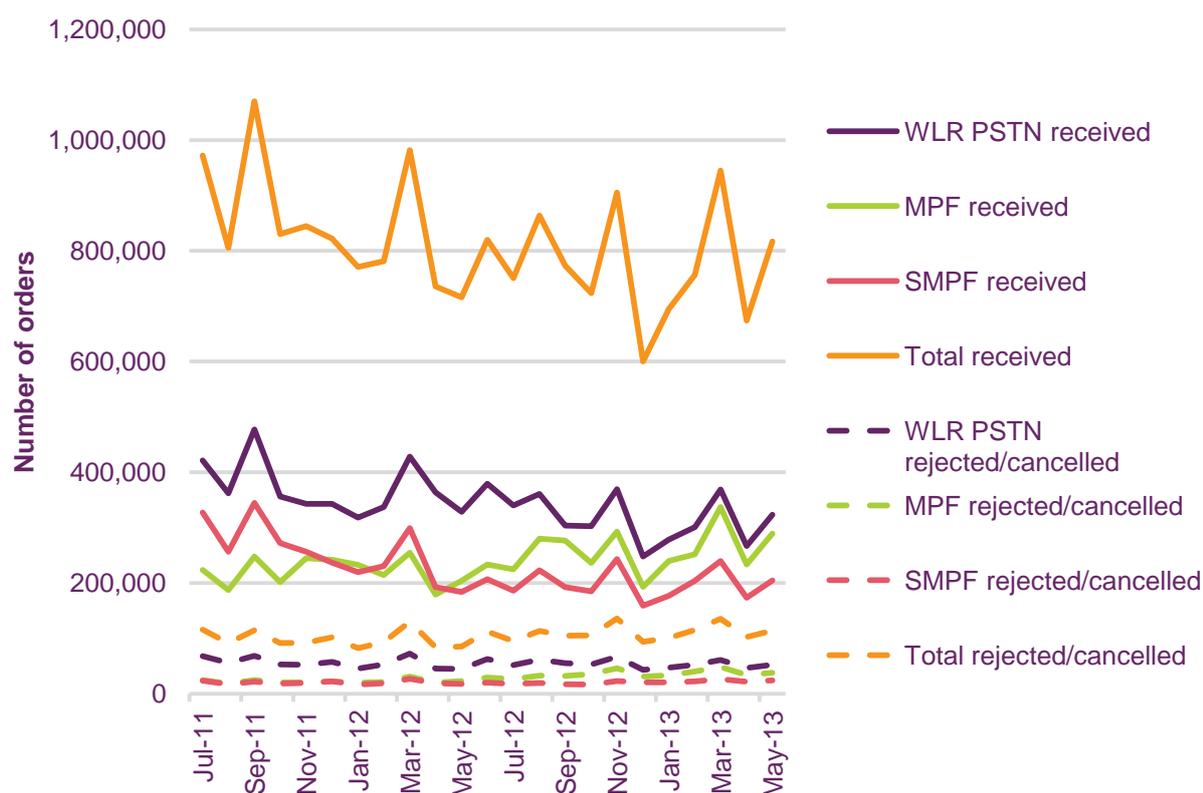
Source: Ofcom analysis of BT's response dated 31 May 2013 to question 1.4 of the Remittal QoS BT Information Request.

A31.42 Figure A31.6 shows that during this period fault reports were generally in the range of 300,000 to 350,000 per month with a peak variation between 270,000 to 360,000 per month. Perhaps the most notable aspect is that whilst peak volumes in 2012-13 are higher, in other respects the fault report patterns for 2011-12 and 2012-13 appear somewhat similar. This suggests that in terms of the overall volume of fault reports, 2012-13 was similar to 2011-12, with approximately 3% more faults reported for the period April 2012 to February 2013 compared with the same period in 2011-12. Pro-rata this is equivalent to about ten days additional repair work.

New order volumes

A31.43 Figure A31.7 below shows the volume of orders received by Openreach each month from April 2011 to February 2013.

Figure A31.7: Volume of orders received by Openreach¹³¹⁰



Source: Source: Ofcom analysis of BT’s responses dated 5 June 2013 and 11 June 2013 to question 1.5 of the Second QoS BT Information Request.

A31.44 Figure A31.7 shows that the overall volume of new orders received by Openreach each month decreased by about 15% from July 2011 to April 2013 due to a fall in order volumes in WLR PSTN and SMPF products. Only the MPF product exhibits a rise in order volumes. Rejected and cancelled order volumes are reasonably constant throughout the period. Total order volumes also exhibited increased volatility towards the end of the period potentially leading to periods of high demand on the Openreach engineering workforce and the increased possibility of periods of delays in order completion.

Openreach’s resourcing

A31.45 We have reviewed Openreach resource trends from information given within BT’s annual report and accounts and from staffing and engineering data obtained under our formal powers. The data shows a slight decline in total Openreach resource (FTE), which is mirrored by the number of Openreach engineers. However the decline implicit within the top level data does not appear to be sufficient to explain the decline in performance. However it should be noted that the data provided excludes agency staff which from BT’s Annual Report we see has declined significantly over the past few years. Further an analysis of top level resource could be misleading as it does not indicate how the resources are deployed.

A31.46 There is some evidence that resource levels engaged in WLR and LLU may have declined as a result of Openreach prioritising other areas of work. A top level review of Openreach provision and maintenance costs allocated to WLR and LLU (from

¹³¹⁰ The volume of orders is before rejected and cancelled orders are subtracted.

BT's regulatory accounts) shows a decline in costs of around 10% per annum for the period 2007/8 to 2011/12 despite relatively flat volumes in aggregate (LLU plus WLR rentals). Total Openreach provision and maintenance costs declined over the same period by 2%.

A31.47 Resources deployed on LLU and WLR may well be impacted by the continuation of Openreach's roll out of its fibre network and in growth in other areas such as Ethernet. In BT's 2012 Annual Report and Accounts, BT stated "*We recruited around 1,600 engineers into the group to help accelerate our fibre broadband rollout*". Further in BT's 2011 Annual Report and Accounts, BT explained the increase in the repair work stack as being a result of "*increased provision volumes coupled with very poor winter weather conditions and a 134% increase in faults relating to cable theft and vandalism*".

A31.48 In conclusion, the evidence is not conclusive as to whether Openreach has cut its resource for access services. However, there appears to have been an increase in the activities Openreach has had to resource in part due to increased demand in the copper area but also in other areas such as Ethernet and fibre. The increased demand and potential prioritisation of the non copper network appear to be likely contributory factors to the recent decline in QoS in LLU and WLR.

Effective field engineering resources

A31.49 In order to get a more detailed view of resourcing trends we asked Openreach to supply a detailed time series of the effective man-hours booked to provision and repair activities relating to WLR PSTN, SMPF, MPF and GEA. Openreach records provision man hours against specific products but most repair activities are not recorded against products, therefore the information presented below relates to repair activities for all products, other than payphones, which were separately identified.

A31.50 Figure A31.8 below shows the field engineering resources Openreach deployed between April 2008 and December 2012 for order provision and fault repairs and is drawn from bookings made by Openreach technicians and contractors/agency staff. Although there is volatility on a month-by-month basis certain trends are discernible:

- repair resourcing declined by about 30% from the start of the period to a low point between April and July 2010. Resources then rose steadily to the end of the period finishing at about 30% higher than at the beginning of the period;
- provision resourcing was roughly flat to about July 2010 and then rose to the end of the period finishing at about 30% above the beginning of the period; and
- there was a decline in the overall level of resourcing (provision and repair combined) from the start of the period to a low point between April and July 2010 followed by a subsequent steady rise to the end of the period, finishing at about 30% higher than at the beginning of the period, an increase of approximately 30% KMH¹³¹¹ evenly spread over a period of 18 months..
- In 2012, overall field resourcing (provision and repair combined) was about 30% higher than in 2011.

¹³¹¹ KMH is Kilo Man Hours, a measure of effort expended by Openreach engineering staff.

A31.51 These increases, particularly those near the end of 2012/13, reflect the response by Openreach to the increased demand for repairs.

Figure A31.8: Openreach field engineering resources



Source: Ofcom analysis of BT's response dated 27 February 2013 to question 1.15 of the First QoS BT Information Request.

Task times

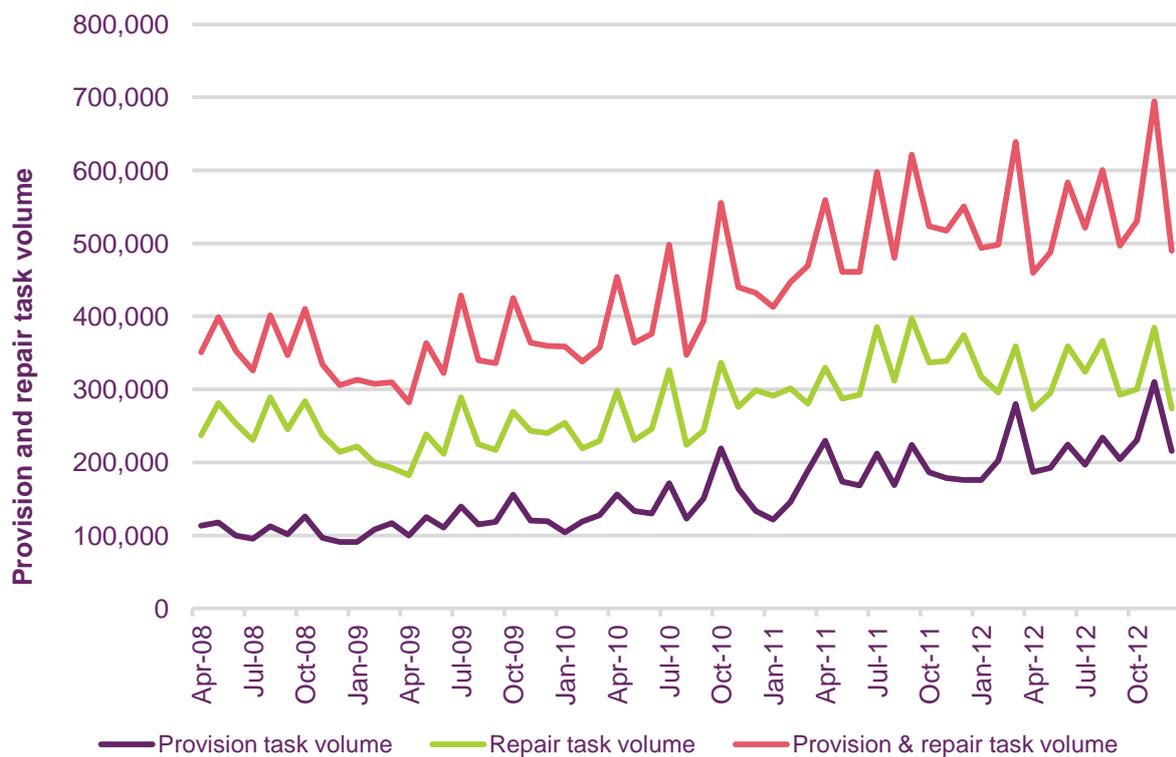
A31.52 We have also reviewed the task times for provision and repair activities to gain an understanding of Openreach's efficiency trends.

A31.53 During the last 4 years Openreach appears to have improved the efficiency of provision field activities as illustrated by Figure A31.10 and Figure A31.11 below.

A31.54 Figure A31.9 shows that within the overall decline in orders (figure A31.2) and the overall increase in faults repaired (figure A31.4) the volume of provision and repair work for field engineers increased steadily after the end of 2008 due to an increase in both provision and repair tasks.¹³¹² Figure A31.8 shows that during 2009 the field engineering resource deployed to perform the work was gradually reduced but from 2010 onwards it was increased and tracks the increase in the volume of tasks almost exactly.

¹³¹² The fall in orders primarily affected frame engineering tasks and produced a correspondingly large decline in frame engineering tasks.

Figure A31.9 Field engineer provision and repair completed task volumes



Source: Ofcom analysis of BT's response dated 27 February 2013 to question 1.15 of the First QoS BT Information Request.

A31.55 Figure A31.10 shows that between April 2008 and April 2011 Openreach gradually reduced the average provision task times for WLR PSTN, MPF and SMPF combined orders, with task times remaining relatively flat between April 2011 and December 2012. A number of factors can affect task times including job mix, factors that affect average travel times, proportion of appointed jobs and engineering booking practices.

Figure A31.10: Average field provision task times for WLR PSTN, MPF and SMPF

✂

Source: BT's response dated 27 February to Q1.15 of the First QoS BT Information Request.

A31.56 Figure A31.11 shows that between April 2008 and January 2012 there was a reduction in the average repair task times for WLR PSTN, MPF and SMPF products combined with average task times increasing between January 2012 and December 2012. A number of factors can also affect repair task times including job mix, average travel times, proportion of appointed jobs, fault location in the network and fault types and complexity.

Figure A31.11: Average field repair task times (all products)



Source: BT's response dated 27 February to Q1.15 of the First QoS BT Information Request.

Impact of weather

A31.57 In this section we describe weather patterns, particularly rainfall, for the past few years and consider the consequences for the Openreach network. In particular we consider whether rainfall in 2012 was particularly high and likely to be a significant contributory factor to poor provisioning and repair performance.

A31.58 We obtained general UK rainfall data from the Met Office web site¹³¹³ and environmental information, specifically water situation reports for England, from the Environment Agency web site.¹³¹⁴ We also commissioned a specific report from the Met Office¹³¹⁵ containing total rainfall per month and the number of days per month with rainfall greater than 10mm for each of the Openreach product forecasting regions.

2012 was the second wettest year since 1910 but is not without precedent in recent years

A31.59 Total UK rainfall for 2012 of 1336mm was the second highest recorded since 1910 only marginally lower than the highest of 1337mm experienced in the year 2000 and 22% greater than the long term average for 1910 to 2012 of 1093mm. However the high rainfall experienced in 2012 is not without precedent as illustrated by Figure A31.12 for rainfall since 1910 and a more detailed view in Figure A31.13 for the period since the year 2000. While there have only been three instances where the annual UK rainfall has exceeded 1300mm there have been 17 instances where it has exceeded 1200 mm (mean value plus one standard deviation for the period 1910 to 2012 inclusive). Seven of these have occurred between the years 2000 and 2012 inclusive, perhaps indicating a longer term trend, indicated by the 10 year moving average in Figure A31.12, of increasing annual rainfall since a low point around 1976-77.

¹³¹³ Met Office, *Ranked ordered statistics*, December 2013

<http://www.metoffice.gov.uk/climate/uk/summaries/datasets>

¹³¹⁴ Environment Agency, *Water Situation Reports*,

<http://www.environment-agency.gov.uk/research/library/publications/33995.aspx>

¹³¹⁵ Commissioned report, *Analysis of 2008-2012 rainfall in Ofcom Regions*, April 2013,

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-reviews/annexes/MO_Ofcom_report.pdf

Figure A31.12: UK annual rainfall since 1910



Source: Ofcom analysis of Met Office data

Figure A31.13: UK annual rainfall since 2000



Source: Ofcom analysis of Met Office data

A31.60 More detailed analysis of weather patterns for recent years shows that:

- between April 2010 and March 2012, central, eastern and southern England experienced drought conditions with below average rainfall (2010 was the eleventh driest year since 1910) although heavy rain and floods were experienced in Cornwall in November 2010, and the summer of 2011 was wetter than average for the UK as a whole;¹³¹⁶
- 2007 to 2009 also had very high rainfall of 1200mm or greater;
- in 2007 UK rainfall for the periods May to July were the highest levels recorded since 1766 and resulted in severe floods affecting over 55,000 premises, transport systems and roads;¹³¹⁷ and
- severe flooding and disruption was also experienced in September 2008, following a wetter than average August, when between 50% and 300%, depending on region, of September's long term average (1971-2000) rainfall was experienced in just three days (4th to 6th inclusive).

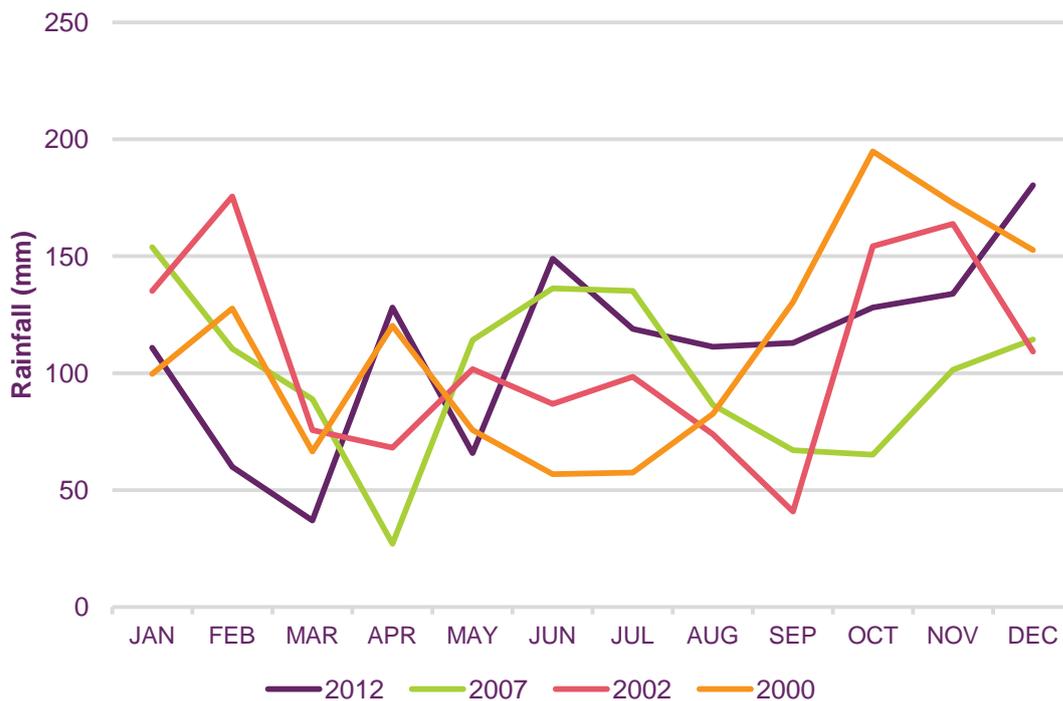
The main distinguishing feature of 2012 was an unusually long period of high rainfall

A31.61 Figure A31.14 shows that the highest levels of rainfall per month in 2012 were not higher than the levels of rainfall experienced in other months in other years with high rainfall since 2000. This was also the case with monthly rainfall levels in Openreach forecast regions.

¹³¹⁶ Met Office, *Past weather events*,
<http://www.metoffice.gov.uk/climate/uk/interesting>

¹³¹⁷ Environment Agency, *Review of 2007 summer floods, December 2007*,
<http://www.environment-agency.gov.uk/research/library/publications/33995.aspx>

Figure A31.14: UK monthly rainfall



Source: Ofcom analysis of Met Office data

A31.62 However, 2012 was unusual in several respects and was characterised by the following distinguishing features:

- record levels of rainfall in April and June, the highest since records began in 1766;
- the period April to July also exceeded the 2007 records where rain and its effects were widespread instead of just affecting some regions as in other years;¹³¹⁸
- a summer period when the rainfall remained relatively high compared to other years; and
- this was followed by an unusually long period of equally high rainfall in the autumn that lasted 4 months. Although there was also a 4 month period of high rainfall in 2000, unlike 2012 it followed a dry period.

Saturated soil and raised ground water levels may have contributed to fault levels

A31.63 The Environment Agency's Water Situation Reports provide further potential reasons for the rise in fault rates. These indicate ground water and soil saturation levels were much higher than normal in most places for much of the autumn of 2012 confirming the cumulative effect of the rain.¹³¹⁹ Flooding in the spring and

¹³¹⁸ Met Office, *Record rainfall, April to July 2012*, <http://www.metoffice.gov.uk/climate/uk/interesting/april-july2012>

¹³¹⁹ The two parameters considered were "soil moisture deficit level" (where a lower number indicates greater saturation with zero indicating soil that cannot absorb any more water) and "ground water

early summer tended to be localised and due to very high levels of persistent rain over a few days, often exceeding the average rainfall for the month and overwhelming the capacity of drainage systems, whereas later in the year flooding was more widespread and due to rain falling on saturated ground.¹³²⁰ Whilst water-logging and floods caused difficulties accessing land and extensive disruption to road and rail infrastructure was reported, only a few thousand properties were flooded compared to the much more damaging floods of 2007 when 55,000 properties were flooded, primarily as a consequence of flood defence work undertaken in response to the 2007 floods.¹³²¹

A31.64 It seems likely that higher ground water levels and soil saturation levels may have contributed to the rise in the volume of underground network faults encountered by Openreach in 2012. Although the underground cables and joints in Openreach's access network are designed to be waterproof, it is likely that these conditions could have led to more underground structures flooding and more faults due to water ingress into failed joints and cables.

A31.65 Soil moisture deficit levels have returned to normal levels and ground water levels are reducing due to below average rainfall for the first four months of 2013.¹³²²

There is clearly a relationship between rainfall and fault report volumes

A31.66 We have also compared fault report volumes with rainfall patterns. Visual inspection of Figure A31.15 below shows that while there is not an exact correlation, peaks in fault report volumes often follow peaks in rainfall levels in the preceding month. This suggests a relationship with rainfall or perhaps stormy weather.

