Final report for Telecom New Zealand and Vodafone New Zealand

Key issues in modelling UBA and UCLL services

Commission consultation on regulatory framework and modelling approaches for FPP process

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0 Executive summary

In determining a TSLRIC price for Chorus' unbundled copper local loop service (UCLL) and unbundled bitstream service (UBA) the Commerce Commission seeks to promote investment efficiency and predictability to serve the long-term benefit of end-users. Accordingly the Commission will develop a TSLRIC (Total Service Long Run Incremental Cost) model to determine the costs incurred by a hypothetical operator using the most efficient means to provide the services, unconstrained by Chorus' or end-users' historical technology choices.

The Commission anticipates that some of its modelling choices may lead to higher prices, given that it proposes to consider the expectations of a 'reasonable investor' in its decision-making as a means of meeting its predictability objective. However, making modelling choices based on an uncertain strawman is fraught with difficulties. The best way to achieve the Commission's objective is to adopt a consistent approach in deciding upon the choices available to the hypothetical efficient operator. In keeping with its standard procedure this approach should be guided by the requirements of the regulatory costing principle, informed by international regulatory best practice and tailored to the specific conditions that prevail in New Zealand.

To this end we recommend that the Commission adopts a consistent approach in all of its decisions relating to the hypothetical operator, and reflects the lowest cost technological solution. Consistent with overseas regulatory best practice our recommendation is that the Commission should not assume in its model that an entirely new civil infrastructure network will be constructed. Furthermore, if a scorched node (brownfields) modelling approach is selected, then effectively constraints are placed on the deployment of the efficient notional network. It would be consistent, in this case, to assume that all civil structures will not need to be reproduced. Alternatively should the Commission prefer a greenfields approach for consistency it should assume the hypothetical operator has no sunk assets – that is, the hypothetical network should reproduce all structures and nodes from scratch.

In New Zealand it is clear that infrastructure sharing is already occurring in UFB deployment, primarily using the existing assets of lines companies. We would expect a hypothetical efficient operator in New Zealand to seek access to the civil infrastructure of the lines companies and other utilities in order to avoid inefficient asset duplication. Thus we recommend that the Commission considers in its assessment of efficient options available to the hypothetical operator the efficiencies that may be achieved in the deployment of fibre both by and through local lines companies.

A significant proportion of costs for a fixed access network is due to trenching. We observe in many regulatory cost models the use of a range of trenching costs associated with different types of terrain, ensuring that the model results are a more accurate representation of the costs of the hypothetical operator. Our recommendation is for the Commission to utilise an independent and consistently defined data source to assist in the derivation of trenching costs. While this type of analysis was previously undertaken for the purposes of the TSO (Telecommunications Service Obligation) costing, at that time there was no national source of terrain data, and so the Commission was obliged to work with the subjective estimates provided by Telecom (now Chorus). Given the problems associated with the TSO terrain information – as well as the relatively coarse granularity of data when compared with other international examples – we recommend that the Commission explores the use of data from Landcare Research.

An efficient operator would utilise FWA (Fixed Wireless Access) technology in areas with low line density, reflecting real-life practice and consistent with local (from the TSO) and overseas regulatory cost modelling practices. We believe that the relevant footprint for a FWA Modern Equivalent Asset (MEA) is considerably wider than the RBI footprint, particularly given the superior performance speeds available through LTE. While several modelling approaches are possible, our recommendation is that an area approach be used in preference to a wireless cap as this will ensure that costs better represent the physical characteristics of the areas being modelled. In any case the Commission should seek to select an approach that is appropriate for New Zealand circumstances and delivers estimates that reflect the costs of a hypothetical efficient operator.

Key issues in modelling UBA and UCLL services

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1 Introduction

The Commerce Commission has published its proposed views in relation to the regulatory framework and modelling approach for determining a TSLRIC price for Chorus' unbundled copper local loop service (UCLL) and unbundled bitstream service (UBA) in accordance with the Final Pricing Principle[1]. This consultation paper was accompanied by two expert reports:

- a discussion of Modern Equivalent Assets (MEAs) and relevant scenarios by TERA Consultants[2]
- a review of the effects of the UCLL contribution to the UBA aggregate on competition by Professor Ingo Vogelsang[3].

Telecom New Zealand (Telecom) and Vodafone New Zealand (Vodafone) have requested that we comment on the following aspects of the Commission's proposals:

- the regulatory framework (Section 2)
- issues related to the use of fixed wireless access (FWA) (Section 3)
- sharing of infrastructure (Section 4)
- terrain and trenching (Section 5)
- implications for backdating of prices (Section 6)

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[1] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014.

[2] TERA Consultants (2014), *TSLRIC price review determination for the Unbundled Copper Local Loop and Unbundled Bitstream Access services: Modern Equivalent Assets and relevant scenarios*, July 2014.

[3] Vogelsang, I. (2014), *The effects of the UCLL contribution to the UBA aggregate on competition for the long-term benefit of end-users in New Zealand telecommunications markets*, 2 July 2014.

- the Commission's proposed annuity tax adjustment (Section 7).

Concluding remarks are presented in Section 8, and annexed to this report is an overview of fixed wireless technologies.

Although this report has been commissioned by Telecom and Vodafone the views expressed here are entirely those of Network Strategies.

2 The regulatory framework

The Commission intends to fulfil its FPP (Final Pricing Principle) obligations through 'building a TSLRIC cost model to determine the costs incurred by a hypothetical operator using the most efficient means at any point in time to provide the service'[4]. This will be 'unconstrained by Chorus' or end-users' historic [*sic*] technology choices' but will reflect the 'core functionality' of the regulated service.

We agree that the Commission should seek an efficiency standard with reference to a hypothetical efficient operator, and that this standard should not be set in the context of Chorus' historical decisions in relation to technology. By definition, the model must be forward-looking and as such the Commission must make *ex ante* decisions concerning appropriate technologies to be applied.

This section examines the Commission's objectives and proposed framework to achieve those objectives.

2.1 The Commission's objectives

The Commission considers that Section 18 should inform its TSLRIC objectives. In particular the Commission focuses on the importance of dynamic efficiencies in the promotion of competition for the long-term benefit of end-users. The Commission acknowledges that TSLRIC may promote various outcomes but Section 18 leads it to prefer:

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[4] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014. Paragraph 103.

- investment efficiency
  - enabling Chorus to continue to invest in copper as a competitive alternative
  - incentivising efficient build or buy decisions for access seekers, including investment in alternative infrastructure
- predictability
  - respecting ‘reasonable investor expectations’ in order to promote investment.

2.2 Investment efficiency

Enabling Chorus to continue to invest in copper as a competitive alternative

The Commission seeks an outcome that will enable Chorus to continue to invest in copper as a competitive alternative. This implies that Chorus should obtain a reasonable return on its copper assets in order to maintain the copper network, and expand it. The Commission’s objective is consistent with the promotion of dynamic efficiency. Internationally this objective is central to most regulators’ concerns with respect to asset valuation in wholesale costing exercises. Ofcom, for example, in setting charge controls for the unbundled local loop places particular weight on ensuring its decisions do not harm dynamic efficiency.

> This is because BT (and potentially other CPs [Communications Providers] operating in markets regulated by Ofcom) would be unwilling to make sunk investments in future, as they could not be confident of recovering these costs in charges affected by regulation. For this reason, we allow BT the opportunity to recover the sunk costs of the access network in charges…[5]

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[5] Ofcom (2014), *Fixed access market reviews: wholesale local access, wholesale fixed analogue exchange lines, ISDN2 and ISDN30 – Volume 2: LLU and WLR Charge Controls,* 26 June 2014. Paragraph 3.35.

Ofcom achieves its objectives while using an 'anchor pricing' approach that delivers 'charges [that] are below the full replacement cost of the assets'[6]. Ofcom describes its anchor pricing approach as:

> The price (and quality) of existing services are 'anchored' by the legacy technology, even if the services are provided over the new technology. This approach is intended to give the regulated firm incentives to invest in new technology only when providing services over the new technology would lower its overall costs, or would enable it to provide higher quality services for which consumers are willing to pay.[7]

This indicates that an assumption of less than full replacement cost in asset valuation is appropriate in the context of a largely depreciated access network and is consistent with dynamic efficiency.

In New Zealand Chorus already has incentives to invest in new technology through the subsidised UFB /and RBI initiatives. As such Chorus has limited scope for further copper-based deployment, nor does it have incentives to adopt such a strategy. The terms of the 2011 Network Infrastructure Project Agreement (NIPA) between Crown Fibre Holdings (CFH) and Telecom (now Chorus) include a commitment that Chorus will actively support the Government's UFB uptake objective to maximise connections to the UFB network[8]. As such Chorus has undertaken to prioritise investment in fibre access and uptake while minimising ongoing copper investment in future business plans. This includes specific limitations on Chorus' further copper deployment. In particular Chorus must:

- not build any new copper to the home networks in Chorus' UFB areas
- not deploy any further copper-based cabinets beyond those in the existing cabinetisation programme
- restrict VDSL deployment to sites that existed as at 31 December 2011.

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[6] *Ibid.*

[7] Ofcom (2011), *Charge control review for LLU and WLR services*, 31 March 2011.

[8] Crown Fibre Holdings (2011), *Network Infrastructure Project Agreement, Telecom New Zealand Limited and Crown Fibre Holdings Limited*, 24 May 2011. See Schedule 1.

Thus, although Chorus must maintain its existing network, Chorus' cannot initiate new investment in copper access in its own UFB areas. Indeed, a review of Chorus' published information indicates that relatively little has been spent on copper investment. In the seven months from separation date (1 December 2011) to 30 June 2012 Chorus spent $274 million on fibre assets, representing 79% of total gross capital expenditure[9]. Chorus stated that it had spent $579 million on fibre assets, representing 85% of its capex in the 2013 financial year, with 10% for copper and 5% for common assets[10].

Chorus' published accounts do not provide financial information disaggregated by line of business. Nevertheless the accounts do provide an indication of the rapid increase in fibre cables since separation compared to copper cables (Exhibit 2.1). The other notable feature from the accounts from separation to 2013 is the extent of investment in ducts and manholes. In this regard Chorus states that:

> The 'UFB communal and UFB connections and fibre layer 2' included in 'fibre' capital expenditure was largely capitalised against the network assets categories of fibre cables (35%) and ducts and manholes (56%)[11].

	Net book value (NBV)		*Capex FY 2013*
	1 December 2011	*30 June 2013*	
Copper cables	675	641	48
Fibre cables	298	516	186
Ducts & manholes	388	752	301
Cabinets	226	220	29
Property	277	287	25
Network electronics	331	269	71
Other	16	17	12

Exhibit 2.1: *Net book value as at December 2011 and as at 30 June 2013, capex 2013 by asset category, $ million [Source: Chorus]*

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[9] Chorus (2012), *Management Commentary*, 27 August 2012, see page 14.

[10] Chorus (2013), *Chorus Full Year Result, FY13 26 August 2013*, see page 16.

[11] Chorus (2013), *Management Commentary*, August 2013.see page 11.

As the FPP costing standard includes 'a reasonable allocation of forward-looking common costs' it is logical to infer that Chorus will achieve a reasonable return on its sunk copper assets. The magnitude of the expected return is likely to be higher if the Commission applies an optimised replacement cost (ORC) approach than a depreciated optimised replacement cost (DORC) approach owing to the advanced age of many of the copper assets. In view of Chorus' contractual UFB commitments which have directed its investment strategy since separation it seems unlikely that its returns from regulated copper products will be used to continue to invest in copper as a competitive alternative. It is more likely that the returns will be used to cross-subsidise its investment in fibre. In circumstances where it is certain that there will be no material further investment in the legacy network it is questionable whether it is appropriate to apply even a DORC standard for asset valuation.

Investment incentives for access seekers

The Commission states that it also aims to incentivise efficient build or buy decisions for access seekers, including investment in alternative infrastructure.

