British Sky Broadcasting Limited (BSkyB)

Fixed access market reviews: Assessment of Ofcom's approach to Openreach Quality of Service

Final Report

13 February 2014

AlixPartners UK LLP
When it really matters.

CONTENTS

1. EXECUTIVE SUMMARY

Focus of the report

1.1.1.   This report examines Ofcom's approach to assessing the costs of increased standards of performance for provisions and fault repairs which may apply over the period of the next LLU/WLR charge controls (April 2014 to March 2017). It provides:

(a)   A broad outline of the approach to establishing performance standards as set out by Ofcom in the context of the review and contrasts this to the appropriate wider framework for performance assessment, including examples from other regulated sectors (Section 2); and

(b)   An assessment of the extent to which the Openreach model of resource costs (and Ofcom's assessment of this model) may fully capture the relevant factors which drive quality of service standards (such as dynamic efficiency) (Section 3).

Regulatory approaches to setting quality of service targets

Ofcom's approach to the FAMR quality of service review

1.1.2.   Ofcom published its Fixed Access Market Reviews consultation on Openreach quality of service and approach to setting LLU and WLR Charge Controls on 19th December 2013 (the "FAMR Consultation").[1] The review of Openreach's quality of service in providing wholesale fixed access services was prompted by a significant decline in performance of Openreach's provision and service repair activity. The review reflected a recognition that minimum standards may be required in order to ensure that the competitive process in retail markets is not distorted and that consumer harm is avoided.

1.1.3.   Ofcom's review confirmed that standards of performance for fault repair and provision order deteriorated between April 2008 and May 2013 (Annex 9 of the July FAMR Consultation)[2] including two periods when the performance was "much lower" than previously achieved. Ofcom also highlights the wide ranging negative effects that such poor performance has on Communications Providers ("CPs") and end-customers before concluding, on the basis of these findings, that targets for improved standards of performance should be established.

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[1] Ofcom (December 2013), "Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR Charge Controls" ("FAMR Consultation"), A9.50.
[2] Ofcom, (July 2013) "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" (the "July FAMR consultation").

1.1.4.   Ofcom's approach in relation to the assessment of the cost implications of increased performance standards relies primarily on a review of the model commissioned by Openreach and produced by Ernst & Young LLP ("EY"). Ofcom commissioned a report by Analysys Mason ("AM"), the purpose of which was to audit and test the construction of the model and underlying assumptions, which informed its assessment.

1.1.5.   On the basis of its assessment, Ofcom proposes to set a minimum performance condition of 80% for repair completion, 80% for 12 day provision appointment availability and 90 % for provision appointment completion by appointment date (prior to any allowance for *force majeure*) measured against the service targets included in existing Service Level Agreements (SLAs) (where relevant).[3] Ofcom is not seeking to review whether the SLA targets themselves are reasonable or to set revised targets. It proposes to make an allowance for increased unit costs of around 4% to reflect what it considers to be the resource increment associated with the above increased performance requirements.

1.1.6.   More detailed consideration of Ofcom's assessment of the EY model is provided below. However, Ofcom's overall approach to determining the appropriate level of performance and the associated cost is characterised as follows:

(a)   Ofcom has not sought to assess the scope for Openreach to resolve the situation through managerial action alone. This contrasts with examples in other regulated sectors (described in more detail in Section 2 of this report), including enforcement action by ORR and remedial actions required to be implemented by the CAA in response to performance declines in the rail and airport sectors.

(b)   Ofcom's assessment of the cost implication of any change in standards of performance fails to consider what more can be achieved by Openreach with existing resources. It fails to allow for any other drivers of change that might impact on service performance beyond resource costs. This is because it relies on the EY model which excludes any dynamic analysis of the scope for productivity gains or any scope for catch up to best-practice.

(c)   Ofcom's analysis is limited to a challenge (informed by the AM report) of certain modelling assumptions. While Ofcom was right to seek to understand the basis of the EY model and the effect of the assumptions it included, a more complete review of operational processes would have challenged Openreach in relation to wider and more fundamental issues. For example, it would have considered

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[3] Ofcom, FAMR Consultation, 19 December 2013, §3.84 and Table 3.4.

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whether Openreach has done enough to restore the situation to that which might be expected in a competitive market, and whether the Openreach model sufficiently captures the effects of productivity gains over time and "catch-up" performance that any operator in a competitive market would be required to meet.

(d)   Ofcom set out an analysis of the potential causes of Openreach's fall in performance in Annex 10 of its July FAMR consultation (and summarised in §5.6 to §5.15 of the FAMR Consultation). It identifies a number of factors which may have potentially contributed to underperformance, including some correlation between persistent wet weather in 2012 and the growth in fault report volumes, as well as other factors such as increasing broadband usage and the redeployment of resource leading to extended timescales for provisions. However, due to an absence of benchmarks Ofcom was unable to identify the extent to which reductions on preventative maintenance, or failure to adopt best practice, may have contributed to underperformance. This is relevant since if exogenous factors (such as bad weather) do not wholly explain the fall in performance, there is no basis for the assumption that existing unit costs are not sufficient to enable an efficient operator to deliver a reasonable quality of service. Rather, this would support a finding that Openreach should be required to reach acceptable standards of performance without any uplift (or, with any uplift being clearly identified as necessary to compensate for any change in external environment that makes the achievement of the standards more difficult in future).

Evidence from UK regulatory practice

1.1.7.   In a competitive market, quality of service is a key driver of firm performance. Consumers' purchasing decisions depend on the combination of service characteristics (including quality of service) and price. Companies offering poor quality will lose customers to those offering better quality (in the absence of barriers to switching, and holding price constant).

1.1.8.   Regulators typically aim to regulate to encourage companies to deliver price and quality levels closest to that achieved under a competitive outcome (or an otherwise "socially optimal" level).[4]

1.1.9.   In the absence of incentives for improving quality a regulated monopoly may have incentives to reduce quality in order to cut costs and increase profits. There are several

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[4] See, e.g., Spence, "Monopoly, quality, and regulation", The Bell Journal of Economics, 1975

mechanisms that regulators may adopt to address these concerns, as illustrated by examples from UK regulatory practice below:

(a) *Target setting with a consideration of efficiencies*. All of the regulated sectors discussed in this report have quality targets, and all considered the potential for different types of efficiencies that may enable firms to achieve the targets;

(b) *Efficient quality targets apply dynamically*. Annual targets are set with an expectation of an improving quality of service over time to reflect anticipated improvements in technology, processes or best practice assimilation. Ofgem expects productivity improvements from "*even the most efficient DNO*" and ORR set falling delay minutes targets for Network Rail over 2006-07 to 2012-13;

(c) *Utilising the threat (and application) of enforcement action* to ensure poor performance is quickly resolved. This is mainly used by ORR, which has taken a number of enforcement actions since privatisations, including both penalties and mandating a recovery plan to be formulated; and

(d) *Specifying investigative and recovery processes* to remedy a situation where a firm has failed acutely to meet quality targets (e.g. snow storms for Heathrow and the Hatfield derailment). Typical ones include conducting thorough reviews of how and why the failure occurred, and mandating improvements to remedy the situation.

Assessment of the Openreach model

1.1.10. The purpose of the EY simulation model is to answer the question of how many resources (engineers) of different skill levels are needed to meet a given level of service performance. This is then used to measure the difference in resources needed to achieve a change from a benchmark level to a target level of performance.

1.1.11. We note that we have not had access to the EY model; therefore large parts of our analysis are interpreted and/or inferred from the descriptions provided in the FAMR Consultation. We would welcome a chance to examine the model in more detail and in the main text we also have a number of suggestions for validity checks which we think should have been carried out and/or reported.

The treatment of flexibility across days

1.1.12.   To our best understanding, the model simulations presented imply that a large number of resources will be idle while there is a queue of jobs about to breach the SLA target. In reality we would have expected any surplus resources to be used to whittle down existing queues.

1.1.13.   This does not seem to accord with the statement in the EY Methodology document, that the model "assumes that Openreach had sufficient ability and incentive to optimise performance given the resource it had available in 2011/12 and 2012/13"[5]

1.1.14.   We suspect that given the way the model has been constructed, there is a considerable overestimation of the number of engineers needed to perform a certain number of jobs (or hours of work), and that this overestimation disproportionately affects the higher performance levels. The AM Report states that idle resource "*could be used to carry out jobs that are in the system and, as such, increase the performance achieved on those days. ... Though it is not possible to calculate the exact impact of this effect, the magnitude is potentially significant*".[6]

1.1.15.   We consider that this is precisely the type of final step that should have been taken within the EY model. In other words, after calculating the "resource requirements", these requirements should have been fed into the model to derive actual completion times based on a queuing model.[7] This would then have given average simulated performance levels across the year. Resource requirements would then need to be revised based on whether the simulated performance levels were higher or lower than the target, and this procedure iterated until the desired performance levels achieved.