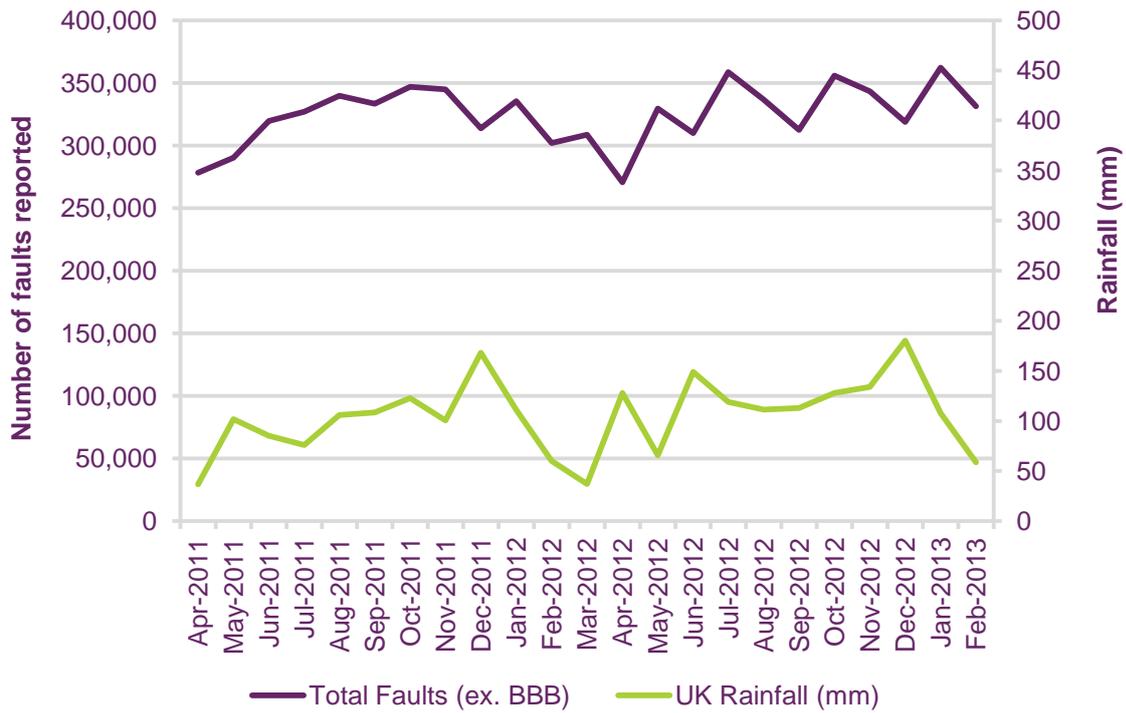
level" (where a higher number indicates higher ground water levels) obtained from Environment Agency, water situation reports.

¹³²⁰ Commissioned report, *Analysis of 2008-2012 rainfall in Ofcom Regions*, April 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-reviews/annexes/MO_Ofcom_report.pdf

¹³²¹ Met Office, *Record rainfall, April to July 2012*

¹³²² Environment Agency, *Monthly water situation report*.

Figure A31.15: Comparison of fault reports volumes and rainfall levels¹³²³

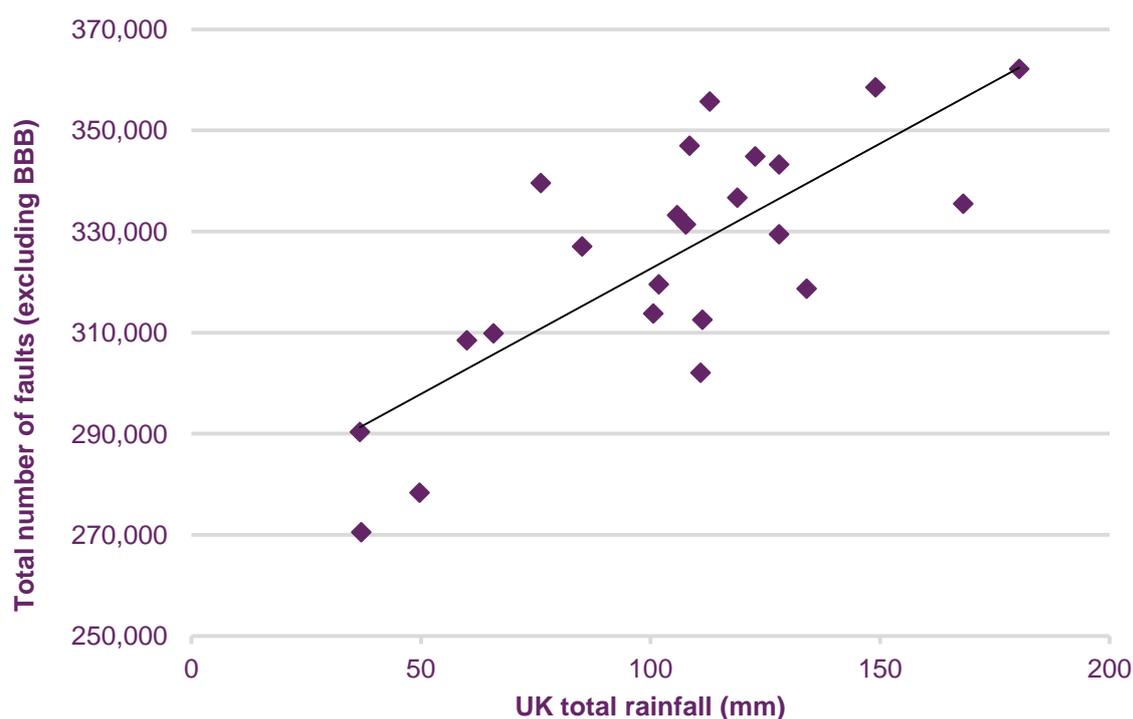


Source: Ofcom analysis of BT’s response dated 31 May 2013 to question 1.4 of the Remittal QoS BT Information Request and Ofcom analysis of Met Office rainfall data

A31.67 More detailed analysis as illustrated in Figure A31.16 shows that there is a strong correlation between rainfall and fault report volumes in the following month.

¹³²³ Faults reported to Openreach for WLR PSTN (basic and premium), SMPF and MPF products. BBB is the Broadband Boost product.

Figure A31.16 Correlation between rainfall and fault report volumes¹³²⁴



Source: Ofcom analysis of BT's response dated 31 May 2013 to question 1.4 of the Remittal QoS BT Information Request and Ofcom analysis of Met Office rainfall data for April 2011 to Feb 2013

A31.68 Figure A31.16 suggests that the increase in the volume of faults reported to Openreach between a dry period (defined as a rainfall of around 50mm in a month) and a particularly wet period (defined as a rainfall of around 150mm in a month) would be of the order of 50,000 faults or 15%.

Summary

A31.69 Although 2012 was in several respects a record year, in other respects it was not without precedent. High levels of annual rainfall have occurred in seven years since 2000 and individual monthly rainfall levels were comparable with levels encountered in previous years.

A31.70 The particular feature of 2012 that appears to have caused problems for Openreach was the persistence of the wet weather rather than the absolute levels of rainfall. In previous years, periods of high rainfall have more commonly been short lived and have followed a dry period. In 2012, rainfall was higher than in previous years from June to August and was followed by a period of high rainfall from September to December. This weather pattern led to a sustained rise in fault reports. Whilst fault report volumes was only slightly higher than 2011 (also a year with high rainfall), average fault repair times also increased causing the repair workload to exceed Openreach's resource capacity, thereby leading to the drop in performance. Also, in previous years periods of high rainfall have been short lived allowing Openreach to recover more quickly.

¹³²⁴ Figure A31.16 illustrates the derived relationship between rainfall and fault report volumes in the following month, correlation coefficient 0.77, significance 99%.

A31.71 We have not been able to establish for certain that water ingress has been the primary cause of the increase in reported faults and if it was, whether the design parameters relating to waterproofing were exceeded in 2012, whether there were shortcomings in terms of Openreach's regular preventative maintenance programme or whether external plant was obsolete and should have been replaced.

CP forecasting

A31.72 Openreach requires CPs to forecast order volumes quarterly in advance on a regional basis to help it plan its resources.

A31.73 We asked Openreach for data summarising the accuracy of CP regional forecasts for appointed provisions. Openreach provided forecast data for three CPs for the period April to November 2012 resources and it specifically relates to the Copper Appointment Availability SLA/SLG regime that covers appointed provision jobs for WLR, MPF, and ISDN2. We also consulted the OTA for their views and understanding of the CP forecasts.

A31.74 CPs provide forecasts for their overall net order volumes (i.e. total order volume less cancellations) and also the proportion of orders that will be appointed. The OTA has told us that CPs forecasts for overall order volumes are generally very accurate but that historically forecasts for appointed order volumes have been less accurate.

A31.75 In the event that the actual volume of orders submitted by a CP in any region is above or below the forecast amount by more than a specified limit, Openreach dis-applies the SLGs for appointment availability in that region. The specified limit prevailing during the period April to October 2012 was +/- 10%. This was increased to +/- 15% from 1 November 2012 and will revert to +/- 10% from 1 November 2013.

A31.76 Figure A31.17 below summarises the accuracy of forecasts for appointed orders submitted by three CPs for the period April to November 2012. It displays the maximum and average values of the proportion of regions each CP successfully forecast within the limit of +/- 10% each month (except November 2012 which was +/- 15%). Forecasting clearly improves throughout the period displayed.

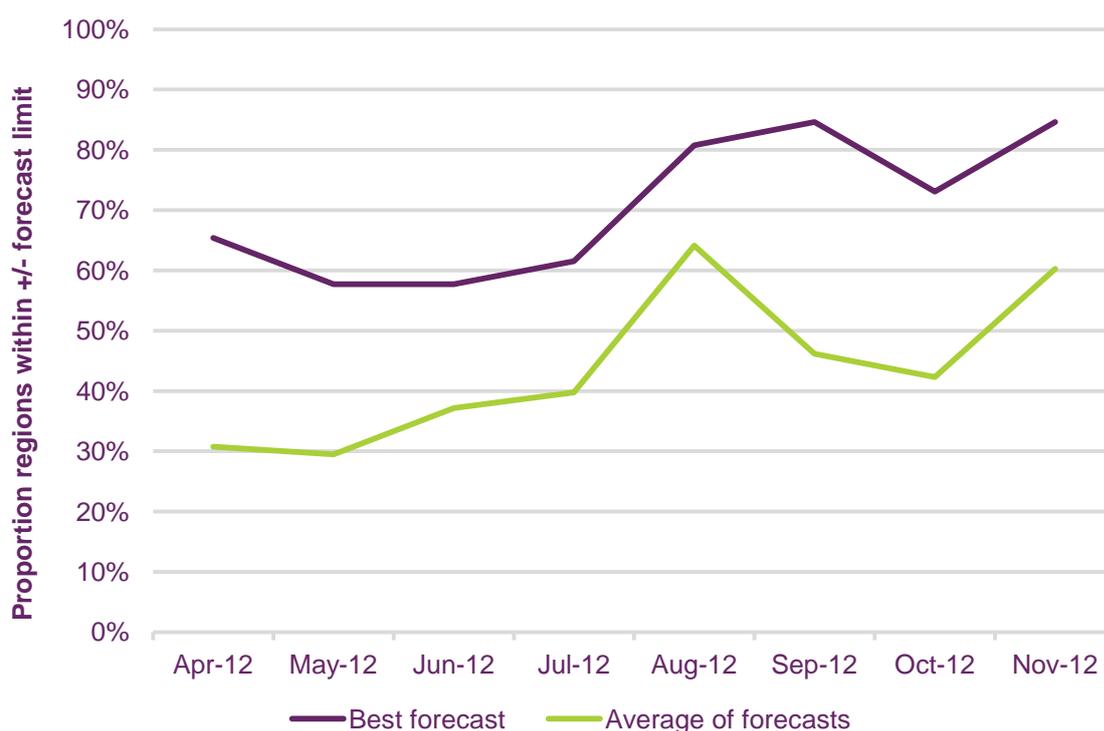
A31.77 We understand from the OTA that forecasts continued to improve after the period displayed in Figure A31.17 until the introduction of the "start of stopped line" process for MPF and WLR products caused a three month disruption (January to March 2013 inclusive forecasts for April 2013) while the CPs adjusted to this change.¹³²⁵ Improved forecasting returned after April 2013 once the forecasts contained none of the superseded products.

A31.78 The OTA has reported that overall the introduction of forecasting has delivered benefits both in terms of improved accuracy but also in terms of enabling a more constructive dialogue between Openreach and its customers regarding CPs' future demand requirements and Openreach's resource planning.

A31.79 We do not consider that the level of forecasting accuracy for appointed orders was a major factor in the decline in installation order performance in 2012 which was apparently due mainly to the diversion of resources to repair activities.

¹³²⁵ We understand from the OTA that forecasts are made three months in advance with limited adjustment permitted in the months up to and including the month being forecast.

Figure A31.17: Regional forecasting accuracy for appointed orders



Source: Ofcom analysis of BT's response dated 31 January 2013 to question 1.14 of the First QoS BT Information Request.

More complex faults/more demanding customers

A31.80 We have also considered whether broadband usage may have contributed to the rise in fault rates as Openreach has suggested. From the information available to us we have not been able to definitively determine whether this is the case.

A31.81 It seems possible to us that consumers may be more likely to experience and report faults as broadband usage, particularly that relating to video and IPTV, increases their expectations of high quality interruption-free delivery. For example, consumers may report faults if video playback is erratic or if line speed is significantly lower than advertised rates.

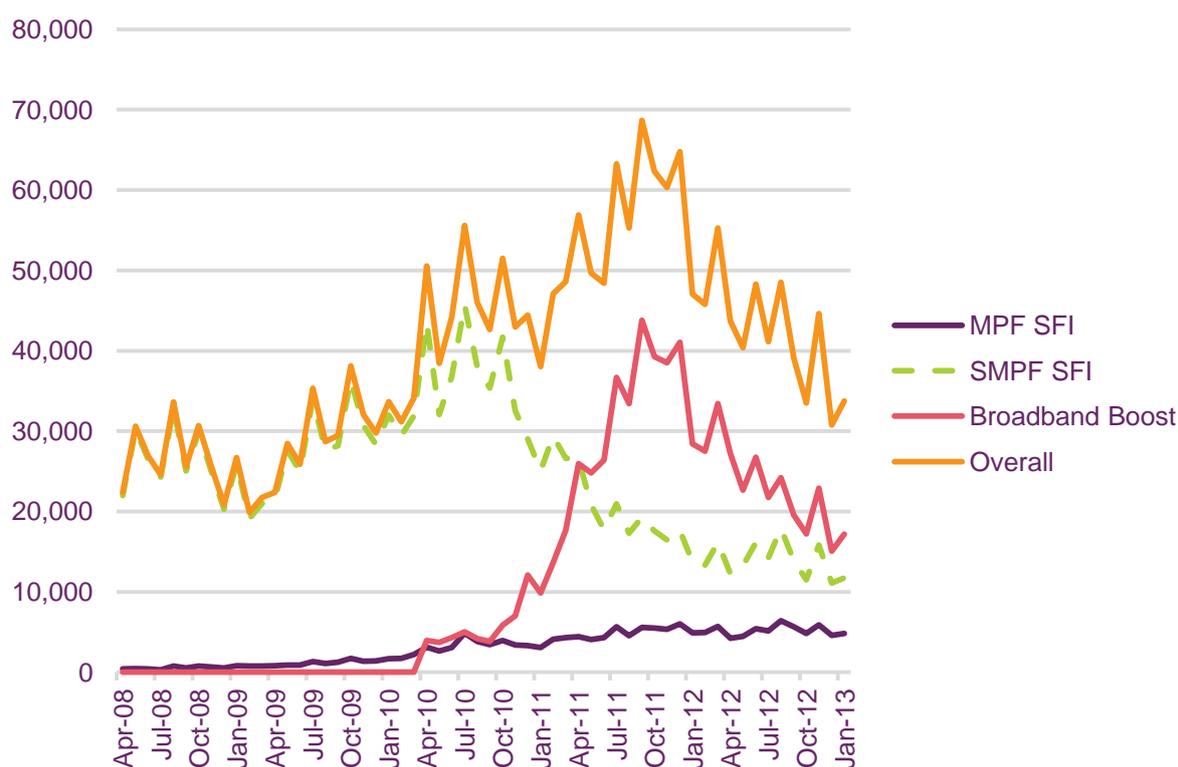
A31.82 It also seems possible to us that consumers may be more likely to experience and report faults because broadband usage is likely to increase the length of time they use the access line, particularly when consuming video and IPTV content. Longer periods of relatively continuous use, compared to the relatively short length of most telephone calls or the intermittent activity of web browsing or email sessions, greatly increases the likelihood of the broadband service experiencing interference arising from repetitive electrical induced noise (REIN), crosstalk from other users (in the access line cables) and other electrical noise sources, e.g. bad joints. Another factor is the mutual interference between multiple consumers in a premise wanting to use the available but limited bandwidth of a single access line at the same time. Also if there are multiple users at a premise using bandwidth-hungry applications at the same time this is likely to lead to a deterioration in end-users' experience as each broadband connection has a physical limit in terms of traffic throughput.

- A31.83 Whereas interference may cause tolerable background noise on a conventional telephone call which users may not even notice or may be tolerant to, similar interference could result in broadband quality degradations that are more likely to be reported by a consumer to their service provider. It also seems likely to us that consumers will more readily complain to their service provider about such issues if they are pushing the limits of the capacity of their broadband connection.
- A31.84 Real time audio and video applications such as VoIP and video telephony are likely to be particularly susceptible to interference due to the content coding techniques used by providers. In contrast providers of video over IPTV often use buffering techniques which allow content to be stored on the consumer's viewing device thus allowing for error correction without deterioration in consumer experience. In the event though that there is either very severe electrical interference (REIN, crosstalk, noise, etc.) on the line or the available bandwidth of the access line is insufficient to deliver the content at the required rate, then consumers can expect their experience to be impacted adversely.
- A31.85 Further, issues with the internet more broadly (i.e. independent of the consumer's line performance), such as capacity constraints in the backhaul network or at the server where the content is hosted are not always transparent to consumers who may think the problem lies with their physical connection.
- A31.86 Whilst consumers are probably more likely to complain to their service provider about issues with their broadband, this does not automatically lead to faults being registered by Openreach, as the CP would only pass a fault to Openreach if initial diagnostic tests indicate the line does not satisfy the requirements of SIN 349.¹³²⁶
- A31.87 Openreach has also told us that a study in 2012 revealed a proportion of non broadband working telephone lines that failed SIN 349 tests which did not subsequently result in a customer reported fault. Such lines would potentially deliver unacceptable broadband service if converted without rectification. Openreach has not yet sized this potential problem.
- A31.88 Openreach and one other CP ~~SC~~ have also made us aware of a further proportion of lines that have defects that affect broadband services and which can only be detected with more sophisticated tests than the standard TAM¹³²⁷ test.
- A31.89 Openreach offers two chargeable broadband performance investigation services, Broadband Boost and Special Faults Investigation. These are generally used in cases where there are broadband performance problems but no apparent line fault. The rise in volume in these activities (as shown in Figure A31.18 below) supports the view that consumer expectations about broadband performance may be increasing.

¹³²⁶ SIN 349 is a suppliers information note describing the technical characteristics of the metallic path facility (MPF), i.e. copper access line, between a customer's premise and either the local exchange or street cabinet (sub-loop FTTC case). It is available at <http://www.sinet.bt.com/sinlist1.htm>.

¹³²⁷ Test access matrix (TAM) is equipment Openreach uses to remotely test customer access lines.

Figure A31.18: Volume of Broadband Boost and Special Faults Investigation activities



Source: Ofcom analysis of BT's response dated 27 February 2013 to question 1.10 of the First QoS BT Information Request.

A31.90 Our initial view is that increasing broadband usage may be causing fault rates to rise somewhat. However with the information currently available to us we are unable to quantify this increase and we are also unable to confirm and quantify the predominant causes.

Preventative maintenance

A31.91 Openreach has provided us with some information on its preventative maintenance expenditure. In the last two years (2011/12 and 2012/13) this was equivalent to about 30 FTE, about 30% lower than in the two years (2009/10 and 2010/11). We understand from Openreach that a significant proportion of this relates to its pole replacement programme but we have not been able to establish the proportion of expenditure specifically on activities relating to reducing the susceptibility of network plant to water ingress.

A31.92 We have also not been able to obtain any benchmark information against which to assess the level of Openreach's expenditure or the effectiveness of its preventative maintenance activities. However, the apparent susceptibility of the underground network to water ingress (as demonstrated by the rise in underground faults observed by Openreach in the wet summer of 2012) suggests there may be further scope to drive down fault rates with preventative maintenance activities (such as waterproofing activities).

Other issues / concerns

Use of MBORC¹³²⁸

A31.93 In view of the concerns expressed by FAMR Call for Inputs respondents about the MBORC provisions in Openreach’s contracts we asked Openreach to provide us with information about MBORC events.

