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Sultanate of Oman

هيئة تنظيم الاتصالات
Telecommunications Regulatory Authority

Position Statement on the BULRIC Models for mobile and fixed networks

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1. Introduction

The Telecommunications Regulatory Authority of the Sultanate of Oman ('the TRA') is empowered under The Telecommunications Regulatory Act, issued by Royal Decree No. 30/2002 (and subsequent amendments thereto), to make decisions in relation to the regulatory remedies that may be required to address the risks that may appear for consumers and competition as a consequence.

On June 24th, 2014, the TRA issued, with the support of Axon Partners Group Consulting, a letter to each of the Operators involved in the process (Omantel, Nawras and OBC) aiming to gather their views on the results of the draft BULRIC Models for fixed and mobile networks developed. The TRA stated that comments on the topics of special relevance for the Models will be especially welcome. These topics are:

- BULRIC Model for mobile networks:
  - Market demand considered in the model
  - Demand Statistics
  - Population coverage of the modelled operator
  - Technical parameters and modelled network
  - Useful lives applied for annualisation
  - Costs
  - Cost allocation to services
- BULRIC Model for fixed networks:
  - Market demand considered in the model
  - Demand Statistics
  - Premises covered
  - Access network links' distance
  - Technical parameters and modelled network
  - Useful lives applied for annualisation
  - Costs
  - Cost allocation to services

As a result of this process, the Authority has received comments from Nawras and Omantel. The TRA appreciates the time and efforts dedicated by these Operators to give their responses, which will contribute to improve the robustness of the BULRIC Models' results.

This statement illustrates TRA's position on the questions and recommendations raised by the Operators. In particular, the structure of the document has been divided in two main sections as described below:

- **Responses to topics of special relevance**, which provides TRA's answers to Operators' comments on the topics of special relevance outlined in the letter submitted by the TRA.
- **Responses to other contributions,** which includes TRA's position on the other contributions made by the Operators, which did not address any of the topics of special relevance.

Additionally, Nawras provided a list of very detailed comments regarding the models' formulas and inputs and requests for clarifications. They have been addressed in Annex A.

2. Responses to topics of special relevance

This section details the TRA's position regarding the comments made by the operators on the specific issues of special relevance outlined in the letter sent to the Operators.

This section has been divided between the responses given to each of the models as described below:

- **Operators'** contributions to the BULRIC Model for mobile networks, addressing the comments provided in regards to the draft BULRIC Model for mobile networks
- **Operators'** contributions to the BULRIC Model for fixed networks, focused on addressing the comments provided in regard to the draft BULRIC Model for fixed networks

2.1. Operators' contributions to the BULRIC Model for mobile networks

This section addresses the contributions received regarding the topics of special relevance for the revision of the draft BULRIC Model for mobile networks, namely:

- Issue 1: Market Demand
- Issue 2: Demand Statistics
- Issue 3: Population coverage of the modelled operator
- Issue 4: Technical Parameters and Modelled Network
- Issue 5: Useful Lives applied for annualisation
- Issue 6: Costs
- Issue 7: Cost Allocation to Services

2.1.1. Issue 1: Market Demand considered in the model

The following answers were provided by the operators to the 1st issue of special relevance:

Nawras' answer

The main comments provided by Nawras regarding the market demand introduced in the model are described below:

- "*The split between mail browsing and video streaming makes no sense. In Oman such services are not defined and offered separately.*
- *We see no reason why volumes for non-existing services should be included for past years*
- *The volumes introduced for services for which no data is available must be reviewed to reflect true picture of traffic pattern*"

Omantel's answer

Omantel views the approach taken for the estimation of most demand projections to be reasonable. However, it outlines that the data consumption per 4G subscriber is uncertain and the availability of 4G could result in an increase in usage per subscriber of up to 10x.

The TRA's response

Based on the contributions provided by the Operators, the TRA's outlines its position in the following paragraphs:

- **Split between browsing and video streaming data services**: The TRA acknowledges that specific video streaming services are not provided in the Sultanate. They have been included in the model with a forward-looking view, in case they can be eventually useful for the TRA. Additionally, the TRA notes that the disaggregation of these services was already agreed in the methodological document, on which the industry was consulted.

- **Volumes for non-existing services**: The TRA understands Nawras' view on this issue. The volumes have been input in order to obtain a theoretic cost for non-existing services that will be useful for the TRA. In order to ensure that the inclusion of these volumes have no impact in other services' results, the traffic of non-existing services has been reduced.

- **Data traffic evolution**: The TRA agrees that the introduction of LTE networks could dramatically increase the consumption of data traffic per subscriber. Given that this increase in traffic would probably lead to lower unit costs, the TRA has followed a more conservative approach so as to avoid the unitary costs being overly lowered in association with a possible surge in traffic.

2.1.2. Issue 2: Demand Statistics

The following answers were provided by the operators to the 2nd issue of special relevance:

Nawras' answer

Nawras has commented on the demand statistics introduced in the model, stating that:

- "*For voice traffic we use blocking probability 1% and not 2% as it is calculated in the model*
- *The basic data traffic has to enable video streaming as part of general internet browsing. Therefore the basic data traffic should have parameters of QoS level Gold instead of Best Effort*"

Omantel's answer

Although Omantel agrees with most of the demand statistics inputs included in the model, it provides the following comments:

- *"Call duration should be equal for incoming and outgoing calls*
- *Traffic "peakiness" (busy hour) seems low*
- *The model should consider a "moving" busy hour"*

The TRA's response

The TRA outlines below its responses to each of the comments provided by the Operators:

- **Blocking probability**: As per Nawras' comments, and given that no previous information was available on this parameter, the blocking probability considered in the Model has been updated to 1%.
- **QoS for data services**: The TRA notes that video streaming is currently provided over best-effort connections. Additionally, as Nawras states in its comments, no Gold QoS services are currently being provided in the Sultanate. Hence, the TRA finds no reason to consider Gold QoS levels for video streaming data traffic.
- **Call Duration**: Omantel's contribution regarding the call durations considered is sound and consequently call durations considered in the model have been adjusted so that they are equal for both incoming and outgoing calls.

- **Busy Hour**: It should be noted that the busy hour percentage used in the BULRIC Model has been based and is aligned with the traffic patterns provided by Omantel in the data request. Therefore, the TRA does not understand Omantel's comment about this figure. On the other hand, it is true that the fact that the subscribers move from one area to another has an impact on the network requirements, especially in the urban and suburban areas. Therefore, the "moving" busy hour effect has been included in the model.

2.1.3. Issue 3: Population coverage of the modelled operator

The following answers were provided by the operators to the 3rd issue of special relevance:

Nawras' answer

Nawras has not commented on the population coverage considered for the modelled operator.

Omantel's answer

Omantel has not commented on the population coverage considered for the modelled operator.

The TRA's response

Given that no comments have been submitted regarding this input, the TRA has preserved the population coverage levels presented in the draft BULRIC Model for mobile networks.