The treatment of flexibility across skill levels

1.1.16.   The EY model allows for engineers of higher skill levels to carry out tasks at lower skill levels rather than be idle. Allowing for such re-allocation seems appropriate and the question of how this is implemented in the model has a potentially large effect.

1.1.17.   For example, AM provide a methodology – the alternative "Top N days" approach – which under some assumptions give rise to vastly lower resource increments than Ofcom's main approach, in one instance a delta of 0.55% instead of 8.11%.[8]. Our interpretation of this

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[5]   EY Methodology Report, page 2.
[6]   AM Report, page 48.
[7]   The difference between the simulated performance levels and the target performance levels would be the impact that AM speak of.
[8]   Repair 85% without uplifted task times, provision 85% without uplifted task times. See FAMR Consultation , Table A5.5, Annex 5.

erosion of the delta is that the extreme peaks have a disproportionate impact not only on resource requirements but on deltas. There is also EY's original "Top N days" approach and Ofcom's favoured "Max Day" approach.

1.1.18. The question of which of these alternative approaches (if any) is appropriate should be possible to resolve by comparing them with the actual utilisation rates of the BT field force. Alternatively, the derived work force under the baseline case could be compared with the actual workforce employed as a sense-check of the methodology. To our understanding neither of these comparisons have been made, or if they have been, the implications for the question of engineer re-allocation have not been clearly set out.

The modelling of the distribution of completion times

1.1.19. The parameters chosen for the assumed distribution of completion times have important consequences for the model outcomes. The gamma distribution determines the period of time a job stays in the queue, and the alpha and beta parameters define the position of the distributional peak and the spread of the distribution.[9] If the gamma distribution has a large variance and a low peak (see below), any peaks in jobs logged will be smoothed over several days in terms of job completion, leading to lower resource requirements.

1.1.20. There are a number of problems with the distribution chosen by EY:

(a)   It fits poorly with the empirical distribution, in particular for provision;

(b)   It induces a cost uplift of more than 1%, even before any performance improvements are assumed; and

(c)   Its mode is assumed to be constant regardless of performance level.

1.1.21. The latter feature leads to the implausible result that in order to hit a more stringent performance target, Openreach would actually be far more, rather than less, likely to hit the target the day just before the SLA deadline in the case of provision. The number of jobs with shorter completion times would be reduced, rather than increased.

1.1.22. According to the AM Report[10], Openreach motivate the fixed mode by reference to empirical data. We think it would be useful to make sure that this is based on time periods and GM areas where the performance levels at hand were achieved. We also think an

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[9]   There is one pair of alpha and beta for each Care Level, job type, GM area, level of performance and week.
[10]   Page 18.

evaluation of the sensitivity of the results to alternative pairs of alpha and beta should be produced and/or reported.

1.1.23.   Finally, we would assert that the constant mode is, in our view, the most extreme assumption that can be maintained regarding the gamma distribution, in terms of its effect on delta (short of assuming that the modal time in the queue increases when performance level rise, which seems impossible to defend *a priori*).

The modelling of Openreach's commercial approach to efficiencies

1.1.24.   The relevant question when considering the cost uplift to Openreach of an increase in performance of x% points is how Openreach would be most likely to achieve it, bearing in mind Openreach's likely commercial objective to minimise costs. We consider it unlikely that Openreach would impose an even x% point increase in every week of the year, as assumed in the model. Rather, Openreach would target the "lowest hanging fruit" rather than seeking to enhance performance evenly throughout the year.

1.1.25.   This argument has application in a number of cases. In our opinion, whenever there is a modelling choice which corresponds to commercial choices that Openreach might make, then the modelling should choose the path which gives rise to the lowest delta. This appears to be the most likely path taken by a cost-minimising firm.

Conclusions

1.1.26.   Based on the analysis in this report, Ofcom's approach to assessing the costs of increased standards of performance for provisions and fault repairs can be improved in a number of ways.

1.1.27.   Firstly, contrary to principles supported by evidence from UK regulatory practice, Ofcom does not appear to have adequately:

(a)   Explored the scope for efficiencies within Openreach, and the extent to which its fall in performance may be explained by a failure to meet best practice in operational performance rather than purely exogenous factors;

(b)   Assessed whether Openreach has underperformed and hence needs to "catch up" to the dynamic efficiency frontier; and

(c)   Followed other UK regulators' example in assessing other mechanisms to encourage this apart from solely increasing the firm's resources. These include

mandating the formulation of an action plan to implement recommendations, as well as considering and implementing recommendations that include operational improvements based on existing resources.

1.1.28. Secondly, there are a number of potential issues with the EY model that may lead to a considerable overestimation of the resources required to meet targets, including:

(a) Presupposing a large amount of resources remain idle while there is a queue of jobs that are about to be delayed;

(b) Understating the impact of flexibility between engineers of different skill levels e.g. where some proportion of idle high skill engineers could be assigned to lower skill jobs;

(c) Using a probability (gamma) function that fits quite poorly with how completion times are actually distributed, particularly the completion times for provision. The error this causes is likely to be larger as performance levels increase (due to assuming a fixed mode); and

(d) Assuming Openreach would seek to enhance performance evenly throughout the year, rather than a cost-minimising path to meet targets.

2. REGULATORY APPROACHES TO SETTING QUALITY OF SERVICE

2.1. SUMMARY OF OFCOM'S APPROACH

2.1.1. In its FAMR Consultation, Ofcom focussed on two key issues in relation to quality of service:

(a) First, what should be the level of performance to which Openreach should be held in relation to the service level agreements for provisions and fault repairs; and

(b) Second, to the extent that any increases in service standards (compared with current performance or targets) are adopted, what implications might this have for Openreach's unit costs?

2.1.2. Ofcom had previously carried out a detailed review of Openreach's quality of service over the period April 2009 to April 2012, in response to complaints from other communications providers ("CPs") and concerns about observed declines in performance in 2010 and the latter half of 2012. The findings of this review were published within the July FAMR Consultation (as Annex 9). The key points that Ofcom identified in relation to quality of service performance across the two consultation documents are as follows:

(a) Performance in relation to a number of wholesale fixed access services (including provision and fault repair for various WLR and LLU products declined over the overall period April 2009 to May 2013 (§A9.50);

(b) Several services experienced particularly sharp deterioration in performance during particular periods, July 2010 to February 2011, and the second half of 2012 (§A9.50);

(c) The costs to CPs from poor performance (in the form of lost revenues, cancellations by customers, and reputational damage) and the costs to end-users (from lost service and time costs) could be significant (§A9.51ff); and

(d) A decline in quality of service could have a negative impact on consumers and competition (by raising perceived switching costs or making it more difficult for efficient operators to retain customers) (§A9.96).

2.1.3. Despite the significant reduction in quality of service identified by Ofcom, and the significant consequences which it recognises stem from this, it could reasonably have been anticipated that Ofcom should have conducted a wider review of Openreach's operational

processes with a view to identifying recommendations for improvement. Instead, Ofcom's approach in relation to the assessment of the cost implications of increased performance standards is limited to a review of the "Resource Simulation Model" commissioned by Openreach and produced by Ernst & Young ("EY"). Ofcom commissioned a report by Analysys Mason ("AM"), the purpose of which was to audit and test the construction of the model and its assumptions which informed its assessment of the EY model.

2.1.4.   On the basis of its assessment of the EY model, Ofcom proposes – in relation to standards of performance – to:

(a)   set a minimum performance condition of 80% for repair completion, 80% for 12 day provision appointment availability and 90 % for provision appointment completion by appointment date (prior to any allowance for *force majeure*) measured against the service targets included in existing Service Level Agreements (SLAs) (where relevant);[11]

(b)   Include a *force majeure* allowance of 3% (i.e., by reducing the performance standard to 77%) for repair completion and of 1% for 12 day provision appointment availability and provision appointment completion by appointment date;[12]

(c)   Allow for a glide path towards the performance targets for repair and 12 day provision appointment availability (i.e., significantly reducing the required targets for the first two years of the charge control);[13] and

(d)   Make an allowance for increased unit costs of around 4% to reflect what it considers to be the resource increment associated with the above increased performance requirements.[14]

2.1.5.   More detailed consideration of Ofcom's assessment of the EY model is provided below. However, Ofcom's overall approach to determining the appropriate level of performance and the associated cost is characterised as follows:

(a)   Ofcom has recognised that recent standards of performance for fault repair and provision order deteriorated between April 2008 and May 2013 (the July FAMR Consultation, §A9.50) including two periods when the performance was "much

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[11] Ofcom, FAMR Consultation, 19 December 2013, §3.84 and Table 3.4.
[12] Ofcom, FAMR Consultation, 19 December 2013, Table 3.5.
[13] Ofcom, FAMR Consultation, 19 December 2013, §3.106ff.
[14] Ofcom, FAMR Consultation, 19 December 2013, Table 3.6.

lower" than previously achieved. Ofcom also highlights the wide ranging negative effects that such poor performance has on CPs and end-customers and concludes on the basis of these findings that targets for improved standards of performance should be established.