A31.94 Openreach declares MBORC events when external events that it considers to be beyond its reasonable control prevent it from fulfilling its SLAs. Orders and faults associated with MBORC events are not subject to SLAs and SLGs. MBORC incidents are generally classified as follows:

- **local incidents or events** covering occurrences such as cable theft, which are of limited or local impact;
- **major incidents or events** affecting more than 2,000 lines or a wider geographic area, typically due to severe weather such as floods or storms, major fires or terrorist attacks.

A31.95 Table A31.2 below shows the number of MBORC events in the last 4 years.

Table A31.2: Number of MBORC events

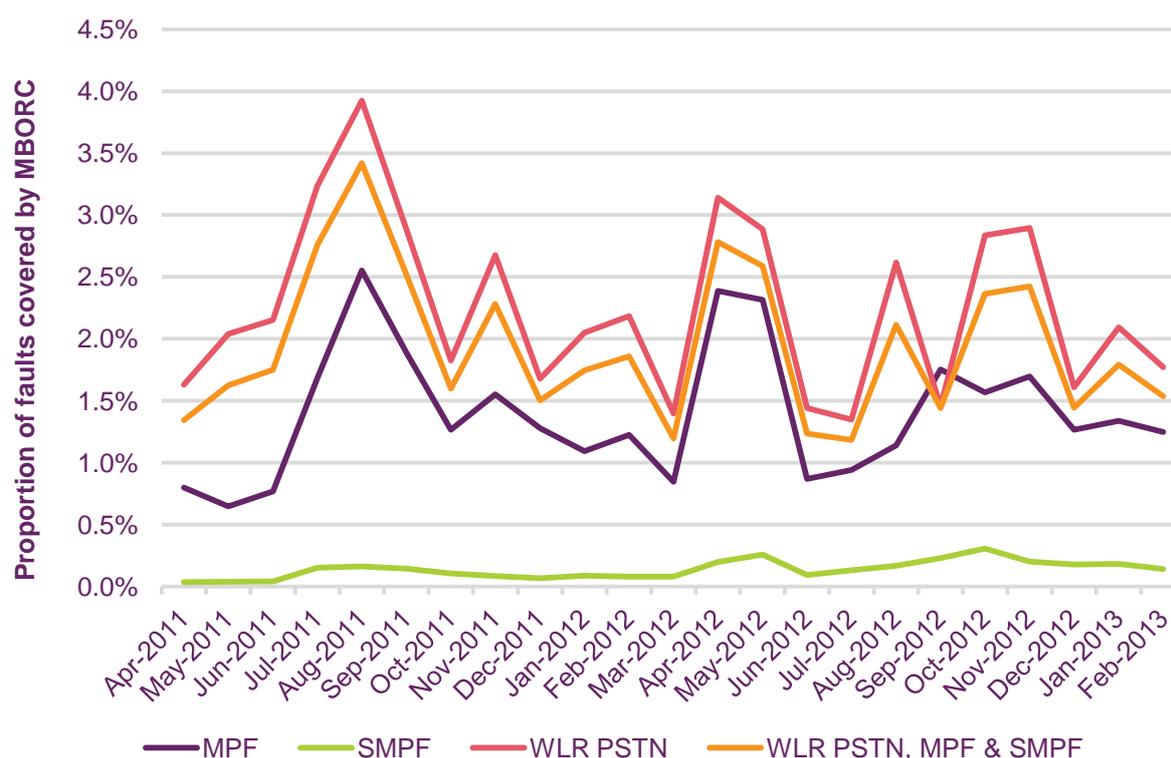
	Major Events	Local Events
2009	73	2,821
2010	61	1,547
2011	17	1,764
2012	123	1,220

Source: Ofcom analysis of BT’s response dated 31 January 2013 to question 1.11 of the First QoS BT Information Request.

A31.96 Figure A31.19 below shows the number of orders and faults that were subject to MBORC events.

¹³²⁸ MBORC is measures beyond our reasonable control.

Figure A31.19: Proportion of faults affected by MBORCs



Source: Ofcom analysis of BT’s response dated 31 May 2013 to question 1.4 of the Remittal QoS BT Information Request

A31.97 Figure A31.19 shows that between 0.6% and 3.9% of faults reported were subject to MBORC events, depending on product, around an overall average of 1.9% for all three products. This compares with SLG payments being made on 10% or less of the faults reported for the majority of the period April 2011 to October 2012, rising to about 15% of the faults reported by the end of 2012 (Figure A30.13, Annex 30). Openreach estimate that for the year 2011/12 approximately 46% of all repairs affected by MBORCs were completed within the SLA target suggesting that up to just over 2% of all repairs would otherwise have incurred an SLG payment because they were covered by MBORCs and simultaneously exceeded the SLA. Openreach expect the figures to be higher for 2012/13.

A31.98 We were unable to obtain comparable information concerning how MBORCs affected completed orders.

Best practice initiatives

A31.99 Recent work led by the OTA has shown that CPs operating practices have led to some inefficiency in the utilisation of Openreach’s field engineering resources, particularly in relation to abortive visits (visited late cancellations¹³²⁹) and unnecessary appointments. Areas of weakness have also been identified within some Openreach processes i.e. different practices between MPF and WLR.

¹³²⁹ Visited late cancellations is where an engineer visits the customer but the appointment has previously been cancelled by the customer and the cancellation has not reached the engineer in time or the customer cancels on the doorstep.

A31.100 While we do not have any evidence that these inefficiencies contributed to the recent service problems (e.g. by worsening significantly), there is potential for industry-wide best practice initiatives to contribute to service performance by reducing the pressure on Openreach's field engineering resources. They could also reduce costs and improve customer satisfaction.

A31.101 The OTA is currently leading a programme that has identified best practices that could potentially reduce the number of appointed engineering visits by 10% to 15%. The programme includes the following initiatives:

- greater use of the “working line takeover” process to reduce the number of appointed provisions and improve delivery times;
- reduction in late notice cancellations that cause abortive site visits;
- optimised address matching to reduce the need for manual intervention;
- reduction in the use of “forced provides” (WLR only) i.e. only sending a technician to the site if specifically requested by the customer;
- reducing the number of late notice repair appointment cancellations that result in abortive journeys; and
- reducing the number of “no access” abortive repair site visits.

A31.102 There is also an industry group known as the Business Market Service Improvement Programme which is working on initiatives specifically for the business market. The group has defined a set of business specific KPIs and will be reporting performance to the OTA Service Management Forum. It has set up working groups to implement process improvements to address business specific requirements. These include:

- better jeopardy management processes;
- a new process for “high risk” orders;
- best practice for booking engineering visits; and
- trial of more focused appointments.

A31.103 In its response to the FAMR Call for Inputs, Openreach said that by adopting best practice initiatives such as those identified by the OTA, CPs could significantly reduce the number of unnecessary provision appointments and abortive visits. Openreach noted that it currently makes around 130,000 site visits per week of which around 20,000 are abortive visits. It estimated that improvement activities could reduce the number of site visits to around 95,000 per week.

A31.104 It is clearly in everyone's interest to adopt working practices that deploy Openreach's resources as efficiently as possible and we therefore support these initiatives.

Summary of assessment

A31.105 During the last 4 years, Openreach's field engineering workload has increased significantly:

- the provisioning workload has been increased by an increase in the volume of appointed orders of about 80%, equating to about 80,000 more appointments per month, of which GEA rollout has been a significant contributory factor;
- the repair workload has been increased by the rise in MPF volumes, increasing the proportion of lines with repair level 2 and above (rather than repair level 1 with its less challenging repair target) by about 5% to about 44%;
- broadband - increasing usage of broadband services may be contributing somewhat to fault rates;
- fault volumes have risen steadily since mid-2010 driven apparently mainly by higher rainfall than in previous years; and
- 2012 was not particularly exceptional for rainfall with very similar levels also recorded in 7 of the last 12 years. The particular problem with 2012 was not so much the absolute level of rainfall but rather the persistent nature of the wet weather.

A31.106 While there appears to be little or no change in Openreach's overall resource levels, there is evidence of redeployment of resource away from the legacy products, at least for significant periods of time over the last few years. These together suggest that while there is no specific attempt by BT to reduce resources to increase returns on services, BT has reacted to overall cost and work priority pressure by resource re-allocation. In the absence of a clear incentive to maintain quality of service standards there has been no mechanism to ensure resources are maintained in this area.

A31.107 We consider it likely that the increasing workload, combined with reductions in the resources committed to repair activities from 2008 to 2010 contributed to the fall in repair QoS observed in 2010 when completion against repair targets fell by about 10% (for example, prior to April 2010 MPF repair performance ranged from 85% - 90% and from May 2010 to mid-2012 it ranged from 60% - 85%, a period which also exhibited large increases in the MPF product volumes and installed estate).

A31.108 The prolonged period of poor performance in 2012 shows that Openreach lacked the resource capacity (either in house or with agency staff/contractors) to quickly expand its capacity to deal with such a large increase in fault volumes particularly when it persisted for more than a month. While Openreach ultimately reacted to the rise in fault volumes and repair times by expanding its resource capacity by a combination of overtime, contractors and recruitment to levels that were \approx higher in 2012 than in 2011, in the absence of a sustained focus on performance it is likely that resources will again be diverted.

Annex 32

Sources of evidence

Introduction

A32.1 We have noted throughout this Statement the evidence we have relied upon in relation to our findings and how we have relied upon that evidence. This Annex lists the main sources of evidence used. We also list all respondents to our consultations and to our formal information requests.

A32.2 Whilst the Annex lists the main evidence we have relied upon, the list is for convenience only and is not intended to be exhaustive.

List of respondents to 2012 FAMR CFI

A32.3 We published a Call for Inputs (CFI) on 9 November 2012 setting out our proposed approach to this market review and seeking stakeholder input. This can be found at the following link:

Ofcom, *Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 – Call for Inputs*, 9 November 2012, <http://stakeholders.ofcom.org.uk/consultations/fixed-access-markets/>

A32.4 21 stakeholders provided written responses to 2012 FAMR CFI:

- Axis Telecommunications Ltd;
- Birmingham City Council;
- British Sky Broadcasting Group plc;
- British Telecommunications plc;
- Cable and Wireless Worldwide plc/Vodafone;
- Colt Technology Services;
- Cumbria County Council;
- Derby City Council;
- Federation of Communication Services Ltd;
- KCOM Group plc;
- Manchester City Council;
- Modern Communications Ltd;
- Openreach
- SSE plc;

- TalkTalk Telecom Group plc;
- Tesco Broadband;
- The Bit Commons Ltd;
- Verizon UK Ltd;
- Virgin Media Ltd;
- ☒ and
- ☒

A32.5 We have published the non-confidential versions of the responses from all the stakeholders listed above. These can be found on our website:

<http://stakeholders.ofcom.org.uk/consultations/fixed-access-markets/?showResponses=true>

List of respondents to the July 2013 FAMR Consultation

A32.6 We published a Consultation on 3 July 2013 setting out our proposed market definitions, SMP assessments and remedies. This can be found at the following link:

Ofcom, Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 - Consultation on the proposed markets, market power determinations and remedies, 3 July 2013,
<http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-reviews/>

A32.7 13 stakeholders provided written responses to July 2013 FAMR Consultation:

- British Telecommunications plc;
- Colt Technology Services Group Ltd
- EE Ltd;
- Federation of Communications Services Ltd
- KCOM Group
- Openreach
- SCS Telecoms
- British Sky Broadcasting Limited;
- TalkTalk Telecom Group plc;
- Verizon UK Limited;
- Virgin Media Limited;
- Vodafone Limited; and

- ✂

A32.8 We have published the non-confidential versions of the responses from all the stakeholders listed above. These can be found on our website:

<http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-reviews/?showResponses=true&pageNum=1#responses>

List of respondents to the July 2013 LLU WLR Consultation

A32.9 We published a Consultation on 11 July 2013 setting out our proposals for new charge controls for Local Loop Unbundling (LLU) and Wholesale Line Rental (WLR) services and seeking stakeholder input. This can be found at the following link:

Ofcom, *Fixed access market reviews: Approach to setting LLU and WLR Charge Controls - Consultation*, 11 July 2013, Updated 20 August 2013,
<http://stakeholders.ofcom.org.uk/consultations/llu-wlr-cc-13/>

A32.10 12 stakeholders provided written responses to the July 2013 LLU WLR Consultation:

- AdEPT Telecom plc;
- Adaptive Spectrum and Signal Alignment, Inc.;
- British Telecommunications plc;
- EE Limited;
- Federation of Communication Services Ltd;
- Openreach
- British Sky Broadcasting Limited;
- TalkTalk Telecom Group plc;
- Verizon UK Limited;
- Virgin Media Limited;
- Vodafone Limited; and
- ✂

A32.11 We have published the non-confidential versions of the responses from all the stakeholders listed above. These can be found on our website:

<http://stakeholders.ofcom.org.uk/consultations/llu-wlr-cc-13/?showResponses=true>

List of respondents to the December 2013 LLU and WLR Consultation

A32.12 We published a Consultation on 19 December 2013 setting out our further proposals for new charge controls for Local Loop Unbundling (LLU) and Wholesale Line Rental (WLR) services and seeking stakeholder input. This can be found at the following link:

Ofcom, *Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR Charge Controls – Consultation*, 19 December 2013, <http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-llu-wlr-charge-controls/> <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/summary/famr-2013.pdf>

A32.13 13 stakeholders provided written responses to the December 2013 LLU and WLR Consultation:

- British Sky Broadcasting Ltd;
- British Telecommunications plc;
- Colt Technology Services;
- EE Limited;
- Federation of Communication Services Ltd;
- KCOM Group plc
- Openreach
- Prospect
- TalkTalk Telecom Group plc;
- Verizon UK Ltd;
- Virgin Media Ltd;
- Vodafone Ltd; and
- <.

A32.14 We have published the non-confidential versions of the responses from all the stakeholders listed above. These can be found on our website:

<http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-llu-wlr-charge-controls/?showResponses=true>

List of respondents to January 2014 FAMR Consultation

A32.15 We published the consultation on 16 January 2014, setting out further proposals on remedies, including notifying price changes, compliance with VULA margin pricing

regulation and charge controls for TRCs and SFIs. This can be found at the following link:

Ofcom, *Fixed access market reviews: Further consultation on notification periods, compliance with requirements on the VULA margin, and approach to pricing for TRCs and SFIs*, 16 January 2014,

<http://stakeholders.ofcom.org.uk/binaries/consultations/famr-2014/summary/famr-2014.pdf>.

A32.16 Seven stakeholders provided written responses:

- British Sky Broadcasting Group plc;
- British Telecommunications plc;
- EE Limited;
- TalkTalk Telecom Group plc;
- Verizon UK Ltd;
- Virgin Media Ltd; and
- Vodafone Ltd.

A32.17 We have published the non-confidential versions of the responses from all the stakeholders listed above. These can be found on our website:

<http://stakeholders.ofcom.org.uk/consultations/famr-2014/?showResponses=true>

Information-gathering using statutory powers (s.135)

A32.18 During this market review, we have issued a series of notices under section 135 of the Act requiring various CPs to provide specified information as set out in the notice. These information requests are listed below:

LLU WLR Information Requests:

A32.19 Information request of 8 February 2013 regarding the provision of data necessary to inform our cost modelling and analysis of the efficiency of BT's copper access network business (First LLU WLR BT Information request). Request addressed to and response received from:

- BT.

A32.20 Information request of 7 March 2013 regarding historic and forecast volume data (Second LLU WLR BT Information request). Request addressed to and response received from:

- BT;
- CWW;
- Daisy;

- EE;
- KCOM;
- O2;
- Plusnet;
- Post Office;
- Sky;
- TalkTalk; and
- Virgin.

A32.21 Information request of 18 March 2013 regarding information to help inform our cost modelling and the structure of any future such controls (Third LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.22 Information request of 17 April 2013 regarding information to help inform our cost modelling and the structure of any future such controls and information on the costs incurred in connection with the provision and repair of LLU and WLR lines and how these are accounted for by BT (Fourth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.23 Information request of 23 April 2013 regarding information to help inform our cost modelling and the structure of any future such controls and information on the costs incurred in connection with the provision and repair of LLU and WLR lines and how these are accounted for by BT (Fifth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.24 Information request of 8 May 2013 regarding information to help inform our cost modelling and the structure of any future such controls (Sixth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.25 Information request of 15 May 2013 regarding historic and forecast information on the amount of installed Digital Access Carrier System equipment and its use and confirmation of the allocation of line testing equipment (Seventh LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.26 Information request of 29 May 2013 regarding clarification and explanation to better understand how previous information provided by BT in response to section 135 requests reconciles to the RFS and to gather further information on products within

the existing charge control baskets (Eighth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.27 Information request of 13 June 2013 regarding the provision of data necessary to improve our understanding of the basis of BT's efficiency estimates and how the derivation might relate to our charge control modelling (Ninth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.28 Information request of 28 August 2013 regarding the provision of data necessary to understand how BT constructed the system run which produced the results it supplied, so we are clear about the basis on which it was compiled (Tenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.29 Information request of 4 October 2013 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; information to clarify or add to information previously provided by BT; and information to refresh and/or update that previously provided by BT (for example, to capture outturn data where we currently have forecasts) (Eleventh LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.30 Information request of 11 October 2013 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review (Twelfth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.31 Information request of 8 November 2013 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; and information to clarify or add to information previously provided by BT (Thirteenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.32 Information request of 16 December 2013 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; and information to clarify or add to information previously provided by BT (Fourteenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.33 Information request of 24 January 2014 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; and information to clarify or

add to information previously provided by BT (Fifteenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.34 Information request of 26 February 2014 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; and information to clarify or add to information previously provided by BT (Sixteenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.35 Information request of 21 February 2014 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; and information to clarify or add to information previously provided by BT (Seventeenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.36 Information request of 3 March 2014 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; and information to clarify or add to information previously provided by BT (Eighteenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.37 Information request of 17 March 2014 regarding the provision of information on matters for which we do not presently have data where we consider that this information is necessary for the purposes of our review; information that BT has previously provided informally; and information to clarify or add to information previously provided by BT (Nineteenth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

A32.38 Information request of 18 March 2014 regarding the provision of information from BT to ensure that we have the correct information to inform our consideration of any appropriate future LLU and WLR charge controls; and information that BT has previously provided informally (Twentieth LLU WLR BT Information Request). Request addressed to and response received from:

- BT.

QoS Information Requests:

A32.39 Information request of 18 January 2013 regarding Openreach's quality of service commitments to communications providers and resource allocations concerning quality of service (First QoS BT Information Request). Request addressed to and response received from:

- BT.

A32.40 Information request of 13 May 2013 regarding the remission by the Competition Appeal Tribunal of the fault rates ground of appeal (Remission Information Request). Request addressed to and response received from:

- BT.

A32.41 Information request of 23 May 2013 regarding the provision of data on Openreach's quality of service commitments to communications providers and resource allocations concerning quality of service (Second QoS BT Information Request). Request addressed to and response received from:

- BT.

A32.42 Information request of 17 September 2013 regarding the provision of data on Openreach faults and fault repair data (Third QoS BT Information Request). Request addressed to and response received from:

- BT.

A32.43 Information request of 20 September 2013 regarding the provision of data on average line length per relevant product for each BT exchange (Fourth QoS BT Information Request). Request addressed to and response received from:

- BT.

A32.44 Information request of 22 October 2013 regarding the provision of any research commissioned by Openreach on faults (Fifth QoS BT Information Request). Request addressed to and response received from:

- BT.

A32.45 Information request of 3 March 2014 regarding the provision of information on further Openreach fault and MBORC data (Sixth QoS BT Information Request). Request addressed to and response received from:

- BT.

A32.46 Information request of 23 April 2014 regarding the provision of information on Openreach exchanges and General Manager regions (Seventh QoS BT Information Request). Request addressed to and response received from:

- BT.

WLA Information Requests

A32.47 Information request of 26 November 2012 regarding forecasts for use of MPF; capital investment in NGA networks; standard and superfast broadband customer numbers; upgrade and switching information; GEA migration costs; superfast broadband strategy; superfast broadband demand forecasts; competitor analyses for superfast broadband; marketing spend on superfast services; usage information for SLU, PIA and FVA; plans for vectoring; ISDN30 customer details; and ISDN30, ISDN2 and IP-based telephony volume data. Request sent to and response received from:

- BT.

A32.48 Information request of 26 November 2012 regarding local access provision in Hull; the number of unbundled local exchanges; the number of business and residential analogue lines; use of the Business Voice Reseller product; superfast broadband demand forecasts; marketing spend on superfast services; and ISDN30, ISDN2 and IP-based telephony volume data. Request sent to and response received from:

- KCOM.

A32.49 Information request of 26 November 2012 regarding capital investment in networks; superfast broadband strategy; superfast broadband demand forecasts; competitor analyses for superfast broadband; marketing spend on superfast services; usage information for SLU and PIA; and ISDN30 IP-based telephony volume data. Request sent to and response received from: Virgin.

A32.50 Information request of 26 November 2012 regarding superfast broadband strategy; superfast broadband demand forecasts; competitor analyses for superfast broadband; marketing spend on superfast services; usage information for SLU and PIA; and ISDN30 and IP-based telephony volume data. Request sent to and response received from:

- CWW/Vodafone; and
- TalkTalk.

A32.51 Information request of 26 November 2012 regarding superfast broadband strategy; superfast broadband demand forecasts; competitor analyses for superfast broadband; marketing spend on superfast services; and usage information for SLU and PIA. Request sent to and response received from:

- EE;
- Telefonica O2; and
- Sky.

