TSLRIC price review determination for the Unbundled Copper Local Loop and Unbundled Bitstream Access services

Analysis of the responses to the second consultation following the further draft determination

Commerce Commission

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0 Context

Following the publication of the Commerce Commission further draft determination on TSLRIC models and prices, the industry has published its views on the material that was published (second consultation). This document aims at summarizing the different comments that have been raised. For each comment, TERA Consultants describes its view on the relevance. When the issue does not relate to a cost modelling subject or where TERA Consultants does not have any opinion, the following comment is provided “TERA does not have any opinion on this issue”.

The following reports have not been reviewed because they do not raise any comment on the cost modelling work conducted by TERA Consultants.

Such comments are not part of the answer to the comments from the interested parties.

Where comments are filled with off-white we have recommended and implemented a model update for the Commission.

Where we have not been asked to provide additional comment on a matter we have listed it as “Not applicable”.

1 Analysys Mason

1.1 Report

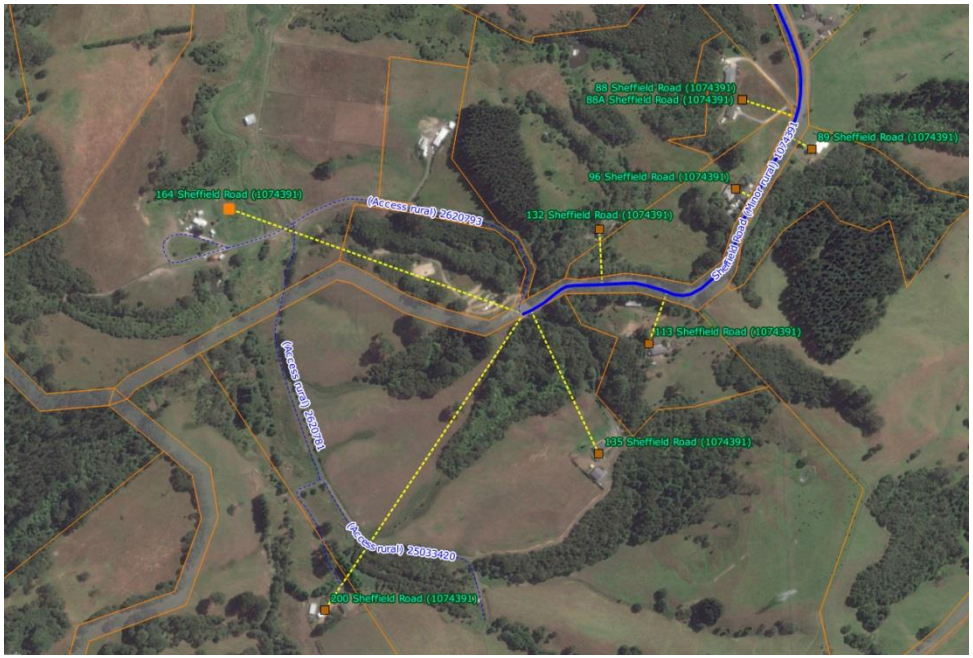
This section aims at addressing the comments detailed in “Analysys Mason report on further draft determination dated 13 August 2015 CONFIDENTIAL (CI).pdf”.

1.2 Analysis of the comments regarding CAPEX

Industry comment	TERA’s views
2.1 Network laterals are incorrectly excluded AM considers that lateral trenches (from the distribution trench to the property limit) shall be included in the modelling as these trenches are incurred for all lines passed.	After a detailed review of common practices in New Zealand and a review of the definition of lead in, it is indeed considered that laterals should be included Laterals’ length has been assessed by BECA at 1.75m in average. Also, laterals are not always deployed for each premise but can be shared between adjacent premises (in average 2.08). As a consequence, Network Access Points have been identified and laterals are only deployed for Network Access Points

Industry comment	TERA's views
	 Network access points (NAP) have been located by taking into account the property boundaries for a given address and the shared boundary between adjoining properties such that the NAP is placed at the shared location of the property road frontage. The first and last NAP location on each segment have been placed to minimise the trench length of the minor side. This saves around 20m of trench per road segment.
2.2 Optimisation of exchange areas AM considers that road-length Voronoï approach is ill-adapted to derive exchange areas boundaries.	The Commission requested TERA Consultants to model the network according to a modified scorched node approach, as FPP is based on a hypothetical efficient operator network. Thus, exchange areas are to be optimised according the road network, while exchange nodes are based on actual exchange nodes. As optimization is based on the road network, it already takes into account natural barriers such as mountains and rivers.

Industry comment	TERA's views
2.3 Lead in assets on rights-of-way AM considers trenches that are shared among multiple lead ins are underestimated, as they do not necessarily follow straight lines.	AM exhibits a specific situation where the two successive trenches form an orthogonal angle. It does not represent the general situation, which is already taken into account by applying a mark up to trenches and cables, in order to capture non-linear paths (SuboptimalPathMarkup). AM provides an analysis to determine the average mark up to trenches and cables (respectively 9.9% and 9.4%). Following AM assessment, a 9.5% mark-up should be used instead of the current 5% markup. Indeed, there analysis has been reviewed and considered reasonable. This change has been applied
2.4 The mapping of buildings to road segments is not always correct and this is leading to material underestimation of horizontal network asset counts.	The model uses the road associated with a building as per the source data, rather than calculating the closest road. In the example used by Analysys Mason the segments that they refer to are privately owned unnamed rural access roads. The address points are correctly associated with Sheffield Road which terminates as shown by the blue line on the following screenshot. The legal road continues to the west from this point but is unformed and therefore a 'paper road'. The following screen shot shows the original CoreLogic data together with the Land Information New Zealand (LINZ) parcel and legal road boundaries. Where **1.** For Corelogic data a) Private roads are shown as a blue dashed line b) Non-Private roads are shown as a heavy blue line c) Address points (shown as brown/orange squares) are labelled with their full address followed by the ID of the associated road segment ie ROAD_SEG_ID in brackets. d) All roads are labelled with their name (where one exists) followed by the road classification in brackets and finally the unique ID of the road segment. **2.** For LINZ data

Industry comment	TERA's views
	a) Parcel boundaries are shown as orange lines b) Areas of legal road are shaded in a light grey The dashed yellow lines represent the shortest line between the address point and associated road segment.  This clearly shows that the address points are correctly associated with the correct road segment, as defined in the CoreLogic dataset, and that the approach recommended by Analysis Mason of connecting the building to the nearest road segment is flawed.
2.5 Some calculated trenches are excluded from the model.	The point identified by Analysys Mason (which is about trenches that cross streets) is

Industry comment	TERA's views
	possible but is not an issue because the length of cross trenched is calculated on the one hand, whatever the demand is while the dimensioning of this cross trenched is calculated separately based on the demand. If the demand is null, the dimensioning step finds that there is no need for a trench while the length of cross trenched has been calculated anyway.
3.1 The trenching costs derived by BECA are not representative of actual costs in New Zealand (and Annex A)	First, while AM performs a statistical analysis based on soil type and geotypes clusters, the underlying data it uses is largely biased towards urban areas (in particular, greater Auckland and Wellington). While those areas are representative of significant share of users, they are not representative of the HEO's footprint, mostly rural. Plus, it is important to note that urban trenches are 20-25% more expensive than the national average in the model developed by TERA Consultants. Processing essentially dense urban areas – as stated in Annex A – may lead to drive up average unit costs. Secondly, trenching long distances provide significant cost relief, due to fixed costs when trenching a section, according to Downer. Average trenching length is much longer in the draft determination (nationwide, in TSO) than in AM sampling ([ ]**CNZCI**). (Source: respectively Access model developed by TERA and "CI_2149140_Copy of AM Trench cost statistical analysis_for CC.xls", sheet "InClutter", column E). This indicates that trench costs are logically cheaper in the model developed by the Commission because sections are 150% longer (this is in reality probably even higher because Chorus prices may cover several sections). Thirdly, the data used by AM in its model is related to 2013 projects: between 2013 and 2015, trenching costs have [ ]**DCI** according to the graph provided by Downer in the last page of their report. Applying this to Chorus prices would bring trench prices close to the ones used in the draft TSLRIC model. Network Strategies also conducted a review of Analysys Mason which raises significant issues. BECA has also reviewed the material provided by Analysys Mason and Chorus but notes

Industry comment	TERA's views
	that direct comparison is not possible between Chorus rates and BECA rates and adds that rates are not dissimilar: BECA rates range from $19/m to $74/m while Chorus' rates range from [**]CNZCI**. The average rate is then determined by the mix of trenching techniques that is adopted. Yet, the type of trenching methodologies is not specifically identified in Chorus data.
3.2 Incorrect use of the cheaper tech, instead of a mix of the cheaper and dir. Drilling (See also Annex A)	The use of the cheapest technology for all road segments has been reviewed: a weighted average of the available techniques is used, to comply with the actual distribution of techniques used in the network. Weights have been assessed by Beca.
3.3 Several drill hole/trench dimensions assumed by BECA are not physically possible	BECA has addressed this point in their report. No change needed
3.4 The harmonic weighting calculation is still not being applied correctly	Weights have been updated to reflect the distribution of trenches in the modelled network. Weights are used solely for XXL trenches. Indeed, M to XL trenches correspond to integer sizes of trenches (respectively, 1 duct, 2 ducts and 3 ducts), while XXL trenches correspond to 4 to 10 ducts.
3.5 Arborist costs may have been omitted	Arborist costs are already included in BECA analysis. See para 4.2.5 of Beca's April 2015 report.
3.6 HFC shall not be included in UCLL demand	HFC demand has been removed from UCLL demand.
3.7 Inconsistent WACC in pole rental capitalisation: TERA Consultants has used December 2014 WACC to infer pole rental capitalisation, then annualises it with a different WACC (April 2015)	TERA Consultants has adjusted pole rental capitalisation consistently with the relevant up-to-date WACC used in the modelling.
4.1 UBA Unit Costs 4.1.1 Fees and management uplift calculation is incorrectly applied	TERA has updated the model by adjusting the unit cost calculation for the ISAM rack and subrack. This was based on additional data received from Chorus (Q 1 Project Management costs).

Industry comment	TERA's views
4.1 UBA Unit Costs 4.1.2 Design and test is omitted	TERA has updated the model in order to take into account all design and test costs. We confirmed the scope of input costs with Chorus (Q 2 Design and Test Costs).
4.1 UBA Unit Costs 4.1.3 Direct unit costs are incorrect for certain items The purchase cost of a switch rack is not included at all	TERA has updated the model by including switch rack costs. .This was based on additional data received from Chorus (Q 3 Switch rack).
4.1 UBA Unit Costs 4.1.3 Direct unit costs are incorrect for certain items We recommend that TERA uses the with-integrated splitter card for both exchanges and cabinets	Chorus has provided further clarifications to equipment and associated unit costs that allow updating the model. Splitters were partially used. Now Splitters are used for all ports and costs are allocated 50% to UBA because the splitter is used by voice and UBA (allocation computed in the UBA input file)
4.1 UBA Unit Costs 4.1.3 Direct unit costs are incorrect for certain items TERA has selected an earlier generation of switch fabric module (SFM-3, not SFM-4). SFM-4 is the up to date variant currently being deployed by Chorus. We recommend that TERA updates its switch unit costs to consider SFM-4.	TERA's choice was made based on Chorus' submission. Chorus has provided SFM-3 equipment unit costs, and not SFM-4 equipment therefore TERA chose to model the SFM-3 equipment. WIK also pointed that equipment used in the cost model may be outdated and would not be used for a new deployment. Chorus has provided unit costs for the SFM-4 pieces of equipment of ESS-12 (Q 5.First data switch MEA), TERA has included these costs in the model and the mode selects the most cost efficient equipment between SFM-3 and SFM-4/ESS12 since Chorus confirmed that both could be used.
4.1 UBA Unit Costs 4.1.3 Direct unit costs are incorrect for certain items TERA has not included either the direct or indirect cost of IOM switch cards, which are required to mount MDA cards in the switch subracks, as indicated in the s98 response.	TERA has adjusted the model to include IOM cards. The comment is consistent with WIK comment but also with documentation we have find: http://www.alcatelunleashed.com/viewtopic.php?t=21688

Industry comment	TERA's views
4.1 UBA Unit Costs 4.1.4 2014 cost data is used as 2013 data without taking price trends into account	TERA has adjusted the unit cost calculation for all assets specific to UBA.
4.2 Traffic dependence	TERA has adjusted the model so the traffic required per DSLAM does not exceed the backhaul capacity.
4.3 Spare capacity in DSLAMs and FDS	TERA understands that the design of the network does not allow to have fully loaded equipment due to several reasons including geography and churn. Spare capacities have already been taken into account. Analysys specified that equipment is usually loaded at 80% of its capacity. The load of the modelled DSLAMs subracks is 65% in terms of cards, and the load in terms of traffic cannot exceed 85% according to engineering rules. TERA does not believe further adjustments are needed, especially since the modelled demand is stable. Also, [**]CNZRI** and this is what has been done in the model since the model uses the demand for each modelled year based on forecasts provided by Chorus.
4.4 Errors relating to handover connections Error in RSP port gradient formula	TERA has updated the model: The formulas J122 and J124 of the Parameters spreadsheet will be adjusted.
4.4 Errors relating to handover connections 10G handover cost differential: The gradient based on costs does not take into account a 2x10G switch card	At a national scale, the use of 2x10G cards increases the cost of UBA, therefore the card model selected for switches is a1x10G card, therefore 2x10G cards cannot not be taken into account for the gradient calculation. No change was needed
4.4 Errors relating to handover connections Cost of handover connection	TERA has updated the model accordingly: The missing elements have been integrated in the handover cost calculation.