2.1.4. Issue 4: Technical Parameters and Modelled Network

The following answers were provided by the operators to the 4th issue of special relevance:

Nawras' answer

The main contributions provided by Nawras regarding the technical parameters and the modelled network are outlined below:

- "*The fact that the number of sites in urban and suburban areas is falling sharply seems very suspicious*

- *The fact that the number of RNC ports is 0 for FAC in years 2013-2018 seems very suspicious*
- *The radii of cells in individual geotypes is too big*
- *Coverage by municipalities in our opinion is inaccurate*
- *It is also not correct to calculate backhaul separately by geotypes*
- *It is not possible to connect one site to a Hub which is at the location of another site with link, which is shorter than half of the cell radii*
- *The model does not use any redundancy for backhaul links*
- *The model uses only 10% dimensioning overcapacity*"

Additionally, Nawras is of the opinion that the formula employed for calculating the area of a hexagon is not accurate.

Omantel's answer

Omantel has agreed with most of the resources' volumes outlined in the letter. However, Omantel has outlined that the number of TRXs dimensioned is substantially below the number of units installed in its network.

The TRA's response

The TRA's response to each of the contributions provided by the Operators is structured in the following paragraphs:

- **Evolution in the number of sites**: The TRA does not understand Nawras' comment on the reduction in the number of sites as, in fact, this figure is estimated to increase by 45% from 2011 to 2018.
- **RNC ports**: As Nawras pointed out, there was a miscalculation in the calculation of the RNC ports in the draft model. This calculation has been adjusted, and the number of RNC ports is now properly dimensioned in the model.
- **Cell radii**: The TRA appreciates Nawras' contributions on the cell radii to be considered in the urban dense geotype. However, although the distance between sites in urban dense geotypes may be in the range of 0.5Km, it should be noted that most of these sites are installed due to capacity constraints.

- **Coverage by municipalities**: Although Nawras does not agree with the calculation of coverage requirements at municipality level implemented in the model, it has not provided appropriate arguments on why it believes the calculations performed are inaccurate, neither has it indicated whether it considers the results to be reasonable or not. As the TRA finds it, there is not a solid argument advocating for the removal of this algorithm, and therefore, it has been kept in the final version of the model.

- **Backhaul calculation per geotype**: The TRA appreciates Nawras' observations on the backhaul calculations. However, the distance from the hub to the controller varies significantly among geotypes and, therefore, they should be calculated in a per geotype basis. In any case, the TRA agrees with Nawras that these distances were underestimated and they have been updated based on the real locations provided by the operators.

- **Redundancy in backhaul links**: The TRA agrees with the fact that the mobile operators in Oman may be using some kind of redundancy in their transmission networks, especially in the denser areas. The model has been updated to recognise the use of a ring topology (that provides redundancy) in the links between hubs and controllers in urban and suburban geotypes.

- **Dimensioning overcapacity**: Although the 10% overcapacity considered in the model may be below the operators' overcapacity thresholds, it should be noted that the model also considers a planning horizon (which involves dimensioning the network as per the traffic requirements expected in the next x years). Consequently, the effective overcapacity considered in the model is closer to the 20% suggested by Nawras and, therefore, the TRA does not see a need to adjust this figure.

- **Number of TRXs**: It is important to bear in mind that the figures presented refer to a 'Reference Operator', and therefore the equipment dimensioned should not represent Omantel's network. The results of the model are consistent with the 'Reference Operator' described in the Methodological Document, agreed previously with the industry. Therefore, the TRA does not see a need to adjust the TRXs dimensioning algorithms.

Finally, regarding Nawras' contribution on the formulae employed for calculating the area of a hexagon, it is important to bear in mind the definition of the parameters employed in the calculation of the maximum area of a cell.

In this regard, it is known that the area of a regular hexagon corresponds to the following formulae, where C represents any of the sides of the hexagon under analysis:

$$A = \frac{3\sqrt{3}}{2} \cdot C^2$$

On the other hand, R represents the coverage radii of a site, which is calculated as half of the average distance between two adjacent sites, as detailed in the exhibit below:

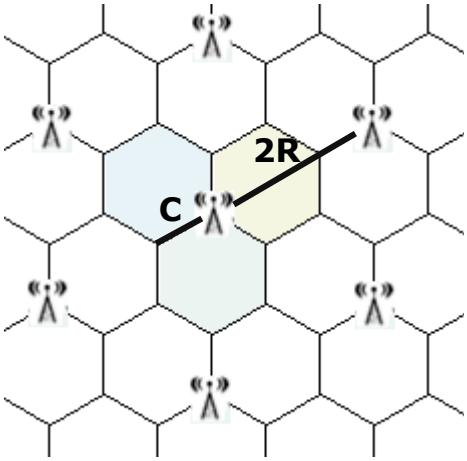

Exhibit 2.1: Graphical representation of the area covered by a site. Note: The three colored hexagons represent the three sectors covered by the plotted site

When using tri-sectorial sites, the distance between two sites (2R) is equal to 3 times the side of the hexagon. Therefore, the side (C) is equal to 2/3 of the coverage radii; R. Accordingly, the formula applied, under the definition of the parameters given in this point, is presented below:

$$A = \frac{3\sqrt{3}}{2} \cdot \left(\frac{2}{3}R\right)^2$$

Therefore, the TRA concludes that the formulae employed for calculating the maximum area covered by a site is correct.

2.1.5. Issue 5: Useful Lives applied for annualisation

The following answers were provided by the operators to the 5th issue of special relevance:

Nawras' answer

Nawras has not commented on the useful lives employed for the annualisation of network resources.

Omantel's answer

Omantel agrees with the useful lives proposed by the TRA

The TRA's response

Given that no objections have been raised regarding this input, the TRA has preserved the useful lives presented in the draft BULRIC Model for mobile networks.

2.1.6. Issue 6: Costs

The following answers were provided by the operators to the 6th issue of special relevance:

Nawras' answer

Nawras has provided a number of comments regarding the costs considered in the model which are described below:

- The Operator remarks that for a number of resources (including micro BTSs, ports, core platforms, etc.) no OpEx and/or CapEx has been introduced
- Nawras outlines different network elements for which it believes unit CapEx has not been properly input in the Model, namely:
  - Rural towers
  - Single band antennas
  - Micro sites
  - BSCs
  - RNCs
- Nawras outlines that the overhead considered seems low and wonders why it has not been applied on the cost of capital.
- Nawras stressed that the cost of working capital has not been included in the model

Omantel's answer

Omantel has commented that the draft BULRIC Model for mobile networks contained a number of items that have quantities attached, but their unit cost has been set to zero.