A32.52 Information request of 26 November 2012 regarding ISDN30 and IP-based telephony volume data. Request sent to and response received from:

- Verizon; and
- Colt.

A32.53 Information request of 10 January 2013 regarding GEA migration costs. Request sent to and response received from: BT.

A32.54 Information request of 18 January 2013 regarding Quality of Service. Request sent to and response received from: BT.

A32.55 Information request of 28 January 2013 regarding Quality of Service. Request sent to and response received from:

- BT;
- Colt;

- CWW;
- Daisy;
- EE;
- KCOM;
- Telefonica O2;
- TalkTalk;
- Verizon; and
- Virgin.

A32.56 Information request of 25 February 2013 regarding the accuracy of information previously submitted to Ofcom as part of the BCMR on plans for the Hull area. Request sent to and response received from:

- MS3.

A32.57 Information request of 27 February 2013 regarding clarification of certain strategy documents submitted in response to s.135 notice of 26 November 2012. Request sent to and response received from:

- TalkTalk; and
- Virgin.

A32.58 Information request of 7 March 2013 regarding Plusnet subscriber and customer switching information; Plusnet superfast broadband forecasts; BT FTTC deployment where SLU is used; financial information relating to the BT Phone Book; and confirmation of previous information provided for the 2012 ISDN30 Charge Control review. Request sent to and response received from:

- BT.

A32.59 Information request of 28 March 2013 regarding ISDN2 cost information and customer details; and technical and financial information on calling and network features (call waiting, voicemail, three-way calling and caller ID). Request sent to and response received from:

- BT.

A32.60 Information request of 18 April 2013 regarding clarification of ISDN30 data provided in response to s.135 notice of 26 November; and wholesale ISDN30 customer numbers. Request sent to and response received from:

- Colt.

A32.61 Information request of 22 April 2013 regarding confirmation of information provided at meetings; clarification of revenue forecasts; clarification of customer take-up forecasts for superfast broadband; clarification of superfast broadband and

standard broadband profitability forecasts; and retail and wholesale fibre strategies.
Request sent to and response received from:

- BT.

A32.62 Information request of 2 May 2013 regarding the accuracy of ISDN30 channel data previously submitted to Ofcom as part of the 2012 ISDN30 charge control. Request sent to and response received from:

- CWW/Vodafone; and
- Verizon.

A32.63 Information request of 2 May 2013 regarding the accuracy of ISDN30 channel data previously submitted to Ofcom as part of the 2012 ISDN30 charge control. Request sent to and response received from: Colt.

A32.64 Information request of 23 May 2013 (including a 'Discussions Topics' Letter) regarding Quality of Service. Request sent to and response received from:

- BT.

A32.65 Information request of 14 October 2013 regarding data on SMPF and MPF lines by exchange, the coverage of LLU and wholesale broadband products provided. Request sent to and response received from: BT.

A32.66 Information request of 25 October 2013 regarding the uses of ISDN 2, volumes, costs and revenues for TRCs and SFI2s, contestability of TRCs and SFI2s, and the ordering and diagnostic process steps involved in TRCs and SFIs. Request sent to and response received from:

- BT.

A32.67 Information request of 25 October 2013 regarding diagnostic processes, and TRC and SFI2 ordering processes, costs, prices, usages and service quality. Request sent to and response received from:

- TalkTalk; and
- Sky

A32.68 Information request of 19 November 2013 regarding superfast broadband strategy, subscriber forecasts and competition assessments, and bandwidth forecasts. Request sent to and response received from:

- TalkTalk; and
- Sky

A32.69 Information request of 22 November 2013 regarding cost, revenue and volume data for TRCs and SFIs. Request sent to and response received from:

- BT.

A32.70 Information request of 13 December 2013 regarding TRC and SFI2 volumes and costs, and price changes made to TRCs and SFI2s. Request sent to and response received from:

- BT.

A32.71 Information request of 6 January 2014 regarding TRC and SFI2 volumes and costs, and price changes made to TRCs and SFI2s. Request sent to and response received from:

- BT.

A32.72 Information request of 3 February 2014 regarding volume, pricing, cost and revenue Information on wholesale ISDN2 external service transfers. Request sent to and response received from:

- BT.

A32.73 Information request of 12 February 2014 regarding actual and forecast numbers of UK passed by FTTP; forecasts for superfast broadband demand; usage information for SLU, PIA and FVA; strategy and plans for vectoring and impact on SLU; and ISDN30, ISDN2 and IP-based telephony volume data. Request sent to and response received from:

- BT.

A32.74 Information request of 12 February 2014 regarding forecasts for superfast broadband demand; strategy and plans for SLU and PIA; and ISDN30 and IP-based telephony volume data. Request sent to and response received from:

- TalkTalk;
- Virgin; and
- Vodafone

A32.75 Information request of 12 February 2014 regarding forecasts for superfast broadband demand; and strategy and plans for SLU and PIA. Request sent to and response received from:

- EE.

A32.76 Information request of 12 February 2014 regarding ISDN30 and IP-based telephony volume data. Request sent to and response received from:

- Verizon.

A32.77 Information request of 21 February 2014 regarding forecasts for superfast broadband demand. Request sent to and response received from:

- Sky.

A32.78 Information request of 10 March 2014 regarding strategy and plans for SLU and PIA. Request sent to and response received from:

- Sky.

A32.79 Information request of 23 April 2014 regarding TRC prices, the approach to TRC billing, the duration of TRCs and SFIs, the accuracy of line tests, and innovations made to TRC, SFIs and line diagnostics. Request sent to and response received from:

- BT.

A32.80 Information request of 13 May 2014 regarding the TRC duration data previously provided and asking for any caveats. Request addressed to and response received from:

- BT.

Other information requests

A32.81 Information requests of 20 November 2009 as part of the 2010 ISDN market review, regarding ISDN30 volumes. Request addressed to and response received from:

- BT.

A32.82 Information requests of 17 August 2013 as part of the Single Jumpered MPF Dispute. Request addressed to and response received from:

- BT.

A32.83 Information requests of 9 October 2013 as part of the 2014 WBA Review. Request addressed to and response received from:

- Sky.

A32.84 Information requests of 14 October 2013 as part of the 2014 WBA Review. Request addressed to and response received from:

- BT.

A32.85 Information requests of 27 November 2013 as part of the 2014 WBA Review. Request addressed to and response received from:

- MS3.

UK Legislation

A32.86 The Competition Act 1998, www.legislation.gov.uk/ukpga/1998/41/contents

A32.87 The Enterprise Act 2002, www.legislation.gov.uk/ukpga/2002/40/contents

A32.88 The Communications Act 2003, as amended, www.legislation.gov.uk/ukpga/2003/21/contents

Ofcom documents

A32.89 Oftel, *Access to Bandwidth: Delivering Competition for the Information Age*, November 1999,

<http://www.ofcom.org.uk/static/archive/oftel/publications/1999/consumer/a2b1199.htm>

- A32.90 Oftel, *Oftel's market review guidelines: criteria for the assessment of significant market power*, 5 August 2002,
www.ofcom.org.uk/static/archive/oftel/publications/about_oftel/2002/smpg0802.htm
- A32.91 Oftel, *Imposing access obligations under the new EU Directives*, 13 September 2002,
http://www.ofcom.org.uk/static/archive/oftel/publications/ind_guidelines/acce0902.htm
- A32.92 Ofcom, *The regulatory financial reporting obligations on BT and Kingston Communications, Final Statement and notification. Accounting separation and cost accounting: Final statement and notification*, 22 July 2004,
http://stakeholders.ofcom.org.uk/binaries/consultations/fin_reporting/statement/finance_report.pdf
- A32.93 Ofcom, *Direction concerning ADSL Broadband Access Migration Services; and a Determination to resolve a dispute between Tiscali, Thus and BT concerning ADSL Broadband Access Migration Services - Final Statement*, 9 August 2004,
www.stakeholders.ofcom.org.uk/binaries/consultations/bam/statement/statement.pdf
- A32.94 Ofcom, *Direction Setting the Margin between IPStream and ATM interconnection Prices - Consultation*, 26 August 2004,
www.stakeholders.ofcom.org.uk/binaries/consultations/adsl_price/statement/statement.pdf
- A32.95 Ofcom, *Strategic Review of Telecommunications – Phase 2 consultation document*, 18 November 2004,
www.stakeholders.ofcom.org.uk/binaries/consultations/telecoms_p2/summary/main_condoc.pdf
- A32.96 Ofcom, *Review of the wholesale local access market. Identification and analysis of markets, determination of market power and setting of SMP conditions. Explanatory statement and notification*, 16 December 2004,
www.stakeholders.ofcom.org.uk/binaries/consultations/rwlam/statement/rwlam161204.pdf
- A32.97 Ofcom, *Ofcom's approach to risk in the assessment of the cost of capital - Consultation*, 26 January 2005:
http://stakeholders.ofcom.org.uk/binaries/consultations/cost_capital/summary/cost_capital.pdf
- A32.98 Ofcom, *Broadband Regulation - Statement*, 30 June 2005,
www.stakeholders.ofcom.org.uk/binaries/consultations/rwlam/statement/bbr.pdf
- A32.99 Ofcom, *Ofcom's approach to risk in the assessment of the cost of capital – Final statement*, 18 August 2005,
www.ofcom.org.uk/consult/condocs/cost_capital2/statement/final.pdf
- A32.100 Ofcom, *Valuing copper access – Final statement*, 18 August 2005,
<http://stakeholders.ofcom.org.uk/binaries/consultations/copper/statement/statement.pdf>

- A32.101 Ofcom, *Final statements on the Strategic Review of Telecommunications, and undertakings in lieu of a reference under the Enterprise Act 2002 - Statement*, 22 September 2005,
www.stakeholders.ofcom.org.uk/binaries/consultations/752417/statement/statement.pdf
- A32.102 Ofcom, *Undue discrimination by SMP providers: How Ofcom will investigate potential contraventions on competition grounds of requirements not to unduly discriminate imposed on SMP providers*, 15 November 2005,
<http://stakeholders.ofcom.org.uk/binaries/consultations/undsmf/statement/contraventions4.pdf>
- A32.103 Ofcom, *Local loop unbundling: setting the fully unbundled rental charge ceiling and minor amendment to SMP conditions FA6 and FB6 – Statement*, 30 November 2005,
http://stakeholders.ofcom.org.uk/binaries/consultations/llu/statement/llu_statement.pdf
- A32.104 Letter from Paul Reynolds, BT to Sean Williams, Ofcom, dated 10 November 2006,
<http://stakeholders.ofcom.org.uk/binaries/telecoms/policy/bb/ceilings.pdf>
- A32.105 Letter from Sean Williams, Ofcom to Paul Reynolds, BT, dated 10 November 2006,
<http://stakeholders.ofcom.org.uk/binaries/telecoms/policy/bb/ofcomresponse.pdf>
- A32.106 Ofcom, *Review of the wholesale broadband access markets 2006/07. Identification of relevant markets, assessment of market power and proposed remedies - Consultation*, 21 November 2006,
<http://stakeholders.ofcom.org.uk/binaries/consultations/wbamr/summary/wbamr.pdf>
- A32.107 Ofcom, *Review of the wholesale broadband access markets 2007/06: Identification of relevant markets, assessment of market power and proposed remedies. Explanatory Statement and Notification - Consultation*, 15 November 2007,
www.stakeholders.ofcom.org.uk/binaries/consultations/wbamr07/summary/wbamr07.pdf
- A32.108 Ofcom, *Service Level Guarantees: incentivising performance – Statement and Directions*, 20 March 2008,
www.stakeholders.ofcom.org.uk/binaries/consultations/slq/statement/statement.pdf
- A32.109 Ofcom, *Review of the wholesale broadband access markets. Final explanatory statement and notification – Statement*, 21 May, 2008,
<http://stakeholders.ofcom.org.uk/binaries/consultations/wbamr07/statement/statement.pdf>
- A32.110 Ofcom, *A new pricing framework for Openreach: Developing new charge controls for wholesale line rental, unbundled local loops and related services - Consultation*, 30 May 2008,
www.stakeholders.ofcom.org.uk/binaries/consultations/openreach/summary/openreachcondoc.pdf
- A32.111 Ofcom, *Next Generation New Build: Delivering super-fast broadband in new build housing developments - Statement*, 23 September 2008,
www.stakeholders.ofcom.org.uk/binaries/consultations/newbuild/statement/new_build_statement.pdf

- A32.112 Ofcom, *A New Pricing Framework for Openreach - Second Consultation*, 5 December 2008,
www.stakeholders.ofcom.org.uk/binaries/consultations/openreachframework/summary/off.pdf
- A32.113 Ofcom, *Delivering super-fast broadband in the UK: Promoting investment and competition - Statement*, 3 March 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/nga_future_broadband/statement/statement.pdf
- A32.114 Ofcom, *Fixed narrowband retail services markets: Consultation on the identification of markets and determination of market power - Consultation*, 19 March 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/retail_markets/summary/fnrm_condoc.pdf
- A32.115 Ofcom, *Review of the fixed narrowband services wholesale markets: Consultation on the proposed markets, market power determinations and remedies - Consultation*, 19 March 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/review_wholesale/summary/fnwm.pdf
- A32.116 Ofcom, *A new pricing framework for Openreach – Annexes*, Statement, 22 May 2009,
<http://stakeholders.ofcom.org.uk/binaries/consultations/openreachframework/statement/annexes.pdf>
- A32.117 Ofcom, *Variation to BT's Undertakings under the Enterprise Act 2002 related to Fibre-to-the-Cabinet - Statement*, 11 June 2009,
<http://stakeholders.ofcom.org.uk/binaries/consultations/fttc/statement/statement.pdf>
- A32.118 Ofcom, *Leased Lines Charge Control: A new charge control framework for wholesale traditional interface and alternative interface products and services - Statement*, 2 July 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/lcc/statement/lccstatement.pdf
- A32.119 Ofcom, *Fixed Narrowband Retail Services Markets: Identification of markets and determination of market power - Statement*, 15 September 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/retail_markets/statement/statement.pdf
- A32.120 Ofcom, *Review of BT's Network Charge Controls. Explanatory Statement and Notification of decisions on charge controls in wholesale narrowband markets*, 15 September 2009,
http://stakeholders.ofcom.org.uk/binaries/consultations/review_bt_ncc/statement/ncstatement.pdf
- A32.121 Ofcom, *Review of the fixed narrowband services wholesale markets: Statement on the markets, market power determinations and remedies including further consultation – Statement and Consultation*, 15 September 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/wnmr_statement_consultation/summary/main.pdf
- A32.122 Ofcom, *Determination to resolve disputes between each of Cable & Wireless, THUS, Global Crossing, Verizon, Virgin Media and COLT and BT regarding BT's*

- charges for partial private circuits – Determination and Explanatory Statement*, 14 October 2009,
http://stakeholders.ofcom.org.uk/binaries/consultations/draft_deter_ppc/PPC_final_determination.pdf
- A32.123 Ofcom, *Charge control for Wholesale Line Rental and related services – Statement and consultation*, 26 October 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/wlr/summary/wlrcondoc.pdf
- A32.124 Ofcom, *Protecting consumers from mis-selling of fixed line telecommunications services - Statement*, 18 December 2009,
www.stakeholders.ofcom.org.uk/binaries/consultations/protecting_consumers_misselling/statement/statement.pdf
- A32.125 Ofcom, *Undertakings given to Ofcom by BT pursuant to the Enterprise Act 2002 – consolidated version*, 23 March 2010,
www.stakeholders.ofcom.org.uk/binaries/telecoms/policy/bt/consolidated.pdf
- A32.126 Ofcom, *Review of retail and wholesale ISDN30 markets: Consultation on the proposed markets, market power determinations and remedies – Consultation*, 4 May 2010,
www.stakeholders.ofcom.org.uk/binaries/consultations/isdn30/summary/isbn30.pdf
- A32.127 Ofcom, *Review of retail and wholesale ISDN30 markets: Statement on the proposed markets, market power determinations and remedies - Statement*, 20 August 2010,
www.stakeholders.ofcom.org.uk/binaries/consultations/isdn30/statement/statement.pdf
- A32.128 Ofcom, *Strategic review of consumer switching: A consultation on switching processes in the UK communications sector - Consultation*, 10 September 2010,
www.stakeholders.ofcom.org.uk/binaries/consultations/consumer-switching/summary/switching.pdf
- A32.129 Ofcom, *Review of the wholesale local access market: Statement on market definition, market power determinations and remedies - Statement*, 7 October 2010,
<http://stakeholders.ofcom.org.uk/consultations/wla/statement>
- A32.130 Ofcom, *Retail Bundling in Hull: KCOM Bundling of SMP and non-SMP Products - Consultation*, 8 October 2010,
<http://stakeholders.ofcom.org.uk/binaries/consultations/retail-bundling-in-hull/summary/main.pdf>
- A32.131 Ofcom, *Review of the wholesale fixed analogue exchange lines markets: Consultation on the proposed markets, market power determinations and remedies – Consultation*, 15 October 2010,
www.stakeholders.ofcom.org.uk/binaries/consultations/review-wholesale-fixed-exchange/summary/main.pdf
- A32.132 Ofcom, *CW/00613/04/03: Investigation into BT's residential broadband pricing - Decision*, 2 November 2010,
http://stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_613/decision.pdf

- A32.133 Ofcom, *Review of the wholesale broadband access markets. Statement on market definition, market power determinations and remedies*, 3 December 2010, <http://stakeholders.ofcom.org.uk/binaries/consultations/wba/statement/wbastatement.pdf>
- A32.134 Ofcom, *Review of the wholesale fixed analogue exchange lines markets: Statement on the proposed markets, market power determinations and remedies - Statement*, 20 December 2010, www.stakeholders.ofcom.org.uk/binaries/consultations/review-wholesale-fixed-exchange/statement/statement.pdf
- A32.135 Ofcom, *LLCC PPC points of handover pricing review. Proposal for modification of SMP Conditions – Consultation*, 26 January 2011, <http://stakeholders.ofcom.org.uk/binaries/consultations/points-handover-pricing/summary/main.pdf>
- A32.136 Ofcom, *Charge control review for LLU and WLR services - Consultation*, 31 March 2011, <http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/summary/wlr-cc-2011.pdf>
- A32.137 Ofcom, *Dispute Resolution Guidelines: Ofcom's guidelines for the handling of regulatory disputes - Guidelines*, 7 June 2011, www.stakeholders.ofcom.org.uk/binaries/consultations/dispute-resolution-guidelines/statement/guidelines.pdf.
- A32.138 Ofcom, *CW/01067/02/11: Determination to resolve a dispute between DRL/Thales and BT relating to Sub Loop Unbundling charges*, 15 July 2011, www.stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01067/
- A32.139 Ofcom, *WBA Charge Control. Charge Control framework for WBA Market 1 Services - Statement*, 20 July 2011, www.stakeholders.ofcom.org.uk/binaries/consultations/823069/statement/statement.pdf
- A32.140 Ofcom, *LLU Charge Control – Further consultation*, 23 November 2011, www.stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc/summary/condoc.pdf
- A32.141 Ofcom, *Pensions Review - Statement*, 15 December 2011, <http://stakeholders.ofcom.org.uk/binaries/consultations/btpensions/statement/statement.pdf>
- A32.142 Ofcom, *Price controls for wholesale ISDN30 services: Consultation of the form and level of price controls on Openreach wholesale ISDN30 services - Consultation*, 22 December 2011, www.stakeholders.ofcom.org.uk/binaries/consultations/isdn30-2011/summary/isdn30-2011.pdf
- A32.143 Ofcom, *Consumer switching: A consultation on proposals to change the processes for switching fixed voice and broadband providers on the Openreach copper network - Consultation*, 9 February 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/switching-fixed-voice-broadband/summary/condoc.pdf
- A32.144 Ofcom, *Charge control review for LLU and WLR services - Statement*, 7 March 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/statement/statementMarch12.pdf

- A32.145 Ofcom, *Securing the Universal Postal Service. Decision on the new regulatory framework - Statement*, 27 March 2012, <http://stakeholders.ofcom.org.uk/binaries/consultations/review-of-regulatory-conditions/statement/statement.pdf>
- A32.146 Ofcom, *Wholesale ISDN30 charge control - Statement*, 12 April 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/isdn30-price-control/statement/ISDN30_final_statement.pdf
- A32.147 Ofcom, *Business connectivity market review*, 18 June 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/business-connectivity/summary/sections815.pdf
- A32.148 Ofcom, *Leased Lines Charge Control. Proposals for a new charge control framework for certain leased lines services - Consultation*, 5 July 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/lcc-2012/summary/LLCC_2012.pdf
- A32.149 Ofcom, *Assessment of future mobile competition and award of 800 MHz and 2.6 GHz - Statement*, 24 July 2012, <http://stakeholders.ofcom.org.uk/binaries/consultations/award-800mhz/statement/statement.pdf>
- A32.150 Ofcom, *Enforcement Guidelines: Ofcom's guidelines for the handling of competition complaints and complaints concerning regulatory rules - Guidelines*, 25 July 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/draft-enforcement-guidelines/annexes/Enforcement_guidelines.pdf.
- A32.151 Ofcom, *Regulatory financial reporting: a review - Consultation*, 6 September 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/reg-financial-report/summary/condoc.pdf
- A32.152 Ofcom, *Narrowband Market Review: Consultation on possible approaches to cost modelling for the Network Charge Control for the period 2013-2016 - Consultation*, 28 September 2012, www.stakeholders.ofcom.org.uk/binaries/consultations/narrow-band-market-review/summary/condoc.pdf
- A32.153 *Fixed access markets review: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 - Call for Inputs*, 9 November 2012, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/summary/condoc.pdf>
- A32.154 Ofcom, *Consolidated version of General Conditions as at 22 November 2012 (including annotations)*, 22 November 2012, www.stakeholders.ofcom.org.uk/binaries/telecoms/ga/general-conditions22nov12.pdf
- A32.155 Ofcom, *CW/01098/12/12: Dispute relating to whether Openreach offered MPF New Provide to TalkTalk Telecom Group PLC on fair and reasonable terms and conditions*, http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01098/
- A32.156 Ofcom, *Review of the fixed narrowband services markets: Consultation on the proposed markets, market power determinations and remedies - Consultation*, 5