1.3 Analysis of the comments regarding OPEX

Industry comment	TERA's views
§5.1 The use of short-term Eircom LFI data to drive New Zealand costs is inappropriate: - The fault rate used by TERA is strongly affected by a single exceptional period - The Commission should revert to using 12.8% as the relevant "actual" figure	As explained by AM, the model efficient copper LFI used Irish operator Eircom real LFI as part of its inputs (in the absence of NZ-based estimates for the LFI of a new network). The Eircom LFI used in the model is 16.4% and corresponds to the year 2014 figure[1] (1 Jul 2013 -30 June2014) in red on Figure 1. Monitoring the evolution of Eircom's LFI over time (see Figure 1), TERA Consultants shares AM's view that the 2014 figure is highly impacted by the exceptional weather conditions occurring in Winter 2013/14 and that are highlighted by a historically high LFI for Q1 2014. As a consequence, this figure is not necessarily representative of the long run LFI of an old copper network. To address this issue, an average Eircom LFI (14.3%) over the period for which data is available has been implemented considering that no clear increasing / decreasing trend can be observed for the evolution of this LFI. As a consequence, TERA is of the view that a new copper network with a LFI of 10.5% (calculation detailed in the model documentation) should be modelled. It is also to be noted that the same study has been performed on Chorus side, to check that the Chorus LFI is not historically high or low. Chorus has provided its copper LFI evolution for years 2009 to 2015. The current Chorus LFI assumption ([ ]**CNZCI)** is consistent with the average LFI over the 2009 to 2015 period ([ ]**CNZCI**, see Figure 1) and the latest available figure ([ ] **CNZCI** for 2015). As a consequence, this part of the calculation should remain unchanged.
§5.2 Correction for additional aerial deployment in the aerial opex: - The assumption Aerial LFI = Underground LFI + 4.0% is underestimated - The use of confidential benchmark is not transparent - According to ARMIS data, per km maintenance cost of aerial network is 167% the	It is TERA Consultants' understanding that the 111% multiplier of maintenance OPEX when aerial rate move from 5 to 47% quoted by Analysys Mason as the output of the aerial deployment adjustment corresponds to the multiplier that is applied in column J of the "cost summary" sheet when the fibre scenario is selected. It means that the 111% is assessed based on the modelling of an "old copper network" (for

[1] http://www.comreg.ie/_fileupload/publications/ComReg14128.pdf

cost of the underground network. This would imply a 127% multiplier when aerial rate moves from 5 to 47%. Other studies show higher figures - TERA consultants multiplier is 111% - ARMIS inputs should be used.	the fibre scenario, an "old copper network" has to be modelled as the 40% adjustment compares an old copper network with a new fibre network). So the TERA figures for the LFI adjustment due to increased aerial % (from 5% to 47%) are derived as follow: • Old network: 15.8% → 17.5% (ie +1.7%) (111% multiplier of maintenance OPEX) • New network: 7.7% → 9.4% (ie +1.7%) (122% multiplier of maintenance OPEX) In the absence of NZ-based information, the assumption currently implemented is based on benchmark from Ireland: "Aerial LFI = Underground LFI + 4%" (meaning that "4% x (47% - 5%) = 1.7%" is added). The impact is indeed more important in percentage in the case of a new network as LFI are lower. As a consequence, the right figures to compare as far as the copper network is concerned are 127% (ARMIS) and 122% (TERA/Commerce Commission). The ARMIS figure is then close to TERA/Commerce Commission figure and tends to support current implementation. In addition, the ARMIS is not necessarily the most robust source of information to be used in the case of the NZ BU LRIC model:: • It is dated 2007 data, so is now 8-year old data. • The poles and conduit opex within the ARMIS data includes both maintenance opex and pole/conduit rental[2]. The maintenance opex figures only should be studied, so the inclusion of rental costs distorts the analysis. • The ARMIS unit costs that Analysys Mason calculates in their Annex B are based on comparing either aerial vs underground (using conduit) opex or aerial vs buried (no conduit) opex. This is not really the right comparison, since we are comparing aerial opex with a combined underground/buried network (as is Chorus' current network). It is to be noted that NZ-based figures have been requested from Chorus on the difference between underground LFI and aerial LFI. They replied that, to the best of their knowledge,

[2] See "FCC Report 43-01 and Pole Attachment Data Report Definitions December 2014", pole and conduit expenses are split into maintenance and rental expenses.

	such data is not available: *[* ***]CNZCI***[3] As a consequence, no change is needed.
§5.3 A non-labour OPEX trend of 0% nominal is too low for floor space and power assets: - TERA model uses a positive cost trend to depreciate the power assets, this should be applied to non-labour power opex (e.g. Energy allocation worksheet).	A non-labour OPEX trend of 0% has been set on non-labour OPEX on the grounds that the costs categories included within non-labour OPEX are highly heterogeneous. It is TERA's view that "cherry-picking" one or two categories such as power or floors space for which 0% nominal appears too low and apply a different trend would tend to distort the result as the opposite reasoning could be applied for other categories for which 0% nominal appears to be high (e.g. software). It is to be noted that the price trends assumptions used to derive the 'per MWh' energy charges and the 'per square meter' floor space charges are not set to zero on the CAPEX side of the calculations (NB: Calculation run in the OPEX model). For CAPEX, the following inputs are used (see sheet "Parameters", lines 29 to 41 of the OPEX model): • Property fit outs: 0% (as the content of this category is probably heterogeneous) • Buildings/Lands: 2.19% (based on NZIER inputs) • Energy: 2% (set as the "energy assets" price trends even though it mainly consists of KWh consumption in the absence of better input).

[3] Chorus answer to questionnaire sent in the context of the 2nd consultation process (Q 27 NZ-based figures on underground LFI - aerial LFI)

Figure 1 - Evolution of Eircom LFI over time

[ ]CNZCI

Source: TERA Consultants analysis of ComReg "Provision of Universal Service by Eircom Performance Data reports, Q25 s98 Copper fault data.xslx

1.4 Analysis of the comments regarding NRC

Industry comment	TERA's views
6.1 Overall approach is not robust: instead of times, it is the nature of processes that should be compared, between Service companies, LFC and potentially other countries, and differences should be noted and explained.	Whenever, in other countries, processes required to complete a given service transaction are more efficient, this means that the times required to perform the tasks will be shorter. Therefore, this analysis includes some process analysis of the service transaction. In addition, such an approach ensures that only efficient times are considered, and therefore reduces the risks for cross subsidization of costs between copper based transaction charges and fibre based transaction charges.
6.2 (i) TERA's NRC benchmark only compares processes on one dimension (total process duration) without taking other factors into account	Focusing only on one dimension allows excluding any difference regarding final cost of non-recurring charges that would not be under Chorus responsibility. Analysys Mason takes the example of a trade-off between tasks duration and labour costs: by retaining the lowest times, the time comparison will lead to retain the time of countries using more experienced staff, which should be more expensive. This point is relevant and needs to be considered. In order to capture the experience of staff in the benchmark, we have compared gross

	national average labour rates to gross New Zealand labour rates for the countries benchmarked. In Denmark, the loaded hourly rate of a technician is 85,4 NZD. However, the average wage in Denmark is 8596 NZD while it is 4852 NZD in New Zealand. The Danish loaded rate adjusted for the comparison is therefore 55.83 NZD. In comparison, the loaded hourly rate from service companies is [ ]**CNZCI** NZD (see NRC model), which corresponds to a [ ]**CCNZCI** % delta with Denmark rates). The same calculation, adjusted for average gross monthly wages ratio, shows that labour rates in NZ is 26% higher than in Spain, and 5% higher than in Romania, 46% lower than in the UK, 87% lower than in France, and 19% than in Italy. These differences are likely to reflect a difference in technician experience and skills. Therefore, the times in the international comparison have been adjusted with those percentages. For each country, the delta calculated above has been applied on times as a mark up (if country's adjusted labour rate is lower than New Zealand's) or a mark down (if country's adjusted labour rate is higher than New Zealand's). Analysys Mason also takes the example of a trade-off between tasks duration and level of investment in IT equipment. It must be recalled that IT costs account for approximately [ ]**CNZCI**% of Chorus overhead costs (see OPEX model), which are captured through a 5% mark up on Service companies costs. In total, IT costs do not account for more than 2% of the total NRC charges in our model. The comment is therefore not considered to be relevant as costs of a new IT system will not have any impact on the overall level of charges. In Spain, which is part of the benchmarked countries, publicly available data shows that the part of IT costs into total cost of non-recurring service does not exceed 4%, which is consistent with the statement above for New Zealand.
6.2 (ii) If TERA is seeking to benchmark times excluding travel time, then it needs to select inputs that also exclude travel time	The benchmark was performed on the basis of available data from other countries. In order to be more transparent, TERA has raised the potential issues that could occur when using this data and is aware of the bias it contains. Using data including transport time was considered to be a conservative approach.

	Anyway, only two countries provided data with transport included: Country A and Romania. Country A will be excluded from the benchmark, and Romania is never selected.
6.2 (iii) TERA's NRC adjustment is biased toward cost under-recovery and is highly dependent on outliers	As the analysis focuses on times only, it is assumed that any time value achieved by one country to perform a given set of tasks can be reproduced by any other country, provided that the necessary efficiency adjustments are made. This is why the lowest time value has been retained for each service code.
6.3 Lack of transparency : country A is not identified while its data is sometimes setting the time and hence the price	The NRA from country A requires data to remain confidential: this data has been excluded from the international indexation.
6.4 Model does not seem to include provision for Labour Cost Index adjustment of the labour part of the cost.	The Labour Cost Index is designed to capture both wages evolution and efficiency gains. The issue to consider provision for Labour Cost Index adjustment is therefore linked to the issue of considering efficiency gains in the following years. This point is dealt with in the focus on efficiency gains, in section 2.4 of this report.
6.5 Chorus overhead calculation method will result in an underestimate, as the percentage is set on former charges and then applied to new (lower) charges	To assess Chorus overheads, two approaches can be implemented. In the first approach, overhead costs are calculated as a percentage of current NRC revenues, and then this percentage is applied to adjusted costs, thus leading to less overheads recovery. This approach therefore considers that same efficiency gains can be achieved on overheads than on direct costs, since more efficient processes can lead to more efficient structure. In this approach, The second approach, by contrast, consists in keeping constant the absolute level of overheads. It requires calculating an appropriate new overhead mark-up per transaction charge that allows recovering the same total amount of overheads than before the adjustment. TERA had first implemented the first approach, but considered investigating the second as a result from Industry comments. However, the implementation of the second approach relies on a set of data much more detailed than the first approach, which was not provided by Chorus. Considering the data provided, it was not possible to calculate

	more precisely a new overhead mark-up that would lead to keep the same absolute level of overheads for Chorus. It is decided to remain with the current approach.
6.7.1 No fault found : alternatives could be used, such as “unwarranted claim for debugging, transmission” in Denmark. Given the wide variation in the nature of services and time taken, using local NZ value is recommended.	In Denmark, the product “unproductive fault handling” was considered, which is related to both LLU, and leased lines. The proposed product “unwarranted claim for debugging, transmission” is related to capacity services only, therefore less relevant. The current comparison is maintained.
6.7.2 Abortive end user site visit/cancellation charge post truck roll : benchmark is based on purely administrative cost and ignore the cost of truck roll itself. a superior benchmark within the TERA data set might be the Danish leased line charge for “Postponement fee, at point of delivery”; the travel element could be based on average NZ costs for a site visit. It may also be useful for the Commission to understand how the service companies currently charge for these events. We understand that the current charging mechanism is for the service company to charge as if the ordered job had been executed	Such charges do include truck roll in the current benchmark. This truck roll is considered in the “transport” component and “vehicle cost” component of the service cost. Regarding the way service companies charge Chorus, see related comment in Chorus section. Therefore, no change was required.

1.5 Analysis of the comments regarding FWA modelling

Industry comment	TERA's views
7.1 The assumed site sharing with mobile operators should not apply to all the costs	FWA sites have been split into passive assets – that are shared among operators – and active assets – that are not shared with mobile operators.
7.2 FWA electronics are currently omitted	The costs of cabinets, DC power system and batteries were indeed omitted. They have been integrated into the aggregated cost of the FWA base station.
7.3 The FWA network modelled by the Commission does not have sufficient coverage	In the updated model, FWA coverage is based on actual RBI sites' coverage and capped by site capacity. The costs of the FWA network modelled by the Commission are the costs of a subset of the Vodafone RBI network. It has therefore sufficient coverage.
7.4 The assumed site sharing with two mobile operators is unrealistic in practice	In the revised model, while FWA is used within areas with existing RBI coverage, FWA coverage is limited to remote areas, where mobiles operators are usually keener to colocation. Therefore, no change was required. In any case, the average number of operators per site is greater than two (sharing with one), as it is a mean of sites with two operators and sites with three or more operators. The fact that FWA coverage is limited to remote areas increases the weight of the sites with three operators.
7.5 Spectrum costs should be the opportunity costs, i.e. the total spectrum cost, rather than a fraction of it.	FWA coverage does not address a fraction of premises all over the country but a fraction of premises within a given set of remote areas. Hence, the relevant cost of the spectrum is not the opportunity cost of a national spectrum but the opportunity cost of regional spectrums. This cost can be estimated as a fraction of the opportunity cost of a national spectrum.
7.6 The opportunity costs of the spectrum are better estimated by the recent auction	The reserve on a future auction reflects the fundamental value of the spectrum to be sold

results than the reserve on a future auction	in the point of view of the buyer. As spectrum is sold through auctions, they are sold at the value the first or the second best buyer confers to it.
7.7 The modelled sites will not serve 100% of premises	See answer to 7.3
7.8 FWA backhaul assets are deployed even in the FTTN/copper model	The simple fix proposed by AM has been implemented by setting to 0 the "FWA" in the VBA routine "Dimensioning at the section level" for copper-network assets. This field "FWA" represents the number of FWA links passing through a section.
7.9 Scaling of FWA fibre assets is incorrect as only half of FWA trenches are dedicated trenches, the remaining half stemming from an allocation of shared trenches	In the updated model, there is no more scaling of FWA assets, as coverage is defined according to a subset of RBI sites, without any extrapolation.
7.10 FWA is used in a way inconsistent with the assumptions about demand.	FWA coverage has no impact on demand. Demand is based on actual demand for a given set of services (see answer 3.6) and represents the demand of a hypothetical efficient operator. On the contrary, FWA coverage is assessed and optimized to dimension the costs of a hypothetical efficient operator.
7.11.i. It serves premises which today have access to superior options	See answer to comment 7.10 In the final determination, FWA coverage is based on ADSL 2+ quality of service criterions: • Users below 4.4km from an exchange or from a non-RBI active cabinet have a speed of 1.9Mbps • Users above 4.4 km from an exchange or from a non-RBI active cabinet have a speed of what ADSL2+ allows (based on table 4.2 of Chorus Interference Management Plan[4]) • Users that would get 150 Kbps or less get 150 Kbps

[4] New Zealand copper local loop preliminary interference management plan, part 2, spectral compatibility determination process, November 2007

7.11.ii. It does not fully account for the costs of serving these premises in terms of the RAN assets, the nature of the assets at those base station sites that are shared with other operators, the full opportunity cost of the spectrum used, and the additional expenditure needed to ensure 100% of the assumed sites can be reached.	See answers to comments 7.1 and 7.2
7.11.iii. It serves small numbers of very widely dispersed premises, leading to large numbers of base stations being required to provide the coverage needed	First of all, areas unlikely to be unbundled and within the RBI coverage are considered for FWA in the final determination. Second, each premise with areas unlikely to be unbundled are being attributed a throughput of: • Users below 4.4km from an exchange or from a non-subsidised cabinet have a speed of 1.9Mbps • Users above 4.4 km from an exchange or from a non-subsidised cabinet have a speed of what ADSL2+ allows • Users that would get 150 Kbps or less get 150 Kbps

2 WIK Report

2.1 Report

This section aims at addressing the comments detailed in “WIK Report_confidential_Final_2015_08_12.pdf”.

NB: redundant remarks or remarks acknowledging changes in the model are not commented in the present document.

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2.2 Analysis of the comments regarding CAPEX

Industry comment	TERA’s views
§176 The Commission considers the architecture, the nodes and also major engineering principles of Chorus’ existing network: the modelled network does not represent an efficient greenfield deployment.	Not applicable.[5]
§177 to 179 ORC is mis-implemented by the Commission in the network modelling as it is based on inefficient reused assets. In a general manner, modelling is performed by implicitly taking into account asset re-use.	Not applicable.
§181 to 184 For UBA, the Commission applies the existing copper access network architecture instead of a fibre, inconsistently with UCLL fibre topology.	For consistency purposes, infrastructures (cables and trenches) stem from the fibre modelling, in order to take into account specifics features of the fibre access network in terms of infrastructure sharing and backhaul. Only core active assets (switch, DSLAM, etc.) are based on the copper topology.

[5] Where TERA have not been asked to provide additional comment on a matter we have listed it as “Not applicable”.

Industry comment	TERA's views
	Two FTTH configurations are available in the model (and they were available in the draft model): - A FTTH Point to Point configuration, which was already in the model and which has been updated - A FTTH Point to Point with splitters in front of the OLT to limit the number of ports needed. While the first configuration is as expensive as copper UBA, the second is cheaper.
§196 Underground infrastructure sharing is deemed small and overhead lead in infrastructure sharing is deemed inexistent.	Underground infrastructure sharing is in line with benchmarks. Overhead lead in infrastructure sharing is implicitly taken into account in the July draft and final models when assessing the rental cost of a distribution pole: it reflects the amount of poles rented by the HEO to the EDB (on the distribution side), as well as the amount of poles rented by the EDB to the HEO (on the lead in side).
§197 Node location should be optimized as the Commission models the network of a HEO	Not applicable.
§197 Rationale for preferring fibre-based optimization rather than a trench-based optimization is not provided.	See answer to §295-296.
§198 & 199 The actual implementation of network optimization is not consistent with the modified scorched-node approach stated by the Commission.	No change is required. This is a wrong understanding of the approach since road distance is used, not straight line distance
§200 The weights chosen by the Commission for private roads and motorways in order to increase costs of its use compared to public roads are inherently arbitrary.	The weights are used to dis-incentivize the use of private roads and motorways. However, in the modelling, they do not increase costs of infrastructure on such segments: infrastructure unit costs are identical on all types of road (for a given soiltype and geotype), regardless with the private/public/motorway type of road and regardless of the weights used to implement the shortest path algorithm. Private roads and motorways are to be avoided for practical reasons (traffic management, access to infrastructure, fault repairing).