(b)   Ofcom has not used any regulatory tools to require Openreach to resolve the situation through managerial action alone. This contrasts with examples in other regulated sectors (described in more detail below), including enforcement action by ORR and remedial actions required to be implemented by the CAA in response to performance declines in the rail and airport sectors.

(c)   Ofcom's assessment of the cost implication of any change in standards of performance fails to allow for any other drivers of change in service performance beyond resource costs. This is because it relies on the EY model which excludes any dynamic analysis of scope for productivity gains or any scope for catch up to best-practice.

(d)   Ofcom's analysis is limited to a challenge (informed by the AM report) of certain modelling assumptions. While Ofcom was right to seek to understand the basis of the EY model and the effect of the assumptions it included, a more complete review would have challenged Openreach in relation to wider and more fundamental issues. These include a detailed assessment of the causes of any deterioration in performance; whether Openreach has done enough to restore the situation to that which might be expected in a competitive market; and whether the Openreach model sufficiently captured the effects of productivity gains over time and "catch-up" performance that any operator in a competitive market would be required to meet.

(e)   Ofcom set out an analysis of the potential causes of Openreach's fall in performance in Annex 10 of its July FAMR consultation, including some correlation between persistent wet weather in 2012 and the growth in fault report volumes. However, due to an absence of benchmarks Ofcom was unable to identify the extent to which reductions on preventative maintenance, or failure to adopt best practice, may have contributed to underperformance. This is relevant since if exogenous factors do not wholly explain the fall in performance, there is no basis for the assumption that existing unit costs are not sufficient to enable an efficient operator to deliver a reasonable quality of service. Rather, this would support a finding that Openreach should be required to reach acceptable standards of

performance without any uplift (or, with any uplift being clearly identified as necessary to compensate for any change in external environment that makes the achievement of the standards more difficult in future).

2.2. REGULATORY APPROACHES TO QUALITY OF SERVICE REGULATION

Introduction

2.2.1. In a competitive market, quality of service would be an aspect of competition – consumers' purchasing decisions would reflect their utility from a combination of product characteristics, including quality of service, as well as price. Companies offering poor quality will lose customers to those offering better quality (in the absence of barriers to switching, and holding price constant).

2.2.2. Accordingly, firms will provide quality based on the demand and competitive pressure they face for such quality. Firms may improve their quality over time through a number of methods, including adopting improved technology, operational best practice from within the sector and/or the wider economy, and/or better incentive mechanisms for staff.

2.2.3. Regulators typically aim to regulate to encourage companies to deliver price and quality levels closest to that achieved under a competitive outcome (or an otherwise "socially optimal" level). Since privatisation, regulated industries generally have been mandated to find cost efficiencies in their price controls while improving quality, often through similar methods used by firms in competitive markets. A number of quality of service regimes are discussed below to illustrate these approaches.

Evidence from UK regulatory practice

2.2.4. A number of common themes (over and above the standard use of financial incentives, analysis of which is outside of the scope of this report) emerge from the quality of service regimes examined below, where UK regulators all tend to engage in:

(a) *Target setting*, to determine and periodically review what level of quality regulated firms would be expected to provide, given a particular price control or level of allowed spend;

(b) *Setting dynamic efficiencies in quality*, where targets for each year are set with an expectation of an improving quality of service over time to reflect anticipated improvements in technology, processes or best practice assimilation;

(c) *Utilising the threat (and application) of enforcement action* to ensure poor performance is quickly resolved, with effective monitoring and enforcement; and

(d) *Specifying investigative and recovery processes to remedy the situation* where a firm has failed acutely to meet quality targets.

2.2.5. Each of these points are considered in turn below, using examples of regulatory approaches drawn from the UK electricity, rail and airports sectors.

Target setting

Electricity

2.2.6. In setting price controls for electricity Distribution Network Operators ("DNOs"), Ofgem sets quality of service targets, as measured by the frequency and durations of interruptions to supply.

2.2.7. These measures are Customer Interruptions ("CIs") and Customer Minutes Lost ("CMLs"). CIs are measured as the proportion of customers whose supply is interrupted. CMLs are measured as an average (the total number of minutes lost by those customers interrupted divided by the total number of customers) i.e. for both of these measures, a lower score represents better performance.[15] In addition to these interruptions measures, DNOs are also assessed against a broad measure of customer satisfaction, speed of providing quotes and connecting customers.[16].

2.2.8. In its methodology paper for setting price controls for the period 2010-15 (distribution price control review 5, or "DPCR5"), Ofgem discuss how it sets targets for quality of service improvements.[17] The quality of supply performance, as measured by CIs and CMLs, is benchmarked across DNOs to assess the scope for improvement.

Rail

2.2.9. In setting Network Rail's access charges, the Secretary of State for Transport informs ORR what needs to be achieved by railway activities over the control period through producing high-level output specifications ("HLOS").[18]

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[15] See, e.g., Ofgem (Dec 2009), "Electricity Distribution Price Control Review Final Proposals", Appendix 2 glossary.
[16] See, e.g., Ofgem (Dec 2009), "Electricity Distribution Price Control Review Final Proposals", §1.12.
[17] Ofgem (May 2009), "*Electricity distribution price control review: methodology and initial results paper*", §7.17, and changes to benchmarking in the relevant final proposals technical paper (Ofgem (Dec 2009), "Electricity Distribution Price Control Review Final Proposals - Incentives and Obligations", §16.3).
[18] ORR (October 2008), "*Determination of Network Rail's outputs & funding for 2009-14*", §15.

2.2.10. In deciding the HLOS for the current control period ("CP4"), the Department of Transport (DfT) cited, as context, a transport study confirming that unreliability has an economic cost.[19] Furthermore, it stated that the Government had regard to the following:[20]

(a) 80% of rail passengers believe that current reliability levels are good or satisfactory, but "*expectations will inevitably rise*" (emphasis added);

(b) As Network Rail emphasised, "*a more reliable railway makes more efficient use of scarce network capacity*" i.e. quality should increase efficiency; and

(c) Disparities in performance indicate scope for improvement, borne out by ORR advice.

2.2.11. In CP4, reliability was measured by the Public Performance Measure (PPM),[21] as well as delay minutes and cancellations. However, in the next control period ("CP5"), reliability will be mainly measured by PPM[22], and in the previous price control ("CP3") reliability has been predominantly measured by delay minutes. (Control Period 2 is not considered here, since this was set immediately following the Hatfield derailment.)

Airports

2.2.12. Heathrow's quality regime sets out service standards that airlines could expect from the airport. The quality regime includes metrics that relate to passenger satisfaction, security queue times, passenger operations, and the availability of infrastructure that airlines require including pier service and jetties, for example.[23]

2.2.13. Compliance with this regulation requires Heathrow to collect a substantial amount of data on the key indicators, including the use of various methods to measure queue times,[24] and CAA commissioned consultants to carry out two full audits of the scheme in the last control period.[25] In contrast, Ofcom appears to have simply carried out a high level analysis of the causes of a deterioration in Openreach's performance and has commissioned expert assistance primarily in respect of the review of Openreach's resource simulation model.

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[19] This is the Eddington Transport Study. DfT (July 2007), "*Delivering a Sustainable Railway*", §3.1.
[20] DfT (July 2007), "*Delivering a Sustainable Railway*", §3.14.
[21] The PPM is not met if a scheduled train service is cancelled or arrives at its final destination more than 5 minutes late (or 10 minutes for inter-urban services). DfT (July 2007), "*Delivering a Sustainable Railway*", §3.15.
[22] ORR (October 2013), "*Periodic Review 2013: Final determination of Network Rail's outputs and funding for 2014-19*", §3.63.
[23] CAA (April 2013), "*Economic regulation at Heathrow from April 2014: initial proposals*", §11.2 – §11.3.
[24] Heathrow (August 2011), "*The Heathrow Service Quality Rebate Scheme: An overview of how the scheme is implemented*".
[25] See, for example, the second full audit – Scott Wilson (September 2010), "*Audit of Service Quality and Rebate Scheme at Heathrow and Gatwick Airports: Heathrow Airport Findings Report*".

