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Assessment of Type II asymmetric risk for Chorus’ fibre network

Chorus

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1. Introduction

1. In its 19 November 2019 "Fibre input methodologies: Draft decision – reasons paper" (the "Draft Reasons Paper"), the New Zealand Commerce Commission (NZCC) proposes to provide a 10 basis point allowance to provide compensation for "type II asymmetric risk".

2. Type II asymmetric risk can be characterised as asset stranding risk: it is the risk that technological change or competitive entry/expansion results in an inability for the firm to earn a competitive return over the lifetime of its assets. It is asymmetric in the sense that there is a downside from such an event occurring, but no offsetting upside if such an event does not occur.

3. This allowance is derived using the "exponential decay" model of asset stranding developed by Dixit and Pindyck that the NZCC has previously used in relation to assessing type II risk for gas pipeline distribution businesses (GPBs) and for Chorus' copper network as part of the final pricing principle (FPP) process.

4. The NZCC's application of the model in the present context has three inputs:

   a) the "probability of stranding";

   b) the "% of regulatory asset base (RAB) which may be stranded"; and

   c) the timeframe over which the preceding two parameters are measured.

5. The impact of assumptions concerning the probability of stranding and the percentage of the RAB which would be stranded is demonstrated by Table 3.14 of the Draft Reasons Paper. A higher probability of stranding and/or a higher % of the RAB subject to stranding risk both result in a higher allowance.

6. The NZCC reaches the 10 basis point allowance based upon an assessment that:

   a) There is at most a 10% chance of asset stranding in the next ten years, broadly because the main risk of stranding from fixed-mobile substitution via 5G is low, due to low likely substitution between wireless and fixed networks, the incumbency advantage of local fibre companies (LFCs) in New Zealand, and delay in delivering 5G spectrum;

   b) At most 40% of the RAB will be subject to stranding, due to various mitigating factors, which essentially relate to the ability of Chorus to continue to utilise and earn revenue on the stranded assets;

   c) Applying these inputs to the NZCC's application of the exponential decay model, the increment to the WACC to account for stranding risk lies in the range of between 5 to 40 basis points; and

   d) The NZCC then considers that a point at the low end of the range should be selected, based on the various mitigating factors that led it to choose the 10% probability/40% of the RAB. Accordingly, the NZCC selects 10-basis points as the appropriate allowance for Type II asymmetric risk.

7. We have been asked by Chorus to prepare a report that reviews the NZCC's methodology for estimating the ex-ante stranding allowance.

8. In summary, we consider that:

   a) It is important to jointly consider the categories of assets within the RAB that might be stranded, and their probability of stranding. The NZCC does not take this approach, and its application of the exponential decay model implies that 60% of the RAB is attributed a zero probability of stranding. However, there are likely to be different parts of the network which are subject to differing (and non-zero) stranding risks and therefore probabilities;

b) In particular, the risk of stranding arising from fixed-mobile substitution is concentrated at the very edge of Chorus' network i.e., the "fibre lead-in". If these assets are stranded by mobile substitution, they will no longer be used, and therefore no revenue will be earned by these assets except in the circumstances where that premise returns to a fibre connection in the future;

c) As Chorus' RAB is yet to be determined, we do not know what proportion of the RAB the lead-in accounts for. Using illustrative figures for the RAB, as used by the NZCC in the Draft Reasons Paper, and public information on Chorus' capex spend, suggests a figure of 29% of the RAB, though this is an overstatement as it includes layer 2 equipment.[1] The Commission will be able to refine this estimate as part of its work on setting the price quality (PQ) path and determining the opening RAB;

d) We consider that the NZCC has likely understated the impact that 5G will have on this stranding risk over the 10 year period starting in 2023 given:

    i) The risk of 5G becoming a viable economic substitute for fixed fibre broadband;

    ii) Limited incumbency advantage to Chorus given that the RSPs own the retail relationship and the incentives of mobile network owning RSPs to bypass Chorus; and

    iii) Delays in spectrum availability that are unlikely to extend beyond 2022-2023;

e) A more plausible estimate is therefore likely to be in the range of 10-20% with this risk being concentrated at the edge of Chorus' network (the fibre lead-ins);

f) However, this does not imply that the other assets in the RAB have a zero probability of stranding. Importantly, parts of the RAB may be at risk due to unbundling or fixed network bypass. While these risks are likely to be much smaller (in a probability sense) than fixed mobile substitution, they are unlikely to be zero. Based on an assessment of probabilities of stranding for the remaining asset categories that make up the RAB (set out in more detail later in our report), we have performed an illustrative/"back of the envelope" calculation of the overall stranding allowance which gives a range of approximately 31 to 87 basis points (compared to the NZCC's range of 5 to 40 basis points);

g) Our illustrative calculation should not substitute for a more detailed analysis of Chorus's actual RAB, once it has been established. Once the initial RAB has been set, the NZCC will be able to perform a similar exercise with much more accuracy and granularity than we have attempted to achieve using public data;

h) The NZCC has in other contexts (i.e. when estimating the cost of capital and conducting international benchmarking) considered that an appropriate starting point is the mid-point of a range, and then considers whether there are any reasons to deviate from this mid-point. In the present circumstances we do not consider there are any valid reasons for deviation from the mid-point, particularly when considering risk related to the fibre lead-in; and

i) Taking the mid-point of our illustrative calculation gives an ex ante allowance to account for Type II asymmetric risk of 59 basis points. As already noted, the NZCC will be able to perform this calculation with more precision once the RAB has been determined.

[1] Specifically, this is the "UFB connections and fibre Layer 2" capex category contained in Chorus's annual reports.