Industry comment	TERA's views
	They are then used either - To access to local users when the last sections are private (most of cases); - To permit significant shortcuts when necessary. Further analysis on the impact of weighting private roads has been conducted and has shown that it was lowest cost to use existing weightings.
§203 & 204 Underground lead ins are excluded from the model as they benefit from capital contribution. At the same time, aerial lead ins are accounted for while they may benefit from the same capital contribution. This remark is repeated in §257-263 and in §387	Not applicable.
§205 The Commission has not considered the subsidies and capital contributions related to the UFB deployment.	Not applicable.
§235 & 236 TERA Consultants has increased the cost of active equipment.	No change was required. Some unit costs of assets, including active equipment, have been updated as indirect costs were omitted, such as installation costs, project management or service company overheads. The two latters differ from opex as they stem solely from network deployment and not from network maintenance.
§243 to 246 TERA Consultants does not provide rationale for the calibration of the benefits of infrastructure sharing with leased lines	TERA has developed a TSLRIC model for a regulation authority in which leased lines are assessed as 4.7% of infrastructures, thanks to a calibration based on a top-down approach. As a consequence, the values used are consistent with practices elsewhere.
§252 Replication of poles on both sides of the street is not justified	No change required. Poles are positioned on both sides of the street when buildings are located on the minor side of the street. In such situation, the rules fixing the crossing of roads by aerial cables apply: poles are duplicated to permit the gathering of lead-in cables, i.e. reducing the number of road crossings, and to ensure the height of cables is compliant.
§253 Lead-in poles shall be shared when buildings are aligned	"Vertical" poles are deployed solely when building is far from the footpath. Optimization of lead in poles has then not been considered, as the benefits would have been very low and partially mitigated by an increased length of cable. .

Industry comment	TERA's views
§254 Electricity poles are used solely on the major side of the street, but not on the opposite side nor for lead in.	Electricity poles are deployed solely on one side of the street. The EDB, however, uses the telecom poles deployed by Chorus on the other side of the street. No change required.
§255-256 Design costs are included in the unit cost of joints and poles without rationale.	All costs incurred by the HEO for the network deployment are to be modelled, including design costs, project management and service company overheads. Such costs differ from OPEX as they are not related to network maintenance and operational expenses but to network deployment. It is to be noted that a full review of service company overheads, design costs, project management costs, etc. has been conducted to make sure there was no double counting or no cost omitted. This was done by asking further questions to Chorus.
§258	After review of lead-in definition and network design rules, cost of laterals needs to be included (see response to Analysys Mason comment).
§260 It is unclear whether lead in cables are charged to the end-user or taken into account in the modelling.	Lead in cables are taken into account in the modelling, up to the ETP.
§262 The Commission does not recognize capital contributions for aerial lead in.	Not applicable.
§263 Accounting of capital contributions can be made either through deduction of capital contributions for eligible lead ins, or through exclusion of recovered costs. WIK considers a more pragmatic approach would be to directly exclude the corresponding cost from the relevant cost base.	The latter approach has been constantly used in the model developed by TERA Consultants in this project. Conceptually, these 2 approaches are equivalent.
§264 When lead in threshold is activated, above-100 m lead ins are excluded from the model and costs go down.	All lead-ins, standard and non-standard, are taken into account in the model. Lead threshold is not activated.
§266.a Service company overheads may imply double counting of costs for CCTs and FATs.	Service company overheads apply to total costs of the service delivered by the service company, inclusive of material *and/or* installation costs. Service company overheads do

Industry comment	TERA's views
	not represent installation costs. As such, there is no double recovery in applying overheads to material and installation costs. It is to be noted that a full review of service company overheads has been conducted to make sure there was no double counting or no cost omitted. This was done by asking further questions to Chorus.
§266.b Distribution point installation costs already include pit digging (when underground).	FAT costs did include pit digging. The model has been updated and they have been removed from underground FAT costs.
§266.c Updated data has not been checked for efficiency	Unit costs have been compared to international models. Refer to section 9 of the Model Specification.
§267 Chorus input data for distribution points was already available in August 2014.	Some documents from Chorus data collection were omitted before the first release of the model. They have been taken into account since.
§268.a Subducts are still encapsulated in ducts	Subducts (ducts within a duct) can be used to aid with the administration, organisation and protection of the cable (e.g., fibre) assets. While FTTH deployments are often made with the use of subducts, this is mainly because several operators deploy cables in the same ducts. For the HEO, this is not necessary. For instance, in France, the access network operator recently allowed alternative operators to deploy fibre in its own ducts without subducts if the cable was alone in a duct. In a report for the UK Ofcom (Operational models for shared duct access, 1 April 2010, Ref: 16873-135a), Analysys Mason states : *"While sub-ducts reduce the absolute capacity of the main duct, it is a useful device for allowing cables to be installed and removed without risking damage to existing cables. The use of sub-ducts may become essential if more than one operator plans to share the same duct, [i.e. subducts are useless when ducts are not shared. In the network modelled, the HEO does not share its ducts with other operators.]*

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	[…] Rigid sub-ducts do not use the space available in ducts very efficiently as they create many stranded pockets of unusable space". Thus, subducts have been removed from the modelling of fibre in the distribution network because in the specific context of the HEO which is using ducts, subducts do not provide any additional benefits. There is not a significant market for duct sharing in New Zealand, the HEO would not require sub-ducts for this purpose. Also a possible benefit of sub-ducting is demand management, whereby an operator can over-provision its ducting infrastructure to facilitate future, planned and unplanned, demand for services. In the TSLRIC modelling, demand is assumed to be both known and constant over time so such planning is not required. Subducts in the core network have however been kept, in order to provide for network robustness: core links feed entire exchange areas, then must be protected.
§268.b Installation of subducts might be already taken into account in the BECA trenching costs.	BECA does not take into account the cost of installing subducts in ducts. It solely takes into account the cost of installing ducts in trenches. In December 2014 draft, subduct installation costs were omitted. For such reason, they have been integrated to the July 2015 draft. As subducts have been removed from the modelling, unit costs of subducts are not relevant anymore.
§268.c Average subduct cost stems from statistics from the Access model.	Whenever the model is updated, all the unit costs deriving from the Access model are updated in the "Input" file. For the purpose of sensitivity analyses, such update is not systematically performed, as some statistics from the Access model do not vary significantly (some by less than 0.1%), hence have infinitesimal impact on UCLL and UBA costs, as compared to the tested change for the sensitivity analysis.
§268.d There are inconsistency between subducts diameters.	In the updated model, subducts are not used anymore in the distribution network. Small subducts are used for the core network.
§269 Multiple sizes of cables for backhaul could lead to more efficient costs.	Considering that this would have a very low impact on costs and that a HEO could see

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	some benefits in having two separate cables (in case one of the two needs to be replaced) and considering it would bring unnecessary complexity to network deployment (and modelling), it has not been implemented.
§270 to 274 Cable costs have largely increased.	It is important to note that installation costs are way less sensitive to cable size than material costs. Indeed, cable diameter of fibre cables is not proportionate to the number of fibres. This is in line with international material + installation unit costs observed in other countries. Installation costs are based on Chorus data. They have been compared with benchmark data and look in line with these benchmarked countries.
§275 Service company overheads may imply double counting of installation costs.	See answer to §266.a, which is also relevant for cables. Service company overheads were omitted in the first draft determination.
§276 In an efficient network, street cabinets shall be located at the border of its access area.	This would not be consistent with the modified scorched node approach. Also, such a situation would lead to some buildings located between the exchange and a cabinet but close to the cabinet to be connected directly to the exchange which is not realistic.
§277 Updated geomarketing database update implied a significant increase in average horizontal length.	There was an issue identified in section 2.4 of the Analysys Mason UCLL and UBA FPP draft determination submission dated 20 February 2015 titled '*The horizontal lengths appear often to be measured in the wrong end of the road segment*'. This was corrected for the July draft which will have resulted in a change in the horizontal lengths. As the entire length of a road segment is trenched when the road segment is on a path to an Exchange the impact is only relevant when the road segment is a terminal road e.g. a cul-de-sac.
§278 Straight roads have been used in exchange area modelling. Such simplifications may reduce efficiency of the modelled network.	This is a wrong understanding of the Voronoi approach we have used. Road distance has been used.
§279 Weights chosen by the Commission for avoiding private roads and motorways are arbitrary.	See answer to §200
§280 Motorways and railway tracks are included in the optimization approached and	See answer to §200

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are covered by rights of way for telecommunication line use.	
§281 Doubling trenches may be a more efficient way to provide network resilience, as compared to trenching reinforcement costs.	Doubling of infrastructures has been implemented, instead of trench reinforcement, as the latter method is not used in New Zealand, according to Downer (see comments to Downer report, 1.e)
§282 Assuring network resilience is even more acute for core cables than for feeder and distribution cables.	Core routes are based on Chorus data (starting and ending points of core links). They are already designed to mitigate risks and provide network resilience. As a result, they are not duplicated on both sides of the road. Plus, cables are protected within subducts, which provides further network resilience.
§283 Taking into account non-linear paths from the road to buildings is not justified	The vertical length represents the length between the building and the projection of the building property onto the road (projection point). As such, it measures a straight line which has not to be confused with the rectangular line from the distribution point to the projection point (1st segment) then from the projection point to the ETP (2nd segment).
§284 to 286 Sharing of underground infrastructures is underestimated.	See answer to §196.
§287 Sharing of aerial is not sufficient	Reuse of electricity poles is implemented in two steps: • Poles are used where available, i.e. in 49% of the country • For such electricity poles, only 10% of costs are incurred, the other 90% being incurred by utility companies. Trenches are used in the remaining 51% for distribution cables. 5% of such trenches benefit from infrastructure sharing. When electricity poles are used, telecommunications poles replicate them in front of distribution points in order to gather lead in cables across the roads. Such telecommunications poles are not shared. They are however less costly than electricity poles.

Industry comment	TERA's views
§292 & 293 Network architecture, as well as opex and common costs still rely on Chorus' actual costs.	Chorus is a wholesale network operator only which is relatively unique in the world (even Openreach is still a subsidiary of BT). This means it has lower economies of scope. As a consequence, it is impossible to assess the efficiency of corporate overhead costs and the best proxy to efficient costs in New Zealand. It is also noted that common costs include some network IT costs and network rates which could in other countries be included in the OPEX or CAPEX. Removing these would bring common costs closer to 10% for example.
§294 Geospatial work lacks of transparency.	Not applicable.
§295 and 296 No supportive analysis is provided to justify the use of fibre-based optimization rather than trench-based optimization.	The Commission has already tested trench-based optimisation against cable-based optimisation. The following conclusions were reached. When fibre-based optimization is used, fibre cable length is by definition optimized: 13.6% less cables are needed than in the trench-based optimization. Plus, fewer joints are used (13.3%) as there are fewer "nodes" in the network: trench-based optimisation involves path sharing, then numerous nodes in the network. As there are fewer intersections in the network as well as fewer fibre cables, there are fewer joints. On the opposite, trenches are very slightly optimised in the trench-based optimization. Indeed, in the modelled network, 87% of network length is in front of buildings: it would have been trenched anyway, regardless of the optimisation method selected. Trench footprint can only be very partially optimised. It results a slight 1% decrease in trench length using the trench-based optimization. At total, as cables and joints' costs are of the same order of magnitude as infrastructures (39% vs. 49%), saving 15% on the first cost category exceeds the 1% extra cost on the second category and justifies the use of a cable-based optimisation. Note that in any case, optimisation is performed at the section level and not a more detailed level (building), hence two buildings on the same section would follow the same

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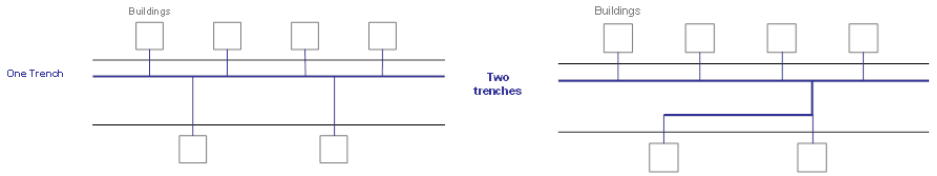
	path to the cabinet/exchange. All in all, using trench-based optimisation, trenching costs are very slightly reduced while fibre-driven costs (cables + joints) largely increase, leading to large increase in UCLL (+ c. NZD1.50): the fibre-based optimization is preferred to the trench-based optimization
§301-303 Efficiency gains by optimization of cabinet locations is ignored.	See answer to §276.
§304 Too many street crossings overestimate cost	Multiple street crossing is preferred to single street crossing when efficient. Selection is performed through comparison of the length of single trench with multiple street crossings and the length of one street crossing and a duplicated trench on the major side. As such, street crossings are already optimized and avoided when inefficient. Had street crossings been costlier than horizontal trenches, street crossings may be avoided through specific weightings in section configuration selection but this is not the case. 
§307 Methodology to determine FWA coverage shall be reviewed	See answer to sub-section 7.1.1.iii. of Analysys Mason report, in section 1.5 of the present report.
§308 FWA sites' capacity is underestimated	See answer to sub-section 7.7 of Analysys Mason report, in section 1.5 of the present report.
§309 Core infrastructures shall be discounted to account for users not using UCLL or UBA.	TERA has adjusted the core infrastructures to account for users not using UCLL. In the second draft determination, DSLAM-FDS links already account for TES and leased lines, according to share of revenues. However, they do not account for UFB customers. It has been adjusted.

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	Plus, FDS dimensioning and costing does not account for those customers. Dimensioning is conducted according to the number of users or volume traffic not using UCLL. Therefore FDS costs will be then allocated to UBA customers on one side and other customers on the other side.
§310 to 312 Location of FDS shall be optimized.	This would not be consistent with the scorched node approach and the scope of the regulated network in New Zealand following separation between Chorus and Telecom.
§321 Use of one lead-in cable per dwelling remains inefficient	No change in the model was required since the cost benefits are not clear. Using shared cables for multi dwellings units would involve additional costs of building distribution frame, which would be in the scope of the modelling, as all costs from distribution to ETP (exclusive of ETP) are to be modelled.
§322 & 323 The model should implement larger cable sizes, in particular 592 fibres.	A 624F cable has been added to the list of eligible assets in the modelled inventory. The unit cost has been provided by Chorus. The cost of 592F cables was unavailable.
§324 & 325 Number and location of street cabinets remain inefficient	Optimisation of cabinets is not always the practice in cost models. The advantage of this is that it enables to reflect local constraints for the installation of cabinets.
§326 & 327 Core network structure remains un-optimised	See answer to §310-312.
§328 Scope of UBA service shall not stop at FDS	See answer to §310-312.
§329 Core cables could be merged without jeopardizing network resilience.	Core routes are designed to provide network resilience. They cannot be merged without jeopardizing network resilience.
§330 Modelled network does not provide resilience for SOHO, SME and large business customers.	No extra resilience was required based on Chorus data.[6]
§331 to 333 Costs of joints are overestimated and have been increased from December 2014 to June 2015.	Design costs were omitted in December 2014 draft determination. Consequently, they were taken into account in June 2015 further draft determination.