February 2013, www.stakeholders.ofcom.org.uk/binaries/consultations/nmr-2013/summary/NMR_Consultation.pdf

- A32.157 Ofcom, *CW/01103/03/13: Complaint from TalkTalk Telecom Group plc against BT Group plc about alleged margin squeeze in superfast broadband pricing*, www.stakeholders.ofcom.org.uk/enforcement/competition-bulletins/open-cases/all-open-cases/cw_01103/
- A32.158 Ofcom, *Annual Plan 2013/14*, 28 March 2013, www.ofcom.org.uk/files/2013/03/annplan1314.pdf
- A32.159 Ofcom, *Business connectivity market review. Review of retail leased lines, wholesale symmetric broadband origination and wholesale trunk segments - Statement*, 28 March 2013, <http://stakeholders.ofcom.org.uk/consultations/business-connectivity-mr/final-statement/>
- A32.160 Ofcom, *Dispute between BT and TalkTalk relating to MPF to WLR + SMPF simultaneous migration offer - Determination*, 23 April 2013, http://stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01097/Final_Determination_Non_Con1.pdf
- A32.161 Ofcom, *Changes to BT and KCOM's regulatory and financial reporting 2012/13 update - Statement*, 25 April 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/bt-kcom-2012-13/statement/bt-kcom-statement.pdf>
- A32.162 Ofcom, *UK broadband competition reaches new milestone*, 25 April 2013 www.media.ofcom.org.uk/2013/04/25/uk-broadband-competition-reaches-new-milestone/
- A32.163 Ofcom, *Charge control for LLU and WLR services: Adoption of revised SMP Services Conditions following the Competition Appeal Tribunal's Directions of 29 April 2013*, 30 April 2013, <http://stakeholders.ofcom.org.uk/consultations/wlr-cc-2011/charge-control-april2013/>
- A32.164 Ofcom, *File note of meeting with VOA on Cumulo*, 16 May 2013.
- A32.165 Ofcom, *Cost orientation: Review - Consultation*, 5 June 2013, www.stakeholders.ofcom.org.uk/binaries/consultations/cost-orientation/summary/Cost_orientation.pdf
- A32.166 Ofcom, *CW/988/06/08: Complaint from THUS plc and Gamma Telecom Limited against BT about alleged margin squeeze in Wholesale Calls pricing*, 20 June 2013, www.stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_988/final.pdf
- A32.167 Ofcom, *Fixed Access Market Reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30: Consultation on the proposed markets, market power determinations and remedies*, 3 July 2013, <http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-reviews/>
- A32.168 Ofcom, *Review of the wholesale broadband access markets. Consultation on market definition, market power determinations and remedies - Consultation*, 11

July 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/summary/WBA_July_2013.pdf

A32.169 Ofcom, *Fixed access market reviews: Approach to setting LLU and WLR Charge Controls - Consultation*, 11 July 2013, Updated 20 August 2013, <http://stakeholders.ofcom.org.uk/consultations/llu-wlr-cc-13/>

A32.170 Ofcom, *Review of the fixed narrowband services markets. Statement on the proposed markets, market power determinations and remedies – Statement*, 26 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/nmr-2013/statement/Final_Statement.pdf

A32.171 Ofcom, *CW/01109/06/13, Dispute between TalkTalk Group and BT Openreach about single jumpered MPF*, 15 November 2013, http://stakeholders.ofcom.org.uk/enforcement/competition-bulletins/closed-cases/all-closed-cases/cw_01109/

A32.172 Ofcom, *Dispute between TalkTalk and Openreach related to single jumpered MPF – Statement and Determination*, 15 November 2013, http://stakeholders.ofcom.org.uk/binaries/enforcement/competition-bulletins/open-cases/all-open-cases/cw_01019/determination.pdf

A32.173 Ofcom, *LLU and WLR Volumes Forecasts*, December 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex13.xlsx>

A32.174 Ofcom, *Charge control for LLU and WLR services Adoption of revised SMP Services Conditions further to paragraph 3 of the Competition Appeal Tribunal's Directions of 29 April 2013*, 19 December 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/charge-control-december2013/amendment.pdf>

A32.175 Ofcom, *Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR Charge Controls – Consultation*, 19 December 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/summary/famr-2013.pdf>

A32.176 Ofcom, *Consumer Switching. A statement on the GPL NoT+ elements – Statement*, 20 December 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/consumer-switching-review/statement/statement.pdf>

A32.177 Ofcom, *Regulatory Financial Reporting: A review - Consultation*, 20 December 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/bt-transparency/summary/BTRFS.pdf>

EC documents

A32.178 *Judgment of 24 October 1996, Viho / Commission (C-73/95 P, ECR 1996 p. I-5457)*, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:61995CJ0073:EN:PDF

A32.179 *Regulation (EC) No 2887/2000 of the European Parliament and of the Council of 18 December 2000 on unbundled access to the local loop*, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32000R2887:EN:HTML

- A32.180 *Directive 2002/19/EC of the European Parliament and of the Council of 7 March 2002 on access to, and interconnection of, electronic communications networks and associated facilities*, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0007:0020:EN:PDF
- A32.181 *Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services, as amended by Regulation (EC) No 717/2007, Regulation (EC) No 544/2009 and Directive 2009/140/EC*, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CONSLEG:2002L0021:20091219:EN:PDF>
- A32.182 *Directive 2002/22/EC of the European Parliament and of the Council, 7 March 2002*, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2002:108:0051:0051:EN:PDF
- A32.183 *Directive 2002/22/EC of the European Parliament and of the Council (as amended by Directive 2009/136/EC), 7 March 2002*, www.ec.europa.eu/information_society/policy/ecom/doc/136univserv.pdf
- A32.184 *Commission guidelines on market analysis and the assessment of significant market power under the Community regulatory framework for electronic communications networks and services (2002/C 165/03), 11 July 2002*, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2002:165:0006:0031:EN:PDF
- A32.185 *The Treaty of the European Union and the Treaty establishing the European Community (Consolidated Versions), 26 December 2006*, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2006:321E:0001:0331:EN:PDF,
- A32.186 *Commission Recommendation of 17 December 2007 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and of the Council on a common regulatory framework for electronic communications networks and services, (2007/879/EC)*, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:344:0065:0069:en:PDF>
- A32.187 *Explanatory note accompanying the Commission recommendation on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with Directive 2002/21/EC of the European Parliament and the Council on a common regulatory framework for electronic communications networks and services*, https://ec.europa.eu/digital-agenda/sites/digital-agenda/files/sec_2007_1483_2_0.pdf
- A32.188 *Communication from the Commission – Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty (now Article 102 of the Treaty on the Functioning of the European Union) to abusive exclusionary conduct by dominant undertakings (2009/C 45/02), 24 February 2009*, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2009:045:0007:0020:EN:PDF
- A32.189 *Directive 2009/140/EC of the European Parliament and of the Council of 25 November 2009 amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorisation of electronic*

communications networks and services, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0037:0069:EN:PDF

A32.190 *Regulation (EC) No 1211/2009 of the European Parliament and of the Council of 25 November 2009 establishing the Body of European Regulators of Electronic Communications (BEREC) and the Office (the BEREC Regulation)*, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:337:0001:0010:EN:PDF>

A32.191 *Revised European Framework for Electronic Communications*, 18 December 2009, www.ec.europa.eu/information_society/policy/ecomm/index_en.htm

A32.192 *EC response to 2010 WLA consultation*, 1 June 2010, www.stakeholders.ofcom.org.uk/binaries/consultations/wla/responses/european-commission.pdf

A32.193 *Commission recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (NGA) OJ L251/35*, 20 September 2010, www.eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:251:0035:0048:EN:PDF

A32.194 Vice President N. Kroes, *Building our Digital Single Market: 10 steps to deliver broadband*, 30 January 2013, www.europa.eu/rapid/press-release_SPEECH-13-80_en.htm#PR_metaPressRelease_bottom

A32.195 EC, *Commission Recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment*, 11 September 2013, <http://ec.europa.eu/digital-agenda/en/news/commission-recommendation-consistent-non-discrimination-obligations-and-costing-methodologies>

Ofcom research

A32.196 Ofcom, *The Communications Market 2005*, July 2005, www.stakeholders.ofcom.org.uk/binaries/research/cmr/comms_mkt_report05.pdf

A32.197 Ofcom, *The Communications Market 2006*, 10 August 2006, www.stakeholders.ofcom.org.uk/binaries/research/cmr/main.pdf

A32.198 Ofcom, *The Communications Market 2007*, August 2007, www.stakeholders.ofcom.org.uk/binaries/research/cmr/telecoms1.pdf

A32.199 Ofcom, *Narrowband Multi-channels Market Research*, 4 May 2010, www.stakeholders.ofcom.org.uk/binaries/consultations/isdn30/narrowband.pdf

A32.200 Ofcom, *Communications Market Report: UK*, 4 August 2011, http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr11/UK_CM_R_2011_FINAL.pdf

A32.201 Analysys Mason for Ofcom, *UK local access fibre deployment study*, 27 January 2011, www.stakeholders.ofcom.org.uk/binaries/telecoms/policy/local-fibre-access.pdf

A32.202 Ofcom, *Communication Market Report*, 18 July 2012, www.stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/CMR_UK_2012.pdf

- A32.203 Jigsaw Research for Ofcom, *Report for the 2013 Narrowband Market Review*, January 2013, www.stakeholders.ofcom.org.uk/binaries/consultations/nmr-2013/annexes/JR-report.pdf
- A32.204 Ofcom, *The Consumer Experience of 2012*, January 2013, www.stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-12/Consumer_Experience_Research1.pdf
- A32.205 Ofcom, *The Consumer Experience of 2012. Telecoms, internet, digital broadcasting and post - Policy Evaluation Report*, 8 January 2013, http://stakeholders.ofcom.org.uk/binaries/research/consumer-experience/tce-12/Consumer_Experience_Policy_1.pdf
- A32.206 Ofcom, *Technology Tracker*, January-February 2013, www.ofcom.org.uk/static/research/Wave-1-2013-data-tables.zip
- A32.207 Ofcom, *Fixed line installations and fault repair quality of service research*, April 2013, <http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/telecoms-market-data/fault-repair-research.pdf>
- A32.208 Ofcom, *Fixed line installations and fault repair quality of service research*, 3 July 2013, <http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/telecoms-market-data/fault-repair-research.pdf>
- A32.209 Ofcom, *Communications Market Report 2013*, 1 August 2013, http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr13/2013_UK_CMV.pdf
- A32.210 CSMG for Ofcom, *WLR and LLU Fault Rates Analysis: Final report, prepared for Ofcom*, November 2013.
- A32.211 Analysys Mason for Ofcom, *Quality of Service model assessment: Final report for Ofcom*, November 2013.
- A32.212 Analysys Mason for Ofcom, *Review of BT's 2011/12 cost allocation for fixed access markets*, 27 November 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/2011-12-cost-allocation.pdf>
- A32.213 Ofcom, *Infrastructure Report. 2013 Update*, 24 October 2013, updated on 6 December 2013, http://stakeholders.ofcom.org.uk/binaries/research/telecoms-research/infrastructure-report/IRU_2013.pdf
- A32.214 Ofcom, *Business Connectivity Market Review. Timetable and initial call for inputs – Consultation*, 1 April 2014, <http://stakeholders.ofcom.org.uk/consultations/business-connectivity-market-review/>

Third party research

- A32.215 Gilbert Tobin, *Separation regulation of dominant telecommunications operators in today's legacy networks and tomorrow's next generation networks*, <http://www.gtlaw.com.au/wp-content/uploads/Separation-regulation.pdf>
- A32.216 Paul W. Dobson and Michael Waterson, *Chain-Store Competition: Customized vs. Uniform Pricing*, Warwick Economic Research Paper No. 840,

www2.warwick.ac.uk/fac/soc/economics/research/workingpapers/2008/twerp_840.pdf

- A32.217 Wright, S., Mason, R. and Miles, D. on behalf of Smithers and Co, *A Study into Certain Aspects of the Cost of Capital for Regulated Utilities in the U.K.*, 13 February 2003,
http://ofwat.gov.uk/publications/commissioned/rpt_com_costofcapital130203.pdf
- A32.218 Copeland, T.E., Weston, J.F. and Shastri, K., *Financial Theory and Corporate Policy*, 4th Edition, Pearson, (2005).
- A32.219 Brealey, R. A., Myers, S. C., and Allen, F., *Principles of Corporate Finance*, 9th Edition, McGraw-Hill (2006).
- A32.220 Oxera, *Stand-alone costs of capital of Heathrow, Gatwick and Stansted Airports*, 2006.
- A32.221 Arthur D.Little, *The Moment of Truth. Cable infrastructure as a competitive Next Generation Access (NGA) platform in a financial crunch?*, (2009),
http://www.adlittle.com/downloads/tx_adlreports/ADL_The_Moment_of_Truth_02.pdf
- A32.222 EC, *Consumer Market Monitoring Survey (2010)*,
www.ec.europa.eu/consumers/consumer_research/dashboard_part3_en.htm
- A32.223 WIK Consult, *Architectures and competitive models in fibre networks*, December 2010,
http://teams.loop/kc/elib/br/Fixed%20operators%20UK/BT/BT_Redburn%20120314.pdf.
- A32.224 Brealey, R. A., Myers, S. C., and Allen, F., *Principles of Corporate Finance*, 10th Edition, McGraw-Hill (2012).
- A32.225 Deloitte, *Analysis of the Efficiency of BT's Regulated Operations. A report for BT*, 16 February 2012.
- A32.226 WIK-Consult's Study for ECTA, *NGA Progress Report*, March 2012,
www.ectaportal.com/en/upload/File/Press_Releases/2012/NGA_Progress_Report_final.pdf
- A32.227 Roy Morgan Research for the New Zealand Commerce Commission, *Consumer Switching Behaviour in Telecommunications Markets*, April 2012,
www.comcom.govt.nz/assets/Telecommunications/Market-Monitoring/Consumer-Switching-Study-December-2011.pdf
- A32.228 Charles River Associates for DG Information Society and Media, *Costing methodologies and incentives to invest in fibre*, July 2012,
http://www.crai.com/ecp/assets/20120705_finalreport_costing_cra.pdf
- A32.229 Illume Research, *SIP/IP Trunking Market Report & Forecast 2012*, 8 August 2012,
www.matttownend.wordpress.com/tag/sip-trunking
- A32.230 Analysys Mason, *Western Europe telecoms market: forecasts and analysis 2012–2017*, September 2012
- A32.231 Alix Partners, *Economic issues relating to Ofcom's market review of wholesale local access*, 20 December 2012,

www.stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/TalkTalk_Group_additional_p1.pdf

- A32.232 BrandZ™ Top 100 Most Valuable Global Brands 2013, http://www.millwardbrown.com/brandz/2013/Top100/Docs/2013_BrandZ_Top100_Report.pdf
- A32.233 Cullen, *Duct sharing – Prices*, www.cullen-international.com/report/3294/t2456
- A32.234 Frontier Economics, *Fixed Access markets reviews: Call for Inputs. A report on Ofcom's proposals for the cost standard to be used for LLU and WLR charge controls*, January 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/BSkyB_and_TTG_cost_standard1.pdf
- A32.235 Policy Exchange, *The Superfast and the Furious*, 7 January 2013, www.policyexchange.org.uk/images/publications/the%20superfast%20and%20the%20furious.pdf
- A32.236 Europe Economics, *Methodological issues regarding BT's WACC Determination*, 28 January 2013, <http://stakeholders.ofcom.org.uk/consultations/fixed-access-markets/?showResponses=true>
- A32.237 Dimson, E., Marsh, P. and Staunton, M., *Credit Suisse Global Investment Returns Sourcebook 2013*, Credit Suisse Research Institute (February 2013).
- A32.238 Europe Economics, *Heathrow Airport's Cost of Capital. A report on behalf of Heathrow*, February 2013, <http://www.caa.co.uk/docs/78/HeathrowCostOfCapitalStudy.pdf>
- A32.239 WIK-Consult, *Estimating the Costs of GEA*, March 2013, www.stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/TalkTalk_Group_second_addit1.pdf
- A32.240 Enders Analysis, *UK broadband, telephony and pay TV trends Q4 2012*, 4 March 2013.
- A32.241 Fernandez, P., Aguirreamalloa, J. and Linares, P., *Market Risk Premium and Risk Free Rate used for 51 countries in 2013: a survey with 6,237 Answers*, 26 June 2013, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=914160
- A32.242 Analysys Mason, *Western European telecoms market: trends and forecasts 2013 – 2018*, 27 June 2013, <http://www.analysismason.com/Research/Content/Regional-forecasts-/Western-Europe-forecast-2013-2018-Jun2013-RDDF0-RDDG0/#27%20June%202013>
- A32.243 A. Holmans, *New Estimates of Housing Demand and Need in England, 2011 to 2031*, T&CP Tomorrow Series Paper 16, September 2013, http://www.cchpr.landecon.cam.ac.uk/Downloads/HousingDemandNeed_TCPA2013.pdf
- A32.244 Grzybowski, L. and Verboven, F., *Substitution and Complementarity between Fixed-line and Mobile Access*, Net Institute, September 2013, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2335696

- A32.245 Plum Consulting, *Future evolution of fibre regulation. A report for BT*, September 2013,
http://www.plumconsulting.co.uk/pdfs/Plum_Sept2013_Future_evolution_of_fibre_regulation.pdf
- A32.246 Competition Economists Group, *Assessing the glide path for the removal of pricing distortions*, 4 September 2013,
http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/EE_-_Annex_A.pdf
- A32.247 Deloitte, *Analysis of the Efficiency of BT's Regulated Operations*, 19 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/responses/BT_Deloitte_Report.pdf
- A32.248 Oxera, *Assessment of Ofcom's analysis to set the efficiency target. Is the proposed 4–6% range consistent with the evidence?*, Report prepared for BT/Openreach, 25 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Openreach_Annex_C.pdf
- A32.249 Europe Economics for Sky, *Disaggregating the BT Group Asset Beta. Report for Sky and TalkTalk*, October 2013,
http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Europe_Economics_report.pdf
- A32.250 Frontier Economics for Sky and TalkTalk, *Ofcom's LLU and WLR Charge Controls Proposals. A report prepared for Sky and TalkTalk*, October 2013,
http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Frontier_Economics_report.pdf
- A32.251 Deloitte, *BT RFS Attribution Methodology Changes*, 15 October 2013,
<http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/IndependentreviewbyDeloitteofBTRFSAttributionMethodologyChanges.pdf>
- A32.252 Frontier Economics for Vodafone, *The Profitability of BT's Regulated Services. A report prepared for Vodafone*, November 2013,
http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Vodafone_Frontier_Economics_report.pdf
- A32.253 Ernst & Young, *Openreach's Discrete Event Simulation Model: Methodology Document*, November 2013.
- A32.254 Berkeley Research Group (BRG), *BT's Regulatory Financial Statements 2012/13: Executive Summary*, December 2013,
http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Colt_and_Vodafone_-_BRG_Report_on_BT_RFS.pdf.
- A32.255 Brealey, R., A., Myers, S., C. and Allen, F., *Principles of Corporate Finance*, 11th Edition, McGraw-Hill (2014).
- A32.256 Frontier Economics for Sky and TalkTalk, *Regulated Costs for BT's Copper Cable: a report prepared for Sky and TalkTalk*, January 2014,
http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky_and_TalkTalk_Group_Regulated_Costs_for_BTs_Copper_Cable.pdf
- A32.257 Alix Partners for Sky, *Fixed access market reviews: Assessment of Ofcom's approach to Openreach Quality of service, report for Sky*, February 2014,

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Sky_Alix_Partners_report.pdf

A32.258 Analysys Mason for Openreach, *Report for Openreach: SLA and SLG comparisons for WLR and LLU MPF*, February 2014,

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Openreach_Annex_D.pdf

A32.259 Deloitte for Openreach, *Openreach Faults Data - Data Analysis. Update report covering the period April 2011 to January 2014, report for Openreach*, February 2014.

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Openreach_Annex_B.pdf.

A32.260 Ernst & Young for Openreach, *Fixed Access Market Review: EY response to comments made by Ofcom and Analysys Mason in respect of the Openreach Discrete Event Simulation Model, report for Openreach*, February 2014,

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Openreach_Annex_C_E_and_Y.pdf.

