

## **Fixed Access Market Review**

EY response to comments made by Ofcom and  
Analysys Mason in respect of the Openreach  
Discrete Event Simulation Model

February 2014

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# 1. Executive summary

- 1.1 Ofcom is currently conducting the Fixed Access Market Review (FAMR)<sup>1</sup>, in which it will set regulated charges for Local Loop Unbundling (LLU) and Wholesale Line Rental (WLR) services<sup>2</sup>. As part of the FAMR, it is considering a number of aspects of Openreach's service quality and cost base, including Service Level Agreement (SLA) and Service Level Guarantee (SLG) arrangements<sup>3</sup>, the potential set of minimum service standards for Provision and Repair activities, and the different levels of resource required to provide differential Repair performance (referred to as "Care Levels" by Openreach<sup>4</sup>).
- 1.2 In this context, EY has supported Openreach through the development of the Openreach Discrete Event Simulation Model (the "Model")<sup>5</sup> in order to understand the costs of providing service at different levels of performance and to use the analysis generated by the Model as an input to: (i) Ofcom's latest modelling for LLU and WLR services, which is expected to inform charge controls coming into force from 1 April 2014; and (ii) its own internal business planning and field force management.
- 1.3 Ofcom's proposals imply a broad acceptance of the appropriateness of the Model, and Ofcom proposes to use its outputs to inform regulated charges for WLR and LLU services when setting the forthcoming charge controls. Ofcom plans to use the Model to reflect two key points, namely:
1. The level of additional resource required to meet higher average levels of performance against SLA targets for Provision and Repair activities (the "Service Performance Resource Delta"); and
  2. The cost difference between LLU and WLR services, to reflect the different Care Level mix for Repair activities (the "Service Level Cost Differential")<sup>6</sup> and, hence, the difference in costs in respect of field activity.
- 1.4 Ofcom's FAMR consultation on "Openreach quality of service and approach to setting LLU and WLR Charge Controls"<sup>7</sup> (the "Consultation") identified what it considered to be issues regarding the Model approach and the adoption of certain Model parameters<sup>8</sup>. These include:
1. General methodological issues including the Model approach, the method for constraining performance through the implementation of a "glass ceiling"<sup>9</sup>, and the approach to "flexing" the gamma distribution<sup>10</sup>;

<sup>1</sup> <http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-reviews/>

<sup>2</sup> [http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/summary/LLU\\_WLR\\_CC\\_2014.pdf](http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/summary/LLU_WLR_CC_2014.pdf)

<sup>3</sup> SLAs cover the maximum time available to Openreach to complete a Repair activity or the lead-time to the earliest Provision appointment date offered. SLGs represent the charges that Openreach is liable to pay to other Communications Providers in the event it fails to meet a SLA for a particular Provision or Repair activity

<sup>4</sup> Openreach offers four Care Levels for Repair, with Care Level 1 being the most basic (with the longest SLA target)

<sup>5</sup> Ofcom refer to the Model as the "Resource Simulation Model"

<sup>6</sup> The Service Level Cost Differential refers to the difference between the unit costs for relevant components in the Ofcom charge control model, between Care Level 2 copper products (MPF or WLR) and Care Level 1 copper products (WLR). The Service Level Cost Differential reflects the higher level of fault repair costs associated with the need to repair Care Level 2 products by the end of the next working day following fault report receipt, compared to Care Level 1 products, which include an additional day allowed in the SLA

<sup>7</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR Charge Controls, 19 December 2013

<sup>8</sup> Ofcom's conclusions regarding the Model have been informed by an independent validation and verification of the Model conducted by Analysys Mason, a consultancy which specialises in telecoms, media and technology

<sup>9</sup> The "glass ceiling" constraint reflects that there is a limit to the number of tasks that can be successfully completed for Provision and Repair activity on any given day due to factors such as the requirement for civil works or other physical limitations

<sup>10</sup> The gamma distribution refers to a statistical distribution which has been fitted to Openreach's empirical data in order to represent the waiting time of Provision and Repair activities in the Model prior to execution and to be able to

2. The reliability of results generated from 2012/13 data compared with those generated from 2011/12 data; and
  3. The amendments made to the Model when assessing the Service Level Cost Differential.
- 1.5 The main body of this report responds to these issues, supported as appropriate by additional data and analysis. The key points relating to EY's response are as follows:

**Model limitations**

- 1.6 The Model is robust and unbiased, as recognised by Ofcom in its conclusions regarding the Model. The use of any simplifying assumptions has been driven by the need for pragmatism, and EY considers that the use of these assumptions does not materially distort the results and, for example, as in the case of the assumption regarding the level of geographic modelling, may even underestimate the results<sup>11</sup>.
- 1.7 The Model benefits from the use of Openreach's actual performance as an input, and the modelling approach has sought not to adjust Openreach's operating model. This results in a less theoretical outcome than alternative modelling approaches could produce and, in EY's view, leads to a superior modelling outcome given the objective of the modelling exercise.
- 1.8 EY considers that the issues raised by AM regarding the glass ceiling constraint to be immaterial, and notes that AM, whilst raising queries regarding this parameter, does not propose an alternative approach to be taken in the Model. Similarly, with regards to the queries raised in respect of the use of a gamma distribution and the approach taken to "flex" the gamma with changes in performance, no alternative method has been proposed by AM or Ofcom. EY considers the approach taken in respect of these parameters in the Model to be reasonable and appropriate and therefore considers that no amendments are necessary to these parameters.

**Use of 2012/13 data to determine resource requirements**

- 1.9 The appropriate data set used will be that which best reflects the expected characteristics of Openreach's business – considering both demand and supply aspects – during the relevant charge control period (i.e., from April 2014 onwards).
- 1.10 Openreach considers that results based on 2012/13 data, rather than 2011/12 data, are likely to provide a more appropriate basis for a forward looking charge control due to the considerable operational and market changes that have occurred since 2011/12 (such as the introduction of an explicit SLA for Provisions and a shift from MPF to WLR), which Openreach considers are likely to be enduring features of future demand (and hence Openreach's current and future operating model)<sup>12</sup>.
- 1.11 The results for 2011/12, by not reflecting these operational changes, potentially underestimate the resulting Service Performance Resource Delta, as the performance level for Repair is likely to have been lower had there been a formal SLA in respect of Provision activities, and a greater proportion of MPF lines than was

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modify this distribution when considering Model scenarios. The mode of this distribution is fixed at one day prior to the SLA for activities with an SLA target of two or more days. The Model maintains the position of the mode of the distribution in scenarios of higher performance, where the distribution is "flexed"

<sup>11</sup> The Model allows movement of resource within individual General Manager (GM) areas, and the Model assumes that an engineer is free to complete an activity anywhere within a given GM (e.g., Scotland) without any additional time and cost implications. In practice engineers would not typically travel outside a geographically smaller Senior Operations Manager (SOM) area

<sup>12</sup> "Openreach response to service-related questions in Ofcom's consultation documents "Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30" and "Fixed access market reviews: Approach to setting LLU and WLR Charge Controls", 30 September 2013, §201

actually the case. As a sensitivity, EY has run the model for 2011/12 with Repair performance set to 70%, which results in a Service Performance Resource Delta of 5.1% at the 80% performance target, compared with the 3.9% proposed by Ofcom. This figure may well provide a more appropriate indication of the required additional resource given 2011/12 levels of performance but with operational characteristics closer to 2012/13.

- 1.12 The Model parameters for the 2012/13 data set were designed specifically to adjust for the exogenous factors faced by Openreach in 2012/13 that Openreach considers it could not have reasonably foreseen, and we consider this adjustment to be a pragmatic solution to address this issue.
- 1.13 EY recognises that, when choosing the most appropriate base data for inclusion in Ofcom's charge control modelling for LLU and WLR, there is a trade-off between using unadjusted data which is less recent (i.e., 2011/12), and therefore may be less representative of the current (and future) reality of Openreach's operations, and using data from the most recent financial year (i.e., 2012/13), which has been adjusted to reflect "business as usual" accuracy in short-term forecasting.
- 1.14 Given the considerable operational changes since 2011/12, and the fact that the adjustments made to the 2012/13 data sought to remove distortions arising from inaccuracies in forecasting during the year, the Service Performance Resource Delta derived from the 2012/13 Model should, we consider, form the basis of the analysis used by Ofcom when setting the forward looking charge controls.
- 1.15 On this basis, the relevant Openreach costs would require an estimated uplift of between 15.3% and 20.0%, depending on the approach taken to adjust for the distortions in the 2012/13 data set, to increase service levels to an average of 80% performance.

### **Model application for the Service Level Cost Differential**

- 1.16 The approach taken to consider the Service Level Cost Differential reflects the need to calibrate the Model for a revised "baseline"<sup>13</sup> of higher service performance levels, and to reflect how Openreach's resourcing profiles would need to change to reflect a change in the Care Level mix.
- 1.17 AM derives an alternative relationship between the resource requirements relating to the extremes of 100% Care Level 1 activities and 0% Care Level 1 activities (which informs the Service Level Cost Differential). AM's output for 2011/12, under the 80% performance scenario and the "Maximum Day" resource redistribution approach, gives a result of 17.9%. This figure is then reduced by a factor of 21% to reflect economies of scope to give a resulting Service Level Cost Differential of 14.1%. Ofcom proposes to use this figure of 14.1% in its charge control modelling.
- 1.18 The Ofcom consultation, and its accompanying reports, do not provide sufficient information for EY to comment on these results in detail, and we await responses to questions we have put to Ofcom to establish clarity, but we note the following:
- ▶ the result computed by EY from the Model based on 2011/12 data under the 80% performance scenario and using the Maximum Day approach is 23%. This differs from the 17.9% calculated by AM, but EY has not been provided with details of AM's calculations and therefore is not in a position to understand and comment upon the difference in results;

<sup>13</sup> The "baseline" refers to the resource estimates produced by the Model to which scenarios are assessed. For scenarios considering a change in performance against SLAs, the baseline is based on Openreach's actual historic performance. However, when considering the change in Care Level mix to determine the Service Level Cost Differential, the baseline of this analysis is a scenario that reflects higher performance against SLAs than is reflected in Openreach's historic data. This revised baseline reflects performance levels of 80% for Provision and Repair

- ▶ AM's report shows that a figure of 17.9% is derived for the 2012/13 data set at 80% performance and using AM's "Top 10 AM" redistribution approach. It is not clear whether it is coincidence that this figure is identical to what AM quotes as its result for 2011/12 using the Maximum Day approach, or a mis-statement by AM; and
- ▶ AM does not provide a rationale for the adjustment made to the proposed Service Level Cost Differential (i.e., a 21% reduction) to account for economies of scope.