9. The remainder of this report is set out as follows:

   a) Section 2 describes the concept of type II asymmetric risk, the NZCC's model/approach to compensating for it and the previous instances where the NZCC has used this model;

   b) Section 3 sets out that proper application of the model involves assessing the probability of stranding for individual assets or asset categories, rather than adjusting the output of the model for the "% of the RAB that would be stranded"

   c) Section 4 applies the stranding allowance model to Chorus, including an overview of Chorus' RAB and assessment of the impact of fixed-mobile substitution, unbundling and fixed network substitution on Chorus' RAB;

   d) Section 5 provides an illustrative calculation of the stranding allowance based on the analysis of the preceding sections and public data to proxy Chorus' RAB; and

   e) Appendix A describes our illustrative calculations of the proportion of Chorus' RAB made up by different asset categories.

2. The Commission's approach to Type II asymmetric risk

2.1. Type II asymmetric risk explained

10. An asymmetric risk is a risk that a firm faces in which its returns are affected in one direction, without any offsetting impact on its returns in the other direction. For example, a firm may face a certain downside from a specific action or event, without there being any offsetting upside from the counteraction (or vice versa). Regulation introduces these risks by capping the upside of return distribution at the weighted average cost of capital (WACC).

11. The NZCC distinguishes between two categories of asymmetric risk: type I and type II ([3.1288]). Type I risks relate to infrequent events with the potential for large losses, such as natural disasters and terrorist threats. Type II risks arise from events such as the threat of technological change, competitive entry or expansion. These type II risks can lead to assets become stranded; for example, where technological change or changes in competition lead to insufficient demand for a firm to earn a competitive return on its assets. Accordingly, type II asymmetric risk can be characterised as asset stranding risk.

2.2. The Dixit and Pindyck/NZCC model

12. The NZCC uses an approach to quantify an *ex ante* allowance to allow for the risk of asset stranding that is based on a model set out in Dixit and Pindyck (1994),[2] supplemented by some of the NZCC's own calculations. The Dixit and Pindyck approach considers how the value of an asset is affected by its depreciation path.

13. Dixit and Pindyck discuss a model referred to as the "exponential decay model". In this model, the asset's lifetime follows a Poisson process,[3] where if an asset has lasted to time T, there is some probability given by λdT that the asset will fail in the next increment of time dT.

14. The parameter λ is known as a "hazard rate" or "death rate". This is the instantaneous (and conditional) probability of failure i.e., the probability that an asset will fail between time T and $T + dT$, conditional on prior survival to time T.[4] Put another way, at any given point in time, this is the probability that the asset will instantly die. To give an analogy, if $\lambda = 50\%$, this is equivalent to a coin toss occurring at every time increment dT, where the asset dies if the coin lands on heads or continues for another period if the coin lands on tails.

15. The hazard/death rate can be related to the *cumulative* probability of failure (Q) (i.e., the cumulative probability that the asset will fail by time T) using the following equation:[5]

$$Q = 1 - e^{-\lambda T} \qquad (1)$$

16. Since λ is a probability, its value always lies between zero and one. For large values of T, it can be shown that the value of Q is always greater than the value of λ. This makes sense intuitively: the cumulative probability that an asset has failed by time T is likely to be greater than the probability that it will fail in some small increment of time dT. Returning to the coin toss example, T=10 is

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[2] Avinash Dixit and Robert Pindyck (1994), *Investment Under Uncertainty*, Princeton University Press.

[3] In broad terms, a Poisson process is a random process in which an event (e.g., an asset becoming stranded) occurs randomly but at a certain rate (or probability) per unit of time.

[4] See John C. Hull (2012), *Options, Futures, and Other Derivatives*, Eighth Edition, Prentice Hall, Boston, at p.522.

[5] Hull (2012), *op cit.*, at p.523. The NZCC also refers to this equation at paragraph [5.174.1]. NZCC, *Fibre input methodologies: Draft decision - reasons paper*, 19 November 2019, p. 559, para. 5.174.1.

equivalent to 10 coin tosses. Using equation 1, there is a 99% probability that having done 10 coin tosses, at least one of them would have landed on heads. That is, with an 50% chance of the asset dying in a given year,[6] there is a 99% cumulative probability it will have died by year 10.

17. Dixit and Pindyck show that, in the exponential decay model, the expected value of the annuity A that dies with probability λ over time period dT is given by:

$$\mathrm{V} = \frac{A}{\delta+\lambda}$$

where δ is the discount rate (in this case, the WACC).

18. From this point the NZCC sets out the following calculations.[7] Where A is a constant, the NZCC shows that $d\lambda = d\delta$.[8] That is, an increase in the hazard/death rate causes a directly proportional increase in the WACC. The NZCC also notes that, in starting with no stranding risk (i.e., $\lambda = 0$) then it must be that $d\lambda = \lambda$, and therefore:

$$\lambda = d\delta \qquad (2)$$

19. By substituting equation (2) into equation (1), the NZCC obtains:

$$Q = 1 - e^{-d\delta T}$$

20. Re-arranging this equation, the NZCC finds that the WACC increment to account for stranding risk is:[9]

$$d\delta = -\frac{\ln(1-Q)}{T} \qquad (3)$$

21. Equation (3) shows that the increment to the WACC is purely a function of the cumulative probability of failure (Q) and the timeframe over which that cumulative probability is measured (T).

2.3. The NZCC's previous and current application of the model

22. In Table 2.1 below we summarise the NZCC's recent use of the Dixit and Pindyck model outside of the Fibre IMs.

[6] Assuming that dT is equal to one year.

[7] These are set out in the NZCC's spreadsheet accompanying the Draft Reasons Paper. NZCC, *Fibre IMs draft decision WACC calculations spreadsheet 19 November 2019.xlsx* in the "ex-ante compensation" worksheet, 19 November, 2019.

[8] We note that this follows by calculating $\frac{dV}{d\lambda}$ and $\frac{dV}{d\delta}$ and showing that they are equal, which implies $d\lambda = d\delta$.