> The intention is that an access seeker who has access to more efficient alternatives will choose to build such an alternative rather than purchase the regulated access product. Alternatively, the price will be competed down to the point that the access seeker will purchase the regulated access product. Efficiency overall should be enhanced where this is possible. Likewise, where an access seeker is not more efficient it will purchase the regulated access product, ensuring no inefficient duplication of assets.
>
> For an incumbent considering further incremental investment in its network, this should remain profitable in so far as the incumbent is efficient. For incremental expansion of the network, we have an expectation that the incumbent would be efficient.[12]

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[12] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014. paragraphs 113 to 114.

The Commission contrasts the TSLRIC approach with the Part 4 building block methodology, noting that for the latter 'the primary emphasis is on incentivising efficient investment by the regulated incumbent, not the customers'[13].

In discussing incentives for build or buy decisions, the Commission clearly seeks to promote productively efficient outcomes. In order to achieve this it follows that the modelled price point should reflect the lowest cost technological solution. As we have noted previously[14] this emphasis on the lowest cost technology is an integral part of regulatory definitions for the Modern Equivalent Asset (MEA) concept. For example:

- the Danish regulator considers that the MEA asset must produce the stream of services produced by the existing asset at lowest cost, and 'in cases where the cheapest replacement provides additional functionality or capacity, this should still be the basis for the MEA' with adjustments to allow for either the existing asset or MEA being superior[15]
- the Swedish regulator also emphasises selection of MEAs with the lowest cost in order 'to create neutral incentives for infrastructure investment'[16].

Implicit in this approach is the efficiency incentives provided for the access provider in the delivery of regulated services with existing technology and with the potential adoption of the alternative modelled technology. The investment behaviour of a cost-minimising access provider using legacy technology may be expected to change over time as it would eventually choose to adopt the newer more efficient technology. However, in New Zealand Chorus is already deploying a fibre network, with the aid of Government subsidies. As such no incentives are required to engender a shift from the legacy technology to the newer more efficient technology. Thus the Commission must focus on ensuring that Chorus has incentives to provide the regulated services efficiently. The effective application of TSLRIC principles should achieve this by ensuring that Chorus is not compensated for

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[13] *Ibid*, paragraph 115.

[14] Network Strategies (2014), *Cross-submission on UCLL and UBA TSLRIC further consultation paper*, 30 April 2014.

[15] National IT and Telecom Agency (2008), *Model Reference Paper*, 18 September 2008. See page 44.

[16] SG-Greffe (2011) D/7587, *Commission decision concerning Case SE/2011/1205: Further details of price control remedies – review of the LRIC model,* 12 May 2011.

inefficiencies. If the yardstick for this is to be a fibre / FWA MEA then the Commission must seek the least cost implementation of this in its modelling.

In this respect it is encouraging that the Commission states that it will adopt TERA's recommendation to model a copper MEA in addition to a FTTH/FWA MEA to identify the least cost alternative.

> Although our UCLL MEA is FTTH, TERA recommends modelling two networks, a copper network and a FTTH/FWA network, and deciding whether or not to make a cost adjustment to our FTTH MEA depending on the results to identify the least cost, subject to section 18 considerations. If the copper cost appears to be higher than FTTH/FWA cost, adjustments are not necessary and the UCLL price is set based on the FTTH/FWA cost[17].

Although the Commission does not mention FWA in conjunction with modelling the copper MEA we assume that its intention is to explore copper / FWA as a cost minimising technology combination rather than a fully copper network.

In the same way that the UFB initiative affects Chorus' investment behaviour, UFB has an impact on access seekers' investment decisions. The Commission is aware that this introduces uncertainties into its FPP process.

> … the migration to fibre is affecting access seekers' investment intentions in a way that means that we cannot be sure that any incentives we attempt to introduce through these pricing reviews in favour of unbundling will in fact lead to unbundling, or will instead simply result in end-users paying more[18].

It is certainly the case that service providers consider many different factors in their forward-looking investment decisions given existing market conditions in New Zealand, and regulatory attempts to influence these through the price mechanism may have unintended consequences. Thus we agree with the Commission's proposal to remain competitively neutral in this regard.

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[17] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014, paragraph 180.

[18] *Ibid*, paragraph 77.

> Our preliminary view is that section 18, and relativity, is best met for UBA by a position of competitive neutrality in respect of unbundling. The UBA price (and the method by which this is constructed under a TSLRIC model) should not independently incentivise or disincentivise unbundling. This will allow for unbundling to occur where it is efficient[19].

Once again the implication is that the TSLRIC model must deliver robust estimates of the efficient forward-looking cost of UCLL and UBA services.

2.3 Predictability and the reasonable investor

The Commission acknowledges that predictability will be difficult to achieve given that:

- this is the first time modelled UCLL and UBA prices will be delivered
- the modelled costs will be the costs of a hypothetical efficient operator rather than Chorus' actual costs
- TSLRIC is 'inherently less predictable than RAB-based regulation' (122).

The Commission states that predictability supports investment, and as such the Commission intends to adopt an approach that takes into account 'reasonable investor expectations'[20]. This will guide the Commission's decision-making both within the modelling process and in its post-modelling price point selection.

> …this concern for investment will influence our choices on the re-use of Chorus' assets and the rejection of a capability-based performance adjustment for the UCLL MEA.
>
> This concern may also affect our consideration of adjustments, if any, to the modelled price either upwards or downwards.[21]

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[19] *Ibid*, paragraph 88.

[20] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014. See, for example, paragraph 80.

[21] *Ibid*, paragraphs 126 to 127.

We agree that regulatory predictability is important in relation to investment. An uncertain regulatory environment can deter investment, particularly where investment projects involve long-term commitments with substantial amounts of capital. Predictability will be served via regulatory consistency, both within the present FPP costing exercise and on an ongoing basis. Although the Commission has not previously modelled TSLRIC UCLL and UBA prices it has previously undertaken relevant efficient cost modelling exercises, such as the modelling in the 2000s for the Telecommunications Service Obligation (TSO). Given that the TSO required the modelling of an efficient access provider, many of the issues traversed in that process remain relevant in the current FPP process.

We doubt that predictability will be obtained by the Commission attempting to form a judgement on what the strawman 'reasonable investor' would expect. To our knowledge this is a new conceptual approach not previously applied by the Commission, and as such immediately fails the regulatory consistency test. Furthermore the Commission does not specify which particular model of expectations should underpin its strawman. In economic theory there are two main candidates: 'adaptive' and 'rational' expectations. Although in the literature there are no universally accepted definitions, in broad terms:

- 'adaptive' investors tend to rely solely on historical experience as a predictor of future values, learning and adapting their behaviour in response to previous errors
- 'rational' investors consider a much wider range of information relevant to their decisions than historical data.

So which model is more appropriate in the New Zealand context? At the time the Commission announced its final decision on the UBA benchmarked price, some commentators claimed that investors could not have expected this result. However investors were made aware of the change in the regulatory costing principles for UBA in 2011 by Chorus and the possible risks and implications:

> From three years after the Demerger Date, the UBA price will transition to a cost-based pricing methodology. This transition may result in lower regulated UBA prices[22].

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[22] Chorus and Telecom (2011), Share in two journeys, 13 September 2011, section 3.6.3.

A 'rational' investor taking all relevant information into account would be expected in principle to consider the likely magnitude of the price decline by referring to relevant information on UBA benchmarks required for the Initial Pricing Principle (IPP). That the UBA decision was greeted with such surprise in the market suggests that this interpretation of rational expectations may be unsuitable for the 'reasonable investor'. Perhaps this experience signals that the strawman has adaptive expectations? It certainly seems that investors relied heavily on previous pricing decisions as an indicator of future ones, despite the change in the legislated costing basis. This would also imply that the strawman's expectations now in respect to the FPP price will be influenced strongly by the IPP price, as the adaptive strawman will seek to revise current expectations in the light of previous errors in expectations.

With the difficulties in characterising the expectations of a 'reasonable investor' we conclude that the use of this concept to direct modelling choices introduces considerable uncertainty into multiple aspects of the FPP process. As such it would not serve the purpose of fostering predictability. Invariably the introduction of this strawman will lead to disagreement and extraneous debates about exactly what the reasonable investor would expect.

We recommend that the Commission focuses on regulatory consistency, both within the FPP costing exercise and on an ongoing basis, as a means of ensuring predictability. In previous costing exercises the Commission has consistently considered overseas regulatory best practice, its own relevant previous practices and precedents, and relevant local conditions. Leaving definitional issues aside one might anticipate that the 'reasonable investor' would expect the Commission to adopt the same consistent approach in its UCLL / UBA FPP process.

A focus on consistency would also suggest that the MEA for UCLL should also be used for UBA. A UBA price that is based on an alternative MEA to those used for UCLL may give rise to prices that do not reflect a consistent (or feasible) technology platform and risk double-counting or omission of costs.

2.4 Optimised replacement cost

The Commission proposes to use optimised replacement cost in its TSLRIC model with no allowances for re-use of Chorus' existing assets. This decision is apparently based on the Commission's assumption that the reasonable investor would expect that a TSLRIC model would not allow for the re-use of Chorus' existing assets.

> Our view is that there would have been a reasonable expectation that assets would be valued at ORC [Optimised Replacement Cost] under a TSLRIC model. This suggests that having special rules for valuing re-used assets may not best meet the requirements of Section 18[23] .

Indeed the Commission characterises the 'essential feature' of TSLRIC as:

> [setting] prices based on a replacement cost and, therefore, affects both the value of the relevant Chorus copper assets and provides for their upkeep[24].

As we have already noted, we believe it is unwise for the Commission to rely upon assessments of the expectations of a reasonable investor to guide its decisions in relation to the TSLRIC model. A 'rational' investor, for example, may have referred to the European Commission's 2013 recommendation on fixed access pricing which provides the following guidance for LRIC modelling:

> When modelling an NGA [Next Generation Access] network NRAs [National Regulatory Authorities] should define a hypothetical efficient NGA network, capable of delivering the Digital Agenda for Europe targets set out in terms of bandwidth, coverage and take-up, which consists wholly or partly of optical elements. When modelling an NGA network, NRAs should include any existing civil engineering assets that are generally also capable of hosting an NGA network as well as civil engineering assets that will have to be newly constructed to host an NGA network. Therefore, when building the BU [Bottom Up]

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[23] *Ibid*, paragraph 147.

[24] *Ibid*, paragraph 109.

> LRIC+ model, NRAs should not assume the construction of an entirely new civil infrastructure network for deploying an NGA network[25].

The European Commission recommends that asset valuation should recognise that some assets such as ducts and trenches will not be replicated in the competitive process and an ORC valuation would lead to inefficient cost over recovery:

> The reusable legacy civil engineering assets is [*sic*] valued at current costs, taking account of the assets' elapsed economic life and thus of the costs already recovered by the regulated SMP operator. This approach sends efficient market entry signals for build or buy decisions and avoids the risk of a cost over-recovery for reusable legacy civil infrastructure. An over-recovery of costs would not be justified to ensure efficient entry and preserve the incentives to invest because the build option is not economically feasible for this asset category[26].

Given the uncertainties of reliance on anticipated expectations of a 'reasonable' investor, we recommend that the Commission focuses on regulatory consistency by taking into account overseas regulatory best practice and relevant local conditions, together with any relevant previous practices.

So, following overseas best practice it is efficient to include the re-use and sharing of assets in TSLRIC models for costing fixed access, but are there local conditions that might dictate against this? The Commission suggests that in the New Zealand context there are practical difficulties. In particular, there is no mandatory access to ducts in New Zealand which means that it would be difficult to assess whether and on what terms access would be granted. Thus the Commission concludes that it will value assets at ORC, regardless of the possibility of re-using Chorus assets although third party asset use (for example, electricity poles) will be permitted in the modelling. We note that the Commission states that

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[25] European Commission (2013), *Commission recommendation of 11.9.2013 on consistent non-discrimination obligations and costing methodologies to promote competition and enhance the broadband investment environment*, 11 September 2013.