[6] See Q 11 Business Customer Resilience

Industry comment	TERA's views
§334 & 335 Submarine and microwave links are based on Chorus actual core network architecture.	See answer to §310-312.
§336 & 337 Equipment choice should be supplier neutral. Chorus may not have a greater market power than other New Zealand operators, thanks to their international footprint.	Not applicable.
§338 & 339 List prices do not reflect volume discounts.	This point has been further verified and it is confirmed that the source prices reflect volume discounts[7]: prices provided by Chorus are average prices in each service company patch. They correspond to the average price incurred by Chorus in the service company area, which reflect volume discounts
§340 to 344 Duct prices are indeed comparable from New Zealand to Denmark (same scope)	Indeed, duct costs in the model developed by TERA Consultants exclude installation costs (transferred into trenching costs). As such, comparison with Denmark does hold.
§345 & 346 TERA Consultants may have used installation rates rather than material rates. Plus, TERA Consultants may have double counted the material costs of ducts.	TERA Consultants has used the material rates provided by Beca, namely the "discounted supply rates". Beca has provided separately installation rates. At total, duct costs inclusive of installation would be the sum of supply rate plus installation rate, i.e. NZD 22 and NZD 30. There is no double counting of material costs. Duct material costs are excluded from trenching costs. This is performed by removing duct material costs from Beca model *before* exporting the results of Beca model to the TERA model which computes the MDF-specific trenching costs.
§347 & 348 FWA site costs too high.	FWA site costs are based on Vodafone's data collection.
§351 Discrepancies of demand figures remain.	Different data sources are used in different part of the model. For instance, the demand used in the OPEX model is in line with the OPEX accounts

[7] See Q 22 Volume Discounts

Industry comment	TERA's views
	and is used to infer an average OPEX per line. It does not necessarily align with other demands since in the OPEX model the demand must be consistent with Chorus demand and not necessarily the HEO demand.
§352 to 355 Dimensioning the network for more than 100% of demand remains an error.	Not applicable.
§361 to 363 The choice of MEAs for UBA and for UCLL is inconsistent and might be inefficient.	Not applicable.
§364 FWA in the context of copper shall be considered.	Not applicable.
§365 to 367 Cost adjustment has to be conducted at the exchange level.	Not applicable.
§368 & 369 The model mostly relies of data provided by Chorus.	Not applicable.
§370 BECA's approach to determine trenching costs cannot be verified, in particular traffic management costs.	See BECA report
§371 Mini and micro trenching shall be considered.	See BECA report
§372 & 373 Difference of copper connections of the model and Chorus numbers remains unexplained.	Not applicable.
§379 to 381 Overlapping of non-TSO and FWA coverage area remains	This stems from edge effects at the TSO boundary, which is partly compensated by opposite cases of TSO buildings allocated to the non-TSO (then excluded from FWA coverage). Sections crossing the TSO boundary have been split into two to avoid such effect.
§382 WACC not consistently applied to poles.	See answer to section 3.7 from Analysys Mason (section 1.2 of the present report). We agree and the model has been updated.
§383 to 385 SLU rural price results negative	SLU results are based on SLUBH and UCLL. As UCLL and SLUBH stem from independent calculations (the first deriving from the fibre network, the second from the

Industry comment	TERA's views
	copper network), it may lead to negative results for SLU, which is defined as UCLL price minus SLUBH price. It is to be noted that this is not the case anymore in the final version.
§387 Incorrect treatment of lead-in contributions	See answer to §203-205
§388 & 389 Inconsistencies between various modules of the model. For instance, the numbers of address points, buildings, connections in the Opex model and connections in the UBA model are not consistent.	There are about 10% more address points than buildings: indeed, some buildings contain more than one address point (multi dwelling units). The demand differs from the number of lines passed as only a subset of lines are deemed active. Finally, the number of connections used in the Opex model is not line with the number of connections used in UBA model, as the HFC demand has not been accounted when updating the Opex model. Indeed, the Opex model is based on the sole Chorus demand, such as Chorus top-down opex are in line with the number of lines.
§390 & 391 The treatment of duct costs seems inconsistent.	See answers to §340-346
6.1.1 Cost differentiation between different UBA variants TERA should attribute costs based on traffic	As this information is not available from Chorus (throughput for each variant), this cannot be implemented.
6.1.2 Geographic variation of UBA costs Generate outputs on urban and non-urban UBA TSLRIC values	This could be possible but the benefits are not clear since urban UBA and non urban UBA are useless
4.2/6.2 MEA for UBA Use FTTH instead of Copper as MEA	Not applicable.
6.2 For UBA the Commission applies a copper MEA with a quite different access network topology, using different trenches, using street cabinets as scorched nodes and terminating the network in 92 FDS locations instead of 790 MDF locations like in the FTTH UCLL approach. 7.3.1.12 Core network structure remains un-optimised Scorched nodes approach should not be followed	Not applicable.

Industry comment	TERA's views
6.3 Network optimisation (See 7.3.1.7.) Do not use a scorched Nodes approach for the FDS	
6.2 UBA based on FTTH (option 1) vs UBA based on copper (option 2)	There are much less active equipment required in Option 1 (FTTH), mainly due to the fact that Cabinets are no longer required (less equipment and no cabinet backhaul). However it should be noted that service cards are much more expensive (a single FTTH card port costs [ ]**CNZCI**x a xDSL card port) and SFPs required to provide a FTTH connection are very expensive and represent about 27% of the UBA increment costs (around [ ]**CNZCI**NZD per unit[8]). It results that the two options are equivalent in terms of costs. However, adding splitters to save costs reduces significantly the cost of UBA
6.4 Network dimensioning For UBA the model at least miss smaller (and more efficient) DSLAM sizes (and cost) for the large number of small cabinets, and we miss larger FDS in the larger switching locations. For more details see Sections 7.2.3 and 7.3.1.8 below.	The models of DSLAMs used in the modelling are consistent with the models installed by Chorus for its network. Most of costs at cabinet are related to installation costs, and therefore do not vary with the size of the DSLAM itself. FDS sizes used are consistent with Chorus implementation. Using larger FDS would impact only 7 sites where 2 or 3 FDS can be installed (8 additional switches are installed). TERA considers that is not necessary to introduce another model of switch.
6.5 Exclusion of certain capital costs More elements should be removed by the RBI contribution	Not applicable.
7.2.1 Regarding the "service company management overhead fee" We have recognised in our February Submission that overheads on Chorus' maintenance contracts are not justified because they represent double-counting	The Service company management overhead fees have been confirmed by Chorus as an external cost accounted as CAPEX, and should therefore be taken into account in the modelling.

[8] See Chorus response to 29 May 2015 s98 Notice date 3 June 2015 CONFIDENTIAL ...

Industry comment	TERA's views
with OPEX.110 These arguments are also relevant in the present context of overheads on installation contracts.	
7.2.1 Increase of cabinets costs	For consistency purposes, costs of active cabinets have split into passive parts (aligned with passive cabinet costs), accounted in UCLL, and active parts, accounted in UBA. As a consequence, costs of rack cabinet have a larger scope in July 2015 than in December 2014, then significantly higher prices. Such toggle has no impact on total costs, i.e. UBA (zero-sum game), but in the relative costs of UCLL and incremental UBA. Plus, there is no double counting of active parts: the price of an active cabinet, as compared to a passive cabinet, includes solely additional costs related to electricity supply and no active assets (based on s98 question 3.7). Those electricity supply costs are transferred from the UCLL model to the UBA model.
7.2.3 New FDS dimensioning not efficient	The new FDS dimensioning considers that if several switches are required at a same location, they should be all linked in a local ring topology with a 10G port in order to ensure a RSP could interconnect locally to only one switch. In order to minimize the risk in case of failure, all switches are interconnected to the REN. The costs driven by the REN interconnection are not included in the UBA cost.
7.3.1.8 Switch parameters of the model still outdated WIK stated examples for more cost efficient switch equipment configurations and described these in detail in para. 369-373 of its February Submission	TERA has adjusted the model: TERA added the IOM cards to the switch configuration and take into account the two ports of each IOM card.

2.3 Analysis of the comments regarding OPEX

Industry comment	TERA's views
§236 – Overheads on Chorus maintenance contracts are not justified as they represent a double counting with OPEX.	As stated in its previous consultation comments, TERA Consultants remains of the view that Chorus use of service companies does not necessarily imply inefficiencies: • Chorus has selected service companies on the basis of a competitive process; • LFCs are doing the same and also make use of service companies. • This is a common process for many incumbents. For the avoidance of doubts, service companies' overheads represent an allowance for service companies' internal management costs and do not represent the cost of Chorus staff. As a consequence, this does not create double counting. As regards non-recurring charges, service companies' overheads are accounted for in category [ ]**CNZCI** of the "provisioning allocation" sheet and excluded from the OPEX calculations so no double counting occurs. Chorus has provided further explanation on the mapping of Service companies costs within the accounts. This confirms that these represent no double counting with OPEX (cf. Table 1). **As a consequence, no change is required.**
§248-251 – Change of OPEX efficiency adjustment not appropriate: - The Commission has scaled down efficiency adjustments for UCLL OPEX - Cost of share OPEX (10.9%) exceeds benchmark from other juridictions - Not applying the fibre and the copper adjustments together tends to mimic the costs of an old fibre network. - Adjusting OPEX of a fibre network with an adjustment factor derived from a copper network environment does not make sense - previous approach should be kept - Reduction of fibre adjustment is not justified: A new Verizon study shows a 60% saving. So 50% is more relevant than 40%	TERA Consultants does not support the benchmark comparisons performed by WIK for the following reasons: • The limit between what is accounted for in the CAPEX and the OPEX from a regulatory model to another can vary from a country to another. As a consequence, it is more relevant to compare the total costs; • Chorus, and the HEO, is an almost unique case of a pure wholesale player: as a consequence, it has a very different economy of scale structure as compared to benchmarked examples. As regards, what the new adjustment approach tends to mimic, TERA Consultants

	disagrees with WIK's conclusion that not applying the fibre and the copper adjustments together tends to mimic the costs of an old fibre network. The studies used to derive the 40% adjustment factor tend to compare the likely savings of an operator moving from its existing (old) copper network to a new fibre network. As a consequence, TERA Consultants remains of the view that the implemented approach is suitable and is more robust than the 2-step approach implemented in the previous version of the model (old copper to new copper adjustment and then new copper to new fibre adjustment). WIK then states that the 40% fibre adjustment is understated and provides a new Verizon study that seems to support the 50% adjustment. It is to be noted that the current benchmark already includes Verizon figures[9] supporting 50% savings. As a consequence, TERA Consultants considers the new study should be seen as an update not as an additional source and this would lead to no change on the assumption. **As a consequence, no change is required.**
§288-291 – No efficiency consideration conducted for non –network costs: - No efficiency checks have been performed for non-network costs - In December models level of common costs were above those observed in other juridictions - These have increased again by 78.8%, the increase being due to UCLL. UCLL common costs are 22.5% whereas figure from other juridictions are below 10% - there are no justification except inefficiency - Common costs allocated to UCLL have more than doubled with no reason being provided	TERA Consultants disagrees with WIK's statement that change to common costs calculations have not been documented as an exhaustive track change document has been provided along with the precise locations of these changes in the model. According to TERA Consultants' experience in similar modelling projects, this is in line with best practices. In particular, this documents lists the following changes impacting commons costs calculations: • Change the model to allocate non-network expenses based on both annualised CAPEX and OPEX already allocated; • IT systems for which no allocation key could be derived are treated as non-network cost.

9 AGCOM (Italian NRA), Challenges in moving towards the Next Generation of Fixed and Mobile Networks, January 2010

In a presentation on next generation networks, the Italian NRA AGCOM compares copper and fibre networks and states that the fibre opex saving as compared to copper is circa 50%: *"NTT / Verizon: 40-60% Opex decrease with FTTH networks w.r.t. copper local loop"*

	As regards the level of common costs and room for efficiency adjustments, please refer to comment related to WIK's §358-360. **As a consequence, no change is required.**
§297-300 – Overall OPEX approach still flawed: - The Commission has started from Chorus accounts and made limited adjustments - This is not appropriate and leads to higher costs	TERA Consultants does not supports WIK's analysis and remains of the view that Chorus accounts are the best available starting point representative of a nationwide deployment in NZ (rather than benchmark inputs for example). However, to make sure that the costs modelled are representative of a recently built efficient network, efficiency adjustments have been performed when robust evidence was available (e.g. access network maintenance OPEX based on the LFI). **As a consequence, no change is required.**
§356-357 – Problem of double recovery of costs remain unsolved: - TERA did not demonstrate how they separate costs related to UBA/UCLL from costs related to transaction services.	"Maintenance costs are allocated to network elements in "maint alloc" sheet and then allocated to services that make use of these network elements. Costs that are corresponding to non-recurring charges are considered apart (sheet "provisioning allocation" and are not captured in the rental charge calculation. As a consequence, the risk of double recovery is very limited. **As a consequence, no change is required.**
§358-360 – No efficiency considerations conducted for non-network costs: - TERA's approach does not deal with non-network costs efficiency so the approach is not robust	TERA Consultants confirms that no efficiency adjustments have been performed on non-network costs. TERA Consultants considers that benchmarking is probably the only approach to challenge Chorus overheads and is likely to have drawbacks in this case: • The limit between what is accounted for in the corporate overheads and in the OPEX from a regulatory model to another can vary from a country to another (e.g. in pay costs Sales and Marketing, Customer Services, Core platforms, Core network technicians). As a consequence, it is more relevant to compare the total costs; • A number of costs within the "Other costs" category would not be considered "non-network costs" in other models (GL codes [ ]**CNZCI** [ ]**CNZCI**, GL codes

	[ ]**CNZCI** relate to Network costs and [ ]**CNZCI** Regulatory Levies). • Chorus is an almost unique case of a pure wholesale player: as a consequence, it has a very different economy of scale structure as compared to benchmarked examples. Despite being provided with the same s98 raw material made available to TERA Consultants and the Commission, it should be underlined that no consulting firm responding to this consultation has provided supporting evidence that efficiency adjustments should be performed for non-network costs. Finally, after having removed costs that would not necessarily fall within the common costs category in some other countries (e.g. network IT costs for example for which an allocation based on service usage was not manageable have been categorised as common costs in order to be allocated with the EPMU approach), the ratio of common costs falls close to 10% which does not seem to be very different from what could be observed elsewhere. **As a consequence, no change is required.**
§374-378 – Efficiency improvements for OPEX over time still ignored: - Labour related OPEX evolves with LCI, an efficiency adjustment (no less than 5% based on benchmark) should be taken into account - Major Telecommunications companies are running productivity improvements programs: this should lead to efficiency gains	For the avoidance of doubts, it is to be underlined that the LCI index used in the Labour OPEX trends calculation already accounts for some long term productivity gains (due to labour quality changes) for the whole New Zealand economy. Additional adjustment to LCI trend growth should be considered, when calculating OPEX costs, if there is good evidence that providers of UCLL and UBA services achieve productivity gains which are larger than those achieved across the entire economy, on average. In order to assess the relevance of these higher productivity gains of UCLL and UBA service providers, the Commerce Commission has requested expert view of NZ-based economic research firm NZIER. On that matter, their report concludes that *"there is not a statistically significant difference between productivity growth in the Information Media*

	and Telecommunications industry and other industries". TERA Consultants also notes that respondents to the public consultation have provided no NZ-based supporting evidence on the relevance of additional productivity gains for NZ UCLL and UBA service providers. Responses only quote the outputs of regulatory decisions from other jurisdictions. In that sense, it should also be noted that the question of productivity adjustment also raises questions of regulatory incentives. These decisions have been taken in the context of their own national market and may not be relevant for the case of New Zealand. As regards the reference to benchmark figures made by WIK, TERA Consultants does not share the view that efficiency adjustments should not be below 5%. As examples, the Danish model and the Irish models recently developed by TERA have 2% and 0% efficiency factors respectively. **As a consequence, no change is required.**

Table 1 - Service companies' costs mapping

Service company cost category	Comments
[	Disregarded in the OPEX calculations (see sheet "Provisioning allocation" where costs related to NRC are considered as "not relevant")

]CNZCI	
[ ]CNZCI	Recorded in sheet “other costs” (lines 15 to 23). In this sheet, costs are allocated either to maintenance (and considered as relevant) or to provisioning (and disregarded from the OPEX calculation)
[ ]CNZCI	These costs are disregarded from the OPEX calculation in the sheet “Maint allocation” (lines 331 and following) as related to customers’ networks.
[	These are proactive and reactive maintenance costs and are then relevant for the OPEX calculation except for non-relevant network parts such as fibre (see the sheet “Maint allocation” lines 12 and following).