[9] We note that the NZCC's spreadsheet presenting the quantification that underlies Table 3.14 incorrectly describes the WACC increment as being calculated as $d\delta = \frac{\ln(1-\lambda)}{T}$, i.e. the instantaneous death rate (λ) appears in place of the cumulative probability of failure (Q)), and a negative sign is missing from the right-hand side of this equation. The calculations in the NZCC's spreadsheet, however, appear to correctly use Q and incorporate the negative sign.

Table 2.1
NZCC’s previous application of exponential decay stranding model

Decision	Timeframe		% of RAB		Probability of stranding	
Copper FPP[10]	Various (14 and 50)	Economic life provided by Chorus used for assets	100%	No explanation	Various (14% - 47%)	Implied by difference in economic and engineering life used
GPBs during 2016 IM review[11]	5-25 years	Range used as an illustration to cross-check beta uplift.	100%	No explanation	2-9% depending on timeframe	Implied cumulative probabilities for different time frames calculated as cross check on asset beta uplift of 0.05.
Airports during 2016 IM review[12]	10 years	Used as an illustrative cross check on 1% WACC increment proposed by Airports.	100%	No explanation	10%	Implied cumulative probability for 1% WACC increment proposed by airports if 10 year life is assumed.

23. The table above illustrates that rather than using the model to *estimate* the allowance the NZCC has previously used the model as a *cross-check* on:

    a) The impact of using economic asset lives that are shorter than an asset’s technical life;

    b) Type II asymmetric risk allowances proposed by submitters; and

    c) Its own estimates of the beta uplift for systematic stranding risk.

24. In addition, in these instances the model has generally been applied assuming the *entire* RAB is stranded.

25. In contrast, for fibre, the NZCC is now proposing to use the model to directly estimate the allowance for Type II asymmetric risk. Furthermore, the NZCC is adjusting the *output* of the model[13] to allow for situations where the entire RAB is not stranded. Specifically, the NZCC takes the allowance for a given probability of stranding and multiplies it by “the % of the RAB which may be stranded”.

26. Focusing on line loss due to fixed mobile substitution, the NZCC argues that the proportion of the RAB subject to stranding risk is between 10% and 40% [3.1386] and that the probability of stranding is at most 10% [3.1383]. This gives a range of 5 to 40 basis points for the allowance to account for stranding risk. Though having considered a 10% chance of 40% of the RAB being stranded, the NZCC argues for a point at the low end of the range and reaches a draft decision to set a 10 basis point allowance [3.1387]. Based on Table 3.14 of the Draft Reasons Paper, this is equivalent to assuming a 5% chance of a 20% stranding (10.3 basis points) or a 10% chance of a 10% stranding (10.5 basis points). The selection of a point at the low end of the range is largely on the basis that the

[10] NZCC, *Further draft pricing review determination for Chorus’ unbundled copper local loop service*, Further draft determination, 2 July 2015, p. 255, para. 1362.

[11] NZCC, *Input methodologies review decisions - Topic paper 4: Cost of capital issues*, 20 December 2016, p. 111, para. 431.

[12] NZCC, *Input methodologies review decisions - Topic paper 6: WACC percentile for airports*, 20 December 2016, p. 19, para. 71.

[13] I.e., the model itself has not been adjusted for a situation of partial (i.e., economic) stranding, the NZCC is simply taking the output of the model, which assumes *complete* stranding, and scaling that output.

assets in question will still be used and generate revenue, so the full allowance the NZCC has calculated would result in over compensation [3.1388.1]. The NZCC cites this and other “mitigations” [3.1388.2] as its reasons for taking the low end of the range.

3. Appropriate application of the model should consider how risk differs across assets in the RAB

27. As highlighted in section 2.3, the NZCC's proposed approach in the Draft Reasons Paper of adjusting the allowance to account for the % of the RAB which may be stranded is a departure from the way that model has been applied in the past.

28. By scaling the allowance to account for the % of the RAB which may be stranded, the NZCC is implicitly doing either/both of the following:

    a) Applying the Dixit and Pindyck model (which assumes complete "death" of an asset) to a situation where individual assets do not completely die; and/or

    b) Carving out assets it thinks are subject to stranding (40% of the RAB) and applying the full allowance to that subset of assets and applying an allowance of zero to all other assets (60% of the RAB).

29. It is unclear from the NZCC's discussion which of these two approaches it is adopting when it scales the allowance. For example, at [3.1382] when it states that there is a 10% chance of 40% of the asset value being stranded, is it:

    a) treating the RAB as a single asset that might suffer 40% impairment if a stranding event occurs; or

    b) does it consider that assets that comprise 40% of the RAB are subject to complete stranding?

30. If the NZCC is adopting the former approach, then it is not clear this is an appropriate application of the model. The Dixit and Pindyck model assumes that an asset completely dies if a stranding event occurs. By applying the model to part of an asset, this amounts to an implicit assumption that the stranded portion of the asset "completely dies", but the non-stranded portion of the asset faces zero stranding risk. Furthermore, this involves treating the entire RAB, which is made up of many assets that may face different stranding risks, as a single asset, part of which dies.

31. If it is the latter approach, which is the natural interpretation of the Dixit and Pindyck model, this is an explicit assumption of zero probability of stranding to some assets (i.e. 60% of the RAB). Because the ex ante allowance covers the *risk* of asset stranding it functions like an insurance premium. I.e., providers of fixed fibre local access service (FFLAS) are provided an allowance today to compensate them for the chance that they may not be able to recover the value of certain assets later. So even if some parts of the network may be less (and potentially materially less) likely to be stranded in the future, if there exists some non-zero probability of their stranding, then ex ante compensation is still required.

32. Therefore, under either interpretation, the NZCC may be incorrectly attributing zero probability of stranding to a portion of the asset base.

33. Furthermore, the NZCC's description of its logic for the probability of stranding ([3.1382]) and the proportion of the RAB that is subject to stranding risk ([3.1385]) suggests that it is independently, rather than jointly, assessing the probability of stranding and the % of the RAB which may be stranded. Given the risk of stranding is likely to differ for different assets in the RAB, this approach is inappropriate. Instead, to the extent the risk differs and is non-zero across different asset classes, the NZCC should recognize this in its consideration of the stranding allowance.