1.19 EY has conducted further analysis of the Model with Provision activities included in order to assess the impact of economies of scope between Provision and Repair activities. The inclusion of Provision activities reduces the 2011/12 Service Level Cost Differential of 23% down to 21%. We therefore continue to support the view proposed by Openreach that the Service Level Cost Differential is approximately 20%.

## 2. Introduction

- 2.1 Ofcom is currently conducting the Fixed Access Market Review (FAMR)<sup>14</sup>, in which it will set regulated charges for Local Loop Unbundling (LLU) and Wholesale Line Rental (WLR) services<sup>15</sup>. As part of the FAMR, it is considering a number of aspects of Openreach's service quality and cost base, including Service Level Agreement (SLA) and Service Level Guarantee (SLG) arrangements<sup>16</sup>, the potential set of minimum service standards for Provision and Repair activities, and the different levels of resource required to provide differential Repair performance (referred to as "Care Levels" by Openreach<sup>17</sup>).
- 2.2 The proposals that Ofcom set out in the July 2013 FAMR consultation included a significant market power (SMP) condition affecting BT that would establish minimum standards for Provision and Repair for LLU and WLR services. Ofcom considered that these higher standards might cause Openreach to incur additional costs, which in turn required Ofcom to consider how such costs might be reflected in the charge controls.
- 2.3 In this context, EY has supported Openreach through the development of the Openreach Discrete Event Simulation Model (the "Model")<sup>18</sup> in order to understand the costs of providing service at different levels of performance and to use the analysis generated by the Model as an input to: (i) Ofcom's latest modelling for LLU and WLR services, which is expected to inform charge controls coming into force from 1 April 2014; and (ii) its own internal business planning and field force management. In the July 2013 FAMR consultation Ofcom highlighted the need to conduct an independent validation and verification of the Model.
- 2.4 The Model was submitted to Ofcom in July 2013 and a detailed methodology document<sup>19</sup> was submitted to Ofcom in October 2013.
- 2.5 Ofcom plans to use the Model to reflect two key points, namely:
1. The level of additional resource required to meet higher average levels of performance against SLA targets for Provision and Repair activities (the "Service Performance Resource Delta"); and
  2. The relative cost difference between LLU and WLR services to reflect the different Care Level mix for Repair activities (the "Service Level Cost Differential")<sup>20</sup> and, hence, the difference in costs in respect of field activity.
- 2.6 On 19 December 2013, Ofcom published its FAMR consultation on "Openreach quality of service and approach to setting LLU and WLR Charge Controls"<sup>21</sup> (the "Consultation"). The Consultation sought, *inter alia*, to gather stakeholder views on its analysis and proposals in relation to the Service Performance Resource Delta and the Service Level Cost Differential.

<sup>14</sup> <http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-reviews/>

<sup>15</sup> [http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/summary/LLU\\_WLR\\_CC\\_2014.pdf](http://stakeholders.ofcom.org.uk/binaries/consultations/llu-wlr-cc-13/summary/LLU_WLR_CC_2014.pdf)

<sup>16</sup> SLAs cover the maximum time available to Openreach to complete a Repair activity or the lead-time to the earliest Provision appointment date offered. SLGs represent the charges that Openreach is liable to pay to other Communications Providers in the event it fails to meet a SLA for a particular Provision or Repair activity

<sup>17</sup> Openreach offers four Care Levels for Repair, with Care Level 1 being the most basic (with the longest SLA target)

<sup>18</sup> Ofcom refer to the Model as the "Resource Simulation Model"

<sup>19</sup> <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex6.pdf>

<sup>20</sup> The Service Level Cost Differential refers to the difference between the unit costs for relevant components in the Ofcom charge control model, between Care Level 2 copper products (MPF or WLR) and Care Level 1 copper products (WLR). The Service Level Cost Differential reflects the higher level of fault repair costs associated with the need to repair Care Level 2 products by the end of the next working day following fault report receipt, compared to Care Level 1 products, which include an additional day allowed in the SLA

<sup>21</sup> <http://stakeholders.ofcom.org.uk/consultations/fixed-access-market-llu-wlr-charge-controls/>

- 2.7 In the Consultation, Ofcom set out its assessment of the Model and its outputs, based in part on an Ofcom-commissioned report by Analysys Mason<sup>22</sup> (AM). AM's report sets out its conclusions following the undertaking of two reviews, namely:
1. Model audit: This entailed an assessment of the Model design, inputs, assumptions, operation, limitations and how accurately it reflects the operational organisation and processes being modelled; and
  2. Model testing: This entailed a review of the modelling scenarios specified by Ofcom, how they have been implemented by Openreach, the inputs, assumptions, identification of limitations of the modelling and a verification of the results provided by Openreach.
- 2.8 AM's assessment was that its *“overall impression was that a useful and productive effort had been made to significantly improve the understanding of the relationship between Openreach's QoS [Quality of Service] and resources that previously had not been addressable in a systematic way”*<sup>23</sup>. Ofcom concludes that its *“overall assessment is that the Resource Simulation Model has been partially successful in simulating Openreach's operations”*<sup>24</sup>. Ofcom therefore proposes to use the Model to inform allowable cost increases and the appropriate Service Level Cost Differential for LLU and WLR services.
- 2.9 EY welcomes the general support and acceptance of the Model following the detailed review and audit work conducted by AM and Ofcom.
- 2.10 However, Ofcom and AM have highlighted what they consider to be issues regarding some areas of the Model approach and the adoption of certain Model parameters. These issues are summarised as follows:
1. Ofcom and AM highlight limitations of the Model approach, namely: the approach that has been taken to the modelling (a “distribution” approach rather than an “allocation approach”<sup>25</sup>) being different to what Ofcom considers to be the “normal” queuing model approach; the “glass ceiling” constraint defined in the Model may be set too low; the performance redistribution assumptions are not based on empirical data; the fit of the gamma distribution for the 2011/12 Provision data is *“very rough and does not accurately represent a large number of jobs which have short times to complete”*<sup>26</sup>; and alternative methods for fixing the mode of the gamma distribution may be appropriate when performance is changed;
  2. Ofcom considers that analysis using 2012/13 data is less reliable than 2011/12 for the purposes of estimating the resource impact of service quality improvements, and is not satisfied with the approach taken to calibrate the Model for the use of 2012/13 data to address backlog<sup>27</sup> accumulation. Specifically, Ofcom states that *“the simulation approach adopted, whilst reasonable, has not coped well with the large drop in performance observed in*

<sup>22</sup> <http://stakeholders.ofcom.org.uk/binaries/consultations/fixed-access-market-llu-wlr-charge-controls/annexes/annex9.pdf>

<sup>23</sup> Ofcom, FAMR Consultation: Openreach quality of service and approach to setting LLU and WLR Charge Controls Annexes, 19 December 2013, §A5.52

<sup>24</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §3.73

<sup>25</sup> An “allocation” approach models incoming activities arriving in a queue at a specific rate, which are then held in the system, waiting to be completed by a fixed volume of resource. The output of this approach is the time the activities are completed which can be compared to a fixed service level target to establish the performance against target. A distribution approach works in reverse, with the performance target as an input and a fixed volume of activities to be completed. The output of this approach is the resource level required to meet the performance target

<sup>26</sup> Analysys Mason, Quality of Service model assessment, 22 November 2013, §3.2, page 16

<sup>27</sup> “Backlog” refers to activities that were not completed within the SLA and remain in the system waiting to be cleared. Backlog can reach a level whereby the day-to-day demand for resource is driven by the need to clear this backlog as opposed to completion of new activities in the system

*2012/13 [...] we consider that the 2012/13 results are not reliable and are not therefore suitable for use as an input to our Charge Control models<sup>28</sup>; and*

3. Ofcom highlights issues with the modelling approach for the Service Level Cost Differential and, as such, has taken into consideration analyses conducted by AM using the Model in its proposals set out in the Consultation. AM produces a different result to EY for a scenario which Ofcom use to inform its proposed Service Level Cost Differential. Ofcom proposes to use AM's derivation of this Model scenario rather than the result produced by EY using the Model.
- 2.11 Openreach has engaged EY to assist in responding to the material points made by Ofcom and AM in their assessment of the Model, supported as appropriate by additional data and analysis.
- 2.12 The remainder of this report is structured as follows:
- ▶ Section 3 sets out EY's response to general points made by Ofcom and AM in respect of the overall modelling approach;
  - ▶ Section 4 sets out EY's response to specific points raised by Ofcom and AM regarding the choice of the most suitable base year data to use in the Model to assess the additional resource required to meet the higher level of service performance; and
  - ▶ Section 5 sets out EY's response to points made in respect of the application of the Model to certain specific issues regarding its application to the Service Level Cost Differential and sets out EY's views on the validity of the data produced by AM which Ofcom has used in forming its proposals in the Consultation.