]CNZCI	
[ ]CNZCI	These are recorded in the "Other costs" sheet (lines 34 to 43) and are relevant to the OPEX calculations (maintenance and co-location costs). It is to be noted that capitalised costs are subtracted to avoid double counting with the CAPEX model.
[ ]CNZCI	These are Power maintenance costs recorded in the sheet "Maint allocation" lines 84 and following. These are relevant for the calculation of power costs.

Source: TERA Consultants' analysis of "Q 29 Mapping of GL codes to service company cost"

2.4 Analysis of the comments regarding NRC

Industry comment	TERA's views
§79 The Commission has not made clear what the obstacles have been preventing the development and application of a first best bottom up costing model approach.	This was explained in the consultation paper: the implementation of a bottom up approach "*requires a large amount of data regarding the non-recurring activities process (times, materials, detailed process): Chorus is not in a position to provide such detailed inputs as most transaction charges activities are outsourced from service companies. Chorus has indeed no access to the service companies times and materials inputs. As a consequence, such an approach cannot be implemented in the New Zealand context*."
§81 the top-down approach implies an assumption that transaction processes are structured efficiently and represent efficient costs	It is a top down approach as it relies on Chorus real cost structure. Yet, it is the purpose of the task time adjustment per service code to ensure that the process which lead to the costs are efficiently structures, as most efficient benchmarked times are adopted for each service code.
§82 the Commission's approach for service transaction charges provides incentives for Chorus to improve efficiency over time, but does not ensure that access seekers will share such efficiency improvement benefits: Chorus is entitled to keep all such future benefits itself.	The present work aims at setting prices for a given period (5 years), after which another analysis should be carried out to assess new tariffs, in order to ensure that Chorus will not keep all the benefits of its efficiency improvements. Many regulatory authorities in the world are following this approach when setting regulated prices.
§171 (1) Develop an efficiency adjustment approach which would not limit the scope of efficiency adjustments to significantly less than 50% of the service transaction cost. 100% of the relevant cost base should be subject to efficiency adjustments.	No change required. It is considered that efficiency of the other components of the service transaction costs is achieved through the tender process, as explained in the consultation: *"This focus on times relies on the following reasoning: the tender process ensures that Chorus benefits from a reasonably competitive price for each CSA zone. It is to be noted that LFC select the same service companies as Chorus, which further supports the assumption that service companies are competitive. However, those tasks may not always correspond to the most efficient process today: indeed, the content of the service codes which service companies are required to carry out may include some inefficient process. Therefore, assessing the time spent to complete those tasks, through an international indexation, safeguards against inefficient/redundant tasks being asked of by Chorus to service companies, and then charged to alternative operators."* In any case, the efficiency of such components cannot be assessed through an international benchmark as those costs are specific to New Zealand.

§171 (2) include in the international benchmark for efficiency adjustments only countries which have a similar or roughly similar level of labour productivity and labour costs compared to New Zealand.	The model has been updated to incorporate this view. The international indexation includes countries which provide public data regarding time required to complete similar tasks. Such countries were chosen on the basis of data availability. The internal indexation aims at retaining the lowest time achieved in any country for each task. No average/median calculation is considered. In this view all countries are relevant for the analysis. However, adjustments have been made to capture the level of experience of staff, as explained in comment 6.2 (i) of the NRC section of Analysys Mason comments.
§171 (3) update its "old" benchmark figures to make them more reflective to efficiency gains in the benchmark countries. The "raw" benchmark figures should for that purpose be indexed with an annual productivity factor of 5% p.a.	The -5% price trend proposed is based on LLU efficiency adjustments that have been applied in international models. While these are useful as a guide, the purpose is not to incentivise efficiency gains via price trends specifically but rather via the TSLIRIC methodology more generally.
§171 (4) make more efforts to avoid using inflated benchmark numbers by excluding (a) transport times and (b) administrative times from the relevant processing time.	No change was required. Regarding transport times, only two countries provided data with transport included: Country A and Romania. Country A will be excluded from the benchmark, and Romania is never selected. Therefore, transport is not an issue. Regarding administrative costs, it is considered that there is remote work done by whether the Service company or Chorus (i.e. work that is not done directly by technician on field) that is not covered by overheads. This is what is covered by "administrative times", and has therefore been included.
§171 (5) withdraw its national cross-checking approach based on fibre connection costs totally because they are not comparable to copper connection costs.	Following cross submissions, it is considered that the comparison between fibre and copper non-recurring costs is not relevant for the various reasons mentioned by the respondents. It is decided to discard the LFC analysis.
§171 (6) if does not follow this more far reaching approach, definitively apply the national cross-checking approach symmetrically. Also in case where it would lead to lower costs it should be applied and not only in case where it would lead to higher prices.	Following cross submissions, it is considered that the comparison between fiber and copper non-recurring costs is not relevant for the various reasons mentioned by the respondents. It is decided to discard the LFC analysis.
§171 (7) apply a bulk discount scheme which is more cost reflective and not only be defined by a particular threshold.	Not applicable.
§171 (8) apply bulk discounts to the UBA-related service transaction charges.	Not applicable.

§171 (9) limit the scope of POA based pricing to the absolute necessary minimum. The services 1.48 and 1.50 should not be priced according to POA.	Services 1.48 and 1.50 have not been assessed, as no sufficient information was provided by Chorus. They are still POA.
§171 (10) extend the scope of price determination to include the services "10 GigE handover installation", "network investigation" and "capacity where customers re-connect to the network".	Not applicable.
§171 (11) "clean" the use of service codes in its mapping approach such that cost and work elements which do not belong to the regulated transaction services are excluded from the relevant cost base.	No change required. In practice, one transaction service can call various company codes, depending on the situation. The mapping provided by Chorus simplifies the complexity of switching from a "transaction charges" view to a "service company codes" view, by providing the most relevant service company code for each service transaction. It is clear that in some cases, the service company code contains some tasks that are not in the scope of the transaction charges, but in other cases, a given transaction charges also calls some service company codes that were not considered into the cost estimation. This approach is recommended by Chorus, as explained in the document "response to CC questions 10 march 2014": [***]CNZCI*** Therefore, the current approach constitutes an average estimate of the cost really incurred by Chorus when providing a non-recurring service.
§171 (12) not accept the direct cost of service companies as given. It should in particular check the appropriateness of the cost allocation within the multi-product relationship between Chorus and the service companies. There is an incentive on Chorus' side to distort these allocations at the expense of transaction charges.	The direct cost of service company is not accepted as given: it is broken down into 7 components, from which one component is assessed for efficiency: time required to complete tasks. It is considered that all the other components (labour cost, material, transport, vehicle costs, etc.) are more objective. Therefore, it is likely that potential distortion, if any, would occur on the "time" component. The current approach, which consists in benchmarking the times, therefore minimizes the risk of cross subsidization mentioned.
§171 (13) revise the service company overhead mark-up because it is generally too high and leads in some cases to a double-recovery of costs.	Service company mark-up has been double checked and is considered to be consistent.

§171 (14) correct Chorus' overheads for efficiency and automation savings.	The approach adopted implicitly adjusts Overheads for efficiency, as we consider a fixed mark up on direct costs, which are themselves adjusted. Therefore, absolute amount of overheads is reduced in proportion.
§171 (15) foresee efficiency improvements in the provision of transaction services within the regulatory period. This could be conducted by implementing a productivity improvement factor as a price path of -3% to -5% p.a. from the calculated cost of the base year.	Application of an efficiency trend is dealt in the focus below.

2.5 Analysis of the comments regarding international comparators

Industry comment	TERA's views
WIK explains that putting TERA's metrics for New Zealand versus Sweden within the Swedish model shows that New Zealand costs should be much lower than 38 NZD	TERA would like to note that the whole reasoning is based on a wrong assumption of a total investment of 40.5 billion SEK. As specified by WIK, this figure has been extracted from the consolidated Swedish model AFTER removing some "expensed" costs (i.e. costs recovered by one-off fee that are not recovered by the line rental). However in Sweden most of the final-drop costs are considered as "expensed", where TERA in its benchmark specified that the benchmark should consider the "*same scope of costs (from exchanges to premises, excluding external termination point, but including final drop)*". TERA could not reproduce exactly the 40.5 billion SEK figure, however the sum (C_Cost_Category!M10:125 + V10:125) excluding the "expensed" costs at a level of 40.0 billion SEK seems to be a good proxy. The correct figure would be the sum including the "expensed" costs except NTP specific costs, that is to say 67.2 billion SEK. Taking these additional costs into account (but excluding NTP costs) raises the total investment to 66.2 billion SEK.

	By applying a cross-multiplication, 23.09 x 67.2 / 40.0 = 38.79 NZD, which is quite comparable to 38.13 NZD given by the Commission's model. Some OPEX or common costs may not be proportional to CAPEX, therefore applying the cross-multiplication to CAPEX only would lead to 16.09 x 67.2 / 40.0 = 27.03 annual CAPEX. WIK accounted for 7.0 NZD of OPEX + common costs, which leads to 34.03 NZD. The result of the adjustment of the Swedish cost model to New Zealand would therefore stand between 34.03 NZD and 38.79 NZD and would therefore be comparable to the result issued from the Commission's modeling. Analysys Mason has observed the same issue in their cross submission.

3 Network strategies reports

3.1 Report

This section aims at addressing the comments detailed in “Network Strategies revised draft determination report 13 August 2015 – C….pdf”

3.1 Analysis of the comments regarding CAPEX (including FWA modelling and TSO boundary)

Industry comment	TERA’s views
2.1, p. 16: NS notes that the addition of FWA, FTTH and non TSO end users represents only 99.5% of the total of 1 994 654 end users assumed in the model.	The difference between the total number of lines and the sum of TSO FTTH, non TSO FTTH and FWA lines stems from the few post-2001 lines that are located in FWA coverage areas (which are based on pre-2001 lines). For consistency purposes (in particular, the calculation of opex), the total number of lines is used in the UBA model, inclusive of the aforementioned lines.
2.1, p. 16: NS considers TERA has underestimated the number of low capacity users.	The number of low capacity users is driven by the choice of customers that should be covered by FWA which is the choice of the Commission.
2.3.1, p. 21: NS considers TERA applies the FWA cost scaling inconsistently	FWA costs are no longer stemming from an extrapolation in the base case (See answers to AM comments on FWA). In the alternative FWA scenarios, FWA costs are extrapolated on a national level (i.e. not MDF per MDF) which ensures that extrapolation is made efficiently. Therefore, no change required.
2.3.1 p. 22 The current calculations in the model appear to focus on demand and cost in each MDF. This means FWA analysis and base station signals are being restricted to MDF or ESA boundaries.	Breaking down costs into MDF areas does not mean signals are being restricted to MDF boundaries. FWA network is dimensioned independently from MDF boundaries. Network Strategies comment is not correct. The model provides costs at MDF level. For consistency purposes, FWA costs are allocated to MDF areas. It permits a better assessment of urban and rural costs.

Industry comment	TERA's views
2.3.1 p.22 The Commission states that it has used the conservative coverage area of RBI sites designed for 3G technology in 900MHz to mitigate topology and other factors. However Vodafone's RBI sites were not designed for maximum theoretical coverage and already take topology and other factors into account	TERA uses the coverage areas provided by Vodafone, in order to infer which premises shall be covered by FWA. In this coverage provided by Vodafone, topology and other factors are already taken into account.
2.3.2 p.24 It would be illogical for the HEO to serve only 40 833 users, with its decision based on distance from the node rather than economic costs.	TERA has tested multiple scenarios for FWA coverage: - FWA coverage based on RBI sites and sites are filled with customers until the capacity is reached - FWA coverage based on RBI sites extrapolated to other areas unlikely to be unbundled by keeping the same proportion of the population covered by FWA. - FWA coverage fully based on areas unlikely to be unbundled. Only the first scenario costs less compared to full fibre. Due to the aforementioned optimization, FWA coverage has been set to 26k lines.
2.3.2 p. 24 to 26 Examples show that the RBI sites in the model are only serving a reduced number of the users which are located more than 5.3km away from the exchange. It can be seen that some fibre-served buildings are in the midst of FWA-served buildings – this cannot represent efficient deployment by the HEO	Exhibit 2.2 and 2.3 exposed by NS misrepresent the distance criteria established by the Commission: • The 5.3 km distance represent the distance to the last active node, i.e. the exchange or the active cabinet (about 700 exchanges, about 5000 active cabinets) • The distance is measured according to the road network and not according to crow-fly distance. Because of this, it can appear that buildings are served by fibre in the midst of FWA-served buildings when the first buildings have been built after 2001 while the latter existed before 2001.
2.3.3 p.26 to 30 Of the 40k buildings which are served by FWA, 34k are located within a radius of 5.3km from the closest cabinet.	As mentioned previously, the 5.3 km criterion applies to the road network, not to the crow-fly distance. Secondly, the criterion applies to the distance to the first active node. About half of cabinets do not have fibre (passive cabinets) and are then not taken into account for the purpose of the application of the criterion: the distance considered is then the distance from the

Industry comment	TERA's views
	building to the exchange. In the updated model, sections have been split into two when crossing the TSO boundary, in order to avoid any edge effect when assessing which lines are to be covered by FWA. **Finally, those criterions are no longer in use (see answers to AM comments on FWA)**
2.3.3 p. 30 to 32 When analysing the location of premises which are served by fibre, we can find examples of buildings located further than 5.3 km from the closest node.	The distance criteria was not the sole criteria for selecting FWA technology, as explained in the July documentation. Three other criteria may apply to select the fibre technology while a building is located further than 5.3 km • The building is outside the TSO; • The building belongs to a section where all buildings have been built after 2001 • The section in which the building is located taken by a core or backhaul cable – in such case, the section is already trenched and fibered and the incremental cost to fiber the buildings is economic.
2.3.4 UCLL rural results are based on SLUBH and lead to negative results for SLU	UCLL results are not based on SLUBH. SLU results are based on SLUBH and UCLL. As UCLL and SLUBH stem from independent calculations (the first deriving from the fibre network, the second from the copper network), it might lead to negative results for SLU, which is defined as UCLL minus SLUBH. In the updated scenario, SLU price is positive in non-urban areas. It is important to note that SLUBH infers UCLL results solely in the technology selection: "Fibre access network" (fibre is compared to copper access network + backhaul. When backhaul costs decrease, spread between fibre and copper decrease). Had copper have been cheaper than fibre, SLU would have been always positive, as UCLL and SLUBH would have stem from the same calculation. As mentioned previously, this issue is no longer present in the final model, the rural SLU price is positive.