The TRA's response

The TRA outlines below its responses to each of the comments provided by the Operators:

- **Items with no Opex and/or CapEx**: The TRA notes that, on some occasions, either CapEx or OpEx was set to zero as it is not applicable for a given resource (e.g. no CapEx has been introduced for Leased Lines, as this resource will only have an OpEx, recurrent cost). On the other hand, the cost of some resources was introduced as part of other resources with higher relevance, such as:
  - TRXs and Carriers: Included in the BTSs and NodeBs
  - HSPA releases: Included in the 3G equipment
  - Hub's ports: Included in the cost of the hub
  - Core ADM STM16 port: This cost has been introduced
  - Generators: Included in the sites' cost

In order to avoid confusion regarding the unit costs of the network elements considered, the TRA has expanded the documentation included in the model, describing the considerations made in the definition of the unit costs of the resources. Additionally, the costs of BTSs, NodeBs, etc. have been disaggregated to ensure that every resource contains its own costs.

- **Unit CapEx figures considered for different resources**: Nawras has outlined that the unit CapEx considered for some network equipment (e.g. sites, BSC, RNC) is not aligned with its knowledge about the unit costs of such equipment. In this regard, the TRA considers that it is important to note that the costs included in the contributions to the letter are different than those provided to the TRA during the data gathering phase. The TRA asked for clarifications regarding this issue to Nawras on 30th October 2014 and no answer has been provided.

Therefore, according to the approach described in the methodological document, Nawras' inputs have not been included in the model since they are not aligned with international practice and no clarifications have been provided.

- **Overheads**: The TRA notes that although Nawras states that the overhead considered is too low, it does not provide evidence on why it should be higher. On the other hand, overheads have been calculated based on the Operators' P&L, which does not include a cost of capital term. Therefore, the uplift introduced for overheads should not be applied over the Cost of Capital.

- **Working capital**: As it was stressed in the methodological document, Operators had to provide evidence that they had working capital and that it was relevant. Given that no operator has proved this prerequisite, working capital has not been included in the Model.

2.1.7. Issue 7: Cost Allocation to Services

The following answers were provided by the operators to the 7th issue of special relevance:

Nawras' answer

Nawras agrees with most of the allocation rules presented in the model. Nevertheless, it comments that no costs should be allocated to subscribers as they should be allocated to the services subscribers actually pay for.

Omantel's answer

Omantel has expressed that, due to the way the model has been constructed, it is impossible to assess the breakdown of costs for a service by network element/component.

The TRA's response

The TRA considers that, given the nature of the BULRIC costing Models, the costs of network resources should always be allocated to the services that cause them, independently of how they are billed to customers. Accordingly, given that subscribers make use of some specific equipment (e.g. HLR, billing systems), the cost of this equipment should be allocated to them.

On the other hand, the TRA does not agree with Omantel's view that it is not possible to assess the cost allocation to services. In fact, Nawras has proved that it is possible to provide valid comments on the cost allocation.

Independently, the Authority has considered it appropriate to include a disaggregation of costs per resource in order to increase the level of information available on the disaggregation of the services' costs.

2.2. Operators' contributions to the BULRIC Model for fixed networks

This section addresses the contributions received regarding the topics of special relevance for the revision of the draft BULRIC Model for fixed networks, namely:

- Issue 1: Market Demand considered in the model
- Issue 2: Demand Statistics
- Issue 3: Premises covered
- Issue 4: Access Network Links' Distance
- Issue 5: Technical Parameters and Modelled Network
- Issue 6: Useful Lives applied for annualisation
- Issue 7: Costs
- Issue 8: Cost Allocation to Services
- Issue 9: Model for ancillary, one-off and reduced materiality services

2.2.1. Issue 1: Market Demand considered in the model

The following answers were provided by the operators to the 1st question:

Nawras' answer

Nawras provided the following comments regarding the market demand introduced in the model are described below:

- Retail LL km are very low compared to the number of retail LL.
- LLU did not exist but has volumes also in past years

Omantel's answer

Omantel agrees on the demand introduced for voice, broadband and copper access services. However, the Operator is not convinced of the rapid growth expected in the take up of FTTH lines.

The TRA's response

Based on the contributions provided by the Operators, the TRA outlines its position in the following paragraphs:

- **Kms of retail LL**: The Authority notes that although Nawras does not agree with the number of km. per LL, it has not provided an alternative figure, and this input was originally provided by Omantel. Therefore, it lacks sufficient argument to adjust the number of Km per leased line considered in the draft model.

- **LLU historical traffic**: The TRA acknowledges Nawras' comment on the number of LLU volumes considered in the model. As these figures were not available on historical years (as the service was not provided), it would be appropriate to introduce lower volumes for these services, so as to ensure they do not distort the model's results. Therefore, similarly to the approach followed in the BULRIC Model for mobile networks, the demand for non-existing services has been reduced to avoid any impact on other services.

- **FTTH take-up**: As agreed in the methodological document, the NGA network dimensioned in the BULRIC model for fixed networks considers the most ambitious FTTH rollout plan of any operator in the market. This approach has resulted in the consideration of the National Broadband Plan as the base case scenario of the model. Consequently, even though Omantel's FTTH roll-out plan may be more conservative than the one included in the model, the figures considered are aligned with the methodological approach approved and the Authority does not see a need to lower the take-up rates considered.

2.2.2. Issue 2: Demand Statistics

The following answers were provided by the operators to the 2nd issue of special relevance:

Nawras' answer

Nawras has not commented on the demand statistics considered in the BULRIC Model for fixed networks.

Omantel's answer

Although Omantel agrees with most of the demand statistics adopted, the Operator commented that there is no mention of the busy hour for data services, outlining that the use of a contention ratio is not acceptable as networks are not dimensioned on the basis of contention levels.

The TRA's response

The TRA feels that it is important to clarify that both busy hour and contention ratio refer to the same concept (calculating the traffic in the busy hour), as inferred from the formulas:

$$Busy\ Hour = \frac{BroadbandTraffic\ (BH)}{BroadbandTraffic(Average\ Hour)}$$ and $$Contention\ Ratio = \frac{NorminalBroadbandTraffic\ (Mbps)}{BroadbandTraffic\ (BH)}$$

Additionally, the use of contention ratios for modelling broadband data in fixed network models is the standard approach taken in the industry. Moreover, Omantel has provided no information on the busy hour that would be applicable for broadband services

After reviewing the issue, the Authority believes it is appropriate to keep the use of the contention ratio for modelling fixed broadband networks. However, the draft model considered one contention ratio for all the broadband bitrates. This view may be simplistic and the TRA has decided to improve the model by introducing different contention ratios for each bitrate. The following table presents the updated contention ratios.

Bandwidth	Contention ratio
1 Mbps or less	10
2 Mbps	17
4 Mbps	30
5 Mbps	33
6 Mbps	35
12 Mbps	45
40 Mbps	50
100 Mbps	65

Table 2.1: Updated contention ratios [Source: Axon Consulting]

2.2.3. Issue 3: Premises covered

The following answers were provided by the operators to the 3rd issue of special relevance:

Nawras' answer

Nawras has not commented on the demand statistics considered in the BULRIC Model for fixed networks.