[26] *Ibid*, paragraph 35.

'exceptions that may be appropriate for certain assets'[27] and assume this refers to third party assets.

As noted by the European Commission this approach may lead to inefficient outcomes and over-compensation for Chorus. At the same time we note that the impact of this assumption can be mitigated to a certain extent in the modelling process, for example by assuming very long lifetimes for the assets.

It is clear that it makes economic sense for Chorus to re-use as much as possible its existing legacy infrastructure. Chorus discusses techniques for increasing its re-use of duct in a presentation during a Chorus lab visit in 2013[28] as an evolution from its current distribution mode, namely:

- installing microduct where new duct is required or there is space in existing duct
- installing 'lean' fixed fibre where there is existing duct, but no space for microduct.

Equally the hypothetical operator would seek to use as much existing civil infrastructure as possible in its efficient deployment. The Commission's proposed approach means that a full replacement network is being costed, using an interpretation of the hypothetical operator as a new entrant developing an alternative network in competition with Chorus. In the next section we consider whether this is appropriate in the New Zealand context.

2.5 The hypothetical operator

Following its previous practices in costing exercises, the Commission has indicated that it will take local conditions into account. Accordingly, the Commission must decide upon the choices available to the hypothetical efficient operator deploying a MEA network in New Zealand, or equally what constraints will face the hypothetical operator.

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[27] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014. Paragraph 138.

[28] Chorus (2014), *Building New Zealand's fibre future*, 16 May 2013.

The Commission's consultants point to the UFB and RBI programmes as local evidence that the appropriate MEA is fibre and FWA. While this inference is reasonable, it does not necessarily follow that the hypothetical operator should be constrained in its hypothetical technology deployment options by considerations related specifically to the UFB and RBI. These initiatives represent a form of Government-driven subsidised universal access provision with very specific commitments to be delivered by UFB / RBI service providers. The hypothetical operator building an efficient network cannot be building a UFB or RBI network unless of course subsidies are provided, and therefore arguably included in the model. However the Commission has indicated that subsidies will not be included in the model but may be considered *ex post*:

> while we will not include in the model any subsidy received by Chorus for its RBI contract, we will consider it in our subsequent cost to price analysis'[29].

Prior to the announcement of the UFB initiative, Network Strategies undertook an independent evaluation of the costs of efficient deployment of new fibre in New Zealand[30] with a target to provide 100Mbit/s broadband services for domestic users and 1Gbit/s for commercial users across 75% of New Zealand's population.

We developed techno-economic models examining a number of different deployment models and scenarios, including both a greenfields new entrant with no existing infrastructure and a brownfields utility company using its existing ducts and poles (the 'utility expansion' approach). We assumed different structure costs in the model including traditional ducting (under road, footpath and grass berms); micro-trenching (road, footpath and grass), and overhead. Note that although considerable economies may be gained through use of existing infrastructure for aerial (as opposed to underground) fibre, we did not assume that structure costs of the utility operator were dominated by the use of overhead reticulation. Nevertheless it should be noted that while in urban areas of New Zealand overhead wires are considered undesirable, aerial deployment of fibre is still

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[29] *Ibid*, footnote 110.

[30] Network Strategies (2008), *Broadband Strategy Options for New Zealand, Analysis of possible infrastructure models*, 10 December 2008.

occurring, notably where aerial infrastructure is already in place. For example, we understand that the Northpower fibre deployment is 60% aerial and 40% underground[31].

From our modelling analysis we found that the utility offered the most cost-efficient deployment possibilities. In particular we concluded:

> … that the utility expansion approach has considerable potential for the widespread deployment of high-speed fibre-based broadband networks in New Zealand, similar to the networks in Denmark and Sweden. To be more specific in the New Zealand context, it is the electricity lines companies that offer this potential as these entities have existing resources and infrastructure that offer synergies with the telecommunications business that could ultimately lower deployment costs[32].

It is notable that subsequently two lines companies obtained UFB contracts (Northpower and Ultra Fast Fibre) while the third non-Chorus local fibre company (LFC) is Enable, a council-owned company with access to public infrastructure.

On the basis of our earlier modelling and subsequent observed behaviour it is clear that in New Zealand a hypothetical efficient new telecommunications operator deploying a widespread fibre network is most likely, on balance, to be a lines company (or a consortium of lines companies). In fact with respect to structure costs for the deployment of a new network there are many parallels between Chorus and lines companies in New Zealand. Just as Chorus does not have existing duct available for a whole new fibre network, lines companies would not have existing duct available for a whole new fibre network. However, both Chorus and lines companies do have existing usable civil infrastructure, including ducts.

Given these particular local circumstances the Commission should consider in its assessment of efficient options available to the hypothetical operator the efficiencies that may be achieved in the deployment of fibre both by and through local lines companies. This would have the added advantage of consistency with overseas regulatory best practice

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[31] http://www.nbr.co.nz/opinion/chris-keall/as-first-crown-fibre-laid-northpower-talks-costs-and-partnerships.

[32] *Ibid.*

in that it would not be necessary to assume that an entirely new civil infrastructure network will be constructed.

There are other local issues associated with the constraints on the hypothetical operator that will exercise considerable influence over the outcome of the modelling, but the Commission is silent on these. In particular the Commission does not discuss the degree of optimisation that will be permitted in the modelling in relation to scorching, nor does it yet consider appropriate assumptions for the extent of aerial versus underground plant.

The Commission's stated intention that it will not be constrained by Chorus' historical technology decisions suggests that it should permit a reasonable degree of flexibility in scorching assumptions, but on the other hand it might equally consider that Chorus' existing nodes constitute an intransigent local factor which must be accommodated by the hypothetical operator. Such an approach may severely compromise the ability of the model to deliver efficient forward-looking costs. The key concern is that the definition of scorched node that the Commission applies must deliver efficient outcomes that would occur in practice. Only then will the model provide results that do not distort build or buy decisions.

In the Telecommunications Service Obligation (TSO) modelling the Commission regarded its use of replacement cost in asset valuation as tempered by its scorched node approach.

> In the case of telecommunications and the provision of the TSO services, the Commission believes that it may be appropriate to value assets consistent with replacement cost, after having to some extent optimised the configuration of the TSP's [Telecommunications Service Provider's] network. The Commission considers the costs of an "efficient service provider" to be the costs a provider would incur in providing TSO services using best available technology, but given the location of the TSP's current network nodes. This involves a "scorched node" approach to network configuration[33].

Unfortunately in implementing this the Commission adopted a scorched node interpretation which led to a situation where for a wireless MEA each exchange area was modelled with

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[33] Commerce Commission (2003), *Determination for TSO Instrument for Local Residential Service for period between 20 December 2001 and 30 June 2002*, 17 December 2003. Paragraph 98.

its own base station (even though one base station could have readily served multiple exchange areas), thus inflating the total costs unnecessarily. In other words inefficient wireless design criteria were introduced into the modelling, caused by the judgement that normal wireless planning and design procedures could not be used under the Commission's particular interpretation of the scorched node approach. That this did not occur in practice was evident as Telecom itself served regions comprising multiple exchange areas (or nodes) using a single radio infrastructure rather than the Commission's assumption of duplicating this infrastructure in each exchange area.

2.6 Summary

The Commission anticipates that its proposed approach may lead to higher prices, but that the long term benefit of end-users will be served through avoiding the risk of chilling investment, 'combined with the associated positive externalities and migration efficiencies from the generally higher prices that may result'[34]. To substantiate its claims concerning externalities and migration efficiencies, the Commission relies on Vogelsang's report. We note, however, that Vogelsang provides no substantive evidence of the existence of such externalities and migration efficiencies.

Underlying its expectation of 'higher prices' is the Commission's proposed reasonable investor standard. However, making modelling choices based on an uncertain strawman is fraught with difficulties. The best way to achieve the Commission's objective of predictability is to adopt a consistent approach in deciding upon the choices available to the hypothetical efficient operator. In keeping with its standard procedure this approach should be guided by the requirements of the regulatory costing principle, informed by international regulatory best practice and tailored to the specific conditions that prevail in New Zealand.

As such we recommend that the Commission adopts a consistent approach in all of its decisions relating to the hypothetical operator. If the Commission selects a scorched node (brownfields) approach, then effectively it is placing some constraints on the deployment of the efficient notional new network. It would be consistent, in this case, to assume that all

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[34] Commerce Commission (2003), *Determination for TSO Instrument for Local Residential Service for period between 20 December 2001 and 30 June 2002*, 17 December 2003. Paragraph 86.

structures will not be reproduced. Alternatively should the Commission prefer a greenfields approach it should assume the hypothetical operator faces no sunk assets – that is, the hypothetical network should reproduce all structures and nodes from scratch.

Consistent with overseas regulatory best practice our recommendation is that the Commission should not assume in its model that an entirely new civil infrastructure network will be constructed. We also recommend that the Commission consider in its assessment of efficient options available to the hypothetical operator the efficiencies that may be achieved in the deployment of fibre both by and through local lines companies.

3 Fixed wireless access

In its consultation paper, the Commission explores potential technology options for the selection of modern equivalent assets (MEAs).

> A standard approach to TSLRIC cost modelling internationally is to adopt the concept of a modern equivalent asset (MEA). The MEA concept enables the calculation of costs a hypothetical efficient provider investing today in fixed telecommunications networks would face.[35]

After evaluating various options, the Commission proposes for the UCLL MEA to model FTTH and, 'at the edges of the network' FWA, where the edge of the network are defined by the current and project RBI wireless footprint.

This section examines various issues associated with the use of FWA as MEA.

3.1 Approaches for modelling FWA

The process of incorporating additional MEAs within the cost model can use several different approaches, including the use of wireless caps or an area approach.

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[35] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014, paragraph 150.

TSO modelling: wireless cap

The wireless cap approach was used in the Telecommunications Service Obligation (TSO) cost modelling undertaken by the Commission. Certain wireless options were viewed as potential technology solutions for the wireline TSO service in particular for areas with high TSO costs.

In the 2001/02 TSO Determination[36] Multi-Access Radio (MAR) was viewed as a viable alternative, with around 12 000 TSO services in remote and low line density areas utilising MAR technology. The wireless technology price cap (per line) was calculated as the average annualised cost of providing the MAR service, where costs were based on information provided by Telecom and TelstraClear.

The TSO model identified clusters of customers[37] where the average incremental cost per line exceeded the estimated wireless cap. In such cases the model simply replaced the cost per line for the cluster with the wireless cap, and used its standard approach for estimating TSO net revenues.

For the 2002/03 TSO Determination, a second wireless cap was introduced, based on the wireless local loop (WLL) technology used by Kordia in some Project Probe regions. The subsequent 2003/04 TSO Determination introduced a third wireless cap (MT) based on GSM technology.[38] Where there were multiple caps the TSO model selected the most cost-effective solution.

However, the Commission decided not to apply the WLL and MT caps in the 2004/05 and subsequent Determinations, the caps being assigned arbitrarily high values that had no effect on cost optimisation. The Commission claimed that:

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[36] Commerce Commission (2003),*Determination for TSO Instrument for Local Residential Service for period between 20 December 2001 and 30 June 2002*, 17 December 2003.

[37] It should be noted that the TSO model – which was an adaptation of the Hybrid Cost Proxy Model (HCPM) developed by the United States Federal Communications Commission (FCC) – evaluated costs and net revenues on a per-cluster basis, not a per-line basis. A cluster was defined as a group of customers connected to the same feeder cabinet. Commercial viability for TSO purposes was assessed at the cluster level.

[38] Commerce Commission (2007), *Final Determination for TSO Instrument for Local Residential Service for period between 1 July 2003 and 30 June 2004*, 23 March 2007.