Industry comment	TERA's views
2.3.4 Vodafone does use microwave links while the modelled network do not takes into account microwave links.	The modelled network does not take into account microwave sites even for FWA. This is because the fibre backhaul used to connect FWA sites is also used to connect customers with FTTH. Also, according to Vodafone information, microwave backhaul is mainly relevant and cheaper when the distance to the site is greater than 3 or 4 km. In the modelled FWA scenario, FWA is deployed in exchange unlikely to be unbundled but only in areas covered by RBI. As a consequence, there is generally a significant amount of FTTH in the exchange and therefore FWA sites are close to a fibre point of presence. All core and backhaul links are either fibre, DWDM or submarine. None is microwave.
2.4 Network Strategies' FWA approach should be used	We disagree. See answer to comment 7.11 from Analysys Mason

3.1 The new approach has been implemented by modifying queries related to distribution and feeder inputs in the Access model but no details were provided about the changes made, or which network components were dimensioned in non-TSO areas	• Inside the TSO: dimensioning is based on the whole network
	  ○ Queries "Select distribution inputs per section - National" and similar (per street cab, feeder inputs, fibre inputs, etc.) are based on the national demand
	• Outside the TSO: dimensioning is based only on the TSO demand.
	  ○ Queries "Select distribution inputs per section - TSO" are based on the TSO demand.
	  ○ Outside the TSO, most of the time the TSO demand is null (Non-TSO are usually the most remote areas, *without any rear area*).
	• The two sets of inputs are combined thanks to the query "Select distribution inputs" and similar
	  ○ If the section is in the TSO, the result of "… - National" is selected, otherwise the result of "… - TSO is selected
	  ○ It serves as a basis for the dimensioning of **all network access assets**(cables, joints, trenches, poles, ducts, manholes) at feeder, distribution and lead in levels.
	• Lead in is not rolled out for buildings outside the TSO. Most of lead in assets are modelled separately, thanks to the routine "Dimensioning at the building level". Non-TSO buildings are not copied into "PROCESS BUILDING MODELLING", on which "Dimensioning at the building level" is applied;

Industry comment	TERA's views
3.2 Some non-TSO buildings are served by FWA	Sections crossing the TSO boundary have been split into two to avoid such effect.
5.1 p. 65 The percentage of aerial lead-ins, based on EDB data, is incorrect in the revised determination.	Not applicable.
5.1 p. 65 The EDB's percentage of distribution cables is assumed lower in this determination without further explanation.	Not applicable.
5.1 p. 66-68 The Commission does not provide sufficient rationale when assessing the cost of consents. Proposed amendments in NESTF would speed up the availability of the new and better communications technologies, hence reduce consenting costs. Plus, le lease cost can be estimated through the difference between the distribution and lead-in cables and the only lead-in cables ($22 difference, as compared to $25 consenting and management cost).	Not applicable.
5.1 p. 68 The replacement of electricity poles estimated to be incapable of carrying the HEO's distribution cables is overestimated, as • Data from LFC is ignored: • Chorus data regarding EDB poles lacks of transparency;	Not applicable.

3.2 Analysis of the comments regarding Price Trends

Industry comment	TERA's views
§6.1 – Methodology NS supports NZIER's methodological choices	Comment noted

	No change needed.
§6.2 - Consumer price index NS supports NZIER's approach	Comment noted **No change needed.**
§6.3 - Trenching price trend - Long term trend will take little account of recent technological developments in the telecommunications sector which seek to reduce construction costs. - Long-term price trend estimated for the heavy and civil engineering sector is likely to over-state the trend for trenching costs	TERA Consultants does not share Network Strategies views that price trends calculations should be based on a short period of time to be representative of the latest technological evolutions. TERA Consultants supports the use of long term price trends that would not be affected by "technological revolutions" to a large extent as the trend observed during this period is unlikely to be sustained in the long run. As a consequence, NZIER approach based on "A Statistics New Zealand Producer Price Index for Civil Construction sector outputs" appears more relevant. Based on the new elements provided during this consultation process, NZIER has recommended not to change the figure. **No change required**
§6.4 - Fibre optic cable price trend - NS do not understand why NZIER claims that data from 2003 was used, yet its recommended value was based on the period 2006 to 2014. NS states that no reason was given for omitting the data from 2003 to 2005. If the period 2003 to 2014 is used, NS estimate the average annual growth rate to be -3.0%. - NS recommends that the price trend for fibre optic cable should be -3.0%, based on US data for the period 2003 to 2014	Based on the new elements provided during this consultation process, NZIER has recommended not changing the figure from -1.3%. **No change proposed.**
§6.5 - Implementation of price trends Price trends used in the models for Copper cables, Fibre cables, Ducts, Trenches, Building/land are not those advised by NZIER.	**Copper cables:** NZIER inputs are use as the starting point for the escalation approach as cost of copper cables are not only driven by the copper index but also by the cost of the plastic coating (the CPI is used) and labour (the LCI is used). Copper cables trend (2.61%) is composed of: • 35% CPI (2.0% as provided by NZIER)

	• 45% LCI (2.0% as provided by NZIER) • 20% copper index (5.0% as provided by NZIER) **Fibre cables:** NZIER inputs are use as the starting point for the escalation approach as cost of fibre cables is not only driven by the fibre cables material index but also by labour (the LCI is used). Fibre cables trend (-0.30%) is composed of: • 30% LCI (2.0% as provided by NZIER) • 70% fibre cables material index (-1.3% as provided by NZIER) **Trenches** Trenches price trends inputs have been provided by NZIER. **Building/Land** The "default approach" (using CPI: +2.0%) was used so far in the price trends model for the "Building/Land" category. This default approach is supposed to be used when no asset category specific index is available. **TERA Consultants agrees with Network Strategies that the use of NZIER input based on a Statistics New Zealand Capital Goods Price Index for non-residential buildings (+1.9%) is more relevant as it is specific to the Building/Land asset category.**

3.3 Analysis of the comments regarding the demand

Industry comment	TERA's views
4.1 Vacant and double connections shall be accounted	Agreed. Vacant lines have been removed from the network footprint.

Industry comment	TERA's views
4.2 Demand growth shall be accounted (number of lines)	Not applicable.
4.2 Demand growth shall be accounted (throughput)	Cloud services and streaming increase significantly the throughput demand. However, such increase does not involve an increase in the number of lines: a stable number of lines has been observed in New Zealand in the last ten years. Plus, internet of things should not add lines but use existing lines or ultra-narrow band mobile networks.

3.4 Analysis of the comments regarding international comparators

Industry comment	TERA's views
10.1 p. 106 Labour costs in New Zealand should be lower than in the sample countries, according to GDP per capita benchmark.	Not applicable.
10.1 p. 107 TERA Consultants uses sample models established from 2005 to 2015. Plus, Swedish model seems outdated.	A price trend adjustment is performed onto the models to ensure comparability. The Swedish model used in the benchmark is in line with the one used by the Swedish Regulation Authority to derive the public unit prices (see comment 10.3 p. 113 below)
10.1 p. 108 Norway, Netherlands or Spain should have been included in the sample	Indeed, these countries could have been included. But focus was on models which are the most well-known.
10.2 p. 108 The up-to-date Swedish model uses fibre, hence the New Zealand model should have been used in the fibre scenario.	It was preferred to work on copper scenarios for all the countries since most of the countries work on this basis. It is not clear what it would provide in terms of benefits in the analysis.
10.2 p. 109 Purchasing Power Parity exchange rates should be used rather than nominal exchange rates.	Responded in TERA report "Analysis of the critiques to the international comparator report".
10.3 p. 110 French data cannot be extrapolated from 2002 to 2015	NS does not explain why French data is not reliable. The model was used to derive costs and was the process of a 3 year review. Also, price trends have been reviewed by ARCEP

Industry comment	TERA's views
	later on and are the ones we used. To our knowledge, those price trends are still used by ARCEP in their tilted-annuity-derived accounting approach.
10.3 p. 111 Irish national cost cannot be inferred from New Zealand and Denmark distributions of costs Plus, there is a typo in the explanation of the cost distribution in New Zealand and Denmark.	TERA Consultants has been working for ComReg since 2007 and has worked on several projects in relation to the copper local loop and, even if we cannot disclose confidential information, we can confirm that the assumptions taken in this report are appropriate and that Ireland remains a relevant country for comparison. Plus, ComReg has published in July 2015 a public report on "the determination of appropriate costing and pricing methodologies for the copper access network in Ireland"[10], in which they provide for the national bottom-up LRIC price at €28.6, i.e. NZD 45 (using 1.58 NZD/EUR average exchange rate in the past 12 months (min NZD 41, max NZD 50)), which support TERA analysis in which Irish national cost is inferred from distribution of costs in New Zealand and Denmark (proposed range : NZD 44-51).
10.3 p. 112 As data about Dublin is not public, therefore no conclusion can be drawn from it.	See answer to 10.3 p. 111
10.3 p. 113 Swedish extrapolated prices are very close to the actual results of the most recent Swedish model	The version of the Swedish model used by TERA for the purpose of the benchmarking report has been used for that reason.
10.4 p. 114 The model developed by TERA Consultants does not reflect the costs of an efficient operator as ducted trenches are used rather than directly buried cables.	Direct buried cables are not necessarily more efficient since they are less future proof (ducts cannot be reused), have shorter asset lives and can drive higher OPEX. The use of direct buried cables is not international best practice: - the cost model of the Danish regulator is fully ducted for the fibre network - direct buried cables had been widely used in some countries in the past for copper networks, including Denmark and New Zealand. In many countries (e.g., Ireland, France, Italy, UK), the use of ducts had been used for at least 20 years, and in the

[10] http://www.comreg.ie/_fileupload/publications/ComReg1567A.pdf

Industry comment	TERA's views
	case of France for 40 years; - research undertaken by Analysys Mason on behalf of Ofcom, on the cost of different construction methods for next generation fibre access network (FTTH), reported *"direct burying in soft ground offered savings of around 24% versus traditional trenching. The lower construction costs however must be balanced against higher maintenance costs and a shorter life expectancy."*[11] - The fundamental difference between ducted and direct buried networks is the need with direct buried cables to re-dig trenches every time the operator needs to replace or augment its cables. As a consequence, the effective "economic" life of a trench associated with direct buried cables equates to the life of the cable, whereas for ducted cables the life of the trench equates to the longer asset life of the ducts - It is noted Downer confirmed that the majority of the UFB build, being undertaken by the LFCs, is ducted[12].
10.4 p. 115 National average of road length does not convey regional variation	National average does capture regional variation: indeed, average is used rather than median. Thus, low density areas effect on costs is comprehensively taken into account.
10.4 p. 115 According to road network, New Zealand and Sweden have a similar "road length per user".	TERA's report is based on infrastructures, which is more relevant metric than the road network, as costs are derived from infrastructures.
10.4 p. 116 Network length in Sweden is extrapolated from a sample of 25 exchange zones.	This weakens further the comparison with Sweden road network provided in 10.4 p. 115 (previous comment)
10.4 p. 116 Average copper loop length is greater in France and Sweden than in New Zealand	Average copper loop length does not reflect cost recovery. Indeed, when buildings are concentrated but cabinets are sparsely located, average copper loop can be lengthy while its costs are recovered among a large number of lines.

[11] http://stakeholders.ofcom.org.uk/binaries/consultations/wla/annexes/csmg.pdf.

[12] Downer New Zealand Limited "Submission on the further draft pricing determination for Chorus' unbundled copper local loop and unbundled bitstream access services" CONFIDENTIAL, 12 August 2015, p. 2.

Industry comment	TERA's views
	Network length per active line, i.e. the total length of infrastructures divided by the number of active lines, is rather relevant to measure the average cost per line.
10.4. p. 117 Benchmark of common costs is flawed. New Zealand and Denmark shall benefit from similar economies of scope.	In New Zealand, the access network wholesale provider (Chorus) has been separated from the retail provider (Spark). Hence, New Zealand UCLL provider benefits from less economies of scope on common costs than Denmark.
10.4 p. 117 The WACC used in the Swedish and Danish models are lower than in the New Zealand model	TERA Consultants provides a comprehensive explanation of differences in depreciation factor stemming from differences in WACC in the benchmarking document.

4 CEG report

4.1 Analysis of the comments regarding Price trends

This section aims at addressing the comments detailed in “2168756_CEG Report - Response to further draft determination PUBLIC”

Industry comment	TERA’s views
§5 Estimating the long term price trend for trenching costs - Four alternative bespoke PPI series for the purpose of determining the long term price trend for trenching are studied. - Reasonable range for the long term price trend for trenching ranges from 1.99 per cent to 2.77 per cent, with the lower end of this range representing CEG’s preferred estimate.	Based on the new elements provided during this consultation process, NZIER has recommended not changing the figure. **No change required.**

5 L1 report

This section aims at addressing the comments detailed in "L1 Commerce Commission Letter August 2015"

5.1 Analysis of the comments regarding OPEX

Industry comment	TERA's views
Opex Fibre Adjustment - 40% OPEX savings are based on a median of heterogeneous studies - this figure is overstated - 40% should not apply to all cost categories (central overheads, insurance costs.etc)	For the avoidance of doubts, TERA Consultants would like to highlight that the 40% adjustment does not compare the cost of Chorus with the costs of an efficient operator. This intends to mimic the likely savings due to the move from an old copper network to a new fibre network. As a consequence, this does not necessarily represent "Chorus inefficiency". In reality, TERA Consultants agrees that cost categories would not be equally impacted. Insurance costs quoted by L1 capital are unlikely to be significantly impacted whereas energy costs or repair costs could imply savings above 40%. The studies benchmarked are discussing the average level of savings due to the move to fibre. **No change required.**
LFI aerial adjustment is not transparent - cannot be interrogated - rely on a single country benchmark to set assumptions for NZ that may not be relevant and have the perverse effect of lowering LFI calculations based on one off weather events in a single country benchmark Commission has access to a large variety of real data including data from global telecommunications companies that have rolled out fibre networks over the last 5-10 years and have real fault rates, data from NZ power transmission companies on line fault rates for overhead deployment, and line fault assumptions from Chorus and LFC's business plans.	TERA Consultants shares L1 view that setting copper network LFI assumption based on the unique Irish benchmark can lead to potential drawbacks. However, to the best of TERA Consultants' knowledge, this is the only source available. Significant work has been performed in the annex of the model documentation to ensure that Ireland and New Zealand can reasonably be compared (length of the local loop, weather, etc) TERA Consultants would like to highlight that no NZ based inputs on recently deployed copper networks was available at the time of the modelling. **No change required.**

6 Downer report

6.1 Downer report

This section aims at addressing the comments detailed in “Comments on the Beca report to the Commerce Commission CONFIDENTIAL VERSION.pdf”

6.2 Analysis of the comments regarding CAPEX

1.b. TERA does not model differences between inside boundary (lead in) and communal network (distribution)	TERA does model differences between trenches for lead in and trenches for distribution. Indeed, lead in trenches are almost entirely “small trenches” which are price differently from distribution trenches, which have a size from “medium” to “XXL” – at the exception of “laterals” (see answer to AM report, subsection 2.1)
1.c In terms of providing network to each customer the outside boundary trenching requirement is generally around 20m per premise (typical property frontage length in urban situations) and the inside boundary requirement is typically approx. 14m (distance from boundary to the house), so the inside boundary work is a considerable portion of the scope when looking at a complete new network build	Agreed. See answer to AM report, subsection 2.1
1.d Inside boundary trenching differs from outside boundary trenching in predictability, efficiency and soil congestion	Lead-in trenches are not incurred in the model as they are paid by the end-user through a lump sum.
1.e TERA does not model laterals	Agreed. See answer to AM report, subsection 2.1
1.f Trench reinforcement is not used in New Zealand	Agreed. See answer to WIK report, §281
1.g 110 mm and 50 mm have been superseded by microducts in 40-50 mm ducts and hydrotrenching techniques. See also 9.	Ducts size and trenching costs have been reviewed accordingly. The traditional 110 mm ducts can be replaced by smaller ducts of approximately 40-50 mm in diameter for fibre. However, these ducts would necessarily contain micro-ducts in an environment where the hypothetical efficient operator faces known and constant demand

	We note that Downer indicates that small sections have lower productivity which supports our view that the HEO's trenching costs would be lower than Chorus' observed costs.
1.h The scope of trenching costs is not based on actual construction technologies and network architecture.	See answer to 1.d. and 1.g.
2. The selection of trenching techniques is largely complete at the exception of hydro-trenching.	Hydro trenching has been added to the list of eligible techniques.
3. Open cut trenching specifications shall be downsided	Not applicable.
4. Chain trenching is little used in New Zealand	When chain trenching is an available technique for a given soil type, mole ploughing is also an available and cheaper technique, hence chain trenching is not used to derive average trenching costs.
5. Downer agrees with BECA's approach on mole ploughing.	In addition, in the model developed by TERA, mole ploughing is widely used in rural areas, while it is not used in urban areas.
6. Trench reinstatement can be a significant cost	Agreed, Trench reinstatement represents a significant cost in TERA's model.
7. Directional drilling is not efficient in short sections.	Not applicable.
8. Thrust boring shall be limited to short sections.	Not applicable.
10. and 11. Contractor discounting is negligible because of the atomized structure of the civil engineering market in New Zealand	Noted
12. Reinstatement costs are underestimated.	Not applicable.
13. Reinforcement of trenches is not used in New Zealand.	See answer to WIK report, §281
14. HDPE ducts have been superseded by microducts	While these are currently used in New Zealand, microducts do not comply with the selected network architecture for the HEO, where cables are hauled from joint to joint rather than blown from the exchange to the end user. Indeed, as the HEO serves a full demand, the aforementioned network architecture is preferred to microduct/on-demand fibre blowing. Also microducts are more expansive than normal ducts and require generally many smaller cables (which is more expansive than

	larger cables with same number of fibres). In summary, microducts are likely to be cheaper when deployment is made on demand but not for a 100% demand HEO.
15. Traffic management is in line with actual costs.	Noted
Appendix 1 & 2: there is a strong relation between trenching technique, productivity and cost	Relation between productivity and cost is already taken into account by BECA as non-productive techniques or soils coincide with higher costs (for instance, rock (soil type n°5), urban soil type).
Appendix 3: average trenching costs have been reduced by [ ]**DNZCI**	The costs considered by AM in their model are based on 2013 data, while costs have decreased by [ ]**DNZCI**. On the contrary, BECA model is based on 2015 data. This supports BECA's analysis on trenching costs.