Productivity assumptions

Electricity

2.2.14. Ofgem recognises the potential for productivity improvements in its document outlining its decisions for the price control to be in place from 2015 known as "RIIO-ED1". Ofgem expects such improvements from "*even the most efficient DNO*", citing the use of new technologies as a potential driver of efficiency, while inputs should be reduced "*whilst delivering the same outputs*", implying that cost efficiencies are not expected to be made at the expense of service quality.[26] The fact that Ofcom has not previously explicitly recognised the interaction between cost and quality incentives is likely to be at least partly responsible for the reduction in performance standards in recent years.

2.2.15. Targets for both CIs and CMLs have fallen over time (i.e. they have become more stringent). DNOs' quality of service has, on average, improved over time, as indicated by the improvement of IIS performance. The figures below show how performance has evolved over time against the targets set by Ofgem.
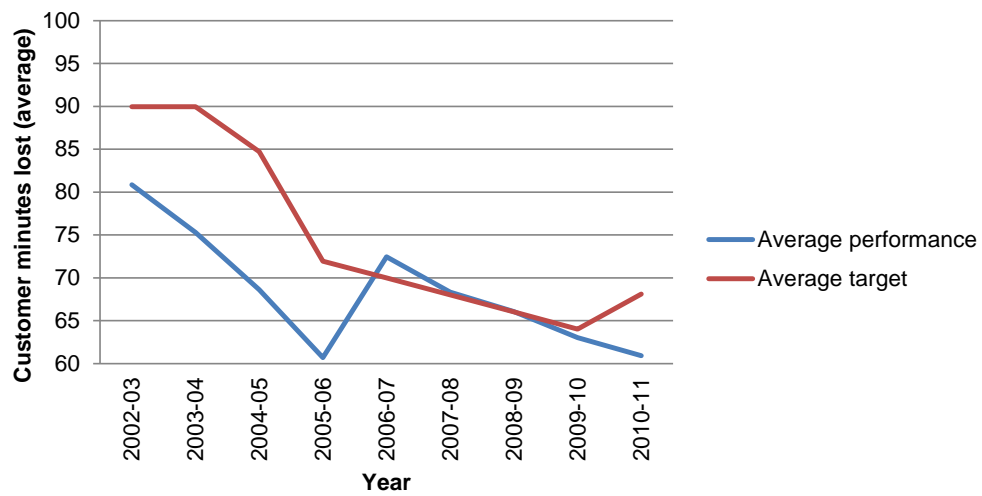
Figure 1: CI performance and targets
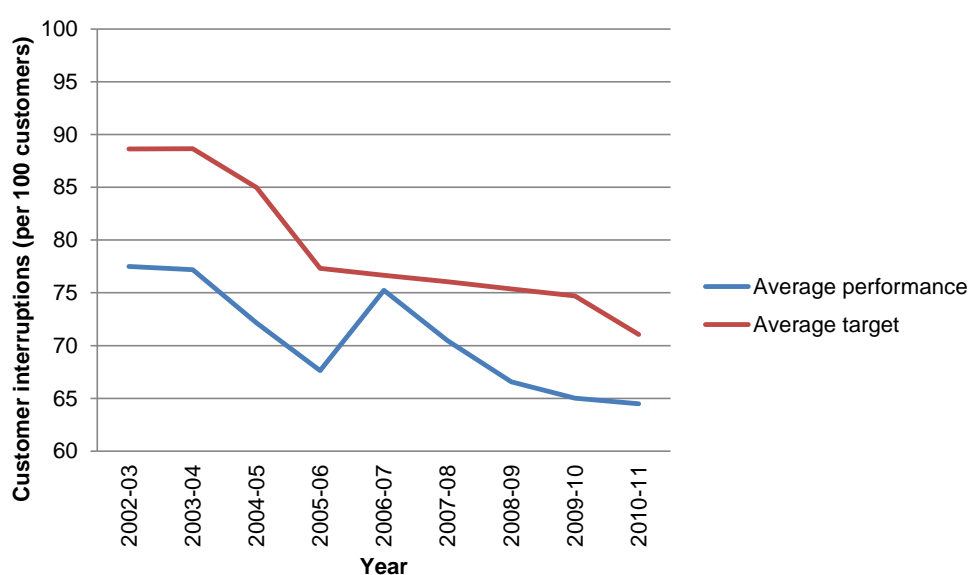
Source: Ofgem

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[26] Ofgem (March 2013), "*Strategy decisions for the RIIO-ED1 electricity distribution price control: tools for cost assessment*", §4.3.
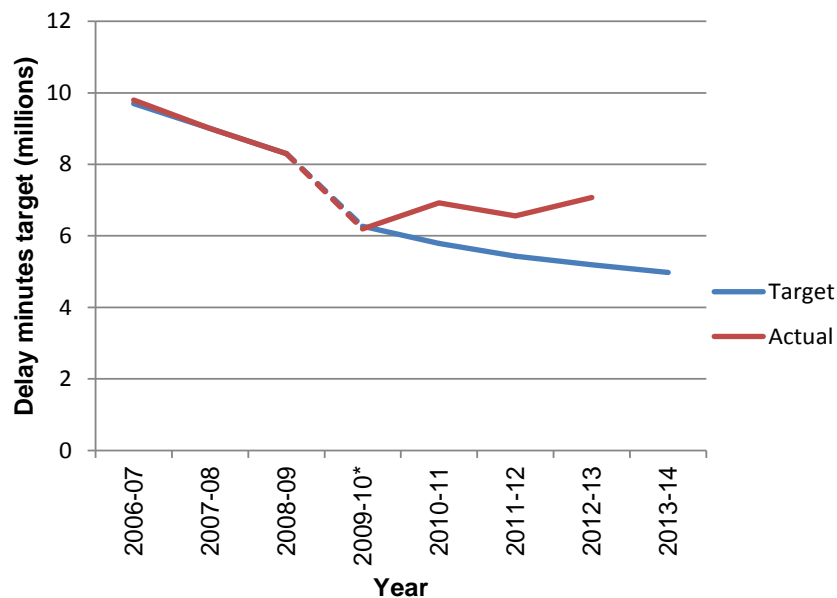
Figure 2: CML performance and targets

Source: Ofgem

Rail

2.2.16.   As shown in the figure below, between CP3 and CP4 target delay minutes have been falling over time, i.e. quality standards are being raised.[27]

Figure 3: CP3 and CP4 delay minutes targets

Source: ORR. Note: CP4 numbers are for passengers only, excluding freight.

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[27] PPM data for CP4 not shown since full-year actuals are available only for four years.

2.2.17.   As part of its quinquennial review of economic regulation at Heathrow Airport for the new five-year regulatory period ("Q6"), CAA has reviewed whether Heathrow has met its quality targets across a broad range of areas. While it is beyond the scope of this report to discuss Heathrow's financial incentives scheme, CAA has commented on Heathrow's "*improvements in the passenger experience achieved during Q5* [the previous regulatory period]".[28] The CAA has also maintained quality standards for Q6 (with some additions such as that of free wifi provision as a reporting metric[29]), while setting the price control for real price decreases by 1.5% annually.[30]

Enforcement action

Rail

2.2.18.   ORR has imposed a number of enforcement orders on Network Rail since privatisation following breaches of its licence conditions or failure to deliver.

2.2.19.   Some of these enforcement orders involve the imposition of fines, such as the penalty issued in relation to weaknesses in Network Rail's planning of a resignalling scheme in 2007. ORR deemed decisions made by Network Rail to risk "*failing to meet the reasonable requirements of its customers over a significant period of time*" and issued a penalty of £2.4 million.[31]

2.2.20.   However, in some instances recovery plans are issued when targets are not met, in lieu of a fine. One example of this follows Network Rail's failure to deliver performance targets in the freight sector.[32] ORR required Network Rail to set up and facilitate a recovery board, comprising relevant freight operators, to agree steps to remedy the breach of its licence.