> Only MAR costs have had an impact on the 2003/2004 Determination. Two of these technologies, MT and WLL, are no longer applicable Radio Cap technologies as neither has been effective in the modelling process for 2003/2004.[39]

In fact, the Commission's interpretation of scorching for wireless technologies meant that its cost modelling for the estimation of the WLL and MT caps installed base station infrastructure in each exchange service area (ESA), even though a single base station could provide services to more than one ESA. This inflated costs and essentially caused the WLL and MT technologies to be uneconomic for delivery of TSO services.

Nonetheless the wireless cap was a relatively straightforward process to implement within the TSO model. Unlike the area approach (discussed below) the wireless cap applied a single average cost per line for all clusters. There was no ability to tailor the wireless cap to take into account variation in the characteristics of the clusters that may have an effect on costs. In normal circumstances the use of averages is a reasonable approach, however in this case the focus is on high cost areas, typically with very low line densities, and variations in the cluster characteristics are likely to have a significant effect on costs. As the Commission noted:

> The Commission has identified 201 ESAs with geography appropriate for WLL and has tagged these within the TSO model. A subset of 79 ESA's [*sic*] with similar geography has been identified as being suitable for both MT and WLL technology. The TSO model will select the most cost effective solution to deliver at least the requisite service quality levels For all other ESA geographies, WLL costs are unpredictable, being highly dependent on customer locations[40]

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[39] Commerce Commission (2008), Final Determination for TSO Instrument for Local Residential Telephone Service for period between 1 July 2004 and 30 June 2005, 10 September 2008, paragraph 189.

[40] Commerce Commission (2007), *Final Determination for TSO Instrument for Local Residential Service for period between 1 July 2003 and 30 June 2004*, 23 March 2007, paragraph 218.

Area approach

Cost modellers recognise that the cost of deploying any technology – whether it is wireline or wireless – will depend on the physical characteristics of the geographic location. These characteristics may include factors such as line density and terrain, as well as the location of services and other infrastructure such as roads. Thus the use of a single average cost per line – such as that used in the wireless cap approach described above – may result in only a very rough approximation of costs, especially when there may be dramatic variation in the areas to be covered which would affect the subsequent costs of deployment.

In most circumstances, using average costs over all areas would provide a reasonable estimate of total costs, however those areas where an efficient operator would be likely to deploy FWA will typically be lightly populated. The geography of such areas – and the resultant costs of deployment – will vary dramatically, representing a range of extreme situations. For example, if we consider the differences between the Canterbury Plains and Central Otago it is evident that the use of a single average cost per line is likely to result in a fairly high risk of error.

The ideal approach would be to determine the least cost technology option by modelling the various types of networks for every area within the country. It may be reasonable to identify specific areas, such as those within urban areas or the UFB footprint, as being fibre-only, as this would reduce the amount of computation within the model. In that case the cost optimisation process would only be applied to the remaining areas.

The Swedish case study described below uses a method that is midway between the simple wireless cap and modelling all technologies in all areas. In this instance the average annualised cost was determined for each member of a sample of zones and extrapolated to all zones nationwide. So this particular example would give a more accurate result than the wireless cap approach, as it allowed for better matching of areas to likely costs, but would not be as accurate as modelling both technologies for every area.

Case study: Sweden

The Swedish regulator (Post- och telestyrelsen, or PTS) uses a combination of fibre and FWA as MEA in its fixed network cost model.[41]

The model classifies each of the 7546 zones[42] nationwide into one of five geotype groups (Exhibit 3.1). A zone may or may not include all or part of a 'tätort' – a city, town or village with at least 200 inhabitants. PTS now considers FWA as a potential solution only for geotype 5, with fibre being used for all other geotypes, however prior to 2010 FWA was considered for both geotypes 4 and 5.

	Description	*Definition*
Geotype 1	City	500+ lines/km^2
Geotype 2	Town / Urban	50-500 lines/km^2
Geotype 3	Rural A	5-10 lines/km^2
Geotype 4	Rural B	1-5 lines/km^2
Geotype 5	Sparse	up to 1 line/km^2
Geotype 6	Empty	no lines

Exhibit 3.1: *Geotype definitions within the Swedish model [Source: PTS]*

A sample of 50 zones was selected, and for each zone within the sample, the model estimates the cost of three types of network architecture:

- Option 1: fibre for all network termination points (NTPs) – no FWA
- Option 2: FWA for all residential NTPs (fibre for all business NTPs)
- Option 3: FWA for residential NTPs outside the tätort (fibre for residential NTPs inside the tätort, and for all business NTPs)

This sample includes zones from all geotypes, with ten zones of geotype 5. In all of these geotype 5 zones, FWA (Option 2) proved to be the least cost technology, which was also the case for the nine sample geotype 4 zones (Exhibit 3.2). Note that even in geotypes 1 to

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[41] Post- och telestyrelsen (2013), *Hybridmodell version 10.1,* 16 December 2013.

[42] In version 10.1 of the model.

3 there were sample zones for which FWA or a mix of fibre and FWA (Option 3) was the least cost option.

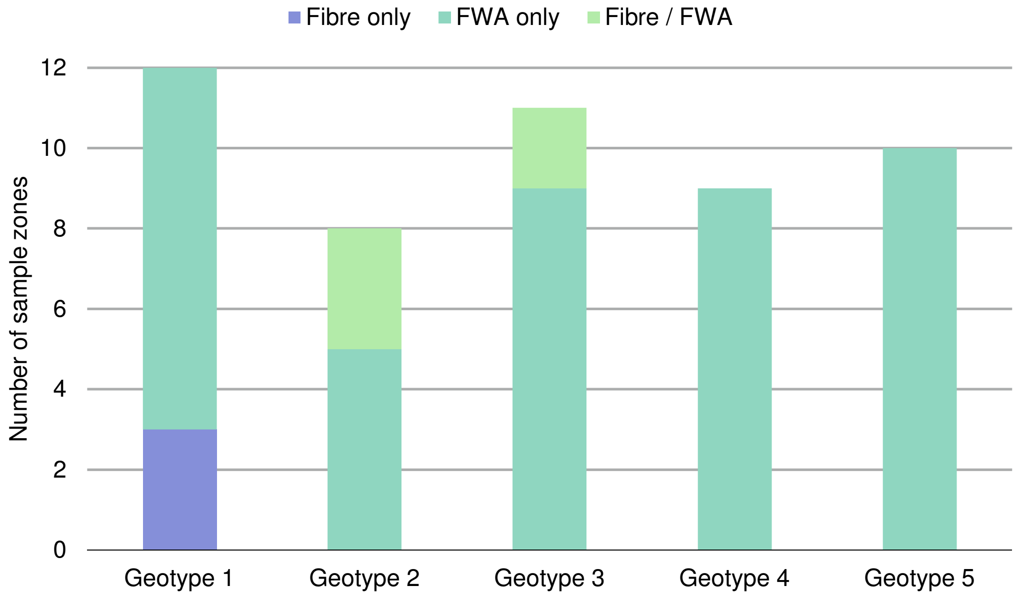

Exhibit 3.2: *Least cost option for sample zones [Source: PTS]*

Within the geotype 5 sample zones, using FWA rather than fibre results in savings of between 93% and 98% (Exhibit 3.3). The model determines the FWA costs for the entire country by extrapolating the annualised costs for the geotype 5 sample zones. Each of the sample zones is assigned a weighting, with the total of the weights being the number of zones. Each of the sample zone costs are then multiplied by the relevant weighting. The total savings achieved by use of FWA in geotype 5 was SEK287 million per year (NZD48 million[43]), or around 6% of the total annualised cost of nationwide fibre.

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[43] Based on 2013 purchasing power parity rates, sourced from the World Bank.

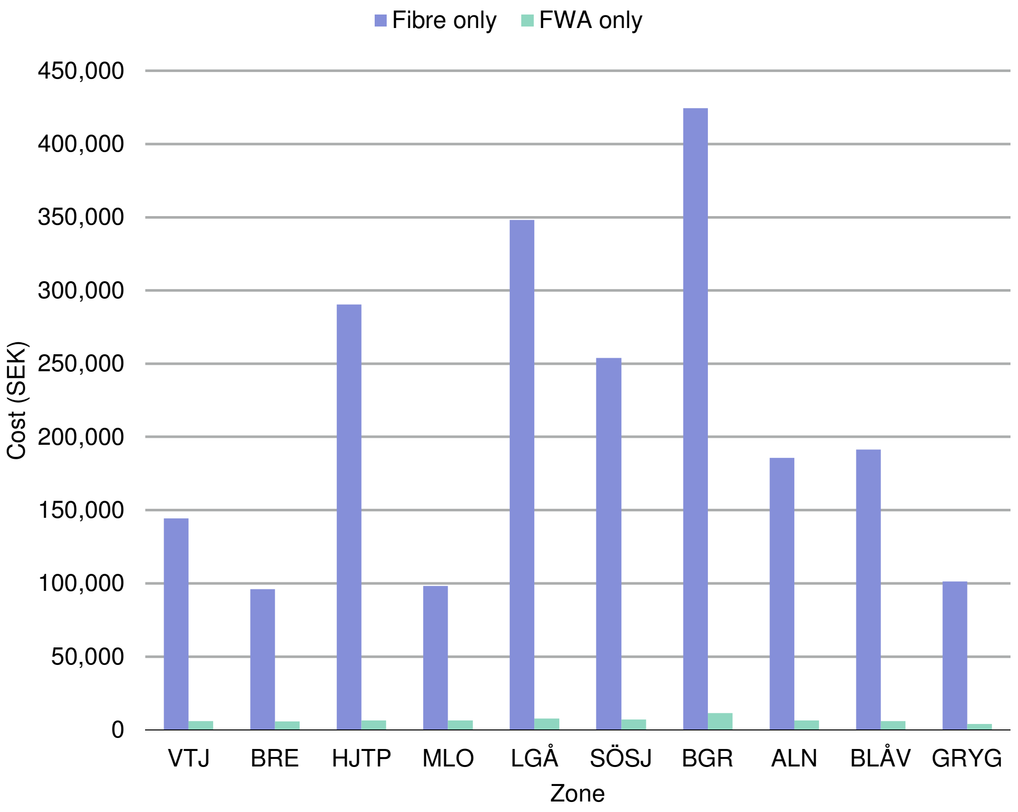

Exhibit 3.3: *Estimated annualised cost of fibre and FWA for the sample zones with geotype 5 [Source: PTS]*

Although PTS considers FWA only for geotype 5, it also proved to be the least cost option for the nine sample zones of geotype 4. Similar savings to those of geotype 5 – 92% to 98% – are achieved by using FWA rather than fibre in the geotype 4 sample zones (Exhibit 3.4). At the national level, savings of SEK749 million per year (NZD125 million) would be achieved by modelling FWA instead of fibre in geotype 4, or around 15% of the cost of nationwide fibre.