7 Chorus report

7.1 Report

This section aims at addressing the comments detailed in “1981784_Chorus_PRD_Draft_UCLL_and_UBA_Submission - CONFIDENTIAL.PDF”.

The comments raised in this report that are already addressed in another report have not been analysed in this section.

7.2 Analysis of the comments regarding CAPEX

Industry comment	TERA’s views
40.4 (a) FWA cannot be the MEA because it does not provide the ability to unbundle.	Not applicable.
50 Optimizing exchanges areas shall take into account geographical constraints	Exchange areas’ optimization already takes into account geographical constraints as it based on the road network distance.
51 to 54 Spare capacity shall be added in the fibre network, in addition to natural inevitable over-dimensioning of cables.	Not applicable.
55 to 65 The Commission shall review the accounting of capital contributions for the non-TSO areas	Not applicable.
69 to 72 Capital contributions shall be accounted as a one-off payment.	Not applicable.
70 to 75 TSO boundary shall be reviewed, as it is now based on December 2001 network.	Not applicable.
76 to 79 Capital contributions for lead-ins shall be reviewed.	Not applicable.

99 to 103 Directiional drilling estimates are too low.	Not applicable.
111 Some cost categories have been omitted - Arborists - Aerial cable and underground cable installation	Arborist costs are included in BECA trenching analysis. Installation costs for both aerial and underground cables, i.e. hauling, are indeed included in the model. This includes in particular service company overheads.
116 to 120 Proportion of aerial deployment is overestimated	Not applicable.
121 to 128 Pole rental and access costs are underestimated.	The rental fee has been updated to $38. Chorus has provided a new estimate and the number TERA applies includes the money that the HEO would earn from EDBs for providing access to its telco cables.

7.3 Analysis of the comments regarding non-recurring charges

Industry comment	TERA's views
333 and 342 to 346. The Commission appears to assume (without reason) that Chorus' costs are inefficient. However, the rates are set by competitive tender with third party providers. There is no evidence that our negotiated rates are anything but efficient.	It is not assumed that Chorus costs are inefficient. The competitive tender allows setting efficient rates for the tasks required by the tender. Actually, benchmarking the times needed to complete the tasks allows checking if the process submitted to tender are efficient, not the rates to provide those task.
335 336 Chorus will be unable to recover the full amount of the competitively determined costs. Setting charges below market rates creates adverse incentives for Chorus as the provider of the relevant services, and RSPs as consumers of the service, creating a real risk for Chorus that its ability to offer its current levels of service quality will be adversely affected	It must be noted that the analysis does not aim at modelling Chorus current cost, but at assessing efficient costs of an HEO operator.
347 the comparison demonstrates the task times estimated by Chorus' service companies are generally within the lowest section of the benchmark range.	The approach retained by the Commission is to select for each transaction charge the lowest cost within the countries benchmarked. When Chorus' current cost is the lowest, then it is selected. This approach ensures that the processes required to complete a

	given task will be as efficient as possible.
354 355 Elementary activities are compared to service company codes, which is not relevant as individual activities may vary significantly in terms of average task times.	The non-recurring charges are based on service codes. The mapping was provided by Chorus, therefore it means that Chorus uses those service codes to set the prices of the non-recurring charges. Indeed, in most cases, non-recurring charges which are based on the same service company codes have the same prices, which means that the approach is consistent with the way Chorus sets its prices today.
356 3576 Strong variations between benchmark countries in the duration of similar activities mean that task times cannot be used as a basis of an efficiency adjustment.	There are indeed some variations between countries regarding the time required to perform similar activities. This means that the level of efficiency is not the same in the benchmarked countries. The approach leads to retain lowest time from the benchmark, which ensures efficiency of processes in New Zealand.
360 – 361 : No fault found and cancellation charges are employed not only to compensate service companies for time taken, but to encourage RSPs to diagnose service complaints and end-user related errors, as a preventive measure before the fault is referred to Chorus.	Transaction charges should be calculated to cover costs, i.e. to compensate service companies for time taken: such cost should be sufficient to encourage RSPs not to inappropriately refer to Chorus. There is no need to add any incentive, which would not be compliant with the TSLRIC approach.
362-367 : If the Commission decides to make an efficiency adjustment based on task times for non-recurring charges, the Commission must at least adopt an orthodox and consistent approach to benchmarking, and select a price point at, or above, the mid-point	The current approach consists in choosing for each transaction charge the lowest time achieved in the benchmarked countries. This is a consistent approach which ensures efficiency in Chorus processes. Such an approach is different from a situation where we need to set a parameter to a given value, and where we use an average midpoint amongst a range of comparable values. For example, when calculating a WACC, some parameters can be set as an average of comparable values for other firms/other countries. Here, the goal is to determine the most efficient value for a given service, therefore there is no need to calculate any midpoint.
368 to 372 : Using a 75th percentile for the determination of a single national price for service company codes mitigates the risks of fluctuation of non recurring charges locations. .	Using a 75th percentile in the calculation of average costs at the national level is not in line with the TSLRIC cost orientation principle as it artificially increases the costs incurred by Chorus, which a weighted average national cost does not. The risk of greater location fluctuation in the next regulatory period should not allow Chorus to perform over recovery of costs using a 75th percentile.
375 to 378 : use of LFC as a cross check is not consistent.	Following cross submissions, it is considered that the comparison between fibre and copper non-recurring costs is not relevant for the various reasons mentioned by the respondents. It is decided to discard the LFC analysis.

379 to 384: approach to charges based on chorus internal time only • Approach is inappropriate in a TSLRIC context, and lowest benchmark values were taken while Chorus values felt well into benchmark. • Besides, various charges do map with service company codes: special manual qualification order (UCLL 3.3, UBA 3.2); manual line testing (UCLL 3.4); abortive end user site visit (UCLL 3.8, UBA 3.4); cancellation charge post truck roll (UBA 3.14) • Prices set below cost create a distortion as it incentives RSPs not to manage efficiently their networks and customers.	• See answer to comment 347 • New mapping provided by Chorus in "1981784_Chorus_PRD_Draft_UCLL_and_UBA_Submission- CONFIDENTIAL .PDF" has been used to set charges for corresponding non-recurring charges. • The new rates create an incentive for Chorus to update its process and the corresponding service codes in order to achieve cost reduction in its processes. In any case, the existence of costs, whatever its value, for a given non-recurring charge, incentives RSPs to manage efficiently their networks in a competitive environment.
420: UCLL3.6 "no fault found" should be consistent with UBA "No fault found" and set to $81.40	Not applicable.
421: no fault found is not adapted to a time based benchmark approach	No fault found was mapped to service company code [ ]**CNZCI**, which is calculated following same structure as any other service company codes: average time to complete task, average labour rate, and other cost components. Therefore, same approach for efficiency adjustment is relevant.
422 to 430 : Abortive end user site visit can be mapped to service code [ ]**CNZCI**	This has been amended
431: UCLL 3.8 and equivalent UBA service should be consistent	Not applicable.
432 to 435: Additional copies of invoices should be set to 0 for electronic copies but charged on an hourly rate basis (corresponding to length of invoice) for hard copies.	Cost of hard copies has been assessed. Not applicable.
436 to 437: Three UBA STD charges have no equivalent in UCLL and should have equivalent set to same charge. UBA 1.1 new connection – no site visit required UBA 3.13 Cancellation charge pre truck roll UBA 3.14 cancellation charge post truck roll	Not applicable.
441: UBA 1.34 is set at $442.17 but should be set at $45 as specified for other UBA core charges	Not applicable.
443 444: UBA 1.48 Remapping design charge should not be POA	No sufficient data provided by Chorus. 1.48 remains POA.

445: UBA 3.3 No fault found should be set at 81.40 for consistency.	Not applicable.

8 Spark report

8.1 Spark report

This section aims at addressing the comments detailed in “SPARK_Submission on FPP further draft for 13 August 2015 Final”.

Most of the comments raised in this report are already addressed in either Chorus or in Network Strategies reports. This section will thus address solely the new comments.

8.2 Analysis of the comments regarding CAPEX

Industry comment	TERA’s views
264 Spark recalls that the end user contribution to lead-in installation goes far beyond trenching.	Within-property underground infrastructures (trench, duct) as well as ETP are excluded, in the July draft as well as in the current version of the model.
310 The Commission should derive the price for SLU from a full copper network, in order to avoid inconsistencies stemming from the independent calculus of fibre and copper prices.	Not applicable.
311 There are possible cross-subsidies between regulated and non-regulated services in the calculation of UBA	Consistent with TSLRIC, cost allocation approaches are used and there would be cross subsidies only if cost allocation were not appropriate.

8.3 Analysis of the comments regarding non-recurring charges

Industry comment	TERA’s views
352 to 358: Large number of efficiencies could be obtained in the provision of UCLL	No change required in the model.

Industry comment	TERA's views
and UBA	
359 to 369: Process efficiencies in a modern network	The approach that was implemented aims at estimating the cost of some non-recurring charges provided by Chorus to RSPs, but not at assessing the relevancy of such non-recurring charges: i.e. we do not assess whether the nature of transaction charges is relevant and if such services should be charged to RSPs.
370 (a) : Adjust UCLL/UBA site connection charges (1.1 site visit) by clarifying that the charge only applies where premises connection at the ETP is required	Not applicable.
370 (b): Set the UCLL cabinet/exchange connection charge (UCLL 1.1 cabinet/exchange) equal to the charge for remote connection.	Not applicable.
370 (c): Set the UBA cabinet/exchange connection charge (UBA 1.1 cabinet/exchange) equal to the charge for remote connection.	Not applicable.
370 (d) : Set transfers between UBA service variants where a port change is required (1.9, 1.10 port change) equal to the charge for a remote connection	Not applicable.

9 Vodafone report

9.1 Vodafone report

This section aims at addressing the comments detailed in "FINAL Vodafone NZ - FPP Submission Further Draft Determination - Aug2015 CONFIDENTIAL.pdf".

Most of the comments raised in this report are already addressed in WIK report. This section will thus address solely the new comments.

9.2 Analysis of the comments regarding CAPEX

Industry comment	TERA's views
D1.1 FWA footprint is based on current real-world copper connection capability.	FWA coverage has been narrowed to areas unlikely to be unbundled covered by RBI.
D2.5(b) What should be the key consideration for determining FWA footprint is minimising the costs of the HEO.	The HEO does not only minimise its costs but also insures a given quality of service, based on real-world connection capabilities. The HEO would not deteriorate quality of service for users that actually benefit from broadband connection in order to reduce its costs.
D4.7 34k buildings are served by FWA while located at less than 5.3km from cabinet	See answer to NS comment 2.3.3 (in section 3.1 of this report).

9.1 Analysis of the comments regarding non-recurring charges

Industry comment	TERA's views
C2.6 & C2.7 A HEO does face capacity vs. site visit dilemma as it already builds a full capacity network (at cabinets and at lead in).	The purpose of the project is to assess the cost of some transaction charges. Chorus has provided new codes for some services, which have been used to assess efficient prices. The assessment of the relevancy of the services in an HEO network (especially visits at the exchange vs leaving lines intact) is out of the scope of this assessment
C4.1 Chorus is investing in IT system improvements.	No change required. IT costs account for approximately [ ]**CNZCI**% of Chorus overhead costs (see OPEX model), which are captured through a 5% mark up on Service companies costs. In total, IT costs do not account for more than 2% of the total NRC charges in our model.

10 Cross submissions

10.1 Analysys Mason

Industry comment	TERA's views
3.6 In the model developed by TERA, a 5% markup is applied onto lead in to take into account non-linear paths According to WIK, the mark up is not relevant as lead in paths are already rectilinear. According to AM, deviations would still be needed, even if paths are rectilinear.	TERA suggests updating markup from 5% to 9.5% according to AM real world analysis. References to the results of Denmark real world analysis are however not relevant, as they are not based on New Zealand network architecture while a real world analysis performed by AM provides results relevant for New Zealand.
3.8 Underground infrastructure sharing AM disagrees with WIK stating that 50% benefits when sharing are conservative. AM suggests that benefits of sharing range from 28% to 40%	Not applicable.
3.8 Underground infrastructure sharing AM performs a benchmark of the proportion of shared trenches in selected countries. AM assesses the value assumed by TERA as reasonable.	The assumption taken by TERA Consultants is in line with the benchmark provided by AM, based on Denmark, UK and Sweden (1% to 12%, median 5%).
3.8 Underground infrastructure sharing According to AM, not all trenching techniques can provide for trench co-ordination (no guarantee of sufficient separation)	All the trenching techniques considered by BECA can handle multiple ducts.
3.9 The proportion of access network costs allocated to leased lines is too high, as compared to benchmark performed in Denmark, Belgium, Norway and Australia	This is line with benchmarks performed in other countries.
3.10.1 Mole plough trenching According to WIK and AM, cost of material for ducts should have been removed from mole plough trenching costs. Plus, the rates for mole ploughing seem far lower than the cost experienced by Chorus.	TERA uses the model developed by BECA as an input to its "Inputs for trenches" model. However, TERA does remove the duct material before exporting the costs from BECA to its model, therefore duct costs are not double counted. NB: duct material costs are excluded from trenching costs, but are taking into account separately in the UCLL model.

Industry comment	TERA's views
3.10.2 Installation costs of ducts TERA provides a feature that allows for switching ducting costs from trench unit costs to duct unit costs. According to AM, this feature contains an error and the ducting costs are always accounted within the trench unit costs.	This issue has been fixed. However, this has no impact on aggregated unit costs, nor on total costs, since the duct installation costs are taken into account within trenching costs in the base case scenario.
3.10.3 Installation costs of subducts WIK states that installation costs of subducts are double-counted. AM disagrees with this statement.	Indeed, installation costs of subducts are not accounted in trenching costs, then are to be taken into account in subduct unit costs. Subducts have however been removed in the final version of the model (except for core cables). Therefore, no change is required..
3.10.7 TERA forgot to apply the mark-up on "Rack exchange" and "Subrack Exchange" The company overhead and project management Mark-up of [ ]**CNZCI** is only applied to installation costs, it should be applied to both material and installation components.	The UBA input model has been adjusted so that the markup is applied to both material and installation costs.