2.2.21.   ORR emphasises that its main aim in setting a penalty is to deter non-compliance of the offender and others in the future. Typically, ORR has imposed recovery plans when there is a possibility of the offender remedying the breach.[33]

Airports

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[28] CAA (January 2014), "*Economic regulation at Heathrow from April 2014: notice of the proposed licence*", §7.
[29] CAA (January 2014), "*Economic regulation at Heathrow from April 2014: notice of the proposed licence*", §J64ff.
[30] CAA (January 2014), "*Economic regulation at Heathrow from April 2014: notice of the proposed licence*", §4.
[31] ORR (September 2007), "*Notice of ORR's decision to impose a penalty on Network Rail*", §1.
[32] ORR (January 2012), "*Breach of condition 1 of Network Rail's network licence with regard to operational performance*".
[33] In deciding on the most appropriate measure of enforcement, ORR aims to follow the principles of proportionality, targeting, consistency, transparency, and accountability as well as abiding by recognised best practice in setting penalties. ORR (July 2012), "*Economic enforcement policy and penalties statement*", §4.6.

2.2.22.   While not a formal enforcement action, it is worth noting that in the Competition Commission's (CC) final report on the market investigation into BAA, the CC observed Heathrow and Gatwick had continued to exhibit poor service quality despite a service quality regime being implemented following the CC's public interest report in 2002.[34] To further incentivise performance, the CC recommended – in addition to expanding the scope of the regime and tightening some of the benchmarks – "*an increase in the penalties for non-performance under service quality conditions*", bringing BAA's airport charges at risk from 3% to 5%.[35]

Investigative and recovery processes in the event of acute failure

2.2.23.   There are a number of examples in recent years where regulated firms have failed acutely to achieve their quality targets, and regulators have chosen to adopt a number of processes to remedy the situation. Commonalities between these processes include: (1) a detailed investigation into the circumstances and likely causes of the failure; and (2) mandating the formulation of an action plan to implement recommendations from the investigation, or otherwise remedy the situation. The action plan may contain measures that require further infrastructure enhancements or operational improvements, for example optimising existing infrastructure and/or adopting best practices. Two UK examples are set out below.

Heathrow winter resilience

2.2.24.   In 2011, BAA published its findings from the Heathrow Winter Resilience Enquiry, which examined the disruption caused by snow at Heathrow airport in 2010 and recommended changes to BAA's operation.[36] The report focused on improving BAA's ability to deliver a good quality of service to passengers during such events as well as its planning and response abilities.

2.2.25.   In the wake of the weather disruptions, The Department for Transport established the South East Airports Taskforce (SEAT), "*to explore how to improve performance and deliver a better passenger experience by making the best use of existing capacity*". The SEAT's primary focus was on increasing quality of service by improving punctuality, increasing resilience and reducing delay, particularly at Heathrow.[37]

2.2.26.   CAA, the sector regulator, was appointed as the leader of the SEAT. The proposals recommended by the taskforce mainly centred on operational improvements, including:

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[34] CC, *BAA airports market investigation*, Final Report §7.94.
[35] CC, *BAA airports market investigation*, Final Report §7.96(a).
[36] BAA (March 2011), "*Report of the Heathrow winter resilience enquiry*".
[37] Department for Transport (July 2011), "*South East Airports Taskforce: report*".

operational freedoms, to allow anticipation, prevention and mitigation of disruption; performance charters, setting out expected levels of service; and policy guidelines to optimise runway utilisation.[38]

Hatfield derailment

2.2.27. Following the Hatfield derailment in 2000, the Health and Safety Executive (HSE) – then responsible for health and safety on the railways – published recommendations for avoiding such events in the future, including operational and performance improvements (in addition to new investments).[39]

2.2.28. For example, recommendations in relation to additional training, improving communications systems and a review of track and rolling stock design were likely to require additional costs to be incurred.

2.2.29. However, the HSE also recommended quicker mechanisms for employees reporting safety issues, reinforcing the importance of track maintenance, implementing best practice in track inspection and a review of the regulatory regime to eliminate any conflicts of interest between target attainment and safety improvement. These are all operational and performance improvements that are likely to incur minimal incremental costs.

2.3. IMPLICATIONS FOR OFCOM'S TREATMENT OF COSTS

2.3.1. Based on the principles and examples from other UK regulators outlined above, there are a number of factual considerations that Ofcom needs to investigate to reach conclusions on its treatment of cost impact, in particular: (1) what quality of service should be expected to be achieved by Openreach given current charges, and how this compares with Openreach's current level of service; (2) whether Openreach's costs of providing a given level of quality have increased beyond the dynamic efficiency frontier; and (3) if not, how Ofcom should deal with the "catch up" required.

a) Quality of service implied by charges, and how this compares with current levels

2.3.2. Ofcom's current proposal "*is still to use the existing SLAs as the basis for the minimum standards*" (§3.19 of the FAMR Consultation), where Openreach's price controls implicitly take into account these SLAs. This is similar to service quality benchmarks set in the regulatory precedents above.

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[38] Department for Transport (July 2011), "*South East Airports Taskforce: report*".
[39] HSE (August 2002), "*Hatfield derailment investigation: interim recommendations of the investigation board*".

2.3.3.   As Ofcom notes, "*The problems with the current level of service appear to be both the absolute levels and the inconsistency of performance for extended periods (for example the extended period of very poor performance in 2012/13 where, as we noted in the July 2013 FAMR Consultation, <u>at times only 55% of repairs were delivered to the SLA target</u>).*" (§3.3.4, emphasis added)

2.3.4.   As such, the quality of service appears to be (significantly) below that reflected in Openreach's current charges.

b) Openreach's costs and the dynamic efficiency frontier

2.3.5.   Ofcom considers that it needs to recognise "*any additional costs that we calculate occur as a consequence of imposing minimum standards*" (§3.67), and any cost savings resulting from improved service quality "*are best estimated through our overall efficiency estimates*".

2.3.6.   Ofcom recognises that they have based their assessment on "*existing evidence of the relationship between cost and service outcomes in Openreach's business*". However, Ofcom does not test whether such costs are efficient due to the "*high risk of regulatory failure of us doing so in the absence of a very significant understanding of Openreach's business.*" (§3.68) But if this were the case, it is not clear how Ofcom can avoid regulatory failure in estimating the incremental resource input required by Openreach's business. This represents a significant limitation in Ofcom's approach which can only be rectified by carefully analysing the scope for improved operational performance given existing resources.

2.3.7.   Without testing whether Openreach's costs are efficient, Ofcom does not address the need to separate "catch up" to the efficiency frontier with movement along it.

c) Approach to "catch up"

2.3.8.   Furthermore, as examples such as Heathrow's winter resilience plan and ORR's approach to enforcement demonstrates, there are clearly other mechanisms to encourage "catch up" apart from increasing the regulated firm's resources. As set out above, such mechanisms would include mandating the formulation of a recovery plan, including operational improvements that can be made to achieve the recovery.

3. ASSESSMENT OF THE OPENREACH MODEL

3.1. SUMMARY OF OFCOM FINDINGS

3.1.1. Ofcom's approach in relation to the assessment of the cost implications of increased performance standards is limited to a review of the model commissioned by Openreach and produced by EY. Ofcom commissioned a report by AM, the purpose of which was to audit and test the construction of the model and its assumptions which informed its assessment of the EY model.

3.1.2. On the basis of its assessment, Ofcom proposes to set a minimum performance condition of 80% for repair completion, 80% for 12 day provision appointment availability and 90 % for provision appointment completion by appointment date (prior to any allowance for *force majeure*) measured against the service targets included in existing Service Level Agreements (SLAs) (where relevant).[40] Ofcom is not seeking to review whether the SLA targets themselves are reasonable or set revised targets. It also proposes to make an allowance for increased unit costs of around 4% to reflect what it considers to be the resource increment associated with the above increased performance requirements.

3.2. OUR COMMENTS ON THE APPROACH

3.2.1. The purpose of the EY simulation model is to answer the question of how many resources (engineers) of different skill levels are needed to meet a given level of service performance. This is then used to measure the difference in resources needed to achieve a change from a benchmark level to a target level of performance.

3.2.2. We note that we have not had access to the EY model; therefore large parts of our analysis are interpreted and/or inferred from the descriptions provided in the FAMR Consultation, including:

(a) The methodology document provided by EY (FAMR Consultation, Annex 6; the "EY Methodology paper");

(b) Information provided by BT/Openreach to EY as input for modelling (FAMR Consultation, Annex7; the "Openreach inputs"); and

(c) The report by AM detailing their evaluation of the E&Y model (FAMR Consultation, Annex 9; the "AM report").

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[40] Ofcom, FAMR Consultation, 19 December 2013, §3.84 and Table 3.4.

3.2.3.   The model by EY is based on a rich dataset and incorporates a number of factors relevant to the costs of provisioning and repair under different performance levels. Nevertheless, our opinion, based on the information available to us, is that there are substantial weaknesses or likely weaknesses which cannot be verified without access to the model. These involve fundamental issues such as the internal consistency of the model and whether the assumptions (and outcomes) of the model have been verified against real-world data.