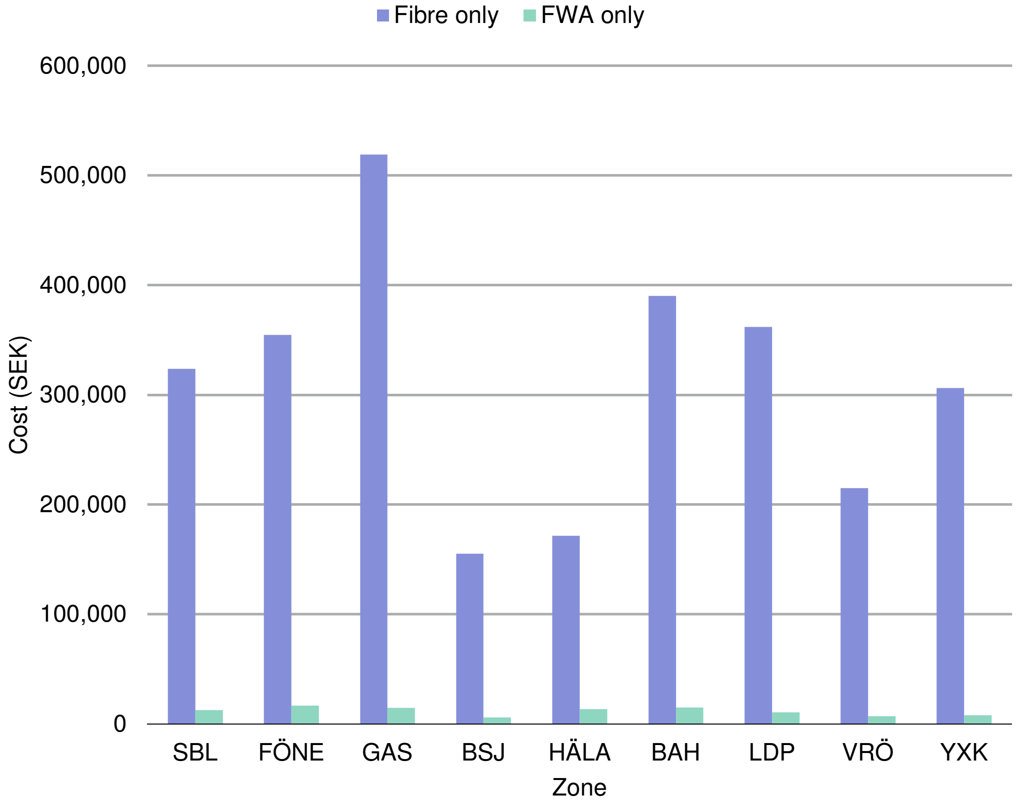

Exhibit 3.4: *Estimated annualised cost of fibre and FWA for the sample zones with geotype 4 [Source: PTS]*

Case study: Spain

In a bottom-up LRIC model for the fixed access network developed for the Spanish regulator (Comisión del Mercado de las Telecomunicaciones, or CMT)[44] the costs of various types of access networks – copper only, fibre-only and combined copper/fibre overlay – are calculated. Around 148 000 services in very remote areas in Spain are delivered via radio access (TRAC). In CMT's model these lines are excluded from the demand for copper and fibre and are thus not included in the estimation of costs for unbundled local loop. The estimation of bitstream costs does include the TRAC lines.

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[44] WIK-Consult (2012), *Bottom-up cost model for the fixed access network in Spain,* reference document, 15 March 2012.

3.2 What geographic area is relevant for FWA?

The Commission has stated that it will use FTTH as the MEA but will model FWA ‘at the edges of the network’ by taking the current and projected RBI fixed wireless footprint. This proposed approach is clearly based on TERA’s advice:

> It is also necessary to define the areas where FTTH and FWA are respectively the MEA for copper/FTTN. Because MEA is defined on the basis of the technology which a new operator deploying a network today would choose…, it is relevant to consider the planned coverage for UFB and RBI. FTTH will cover about 75% of population, corresponding to the UFB planned footprint, while the RBI is intended to will [*sic*] deliver broadband to 252,000 rural households. A large part of the households covered under the RBI will be covered by Chorus extending its existing fibre network and thereby deploying FTTN in the rural areas. The very rural areas where Chorus is not deploying FTTN will be covered by Vodafone deploying FWA. In these areas, the cost of rolling out fibre is so high that an efficient operator would not build an FTTH network there. Therefore, the definition of the MEA suggests that FTTH is not the MEA in these areas where FWA is being deployed, even though it is a superior technology in terms of broadband speed because it is not economically rational.
>
> The areas where FWA is the MEA should correspond to the planned footprint of this technology. It therefore includes the RBI areas where Vodafone is building its FWA network, based on the operator strategy factor. [45]

As TERA notes, the use of FWA in the RBI programme aims to achieve a community coverage target of over 80% of rural (Zone 4) premises at peak speeds of at least 5Mbit/s. Thus implicitly TERA is suggesting that FWA is appropriate for consideration only in relation to Zone 4. Note that the Telecom (now Chorus) Zones are defined in the operational separation undertaking documentation[46]:

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[45] TERA Consultants (2014), *TSLRIC price review determination for the Unbundled Copper Local Loop and Unbundled Bitstream Access services: Modern Equivalent Assets and relevant scenarios*, July 2014, page 37.

[46] Telecom New Zealand (2008), *Telecom separation undertakings*, 25 March 2008.

> Zones 1, 2 and 3 means the Telecom line density zones known as Zone 1, Zone 2, Zone 3a and Zone 3b and generally used by Telecom to describe those urban density areas of New Zealand served by telephone exchanges with a total line count of greater than 500 lines, and which at 30 June 2008 together include not less than 80% of total Existing PSTN Lines.

As part of the operational separation commitments (implemented by 2012), Chorus deployed fibre to the node systems (cabinetisation) providing 10Mbit/s or better ADSL2+ access capability to virtually all lines in the areas that it defines as Zones 1, 2 and 3.

Prior to separation Telecom stated[47] that its own internal zoning criteria (based on typical network costs) do not correspond well with the Statistics New Zealand definitions of urban and rural boundaries. For this reason, it is possible that some areas in Zones 1, 2 and 3 may be designated ‘rural’ using Statistics New Zealand definitions. Lines outside Zones 1 to 3, with the exception of the Chatham Islands, are allocated to Zone 4 (Chorus rural, representing around 20% of lines). Some of Chorus’ suburban exchange area definitions include low population (farming) areas which typically are adjacent to rural urban centres. Furthermore, many Zone 3 areas are not covered by either UFB or RBI.

For example the economic development agency, Enterprise North Canterbury (ENC), considered the implications of both the UFB and RBI for North Canterbury, concluding that the combined effect of the policies would be a pattern of broadband service development ‘partial by location, and varied by quality and capacity’[48]. Its geographic analysis revealed that for many Zone 3 and Zone 4 areas there would be no change in the service standard that existed in 2010 (Exhibit 3.5 and Exhibit 3.6). The relevant service standards were, in general, 10–20Mbit/s (as per the Telecom undertakings, or TUs) for Zone 3 and 5Mbit/s for Zone 4. Although this study was completed in 2010, the agency’s website claims that the analysis remains relevant.[49]

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[47] Telecom New Zealand (2007), *Submissions on UCLL and Co-location draft Standard Terms Determinations*, 29 August 2007,

[48] Enterprise North Canterbury (2010), *North Canterbury Broadband Status Report*, May 2010.

[49] See http://www.northcanterbury.co.nz/NorthCanterbury/Broadband/.

Location / end user	*Telecom zone*	*Relevant policy*	*Service standard as at Dec 2011*	*Proposed service standard over 10 years*
Rangiora				
Businesses	2	UFB	ADSL2+ (10-20Mbit/s)	Fibre to the Premise (100Mbit/s+)
Households	2	UFB	ADSL2+ (10-20Mbit/s)	Fibre to the Premise (100Mbit/s+)
Kaiapoi				
Businesses	2	UFB	ADSL2+ (10-20Mbit/s)	Fibre to the Premise (100Mbit/s+)
Households	2	UFB	ADSL2+ (10-20Mbit/s)	Fibre to the Premise (100Mbit/s+)
Oxford				
Businesses (within township)	3	TU	ADSL2+ (10-20Mbit/s)	No change
Businesses (within 4km of exchange)	3	TU	ADSL1 (up to 5Mbit/s)	No change
Households (within township)	3	TU	ADSL2+ (10-20Mbit/s)	No change
Households (within 4km of exchange)	4	TU	ADSL1 (up to 5Mbit/s)	No change
Woodend				
Businesses (within township)	3	TU	ADSL2+ (10-20Mbit/s)	No change
Households (within township)	3	TU	ADSL2+ (10-20Mbit/s)	No change
Businesses (within 4km of exchange)	4	TU	ADSL1 (up to 5Mbit/s)	No change
Households (within 4km of any exchange)	4	TU	ADSL1 (up to 5Mbit/s)	No change
Balance of district				
Businesses and households (within 4km of any exchange)	4	TU	ADSL1 (up to 5Mbit/s)	No change
Businesses and households (elsewhere)	4	RBI	Dial-up / wireless / satellite	Fast broadband (5Mbit/s) by DSL / wireless / satellite

Exhibit 3.5: *Geographic summary of government policies, Waimakariri District [Source: Enterprise North Canterbury]*

Location / end user	*Telecom zone*	*Relevant policy*	*Service standard as at Dec 2011*	*Proposed service standard over 10 years*
Amberley				
Businesses (within enlarged town area)	3	TU	ADSL2+ (10-20Mbit/s)	No change
Households (within enlarged town area)	3	TU	ADSL2+ (10-20Mbit/s)	No change
Hanmer Springs				
Businesses (within enlarged town area)	3	UFB	ADSL2+ (10-20Mbit/s)	No change
Households (within enlarged town area)	3	UFB	ADSL2+ (10-20Mbit/s)	No change
Balance of district				
Businesses and households	4	TU	ADSL1 (up to 5Mbit/s)	No change
Businesses and households	4	RBI	Dial-up / wireless / satellite	Fast broadband (5Mbit/s) by DSL / wireless / satellite

Exhibit 3.6: *Geographic summary of government policies, Hurunui District [Source: Enterprise North Canterbury]*

This suggests that the relevant footprint for a FWA MEA is considerably wider than the RBI footprint, particularly given the superior performance speeds available through LTE. This FWA MEA footprint should encompass those areas within Zone 3 that are not covered by the UFB.

3.3 Summary

An efficient operator would utilise FWA technology in areas with low line density, reflecting real-life practice. Regulatory cost modelling has also incorporated FWA as an appropriate technology solution: from the Commission’s TSO modelling to the more recent Swedish example where the fixed access models use a combination of fibre and FWA. Such models achieve significant cost savings through the use of FWA, which can have a significant effect on the end result.

The Commission and its consultants do not specify exactly how the models will incorporate additional MEA technologies. Several approaches are possible, however our recommendation is that an area approach be used in preference to a wireless cap as this will ensure that costs better represent the physical characteristics of the areas being modelled. In any case the Commission should seek to select an approach that is appropriate for New Zealand circumstances and delivers estimates that reflect the costs of a hypothetical efficient operator.

Similar to the Spanish case study, we recommend that the cost of MAR lines should be excluded from the estimation of UCLL costs.

4 Sharing

Deployment of fibre access networks is characterised by high fixed costs which are dominated by the costs of civil engineering assets (such as ducts, trenches and poles). Hence in deploying new networks efficient providers often seek to share the existing infrastructure of incumbent operators or other utilities.

4.1 Incentives to share

Sharing of physical infrastructure provides new entrants the ability to access infrastructure of other operators or utilities (including sites, buildings, poles, trenches, towers, ducts and cables) to deploy a network. Infrastructure sharing has many benefits, including[50]:

- reduces capital investments and operating expenditure of re-building/deploying existing infrastructure
- facilitates market entry for new operators, enabling a faster deployment timetable
- optimises the use of resources and has a lower environmental impact than new build
- overcomes local planning issues to encourage network expansion and increase coverage in underserved areas or areas with site access restrictions.

Thus benefits accrue not only to the new entrant, but also to the infrastructure owner (through access arrangements and / or rent) and to consumers (through faster access to new services and a more competitive market).

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[50] International Telecommunication Union (2010), *Infrastructure Sharing: Need, Scope and Regulation,* 31 August 2010 and Fujitsu, *Infrastructure Sharing,* available at http://www.fujitsu.com/uk/services/telecommunications/infrastructure-sharing/.

It has been estimated that 'sharing the incumbent operator's infrastructure leads to 80-90% cost savings over normal network build costs'.[51] A report prepared for Ofcom[52] concluded that

> shared access to infrastructure offers a significant opportunity for cost avoidance versus new build. In the two geotypes modelled (urban and suburban), the upfront fixed costs to a CP [Communication Provider] using duct access were 81 – 84% less than new build. Taking an amortized cost view the saving was lower, but still significant at 34 – 40% of the cost per premises connected, assuming 31% penetration.