Omantel's answer

Omantel agrees with the number of premises passed under copper access networks. In the case of FTTH, it considers that the number of premises passed (as well as its forecast) appears to be too high in light of the FTTH rollout status of Omantel and the OBC.

The TRA's response

As detailed in Issue 1 above, the model considers the most ambitious FTTH rollout plan of any operator in the market for the dimensioning of the NGA network, as stated in the methodological document. This approach has resulted in the consideration of the stated in the National Broadband Plan in the definition of the number of premises passed.

Additionally, data provided by the OBC would indicate that unlike Omantel's statement, the number of premises passed by the Operator would actually be slightly higher than the figure introduced in the BULRIC Model. As a result, the TRA has kept the number of premises passed in FTTH networks as defined in the draft BULRIC Model.

2.2.4. Issue 4: Access Network Links' Distance

The following answers were provided by the operators to the 4th issue of special relevance:

Nawras' answer

Nawras has not commented on the access network links distance introduced in the model.

Omantel's answer

Omantel states that it does not find the numbers presented unreasonable.

The TRA's response

Given that no objections have been raised regarding this input, the TRA has preserved the distance of the access network links as presented in the draft BULRIC Model for fixed networks.

2.2.5. Issue 5: Technical Parameters and Modelled Network

The following answers were provided by the operators to the 5th issue of special relevance:

Nawras' answer

Nawras has stated that it is not able to assess the most important inputs employed for the calculation, as they come from the geomodel.

Omantel's answer

Omantel outlines that it is not able to provide comments since the meaning of some of the resources' names is not clear.

On the other hand, the Operator has provided contributions regarding the capacity considered for some network elements, which are detailed below:

- "*The capacity of 800 lines per Main Distribution Frame is too low, as exchange sites may cope with thousands of lines.*
- *The capacity of 64 line cards per shelf seems too high for MSANs"*

The TRA's response

Based on the contributions outlined by the Operators, the TRA's outlines its position in the following paragraphs:

- **Geomodel details**: Although the TRA acknowledges Nawras' comment, the information employed in the development of the geomodel is highly sensitive, as it contains specific data on Omantel's access network, and hence it can't be shared with Operators.
- **Description of network elements**: The Authority feels it is important to outline that the definition of the network elements is standard among the industry and even Omantel uses the same terms in its own BULRIC model for fixed networks. Moreover, Nawras has not provided any comment in this regard.
- **MDF capacity**: The TRA agrees that exchange sites can handle a high number of lines, although in those cases more than one frame is installed. It may be inferred from Omantel's contribution that the Operator is referring to the site instead of the equipment (which is what the model is actually referring to). In order to avoid confusion, the name of this network resource has been substituted in the model and its supporting documentation by "Distribution Frame"
- **MSANs capacity per shelf**: The TRA agrees with Omantel that 64 line cards per shelf may be too aggressive of an approach. Consequently, this figure has been changed by 16 line cards per shelf in the model.

2.2.6. Issue 6: Useful Lives applied for annualisation

The following answers were provided by the operators to the 6th issue of special relevance:

Nawras' answer

Nawras has not commented on the useful lives employed for the annualisation of network resources.

Omantel's answer

Omantel agrees with the useful lives proposed by the TRA.

The TRA's response

Given that no objections have been raised regarding this input, the TRA has preserved the useful lives presented in the draft BULRIC Model for fixed networks.

2.2.7. Issue 7: Costs

The following answers were provided by the operators to the 7th issue of special relevance:

Nawras' answer

Nawras has not commented on the costs considered in the BULRIC Model for fixed networks.

Omantel's answer

Similarly to its considerations for the BULRIC Model for mobile networks, Omantel has commented that there are a number of items in the fixed model that have quantities attached, but the unit cost has been set at zero.

Additionally, the Operator has outlined that the Model is not properly considering the transmission links required for the core network, providing a detailed map that includes the total length of its transmission network.

The TRA's response

Regarding the unit costs introduced in the model, although the TRA acknowledges that there are items without costs, this is due to the fact that some cost categories may not apply to a given resource (for instance, no OpEx has been introduced for certain resources – e.g. ports -, and no CapEx has been introduced for some others – e.g. Leased Lines). Nevertheless, in order to ease the understanding of the unit costs introduced and to avoid confusions in this regard, the description of the unit costs included in the model has been expanded so as to clarify when and why no costs are introduced.

On the other hand, the TRA notes that the new information provided by Omantel regarding its transmission network could outline a potential underestimation of the total km of fibre cable required for transmission. Based on this new data provided by the Operator, the dimensioning of the transmission network has been updated to recognise the higher density of fibre km installed.

2.2.8. Issue 8: Cost Allocation to Services

The following answers were provided by the operators to the 8th issue of special relevance:

Nawras' answer

Nawras has not commented on the cost allocation to services implemented in the BULRIC Model for fixed networks.

Omantel's answer

Omantel has expressed that, due to the way the model has been constructed, it is impossible to assess the breakdown of costs for a service by network element/component.

The TRA's response

The TRA does not agree with Omantel's view that it is not possible to assess the cost allocation to services, as it is performed in the same manner as in the BULRIC Model for mobile networks (in which Nawras has provided valuable comments about the cost allocations performed). Nevertheless, the Authority has considered it appropriate to include a disaggregation of costs per resource in order to increase the level of information available on the disaggregation of the services' costs.

2.2.9. Issue 9: Model for ancillary, one-off and reduced materiality services

The following answers were provided by the operators to the 9th issue of special relevance:

Nawras' answer

Nawras has not commented on the Model developed for the calculation of the costs related to ancillary, one-off and reduced materiality services.

Omantel's answer

Omantel has not commented on the Model developed for the calculation of the costs related to ancillary, one-off and reduced materiality services.

The TRA's response

Given that no objections have been raised regarding the model for ancillary, one-off and reduced materiality services, the final version of this model will present no changes from the draft version submitted to the Operators.

3. Responses to other contributions

This section presents other contributions provided by the Operators that do not relate to any of the topics of special relevance outlined by the TRA in the letter sent to the Operators.

3.1. Models Performance

Both Nawras and Omantel made contributions regarding the models' performance, which are applicable to both the model for fixed networks and the model for mobile networks. These contributions are presented below:

Nawras' contributions

Nawras states that "*The model is run by macro, which runs all geotypes and increments. After the calculation it stops at the last geotype and last increment. Changing manually dimensioning sheets to another geotype or increment and recalculate the formulas by pressing F9 does not work for all calculation cells*"

Omantel's contributions

Omantel has expressed that "*It is not acceptable that the user is not 'allowed' to press F9 as it results in a meaningless calculation. […] If/when F9 is pressed, at the end of the recalculation it reports a calculation circularity alert, but is unable to list the references that cause it. […] This makes us wonder if the real reason for the Visual Basic is that the circularity problem got into the model somehow and could not be resolved, but Axon found that by stepping through the calculations using Visual Basic 'made the problem disappear'*"

The TRA's response

The TRA understands Nawras' comments regarding the ease of checking the results produced for a specific geotype or a specific increment. In order to ease this process, two new drop-down lists have been included in the control panels of the models that allow the selection of a given geotype and/or increment to be executed independently.