10.2 Wik

Industry comment	TERA's views
35 to 37 According to WIK, laterals are actually included in the modelling. Indeed, it is most efficient to locate the trench at the border line of the private property and not at the edge of the metalled surface of the road. berm	TERA has located the trenches at the border line of the private property. However, for soil congestion consideration, the trench cannot be located exactly at the border of the private property but at least at about one time the depth of the trench. Plus, the network access point is located at the private property boundary. The latter assumptions are confirmed by Downer states: "Also Downer confirms that the connection points for each customer are ***located at*** the property boundaries and that trenching should occur ***as close to the boundaries as possible***" (emphasis added). As such, a lateral was not in the July draft but has been modelled in the final version of the model, which length ranges from 1.75m.

Industry comment	TERA's views
38 to 43 WIK recommends modelling road crossing using a single soil type all along the road crossing, even if it includes pavement, berm and footpath at a time.	This corresponds to the approach implemented by TERA. Therefore, no change is required.
44 Chorus states "the lead-in is the property owner's responsibility" and covers the distance between the network terminal at the boundary and the ETP. WIK concludes that the laterals are not required.	The lateral being the segment between the fibre access terminal and the network access point, outside the property boundary. The lateral is then required.
138 Option 1 (FTTH) should be cheaper than Option 2 (Copper)	The cost and number of equipment is most of the time lower in option 1 than in option 2, however the use of SFPs for each active line which is mandatory for FTTH solution imply additional costs that raise significantly the cost of the option 1.
140 Chorus rejects the inclusion of FWA in the UCLL MEA because it does not meet the full UCLL functionality and cannot be unbundled. A virtual physical unbundling may replace the physical unbundling, this approach is used in Europe under the name of Virtual Unbundled Local Access (VULA).	Not applicable.
145-148 Reducing spare capacity to 9% instead of 15% discards the need of additional 3rd SFPs for the DSLAM backhaul. An HEO would wait for the beginning of the next regulatory period to install additional equipment that would be otherwise idle most of the time.	The model calculates the needs on a per-year basis: the cost calculated to build the network in 2016 does not take into account 2020 dimensioning. Therefore this dimensioning only impacts the cost of the network in 2020. This case occurs only on 2 sites, where DSLAMs are almost fully loaded. The excess of traffic load is indeed less than 1% and changing the spare capacity to 855 would avoid adding an additional SFP. However this issue counts for less than 0.01% of the total costs. Therefore no change required.
Chorus and Analysys Mason recommend to use 20% spare capacity for DSLAMs and switches. This is not correct and reflects the practice of network operators, including the geographic demand constraints.	TERA agrees. 15% of spare capacity is already included for each SFP TERA considers therefore that no additional spare capacity is required for the equipment.
In areas of the network where SMF-4 is not efficient the model should continue to use SMF-3.	When ESS-12 is required, the newest version will be used (SFM-4), however on smaller sites, an ESS-7 SFM-3 switch version will be used.

10.3 Non-recurring charges

For clarity purpose and to avoid redundancy, comments have been classified by issue addressed. For each theme, respondents' similar comments have been merged. Diverging comments addressing common issues have been gathered to provide a unique response.

Industry comment	Respondents (paragraphs)	TERA's views
Benchmarking approach		
Benchmarking is an appropriate approach, relevant for the current exercise, as a Bottom up approach cannot be implemented.	Vodafone (D1,2), Spark (205), WIK (175)	A bottom up approach cannot be implemented, as explained before. Therefore, the current approach is considered as best possible approach. No change is required.
Benchmarking is inappropriate in the context of a cost based modelling exercise.	Chorus (74)	
Variations between processes benchmarked do not prove that comparison are not relevant, they show differences in efficiency achievements between countries and therefore justify the analysis.	Vodafone (D4,7), Spark (207), WIK (182)	
Benchmarking of task times only leads to limited efficiency adjustments (less than 50% of total cost), while other components should also be assessed.	Vodafone(D1,2), Spark (205)	The direct cost of service company is broken down into 7 components, from which one component is assessed for efficiency: time required to complete tasks. It is considered that all the other components (labour cost, material, transport, vehicle costs, etc.) are highly country dependent, therefore not relevant for benchmarking. In addition the 6 other components are considered to be more objective than task times. Therefore, it is likely that potential distortion, if any, would occur on the "time" component. The current approach, which consists in benchmarking the times, therefore
Some components of service companies' costs are highly country specific, and benchmarking them would lead to significant inaccuracies.	Chorus (71), Analysys Mason (7.1.10)	
Service companies' contracts allow chorus to achieve best overall prices rather than optimized prices for individual price points.	Spark (202)	
Overlaps between internal and regulated charges limit the risk of cross subsidization.	Analysys Mason (7.1.1)	

Industry comment	Respondents (paragraphs)	TERA's views
Although an accurate mapping of NRC to service codes would improve cost causation of NRCs, the mapping of several NRCs to same service code and inclusion of activities not related to the mapped NRC core services has its advantages: by providing some protection against alleged incentives for cross subsidy.	Analysys Mason (7.1.14)	minimizes the risk of cross subsidization mentioned by respondents. Also, TERA shares Analysys Mason's view that current mapping of several NRCs to service codes decrease the risk of cross subsidy.
ETP as explicitly not been included in the assets costed as part of the recurring charges, therefore has to be covered through NRC.	Analysys Mason (7.1.14)	TERA shares this view. ETP costs are only included in non-recurring charges.
Potential changes to TERA's efficiency adjustments		
Chorus does not bring evidence of a trade-off between task duration and labour cost, Some countries may have lower costs and lower times, and therefore TERA's benchmarks would underestimate achievable efficiency.	Vodafone (D4,3)	TERA has carried out additional analysis which highlights the existence of such trade-off. Adjustments have been made, as described in section 1.4 (point 6.2).
Chorus does not bring evidence of higher standards of workmanship in NZ.	Vodafone (D4,4), Spark (223), WIK (185)	TERA shares the view of respondents that such requirements, as described by Chorus or not specific to new Zealand and apply in many countries. TERA welcomes the comparative analysis carried out by Spark, which support this view.
A comparison of health and safety requirements in the benchmarked countries shows that frameworks are very similar to new Zealand.	Spark (215)	
A comparison of working at heights requirements in the benchmarked countries shows that frameworks are very similar to new Zealand.	Spark (217)	
Chorus does not bring evidence that local authority compliance requirements are more demanding than in benchmarked countries	Spark (221)	
Chorus does not bring evidence of higher costs due to outsourcing	Vodafone (D4,5), Spark (224), WIK (185)	
Chorus does not bring evidence of higher costs due to existence of aerial lines	Spark (224), WIK (185)	

Industry comment	Respondents (paragraphs)	TERA's views
Chorus statement reveals that some NRC costs are purposefully set above costs to incentivize efficient behaviour from RSPs, which does not reflect cost based regulatory practices.	Vodafone (D4,8), WIK (188)	Transaction charges should be calculated to cover costs, i.e. to compensate service companies for time taken: such cost should be sufficient to encourage RSPs not to inappropriately refer to Chorus. There is no need to add any incentive, which would not be compliant with the TSLRIC approach.
Setting prices at efficient costs level provide incentives for efficient behaviour to both access seekers and access provider.	WIK (188)	
Taking lowest value within benchmarked task times is the correct approach as the purpose is to assess efficient costs, which would not be achieved by taking a midpoint value within the task times benchmarked.	Vodafone (D4,8), Spark (225), WIK (189)	TERA shares the view of RSPs that taking lowest values for the present exercise is appropriate, as the purpose of the project is to assess most efficient time values for a given service. TERA shares the view that Denmark cannot be considered as an outlier within European countries, with or without purchasing power parity adjustments as LLU connection fees in Denmark are above UE average TERA considers that all countries considered are relevant for benchmarking, considering the efficiency adjustment made and the low importance of IT costs in NRC costs. TERA disagrees with WIK and shares Analysys Mason opinion regarding the inclusion of administrative times within the task time values: this administrative time is a directly attributable cost, and is not covered by overheads. Differences are more likely due to travel time or other country specific cost components.
This approach is further supported by the fact that some figures are conservative (including transport times)	WIK (189)	
UE 25 comparison of LLU connection cost shows that Denmark (identified as best practices country in TERA's benchmark) is above UE 25 average, and therefore cannot be considered as an outlier.	WIK (190)	
This approach is further supported by the fact that TERA's benchmark values can include technician time and administrative times, while the latter are already covered by Chorus internal costs.	WIK (189)	
UE comparison made by WIK is inappropriate as it does not take into account purchasing power parity, labour cots, IT costs. It includes countries that WIK considers inappropriate to include in TERA's benchmark.	Analysys Mason (7.1.15)	
In its comparison of NZ and Germany connection costs, WIK claims that the differences that occurs for NRC which include visit to customer premises is due to double counting of activities. The difference is more likely due to specific factors such as travel time. This is in line with the view that such components cannot be benchmarked.	Analysys Mason (7.1.15)	

Industry comment	Respondents (paragraphs)	TERA's views
Administration tasks are not overheads, but non-technician tasks that are directly incremental to the NRC service while OH are considered as indirect or common costs. Directly attributable administrative times should be retained in all the benchmarks.	Analysys Mason (7.1.7)	
It is the correct approach to use a weighted average for service costs per CSA rather than the 75th percentile, with the ability to amend the costs in the future to account for any significant evolution.	Vodafone (D5,1), Spark (225), WIK (191)	Comment noted
Such charges are "manual prequalification order", "manual line testing" are caused by Chorus inefficiencies and should not be charged by a HEO in a TSLRIC approach.	Vodafone (D8,2), Spark (251), WIK (206, 207)	The purpose of the project is to assess the cost of some transaction charges. Chorus has provided new codes for some services, which have been used to assess efficient prices. TERA shares Chorus view that setting transaction below cost is contrary to a TSLRIC approach. The assessment of the relevancy of the services in an HEO network (especially visits at the exchange vs leaving lines intact) is out of the scope of the this assessment
Abortive end user site visit should be charged to zero in order to incentivise Chorus to improve its process. In Europe, it is the service companies responsibility to ensure that the meeting with end customer is effective (by automatic calls one hour before, then a call if no one react to door bell ringing, etc.).	WIK (208)	
Charging a flat fee for cancellation charge post truck roll is not efficient as the real cost depends on the point in time of cancellation.	WIK (212)	
Variations of charges for a given service, depending on whether it requires a port change at the DSLAM or not, are not relevant in the context of a HEO operator.	WIK (217)	
Set transaction charges below TSLRIC Cost or introduce non-price terms in order to provide incentives to invest in capacity and technology is contrary to the requirement to set a cost-based price. Incentives should be provided through an appropriate monthly charge.	Chorus (105)	
Specifically, setting cabinet exchange connection charges at the charge for remote connection is not appropriate. It is not true that technician visits at the exchange are driven by Chorus having removed an intact: for UCLL, a truck roll will be required in almost all cases. In addition, this approach would require higher level of spares.	Chorus (105),	

Industry comment	Respondents (paragraphs)	TERA's views
Reusing intact lines was not identified as a meaningful contribution to the need for truck roll. Reusing intact lines represents does not represent a failure to manage the network efficiently	Chorus (105)	
Bulk discounts are not widely used, and ability to accommodate bulk discounts is limited by requirements to provide services within STD timeframes.	Chorus (105)	Not applicable.
A price reduction factor of -3% to -5% should apply to NRC transaction services to incentivize efficiency improvements. This factor includes labour cost index.	Vodafone (D9,2), Spark(252), WIK (218)	The price trend proposed is based on LLU efficiency adjustments that have been applied in international models. While these are useful as a guide, the purpose is not to incentivise efficiency gains via price trends specifically but rather via the TSLIRIC methodology more generally. LCI-based price trend will apply to core and sundry NRCs. This ensures a consistent approach for core and sundry NRCs and is in keeping with the application of price trends for recurring charges. at there is no need for further efficiency adjustments.
Using old data points is not necessarily incorrect for well-established and mature copper connections like chorus. Chorus processes for copper provisioning are well refined and cost improvements are difficult to find, unlike fibre which is still developing. A price reduction rate for copper is not appropriate	Chorus (94), Analysys Mason (7.1.11)	
A blanket 5% year on year efficiency adjustment as proposed by WIK is not supported by regulatory practice in EU. Productivity factors have only been included in the calculation of NRCs in a small number of cases. In addition, in countries were such approach was retained, it was based on data submitted by operators.	Analysys Mason (7.1.13)	
Contracts with service companies contain specific provisions designed to drive efficiency and deliver further cost savings during the term of the contract	Chorus (78)	
Focus on Fault handling issues		
RSPs have no ability (or limited) to identify the party that caused a fault.	Vodafone (D3,2)	The purpose of the project is to assess the cost of some transaction charges. Chorus has provided new codes for some services, which will be used to assess efficient prices. TERA shares Chorus view that setting transaction below cost is contrary to a TSLRIC approach.
There is a strong correlation between the No fault found and cancellation events (NFF)" and "fault found" data. Thus, reducing the number of faults in the network through appropriate maintenance and equipment replacement would decrease the current inefficient allocation of costs to RSPs through NFF charges.	Spark (229)	

Industry comment	Respondents (paragraphs)	TERA's views
Chorus has no appropriate incentive to invest in network management tools, network maintenance, and to provide RSPs with access to network management tools that would enable RSPs to identify the faults responsibilities and reduce unnecessary requests.	Spark (228), WIK (178)	The assessment of the relevancy of the services in an HEO network is out of scope.
Only 40% of the NFF costs are likely to be attributable to matters that can be influenced by RSPs, therefore it is suggested to apply a 60%M efficiency adjustment on NFF costs for efficiency, in order to incentivize Chorus to implement network management tools.	Spark (243)	
Chorus actively seeks efficiency and is responsive to valid RSP concerns. A number of efficiency improvements have been introduced over the past few years. Where issues arised from a fault in our systems, we have reimbursed the charges in monthly credits to RSPs.	Chorus (97)	
Focus on overheads		
Service company OH costs are inflated and do not reflect efficient costs	Vodafone (D6,1), Spark (225), WIK (193)	Service company mark-up has been double checked and is considered to be consistent. The approach adopted implicitly adjusts Chorus overheads for efficiency, as we consider a fixed mark up on direct costs, which are themselves adjusted. Therefore, absolute amount of overheads is reduced in proportion.
The procurement process should be assumed to create a competitive overhead outcome, and therefore Service companies' OH should be efficient. In addition, these OH are based on a complex mixture of cost components, of which most are highly country specific. There is no evidence that service companies in benchmarked countries split OH and other cost components in the same way as New Zealand service companies.	Chorus (87, 88),	
Chorus OH costs are inflated due to outdated cost data and outdated IT infrastructure. Chorus do not provide any evidence that such costs cannot be adapted for efficiency gains.	Vodafone (D6,3), Spark (225), WIK (194)	The approach adopted implicitly adjusts Chorus overheads for efficiency, as we consider a fixed mark up on direct costs, which are themselves adjusted. Therefore, absolute amount of overheads is

Industry comment	Respondents (paragraphs)	TERA's views
The HEO cannot simultaneously have the lowest IT costs and the lowest OH costs, there is a trade-off. If Chorus OH costs were to be adjusted for cost automation, this should reflect in the IT cost elsewhere in the model. In addition, an HEO would also bne a wholesale only operator which would need to ensure open interface on a nationwide basis., while benchmarks are for vertically integrated operators.	Chorus (90), Analysys Mason (7.1.2)	reduced in proportion.
LFC cross check		
Fibre and copper connection activities significantly differ for various reasons, including material (fibre is more expensive than copper cable), labour (connection and testing are easier for copper than for fibre), and level of preparation of customer premises for connection. Therefore using LFCs connection costs as a national comparable is not relevant.	Vodafone (D7), Spark (226), WIK (195 – 202)	As noted previously, the LFC analysis is not used in the final model
A comparison of Copper and fibre conection charges in Germany shows that connection services for fibre are at least two times more expensive than copper connection services.	WIK (199)	
Changes to the STD price list		
Amending STD falls outside the FPP process and would need to be considered under a Section 30R review.	Chorus (104)	Not applicable.