4.2 Examples of access sharing

Currently new telecommunication providers share infrastructure with existing operators and/or other utilities in many countries. For example, Openreach in UK permits Physical Infrastructure Access (PIA) to share its duct and pole infrastructure.[53] This allows telecommunication operators to build NGA networks and offer superfast broadband and telephony services to consumers.

The operators frequently use the infrastructure of energy / electricity distribution businesses as these firms typically offer wide coverage and favourable technical conditions. In particular, the glass-based fibre optic cable can be deployed alongside the electricity network with no risk of electromagnetic interference.[54] SA Power Networks in Australia receives requests for access to its electricity network infrastructure from 'telecommunication providers rolling out broadband services or mobile phone equipment'.[55] Gas and drinking water utilities can also share infrastructure using special

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[51] Fujitsu, *Infrastructure Sharing,* available at http://www.fujitsu.com/uk/services/telecommunications/infrastructure-sharing/.

[52] CSMG (2010), *Economics of Shared Infrastructure Access,* 18 February 2010.

[53] Openreach, *Duct and Pole sharing,* available at http://www.openreach.co.uk/orpg/home/products/ductandpolesharing/ductandpolesharing/ductandpolesharing.do.

[54] Analysys Mason (2010), *Operational models for shared duct access,* 1 April 2010.

[55] SA Power Networks, *Access to our assets,* available at http://www.sapowernetworks.com.au/centric/industry/contractors_and_designers/network_information_for_contractors_customers/access_to_our_assets.jsp.

techniques to guide fibre cables in and out of the pipes.[56] Also, as fibre is largely unaffected by water, it can be deployed in canals and waterways and alongside sewerage systems. As an example the Parisian sewer network in France shares its space with telecommunication providers, thereby avoiding expensive and disruptive civil works.[57] There are many countries, including Portugal[58] and the United States[59], which have a well-defined regulatory framework for infrastructure sharing on a non-discriminatory basis.

In Sweden, infrastructure sharing with other utilities is encouraged, and in some instances mandatory under local law.[60] The Swedish fixed access model (described in Section 3.1), incorporates assumptions related to sharing with other utilities, including cable TV, electricity and water, as well as other telecoms operators (Exhibit 4.1).

Geotype	*Description*	*% of route km shared with*	
		Cable TV	*Electricity, water and other operators*
Geotype 1	City	75.3%	28%
Geotype 2	Town / urban	19.1%	28%
Geotype 3	Rural A	1.7%	28%
Geotype 4	Rural B	0.0%	28%
Geotype 5	Sparse	–	28%

Exhibit 4.1: *Infrastructure sharing assumptions – percentage of route km shared with utilities [Source: PTS]*

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[56] Analysys Mason (2010), *Operational models for shared duct access,* 1 April 2010.

[57] Global Telecoms Business (2011), *Infrastructure sharing is France's FTTH route, says regulator Philippe Distler,* 29 December 2011.

[58] ANACOM, *Electronic communications law*, available at http://www.anacom.pt/render.jsp?categoryId=333113.

[59] Federal Communications Commission, *Telecommunications Act of 1996,* available at www.fcc.gov/telecom.html.

[60] PTS (2013), *Dokumentation av hybridmodell v.10.1*, 16 December 2013, page 28.

4.3 Sharing in New Zealand

While trenching costs for placing fibre to premises can often be reduced or avoided by using existing ducting, in New Zealand much existing copper access (distribution) cable is direct buried (without duct). As a consequence opportunities for sharing with Chorus duct will not always be available.

It should be noted however that the hypothetical efficient operator to be modelled is not competing with Chorus – it is a substitute for Chorus, and thus the issue of sharing with Chorus may be largely irrelevant.

In New Zealand the networks of the lines companies offer considerable economies of scale and scope. In this respect the LFC Northpower has presented an excellent example of infrastructure sharing while building its UFB network. Utilising its existing electricity service infrastructure Northpower saved more than 50% of costs[61]:

> By using our existing infrastructure (lines Network), Fibre cables can easily be run with our powerlines directly into people's homes at less than half the cost of what Telco's [*sic*] would have to pay to develop the infrastructure, and with very little visual impact.

Thus where Northpower deploys aerial fibre it uses the same poles as the electricity service line. However where the existing electricity service line is already underground, the fibre service line is installed underground.

Northpower commenced fibre deployment in Whangarei prior to the UFB initiative, then successfully won the UFB tender for Northland and in 2014 completed its UFB deployment. In a competitive response to the pre-UFB Northpower fibre deployment Telecom (then a vertically integrated service provider) opted to bring forward its scheduled cabinetisation programme in Northland.

Key considerations for infrastructure sharing in New Zealand are the terms of the Resource Management Act (1991) which require compliance with local district plans and hence local council consent. We understand that Northpower has worked closely with the local council

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[61] Northpower, *Our Next Generation Fibre Optic Network*, available at http://northpower.com/network/fibre_optics/our_fibre_network.

throughout its fibre deployment to understand and respond to council requirements. Conversely the council has sought to improve the commercial viability of the fibre network, through reducing administrative costs and where possible reducing barriers to fibre deployment within the region.

It should be noted that in recent years considerable attention has been devoted by stakeholders to the issue of facilitating broadband deployment across New Zealand, including attempts to streamline council requirements in respect to telecommunications infrastructure and better co-ordination of civil works. The New Zealand Utilities Advisory Group led the development of a National Code of Practice for Utility Operators' Access to Transport Corridors. The Code is a legislated requirement under the Utilities Access Act 2010 and governs access to transport corridors, managing utility access to road and rail. However although the Code may facilitate access to existing infrastructure, it does not mandate it.

CFH clearly anticipated sharing of existing infrastructure in its UFB build to achieve economies. Although in general CFH considers that UFB deployment is to be underground, in addition it envisages the use of existing electricity poles in UFB deployment. On its website CFH also states that the UFB deployment partners are:

> …open to a number of techniques which could reduce the cost and increase the efficiency with which UFB is deployed. This could include use of existing infrastructure such as water and sewerage pipes.[62]

Indeed Chorus is already involved in infrastructure sharing. In the Greymouth area Chorus is using poles from the lines company Westpower to deploy aerial infrastructure for the UFB.

> The Greymouth fibre network will be a mix of underground and aerial cabling, and using Westpower's existing poles means we can minimise the disruption to the community that digging up roads and footpaths would otherwise bring...

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[62] http://www.crownfibre.govt.nz/.

> Westpower's enthusiasm for the project has enabled us to bring forward our use of aerial network from FY15 and is a model that we hope to replicate in other areas as the rollout programme continues to gain momentum.[63]

Sharing assumptions for the TSO

In its TSO modelling the Commission incorporated assumptions relating to the level of sharing with another operator or utility. Exhibit 4.2 shows the assumptions used for the 2004/05 Final Determination[64] (more recent information is not publicly available).

Density	*Buried*	*Underground*	*Aerial*
0	100%	100%	100%
5	100%	100%	100%
100	100%	100%	100%
200	100%	100%	50%
650	100%	100%	50%
850	100%	70%	50%
2550	100%	70%	50%
5000	100%	70%	50%
10000	100%	55%	35%

Note: Percentage of infrastructure that is used by the telecom operator; the remainder is shared with another utility or operator.

Exhibit 4.2: *Infrastructure sharing assumptions used for TSO Final Determination in 2004/05 [Source: Commerce Commission]*

In the 2001/02 Final Determination the Commission quotes TelstraClear as noting:

> …an efficient operator rolling out a network to provide TSO services will employ significant aerial structure and will pursue opportunities to share infrastructure.[65]

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[63] Chorus (2013), *Ultra-fast broadband on the horizon for Greymouth*, media release, 17 December 2013.

[64] Commerce Commission (2008), *Final Determination for TSO Instrument for Local Residential Telephone Service for period between 1 July 2004 and 30 June 2005*, 10 September 2008, Table 34.

[65] Commerce Commission (2003),*Determination for TSO Instrument for Local Residential Service for period between 20 December 2001 and 30 June 2002*, 17 December 2003, paragraph A1.80.

4.4 Summary

In many countries infrastructure sharing is used by telecommunication providers as it has multiple advantages, including significant cost savings along with minimal disruption and optimal use of resources. Civil engineering represents the largest costs involved in building a FTTH network. These costs can be significantly reduced if existing infrastructure can be utilised for deploying fibre. Hence an efficient new hypothetical operator will opt for sharing arrangements with existing infrastructure owners wherever possible rather than duplicating expensive engineering assets.

In New Zealand it is clear that infrastructure sharing is already occurring in UFB deployment, primarily using the existing assets of lines companies. We would expect a hypothetical efficient operator in New Zealand to seek access to the civil infrastructure of the lines companies and other utilities in order to avoid inefficient asset duplication.

5 Terrain and trenching

5.1 Why is terrain important?

A significant proportion of costs for a fixed access network is due to trenching. Key drivers of trenching costs are labour, the type of trenching (for example duct or direct buried) and the nature of the terrain. Trenching in hard rocky ground is more expensive than through sandy soil. Thus we observe in many regulatory cost models the use of a variety of trenching costs associated with different types of terrain, ensuring that the model results are a more accurate representation of the costs of the hypothetical operator.

A key input to many regulatory cost models is information about the distribution of different types of terrain over the geographic area being modelled, together with the associated costs of trenching. For example the Swedish fixed access model (described in Section 3.1), has twelve different types of terrain for street trenching and poles for the purposes of costing (Exhibit 5.1). In addition, the associated costs also vary by geotype – for example, trenching in asphalt/tarmac is more expensive in geotype 1 than in geotype 5. The mix of terrain types by geotype is input to the model, and so the resultant costs reflect the nature of the terrain in each geotype.

Type	*Terrain*
Trench H	Asphalt / tarmac Large stones, eg slabs Small stones Tunnelled, eg under a road Bare rock
Trench S	Forest / woodland Earth or grass Earth/grass – ploughed cable
Poles	Poles over earth / grass Poles over hard surfaces
Surface	Duct on surface, eg at road / railside
Underwater	Cable laid in river, lake or sea (24 pair cable)

Exhibit 5.1: *Terrain used for street trenching and poles within the Swedish fixed access model [Source: PTS]*

5.2 Data sources for New Zealand

Landcare Research has a number of environmental databases available for New Zealand. S-Map is a recently available soil spatial information system that may have suitable data to derive terrain information for fixed access modelling. Exhibit 5.2 illustrates the type of information[66] available from this system. This map shows the depth to a layer that makes augering or digging difficult.

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[66] Available from http://smap.landcareresearch.co.nz.