Regarding Omantel's comments, the Authority agrees with the Operator in that no circularity alerts should appear in the BULRIC models. The TRA appreciates that Omantel has alerted the TRA of the issue and the existing circularity references have been removed from the models, without impacting on the results. Additionally, in order to prevent the use of the F9 key to execute the models, these have been updated to display an alert when F9 is pressed, outlining that it is not possible to run the model with this key, as described in the manual.

Finally, regarding the use of the Visual Basic Macro to execute the model, its use has been introduced to minimise the size and complexity of the model in executing different geotypes and different increments. Additionally, as it can be inferred from the above explanation, this macro was not used to bypass any potential issue within the Models. Therefore, the use of macros to control the calculation flow of the model has been preserved in the final version of the BULRIC models.

3.2. **Negative costs in the outputs**

Both Nawras and Omantel made contributions regarding the existence of negative costs in the models' outputs. The contributions made by the Operators are presented below:

Nawras' contributions

Nawras states that "*Incremental costs of Core SGW and PGW are negative. It was explained in the meeting with Axon Consulting that incremental costs can be negative for transmission links and ports, where one type with higher capacity (for example STM4) needed for FAC (full traffic) can be replaced by lower capacity (for example STM1) sufficient for lower traffic (without the increment). However this explanation is not valid for SGW and PGW - even when we subtract some increment and the traffic decreases, the same SGW and PGW should be used, because lower traffic will not go to equipment.*"

Omantel's contributions

Omantel has "*uncovered four services in the fixed model that contain negative costs:*

- *Leased Line.National.Retail.E1 - port*
- *Other.Duct rental.Wholesale.Sub-duct rental - distance*
- *Leased Line.MPLS.Wholesale.Traffic*
- *Internet connectivity.International.Wholesale.IP Bandwidth*

[…] We would suggest that Axon adapts the [CHECKS] worksheet to include further checks for negative costs in the model outputs."

The TRA's response

As Nawras describes, the rationale behind the presence of negative costs in the SGW and PGW equipment is not the same as that explained during the meetings that took place in August. In particular, in the case of NGN related resources, where the adjusted tilted depreciation is used. In the formulae implemented in the draft model, the production patterns are based on the traffic after removing the increment. This approach results in different production (and cost recovery) patterns when comparing the total traffic and the traffic without the increment. This can lead to negative costs. In order to increase the robustness of the annualisation, the production factors have been changed to be based always in the total traffic.

On the other hand, as Omantel points out it has been observed that the draft model for fixed networks produced negative costs for the four services indicated. This effect has been caused by a mistake in the formulation associated to a resource that affects to those services. After the amendment of the formulae, it has been verified that all services exhibit positive costs.

Additionally, as recommended by the Operator, an additional check has been included in the "CHECKS" worksheets which alerts of the existence of negative costs in the outputs.

3.3. **Tilted annuities**

Nawras and Omantel have provided comments on the implementation of the tilted annuities formulae under both models, as described below:

Nawras' contributions

Nawras states that "*No annuity (combination of depreciation and cost of capital) formula was used in the model. Instead of it, the model calculates separately some tilted depreciation, which does not include cost of capital (sum of depreciation in all years is equal to the initial investment) and separately it calculates the cost of capital.*"

Additionally, it outlines that "*the total costs of asset (sum of depreciation and cost of capital) calculated in the model are around 10% lower compared to the results of the standard tilted annuity formula*."

Omantel's contributions

Omantel outlines that "*the tilted annuities adopts a multi-year approach which, in our view is not relevant for a forward looking, bottom-up calculation. […] The disaggregation of Cost of Capital and Depreciation is not consistent with an annuity approach*"

The TRA's response

Based on the contributions provided by the Operators, the TRA's outlines its position in the following paragraphs:

- **Disaggregation of depreciation and cost of capital**: The TRA has noted that both operators have provided comments regarding the disaggregation of the cost of capital and depreciation components in the tilted annuities formulae. This split has been implemented for informative purposes only, and is obtained considering WACC equal to 0 for the depreciation component. Therefore, the Authority has found no reason to remove this disaggregation from the model.

- **Results of the tilted annuities formulae:** Nawras' comments on this issue have been of special relevance to uncover an inconsistency between the formulae employed in the model and that presented in the methodological document. In fact, whereas the formula presented in the methodological document included a cost of capital term that responded to the formula $\alpha_i = (1 + WACC)^{-(i-i_0+1)}$, the formula that was implemented in the model responded to the equation $\alpha_i = (1 + WACC)^{-(i-i_0)}$. Based on Nawras' contributions, the tilted annuities formulae implemented in the models have been adjusted to ensure their alignment with the methodological document.

- **Over complexity of the formulae employed**: Although the TRA understands that the implementation of the formulae is more complex than what is extracted from widespread literature, it feels it is important to note that this is a result of the practical consideration of the effects of (i) adds, replacements and removals of resources and (ii) no constant price evolution over the years. Therefore, the TRA has not found feasible to reduce the complexity of these formulae while taking into account the same number of factors.

3.4. **Operating costs**

Omantel has provided comments on how unit operating costs have been included in the models which are presented below:

Nawras' contributions

Nawras has not commented on how operating costs have been input in the models.

Omantel's contributions

Omantel outlines that "*Operating costs are entered by asset as a direct input, which then varies from one year to the next. This treatment is essentially the same as considering operating costs as a percentage of capex and can in no way be deemed "Bottom Up" where the need/demand for operating cost activities would be assessed and then that demand priced on the basis of unit costs (such as the salary cost of relevant employees). […] The models should be upgraded to take proper account of the Bottom-Up approach that is required by the methodology document.*"

The TRA's response

Regarding the introduction of unit operating costs in the models, the TRA believes it is important to outline that the Bottom-up approach has been used and costs per unit have been input in the model (not percentages). Additionally, some resources have been created to increase the detail of the bottom-up modelling of certain OpEx components of the network. For example, in the case of the electricity, the Model calculates the energy required (kWh) based on average consumption per unit.

Moreover, it can be verified that, for a specific resource, the computation of the percentage of OpEx over CapEx leads to a non-constant figure over the years.

Consequently, the Authority considers that Omantel's requests were already implemented in the draft Models and sees no need to adapt the process on how unit OpEx is introduced into the BULRIC Models.

3.5. **Use of the IFERROR command in the Model**

Omantel has provided comments on the use of the IFERROR command in the models which are presented below:

Nawras' contributions

Nawras has not commented on the use of the IFERROR command in the models.