3.2.4.   The AM Report sets out a number of comments and critiques of the EY model with which we agree. Most of these have already been considered at least partially by Ofcom, and as such we will not describe them in detail. In some cases, we either disagree with AM or it appears to us that Ofcom may not have fully taken AM's insight into account. In those cases we provide a fuller exposition.

3.2.5.   We will start by outlining the basic mechanics of the model, focusing on the aspects which are relevant for the purposes of our further comments. We will then discuss the model under four main headings:

(a)   The treatment of flexibility across days;

(b)   The treatment of flexibility across skill levels;

(c)   The modelling of the distribution of completion times; and

(d)   The modelling of Openreach's commercial approach to efficiencies.

3.2.6.   Where relevant we propose validity checks which should be carried out or, if they have been carried out, should be reported to allow stakeholders to understand more fully the workings of the model

3.2.7.   Finally, we provide brief comments on the assessments by AM and Ofcom.

Mechanics of the model

3.2.8.   As a preliminary comment, it should be noted that in any scenario, the average amount of resources available over the year must be higher than the average resource requirement, or the backlog would be steadily increasing. Any additional resources serve the purpose of dealing with peaks in demand. The peaks in demand, and how they are smoothed by getting parked in a queue whilst waiting for available resources is therefore of key significance. As this flexibility is reduced, the need for additional resources increases all other things alike.

3.2.9.   In the long run, the reason why lower performance targets are easier to meet is that peaks can be smoothed over a longer period (given that task times are significantly shorter than SLA targets).

3.2.10.   The way that this process takes place in the EY model is, in simple terms, as follows:

(a)   Jobs are logged. There are three basic types of jobs: provision of services[41] and repairs of Care Level 1[42] and Care Level 2.[43]

(b)   Jobs are parked for a random number of days in a queue. This time is determined by a random draw against a statistical gamma distribution, separately for each combination of GM area, Care Level and week.[44]

(c)   Jobs are carried out ("job completion"). The time to carry out the task ("task time") is derived from real-world data.

3.2.11.   The number of engineers needed is calculated based on the estimated dates of completion for each job, which determines how many jobs will be completed in any given day.

3.2.12.   To calculate counterfactual resource requirements, the parameters which determine the gamma distribution (the probability function describing how completion times are distributed) are shifted so that the share of jobs performed on time matches the desired levels. Based on the new estimated dates of completion for each job, resource requirements for each day are calculated.

3.2.13.   Interestingly, however, in the model the completion time for any particular job does not depend on the availability of resources in the days after the job is logged. Instead, jobs are parked until the day they are predicted to be carried out. The resources needed to carry out all the predicted jobs on a particular day are then calculated, as per above. Under the main approach presented by Ofcom in Annex 5 to the FAMR Consultation, the requirement for engineers of a particular skill level is set to the sum of the maximum required per GM area over the year[45].

3.2.14.   For a full explanation of this procedure, see pages 5-10 of the EY Methodology report or pages 4-9 of the AM Report.

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[41]   In the EY model, provision has a target completion time of 13 days.
[42]   These have to be completed by the end of the day two days after being logged (for a job logged on a Monday at 10am, the deadline would then be the end of Wednesday).
[43]   These have to be completed within the end of the day after being logged.
[44]   AM Report, page 8.
[45]   AM Report, pages 31-32.

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3.2.15.   The model is populated with data for 2011/12 and 2012/13 and can be estimated for either of these years.

The treatment of flexibility across days

3.2.16.   The FAMR Consultation[46] lists a number of ways in which Openreach can achieve flexibilities, such as redeploying staff from preventative maintenance activities, using contractors and using overtime. We agree that these options should have been reflected in the model. However, the first-order problem in terms of flexibility appears to be that the model, to our best understanding, presupposes that a large number of resources will be idle while there is a queue of jobs about to breach the SLA target.

3.2.17.   Consider, for example, Figure 9 of the EY Methodology paper[47]. This is an example of how jobs can be re-distributed from lower skilled to higher skilled workers in order to relieve resource constraints. However, this example is illustrative not only of the "Max Day" re-distribution method, but also of what we suspect may be one of the fundamental flaws in the model. We caution, as per above, that Openreach has not granted access to the actual model, so there are limitations to our understanding.

3.2.18.   In this example, the required number of engineers is 216 at CSE level and 292 at CAL level. Now, consider 29th March. According to Figure 9, there are 177 jobs which will be carried out[48] at level CSE and 285 jobs that will be carried out at level CAL. In both cases there are more engineers available than there are tasks to perform, according to the model. On the subsequent day, 30th March, the corresponding job figures are 191 and 295.

Table 1: Example figures of utilisation from the EY Methodology paper

Date	Initial simulation output			Adjusted simulation output				
	CSE	CAL	Total	Used CSE	Available CSE	Required CAL	Used CSE for CAL	Used CAL
28-Mar	214	289	503	214	2	287	2	287
29-Mar	177	285	462	177	39	246	39	246
30-Mar	191	275	466	191	25	250	25	250

Note: The total number of resources available is derived as 216 for CSE and 292 for CAL

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46   Ofcom, FAMR Consultation, §A5.18. Figures reproduced here as Table 1.
47   Page 11
48   *Nota bene* that these are not logged jobs, these are jobs that will be carried out on that day, according to the model.

3.2.19.   We know from the method of simulating times to completion[49] that a proportion of all these jobs will be delayed jobs, i.e. jobs in breach of the SLA target. These delayed jobs of 30th March will have been logged no later than 28th March or they would not have been counted as delayed. In other words, these jobs were in the queue on 29th March. The question we pose is then – why does the model assume that the engineers on 29th March disregard the jobs in the queue which are about to become delayed on the following day? Based on our understanding of the model premises, we would have expected surplus resources to be used to whittle down existing queues.

3.2.20.   To our mind, this does not seem to accord with the statement in the EY Methodology document, the model "assumes that Openreach had sufficient ability and incentive to optimise performance given the resource it had available in 2011/12 and 2012/13"[50]

3.2.21.   There is a segment in the AM Report which, although partly redacted, ties in with this. ("*For a 47 working-week year this would imply just* [REDACTED] *hours per week, which seems low*"[51]) We suspect that given the way the model has been constructed there is a considerable overestimation of the number of engineers needed to perform a certain number of jobs (or hours of work) and that this overestimation disproportionately affects the higher performance levels.

3.2.22.   Shifting between days would appear to be particularly important for Care Level 1 and provisioning, where there is more scope for moving jobs around to mitigate peaks in jobs logged.

3.2.23.   The AM Report states that idle resource "*could be used to carry out jobs that are in the system and, as such, increase the performance achieved on those days. /.../ Though it is not possible to calculate the exact impact of this effect, the magnitude is potentially significant*".[52]

3.2.24.   We take this to mean that the information/model provided to AM was not sufficiently detailed to allow this type of analysis. We consider that this is precisely the type of final step that should have been taken within the EY model. In other words, after calculating the "resource requirements", these requirements should have been fed into the model to derive actual completion times based on the queuing model.[53] This would then have given average simulated performance levels across the year. Resource requirements would then need to be

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49   See for example Figures 2 and 3 of the EY Methodology paper.
50   EY Methodology Report, page 2.
51   AM Report, page 32.
52   AM Report, page 48.
53   The difference between the simulated performance levels and the target performance levels would be the impact that AM speak of.

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revised based on whether the simulated performance levels were higher or lower than the target, and this procedure iterated until the desired performance levels achieved.

3.2.25. Furthermore, this aspect of the model appears to be the fundamental reason why the 2012/13 performance levels needed to be averaged across the entire year in order to be considered an appropriate benchmark by Openreach/EY for the baseline case (i.e., without imposition of performance improvements).

3.2.26. Our understanding is that this modelling step was taken to avoid a situation where high resource requirements towards the end of the year 2012/13 would give rise to unrealistic resource requirements across the year. But this appears to be an artefact of the lack of feed-back in the modelling. If resources across the year had been high enough to achieve the actual results towards the end of the year, then presumably this would have had an effect on the accumulation of a backlog during earlier months, which would have implied less of a need for resources towards the end of the year.

The treatment of flexibility across skill levels

3.2.27. The resources required to carry out the jobs in question can be classified into different skill levels:

(a)   OMI (one man installer);

(b)   Broadband OMI;

(c)   Customer Apparatus and Line (CAL);

(d)   Broadband CAL; and

(e)   Customer Service Engineer (CSE).[54]

3.2.28. The set of jobs that an engineer can carry out is strictly greater the higher his skill level. In order to minimise resource requirements, it therefore makes sense to build in flexibility in terms of skill level, so that idle high skilled engineers (or a proportion of them) are assigned available low skill jobs. The question of how this is managed has a potentially large effect on the cost estimates associated with an increase in performance.