34. This is dealt with by analysing the probability of stranding with respect to specific asset categories and then aggregating this category analysis to give a weighted average that applies to the entire RAB. That is to say, an individual stranding allowance should be calculated for each asset category as follows:

$$d\delta^i = -\frac{\ln(1-Q^i)}{T}$$

35. Where the *i* superscripts denote that the parameter is specific asset category *i*, where categories could relate solely to functional levels/asset types (i.e. layer 1 vs layer 2) or could also include a geographic element (e.g. "Layer 2 assets in Auckland").

36. These category specific factors would then be aggregated up using the weight of each category in the RAB, to give an allowance that applies to the entire RAB. That is, the allowance applying to the entire RAB would be calculated as follows:

$$d\delta = \sum_{i=0}^{n} \frac{1}{w^i} d\delta^i$$

$$d\delta = \sum_{i=0}^{n} \frac{1}{w^i}\left(-\frac{\ln(1-Q^i)}{T}\right)$$

37. Where w^i is the proportion of the RAB that asset category *i* makes up. In other words, the stranding allowance would be calculated by first estimating allowances for individual categories of assets[14] (assuming complete stranding of that category) and then calculating a weighted average of those individual allowances using each category's weighting in the RAB.

[14] With the categories being either functional (e.g. layer 1 vs layer 2) or geographic.

4. Application of the stranding model to Chorus

4.1. Introduction

38. As the NZCC describes at [3.1378], the risk of asset stranding is of:

> *sufficient end-users leaving the network at some point in the future (or failing to join in the future) such that the revenue requirements are unachievable over time (whether for a network as a whole or in microcosm for deregulated areas).*

39. The NZCC notes at [3.1383] that the "main long-term risk is of line loss from fixed mobile substitution, particularly 5G." It then assesses this risk as being low, which we return to shortly. While this may be the "main" risk, as noted above, a risk not being a "main risk" does not mean it should be ignored when considering type II asymmetric risks. In particular, different stranding risks may affect different parts of the asset base in different ways.

40. In our view, the main stranding risks that Chorus (and the LFCs) face are as follows:

   a) **Substitution to mobile**: consumers "cutting the cord" and going mobile-only or substituting fixed line services for fixed wireless access (FWA) services. This could result in the stranding of both Layer 1 (L1) and Layer 2 (L2) assets;

   b) **Unbundling:** RSPs who unbundle Chorus' L1 network will install their own L2 equipment, which result in Chorus' investments in L2 equipment being stranded; and

   c) **Competition from alternative fixed/satellite networks:** If an alternative network is built that completely bypasses Chorus' fibre access network, this could strand Chorus' L1 and L2 assets.

41. These descriptions focus on the functional levels of Chorus network. However, these risks may vary geographically, to the extent the economics of the competing infrastructure investments also vary geographically. For example, if 5G is only initially deployed in densely populated urban areas, then the risk of stranding due to mobile substitution will be concentrated on assets in those geographic areas.

42. In the remainder of this section we:

   a) Provide a brief overview of Chorus' network and the broad asset classes that comprise Chorus' RAB (Section 4.2);

   b) Discuss stranding due to substitution to mobile and how this might impact Chorus' RAB (Section 4.3);

   c) Discuss stranding due to unbundling and how this might impact Chorus' RAB (Section 4.4); and

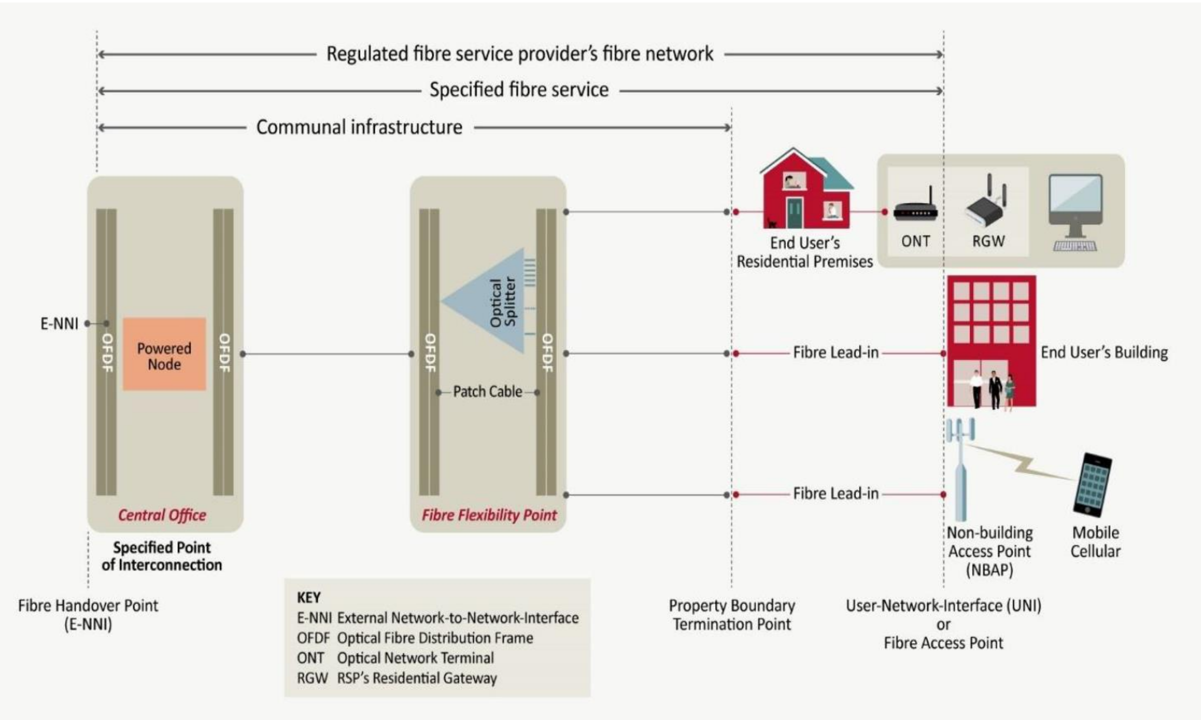
   d) Discuss stranding due to alternative fixed networks and how this might impact Chorus' RAB (Section 4.5).