Omantel's contributions

Omantel states that "*Both models make extensive use of the IFERROR function, […] which can hide problems within the model calculation process as errors are masked.*

As part of making the models fit-for-purpose, the IFERROR formulae must be removed. Another example of very poor exception handling within the models is the use of the number 1,000,000 to mean "not relevant" or "not applicable"

The TRA's response

The IFERROR function is used to prevent known exceptions in the formulas (for instance, the result of some formulas should be 0 when the denominator is equal to 0). The TRA acknowledges the benefits of Omantel's proposal regarding the use of more focused formulas to, for instance, identify when the denominator is 0 and not to overcome any other possible error, although it notes that in those formulas of very high complexity the use of IFERROR simplifies the formula and makes it easier to be understood. Therefore, the use of the IFERROR in the final versions of the models has been minored when feasible, namely:

- Short formulas where the IF element was used to control potential errors
- Cases when the IFERROR did not control a #DIV/0 potential problem

On the other hand, the TRA notes that the use of 1,000,000 (as a representation of infinity) is a standard practice in BULRIC Models, which allows the use of easier and clearer calculation formulas. However, in order to ease the understanding of the use of this figure, its use has been replaced by a variable named 'infinity', which has a value of 10^{15}.

Annex A. Other contributions made by Nawras

In addition to the main comments provided by Operators, which have been presented and treated in the sections above, Nawras has provided a set of comments focused on very specific inputs and calculations included in the models. The TRA outlines its position in regards to the comments provided by Nawras in this annex, which has been split between the comments to the model for mobile networks (A.1) and the model for fixed networks (A.2).

The Authority remarks that these contributions have, in general, minimum impact in the results.

A.1. Comments on the BULRIC Model for mobile networks

The rest of the comments provided by Nawras regarding the BULRIC Model for mobile networks are split as follows:

- Comments addressing specific inputs or calculations, which Nawras feels should be adjusted in the model (A.1.1)
- Requests for clarifications on the dimensioning algorithms (as a whole or for some very specific parts) or on their presentation (A.1.2)

A.1.1. Nawras' comments on inputs and calculations

The table below provides an overview of the contributions provided by Nawras as well as the TRA's position for each of them. Additionally, for the different comments, the Authority indicates the level of agreement reached for each issue.

Comment	Agree	TRA's position
Model inputs: An idle traffic percentage should be included for originating/incoming traffic.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly
Unit conversions: A blocking probability should be considered for signalling traffic.	●	The TRA appreciates Nawras' comment and has considered it into the model

Comment	Agree	TRA's position
Unit conversions: Some of the backhaul bitrates considered in the conversion of units should be adjusted.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly
Unit conversions: Conversion of SMS and MMS traffic to Core IX channels should not convert it into Mbps, as the core channel size is in kbps.	●	The TRA appreciates Nawras' comment and has considered it into the model
Unit conversions: GSM core data traffic (in MB) should be converted to Mbps using the GPRS channel bitrate instead of the GSM channel bitrate.	●	The TRA appreciates Nawras' comment and has considered it into the model
Unit conversions: Unsuccessful calls should be considered in the conversion of call minutes to BHCA.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly
Drivers' mapping: On-net MMS should have twice as high usage factor as off-net MMS for the MMSC.	◑	The TRA is of the opinion that the usage will be only double for MMS with acknowledge of receipt. The usage factor has been updated accordingly.
Drivers' mapping: Usage factor for voice, SMS and MMS outgoing and incoming traffic to other mobile and fixed networks should be independent of intra-MSC/intra-BSC traffic.	●	The TRA acknowledges Nawras' comment and has updated usage factors accordingly.
Drivers' mapping: Other comments of limited materiality.	●	The other comments of limited materiality indicated by Nawras' have been taken into account and included in the model.
Routing Factors: Backbone transmission should use core voice bitrates instead of GSM/UMTS/LTE RAN voice bitrates	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
Routing Factors: Itx MGWs, NOS and SBC equipment should use core voice and video bitrates instead of access bitrates	◔	Only the MGW Itx bitrates have been adjusted. The NOS equipment is not considered in the model and the SBC is considered to be dependent on the access bitrates.
Routing Factors: PCRF should not use HSS routings but CSCF routings, and CSCF should be adjusted in case of migration to fully NGN core.	◑	The TRA acknowledges Nawras' comment and has proceeded to update the routings for the PCRF as suggested. However, no adjustments have been introduced in the routing factors of the CSCF as no migration to fully NGN core is considered.
Routing Factors: HLRs and HSSs should not be allocated to subscribers, but to the services subscribers actually pay for.	○	As it has been set out in section 2.1.7, the TRA considers that network costs should be allocated to services based on their usage, and hence, the costs of these resources should be allocated to subscribers.

Comment	Agree	TRA's position
Routing Factors: Other comments of limited materiality.	◑	The other comments of limited materiality indicated by Nawras' have generally been taken into account and included in the model.
Routing Factors: QoS factor considered for the Billing System.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
Routing Factors: The MMSC factor for on-net MMSs should be 1.	◑	The TRA is of the opinion that the MMS with acknowledge of receipt should receive twice costs. The routing factor has been updated accordingly.
Routing Factors: The MSC routing factor for outgoing and incoming calls should be at least 1	●	The TRA appreciates Nawras' comment and has considered it into the model
Routing Factors: The SMSC factor for on-net SMSs should be 1.	◑	The TRA is of the opinion that the usage will be only twice for SMS with acknowledge of receipt. The usage factor has been updated accordingly.
Access dimensioning: The consideration of the coverage per municipality does not provide the required coverage.	○	As it has been set out in section 2.1.4, Nawras has not provided further details on why it does not consider these formulas to be correct, and therefore, it sees no need to adjust the model.
Access dimensioning: Formulae considered for the calculation of the area of a hexagon.	○	As it has been set out in section 2.1.4, the TRA considers the formulae employed to be correct, and does not see a need to adjust it in the model.
UMTS dimensioning: Other comments of limited materiality.	●	A number of other comments of limited materiality indicated by Nawras' have been taken into account and included in the model.
LTE dimensioning: The number of LTE sites using low, mid and/or high frequency bands are introduced in the opposite order.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
LTE dimensioning: Other comments of limited materiality.	●	The other comments of limited materiality indicated by Nawras' have generally been taken into account and included in the model.
Backhaul dimensioning: Other comments of limited materiality.	●	The other comments of limited materiality indicated by Nawras' have generally been taken into account and included in the model.
Sites dimensioning: The minimum capacity required per GSM/UMTS/LTE site should be higher than that considered.	●	The TRA appreciates Nawras' comment and has considered it into the model.