3.2.29. For example, AM provide a methodology – the alternative "Top N days" approach – for re-allocating jobs from low skill engineers to (otherwise idle) high skill engineers. Under this

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[54]   For descriptions of these engineer skill levels, see Subsection 2.3.3 of the EY Methodology paper.

alternative "Top N days" approach, the total required resources over the year depends not on the day of highest requirements, but rather on the average across the N days with highest requirements, for each skill level.[55] Using an N of 25 days, this leads to a delta of 0.55% instead of 8.11%, which is the corresponding figure when using the so called "Max Day" approach.[56] Our interpretation of this erosion of the delta is that the extreme peaks have a disproportionate impact not only on resource requirements but on deltas.

3.2.30. The question of which of these alternative approaches (if any) is appropriate should be possible to resolve by comparing them with the actual utilisation rates of the BT field force, or where relevant using analysis to assess what strategy would be optimal. Yet no such comparison appears to have been made. Alternatively, the derived work force under the baseline case could be compared with the actual workforce employed as a sense-check of the methodology. To our understanding neither of these comparisons have been made, or if they have been, the implications for the question of engineer re-allocation have not been clearly set out.

The modelling of the distribution of completion times

3.2.31. As noted in Section 3.2.12 above, the two parameters of the gamma function together determine how long a job stays in the queue. In particular the alpha parameter defines the mode (or peak) of the distribution, while the beta parameter defines the variance (or spread) of the distribution. Examples are shown in Figures 4 and 6 below.[57]

3.2.32. This means that the gamma function serves the purpose of evening out spikes in the number of jobs logged per day as they get converted into number of jobs completed per day. If the gamma function has a large variance and a low peak (see below, Figure 3.5 from the AM Report reproduced as Figure 4), any peaks in jobs logged will be smoothed over several days in terms of job completion. In the contrary case, where the variance is small and there is a sharp peak, a larger share of any demand spike is preserved through to the completion stage.
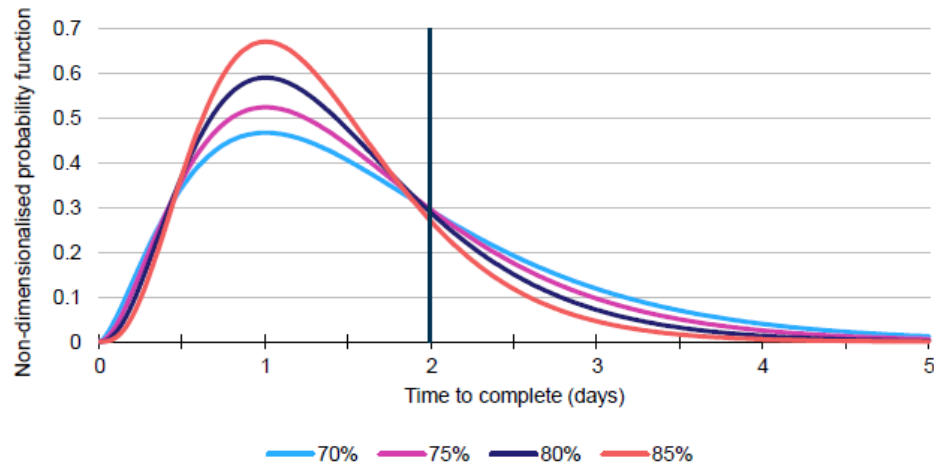
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[55]   AM Report, pages 22-24.
[56]   Repair 85% without uplifted task times, provision 85% without uplifted task times. See Ofcom, FAMR Consultation ,Table A5.5, Annex 5.
[57]   There is one pair of alpha and beta for each Care Level, job type, GM area, level of performance and week.

Figure 4: Example of gamma distributions with mode of one day but different spreads – from AM Report

3.2.33.   The extent of variability at the completion stage is what drives resource requirements. It would therefore appear important that the probability function translating the date of jobs logged into completion dates for those jobs is a reasonably close fit.

3.2.34.   In EY's model, the fit of the gamma function is quite poor for the completion times for repair[58], but for provision, the lack of fit is particularly problematic.[59] We reproduce here Figure 3.2 from the AM report which shows the fit between the gamma distribution and the empirical distribution of completion times for provision.

Figure 5: Completion times for provision: empirical and modelling distributions – from AM Report

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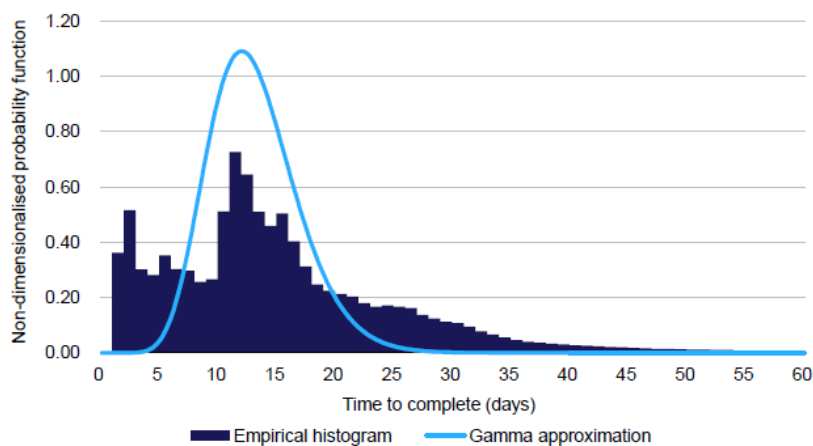
[58]   Figure 3.1 of the AM Report.
[59]   Figure 3.3 of the AM Report.

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3.2.35.   Apart from the apparent lack of similarity in shape, the most important aspect to note is that the peak of the chosen gamma distribution is far higher than the peak of the empirical distribution.

3.2.36.   AM claim that "*any statistical distribution will have a similar peak*"[60]. This is clearly not true. Given the irregular shape of the empirical distribution, it would have been better to use the sum of two distributions or a piece-wise defined distribution. Statistical distributions can be defined relatively freely.[61]

3.2.37.   We also note that we have not been able to locate any formal testing of whether the assumed distribution passes standard statistical tests of goodness-of-fit[62]. Given how central this distribution function is to the output of the model, the poor fit of this distribution function is very concerning.

3.2.38.   AM point out that using the EY distribution applied by EY induces a cost uplift of more than 1%, even before any performance improvements are assumed. AM refer to this as "*validating the shape of the baseline distribution in this specific case*"[63]. We would take the opposite view and argue that this cost uplift indicates that the gamma function chosen is inappropriate and leads to artificially high resource estimates, and that a correction term equal to at least this artificial[64] cost uplift should be introduced to offset this bias.

Mode of the gamma distribution constant across performance levels

3.2.39.   There are reasons to believe that the inherent error in the gamma distribution (smaller variance than the empirical distribution) is likely to be exacerbated as the performance levels increase.

3.2.40.   Openreach use a fixed mode (time from job log to "peak" of distribution) and combined with the requirement that performance levels should increase, this forces the gamma distribution to become narrower. The AM report demonstrates how the distribution would shift for a given mode, depending on performance levels[65]. However, despite pointing out that the problem is likely to be worse for provisioning[66,67] as compared to repair jobs where the mode is roughly halfway to the deadline[68], AM only display examples of the gamma

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[60]   AM Report, page 17.
[61]   The main restrictions are that the probability function should return non-negative values and the area under the distribution function should be one.
[62]   Ocular inspection makes clear that it most likely does not.
[63]   AM Report, page 17.
[64]   This is artificial in the sense of not reflecting any performance improvement but only an arbitrary modelling assumption.
[65]   Figure 3.5, AM Report.
[66]   Page 20, AM report.
[67]   Where the mode is on the 12th day on a 13 day SLA deadline
[68]   The mode is 0.5 days for Care Level 2 and 1 day for Care Level 1.

distributions for repair[69]. Figure 6 below shows the difference in "peakiness" with an SLA target of 13 days and a mode of 12 days, for two different assumptions on SLA performance levels. Here the mode is 83% more likely to occur – almost twice as common – under an 80% performance level compared to a 65% performance level.[70] Bear in mind that even the 65% curve severely exaggerates the peak, as per Figure 5 above[71].