A32.261 Frontier Economics for Sky and TalkTalk, *FAMR: Review of Openreach's DES model. A report prepared for BSkyB and TalkTalk*, February 2014,

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Sky_and_TalkTalk_-_Frontier_Economics_Review_of_Openreachs_DES_Model.pdf

A32.262 Frontier Economics for Sky and TalkTalk, *Treatment of the level of faults in the LLU and WLR charge controls for 2014-17. A report prepared for BSkyB and TalkTalk*,

February 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Sky_and_TalkTalk_-_Frontier_Economics_Fault_Rates_Report.pdf

A32.263 FTI Consulting, *Ofcom's consultation on BT's Regulatory Financial Reporting, February 2014*,

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/BT_Group_-_FTI_Consulting_report_on_BT_RFS.pdf

A32.264 Dimson, E., Marsh, P. and Staunton, M., *Credit Suisse Global Investment Returns Sourcebook 2013*, Credit Suisse Research Institute (February 2014).

A32.265 Plum Consulting for BT, *Mind the gap: why the MPF vs WLR+SMPF price differential should be aligned with costs immediately. A report for BT*, February 2014,

http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Plum_Report_on_MPF_vs_WLRplusSMPF_price_differential.pdf

A32.266 Analysys Mason, *Fixed voice and broadband in Europe: forecasts 2013–2018*, 10 February 2014.

A32.267 Illume Research, *Hosted VOIP Report and Forecast 2014-2018*, 3 March 2014.

A32.268 Illume Research, *SIP/IP Trunking Market Report & Forecast 2014-2018*, 3 March 2014.

Websites and news articles

A32.269 BBC (www.bbc.co.uk)

- *How can a graph be so very wrong?*, 20 April 2009, <http://news.bbc.co.uk/1/hi/8000402.stm>
- *Government reveals super-fast broadband plans*, 6 December 2010, <http://www.bbc.co.uk/news/technology-11922424>
- *Premier League rights sold to BT and BSkyB for £3bn*, 13 June 2012, <http://www.bbc.co.uk/news/business-18430036>
- *Champions League: BT Sport wins £897m football rights deal*, 9 November 2013, <http://www.bbc.co.uk/sport/0/football/24879138>

A32.270 BIS, *Business population estimates*,
(<https://www.gov.uk/government/organisations/department-for-business-innovation-skills/series/business-population-estimates>)

A32.271 BT, *Business products and services* (www.business.bt.com)

- *Business phone lines and call plans*, www.business.bt.com/phone-services/business-phone-lines/
- *ISDN2 and ISDN30 services*, www.business.bt.com/phone-services/isdn
- *ISDN2 and ISDN30 pricing*, www.business.bt.com/phone-services/isdn/pricing/

A32.272 BT, *Home products and services* (www.productsandservices.bt.com)

- *Phone and calling plans*, www.productsandservices.bt.com/products/landline/packages

A32.273 BT, *Managed network IT services and communications*
(www.globalservices.bt.com)

- *ISDN2e pricing options*, www.globalservices.bt.com/static/assets/pdf/products/isdn2e/BT_One_Voice_access_ISDN_2e_pricing_options_010113.pdf

A32.274 Chorus (<http://www.chorus.co.nz/our-products>)

A32.275 DCLG

- *Live tables on household projections*, (<https://www.gov.uk/government/statistical-data-sets/live-tables-on-household-projections>)
- *Definitions of general housing terms*, 14 November 2012, <https://www.gov.uk/definitions-of-general-housing-terms>

A32.276 Gov.uk, *Stimulating private sector investment to achieve a transformation in broadband in the UK by 2015* (www.gov.uk/government/policies/transforming-uk-broadband)

A32.277 Hyperoptic (www.hyperoptic.com)

- *Hyperoptic secures £50 million investment*, 23 May 2013, www.hyperoptic.com/web/guest/press?p_p_id=press_WAR_pressportlet&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-1&p_p_col_count=1&press_WAR_pressportlet_render=article&press_WAR_pressportlet_urlTitle=hyperoptic-secures-%C2%A350-million-investment

A32.278 ISP review (www.ispreview.co.uk)

- *UPDATE2 UK Spending Review Confirms GBP530m for Rural Broadband Development*, 20 October 2010, <http://www.ispreview.co.uk/story/2010/10/20/uk-spending-reviews-confirms-gbp530m-for-rural-broadband-development.html>
- *Digital region picks new operator to run its South Yorkshire UK network*, 7 February 2013, www.ispreview.co.uk/index.php/2013/02/digital-region-pick-new-operator-to-run-its-south-yorkshire-uk-network.html
- *Alternative MS3 Ultrafast Fibre Optic Network Goes Live in Hull UK*, 11 April 2013, www.ispreview.co.uk/2013/04/ms3
- *Fixed Wireless 4G LTE Broadband Networks Face Challenges in Rural Areas*, 24 October 2013, <http://www.ispreview.co.uk/index.php/2013/10/fixed-wireless-4g-lte-broadband-networks-face-challenges-rural-areas.html>

A32.279 KCOM Group (www.kcomplc.com)

- *Price manual – business services* (<http://pricing.k-c.co.uk/business-main.asp>)

A32.280 MS3 (www.ms-3.co.uk)

- *About us*, www.ms-3.co.uk/pages/about-us
- *MS3 expand with Garness Jones*, 11 January 2013, www.ms-3.co.uk/articles/5
- *MS3 network officially live*, 10 April 2013, www.ms-3.co.uk/articles/7

A32.281 NICC, *UK interoperability standards* (www.niccstandards.org.uk)

A32.282 ONS, *National population estimates and projections*, (<http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-315018> and <http://www.ons.gov.uk/ons/publications/re-reference-tables.html?edition=tcm%3A77-318453>)

A32.283 Openreach (www.openreach.co.uk)

- *Equivalence Management Platform*, www.openreach.co.uk/orpg/home/helpandsupport/help_support/downloads/emp_high_level_view.pdf.
- *Fact sheet: Time Related Charges*, www.openreach.co.uk/orpg/home/products/serviceproducts/timerelatedcharges/timerelatedcharges/downloads/TRCs.pdf
- *Fibre only exchanges*, www.openreach.co.uk/orpg/home/products/super-fastfibreaccess/fibreonlyex/fibreonlyex.do

- *GEA-FTTC Product Description (requires login)*, www.openreach.co.uk/orpg/customerzone/products/super-fastfibreaccess/fibretothecabinet/description/downloads/FTTC%20Product%20Description%20Issue%209.pdf
- *Price list, WLR ISDN30*, www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=WH17ucyC%2Fv7E1PoECWJLs3T0E4HidA8NS2h%2Bn9f3uuQIMnGHsqdC0vzO163bJmh34D91D7M0q8u%2F%0AllSqtIFAKw%3D%3D
- *Service maintenance levels*, <http://www.openreach.co.uk/orpg/home/products/serviceproducts/serviceharmonisation/serviceharmonisation.do>

A32.284 OTA2 (www.offta.org.uk)

- *Update for March 2011*, www.offta.org.uk/updates/otaupdate20110405.htm
- *Update for January 2012*, www.offta.org.uk/updates/otaupdate20120207.htm
- *Update for September 2011*, <http://www.offta.org.uk/updates/otaupdate20111004.htm>

A32.285 TalkTalk (www.talktalk.co.uk)

- *TalkTalk Broadband*, www.sales.talktalk.co.uk/product/broadband/essentials
- *TalkTalk partners with Fujitsu and Post Office*, <http://www.talktalkbusiness.co.uk/news-events/news-ttb-listing/video-news/talktalk-partners-with-fujitsu-and-post-office/>

A32.286 TalkTalk, *TalkTalk Business* (www.talktalkbusiness.co.uk)

- *IP-ISDN30*, www.talktalkbusiness.co.uk/products-and-services/voice-services/calls-lines-wlr3--cps/ip-isdn30/
- *UK sports rights inflation in six graphs*, 11 November 2013, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/10440715/UK-sports-rights-inflation-in-six-graphs.html>
- *BT's push on sports TV starts to pay off*, 31 January 2014, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/10609033/BTs-push-on-sports-TV-starts-to-pay-off.html>

A32.287 The Guardian (www.theguardian.com/uk)

- *BT pledges extra £1bn for fibre network after returning to profit*, 13 May 2010, <http://www.theguardian.com/business/marketforceslive/2010/may/13/btgroup-telecoms-fibre-optic-network>
- *Market for TV sport to hit record £16bn in 2014 as broadcasters play hardball*, 3 January 2014, <http://www.theguardian.com/media/2014/jan/03/tv-sport-rights-market-record-growth-2014>

- *BT's push into football and fibre broadband drives up revenues*, 31 January 2014, <http://www.theguardian.com/business/2014/jan/31/bt-sport-football-fibre-broadband-revenues-profits>

A32.288 The Telegraph (www.telegraph.co.uk)

- *BT makes shock grab for Premier League rights*, 13 June 2012, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/media/9330417/BT-makes-shock-grab-for-Premier-League-rights.html>
- *BT wins rights to broadcast Premiership rugby in £152m deal*, 12 September 2012, <http://www.telegraph.co.uk/finance/newsbysector/mediatechnologyandtelecoms/media/9538070/BT-wins-rights-to-broadcast-Premiership-rugby-in-152m-deal.html>

A32.289 Virgin

- *Virgin Media boosts Britain's broadband speeds*, 11 January 2012.
- *Virgin Media full year 2013 operational results*, 13 February 2014, <http://investors.virginmedia.com/phoenix.zhtml?c=135485&p=irol-newsarticle&ID=1899958>

A32.290 ZDNET (www.zdnet.com)

- *BT to roll out fibre to 10m UK homes*, 15 July 2008, <http://www.zdnet.com/bt-to-roll-out-fibre-to-10m-uk-homes-3039447462/>
- *NBN: fibre to the world*, 24 March 2013, www.zdnet.com/nbn-fibre-to-the-world_p3-7000012385/

A32.291 Bloomberg, *BT to Suspend Buyback Plan for Fiber-Optic Investment*, 15 July 2008, <http://www.bloomberg.com/apps/news?pid=newsarchive&sid=a0Dwzplt8tVM&refer=technology>

A32.292 London Stock Exchange, *Welcome stories. The London Stock Exchange welcomes Virgin Media to the Main Market*, 1 October 2009, <http://www.londonstockexchange.com/companies-and-advisors/news-events/welcome/01-10-09-virgin-media.htm>

A32.293 Cable, *BT announces fibre optic broadband pricing*, 21 January 2010, <http://www.cable.co.uk/news/bt-announces-fibre-optic-broadband-pricing-19570774/>

A32.294 Mobile Business, *BT Launches BT Infinity Super>Fast Broadband*, 21 January 2010, <http://commsbusiness.co.uk/news/bt-launches-bt-infinity-superfast-broadband/>

A32.295 Broadband Watchdog, *BT confirm extra £1bn for fibre broadband network*, 14 May 2010, <http://www.broadbandwatchdog.co.uk/story/tag/bt-invest-2-5-billion-in-fibre-optic-network/>

A32.296 GSMA Intelligence, *Germany rolls-out LTE to rural areas*, 2 June 2011, <https://gsmaintelligence.com/analysis/2011/06/germany-rolls-out-lte-to-rural-areas/283/>

- A32.297 BT, *BT speeds up fibre plans once again*, 1 November 2012
www.btplc.com/News/Articles/Showarticle.cfm?ArticleID=B95CCF6C-F125-4ABF-A78D-82476B31A07C
- A32.298 Sky, *Sky to acquire Telefónica UK's broadband and fixed-line telephony business*, 1 March 2013,
http://corporate.sky.com/media/press_releases/2013/sky_to_acquire_telefonicas_uk_broadband_and_fixed_line_telephony_business#
- A32.299 Mobile News, *Customers to replace fixed lines with 4G, claims Ofcom*, 13 August 2013, <http://www.mobilenewscwp.co.uk/2013/08/13/customers-to-replace-fixed-lines-with-4g-claims-ofcom/>
- A32.300 Deloitte, *Deloitte report demonstrates strong outlook for 4G*, 18 September 2013,
http://www.deloitte.com/view/en_GB/uk/industries/tmt/b0aa8cf61c131410VgnVCM200003356f70aRCRD.htm
- A32.301 OBR, *December 2013 Economic and fiscal outlook: Charts & Tables*, December 2013, <http://budgetresponsibility.org.uk/pubs/December-2013-EFO-Charts-and-Tables2.xls>
- A32.302 The Financial Times, *BT reaps benefits from pay-TV drive*, 31 January 2014,
http://www.ft.com/cms/s/047725ba-8a4e-11e3-9c29-00144feab7de.Authorised=false.html?_i_location=http%3A%2F%2Fwww.ft.com%2Fcms%2Fs%2F0%2F047725ba-8a4e-11e3-9c29-00144feab7de.html%3Fsiteedition%3Duk&siteedition=uk&_i_referer=#axzz2tagDY1aA
- A32.303 PCPro, *Three scraps UK's last unlimited tethering package*, 18 March 2014,
<http://www.pcpro.co.uk/news/broadband/387355/three-scraps-uks-last-unlimited-tethering-package>
- A32.304 CWU, *CWU Rejects BT's Pay Offer*, 1 April 2014, <http://www.cwu-cctv.org/article.php?articleid=563>

Other documents

Bank of England

- A32.305 Bank of England, *Inflation Report*, February 2014,
<http://www.bankofengland.co.uk/publications/Documents/inflationreport/2014/ir14feb.pdf>

BEREC

- A32.306 ERG (03) 09rev3, *Revised ERG Working paper on the SMP concept for the new regulatory framework*, September 2005,
http://berec.europa.eu/doc/publications/public_hearing_concept_smp/erg_03_09rev3_smp_common_concept.pdf
- A32.307 ERG (06) 33, *Revised ERG Common Position on the approach to Appropriate remedies in the ECNS regulatory framework*, May 2006,
http://www.irg.eu/streaming/erg_06_33_remedies_common_position_june_06.pdf?contentId=542920&field=ATTACHED_FILE

- A32.308 ERG (08) 20b, *ERG Report on the Public Consultation of the ERG Common Position on Geographic Aspects of Market Analysis (definition and remedies)*, September 2008,
[http://www.irg.eu/streaming/ERG%20\(08\)%2020b%20final%20CP%20Geog%20Aspects%20cons%20report%20081016.pdf?contentId=545368&field=ATTACHED_FILE](http://www.irg.eu/streaming/ERG%20(08)%2020b%20final%20CP%20Geog%20Aspects%20cons%20report%20081016.pdf?contentId=545368&field=ATTACHED_FILE)
- A32.309 ERG (09) 07, *Report on the Discussion on the application of margin squeeze tests to bundles*, March 2009,
[www.irg.eu/streaming/ERG \(09\) 07 Report on the Discussion of the application of Margin Squeeze tests to bundles.pdf?contentId=545844&field=ATTACHED_FILE](http://www.irg.eu/streaming/ERG%20(09)%2007%20Report%20on%20the%20Discussion%20of%20the%20application%20of%20Margin%20Squeeze%20tests%20to%20bundles.pdf?contentId=545844&field=ATTACHED_FILE)
- A32.310 BoR (10) 34, *BEREC report on best practices to facilitate consumer switching*, October 2010, www.berec.europa.eu/doc/berec/bor_10_34_rev1.pdf
- A32.311 BoR (10) 64, *BEREC report on the impact of bundled offers in retail and wholesale market definition*, December 2010,
http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/?doc=209
- A32.312 BoR (12) 127, *BEREC common position on best practice in remedies on the market for wholesale (physical) network infrastructure access (including shared or fully unbundled access) at a fixed location imposed as a consequence of a position of significant market power in the relevant market*, 8 December 2012,
[www.berec.europa.eu/files/document_register_store/2012/12/20121208163628_BoR \(12\) 127 BEREC COMMON POSITION ON BEST PRACTICE IN REMEDIES ON THE MARKET FOR WHOLESALE.pdf](http://www.berec.europa.eu/files/document_register_store/2012/12/20121208163628_BoR%20(12)%20127_BEREC_COMMON_POSITION_ON_BEST_PRACTICE_IN_REMEDIES_ON_THE_MARKET_FOR_WHOLESALE.pdf)
- A32.313 BoR (12) 128, *BEREC common position on best practice in remedies on the market for wholesale broadband access (including bitstream access) imposed as a consequence of a position of significant market power in the relevant market*, 8 December 2012,
[www.berec.europa.eu/files/document_register_store/2012/12/BoR \(12\) 128 CP WBA.pdf](http://www.berec.europa.eu/files/document_register_store/2012/12/BoR%20(12)%20128_CP_WBA.pdf)
- A32.314 BEREC press release, BoR (13) 33, *BEREC provides an update on its opinion on the Commission's draft Recommendation on cost orientation and non-discrimination*, 11 March 2013,
www.berec.europa.eu/eng/document_register/subject_matter/berec/press_releases/?doc=1222
- A32.315 BoR (13) 41, *BEREC Opinion on Commission draft Recommendation on non-discrimination and costing methodologies*, 26 March 2013,
www.berec.europa.eu/eng/document_register/subject_matter/berec/opinions/?doc=1244

BT

A32.316 Regulatory financial statements (RFS):

- BT, *Current Cost Financial Statements for 2012 including Openreach Undertakings*, 31 July 2012, (BT's 2011/12 RFS),
http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/RFS_2012.pdf

- BT, *Current Cost Financial Statements 2013 including Openreach Undertakings – Statement by Ofcom*, 2013, (BT's 2012/13 RFS)
<http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/CurrentCostFinancialStatements2013.pdf>

All BT RFS are available at:

<http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/index.htm>

A32.317 Letter from BT to Ofcom, *Floors for future broadband pricing*, 10 November 2006,
www.stakeholders.ofcom.org.uk/binaries/telecoms/policy/bb/floors.pdf

A32.318 BT, *Delivering super-fast broadband in the UK*, 5 December 2008,
<https://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Consultativeresponses/Ofcom/2008/Superfastbroadband/>

A32.319 BT, *Detailed Attribution Methods (DAM) 2012*, 31 July 2012,
http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/DAM_2012.pdf

A32.320 BT, *Primary Accounting Documents*, 31 July 2012,
http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2012/PADS_2012.pdf

A32.321 BT, *BT's response to Ofcom's Call for Inputs on the Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30*, 8 January 2013,
<http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-markets/responses/BT.pdf>

A32.322 *Results for the Fourth Quarter and Year to 31 March 2013*, 10 May 2013,
www.btplc.com/News/ResultsPDF/q413_release.pdf

A32.323 BT, *Q4/full year 2012/13 results and business update – Part 2*, 10 May 2013,
www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_slides_update_part2.pdf

A32.324 BT, *Q4 2012/13 Results Presentation Transcript - Part 2*, 10 May 2013,
http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q413_transcript2.pdf

A32.325 BT, *Openreach compliance statement for the ISN30 charge controls for the period 1 April 2012 to 31 March 2013*, 14 June 2013.

A32.326 BT, *Openreach compliance statement for the LLU and WLR charge controls for the period 1 April 2012 to 31 March 2013*, 14 June 2013.

A32.327 BT, *BT Pre Q2 2013-14 Consensus*, 25 July 2013,
<https://www.btplc.com/Sharesandperformance/Quarterlyresults/Quarterlyresults.htm>

A32.328 BT, *Detailed Attribution Methods (DAM) 2013*, 31 July 2013,
<https://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/DAM2013.pdf>

A32.329 BT, *BT's response to Ofcom's consultation document, "Review of Wholesale Broadband Access Markets"*, 25 September 2013,

<http://stakeholders.ofcom.org.uk/binaries/consultations/review-wba-markets/responses/BT.pdf>

A32.330 BT, *BT's response to Ofcom's consultation document "Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30" and comments on key charge control issues, including responses to relevant questions in Ofcom's consultation document "Fixed access market reviews: Approach to setting LLU and WLR Charge Controls"*, 30 September 2013, <http://projects/sites/lluwlrcc2014/cons/Main%20consultation/Responses/20131105%20BT%20Group%20NON-CONFIDENTIAL.pdf>

A32.331 BT, *Report requested by Ofcom describing certain changes to the Accounting Documents for the year ended 31 March 2013 and illustrating the resulting differences to the Current Cost Financial Statements had those changes not applied*, 3 October 2013, <https://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/ReportrequestedbyOfcomfortheyearended31March2013.pdf>

A32.332 BT, *Current Cost Financial Statements 2013 including Openreach Undertakings – Statement by Ofcom*, <http://www.btplc.com/Thegroup/RegulatoryandPublicaffairs/Financialstatements/2013/CurrentCostFinancialStatements2013.pdf>

A32.333 BT, *BT Pre-Q4 2013-14 Consensus*, 31 January 2014, <https://www.btplc.com/Sharesandperformance/Quarterlyresults/Quarterlyresults.htm>

A32.334 BT, *Key Performance Indicators Q3 2013/14*, 31 January 2014, <http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q314-KPIs.pdf>

A32.335 BT Group, *TSO methodology changes spreadsheet*, February 2014.