<sup>28</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §3.73

### 3. Model methodology

- 3.1 In this section, EY sets out its response to general points made by Ofcom and AM in respect of the overall modelling approach. These points relate to: the approach that has been taken to the modelling (a “distribution” approach rather than an “allocation approach”) being different to what Ofcom considers to be the “normal” queuing model approach; the “glass ceiling” constraint defined in the Model potentially being set too low; the performance redistribution assumptions not being based on empirical data; the gamma distribution not being a good fit for the Provision data from 2011/12; and alternative methods for fixing the mode of the gamma distribution which may be appropriate when performance is changed.

#### **Model overview**

- 3.2 The Model is a sophisticated and detailed representation of field engineering activity within Openreach’s Service Delivery division<sup>29</sup>.
- 3.3 The Model considers relationships between SLAs, service level performance and the required number of Openreach engineers by skill level to deliver determined service levels. The Model is designed to address the key questions of determining the level and mix of resource required for Openreach to achieve: (i) existing “baseline” service levels; (ii) alternative (i.e., higher) levels of minimum average service standard (the Service Performance Resource Delta); and (iii) alternative Care Level mixes for both LLU and WLR services (the Service Level Cost Differential). The Model uses Openreach source data from the two most recent financial years, i.e., 2011/12 and 2012/13.
- 3.4 EY has used a modelling approach known as Discrete Event Simulation (DES) which mimics the operation of a real or proposed system, in this case being the day-to-day operation of Openreach engineers. A range of data sources from Openreach operational systems has been used, including information on activities completed by Service Delivery, task times associated with each activity, activity prioritisation rules, shift patterns, engineer skill types and skill matrices (which define which activities different skilled engineers can complete). The Model covers Great Britain (with Northern Ireland excluded as this geographic area is not served by the Openreach organisation) and uses input data for historic activities logged per half-day by General Manager (GM) area<sup>30</sup>.
- 3.5 In modelling Openreach’s field engineering operations, a number of simplifying assumptions have been made, the most important being:
1. Modelling Openreach’s operations at a GM area level rather than a more granular Senior Operations Manager (SOM)<sup>31</sup> geographic area level; and
  2. Assuming engineers only require a single visit to complete activities.

<sup>29</sup>Openreach has approximately 15,000 field engineers working on Service Delivery (Provision and Repair) activities, who serve a diverse and geographically dispersed customer base. Openreach customers include downstream BT Lines of Business (LOBs) and external Communications Providers (CPs). This requires a complex resource planning function within Openreach to optimise the allocation of resources to address an uneven pattern of demand for: (i) Provision activity, which is driven by CP requirements; and (ii) Repair activity, the demand for which is by its nature uncertain and can be influenced by exogenous factors both in terms of peak demand on resource and in geographical variability. For example, if a storm creates the need for additional resources to repair faults in a given period in a given area, Openreach is required to respond with existing available resources. Openreach is unable to accurately forecast such events due to the inherent uncertainty of both weather forecasts and the subsequent variability of the impact on the network. Hence, resourcing in advance for peaks in demand at a local level is a complex exercise

<sup>30</sup> Openreach’s Service Delivery workforce is currently split into nine GM areas. These refer to organisational areas responsible for specific geographic areas

<sup>31</sup> Openreach’s Service Delivery organisation has 58 Senior Operations Manager (SOM) areas, each of which addresses sub-divisions of the GM geographic areas

- 3.6 These simplifying assumptions reflect the need for pragmatism, and the need to overcome practical issues such as the availability of detailed historic data<sup>32</sup>. EY considers that these simplifying assumptions do not materially distort or bias the results and, in some cases, for example in the case of the geographic modelling, may underestimate the additional resource requirements<sup>33</sup>.
- 3.7 Further, the Model does not reflect either the time and cost incurred to recruit, train and equip additional resource or the additional cost incurred as new recruits increase productivity to the existing average level, which again is likely to underestimate the true cost of improving performance levels<sup>34</sup>.
- 3.8 Ofcom shares AM's view that *"a useful attempt has been made to investigate the relationship between performance and Openreach's resources"*<sup>35</sup> and that *"[t]he model appears to be well built and to be without significant errors in the coding and implementation and not to be biased towards results more favourable to Openreach."*<sup>36</sup> EY considers that this supports Openreach's view that the Model is robust, unbiased and appropriate for the tasks of estimating: (i) the uplift in costs which would be required (all else being equal) to raise service performance from a baseline level to a specified higher level; and (ii) the difference in costs between different scenarios where specific parameters – such as proportions of different Care Level activities – are varied.

### **Model approach**

- 3.9 Ofcom notes that the simulation approach used in the Model (i.e., a "distribution" approach) differs from a "normal" discrete event simulation (i.e., an "allocation" approach) in that the Model takes the actual performance achieved by Openreach as an input.
- 3.10 EY notes that both approaches are common in operational resource modelling of the nature conducted here. The use of a distribution approach is not unusual, and the choice of the appropriate approach depends on the question that a model is designed to address. However, the use of a distribution approach in this context allows the Model to use actual operational data as an input to define a baseline<sup>37</sup> in order to calculate required incremental resource estimates by conducting scenarios against this baseline. Hence, a distribution approach is less reliant on assumptions (for example, activity prioritisation) when compared with a more theoretical allocation rules approach, and EY considers this to be a benefit given the requirements of the modelling exercise.

<sup>32</sup> There are practical challenges of modelling such a large number of geographic areas (58 SOM areas). Modelling the data at a GM area level has involved around 30 million data points and extending the Model to a greater degree of granularity would have made the Model considerably more complex and potentially unstable. Each SOM area is further split into "Preferred Work Areas" for individual engineers. In total, there are approximately 430 of these Preferred Work Areas covering the UK. It would not be practical to model Openreach activities at this level of granularity, in part because historically the definition of such areas has changed frequently

<sup>33</sup> The Model allows movement of resource within individual GM areas, and the Model assumes that an engineer is free to complete an activity anywhere within a given GM (e.g., Scotland) without any additional time and cost implications. In practice engineers would not normally travel outside a geographically smaller SOM area

<sup>34</sup> In addition to this, the Model does not reflect costs incurred in Network Investment and Service Management units (to meet higher peaks of work), additional costs incurred by different levels of forecasting accuracy, additional costs to meet localised peaks in demand (costs of longer distance travel to meet local work peaks) and overtime payments

<sup>35</sup> Ofcom, FAMR Consultation: Openreach quality of service and approach to setting LLU and WLR Charge Controls Annexes, 19 December 2013, §A5.55

<sup>36</sup> *ibid* at §A5.52

<sup>37</sup> The Model uses Openreach operational data to determine the resource requirement to meet the historic level of demand experienced by Openreach for Provision and Repair activities. This baseline resource requirement is then compared to scenarios of different performance to derive the incremental resource requirements to meet the change in performance levels

- 3.11 Further, an allocation approach would result in an outcome which departed from Openreach’s observed operational model in the years 2011/12 and 2012/13 and is therefore less supportable by empirical data in validating the results.
- 3.12 EY understands that Openreach plans to use the Model and the general modelling approach for its own internal business planning and field force management in related matters. It considers that a distribution approach better represents the operational reality of its business in respect of the questions posed by Ofcom in the FAMR, and that the outputs of such an approach will be more evidence based<sup>38</sup>. Openreach considers, therefore, that the approach employed in the Model represents the best available method to derive the Service Performance Resource Differential and the Service Level Cost Differential.
- 3.13 Ofcom concludes that “[s]imulating the week-by-week performance and then uplifting it to explore the resource impacts seems a reasonable way of exploring the resource impacts of performance improvements. Taking account of the observed variations in performance arguably **makes the simulation less theoretical than a more traditional approach** to discrete event simulation (which would assess resource requirements only by reference to order and fault arrivals) since the variations of performance could reflect factors impacting performance that are not modelled directly such as local variations in demand.”<sup>39</sup>
- 3.14 EY agrees with Ofcom and Openreach that the modelling approach makes the simulation less theoretical and, for this reason, considers that the use of this approach is superior to what Ofcom considers to be a more “normal” approach to discrete event simulation.
- 3.15 Despite the benefits of using this less theoretical approach, Ofcom highlights a risk 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 [...] [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.”<sup>40</sup>
- 3.16 While Ofcom considers that performance improvements are being assessed against an imperfect outcome, Openreach considers this to be a more sensible approach to assessing a resource differential than the use of a theoretical “perfect” outcome which is not reflective of operational reality. Openreach is, and was, under strong incentives to allocate resources in the most efficient way possible<sup>41</sup>, and the real performance achieved by Openreach was, it considers, the optimal performance it could achieve given its available information to forecast and plan to meet levels of peaks in demand.