4.2. Overview of Chorus' RAB

43. The "specified fibre service", which in the present context is FFLAS (the "fixed fibre local access service") involves providing a fibre connection from the end-user's premises to the specified point of interconnection (typically, the "central office").

44. Importantly for present purposes, because the network architecture for residential customers is a point-to-multipoint service, the network has both customer specific and communal infrastructure. The components of FFLAS are shown diagrammatically in Figure 4.1, taken from the NZCC's *Specified Points of Interconnection Reasons Paper*[15], which we have reproduced below.

Figure 4.1: Scope of the regulated fibre service

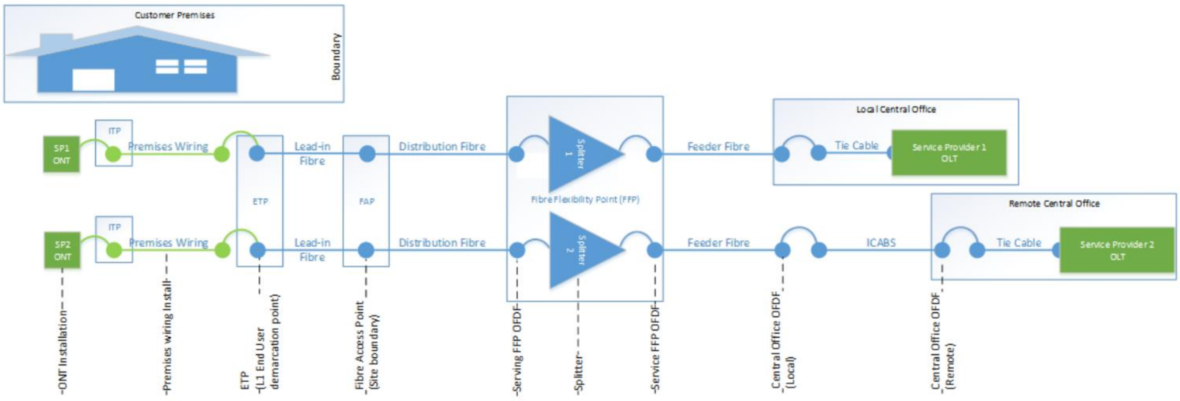


Source: Commerce Commission, *Specified points of interconnection: Reasons Paper*, 19 December 2019.

45. This shows all infrastructure from the central office through to the property boundary is termed "communal infrastructure", so called because the assets in question are used to provide service to multiple end premises. While not demarcated in the diagram, communal infrastructure also comprises both Layer 2 infrastructure (e.g., the OLT) and Layer 1 infrastructure (e.g., the layer 1 feeder fibre between the POI and the FFP and the splitter in the FFP). In the diagram above, customer specific infrastructure is referred to as the "fibre lead-in". This also includes both Layer 1 (the distribution fibre between the FFP and ONT) and Layer 2 (the ONT) infrastructure. The Chorus diagram below, while prepared in the context of unbundling, provides a slightly more granular view of the fibre network.

[15] NZCC, *Specified points of interconnection - Reasons paper*, 19 December 2019, p. 9.

Figure 4.2: Chorus fibre network architecture



Source: Chorus, *Consultation Paper on Layer 1 Unbundling*, September 2018

46. Chorus' RAB is yet to be determined by the NZCC, so there is no concrete information on the proportion of the RAB that will be made up by the communal network and the lead-in. The NZCC will be able to examine this issue (the make-up of the RAB) more granularly once the RAB has been determined, and indeed has effectively acknowledged this at [3.1386] when it states it will have better information once the first PQ path is specified. Building on the categorisation in Figure 4.1 and the asset categories we consider relevant for assessing stranding risk (which will become clear over the following sections), we have split the RAB into the broad categories set out in Table 4.1.

Table 4.1: Overview of FFLAS asset categories relevant for considering stranding risk

Category	Description
Communal L1	Communal L1 assets, i.e. before the property boundary termination point (Splitters, Poles, Ducts, Manholes, Cabinets). Note that this also includes the fibre category, which covers all fibre to property boundary, and thus includes a portion of the distribution fibre, which is a customer specific asset.
Fibre lead-in	L1 assets from the Property Boundary Termination Point onwards.
L2 equipment (excl. ONT)	Layer 2 equipment other than the ONT (i.e. L2 equipment located in the central office).
ONT	The ONT is the layer 2 equipment located on the customer premise
Transport	Backhaul assets used for transport from the central office to the POI.
Other	Property and buildings, IT hardware and software, incentives and the misc. category.

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4.3. Stranding due to mobile substitution

47. The main stranding risk the NZCC considers is line loss due to fixed-mobile substitution. At a high level this will occur if end consumers either:

    a) Switch to **"fixed wireless access" (FWA)** fixed broadband product. In this situation, end consumers would still have a device in their home that provides broadband, but rather than being connected to the fixed fibre network, it would connect to a wireless network. Consumers would connect to this "customer premise equipment" via WiFi or a physical ethernet cable. According to NZCC statistics, in 2018 fixed wireless connections made up 10% of all broadband connections;[16] or

    b) Become **mobile only** and "cut the cord". In this situation, consumers would no longer have a fixed broadband product and instead simply rely on their mobile device data plan for their internet connection.

48. It is also possible converged solutions will result in a mix of the two. For example, if the CPE rebroadcasts the mobile network signal, rather than relying on WiFi or ethernet for consumers to connect to the network. Thus, allowing consumers to have a single plan/connection that gives data at home and on the go.