A32.336 FTI Consulting, *Ofcom's consultation on BT's Regulatory Financial Reporting*, February 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/BT_Group_-_FTI_Consulting_report_on_BT_RFS.pdf

A32.337 BT, *Key Performance Indicators Q4 2013/14*, 8 May 2014, <http://www.btplc.com/Sharesandperformance/Quarterlyresults/PDFdownloads/q414-KPIs.pdf>

A32.338 BT, *Results for the Fourth Quarter and Year to 31 March 2014*, 8 May 2014 <http://www.btplc.com/News/ResultsPDF/q414-release.pdf>

Commission for Communications Regulation

A32.339 Commission for Communications Regulation, *Next Generation Access: Remedies for Next Generation Access market*, 31 January 2013, www.comreg.ie/fileupload/publications/ComReg1311.pdf

Competition Appeal Tribunal

A32.340 *Communication Appeals Tribunal Notice of Appeal under Section 192 of The Communications Act 2003 Case No 1212/3/3/13* 30, May 2013, www.catribunal.org.uk/237-8028/1212-3-3-13-Colt-Technology-Services.html

Competition Commission

- A32.341 Competition Commission, *Stansted Airport Ltd. Q5 price control review*, 23 October 2008, <http://www.caa.co.uk/default.aspx?catid=78&pageid=10232>
- A32.342 Competition Commission, *Bristol Water plc. A reference under section 12(3)(a) of the Water Industry Act 1991*, 4 August 2010, http://webarchive.nationalarchives.gov.uk/+http://www.competition-commission.org.uk/rep_pub/reports/2010/fulltext/558_appendices.pdf
- A32.343 Competition Commission, *The Carphone Warehouse Group plc v Office of Communications, Case 1111/3/3/09 - Determination*, 31 August 2010, <http://www.catribunal.org.uk/237-4154/1111-3-3-09-The-Carphone-Warehouse-Group-plc.html>
- A32.344 Competition Commission, *The Carphone Warehouse Group plc v Office of Communications. Case 1149/3/3/09 - Determination*, 31 August 2010, http://webarchive.nationalarchives.gov.uk/+http://www.competition-commission.org.uk/appeals/communications_act/wlr_determination.pdf
- A32.345 Competition Commission, *Good practice in the design and presentation of consumer survey evidence in merger inquiries*, March 2011, http://www.ofg.gov.uk/shared_ofg/consultations/merger-inquiries/Good-practice-guide.pdf
- A32.346 Competition Commission, *British Telecommunications plc v Office of Communications supported by British Sky Broadcasting Limited, TalkTalk Telecom Group plc Case 1187/3/3/11 - Determination*, 11 June 2011, http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/british-telecommunications-plc-appeal/wba_determination.pdf
- A32.347 Competition Commission, *British Telecommunications plc v Office of Communications, Case 1180/3/3/11; Everything Everywhere Limited v Office of Communications, Case 1181/3/3/11; Hutchison 3G UK Limited v Office of Communications, Case 1182/3/3/11; Vodafone Limited v Office of Communications, Case 1183/3/3/11; and Telefónica UK Limited - Determination*, 9 February 2012, http://www.competition-commission.org.uk/assets/competitioncommission/docs/appeals/telecommunication-s-price-control-appeals/final_determination.pdf
- A32.348 Competition Commission, *References under section 193 of the Communications Act 2003: British Telecommunications Plc v Office of Communications, Case 1193/3/3/12; British Sky Broadcasting Limited and TalkTalk Telecom Group Plc v Office of Communications, Case 1192/3/3/12 – Determinations*, 27 March 2013, http://catribunal.org/files/1192-93_BSkyB_CC_Determination_270313.pdf
- A32.349 Competition Commission, *Northern Ireland Electricity Limited price determination. A reference under Article 15 of the Electricity (Northern Ireland) Order 1992 – Final determination*, 26 March 2014 https://assets.digital.cabinet-office.gov.uk/media/535a5768ed915d0fdb000003/NIE_Final_determination.pdf
- A32.350 Competition Commission, *Cable & Wireless UK v Office of Communications. Case 1112/3/3/09 - Determination*, 30 June 2010, http://www.competition-commission.org.uk/assets/competitioncommission/docs/pdf/non-inquiry/appeals/communications_act/final_determination_excised_version_for_publication

Department of Energy and Climate Change

A32.351 DECC, *Updated energy and emissions projections: 2012. Annex F: Price Growth Assumptions*, 15 October 2012, <https://www.gov.uk/government/publications/2012-energy-and-emissions-projections>

A32.352 DECC, *Energy & Emission Projections*, 17 September 2013, <https://www.gov.uk/government/collections/energy-and-emissions-projections>

EE

A32.353 EE, *Fixed access market reviews: Approach to setting LLU and WLR Charge Controls. Consultation on market definition, market power determinations and remedies. Response of EE Limited*, 27 September 2013: <http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/EE.pdf>

A32.354 EE, *Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30. Consultation on market definition, market power determinations and remedies. Response of EE Limited*, 30 September 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-reviews/responses/EE.pdf>.

A32.355 Letter from Kip Meek to Stuart McIntosh dated 5 March 2014, entitled “Fixed Market Access Review: Openreach quality of service and approach to setting LLU and WLR Charge Controls”, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/EE_Additional_Evidence_to_Ofcom_on_directories.pdf

Federation of Communication Services

A32.356 FCS, *Ofcom FAMR – Approach to setting LLU and WLR Charge Controls Issued 11 July 2013*, 25 September 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Federation_of_Communication_Services_Ltd.pdf

HM Treasury

A32.357 HM Treasury, *Forecasts for the UK Economy: a comparison of independent forecasts*, February 2014, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/283983/2014_02forecomp.pdf

A32.358 HM Treasury, *GDP deflators at market prices, and money GDP: December 2013*, updated 8 January 2014, <https://www.gov.uk/government/publications/gdp-deflators-at-market-prices-and-money-gdp-march-2013>

InfoDev

A32.359 InfoDev, *Telecommunications Regulation Handbook* (2000), www.infodev.org/en/publication.22.html

KCOM

A32.360 KCOM, *New Services Manual, Part 2*, January 2011, www.kcomplc.com/docs/regulatory-pdf/reg_rio_knsm.pdf

A32.361 *Draft Reference Offer for LLU*, www.kcomplc.com/regulatory-information/reference-offers/kc-local-loop-unbundling/

A32.362 *Regulatory Financial Statements for the year ending 31 March 2012*, 27 July 2012, www.kcomplc.com/docs/regulatory-pdf/final_statements_2012.pdf

Office for Budget Responsibility

A32.363 Office for Budget Responsibility, *The long-run difference between RPI and CPI inflation*, November 2011, <http://cdn.budgetresponsibility.independent.gov.uk/Working-paper-No2-The-long-run-difference-between-RPI-and-CPI-inflation.pdf>

A32.364 Office for Budget Responsibility, *Economic and fiscal outlook - March 2013* <http://budgetresponsibility.independent.gov.uk/category/topics/economic-forecasts/>

OFT

A32.365 OFT, *Market definition*, December 2004, OFT403, www.of.gov.uk/shared_of/business_leaflets/ca98_guidelines/of403.pdf

ONS

A32.366 ONS, *Interim 2011-based subnational population projections for England*, 28 September 2012, www.ons.gov.uk/ons/rel/snpp/sub-national-population-projections/Interim-2011-based/index.html

A32.367 ONS, *National Statistician's consultation on options for improving the Retail Prices Index*, October 2012, http://www.teachers.org.uk/files/consultation-options-for-improving-rpi_0.pdf

A32.368 ONS, *National Statistician announces outcome of consultation on RPI*, 10 January 2013, <http://www.ons.gov.uk/ons/rel/mro/news-release/rpirecommendations/rpinewsrelease.html>

A32.369 ONS, *National Population Projections, 2012-based Statistical Bulletin*, 06 November 2013, <http://www.ons.gov.uk/ons/rel/npp/national-population-projections/2012-based-projections/stb-2012-based-npp-principal-and-key-variants.html>

A32.370 ONS, *Consumer Price Inflation Detailed Briefing Note, December 2013*, 21 January 2014, http://www.ons.gov.uk/ons/dcp171776_349509.pdf

A32.371 ONS, *Average Weekly Earnings Dataset*, 19 March 2014, <http://www.ons.gov.uk/ons/rel/lms/labour-market-statistics/march-2014/dataset--earnings.html>

Openreach

A32.372 *Openreach response to 2009 first consultation on WLR charge controls*, www.stakeholders.ofcom.org.uk/binaries/consultations/wlrc/responses/bt_response.pdf

A32.373 Openreach price lists:

- Openreach price list, WLR Pricing, Wholesale Calling and Network Features, 4 September 2009,

- <http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=EwnpVKiM8jvUpuFwx0E%2FdRXQI8%2Bm%2BTHtnjVNUjalCHwIMnGHsqdC0vzO163bJmh34D91D7M0q8u%2F%0AIIStlFAKw%3D%3D>
- Openreach price list, WLR pricing, Wholesale Access (Analogue Lines), 1 March 2013,
<http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=PqMT6el2nnlo4hhO70Yda27EtHRtVUAuOBA%2F5MusDN1UNeIS4WkJBRh6z%2FRUAlt8maxtgrEro1A7%0Aw5V8nzAZpQ%3D%3D>
 - Openreach price list, LLU Pricing, full MPF, 24 May 2013,
<http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=totid5BwFmkf9vLcBITRyZF9loRxWlBKK6V7YWmiYAlMnGHsqdC0vzO163bJmh34D91D7M0q8u%2F%0AIIStlFAKw%3D%3D>
 - Openreach price list, LLU Pricing, shared MPF, 24 May 2013,
<http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=LI%2BLzfp8sh2Y2DndjiRMoqOJDxc5GerAOSBb9tNt8RglMnGHsqdC0vzO163bJmh34D91D7M0q8u%2F%0AIIStlFAKw%3D%3D>
 - Openreach price list, WLR Pricing, Wholesale Access (Analogue Lines), 25 June 2013,
<http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=ccW/y9ZJoVtf1qb2YRVL3pYSkcG%2Bc%2B30URCuKyqKmgSNUNeIS4WkJBRh6z%2FRUAlt8maxtgrEro1A7%0Aw5V8nzAZpQ%3D%3D>
 - Openreach price list, Service Product Pricing, Common products (Subject to applicable LLU/SLU/WLR/Ethernet/GEA Product Agreements), Time Related Charges (Including Shifts),
<http://www.openreach.co.uk/orpg/home/products/pricing/loadProductPriceDetails.do?data=hcaYjIWegP2u2KS8FTdcOBScuIM1Opem5f8dVePnh8UIMnGHsqdC0vzO163bJmh34D91D7M0q8u%2F%0AIIStlFAKw%3D%3D>

All Openreach price lists are available at:

<http://www.openreach.co.uk/orpg/home/products/pricing/loadPricing.do>

A32.374 Openreach, *Presentation to Ofcom: Network and Calling features*, November 2012.

A32.375 Openreach, *How to raise a Statement of Requirement for Openreach Products*, Issue 7, 18 April 2013.

A32.376 Openreach, *GEN027/13 Physical Infrastructure Access (PIA) Update*, 17 May 2013,
www.openreach.co.uk/orpg/home/updates/briefings/generalbriefings/generalbriefings/articles/gen02713.do

A32.377 Email from Openreach to Ofcom, *Fixed Access Market Reviews: Approach to setting any future LLU and WLR Charge Controls*, 28 May 2013

A32.378 Openreach, *Openreach response to questions in Ofcom's consultation document "Fixed access market reviews: Approach to setting LLU and WLR Charge Controls"*, 30 September 2013, <http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Openreach.pdf>

A32.379 Openreach, *Openreach analysis of additional factors impacting service costs in very high performance scenarios*, November 2013,

<http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex7.pdf>

A32.380 Openreach, *Case Study - Recent UK Flooding and Implications for Openreach*, February 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Openreach_-_Annex_A_Weather_Case_Study.pdf.

A32.381 Openreach, *Openreach supplementary submission relating to Ofcom's fixed access market reviews and charge controls*, 26 March 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Openreach_Supplimentary_submission.pdf

Sky

A32.382 Sky, *Unaudited results for the nine months ended 31 March 2013*, https://corporate.sky.com/documents/pdf/latest_results/q3_1213_press_release.pdf

A32.383 Sky, *UK Power Networks, Business plan 2015-2023. Annex 12: Business Transformation*, July 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Sky_UK_Power_Networks_report.pdf.

A32.384 Sky, *Sky's Response to Ofcom's Fixed access market reviews: Approach to setting LLU and WLR Charge Controls Consultation*, October 2013: <http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Sky.pdf>

A32.385 Sky, *Ofcom's Fixed access market reviews. Sky response to the charge control elements of Ofcom's December 2013 and January 2014 Consultations*, February 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/Sky_-_FAMR_Charge_Controls.pdf

TalkTalk

A32.386 TalkTalk, *Openreach, LLU TAM - Selective 'In-Line' Deployment: Proposed Usage*, July 2007, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk_Openreach_presentation_on_single_jumpering.pdf

A32.387 TalkTalk, *Annual Report 2011*, <http://www.talktalkgroup.com/~media/Files/T/TalkTalk-Group/pdfs/reports/2011/talktalk-ar11-web-ready.pdf>

A32.388 TalkTalk, *Charge Control for LLU/WLR Services*, July 2011, <http://stakeholders.ofcom.org.uk/binaries/consultations/wlr-cc-2011/responses/ttg.pdf>

A32.389 TalkTalk, *Interim Results*, 13 November 2012, www.talktalkgroup.com/~media/Files/T/TalkTalk/pdfs/presentations/2012/13-11-2012-interim-pres.pdf

A32.390 TalkTalk, *Preliminary results for the 12 months to 31 March 2013*, 16 May 2013, www.talktalkgroup.com/~media/Files/T/TalkTalk/pdfs/reports/2013/prelim-results-2013.pdf

- A32.391 TalkTalk, *Preliminary Results*, presentation, 16 May 2013, :
<http://www.talktalkgroup.com/~media/Files/T/TalkTalk/pdfs/presentations/2013/preliminary-results-presentation-2013.pdf>
- A32.392 TalkTalk, *Approach to setting LLU and WLR Charge Controls. Consolidated version*, October 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/TalkTalk_Group.pdf
- A32.393 TalkTalk, *Interim Results for the 6 months to 30 September 2013*, 12 November 2013, <http://talktalkgroup.com/~media/Files/T/TalkTalk-Group/pdfs/results/12-11-2013-interim.pdf>
- A32.394 TalkTalk, *Implications of SJ-MPF dispute determination*, December 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk_comments_regarding_SJ-MPF_noncon.pdf
- A32.395 TalkTalk, *LLU/WLR Charge Control Consultation. TalkTalk comments on BT's response*, December 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/TalkTalk_Group_Comments_on_BTs_Response.pdf
- A32.396 TalkTalk, *Price regulation of enhanced services*, December 2013, http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/TalkTalk_Group_Price_Regulation_of_Enhanced_Services.pdf
- A32.397 TalkTalk, *Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR Charge Controls, TalkTalk response*, February 2014, <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk.pdf>
- A32.398 TalkTalk, *LLU charge control. Reply to BT response on price differential and Plum Consulting's report*, March 2014, http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk_reply_to_BT.pdf
- A32.399 TalkTalk Response to BT's QoS and LLU Charge Control submission to the December 2013 LLU WLR Consultation, March 2014. http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/responses/TalkTalk_response_to_Openreach_submissions_regarding_QoS_and_LLU_charge_control.pdf
- A32.400 TalkTalk, *Preliminary results for the 12 months to 31 March 2014 (FY14)*, 15 May 2014, <http://www.talktalkgroup.com/~media/Files/T/TalkTalk-Group/pdfs/reports/2014/preliminary-results-fy14.pdf>

UKSA

- A32.401 UKSA, *Code of Practice for Official Statistics*, January 2009
<http://www.statisticsauthority.gov.uk/assessment/code-of-practice/index.html>
- A32.402 UKSA, *Assessment of compliance with the Code of Practice for Official Statistics. The Retail Prices Index*, March 2013, <http://www.statisticsauthority.gov.uk/assessment/assessment/assessment-reports/assessment-report-246---the-retail-prices-index.pdf>

A32.403 UKSA, *Assessment of compliance with the Code of Practice for Official Statistics. Statistics on Consumer Price Inflation*, July 2013
<http://www.statisticsauthority.gov.uk/assessment/assessment/assessment-reports/assessment-report-257---statistics-on-consumer-price-inflation.pdf>

Valuation Office Agency

A32.404 Valuation Office Agency, *Rating Manual Volume 5 Section 873: Practice Note 2010: Next Generation Access Telecommunications Networks (NGA)*,
http://www.voa.gov.uk/corporate/publications/Manuals/RatingManual/RatingManualVolume5/sect873/1RatingManual%20Vol%205%20Sec873%20PN%202010a.htm#P175_2834

Verizon

A32.405 Verizon, *Verizon Enterprise Solutions response to Ofcom's Fixed Access MR: Approach to setting LLU & WLR Charge Controls consultation*, September 2013,
<http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Verizon.pdf>

Virgin

A32.406 Virgin, *Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. For the fiscal year ended December 31, 2008*, 29 April 2009, at
<http://investors.virginmedia.com/phoenix.zhtml?c=135485&p=irol-reportsannual>

A32.407 *First quarter 2013 results*, 24 April 2013,
<http://investors.virginmedia.com/phoenix.zhtml?c=135485&p=irol-financial-results>

A32.408 Virgin, *Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange Act of 1934. For the fiscal year ended December 31, 2012*, <http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MTcxMTYzfENoaWxkSUQ9LTF8VHlwZT0z&t=1>

A32.409 Virgin, *Virgin Media's response to Ofcom's Consultation on the Approach to setting LLU and WLR Charge Controls*, 30 September 2013:
http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Virgin_Media.pdf

A32.410 Virgin Media, *Q1 2014 Selected Operating and Financial Results*, 7 May 2014,
<http://phx.corporate-ir.net/External.File?item=UGFyZW50SUQ9MjMyOTg3fENoaWxkSUQ9LTF8VHlwZT0z&t=1>

Vodafone

A32.411 Vodafone, *ISDN2 Transfer briefing paper*, February 2012

A32.412 Vodafone, *Vodafone's response to Ofcom's consultation "Fixed access market review and charge control"*, September 2013,
<http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/responses/Vodafone.pdf>

Annex 33

Glossary

21CN: BT's next generation network upgrade.

Access Charge Change Notification (ACCN): BT issues Access Charge Change Notifications (ACCNs) whenever BT changes the price for an existing BT service or offers a price for a new BT service, where BT is deemed, by Ofcom, to have Significant Market Power (SMP). An ACCN is comprised of, at least, two parts, the ACCN main document detailing the prices that are changing and the proposed CPL section page. Prices covered by ACCNs are required to be published in the CPL.

Access Network: The part of the network that connects directly to customers from the local telephone exchange.

Anchor pricing: An approach that bases charge control modelling on the cost of existing technology rather than that of any new technology that might be adopted during the control period.

Ancillary services: Services that relate to the core rental services and that are of an ancillary nature but which fall within markets in which BT has been found to have SMP.

Asset Volume Elasticity (AVE): The percentage increase in capital costs required for a 1% increase in volume.

ASSIA: Adaptive Spectrum and Signal Alignment, Inc.

Average Time To Clear (ATTC): An Openreach measure of the average elapsed time (in days) between the acceptance of faults by Openreach and when Openreach advises CPs that the faults have been cleared.

Average Time To Install (ATTI): An Openreach measure of the average elapsed time (in days) between the acceptance of installation orders by Openreach and when Openreach advises the CP of their completion.

Axis: Axis Telecom Limited.

Backhaul: For the purposes of this review, the term refers to segment(s) of a communications network that connect(s) segments of an access network (e.g. from the Digital Local Exchange to the Premise or from a Cabinet to the Premise) with the core network.

Basket: A set of services where the charge control is applied to the total revenue from those services in a given year, subject to a specified compliance formula.

Birmingham: Birmingham City Council.

Bit Commons: The Bit Commons Limited.

Broadband Boost (BBB): A chargeable investigation product from Openreach.

BT: British Telecommunications plc.

BT Retail: The retail division of BT.

BT Wholesale: The wholesale division of BT.

CAA

Caller Display (Caller ID): Allows the customer to see the caller's number before answering the call, provided they have suitable equipment.

Calling Line Identification (CLI): Data about the calling party, in particular the telephone number that has initiated the call. With the Caller Display service the CLI, or calling number, is displayed provided the end user has a phone with a suitable display (or other equipment that can display the information).

CAT: Competition Appeal Tribunal.

CEG: Competition Economists Group.

Charge Control: A control which sets the maximum price that a communications provider can charge for a particular product or service. Most charge controls are imposed for a defined period.

Colt: Colt Technology Services.

Co-Mingling Services: All essential support services which are used jointly by SMPF and MPF, including the co-location services (e.g. electricity, ventilation).

Common costs: Costs which are shared by all the services supplied by a firm.

Communications Provider (CP): A person who provides an electronic communications network or provides an electronic communications service.

Competition Commission (CC): An independent public body that conducts in-depth inquiries into mergers, markets and the major regulated industries.

Conscious Decision To Appoint (CDTA): A fault report which requires a customer appointment, raised with Openreach by a CP in cases where the Openreach line test system does not indicate a fault.