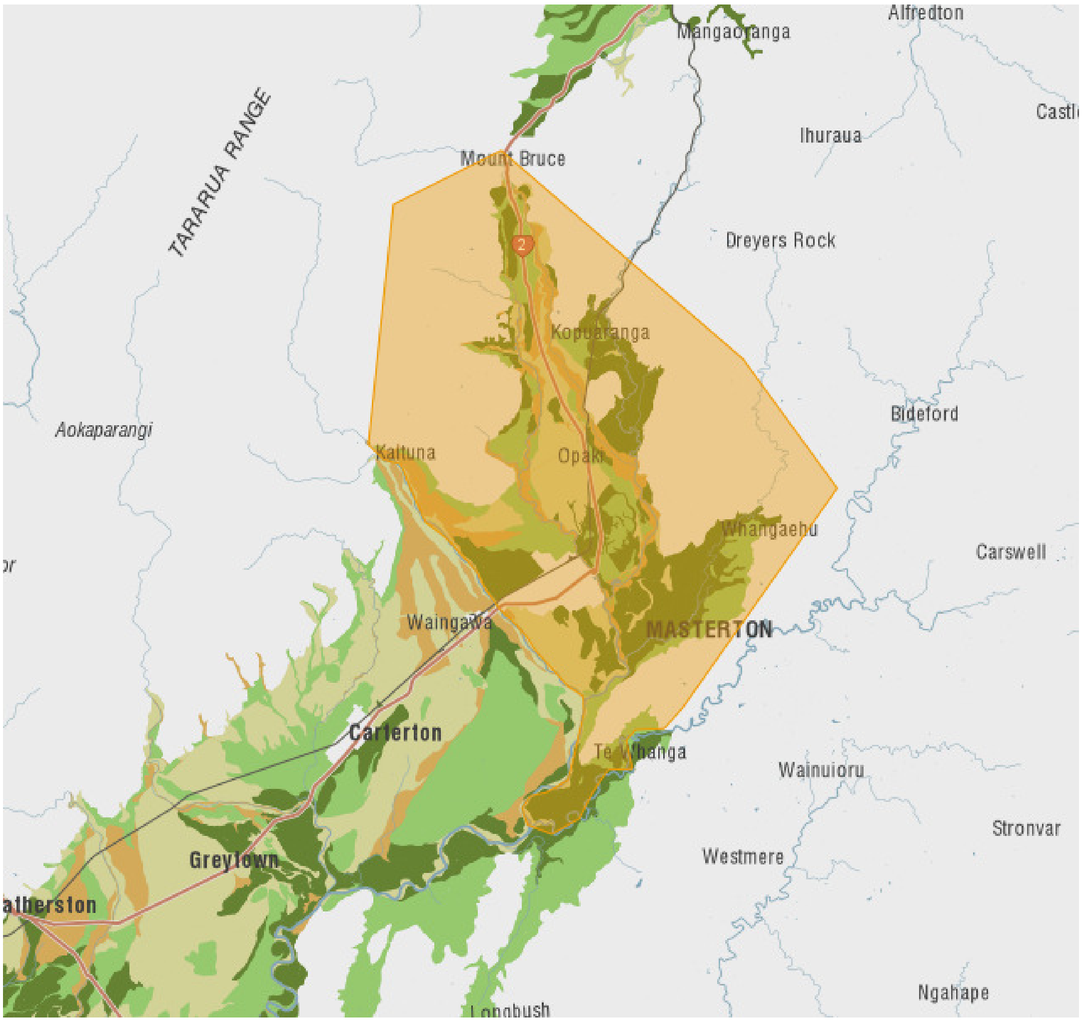

Exhibit 5.2: *Dominant (shallowest) depth to hard soil/gravel/rock for the Masterton region [Source: Landcare Research]*

S-Map reports that less than one-fifth of the shaded area in Exhibit 5.2 – which corresponds to the Masterton local authority – is classed as having very shallow soil (Exhibit 5.3). Note that further detailed information on soil types – such as texture type, stoniness and drainage class – is also available. Note that several characteristics – not just soil depth – would be required to assess and categorise trenching costs.

	Description	*Area (ha)*	*Share of total area (%)*
Depth	Depth > 100cm	7,440	38%
Moderately Deep	Depth between 45 and 100cm	4,500	23%
Shallow	Depth between 20 and 45 cm	4,480	23%
Very Shallow	Depth < 20cm	3,330	17%

Note: Share of total area does not add to 100% due to rounding.

Exhibit 5.3: *Soil depth to hard soil / grovel / rock for Masterton local authority area [Source: Landcare Research]*

Such a system would provide independent and consistent information on terrain, however note that S-Map does not yet have full national coverage.

5.3 TSO approach

Terrain information was used by the Commission in its TSO modelling, with areas being classified into three types – easy, medium or hard. This classification was based on information supplied by Telecom. Even at the time, it was acknowledged that there were problems with this data:

> Telecom has acknowledged [in the Commerce Commission terrain workshop conducted on 5 May 2004] that this dataset may not be reliable, and geophysical expert, David Bell, has previously argued that the data tends to overstate trenching difficulty in New Zealand – that is, it is skewed towards the medium to hard end, whereas in reality the easy end is the more appropriate for rural New Zealand.[67]

Field studies conducted at the time illustrated significant discrepancies with the data used by the Commission (Exhibit 5.4). Note that any comparison of the TSO terrain classifications with those provided by S-Map should be done with extreme caution without a careful mapping of the characteristics of the S-Map data with those of the TSO

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[67] Network Strategies Limited (2004), *ESA field study results*, public version, 13 August 2004.

classifications (also note that the Masterton ESA in the table below will not match the Masterton local authority area of Exhibit 5.3).

	Commission out-of-town probabilities			*Bell-Ducat out-of-town probabilities*		
ESA	*Easy*	*Medium*	*Hard*	*Easy*	*Medium*	*Hard*
BLI, Blairlogie	30%	50%	20%	80%	20%	0%
CU, Cust	80%	20%	0%	97%	3%	0%
DRF1, Darfield 1	0%	50%	50%	88%	7%	5%
DRL, Dargaville	70%	20%	10%	91%	9%	0%
MS, Masterton	30%	45%	25%	90%	9%	1%
OX, Oxford	55%	35%	10%	86%	4%	10%
TN, Tinui	40%	35%	25%	65%	20%	15%
WE, Waimate	60%	30%	10%	77%	18%	5%
WKU, Waiuku	20%	77%	3%	84%	16%	0%
WFD, Wellsford	60%	30%	10%	91%	5%	4%

Exhibit 5.4: *Commission and Bell-Ducat trenching difficulty probabilities **[**Source: Commerce Commission, D Bell and R Ducat**]***

We have undertaken a relatively broadbrush assessment of the TSO terrain classification for four ESAs against S-Map data. This assessment is only approximate, as we do not have access to the ESA boundaries used for the TSO, and our evaluation is based only on soil depth together with a selection of characteristics of the main soil type (all areas have a mix of soil types). A more robust assessment would require access to the ESA shape files and also consider other soil features – in particular this would enable a more robust assessment weighted across the various soil types within the area. Note that Chorus recommends that trenches should be 45cm below finished ground level, which can be reduced to 30cm if the lead-in is under permanent material.[68]

Cust Soil depth is a mix of moderately deep (45-100cm) and shallow (20-45cm). Main soil type:

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[68] Chorus (2012),*Contractors' Information: Installing underground telecommunications lead-ins for urban premises*, and *Contractors' Information: Installing underground telecommunications lead-ins for rural premises.*

- no hard or soft rock within 1 metre
- no significant stony layer within 1 metre.

Commission’s TSO out-of-town probabilities may be reasonable.

Darfield

Soil depth mostly shallow (20-45cm), with some moderately deep (45-100cm). Main soil type:

- no hard or soft rock within 1 metre
- shallow depth to a stony layer.

Commission’s TSO out-of-town probabilities may over-estimate the hardness of the terrain.

Masterton

Soil depth a mix from deep (over 100cm) to very shallow (less than 20cm). Main soil types:

- no hard or soft rock within 1 metre
- no stony layer within 1 metre, or moderately deep to stony layer.

Commission’s TSO out-of-town probabilities may over-estimate the hardness of the terrain.

Oxford

Soil depth mostly shallow (20-45cm) with some moderately deep (45-100cm). Main soil type:

- no hard or soft rock within 1 metre
- shallow depth to a stony layer.

Commission’s TSO out-of-town probabilities may over-estimate the hardness of the terrain.

Waimate	Soil depth moderately deep (45-100cm), with some shallow (25-45cm) and deep (over 100cm). Main soil type: • no hard or soft rock within 1 metre • no significant stony layer within 1 metre. Commission's TSO out-of-town probabilities may slightly over-estimate the hardness of the terrain.

The lack of hard and soft rock in all these areas suggests that the Commission's assessment may be an over-estimate of the hardness of the terrain – however a more complete assessment would require a thorough examination of all soil types within the areas.

5.4 Summary

Our recommendation is for the Commission to utilise an independent and consistently defined data source to assist in the derivation of trenching costs. While this type of analysis was previously undertaken for the purposes of TSO costing, at that time there was no national source of terrain data, and so the Commission was obliged to work with the subjective estimates provided by Telecom.

Given the problems associated with the TSO terrain information – as well as the relatively coarse granularity of data when compared with other international examples, such as the Swedish case study described above – we recommend that the Commission explore the use of data from Landcare Research.

6 Backdating

In regard to backdating the UCLL and UBA FPP prices, the Commission has stated that it is not required to backdate its pricing review determinations, but has discretion to do so.[69]

> In particular, any decision to backdate will need to be demonstrably efficient.
>
> Likewise, a backdated sum payable to the access provider (either as a lump sum, or "smoothed"), or a backdated price reduction in favour of access seekers would need to demonstrably promote competition in a way that is likely to directly benefit end-users.[70]

The challenge of backdating a forward-looking price is that the price is no longer forward-looking at a past moment in time. An efficient forward-looking price set in 2013 would differ from one set in 2014 as the data that informs the estimation of a forward-looking price changes over time, and it would be extremely difficult to create a consistent set of inputs that reflected a prior forward-looking view, particularly if the backdated period spans several years.

Alternatively backward extrapolation of a forward-looking price could be attempted however this would be extremely challenging, as the Commission would have little guidance on what sort of trend would be applicable for efficient prices. In addition, this would create industry uncertainty and may indeed have a negative impact upon competition, and indeed on the broadband market.

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[69] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014, paragraph 298.

[70] *Ibid*, paragraph 299.

If operators incur additional costs through backdating, the implication is that these costs may subsequently need to be recovered from retail customers, which could have a constraining effect on take-up, or even stimulate migration to fibre.

If backdating was to occur, we cannot see how the Commission could ensure that the prices would be efficient, nor that there would be no detrimental effect on competition.

7 Annuity tax adjustment

In Attachment A of its consultation paper, the Commission discusses a potential approach for deriving a tax-adjusted annuity charge.

> We propose to provide for tax costs in the TSLRIC price by deriving a tax-adjusted tilted annuity charge for each type of asset modelled. In addition to taking into account the relevant asset lifetime and asset price inflation rate, each tax-adjusted tilted annuity charge will take into account a diminishing value tax depreciation rate appropriate to that type of asset.[71]

We note that this approach differs from that used by the Commission for the Telecommunications Service Obligation (TSO), where a pre-tax analysis was applied. The Commission stated that:

> … in that [2007/08 TSO] period that at least 62% of the TSO asset base is comprised of trenching cost. The Commission also noted at that time that a significant proportion of the trenching costs were civil works which are non-depreciable with the remainder of the trenching costs relating to ducts conduits and manholes attracting a tax depreciation rate of 4.8%.[72]

At that time, the Commission noted that although regulatory proceedings in other sectors used a post-tax approach, for the TSO a pre-tax approach was considered appropriate.[73] In

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[71] Commerce Commission (2014), *Consultation paper outlining our proposed view on regulatory framework and modelling approach for UBA and UCLL services*, 9 July 2014, paragraph 258.

[72] Commerce Commission (2009), *Draft TSO Cost Calculation Determination for TSO Instrument for Local Residential Telephone Service for period between 1 July 2008 and 30 June 2009*, 4 December 2009, paragraph 63.

[73] *Ibid*, paragraph 64.

the case of the TSO proceedings the post-tax WACC was grossed up by the corporate tax rate to obtain the pre-tax WACC.

Nonetheless, this example also illustrates that different assets can be treated differently for taxation purposes. In the New Zealand taxation regime this is typically handled with diminishing value taxation depreciation rates.

There is no single ‘best’ method for adjusting for tax, or the use of real or nominal costs. These decisions are influenced by modelling choices. The Commission has stated that it proposes to set a TSLRIC price that is constant in nominal terms, in which case it has two fundamental modelling options:

- all costs within the model to be nominal
- all costs within the model to be real, and the results converted to nominal terms.

If the former option was to be used, then as well as costs, other parameters such as the WACC must be represented in nominal terms, while the second option most likely requires a real WACC. The Commission does not explicitly state in its consultation paper whether its model will be in nominal or real terms.