<sup>38</sup> In 2011, Openreach developed a Discrete Event Simulation model (the Workforce Dynamic Simulator (WDS)) in conjunction with the University of Essex. This model was used by Openreach to assess the potential additional resource commitments required to support all Repair activities in the timeframes for the LLU repair SLA as opposed to WLR (LLU being one day faster). Openreach used the WDS model to support its response to the 2012 LLU/WLR charge control consultation but Ofcom concluded that it was not in a position to determine the validity of Openreach’s proposed allocation basis and did not use the outputs from the WDS model as an input when setting the charge control (Ofcom, Charge control review for LLU and WLR services Statement Annexes, 7 March 2012, §A4.297)

<sup>39</sup> Ofcom, FAMR Consultation: Openreach quality of service and approach to setting LLU and WLR Charge Controls Annexes, 19 December 2013, §A5.56, *emphasis added*

<sup>40</sup> *ibid* at §A5.56

<sup>41</sup> Openreach utilises automated planning tools such as its Field Optimisation Suite (FOS) to resource its activities and schedule workflows. This resource planning and workflow tool enables efficient deployment of engineers to match supply to demand. There will always be, however, the potential for a period of time during a day where there is not an immediate requirement for a particular engineer, and also time over the course of a year where engineers require training or are on leave. Openreach schedules more than 80% of activities automatically and uses a variety of inputs relating to skill levels, availability and location to allocate field resources most efficiently

- 3.17 Openreach's operations are sensitive to changes in levels of demand. For example, peaks in demand for Provision and Repair activities, which EY understands from Openreach are often difficult to forecast<sup>42</sup> and are often caused by matters outside of its control<sup>43</sup>, cannot always be met in the short-term due to a lack of immediately available resource, which can lead to enduring problems if demand remains above "normal" levels.
- 3.18 Historic performance that is defined in the Model baseline represents the outcome of forecast decisions made by Openreach for expected demand for Provision and Repair activities and, hence, the requirements for resources. EY understands from Openreach that it forecasts demand for Provision and Repair activities (based in part on forecast data provided by Communications Providers (CPs)) and seeks to set resource levels to meet this level of demand. If the work volume exceeds the resource which has been forecast and deployed (e.g., due to unforecasted variability in demand) this will limit overall performance levels. Variations in performance can therefore be seen, in part, as a reflection of how accurate Openreach's forecasts were *ex post* and need to be understood in the context of the reasons for the forecast error, such as the influence of exogenous factors or timing issues (with high demand coinciding with low shift patterns).
- 3.19 EY discusses the impact of the limitations Openreach experiences when forecasting demand for Provision and Repair activities in Section 4 in respect of its impact on the 2012/13 Model outputs.
- 3.20 In summary, EY considers that the Model benefits from the use of real Openreach data as it is less theoretical in nature than alternative methods of discrete event simulation, and Openreach considers it to be sufficiently sound and fit-for-purpose to be suitable for its internal business planning and field force management purposes. The Model is, therefore, an appropriate tool for deriving the Service Performance Resource Differential and the Service Level Cost Differential.

### **Glass ceiling**

- 3.21 AM raises queries regarding the level of the "glass ceiling" constraint which is applied in the Model in order to ensure that scenarios of uplifted performance do not raise performance to unrealistic levels. This constraint reflects Openreach's experience that there is a limit to the successful completion of all Provision and Repair activities issued to Openreach engineers on any given day due to factors such as being unable to gain access to premises, tasks requiring civil engineering works and the identification of tasks which require either specialist skills or tools that were not available to the engineer on the initial visit.
- 3.22 The Model uses this constraint to cap performance in any given week to 90% for each GM area modelled. For example, if a scenario considers the Service Performance Resource Delta associated with a 20 percentage point increase in performance, performance in all GM areas and all weeks will be uplifted by 20 percentage points (to maintain the weekly performance profile). If performance in a given week in the baseline is already at 85%, rather than the exceeding 100% this performance will be capped at 90%, and other weeks of the year uplifted to redistribute the performance to the required annual target figure for the scenario being modelled (as discussed in the following sub-section).

<sup>42</sup> Openreach discuss the issue of forecasting accuracy in its document entitled "Openreach response to service-related questions in Ofcom's consultation documents "Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30" and "Fixed access market reviews: Approach to setting LLU and WLR Charge Controls", 30 September 2013

<sup>43</sup> In extreme cases, Openreach can declare an MBORC (Matters Beyond Our Reasonable Control) status, which results in Openreach not being liable for SLG payments for activities which are affected for the period of the MBORC declaration

- 3.23 AM highlights that while the glass ceiling is set at 90%, there are several weeks within the historical data where actual performance exceeds this threshold. AM suggests that a higher glass ceiling could therefore potentially be justified. AM tests the effects of this parameter by running the Model with a sensitivity of a 2% difference to the glass ceiling parameter (88% and 92%).
- 3.24 Openreach has presented the rationale for the 90% glass ceiling figure in a separate document entitled “*Openreach analysis of additional factors impacting service costs in very high performance scenarios*”<sup>44</sup>.
- 3.25 AM highlights that the glass ceiling assumption does not have a very significant effect on the resource deltas for scenarios of 80% levels of performance for Provision and Repair activities (the scenarios proposed by Ofcom to be used in its charge control modelling). EY agrees with this conclusion.

**Performance redistribution**

- 3.26 As highlighted above, where required performance in a week exceeds the glass ceiling constraint of 90% in a given week, performance in this week is capped at 90% and higher performance is required in other weeks to make up the shortfall.
- 3.27 The approach taken in the Model is to uplift performance in the lowest performing ten weeks of the year to “redistribute” these activities.
- 3.28 AM conducted a sensitivity of this parameter in the Model, the results of which are reproduced in Table 1 below:

**Table 1: AM performance redistribution sensitivity**<sup>45</sup>

Scenario	Delta
Redistribution over the lowest performing 5 weeks	4.96%
Redistribution over the lowest performing 10 weeks	6.18%
Redistribution over the lowest performing 15 weeks	5.97%

- 3.29 AM concludes that “[a]lthough the choice of 10 weeks seems potentially arbitrary, it does not have a hugely significant impact on the results, unless parameter values of substantially less or substantially more than 10 weeks are used”.<sup>46</sup>
- 3.30 It should be noted that the ten week assumption is not fixed in the Model. The performance redistribution is an iterative process and takes into the consideration the glass ceiling constraint, i.e., the redistribution will be spread across more than ten weeks if the performance redistribution increases performances above the glass ceiling in the ten lowest performing weeks.
- 3.31 EY agrees with AM that this parameter does not have a material impact on the results unless values substantially less or substantially more than ten weeks are used.
- 3.32 The ten week assumption was chosen as EY and Openreach considered that it struck an appropriate balance between concentrating the additional performance in too few weeks, which could result in significant changes from the original performance levels, and spreading the additional performance over too many weeks,

<sup>44</sup> This document is referred to as “Annex 7: Openreach Supporting Document on the Model” in the FAMR Annexes and Associated Documents

<sup>45</sup> Analysys Mason, Quality of Service model assessment, 22 November 2013, §3.4.1, page 26

<sup>46</sup> *ibid* at §3.4.1, page 27

where it could lead to increases on already high performing weeks which could impact the Service Performance Resource Delta.

### **Gamma distribution**

- 3.33 The Model uses a gamma distribution<sup>47</sup> to represent the waiting time of activities in the queue prior to execution, which has been fitted to the empirical data in the Model. AM highlights that “[u]se of a gamma distribution is not a priori unreasonable (as such distributions do arise in queuing theory).”<sup>48</sup>
- 3.34 AM considers that for Repair activities “the gamma distribution approximation appears a reasonable but by no means perfect fit to the empirical data”.<sup>49</sup> AM’s analysis of the Service Performance Resource Delta using the empirical distribution for 2011/12 as the baseline produced results very close to that (just over 1% difference) to that using the gamma distribution, “thereby validating the shape of the baseline gamma distribution in this specific case.”<sup>50</sup> For Provision, AM considers that the “approximation is very rough and does not accurately represent a large number of activities which have short times to complete.”<sup>51</sup>
- 3.35 AM concludes that “[d]espite this, it is not clear that any other statistical distribution would have been a better choice. In particular, any statistical distribution will have a similar peak: the mode is the highest value, by definition”.<sup>52</sup>
- 3.36 As AM highlights, the gamma distribution produces very similar results to the empirical distribution for Repair activities and, for this reason, EY considers it to be an appropriate method to employ in the Model.
- 3.37 For Provision activities, the empirical distribution considered by AM for 2011/12 reflects the absence of an explicit SLA in place during 2011/12 and for part of 2012/13 with, instead, the empirical distribution being a function of activities being completed following commercial negotiations with CPs.
- 3.38 To consider the appropriateness of the use of the gamma distribution for Provision activities, EY has conducted an analysis of available data from December 2012 to January 2014. This period represents the time since the SLA for Provision has been in force. This comparison of the empirical and gamma distribution for this period and for FY 2011/12 are shown in Figures 1 and 2 below:

<sup>47</sup> A gamma distribution is a statistical distribution that is commonly used to model waiting times

<sup>48</sup> Analysys Mason, Quality of Service model assessment, 22 November 2013, §3.2, page 15