Conscious Decision To not Appoint (CDTnA): A fault report which requires a customer appointment, raised with Openreach by a CP in cases where the Openreach line test system does not indicate a fault.

Copper Products Commercial Group (CPCG): An industry forum involving Openreach and its customers.

Customer Premises Equipment (CPE): Also known as consumer equipment or customer apparatus. Equipment on consumers' premises, which is not part of the public telecommunications network and which is directly or indirectly attached to it.

Consumer Price Index (CPI): The official measure of inflation of consumer prices in the United Kingdom.

Cost Allocation Model (CA Model): In this model, costs from the Cost Forecast Model were allocated to individual services' cost and asset data to derive unit cost estimates. The

Cost Allocation Model also drew on a calculation of the forecast asset values and depreciation, for copper and duct, provided by the RAV Model.

Cost Forecast Model (CF Model): This was an activity-based costing model, using data linked to historically observed activity levels and costs together with estimates of future levels of demand. In this model, we forecast operating costs and capital expenditure at an Openreach level. The output was fed into the Cost Allocation model.

Cost orientation: The principle that the price charged for the provision of a service should reflect the underlying costs incurred in providing that service.

Costs Volume Elasticity (CVE): The percentage increase in operating costs for a 1% increase in volume.

Cumulo rates: The business rates paid by BT on its network business. These relate to the use of public land for assets such as poles, duct, street cabinets and the equipment in exchange buildings.

Current Cost Accounting (CCA): An accounting convention, where assets are valued and depreciated according to their current replacement cost whilst maintaining the operating or financial capital of the business entity.

Current Cost Accounting Fully Allocated Cost (CCA FAC): An approach used to measure a company's costs.

Current Generation Network (CGN): A network that uses existing (copper) technology in the core and backhaul.

D-side: Distribution side. The segment of BT's access network between the Primary Cross Connection Points (street cabinets) and Distribution Points.

Daisy: Daisy Group plc.

DECC: Department of Energy and Climate Change

Derby: Derby City Council.

Digital Local Exchange (DLE): The telephone exchange to which customers are directly connected, often via a remote concentrator unit.

Digital Subscriber Line Access Multiplexer (DSLAM): A network device, located in a telephone exchange that provides broadband services to multiple premises over the copper access network using DSL technologies. Also includes a multiplexing function for backhaul.

Distributed Long Run Incremental Cost (DLRIC): The LRIC of the individual service with a share of costs which are common to other services over BT's core network.

Distributed Stand Alone Cost (DSAC): An accounting approach estimated by adding to the DLRIC a proportionate share of the inter-increment common costs. Rather than all common costs shared by a service being allocated to the service under consideration, the common costs are instead allocated amongst all the services that share the network increment.

Distribution Point (DP): A flexibility point in BT's access network where final connections to customer premises are connected to D-side cables. Usually either an underground joint or a connection point on a telegraph pole where dropwires are terminated.

Downstream BT: BT's downstream operations, by which we mean BT Wholesale, BT Retail or any other downstream operation owned or operated by BT.

Dropwire: An overhead cable, connecting BT's access network to a customer's premise. Generally a single span between the premises and a telegraph pole with a Distribution Point.

DSL (Digital Subscriber Line): a family of technologies generically referred to as DSL, or xDSL, capable of transforming ordinary phone lines (also known as "twisted copper pairs") into high-speed digital lines, capable of supporting advanced services such as fast internet access and video-on-demand.

Duct Access: A wholesale access service allowing a CP to make use of the underground duct network of another CP.

Ducts: Underground pipes which hold copper and fibre lines.

Dynamic Line Management (DLM): The process of real time monitoring a communications line and dynamically changing select communications parameters, based on a set of predefined rules (DLM profiles), to achieve a target performance, i.e. a target balance between effective line capacity (speed) and connection stability. DLM systems are typically used for managing the performance of ADSL and VDSL lines.

Dynamic Line Management (DLM) profile: A set of rules defining target line performance characteristics to be monitored in real-time and communication parameters to be applied by a DLM system on a communications line, to achieve a target balance between effective line capacity (speed) and line stability

E-side: Exchange side. The segment of BT's access network between telephone exchanges and Primary Cross Connection Points (street cabinets).

Early Life Failure (ELF): A fault that occurs within a defined period after the completion of an installation order on a line. Several definitions are used, including 8 days, 28 days and 30 days.

Early Termination Charge (ETC): The total fee that will be charged for early termination of a contract or agreement.

EC: European Commission.

EE: Everything Everywhere Limited.

Equal Proportionate Mark-Ups (EPMU): Under EPMU, charges are set to recover the sum of incremental costs and a mark-up for common costs which is the same, as a percentage of incremental costs, for all services.

Evolutionary Test Access Matrices (evoTAMs): Industry name given to an improved version of earlier TAMs.

FAMR: Fixed Access Market Reviews.

FCS: Federation of Communication Services.

Fibre To The Cabinet (FTTC): An access network structure in which the optical fibre extends from the exchange to a flexibility point in the BT network known as a cabinet. The street cabinet is usually located only a few hundred metres from the subscriber's premises. The remaining part of the access network from the cabinet to the customer is usually copper wire but could use another technology, such as wireless.

Fibre To The Premises (FTTP): An access network structure in which the optical fibre network runs from the local exchange to the end user's house or business premises. The optical fibre may be point-to-point – there is one dedicated fibre connection for each home – or may use a shared infrastructure such as a GPON. Sometimes also referred to as Fibre to the home (FTTH).

Frame drop SLA: A Service Level Agreement (SLA) defines the maximum acceptable rate of (data) frames being dropped due to congestion on a communications segment.

Frequency Shift Keying (FSK): A concentrator aggregates telephony traffic for up to 2048 lines before feeding it into the exchange processor. The FSK sender is the part of the concentrator voice platform which sends CLI signalling to the Customer Premises Equipment.

Full Time Equivalent (FTE): A measure of resources or work, defined by reference to the capacity of a full time employee. An FTE of 1 is equivalent to one full time employee.

Fully allocated cost (FAC): An accounting approach under which all the costs of the company are distributed between its various products and services. The fully allocated cost of a product or service may therefore include some common costs that are not directly attributable to the service.

Gamma: Gamma Communications.

General Manager (GM) areas: A geographic area that is the responsibility of an Openreach General Manager. There are currently nine GM areas.

Generic Ethernet Access (GEA): BT's wholesale non-physical product providing CPs with access to higher speed broadband products.

Gigabit Passive Optical Network (GPON): A shared fibre network architecture that can be used for NGA.

Gross Replacement Cost (GRC): The cost of replacing an existing tangible fixed asset with an identical or substantially similar new asset having a similar production or service capacity.

Handover Distribution Frame (HDF): An internal wiring frame provided within an LLU operator's equipment area where tie cables are terminated and cross connected to the LLU operator's exchange equipment by flexible wire jumpers.

Historic Cost Accounting (HCA): A method of accounting under which assets and liabilities are recorded at the values at which they were first acquired.

Hull Area: The area defined as the 'Licensed Area' in the licence granted on 30 November 1987 by the Secretary of State under Section 7 of the Telecommunications Act 1984 to Kingston upon Hull City Council and Kingston Communications (Hull) plc (KCOM).

BIL2 assurance: Assurance to a Business **Impact Level 2**, in accordance with the Communications Electronics Security Group (CESG) standard. CESG is the Information

Security arm of GCHQ, and the National Technical Authority for Information Assurance within the UK. (<http://www.cesg.gov.uk>).

Incremental costs: Those costs which are directly caused by the provision of that service in addition to the other services which the firm also produces. Another way of expressing this is that the incremental costs of a service are the difference between the total costs in a situation where the service is provided and the costs in another situation where the service is not provided.

In-Life Failure (ILF): A fault that occurs after the period defined for an ELF.

ISDN2: A type of digital telephone line service that supports telephony and switched data services. ISDN2 allows a business to handle two phone calls simultaneously. It is primarily used by smaller businesses.

ISDN30: A type of digital telephone line service that provides up to 30 lines over a common digital bearer circuit. These lines provide digital voice telephony, data services and a wide range of ancillary services. It is primarily used by larger businesses..

KCOM: KCOM Group plc, formerly Kingston Communications Limited.

Key Performance Indicators (KPIs): A measure of performance of an important aspect of a service or operational process. In this context, generally a measure of Openreach's performance in the provision and repair of WLR and LLU services.

Kilo Man Hour (KMH): A unit of work or resources, equivalent to 1000 hours of work.

Local loop: The access network connection between the customer's premises and the local serving exchange, usually comprised of two copper wires twisted together.

Local Loop Unbundling (LLU): A process by which a dominant provider's local loops are physically disconnected from its network and connected to a competing provider's networks. This enables operators other than the incumbent to use the local loop to provide services directly to customers.

Long Run Incremental Cost (LRIC): The cost caused by the provision of a defined increment of output given that costs can, if necessary, be varied and that some level of output is already produced.

Long Term Evolution (LTE): Part of the development of 4G mobile systems that started with 2G and 3G networks. Aims to achieve an upgraded version of 3G services having up to 100 Mbps downlink speeds and 50 Mbps uplink speeds.

Main Distribution Frame (MDF)/unbundled local loop: An internal wiring frame where copper access network cables are terminated and cross connected to exchange equipment by flexible wire jumpers.

Main Distribution Frame Block (MDF block): The MDF consists of blocks, each MDF block providing the termination points to facilitate the connection of telephone lines with the required network elements. Each MDF block has a capacity of 100 pairs.

MDF Jumper Cable (jumper): A jumper is a flexible pair of copper wires. A jumper provides the connection between any two copper pairs being terminated on the MDF blocks. The MDF blocks provide appropriate connectors that facilitate the connection and removal of jumpers.

Manchester: Manchester City Council.

Market Review Period: Three years from the date of publication of the final Statement.

Matters Beyond Our Reasonable Control (MBORC): An Openreach term for a declaration that a fault repair or provisioning task fulfils the *force majeure* clauses in its contracts.

MCB customisation at initial build for FCP: Service in Openreach price lists.

MCL: Modern Communications Ltd.

Metallic Path Facilities (MPF): The provision of access to the copper wires from the customer premises to a BT MDF that covers the full available frequency range, including both narrowband and broadband channels, allowing a competing provider to provide the customer with both voice and/or data services over such copper wires.

Minimum Contract Period (MCP): The amount of time a consumer must remain in a contract before being able to cancel it.

Mobile Tethering is the process by which a mobile or tablet device can be used as a modem and offer data access to other connected devices such as laptop or desktop computers.

MiFi, 'Mobile Fidelity', refers to mobile devices that allow sharing a mobile data connection between several devices that are connected to the MiFi using a WiFi connection.

Modern Equivalent Asset (MEA): An approach to setting charges that bases costs on what is believed to be the most efficient available technology that performs the same function as the old technology.

Modified Primary Line (MPL): An Openreach service that temporarily diverts calls from a WLR service to an alternative telephone number.

MPF Rental: The product offered by Openreach and known as "MPF Rental" as provided by Openreach on its website.

MPF Stopped Line Provide (MPF SLP): Service named "MPF Connection Charge Stopped Line Provide" in Openreach price list.

MPF Working Line Takeover (MPF WLTO): The product offered by Openreach and known as "MPF Working Line Takeover (WLTO)" as provided by Openreach on its website.

Multicasting: A method for transmitting a data stream (e.g. for digital radio or TV) that is intended for a predefined group of recipients (called multicast group), over a network in an efficient manner, by transmitting only a single copy of the data stream over each segment of the network, on each path to the intended recipients.

Multiple Service Access Node (MSAN): A network device, located in a telephone exchange which provides telephony and broadband services to multiple premises over copper and/or fibre access networks. Also includes a multiplexing function for backhaul.

Net Replacement Cost (NRC): Gross replacement cost less accumulated depreciation based on gross replacement cost.

Network Charge Change Notification (NCCN): Normal BT Wholesale practice is to issue Network Charge Change Notifications (NCCNs) for price changes to non-significant market power services.

Network Terminating Equipment (NTE): Transmission equipment located at the customer premises. Performs a similar function to LTE and also provides the customer interface.

Next Generation Access (NGA) networks: Wired access networks which consist wholly or in part of optical elements and which are capable of delivering broadband access services with enhanced characteristics (such as higher throughput) as compared to those provided over already existing copper networks. In most cases, NGAs are the result of an upgrade of an already existing copper or co-axial access network.

Next Generation Network (NGN): A network that uses IP technology in the core and backhaul to provide all services over a single platform.

O2: Telefónica UK.

Ofcom: The Office of Communications.

Office of the Telecommunications Adjudicator (OTA): An independent body that facilitates discussion between CPs on operational issues related to new and existing telecoms products and services.

ONS: The Office of National Statistics.

Openreach: The access division of BT established by Undertakings in 2005.

Physical Infrastructure Access (PIA): A regulatory obligation under which BT is required to allow CPs to deploy NGA networks in the physical infrastructure of its access network.

Primary Cross Connection Point (PCP): A street cabinet (or equivalent facility) located between the end user's premises and BT's local serving exchanges, which serves as an intermediary point of aggregation for BT's copper network.

Prioritisation Rate ('PR'): The target data throughput that is provided via traffic prioritisation over a communications network that supports Quality of Service, for a class of service, agreed upon between a network operator and a customer

PSTN switch: A public switched telephone network switch that terminates a customer's telephone line and connects a customer's telephone call to other PSTN switches so that the telephone call reaches the intended destination.

PWNRC: Profit weighted net replacement cost

Rack Space Unit (RSU): Used in the name of services in Openreach's price lists.

Rate of Return (RoR): The ratio of money gained or lost (whether realised or unrealised) on an investment relative to the amount of money invested.

RAV adjustment: An adjustment to the regulatory asset valuation of the pre-1997 assets to historic cost accounting.

RAV Model: This model calculates the forecast asset values and depreciation, for copper and duct. The model also applies a regulatory adjustment (the regulatory asset value adjustment, or RAV adjustment) previously applied by Ofcom.

Regulatory Asset Value (RAV): The value ascribed by Ofcom to the capital employed in the relevant licensed business.

Regulatory Financial Statements (RFS): The financial statements that BT is required to prepare and publish by Ofcom.

Retail Price Index (RPI): A measure of inflation published monthly by the Office for National Statistics. It measures the change in the cost of a basket of retail goods and services.

Return On Capital Employed (ROCE): The ratio of accounting profit to capital employed. The measure of capital employed can be either Historic Cost Accounting (HCA) or Current Cost Accounting (CCA).

RPIJ: A Retail Prices Index (RPI) based measure that will use a geometric (Jevons) formula in place of one type of arithmetic formula (Carli). It was launched in response to the National Statistician's conclusion that the RPI does not meet international standards due to the use of the Carli formula in its calculation.

Senior Operations Manager (SOM): A geographic area which is the responsibility of an Openreach Senior Operations Manager. There are currently 58 SOM areas.

Service Level 1 (SL1): A repair service contract offered by Openreach for fault repair by the end of the next working day plus one day (excluding Saturday) after the acceptance of faults by Openreach.

Service Level 2 (SL2): A repair service contract offered by Openreach for fault repair by the end of the next working day (including Saturday) after the acceptance of faults by Openreach.

Service Level Agreement (SLA): A contractual commitment provided by Openreach to CPs about service standards.

Service Level Guarantee (SLG): A contractual commitment by Openreach to CPs specifying the amount of compensation payable by Openreach to a CP for a failure to adhere to an SLA.

Service Management Centre (SMC): The contact point in Openreach for CPs requesting LLU, WLR and other services.

Shared Metallic Path Facility (SMPF)/shared access: The provision of access to the copper wires from the customer's premises to a BT MDF that allows a competing provider to provide the customer with broadband services, while BT continues to provide the customer with conventional narrowband communications.

Significant Market Power (SMP): The significant market power test is set out in European Directives. It is used by National Regulatory Authorities (NRAs), such as Ofcom, to identify those CPs which must meet additional obligations under the relevant Directives.

Sky: British Sky Broadcasting Ltd.

SMPF New Provide: The product offered by Openreach and known as “SMPF Connection charge, Basic Provide on existing narrowband, Simultaneous Provide of SMPF with narrowband, Singleton Migration (Transfer or change of CP migrations) from Narrowband, MPF, SMPF and ISDN/ Highway” as provided by Openreach on its website.

SMPF Single Migration: The product offered by Openreach and known as “SMPF Connection charge, Basic Provide on existing narrowband, Simultaneous Provide of SMPF with narrowband, Singleton Migration (Transfer or change of CP migrations) from Narrowband, MPF, SMPF and ISDN/ Highway” as provided by Openreach on its website.

Special Faults Investigation (SFI): A chargeable fault investigation product from Openreach.

SSE: SSE plc.

Stand Alone Costs (SAC): An accounting approach under which the total cost incurred in providing a service is allocated to that service.

Sub-Loop Unbundling (SLU): Like local loop unbundling (LLU), except that CPs interconnect at a point between the exchange and the end user, usually at the cabinet.

Superfast broadband: A broadband connection that can support a maximum download speed of 30Mbps or greater.

TalkTalk: TalkTalk Telecom Group plc.

Tesco: Tesco Broadband.

Test Access Matrices (TAMs): A test access matrix connects on demand test signals and measurement equipment to customer lines so that an operator can determine remotely if the connection to the customer is functioning to the required standard. The TAM is owned and operated by Openreach and does not change ownership in relation to the local loop.

Three: Hutchinson 3G.

Throughput: An empirical metric of a communication link’s performance, expressing the effective amount of data or information being transferred over the link within a specified time period. Typically measured in “bits per second” or “bps”.

Tie cable: A cable that connects equipment to the MDF.

Tie Pair Modification: Used in the name of services in Openreach price lists.

Time Division Multiplex (TDM): a method of putting multiple data streams in a single signal by separating each signal into many segments, each having a very short duration. Each individual data stream is reassembled at the destination based on timing.

Time-Related Charges (TRCs) : Time Related Charges are raised by Openreach to recover costs incurred when Openreach engineers perform work not covered under the terms of the Openreach service.

Traffic prioritisation: The process of characterisation of data packets and allocation to appropriate priority queues, for transmission over a data network, to facilitate the effective use of network resources and the provision of Quality of Service.

UKSA: UK Statistics Authority.

Vectoring: A performance improvement technique that reduces the effect of crosstalk on copper lines. It is based on the concept of noise cancellation via the co-ordination of line signals.

Verizon: Verizon Enterprise Solutions.

Virgin: Virgin Media.

Virtual Unbundled Local Access (VULA): It provides a connection from the nearest ‘local’ aggregation point to the customer premises.

Vodafone: Vodafone UK and Cable & Wireless Worldwide Ltd.

Volumes Forecast Model: Ofcom, *LLU and WLR Volumes Forecasts*, December 2013: <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex13.xlsx>

Weighted Average Cost of Capital (WACC): The rate that a company is expected to pay on average to all its security holders to finance its assets.

Wholesale Fixed Analogue Exchange Line (WFAEL): The provision of wholesale analogue voice services using BT or KCOM’s existing voice infrastructure.

Wholesale Line Rental (WLR): The service offered by BT to other CPs to enable them to offer retail line rental services in competition with BT’s own retail services. Line rental is offered along with calls (and other service elements, such as broadband) to retail customers.

Wholesale Local Access (WLA): Covers fixed telecommunications infrastructure, specifically the physical connection between end users’ premises and a local exchange.

WLR+SMPF Simultaneous Migration: The simultaneous provision of WLR Conversion and SMPF New Provide.

WLR+SMPF Simultaneous Connections: The simultaneous provision of either of the products in the WLR Connections basket and SMPF New Provide.

WLR Basic: WLR Rental service that receives Service Level 1.

WLR Connections basket: This is a basket of two connection services. In particular, services named “Supply of new Basic line - Per line” which we refer to as “WLR Standard Connection” and “Supply of new line - Per line – using previously stopped LLU MPF line” which we refer to as “WLR Start of Stopped MPF Line” in Openreach’s price list.

WLR Conversion: The product offered by Openreach and known as “Conversion of Local Loop Unbundling (LLU) Metallic Path Facility (MPF) to a single Wholesale Access line” as provided by Openreach on its website.

WLR Premium: Premium analogue WLR rental service.

WLR Rental: Analogue WLR rental service. In general WLR Rental includes WLR Basic and WLR Premium. Since we do not set a charge control on WLR Premium, WLR Rental has been used with the same meaning as WLR Basic when we discuss the charge control.

WLR Standard Connection: The product offered by Openreach and known as “Supply of new Basic line - Per line” as provided by Openreach on its website.

WLR Start of Stopped MPF Line: The product offered by Openreach and known as “Supply of new line - Per line – using previously stopped LLU MPF line” as provided by Openreach on its website.

WLR Start of Stopped WLR Line: The product offered by Openreach and known as “Line Transfer (inc Working Line Takeover and Starting of Stopped lines) Basic line - Per transfer” as provided by Openreach on its website.

WLR Transfer: The product offered by Openreach and known as “Line Transfer (inc Working Line Takeover and Starting of Stopped lines) Basic line - Per transfer” as provided by Openreach on its website.

WLR Working Line Take Over (WLTO): The product offered by Openreach and known as “Line Transfer (inc Working Line Takeover and Starting of Stopped lines) Basic line - Per transfer” as provided by Openreach on its website.