Comment	Agree	TRA's position
Core network: The model should consider redundancy for the HLRs.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
Core network: Other comments of limited materiality.	●	The other comments of limited materiality indicated by Nawras' have generally been taken into account and included in the model.
General comments: Formulae employed for tilted annuities.	●	As it has been set out in section 3.3, the TRA acknowledges Nawras comment and has proceeded to adapt the tilted annuities formulae accordingly.
General comments: Reuse factors for HSPA and LTE traffic under gold and real time QoS options should be revisited.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
General comments: The model should use the ROUNDUP function instead of ROUND in the consolidation of resources.	●	The TRA appreciates Nawras' comment and has considered it into the model.
General comments: Other comments of limited materiality.	◑	The other comments of limited materiality indicated by Nawras' have generally been taken into account and included in the model.
General comments: Other presentation issues.	●	The TRA has proceeded to implement to presentation issues outlined by Nawras, as it considers will be helpful in facilitating a better understanding of the model.

Table A.1: Overview of the TRA's position regarding Nawras' comments on the inputs and calculations of the BULRIC Model for mobile networks

A.1.2. Nawras' requests for clarifications

The table below provides an overview of the request for clarifications included in Nawras' responses to the Public Consultation. For each of them, the Authority has proceeded to provide sufficient detail so these issues can be better understood by the Operators.

Comment	TRA's clarifications
Access network dimensioning: What is the Municipality coverage needed? How is it calculated by the formula?	The presentation of the coverage calculations in the access network has been adjusted in the model in order to make comprehension easier, while still following the same algorithm outlined in section 6.3.3 of the descriptive manual, and retrieving the same results. Therefore, to make the coverage calculations more understandable, the TRA expects that this presentation improvement is sufficient.
Access network dimensioning: What is the Population coverage needed? How is it calculated by the formula?	
Access network dimensioning: What is the Weighted necessity? How is it calculated by the formula?	
Access network dimensioning: What is the Cell area effectivity? How is it calculated by the formula?	
Access network dimensioning: What is the difference between Municipality and Population centre?	
Access network dimensioning: How does the formula for Additional Sites 1800 if both are added work? Why is the number of sites calculated this way the optimal number?	The algorithm calculates the number of sites required to satisfy the capacity when the number of 900 sites and 1800 sites is the same. This approach minimises the number of sites, which is assumed to be optimum.
Access network dimensioning: Why is the extra HSPA/LTE traffic multiplied by (Erlang factor - 1)?	The philosophy is that only the additional capacity installed due to the consideration of Erlang table is the one that may be reused by best-effort traffic.
Backhaul network dimensioning: Why is the 3G/LTE extra capacity multiplied by (Elastic traffic factor- 1)/Elastic traffic factor?	The philosophy is equivalent to the previous point. However, the formula should be changed to (Elastic traffic factor – 1).
Backhaul network dimensioning: What is the capacity per site without modularity?	In order to ease the comprehension of this item, its description has been changed in the model to "Minimum capacity per site" which better represents its meaning.
Backhaul network dimensioning: Why is the capacity per Hub using as minimum capacity per site the minimum capacity per LTE site divided by the contention ratio at Hub? What does the contention ratio at Hub mean?	The formula has been adjusted in order to consider the minimum capacity of each site type (GSM, UMTS and LTE). On the other hand, even though a minimum capacity per site-hub link needs to be ensured, it is not true that the minimum capacity to be ensured per hub-controller link is the sum of the minimum capacity per site-hub links. Hence, this contention ratio factor is used to represent the fact that there will be some spare capacity in the backhaul links between sites and hubs.
Backhaul network dimensioning: What is the capacity factor for MW? How is it calculated by the function capfactor?	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.

Comment	TRA's clarifications
Backhaul network dimensioning: What is the function conhexavgdist? How does it calculate the distance BS-Hub?	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.
Backhaul network dimensioning: Why is the trench/duct distance per link 8S-Hub calculated as site apothem * 2 and not calculated by the function conhexavgdist like the distance 8S-Hub?	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.
Backhaul network dimensioning: What is the number of subducts per link? How does the function conhexavgdist calculate the number of subducts per link?	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.
Backhaul network dimensioning: Why are trenches, ducts and subducts not included in the model as resources? Their costs are then not calculated.	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.
Backhaul network dimensioning: What is the function hubtohub? How does it calculate the distance Hub-Hub?	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.
Backhaul network dimensioning: Why is the capacity of MW link multiplied by the capacity factor for MW?	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.
Backhaul network dimensioning: Why is the average distance for MW set to 0?	After the adjustment of the backhaul calculations set out in section 2.1.4, this item no longer appears in the backhaul calculation worksheet.
Core network dimensioning: Why is the percentage of controllers in each core centre multiplied by the average coverage percentage in geotypes connected to this core centre?	The traffic they aggregate depends on the coverage of the geotypes they mostly deal with (for instance, a controller which aggregates traffic mainly from rural geotypes, should handle lower traffic when less coverage is given to these geotypes).
Core network dimensioning: Why is the 4G driver multiplied by the percentage of LTE equipment in each core centre (not multiplied by the average coverage percentage in geotypes connected to this core centre) while the sum of 2G, 3G, 4G drivers is multiplied by the adjusted percentage of LTE equipment in each core centre (multiplied by the average coverage percentage in geotypes connected to this core centre).	The TRA acknowledges Nawras' comment and has proceeded to adjust the formula so that all of its terms consider the adjusted percentage of LTE equipment.
Core network dimensioning: Why is migration to fully NGN core not calculated for PGW, HSS, PCRF, CSCF, SBC?	The methodological document did not define a fully NGN core migration.
General Comment: What is tilted annuities denominator? What does it express and how is it calculated by the formula?	The tilted annuities denominator performs the calculation of the denominator included in the tilted annuities formulae (please see the technical manual).
General Comment: What is tilted annuities denominator 2? What does it express and how is it calculated by the formula?	The tilted annuities denominator 2 performs the calculation of the denominator included in the tilted annuities formulae setting the WACC to 0. This is used for the disaggregation of depreciation and cost of capital described in section 3.3.
General Comment: What is depreciation costs? What does it express and how is it calculated by the formula?	Depreciation costs are those obtained applying tilted annuities with a WACC equal to 0. Please see section 3.3 for further detail on this issue.

Comment	TRA's clarifications
General Comment: How is the cost of capital calculated by the formula?	Cost of capital is obtained as the difference between tilted annuities with the WACC and with a WACC set to 0 (depreciation). Please see section 3.3 for further detail on this issue.
General Comment: How is the adjusted tilted annuity calculated by the formula?	The adjusted tilted annuity is calculated according to the description given in the section 8.2 of the descriptive manual.
KPIs Adjustment: What is the KPIs adjustment?	The adjustment of KPIs is performed to calculate the percentage of costs that should be allocated to each technology for each of the increments.