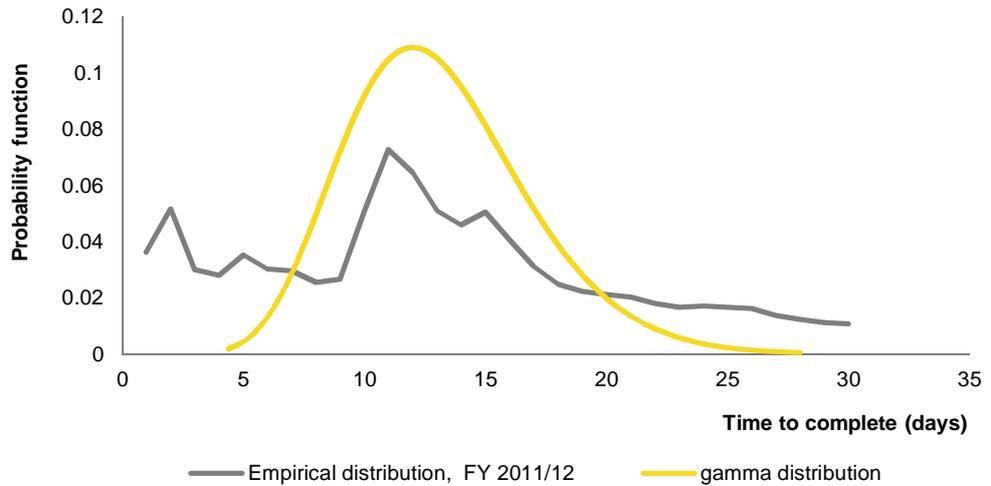
<sup>49</sup> *ibid* at §3.2, page 16

<sup>50</sup> *ibid* at §3.2, page 17

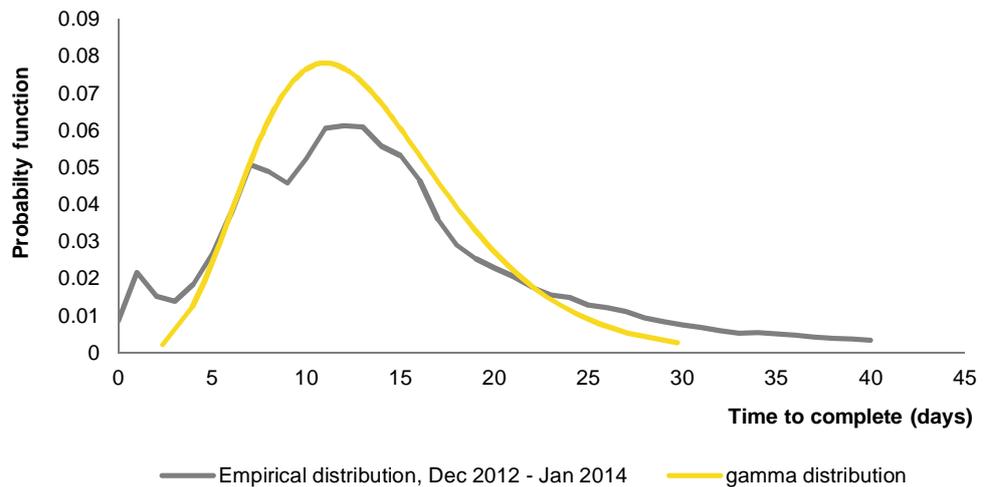
<sup>51</sup> *ibid* at §3.2, page 16

<sup>52</sup> *ibid* at §3.2, page 17

**Figure 1: Provision empirical and gamma distributions, FY 2011/12**



**Figure 2: Provision empirical and gamma distribution, Dec 2012 – Jan 2014**



3.39 EY accepts that the gamma distribution is not a perfect fit to the empirical data for 2011/12 reflecting, EY understands, the absence of any SLA arrangement for Provision activities (Provision or Provision engineering appointment lead time) during 2011/12. However, the gamma distribution is a much better fit to the empirical data for the period where an SLA for Provision has been in place (i.e., since December 2012). This supports EY’s view that the application of a gamma distribution to Openreach’s empirical data is appropriate.

**Fixing the mode of the gamma distribution for performance scenarios**

3.40 In order to run different scenarios in the Model, it is necessary to modify the gamma distribution using a unique combination of two parameters: the *alpha* (the shape parameter, which describes the skewness and kurtosis of the distribution); and the *beta* (the scale parameter, which describes the spread of the distribution). These parameters define the shape of the gamma distribution, i.e., the spread of the number of activities by the number of days to complete. As the Model uses a fixed volume of activities in both the baseline and the scenario, the cumulative distribution remains the same, and the height of the peak of the distribution will determine the resource requirement. There are multiple potential pairs of these parameters that

would produce distributions with the same required performance level for a given SLA.

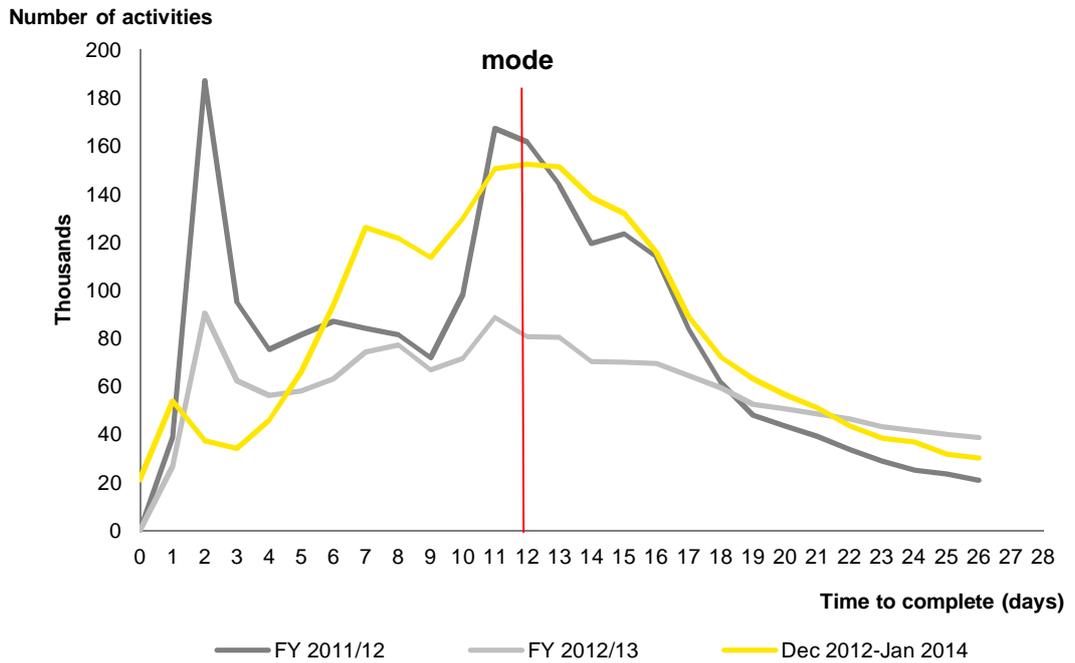
- 3.41 In order to obtain a unique pair of parameters to assess different scenarios, EY has applied constraints in the Model. The first constraint defines the performance level which needs to be achieved (i.e., if the scenario is set at 80% performance then the distribution is specified which meets this target). The second constraint fixes the mode (effectively the position of the peak) of the distribution at one day prior to the SLA for activities with an SLA target of two or more days.
- 3.42 AM highlights that *“this methodology relies heavily on the assumption that the mode of the distribution remains at a fixed point. While that may have been an accurate observation from the empirical data [...] there is nothing a priori to suggest that this should continue to be the case when the performance is adjusted. There does, of course, have to be a second constraint placed on the distribution, in order for a unique alpha-beta pair to be calculated, but it is unclear whether a fixed mode is the most appropriate choice.”*<sup>53</sup>
- 3.43 Ofcom shares AM’s view *“that alternative choices with similar levels of justification could reasonably have increased or decreased the resource estimates”*<sup>54</sup> and states that *“[w]hilst the method used does not seem unreasonable, it is unclear whether it gives a representative distribution of job completions as performance increases. This may be more of an issue for provision activities given the very much longer timescales involved than repair activities and the greater degree of influence that Openreach is able to exert over the workflow via its appointment books. The resource estimates are driven by the peaks in the gamma distribution so an unnecessarily ‘peaky’ profile would lead to resources being overestimated. In our view, this warrants further consideration as a possible refinement to the model.”*<sup>55</sup>
- 3.44 Neither AM nor Ofcom suggest an alternative to the approach taken in the Model in terms of a suitable constraint to place on the distribution.
- 3.45 Figure 3 below compares the empirical distribution for Provision activities for financial year 2011/12 (which did not have an SLA for Provision), 2012/13 (which had an SLA for Provision for part of the year) and for the period from when the Provision SLA came into force (December 2012) to the point where Openreach were able to provide operational data (January 2014).

<sup>53</sup> *ibid* at §3.2, pages 19 and 20

<sup>54</sup> Ofcom, FAMR Consultation: Openreach quality of service and approach to setting LLU and WLR Charge Controls Annexes, 19 December 2013, §A5.64

<sup>55</sup> *ibid* at §A5.65

**Figure 3: Comparison of Provision empirical distribution**



- 3.46 Figure 3 above highlights that, following the introduction of an explicit service performance target for Openreach, the distribution of completed activities aligns to a reasonable approximation of the gamma distribution (as shown in Figure 2 on Page 14), with the mode of the distribution approximately a day prior to the SLA. Openreach considers this to be an inherent empirical relationship which would not change if service performance targets were to change.
- 3.47 EY considers that any deviation from this existing empirical relationship when conducting scenarios in the Model would be more arbitrary, less justifiable, and would represent a change in the assumptions regarding Openreach’s operating model, meaning the Model outcome would not reflect how Openreach considers its operations would change under the circumstances defined in the scenario. As a consequence, EY considers that approach taken in respect of the gamma distribution in the Model to be reasonable and appropriate and therefore considers that no amendments are necessary to this approach.

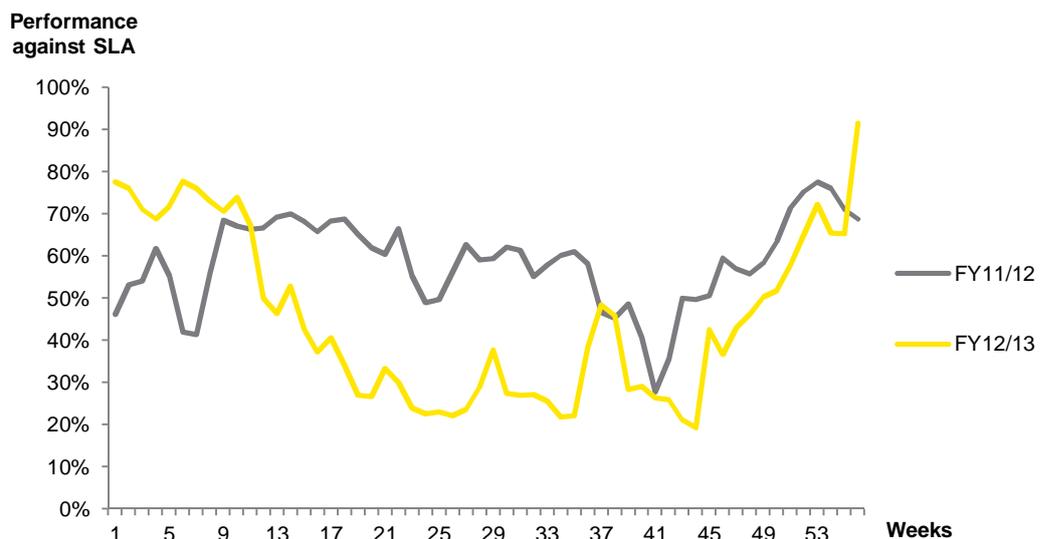
## 4. Base year data

- 4.1 In this section, EY sets out its response to Ofcom’s proposal to use scenarios based on 2011/12 data in its charge control modelling for both the Service Performance Resource Delta and the Service Level Cost Differential, and its related conclusion that results using 2012/13 data are not reliable.
- 4.2 Ofcom states that “[t]he simulation approach adopted, whilst reasonable, has not coped well with the large drop in performance observed in 2012/13 [...] we consider that the 2012/13 results are not reliable and are not therefore suitable for use as an input to our Charge Control models.”<sup>56</sup>
- 4.3 Ofcom concludes that it should use data for 2011/12 in its modelling as it considers that “the 2011/12 modelling is likely to provide more representative estimates of the resource increments required to improve performance because unlike the 2012/13 estimates they are 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.”<sup>57</sup>