Figure 6: Gamma distributions with constant mode of 12 days and 65% vs 80% performance levels of a 13 day SLA
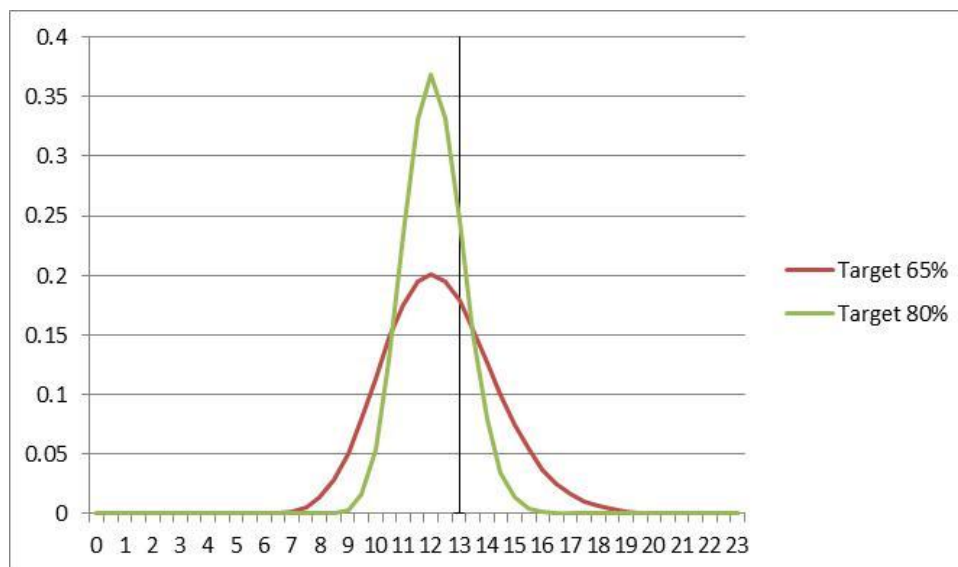
3.2.41.   In our view, AM's summary is not very clear on this point[72]: "Importantly it is unclear to us what magnitude of effects this choice of fixing the mode of the gamma distribution has on the calculated resource requirements, particularly for provision jobs, which is an important point"[73]

3.2.42.   Contrary to this assertion, we consider there are strong indications that fixing the mode of the gamma distribution, rather than allowing it to decrease as would be natural when aiming for higher performance levels, would tend to increase the resource delta. The reason is that it creates a higher modal peak of the distribution of completion times, which means that any peak in jobs logged will be less smoothed by its time in the queue. An alternative reason would be strictly intuitive – as you increase resources then it stands to reason that the representative completion time will be reduced, and not (merely) that the distribution of

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[69]   Reproduced above as Figure 4.

[70]   The corresponding increase in "peakiness" for an SLA of 2 days and a mode of 1 day – i.e. the graph displayed in the AM Report – is only 41%.

[71]   Also note that the density values on the y-axis of Figure 5, reproduced from the AM Report, are implausibly low as the area under the graph should be equal to exactly one.

[72]   "*Importantly it is unclear to us what magnitude of effects this choice of fixing the mode of the gamma distribution has on the calculated resource requirements, particularly for provision jobs, which is an important point*" (AM Report, page 47)

[73]   AM Report, page 47.

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completion times will get compressed, which is the current EY assumption (see Figure 4 and Figure 6 above).

3.2.43.   We find it intuitively implausible that in order to hit a more stringent performance target, Openreach would actually be almost twice as likely to hit the target the day just before the SLA deadline in the case of provision. Furthermore, it is very surprising that Openreach would reduce (rather than increase) the number of jobs with the shortest completion times when attempting to increase the share of jobs that achieve the SLA targets.

3.2.44.   According to the AM Report[74], Openreach motivate the fixed mode by reference to empirical data. We think it would be useful to make sure that this is based on time periods and GM areas where the performance levels at hand were achieved. In our view, cases when the performance levels were not hit would be irrelevant for the reason set out above.

3.2.45.   Furthermore, AM for some reason did not examine the extent to which an earlier mode (i.e. a different pair of alpha and beta values) would have reduced the resource increments needed[75]. Seeing that the assumption of constant mode is not supported by any evidence, this would appear to be an important area to present sensitivities and we think this should have been done in the EY Methodology Report as well.

3.2.46.   We would also point out that the constant mode is, in our view, the most extreme assumption that can be maintained regarding the gamma distribution, in terms of its effect on the delta (short of assuming that the modal time in the queue increases when performance levels rise, which seems impossible to defend *a priori*).

3.2.47.   We acknowledge that the fact that the model assumes that performance is targeted at the GM area (which is likely to be larger than the operational range of the field force engineers) partially mitigates this problem.

The modelling of Openreach's commercial approach to efficiencies

3.2.48.   The relevant question when considering the cost uplift to Openreach of an increase in performance of x% points is how Openreach would be most likely to achieve it, bearing in mind Openreach's likely commercial objective to minimise costs. We consider it unlikely that Openreach would impose an even x % point increase in every week of the year, as assumed in the model (there is an allowance for "glass ceiling" effects, but this is distinct from the question of how Openreach would aim to improve performance)[76]. At page 25 of

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[74]   Page 18.
[75]   Page 21, AM report.
[76]   EY Methodology document, page 14.

the AM report, an example is given of where a more even target distribution of performance over the year gives rise to smaller cost increases[77]. To us, it seems obvious that Openreach would target the "lowest hanging fruit" rather than seeking to enhance performance evenly throughout the year.

3.2.49.   This argument has application in a number of cases. In our opinion, whenever there is a modelling choice which in any way corresponds to commercial choices that Openreach might face, then the modelling should choose the path which gives rise to the lowest delta. This appears to be the most likely path which would be taken by a firm seeking to minimise its costs.

Additional points

3.2.50.   Openreach appears to argue that the figures for provisioning for 2011/12 are less reliable since there was no explicit provisioning target during that year. Openreach could therefore have taken resources from provisioning to repair jobs during times of high demand for the latter. However, according to Table A5.3 in Annex 5 of the FAMR Consultation, the difference between repair and provisioning was 14%[78] in 2011/12, but 21%[79] in 2012/13, i.e. an increase. This does not appear consistent with the critique of the 2011/12 data.

3.2.51.   We agree with the AM Report that the EY approach to performing "Top N Days" re-distribution of resources is inadequate.[80] We note that this alternative approach in some sense deals with re-allocation across days, as there would not be sufficient resources to deal with the most demanding days of the year. However, this would not be a problem as any surplus on those days could simply accumulate in the queue, for later disposal using surplus resources on days with less than 100% utilisation.

3.2.52.   "*Openreach considers that such an outcome would not reflect the actual operational situation, where there exist practical limitations to completing Provision jobs within a shorter SLA target*"[81]. In order to be able to fully evaluate the EY model, it would be important to know these limitations in order to ascertain how reasonable the assumption of constant mode is for the provisioning jobs.

3.2.53.   According to the AM report, the "*2012/13 provision performance was, for a few weeks in the year, very poor. This led to a backlog of provision jobs within the system, which in turn*

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[77]   Another example is the adjustment to baseline performance levels for 2012/13, which as noted in e.g page 34 of the AM Report.
[78]   79% - 65%
[79]   63% - 42%
[80]   See page 22 of the AM report.
[81]   EY Methodology paper, page 15.

caused an unrepresentative spike in resource requirement later in the year"[82]. We think it is remarkable that this backlog could not be dealt with by a smaller, but earlier, increase in resources and we question whether this is really indicative of efficient resource utilisation.

3.2.54.   Drawing on the discussion in this section, four of the validity checks that we think should have been performed are as follows:

(a)   The actual utilisation rates of the BT field force should be checked against the simulated utilisation rates across skill levels to better understand which approach to re-distribution across skill levels is most appropriate ("Max Day", "Top N Days", the alternative "Top N Days", or something else);

(b)   Alternatively, the derived work force under the baseline case could be compared with the actual workforce employed as a sense-check of whichever re-distribution methodology is applied;

(c)   The EY model assumes that the mode of completion times is constant across performance levels. We consider it would be useful to make sure that this is based on a comparison with historical data from time periods and GM areas where the performance levels at hand were achieved, and not when the baseline performance levels were attained; and

(d)   The shape of the gamma distribution is likely to have a large impact on the estimated resource increments. We therefore consider that sensitivity analysis using alternative pairs of alpha and beta values should have been carried out to determine the extent to which the resource increment would have been reduced, in particular for provision. This is especially pressing given that the assumption of a constant mode is not supported by evidence presented in the consultation documents.

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[82]   AM Report, footnote 25.