49. Consideration of stranding risk for the fibre networks due to fixed-mobile substitution requires an assessment of:

    a) How likely is widespread fixed-mobile substitution? and

    b) What assets in the RAB would be affected by widespread fixed-mobile substitution?

50. The first question is the focus of the NZCC's analysis, while the second question is partly addressed in the context of assessing "what % of the RAB would be stranded", which, as already noted, is not the right characterisation of the question.

51. On the question of the likely extent of fixed mobile substitution, the NZCC sets out (at 3.1383]) a number of reasons as to why it considers the likelihood of line-loss to fixed mobile substitution is generally assessed as low. Broadly, these reasons are:

    a) Wireless networks are lower capacity and higher cost than fibre networks and therefore substitution is likely to be low [3.1383.1] [3.1383.4] [3.1383.6];

    b) The incumbency advantage of the LFCs in New Zealand who have achieved a high uptake [3.1383.2]; and

    c) The delay in delivering spectrum that facilitates 5G roll out [3.1383.3].

52. We comment on each of these issues in turn.

[16] Commerce Commission, *Annual Telecommunications Monitoring Report: 2018 Key facts*, 18 December 2018, p.6.

4.3.1. The technical ability of wireless networks to compete with fibre networks

53. As a starting point, we note that the NZCC supports this point, which is effectively that wireless networks are at a technical and cost disadvantage compared to fibre networks and therefore do not represent a significant threat, with references to:

a) an interview with Vodafone CEO Jason Paris discussing data caps limiting substitution to fixed wireless;[17]

b) S&P's May 2018 credit rating for Chorus which describes the risk of fixed-mobile substitution as "low";[18] and

c) the 2011 Grant Samuel advice as part of the Chorus de-merger which noted fixed-mobile substitution was likely to be low.[19]

54. As an initial point responding to these references, before analysing this issue in more detail, we note:

a) Recent statements by Vodafone that it is aiming to have 25% of its fixed broadband customers on fixed wireless in the next 2-3 years[20] and the launch, subsequent to the Draft Reasons Paper, of "ginourmous data plans" for fixed wireless broadband customers of 300 – 600GB;[21]

b) S&P's November 2019 investment guidance on Chorus lists fixed wireless substitution as a "key risk" and describes the risk of fixed wireless substitution as "meaningful".[22] S&P even go so far as to state "We don't currently view Chorus as a utility-like company given nascent wireless substitution risks";[23] and

c) The Grant Samuel report is from 2011 and technology has progressed rapidly since then. For example, the IMT-2020 specification, which outlines the performance characteristics required for what we call 5G was released in 2015[24] and the first full set of standards for 5G (3GPP Release 15) were finalized in 2018/19.[25] That is to say, Grant Samuel's views on the technological characteristics of wireless networks in 2011 are not necessarily relevant in 2020 when the NZCC is setting a regulatory framework that applies from 2022 onwards.

55. As a general observation, the NZCC has not thoroughly tested the potential impact of 5G on the ability of wireless networks to provide a broadband experience that will compete materially with fibre and result in large volumes of customers switching. Ultimately, this is a question of whether the

[17] *Draft Reasons Paper*, para 3.1383.1.

[18] *Draft Reasons Paper*, para. 3.1383.4.

[19] *Draft Reasons Paper*, para. 3.1383.6

[20] "5G paves the way for Vodafone to cut more cables", Stuff, 12 October, 2019. https://www.stuff.co.nz/business/116520997/5g-paves-the-way-for-vodafone-to-cut-more-cables.

[21] "Vodafone launches ginourmous data plans", Scoop, 22 January 2020. https://www.scoop.co.nz/stories/BU2001/S00135/vodafone-launches-ginormous-data-plans.htm. Note that Vodafone's most recent statements

[22] S&P Global Ratings, *Chorus*, 19 November 2019, p. 6.

[23] S&P Global Ratings, *Chorus*, 19 November 2019, p. 2.

[24] "ITU defines vision and roadmap for 5G mobile development", ITU Media Centre, 19 June, 2015. www.itu.int/net/pressoffice/press_releases/2015/27.aspx#.Xhak2yBS9aQ.

[25] "Release 15", 3GPP, 26 April, 2019. https://www.3gpp.org/release-15.

products are economic substitutes and therefore the analysis is similar to what the NZCC conducts when assessing market definition exercises in merger and other competition assessments.

56. In this context, it is important to start by noting that substitutability does not equal "equivalent". That is, two differentiated products can compete with each other without being "perfect substitutes". In more simple terms, mobile broadband does not need to provide an equivalent experience to fibre for the two to be substitutes - what matters is the ability to provide a product that satisfies a customer's demand along the two key product dimensions for broadband: speed and capacity.

57. One (colloquial) way the question of speed and capacity is commonly phrased is, "will a consumer experience buffering when trying to watch Netflix at 9pm?". If this was the only test of substitutability for all broadband customers (it is not), then it would not matter if fibre provides 2-4Gbps download speeds[26] and fixed wireless only provided 100Mbps. What would matter is whether both technologies meet a consumer's demand. In this context it is worthwhile noting that Netflix's recommended speed to watch ultra UD 4K video streams is 25Mbps.[27] In this context it is interesting to note that Optus' recently launched 5G Home Broadband service has no data caps and offers a 50Mbps speed guarantee.[28] Spark's recently announced 5G wireless broadband product allows data caps of up to 600GB per month,[29] well above the average monthly consumption on Chorus' fibre network of 360GB.[30] This simple evidence suggests 5G wireless broadband and fibre broadband might be economic substitutes and therefore mobile substitution represents a significant stranding risk.