### Base year data for charge control modelling

- 4.4 Openreach provided scenario results to Ofcom for two financial years (2011/12 and 2012/13), which set out the modelled estimate of the additional resource required to meet different performance targets compared with baseline performance. There was a considerable difference in the results between the two years, reflecting the much lower performance levels in 2012/13 compared with 2011/12, as shown in Figure 4 below for Provision performance and Figure 5 for Repair performance<sup>58</sup>:

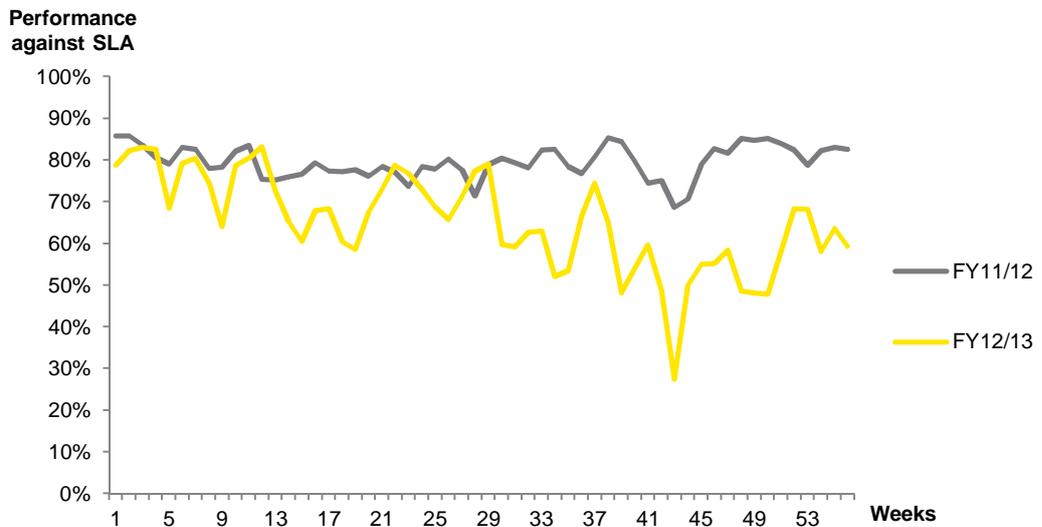
**Figure 4: Provision performance (weekly), 2011/12 and 2012/13**



<sup>56</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §3.73

<sup>57</sup> Ofcom, FAMR Consultation: Openreach quality of service and approach to setting LLU and WLR Charge Controls Annexes, 19 December 2013, §A5.75

<sup>58</sup> More than 52 weeks are shown in these charts to reflect the fact that at the beginning of any given year, Openreach will have activities in its system from the previous year

**Figure 5: Repair performance (weekly), 2011/12 and 2012/13**

- 4.5 Openreach disagrees with Ofcom's conclusion that the 2011/12 data is likely to provide more representative results than 2012/13. Primarily this is because 2012/13 data, being more recent is, other things equal, likely to be more representative of the characteristics of demand and supply over the charge control period from 2014/15.
- 4.6 Further, as highlighted in EY's Model Methodology Document<sup>59</sup>, the results derived using 2011/12 data should be regarded as providing only an indicative view of the relationships between different scenarios due to significant operational changes that have occurred since 2011/12. Most significantly, there was no formal SLA target for Provision activities in 2011/12, and hence the use of a 13 day (or 12 day) SLA in the Model represents a notional SLA target, against which notional performance levels can be derived for the baseline. Hence, the results for 2011/12 potentially underestimate the Service Performance Resource Delta, as the performance for Repair may well have been lower if a more formal constraint had been placed upon Provision activities at that time. As a sensitivity EY has run the model for 2011/12 with Repair performance set to 70%, which results in a Service Performance Resource Delta of 5.1% to achieve 80% performance target, compared with the 3.9% proposed by Ofcom.
- 4.7 There was also a considerable change in Openreach's service mix between 2011/12 and 2012/13. BT's Regulatory Financial Statements show that Openreach provided an additional volume of 1.2m MPF rentals compared to 2011/12<sup>60</sup>. Over the same period, WLR rental volumes fell by 1.1m<sup>61</sup> leaving the overall combined volume of WLR and MPF rentals relatively static (a 0.4% increase). However, in 2012/13 MPF lines represented a total of 25% of the combined WLR/MPF rental base, compared to 20% in 2011/12. This change in product mix will have had a substantial impact on both the Care Level mix and fault levels (as EY understands from Openreach that MPF lines have a higher fault rate compared with WLR only lines), and hence can have been expected to represent a more stringent constraint on performance than was actually the case in 2011/12 potentially supporting a higher Service Performance Resource Delta than 3.9%.

<sup>59</sup> This document is referred to as "Annex 6: EY Model Methodology Document" in the FAMR Annexes and Associated Documents

<sup>60</sup> Current Cost Financial Statements 2013, pages 34 and 35

<sup>61</sup> *ibid* at pages 78 and 79

### **Adjustments to the 2012/13 data set**

- 4.8 EY made adjustments to the 2012/13 data set when running the Model for both the baseline and scenarios to consider both the Service Performance Resource Delta and the Service Level Cost Differential. In particular, rather than modifying actual weekly performance across the year for Provision activities, a constant weekly performance was assumed, set at the actual average for the year<sup>62</sup>.
- 4.9 This adjustment was made to remove the distortive impact of backlog activity (i.e., activities that had already failed SLA targets) being the primary determinant of daily resource requirements that was evident in the 2012/13 data set for Provision activities, and arose as a result of the demonstrable lower performance achieved in 2012/13 compared with 2011/12.
- 4.10 Openreach forecasts and sets its resourcing levels based on its expectations of demand for field activity. EY understands that Openreach is under significant incentives to complete all Provision and Repair activities within SLA targets, and sets its level of resource to achieve these targets, albeit implicitly accepting that in practice, even if the resource which is forecast and deployed is sufficient to receive the actual volume of work, it is highly unlikely it will achieve 100% performance given the presence of activities which fall within the “glass ceiling”. An accurate forecast is considered by Openreach to be characterised by consistent levels of performance across the year such that the demand for service resource is driven by the inflow of new Repair and Provision activities, rather than the backlog of failed or uncompleted activities.
- 4.11 In 2012/13, EY understands that Openreach faced considerable and repeated exogenous shocks in demand for field activity, as a consequence of the highest levels of rainfall on record in some months, and the pattern of weather conditions during the period. This led to an unseasonal and sustained increase in the demand for Repair activity across the summer months, when its supply of labour is typically relatively low due to high levels of annual leave. At the same time, EY understands from Openreach that there was a significant increase in the demand for Provision activity from CPs. The combined result was a reduction in performance, and a corresponding increase in the backlog of failed and uncompleted activities.<sup>63</sup>
- 4.12 This accumulation of backlog activity therefore was a consequence of an unusually sustained period during which the incoming work volumes exceeded the Openreach short-term forecasting of demand for field activities, and hence the required supply and deployment of Service Delivery resource.
- 4.13 The un-adjusted data set for 2012/13 reflects this forecasting inaccuracy, and gives a result that suggests an *ex post* solution to a problem that was impossible to predict *ex ante* i.e., had Openreach known that the summer of 2012/13 was going to have the highest levels of rainfall on record in some months, it could have employed more people earlier in the year, but its inability to forecast such extreme events resulted in insufficient supply of labour and hence significantly lower performance in 2012/13 compared to 2011/12.
- 4.14 The adjustment made to the 2012/13 data sought to reflect a “business as usual” level of forecasting accuracy (represented by preventing the accumulation of relatively high volumes of backlog activity), but still reflecting the lower overall performance achieved in 2012/13. Adjusting a data set should not be considered a

<sup>62</sup> For Repair activity the same approach was taken for 2012/13 as in 2011/12, namely actual weekly performance was modelled in the baseline and then adjusted for different performance scenarios

<sup>63</sup> For example, the number of contractors Openreach employed to complete Provision activity was 240% higher in 2012/13 (1,732 KMH) compared with 2011/12 (504 KMH)

disadvantage *per se*, as any modelling exercise requires calibration and testing to ensure robustness of the results.

- 4.15 EY recognises that, when choosing the most appropriate base data for inclusion in the charge control modelling, there is a trade-off to be made between using unadjusted data which is less recent, and therefore may be less representative of the current (and future) reality of Openreach's operations, and using data from the most recent financial year, which has been adjusted to reflect "business as usual" accuracy in forecasting. However, given the considerable operational changes since 2011/12, and that the adjustments made to the 2012/13 sought to remove distortions arising from inaccuracies in forecasting during the year, the Service Performance Resource Deltas derived from the 2012/13 Model should be considered by Ofcom when setting the forward looking charge control.