With regard to the treatment of taxation within the model, there are two potential approaches:

- incorporate in the model cashflows an allowance for taxation, and use a post-tax WACC
- use a pre-tax WACC.

We would recommend the use of the latter approach, due to the difficulty of modelling a taxation component within cashflows.

It is unclear to us as to the Commission’s intention as to the handling of taxation, in addition to its reasoning for the proposed formula for a tax-adjusted annuity charge. The Commission suggests:

$$a_{it} = \mathrm{PMT}(WACC_{real}, n) \times Adjustment_i$$

where:

- a_i is the tax adjusted tilted annuity factor for the ith asset type (real capital recovery factor)
- PMT() is the payment function in Microsoft Excel
- n is asset life
- $WACC_{real}$ is the real post-tax cost of capital
- $Adjustment_i$ is the adjustment to the pre-tax annuity factor.

Note that the Excel PMT() function has a minimum of three parameters, with the omitted parameter being the present value (or principal).

However, the Commission then appears to define the term $Adjustment_i$ in nominal terms, by the use of the nominal WACC:

$$Adjustment_i = \frac{\left(1 - \dfrac{t \times d_i}{d_i + WACC_{no\min al}}\right)}{(1-t)}$$

where:

- t is the corporate tax rate
- d_i is the diminishing tax depreciation rate for the ith asset type
- $WACC_{nominal}$ is the nominal post-tax cost of capital.

While it is unclear as to the Commission's reasoning behind this formula, we note that tax is paid in nominal terms, not real terms, and this may be underpinning the Commission's intention. In its fixed access services final determination the Australian Competition and Consumer Commission (ACCC) notes that:

> All tax liability calculations, including the tax asset value roll-forward, were undertaken in nominal terms.[74]

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[74] Australian Competition and Consumer Commission (2013), *Inquiry to make final access determinations for the declared fixed line services*, July 2011.

In our view the Commission's formula for a_{it} therefore appears to mix both nominal and real terms and thus does not accurately represent a real capital recovery factor.

However, it is also clear that the Commission is attempting to incorporate within the adjustment the ability for different assets to have differing taxation treatments, as discussed above.

Furthermore, we need to understand key fundamentals of the Commission's cost model, namely the use of nominal or real costs and the treatment of taxation, in order to provide appropriate comments on any proposed adjustments.

8 Concluding remarks

In modelling UCLL and UBA costs, the Commission will achieve its objective of predictability by adopting a consistent approach in deciding upon the choices available to the hypothetical efficient operator. Following its standard procedure the Commission should be guided by the requirements of the regulatory costing principle, informed by international regulatory best practice and tailored to the specific conditions that prevail in New Zealand.

In our consideration of the options available to the Commission we noted that a number of local conditions will be relevant. In particular the implications of the Government-subsidised UFB and RBI programmes should be considered for both investment and the circumstances of the hypothetical efficient operator.

As the Commission recognises, the incentives provided through these initiatives make it very difficult to predict assess seekers' investment intentions and the extent to which the results of the UCLL / UBA FPP process will affect investment decisions. At the same time it is clear that Chorus has undertaken no material investment in extending the legacy copper network since the commencement of the UFB programme, and any such further investment is unlikely in view of Chorus' existing UFB commitments.

Regulatory best practice is to ensure that the method of asset valuation in estimating cost-based prices will provide for the maintenance of existing assets and for delivering new capacity. This implies that in Chorus' case regulated costs based on costing a full replacement network will lead to inefficient outcomes. An assumption of less than full replacement cost in asset valuation is appropriate in the context of a largely depreciated access network that is no longer being extended, and this assumption is consistent with dynamic efficiency considerations.

The Commission's primary focus, then, should be on ensuring that Chorus has incentives to provide the regulated services efficiently. This means that, using the hypothetical operator construct, care must be taken to establish an efficiency standard that is appropriate in local conditions.

Annex A: Current and future characteristics of wireless technology

TERA has specified that FWA:

> …is designed to provide 21 Mbps downstream and 5 Mbps upstream peak speeds. The minimum throughput per FWA customer is 45 kbps. This is based on a maximum number of FWA customers per cell site, and in general, customers get a better speed…..When comparing the different access network technologies it appears that FTTH, HFC, FWA and mobile are able to theoretically provide the same or higher downstream/upstream capacity compared to copper/FTTN.

TERA's discussion is based on the current FWA services being provided in New Zealand 'through the 3G HSPA+ technology operating in the 900 MHz band'. TERA also acknowledges that Vodafone is installing LTE equipment on RBI sites and will be able to deliver 4G LTE services using spectrum blocks acquired in the 700MHz auction. This would mean Vodafone (and other operators) can provide 100Mbit/s downstream and 40Mbit/s upstream peak speeds. As we are modelling an efficient hypothetical operator we would expect it to deploy the latest 3G and 4G technology available.

Superior speeds and efficiencies can be achieved by FWA (and mobile) networks by adopting the latest technologies, such as HSPA+ Advanced and LTE Advanced as well as implementing MIMO techniques.[75] Exhibit A.1 shows the main features[76] and the expected

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[75] Qualcomm (2012), *Rising to Meet the 1000x Mobile Data Challenge,* 20 September 2013.

[76] Nokia Siemens Networks (2012), *Long Term HSPA Evolution meets ITU IMT-Advanced requirements.*

dates of commercial deployments of some 3G and 4G technologies defined under Releases 8-11.[77]

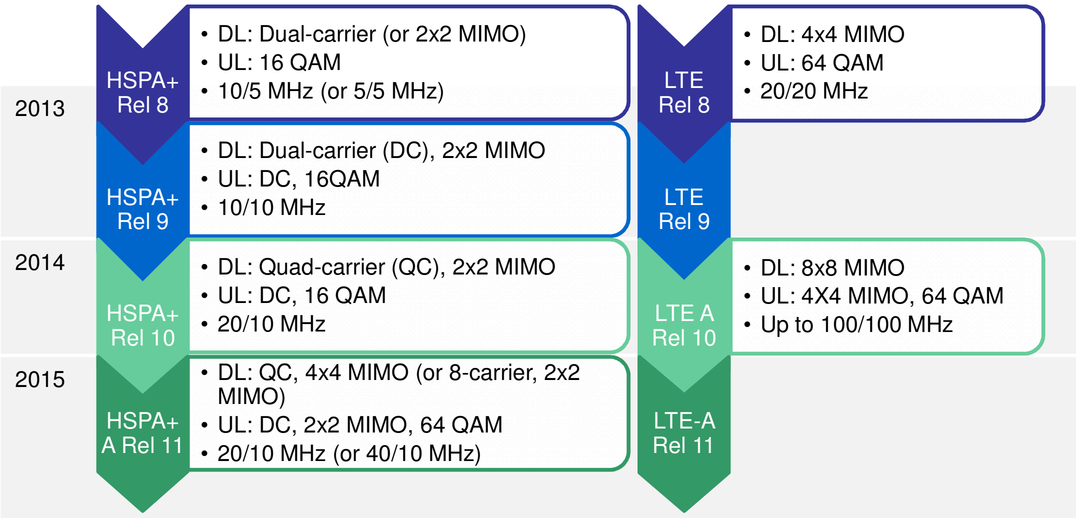

Exhibit A.1: *Evolution of 3G and 4G technologies [Source: Qualcomm[78] and Network Strategies]*

The advanced technologies are spectrally more efficient as they implement enhanced MIMO techniques and support wider bandwidth.[79] They also enable different spectrum holdings across multiple bands – including both paired and unpaired – to be combined in order to improve capacity. Exhibit A.2 shows the maximum speed (in Mbit/s) and peak spectral efficiency (in bit/s/Hz) of some 3G and 4G technologies for downlink.[80]

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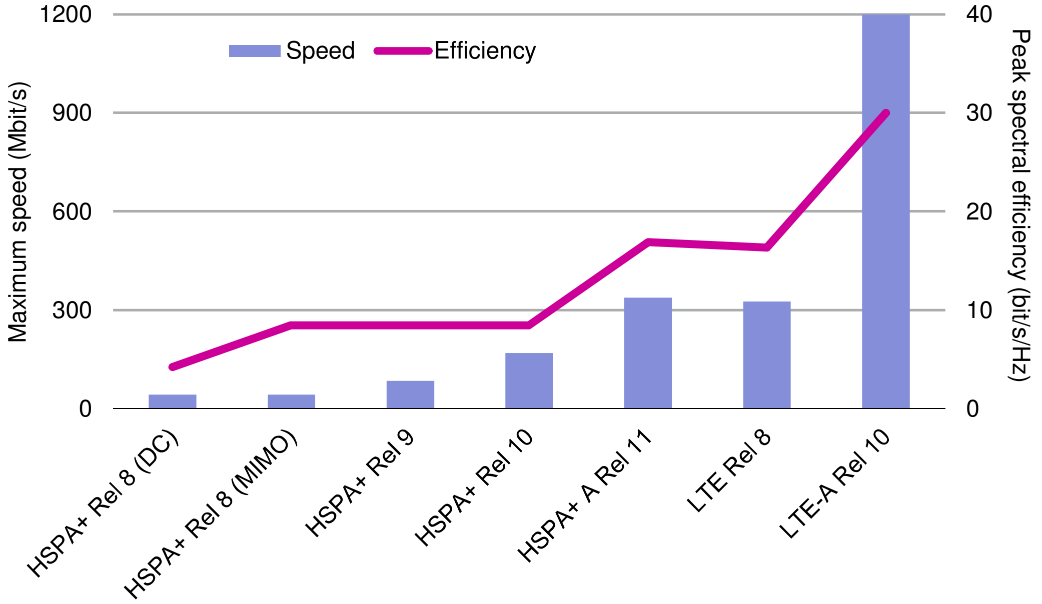
[77] 4G Americas (2012), *Mobile Broadband Acceleration in the Americas,* December 2012.

[78] Qualcomm (2013), *Technology Roadmap with Spectrum Update,* April 2013.

[79] Rysavy Research/4G Americas (2012), *Mobile Broadband Explosion,* August 2012.

[80] Qualcomm (2013), *HSPA+ R7, R8, R9 and R10,* May 2013 and Rysavy Research/4G Americas (2012), *Mobile Broadband Explosion,* August 2012.



Note: LTE-A Rel 10 values are for 40/40MHz spectrum and higher speeds can be achieved with carrier aggregation (up to 100/100MHz spectrum)

Exhibit A.2: *Maximum speed and peak spectral efficiency for downlink [Source: Network Strategies]*

LTE Advanced has already been commercially deployed in many countries (including South Korea, France, Hong Kong, United Kingdom and the United States) and its popularity is expected to increase rapidly.[81] In addition, a number of compatible mobile devices have also been launched.[82] Though the customer uptake/adoption of MIMO devices to support the advanced technologies is still in progress, the existing technologies can also achieve better speeds with carrier aggregation.[83] Hence FWA certainly has the potential to achieve high speeds and its technological performance is expected to improve significantly as advanced technologies are deployed and compatible devices are available/adopted widely.

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[81] 4G Americas (2014), *Launches of Release 12 LTE-Advanced Could Hit 40 by YE2014,* 16 June 2014.

[82] Android Authority (2013), *Samsung officially announces the Samsung Galaxy S4 LTE-A,* 26 June 2013 and ZDNet (2013), *Apple, SK Telecom to unveil LTE-A iPhone 5S,* 2 July 2013.

[83] 3GPP (2012), *LTE-Advanced,* available at http://www.3gpp.org/lte-advanced.

The operators in New Zealand have recently acquired bands in the 700MHz (digital dividend) spectrum which has provided opportunities to adopt newer technologies. With additional spectrum the existing and new operators can provide superior performances on FWA networks compared to what is currently achieved in New Zealand. In fact the efficient hypothetical operator considered for the FL-LRIC model is expected to achieve much better speeds than copper/FTTN as it is likely to adopt latest commercial technologies for FWA.