58. The picture is of course more complicated: different consumers have different demands with respect to broadband product characteristics, concurrent usage by multiple members of a household renders simple comparisons of the required speeds for Netflix to the promised speed of a connection misleading, and the analysis needs to be forward-looking. Note also that the mobility of a mobile product also has some advantages over fixed products:

a) There is little or no physical installation at a customer's premise, so connectivity can be provided relatively quickly;[31] and

b) The product is portable, which may appeal to transient consumers (renters/students etc.) or for use in holiday homes;[32]

59. That said, the key point we are making is that it is the parallel evolution of consumer demand for speed and capacity and the ability of different technologies to meet that demand is what will determine if wireless broadband is a substitute for fibre broadband. If consumer demand for data continues to grow and the ability of wireless networks to meet that demand in a cost effective manner does not keep pace, then the competitive constraint, and thus stranding risk for the fibre network, will diminish.

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[26] Being the speeds offered by Chorus' recently announced XGS-PON "Hyperfibre" products. See "Welcome to the era of Hyperfibre", Chorus Service Providers, accessed 10 January 2020. https://sp.chorus.co.nz/product/hyperfibre-home/overview.

[27] "Internet Connection Speed Recommendations", Netflix, accessed 10 January 2020. https://help.netflix.com/en/node/306.

[28] "5G Home Explained", Optus, accessed 10 January 2020. https://www.optus.com.au/for-you/broadband-nbn/5g-home-broadband.

[29] "Discover 5G Broadband", Spark, accessed 10 January 2020. https://www.spark.co.nz/shop/internet/5g-plans/.

[30] Chorus, *Q1 FY 20 Connections Update*, 9 October 2019, p.9.

[31] This is less of an issue as the UFB network nears completion, though a physical install is still required the first time a premise is connected.

[32] Assuming that MNOs don't place enforceable geographic limits on where a product can be used.

60. The point remains however that 5G, particularly using high frequency mmWave spectrum, offers a step change in the capacity and speed offered by mobile networks. 4G deployments of fixed wireless are typically targeted at low usage consumers (for example, Spark's 4G mobile plans are capped at 240GB per month and Spark has been actively migrating customers off copper)[33] and therefore could only impact part of the market.[34] However, 5G appears set to change that dynamic. For example, Ovum notes: [35]

> *Trials suggest that 5G-FWA can consistently offer speeds faster than 1Gbps (and in some cases up to 3Gbps), meaning that it can not only outperform the vast base of low-speed connections, but eventually compete head to head with fiber-based products in urban, suburban, and rural locations.*

61. Prominent examples of 5G FWA offers that are targeting what might be termed mass market consumers (i.e., they are not specifically focused on low usage users) are Optus' already discussed 5G home broadband launch, Three in the UK[36] and Verizon in the United States.[37] Of these examples, Verizon is the only one that is currently using mmWave frequencies[38] to deliver speeds comparable to fibre. When describing its product, Verizon states, "You should expect ultrafast internet speeds using the new 5G Home Internet service with typical speeds around 300 Mbps and, depending on your location, maximum speeds up to 940 Mbps".[39]

62. Thus, 5G may change the current dynamic in New Zealand whereby fixed wireless is a niche offering targeting the low usage aspect of the market. This point is acknowledged by UBS in a 6 February 2019 research note which, while stating that the threat of mobile substitution had lessened, noted that:[40]

> *We estimate that the addressable market for wireless broadband is ~250k or 12.5% of total lines. Penetration is currently around 70%.* ***There is a possibility that the size of the market could increase post 2020 following launch of 5G.*** *[emphasis added]*

63. More generally, the NZCC's characterisation that analysts view the risk of fixed-mobile substitution as 'low'[41] may understate the way that analysts are thinking about fixed-mobile substitution:

[33] The terms for Spark's Wireless Broadband plan state "If you have Unplan Wireless Broadband and your data usage exceeds 350GB in a month or 240GB a month for three consecutive months, Spark may change you (at Spark's discretion) to Fibre or a new plan." See "Plans & pricing", Spark, accessed 10 January 2020. https://www.spark.co.nz/shop/internet/plans-and-pricing/.

[34] For example, the press release for Spark's "Upgrade New Zealand" initiative to migrate copper customers onto fibre and wireless states: *"…we are encouraging customers who are low to moderate data users and currently have copper broadband to move onto far more reliable and easy to install wireless broadband technology."* See "Spark launches ambitious Upgrade New Zealand programme", Spark, 2 November, 2016, https://www.sparknz.co.nz/news/upgrade-nz/.

[35] Ovum, *5G Wireless Home Broadband: A Credible Alternative to Fixed Broadband*, 2018, pp. 5-6.

[36] "Home Broadband", Three, accessed 10 January 2010. http://www.three.co.uk/store/broadband/home-broadband.

[37] "5G Home", Verizon, accessed 10 January 2020. https://www.verizonwireless.com/5g/home/.

[38] "What frequency is 5G?", Verizon, 18 November, 2019. https://www.verizon.com/about/our-company/5g/what-frequency-5g.

[39] "Verizon 5G Home Internet FAQs", Verizon, accessed 10 January 2020. https://www.verizonwireless.com/support/5g-home-faqs/.

[40] UBS, *RABa-daba-doo; Upgrade to Buy,* 6 February 2019, p. 15.