Table A.2: TRA's responses to Nawras' request for clarifications over the BULRIC Model for mobile networks

A.2. Comments on the BULRIC Model for fixed networks

The rest of the comments provided by Nawras regarding the BULRIC Model for fixed networks are split as follows:

- Comments addressing specific inputs or calculations, which Nawras feels should be adjusted in the model (A.2.1)
- Requests for clarifications on the dimensioning algorithms (as a whole or for some very specific parts) or on their presentation (A.2.2)

A.2.1. Nawras' comments on inputs and calculations

The table below provides an overview of the contributions provided by Nawras as well as the TRA's position for each of them. Additionally, for the different comments, the Authority indicates the level of agreement reached for each issue.

Comment	Agree	TRA's position
Drivers mapping: Access lines mapping to drivers should be revisited.	●	The TRA appreciates Nawras' comment and has considered it in the model
Routing Factors: Transmission 1Gbps and 10Gbps ports should be related to the transmission equipment, instead of interconnection ports.	○	The TRA appreciates Nawras' comment. However, given that the model considers 1Gbps and 10Gbps interconnection services, these resources need to be allocated to services differently from the other transmission equipment.

Comment	Agree	TRA's position
Routing Factors: Retail Lease Lines should also have Routing factors for the access network.	●	The TRA recognises that the definition of leased lines was not sufficiently clear in the draft model. Accordingly, it has provided a full description in the descriptive manual and adjusted their routing factors in the updated model.
Routing Factors: Not intra-MSAN/intra-router percentages should be used for outgoing calls routing factors	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
Routing Factors: Retail Lease Lines should also have Routing factors for the HSS.	●	The TRA appreciates Nawras' comment and has considered it in the model.
General comments: Formulae employed for tilted annuities.	●	As set out in section 3.3, the TRA acknowledges Nawras comment and has proceeded to adapt the tilted annuities formulae accordingly.
Access network dimensioning: Access nodes should be dimensioned based on the number of active connections, and colocation should be considered between DPs and MDFs.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
Access network dimensioning: Other comments of limited materiality.	●	The other comments of limited materiality indicated by Nawras' have been taken into account and included in the model.
Access network dimensioning: The number of MDF/ODF connections should depend on active lines.	●	The TRA appreciates Nawras' comment and has considered it into the model.
Access network dimensioning: The number of GPON splitters should be dimensioned based on the number of active lines.	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.
Core network dimensioning: Other comments of limited materiality.	●	The other comments of limited materiality indicated by Nawras' have been taken into account and included in the model.
Transmission network dimensioning: Voice and LL traffic is distributed based only on data traffic.	○	The TRA appreciates Nawras' contribution. However, given that data traffic accounts for >99% of total traffic, the TRA sees no need to adjust this calculation.
Transmission network dimensioning: Unit cost per link is multiplied by the average distance per link and unit cost per distance is multiplied by the average quantity of links.	●	The TRA appreciates Nawras' comment and has considered it into the model.
Transmission network dimensioning: The number of ports per node should be divided by two (as one is considered in one node and the other one in the next node).	●	The TRA acknowledges Nawras' comment and has updated the model accordingly.

Comment	Agree	TRA's position
Transmission network dimensioning: Other comments of limited materiality.	●	The other comments of limited materiality indicated by Nawras' have been taken into account and included in the model.

Table A.3: Overview of the TRA's position regarding Nawras' comments on the inputs and calculations of the BULRIC Model for fixed networks

A.2.2. Nawras' requests for clarifications

The table below provides an overview of the request for clarifications included in Nawras' responses to the Public Consultation. For each of them, the Authority has proceeded to provide sufficient detail so these issues can be better understood by the Operators.

Comment	TRA's clarifications
Routing Factors: What is the difference between access fibre and access fibre cabling?	There were no differences between these two categories, and therefore only the 'access fibre cabling' category has been preserved in the final version of the model.
Access network dimensioning: What is the aerial distance uplift?	The aerial distance uplift represents the extra length of cable that is required due to the cabling sag between poles. This parameter is described in further detail in the section 3 of the copper access dimensioning in the descriptive manual.
Access network dimensioning: How is the number of fibres aggregated in a FDP splitter calculated by the formula?	The aggregation of fibres in an FDP splitter is directly proportional to the levels of aggregation supported by the splitter and the number of fibres in the FDP (e.g. if a splitter supports the aggregation of 8 and 16 fibre cables, and there are 12 fibre lines reaching the splitter, the number of fibres aggregated by the splitter will be equal to 8 - the aggregation level immediately below the number of fibres reaching the splitter-).
Access network dimensioning: How is the required km of ducts per section in primary and secondary network calculated by the formula?	The dimensioning of the kms of ducts for primary and secondary networks is laid out in step 2 of the section 6.1.3 of the descriptive manual, which is titled 'Calculation of the total kilometres of ducts required'.
Access network dimensioning: How is the required km of subducts per section in primary and secondary network calculated by the formula?	The required km of subducts in each section is calculated assuming that there will be three subducts in each fibre duct. Additionally, the rental of subducts is also considered in the formulae.

Comment	TRA's clarifications
Access network dimensioning: How is the number of joints calculated by the formula?	The dimensioning of the number of joints is laid out in step 3 of the section 6.1.3 of the descriptive manual, which is titled 'Number of joints required'.
Access network dimensioning: Is manhole used for each FDP with buried cable in addition to the manholes for ducts?	As it has been set out in step 4 of the section 6.1.3 of the descriptive manual, titled 'Manholes' dimensioning', a manhole is installed in each buried FDP and at each 'd' km of buried cables.
Transmission network dimensioning: Why is the sum of % of traffic handled in edge-core links only 73%? As a result the traffic in edge-core links gets reduced to only 73% (rows 2939-2948).	The TRA notes that these traffic percentages should be understood as the percentage of traffic over the total carried by a single link, and therefore it is not required that the total is 100%. In fact, the sum of the traffic carried by all links is greater than 100% due to the existence of redundancies (e.g. through ring topologies).
Transmission network dimensioning: Why is the sum of % of traffic handled in core-core links 219%? As a result the traffic in core-core links gets increased to 219% (rows 5430-5439).	The TRA notes that these traffic percentages should be understood as the percentage of traffic over the total carried by a single link, and therefore t it is not required that the total is 100%. In fact, the sum of the traffic carried by all links is greater than 100% due to the existence of redundancies (e.g. through ring topologies).
Transmission network dimensioning: Why are distribution routers used in the modelled network? Why are the edge-core links not directly connected to core routers if they have enough capacity?	Due to the lack of information available in this regard, it was not clear whether distribution routers were currently in use in the Sultanate. Therefore, based on the international practice, these routers have been included in the Model.
General comments: How are the resource removals calculated by the formula?	The calculation of the resource removals is based on (i) the calculation of removals due to a downturn in demand and (ii) the removed resources due to useful life being over. Please note that the removed resources due to completed useful life are replaced (new equipment is installed).

Table A.4: TRA's responses to Nawras' request for clarifications over the BULRIC Model for fixed networks