### **Alternative approach to adjusting 2012/13 data**

- 4.16 Ofcom and AM highlighted concerns with the approach taken in the Model to assume constant performance levels for Provision in 2012/13.
- 4.17 Specifically, Ofcom notes that *"the adjustment to performance data for 2012/13 will have the effect of pushing up resource requirement deltas when trying to improve performance, relative to a normal 'peaky' performance distribution. This is because performance in the lowest-performing weeks is now higher and as such it is relatively more expensive to increase performance, because improving performance in higher-performing weeks requires additional resources."*<sup>64</sup>
- 4.18 EY disagrees with Ofcom as, while there is a risk that a "flat" performance profile in respect of Provision activity may overstate the Service Performance Resource Delta for the reasons cited by Ofcom and AM, it could equally understate the Service Performance Resource Delta because, while performance in the lowest performing weeks is now higher post-adjustment, performance in the highest performing weeks is now lower and so the impact on the cost of increasing performance is ambiguous and will depend on the observed variation from the average.
- 4.19 However, in an attempt to address Ofcom's concerns, EY has developed an alternative approach to implementing scenarios using 2012/13 data in the Model, which utilises logic similar to the "glass ceiling" constraint on high performance. Specifically, EY has implemented a "performance floor" in the Model, which redistributes performance over the year in the event that it falls below a threshold defined in the Model. This approach therefore seeks to maintain the variability of performance over time, but limits the scope for low performance to generate backlogs which subsequently drive day-to-day demand for resources.
- 4.20 This approach assumes that Openreach has greater ability to accurately forecast demand for Provision and Repair activities than was actually the case in the baseline for 2012/13, and therefore additional resources would be deployed to ensure performance did not fall below this performance floor, and the level of accumulated backlog could be managed to "business as usual" levels. This approach results in a smoothing of performance over the year while maintaining some of the volatility seen in 2012/13, and hence seeks to ameliorate the risk of bias to the results discussed in Paragraph 4.18.
- 4.21 EY's analysis has identified that at performance levels of between 30% and 40%, backlog activity will begin to accumulate to the point where it begins to be the dominant factor in determining the day-to-day resource requirement in the Model

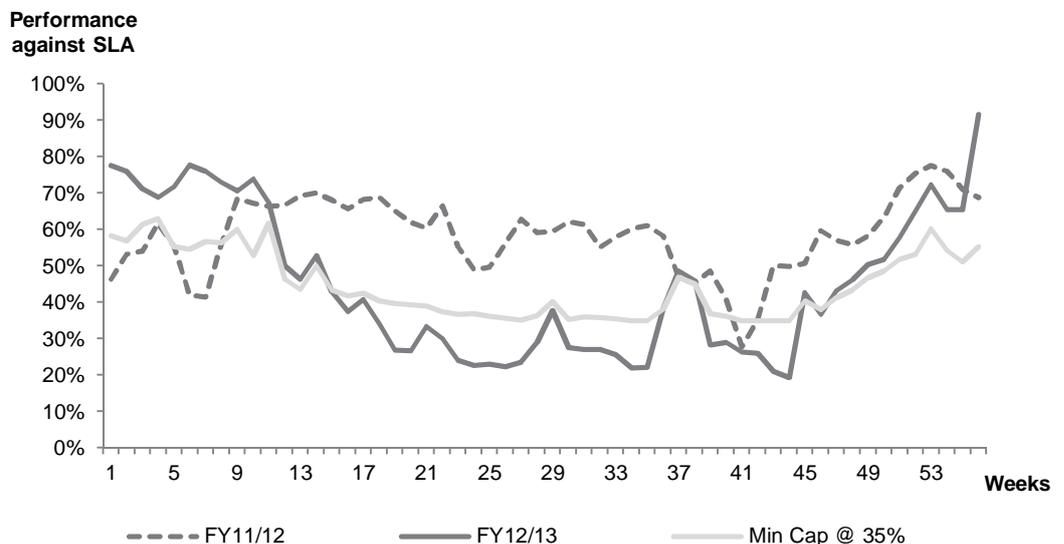
<sup>64</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §4.3.1

run. EY has therefore set a performance floor of 35% for Provisions in the Model when running scenarios using 2012/13 data. The impact of the floor is depicted in Figures 6 and 7 below, which shows a comparison of Provision backlog activity accumulation for different levels of the performance floor, and compares this to: (i) the unadjusted level of backlog activity; (ii) the level of backlog activity assumed when performance is kept constant (flat) throughout the year; and (iii) the actual backlog activity profile for 2011/12. It can be seen that implementing the 35% performance floor substantially adjusts for the impact of forecasting inaccuracies reflected in a lower accumulation of backlog activity than was actually the case in 2012/13, and therefore may be considered a practical means of reflecting “business as usual” forecasting accuracy whilst seeking to address Ofcom’s concerns in respect of risks of bias in the results.

**Figure 6: Provision backlog accumulation with performance floor**

✂

**Figure 7: Adjusted Provision performance with 35% performance floor**



- 4.22 The Service Performance Resource Delta from adopting this approach is shown in Table 2 below:

**Table 2: 2012/13 Model outputs, 80% Provision, 80% Repair, 12 day SLA**

Scenario	Delta
Flat performance	20.0%
Performance with “performance floor” of 35%	15.5%

- 4.23 As an additional exercise, reflecting Ofcom’s expectation that “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”<sup>65</sup>, EY has separately conducted a Model run for the first six months of 2012/13 only, the period over which the data suggests that backlog accumulated. In this run, EY has compared the Service Performance Resource Delta derived from comparing an unadjusted baseline<sup>66</sup> with a scenario run for 80% performance for Repairs, and 80% performance for Provisions against a 12 day SLA. The output from this analysis was a Service Performance Resource Delta of 15.3%, which is consistent with the 15.5% result from imposing a “performance floor” of 35%.
- 4.24 In summary, given the considerable operational changes since 2011/12, and the fact that the adjustments made to the 2012/13 data sought to remove distortions arising from inaccuracies in forecasting during the year, the Service Performance Resource Delta derived from the 2012/13 Model should, we consider, form the basis of the analysis used by Ofcom when setting the forward looking charge controls.
- 4.25 We consider that the performance floor approach represents a valid alternative to a “flat” performance profile for Provision activity, and implies that to consistently achieve 80% performance in the face of uncertain and volatile resource requires an increase of resources in the range of 15.3% to 20.0%, depending on the approach taken to adjust the 2012/13 data set to reflect a “business as usual” level of forecasting accuracy.

<sup>65</sup> Ofcom, FAMR Consultation: Openreach quality of service and approach to setting LLU and WLR Charge Controls Annexes, 19 December 2013, §A5.20

<sup>66</sup> i.e. no adjustments have been made to “smooth” Provision performance

## 5. Service Level Cost Differential

- 5.1 In this section, EY sets out its response to specific points made by Ofcom and AM in respect of the application of the Model to understanding the Service Level Cost Differential i.e., the change that is expected to occur as existing WLR lines which are subject to Care Level 1 SLAs (i.e. next working day plus one) migrate to MPF lines which are subject to Care Level 2 SLAs (i.e. next working day).

### ***Modelling the impact of a changing service level mix***

- 5.2 Ofcom considers that the application of the Model to understanding the impact of a changing Care Level mix on the costs of Service Delivery *“is a substantial improvement on previous submissions by BT Group on the service differential, as the dataset on which it is based can potentially be used to understand real world cost differentials.”*<sup>67</sup>
- 5.3 However, Ofcom comments that the Model was not specially designed to assess the impact on resources from this change, and noted that a number of assumptions in the model were amended to do so, stating that:
- “We understand that the Resource Simulation Model suffers some limitations as it was not originally designed to address the issue of Service Level cost differential [...] we consider that it is 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 leads us to consider that the fact that this model was not designed to address the Service Level cost differential issue is a critical consideration to factor into the weighting we give its results.”*<sup>68</sup>
- 5.4 Therefore, while Ofcom does intend to use the outputs of the Model to set the Service Level Cost Differential, it is proposing to use an adjusted output of 14.1% as opposed to the 20% proposed by Openreach and supported by Model runs for 2011/12 and 2012/13 at various performance levels.
- 5.5 As highlighted in Section 3 above, Openreach intends to use the Model for its own internal business planning and field force management. EY and Openreach discussed applying the Model to consider the impact of changes in the Care Level mix during the model specification process, and hence the Model was constructed with the intention and the required flexibility to address this particular issue. Therefore, we do not agree with Ofcom’s characterisation of the Model as not being designed to assess the impact on resources resulting from a change in Care Level mix.
- 5.6 However, in order to appropriately analyse this change, a number of parameters in the Model were adjusted as part of the testing and calibration process and to reflect discussions between EY and Openreach as to how a change in the Care Level mix would impact Openreach’s operating model. These adjustments were as follows:
- ▶ the gamma distribution parameters were adjusted to align the modes used in the distributions for Care Level 1 and 2;
  - ▶ Saturday was excluded as a working day for Care Level 2 Repair activity; and
  - ▶ all Provision activity was removed from the data set.

<sup>67</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §4.25

<sup>68</sup> *ibid* at §4.36

- 5.7 In its report, AM raised concerns in respect of these changes, considering that these may not be fully justified and, in some cases, may lead to a bias in results<sup>69</sup>. On the basis of the concerns raised by AM, EY understands that Ofcom asked AM to run the Model with changes to a number of parameters; AM produced results for alternative scenarios under a Maximum Day approach and a Top N approach (with N being 10) and for each approach estimated the results by:
- ▶ using the unadjusted gamma distributions (i.e., where modes for Care Level 1 and 2 were not aligned);
  - ▶ including and excluding Saturday working for Care Level 2; and
  - ▶ including and excluding Provision activity.

In the remainder of this section, EY considers each of these points in turn.

### ***Gamma distribution***

- 5.8 In its report, AM highlights that changes have been made to the gamma distributions to align the modes for Care Level 1 and Care Level 2 Repair activities.
- 5.9 As discussed in the EY Methodology document<sup>70</sup>, during the model testing process it was identified that as the modes of the gamma distributions for Care Level 1 and 2 occur at different points in time from when an activity is logged (day one for Care Level 2 and day two for Care level 1) the Model may overstate the additional resource required when the Care Level mix was at the extremes compared with the baseline. It was therefore necessary to make an amendment to the Model to adjust for this; namely to align the modes for both gamma distributions to be at 1.5 days. This adjustment was made both to the baseline and the scenario runs to ensure consistency in approach and minimise the risk of bias in the results.
- 5.10 AM states that *“[w]hilst it is perhaps fair to say that some change in these distributions would be observed in the extreme cases in the real world it is much harder to justify such extreme changes for all scenarios with changes in care level mix; especially given how the position of the mode of the distribution was used as a constraint in the previous version of the model [...] [t]his change is therefore not fully justified as it significantly changes the modelling process.”*<sup>71</sup>
- 5.11 EY agrees that the “real world” extent of alignment (or otherwise) of the modes for Care Level 1 and 2 would vary based on the Care Level mix. However, capturing the extremes is appropriate on the basis that the Service Level Cost Differential reflects the slope of a continuous linear function between 100% Care Level 1 and 0% Care Level 1.
- 5.12 Ofcom concludes that the gamma distribution assumptions in the Model should not be changed as *“neither the methodology used by Openreach nor the change we asked AM to make are a perfect proxy for modelling the service care resource differential. On the basis that AM’s approach is not obviously superior to the approach taken by Openreach, we consider that it is appropriate to adopt the approach suggested by Openreach.”*<sup>72</sup>

<sup>69</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §4.31

<sup>70</sup> Annex 6: EY Model Methodology Document” in the FAMR Annexes and Associated Documents

<sup>71</sup> Analysys Mason, Quality of Service model assessment, 22 November 2013, §5.1, pages 39 and 40

<sup>72</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §4.87

- 5.13 EY agrees with Ofcom's conclusion, although we would highlight that the approach applied in the Model was specifically adopted by Openreach and EY after consideration of the alternative explored by AM, and therefore is, in EY's view, superior.

### **Saturday working**

- 5.14 Care Level 2 activities include Saturday as a working day for the purpose of resourcing and relatedly calculating the SLA target; this contrasts with Care Level 1 where only Monday to Friday are considered as working days. This differentiation is significant because Openreach employs a smaller Saturday shift compared to a normal weekday (i.e., a lower number of available engineers) as there are contractual limitations on the number of Saturdays an engineer will work in any four week period.
- 5.15 Therefore, shifting all Care Level 1 activities to Care Level 2 would result in a higher number of activities assigned to a Saturday than could currently be completed due to engineer availability constraints. Openreach considered that if significantly more work required completion on Saturdays, this would only be achievable if it implemented a major reorganisation of shift patterns. As such Openreach considers that an estimate of the resource differential which was based on the inclusion of Saturday working *"would not reflect reality and would be very misleading, particularly if it is proposed to include such data in the consultation documents at this late stage of the process and without very careful consideration of the consequences."*<sup>73</sup>
- 5.16 AM's view is that the exclusion of Saturday working is *"valid to a point"* but will have the effect of increasing the weekday peak and hence the resource requirement. AM does not quantify the potential impact but notes that *"the resource increase will occur in both the relevant baseline and any performance scenario being tested."*<sup>74</sup>
- 5.17 Ofcom considers that *"in principle, excluding Saturday working for Service Level 2 would lead to an increase in the peak in resource requirements for Service Level 2 in the early part of the week (as repairs that could no longer be undertaken on Saturday will have to be undertaken the following Monday)"*.<sup>75</sup> However, it considers that there are two factors which counter this effect, namely: (i) the potentially limited incentives Openreach has to undertake Repair activities on a Saturday as this is dependent on the relative premium of resource costs on a Saturday; and (ii) the operational changes that Openreach would need to make as previously highlighted.
- 5.18 Ofcom concludes that the exclusion of Saturday working in the Model is *"not entirely satisfactory"*, but considers that the inclusion of Saturday working *"may not be material"* and *"[i]n the absence of strong evidence suggesting one approach is markedly superior to another, we have not considered it appropriate to include a Saturday working assumption in the model at this stage."*<sup>76</sup>
- 5.19 EY and Openreach agree with Ofcom's proposed approach, and further note that as Saturday working is excluded from the baseline and the scenario runs, this reduces the risk of any bias in the results.

<sup>73</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §4.77

<sup>74</sup> Analysys Mason, Quality of Service model assessment, 22 November 2013, §6.3, page 51

<sup>75</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §4.80

<sup>76</sup> *ibid* at §4.81

***Inclusion of Provision activity***

- 5.20 When conducting the analysis of the change in Care Level mix, EY excluded Provision activities from the analysis, in order that the outputs from the Model runs, and hence the slope of the curve used to set the Service Level Cost Differential, were derived from running the baseline and scenarios in the Model with Repair activity only in order to isolate the effects of a change in Care Level mix. Openreach presented a range of results to Ofcom using data for both 2011/12 and 2012/13, and at performances of 75%, 80% and 85%. The range presented was 15% to 24%, and Openreach proposed that a level of approximately 20% would be an appropriate Service Level Cost Differential on this basis<sup>77</sup>.
- 5.21 AM and Ofcom considered that using this result as a basis for setting the Service Level Cost Differential would ignore any potential economies of scope that may exist from the transfer of resources between Provision and Repair activities.
- 5.22 AM derives an alternative relationship between the resource requirements relating to the extremes of 100% Care Level 1 activities and 0% Care Level 1 activities (which informs the Service Level Cost Differential). AM's output for 2011/12, under the 80% performance scenario and the "Maximum Day" resource redistribution approach, gives a result of 17.9%. This figure is then reduced by a factor of 21% to reflect economies of scope to give a resulting Service Level Cost Differential of 14.1%. Ofcom proposes to use this figure of 14.1% in its charge control modelling.
- 5.23 The Ofcom consultation, and its accompanying reports, do not provide sufficient information for EY to comment on these results in detail, and we await responses to questions we have put to Ofcom to establish clarity, but we note the following:
- ▶ the result computed by EY from the Model based on 2011/12 data under the 80% performance scenario and using the Maximum Day approach is 23%. This differs from the 17.9% calculated by AM, but EY has not been provided with details of AM's calculations and therefore is not in a position to understand and comment upon the difference in results;
  - ▶ AM's report shows that a figure of 17.9% is derived for the 2012/13 data set at 80% performance and using AM's "Top 10 AM" redistribution approach. It is not clear whether it is coincidence that this figure is identical to what AM quotes as its result for 2011/12 using the Maximum Day approach, or a mis-statement by AM; and
  - ▶ AM does not provide a rationale for the adjustment made to the proposed Service Level Cost Differential (i.e., a 21% reduction) to account for economies of scope.
- 5.24 EY accepts that running the Model excluding Provision activities would potentially overstate the Service Level Cost Differential as it would not reflect the economies of scope.
- 5.25 Therefore, EY has subsequently run the Model including Provision activities, which for 2011/12 at 80% performance and using the Maximum Day redistribution approach, yields a continuous linear function (from 100% Care Level 1 Repair activities to 0% Care Level 1 Repair activities) with a slope of 12.4%.
- 5.26 In 2016/17 Repair activity is expected to account for 58% of all field activity, therefore the above result implies a Service Level Cost Differential of 21% (12.4%/58%).

<sup>77</sup> At that time Ofcom had not yet proposed which base year or target performance level was appropriate

- 5.27 EY notes that the equivalent result excluding Provisions (i.e., 2011/12 data, 80% performances and Maximum Day redistribution) is 23%, which suggests that the economies of scope impact reduces the Service Level Cost Differential by two percentage points.
- 5.28 We understand that the relatively immaterial economies of scope is in keeping with Openreach's expectations, since it reflects the difference in activity lead times for Provision (12+ days) and Repair (1-3 days) activities, and the fact that Provision activities are appointed some time in advance, which minimises the ability for Openreach to transfer resource between the two types of activity.

### **Redistribution approach**

- 5.29 Openreach used the Maximum Day approach in its submission to Ofcom for all resource estimates for performance improvements and only used an alternative method (the Top N redistribution approach, with N being 10) for the 75% Repair only scenario when considering the Service Level Cost Differential.
- 5.30 Ofcom considers that Openreach *"has 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 is not a useful measure of resources. Therefore, we consider it more appropriate to use the Maximum Day calculation."*<sup>78</sup>
- 5.31 EY and Openreach agree in principle that the Maximum Day approach is preferable for use in all scenarios; however, in the case of this specific scenario (75% performance for 2011/12) the Top 10 redistribution approach was provided to Ofcom as Openreach's view of the appropriate result, because the Maximum Day approach for this scenario gave rise to an inconsistent result. In particular, the result for 48% Care Level 1 activities (3.4%), while directionally correct, was marginally lower than the result for 55% (3.6%). This can be seen in Table 3 below:

**Table 3: 2011/12, 75% scenario**

FY2011\12 @ 75% performance	% Care Level 1 activities	Maximum Day	Top 10
	100%	-9.0%	-9.8%
Baseline	60%	0.0%	0.0%
2013\14 forecast	55%	3.6%	3.3%
2016\17 forecast	48%	3.4%	3.8%
	35%	6.4%	5.7%
	0%	12.4%	13.1%

- 5.32 It was felt that, given the complexity of the Model, this result fell within a reasonable margin of error. However, EY and Openreach considered that, in this instance, providing results to Ofcom using the Top 10 redistribution approach was more appropriate and did not introduce any significant bias. EY notes that the Maximum Day approach produces a higher estimate of the Service Level Cost Differential of 22.9%, when compared the 21.4% calculated using the Top 10 approach.

<sup>78</sup> Ofcom, Fixed access market reviews: Openreach quality of service and approach to setting LLU and WLR charge controls, 19 December 2013, §4.46