[41] NZCC, *Fibre input methodologies: Draft decision - reasons paper*, *op. cit*., p. 385, para.3.1383.

a) The 2019 reports from Forsyth Barr and UBS that the Commission cites directly on this point both appear to consider the near term threat of 5G has lessened.[42] However, the Forsyth Barr report still considers this to be a "key risk" that it will continue to monitor[43] and, as already noted, UBS appear to consider that 5G could alter the addressable market for fixed wireless;

b) Jarden appear to view the threat of mobile substitution as more serious, arguing that competition from FWA should result in the anchor product being removed[44] and stating that:

> *Focus over the next few years will be on the ComCom's implementation of the new RAB framework but network competition could still render this relatively meaningless if fixed wireless competes with fibre for users in a meaningful way in the future (introducing what we perceive as asymmetric risk).*

c) Deutsche Bank's note prior to the release of the draft decision[45] states that bypass by fixed wireless is the "key valuation uncertainty" for Chorus. Deutsche Bank assumes fixed wireless connections will grow to 25% of lines during the first regulatory period as "key mobile players look to monetise their 5G capacity expansions".[46] They do however note that FTTH is likely to emerge as the superior technology in the long term; and

d) As already noted above, S&P's credit rating report following the draft decision describes the threat of mobile substitution as "meaningful",[47] noting that they "…don't currently view Chorus as a utility-like company given nascent wireless substitution risks".[48]

64. This is not to overstate how the investment community is assessing the risk of fixed-mobile substitution; it is clear that some analysts think that the near-term pressure has abated. However, 5G networks are yet to be rolled out in New Zealand (and are only in their infancy overseas), which could change the current dynamics materially, and this is something that is on the minds of investors.

65. There are of course some mitigating factors which may lessen the impact of 5G fixed wireless for Chorus relative to overseas markets, the main one of which is that the fibre network will already be built and have broad coverage. In other markets where there is not a government sponsored fibre roll out, there are likely to be more pockets of consumers where ultra fast broadband has not yet been rolled out yet (the "underserved") that an MNO could target with fixed wireless. Similarly, Chorus may be at less risk than the NBN by nature of the RBI project being separated from the UFB program. This means that compared to the NBN, Chorus' geographically averaged price will not have as great a cross-subsidy between high and low-cost areas that a mobile operator could cherry pick with a fixed wireless offering in the low cost urban areas. Though, as we explore further in section 4.3.2 below, the fact that Chorus is a wholesale only operator and does not have a relationship with end customers works in the other direction, as it might be easier for MNOs to switch their existing customers to a fixed wireless product.

[42] According to Forstyh Barr "Over the past 18 months CNU's share price has rerated, as near-term concern around fixed wireless competition has abated, and uptake of fiber has accelerated and passed 50% where available." Forsyth Barr, *Sticking with a high fiber diet*, 12 March 2019, p. 1.

[43] Forsyth Barr, *Sticking with a High Fiber Diet*, 12 March 2019, p. 11.

[44] "The reality is that it should in fairness be repealed as early as possible. FWA is an appropriate competitive alternative for entry level users which should constrain CNU". Credit Suisse, *RAB model highlights a lot more detail needed*, 19 November 2019, p. 3.

[45] Deutsche Bank, *Squaring the circle*, 15 November 2019, p. 2.

[46] Deutsche Bank, *Squaring the circle*, 15 November 2019, p.2.

[47] S&P Global Ratings, *Chorus*, 19 November 2019, p. 6.

[48] S&P Global Ratings, *Chorus*, 19 November 2019, p. 2.

66. A further technical point to make is that in some sense, the correct comparison is not between fibre networks and 5G wireless, but between 5G wireless and WiFi, given that WiFi may be the primary method by which consumers actually access their fixed internet connection.[49] That is to say, it is WiFi technology, which is slower than speeds achievable over a wired fibre connection, that is the bottleneck which determines the speeds most consumers experience when they access a "fixed" internet connection. For example, a 1Gbps fibre connection that consumers access over a WiFi connection that only has bandwidth of 200Mbps may not, from a consumer experience perspective, perform any better than a 5G FWA connection with average speeds of 300Mbps.

67. Given most consumers are already connecting "wirelessly" to their fixed connections, from an end consumer perspective they are already using a "fixed wireless" product of sorts. This will likely mitigate consumer reluctance to switch to a new technology – unless they cut the cord and go fully mobile, consumers would be using a fixed wireless product where the internet connection is via WiFi, so the end consumer experience is not that different.

68. In summary, the evidence discussed above suggests that:

a) There is a risk that 5G wireless broadband is likely to be a viable economic substitute for fixed fibre broadband, by providing sufficient speed and capacity dimensions that consumers demand; and

b) The NZCC appears to have understated the views of the investment community that the risk of fixed-mobile substitution is low.

4.3.2. Incumbency advantage of LFCs

69. At [3.1383.2], the NZCC notes that the risk of fixed mobile substitution is low, given "The incumbency advantage of the LFCs in New Zealand who have achieved a high uptake." The NZCC does not elaborate on the source of this incumbency advantage. Being an incumbent (and/or having a "high uptake") *per se* does not necessarily confer an advantage. Given Chorus will have already built its network, it may have an incumbency advantage from a sunk cost perspective (i.e. it has already incurred sunk costs that a rival considering building a new operator would not have).[50] However, it's not clear this reasoning applies if the competitors are mobile networks, in that they will be building 5G networks for reasons other than solely to provide fixed wireless broadband (i.e., there are likely economies of scope).

70. Another form of incumbency advantage relates to switching costs/customer inertia. I.e., for whatever reason, customers are "sticky", and it is difficult to get customers to change providers. In the New Zealand market, where Chorus and the LFCs are wholesale-only operators that do not have a direct relationship with customer, it's not clear how material this "incumbency advantage" is, at least compared to other markets where the fixed network operator is also a retailer. I.e., an incumbent fibre operator that is also a retailer and therefore owns the customer relationship might view the threat of alternative networks more benignly than a wholesale only operator who does not own the customer

[49] For example, survey evidence of US adults by Pew Research found that in 2019 the most common way that consumers accessed the internet was using a smartphone. When consumers access the internet at home on laptop or tablet it is also likely they are using WiFi – tablets generally don't have ethernet ports laptops, which are mobile personal computers would be unlikely to be "plugged in" unless they are being used in a fixed location (e.g. a desk). Indeed, this trend is evidenced by the fact that many Apple laptops no longer come with an ethernet port and consumers must buy and adapter if they wish to use a physical ethernet connection. Smart TVs are in a fixed location and could therefore utilise an ethernet connection, but this is only likely to be the method of connection if consumers have wired their house with ethernet ports. Smart TVs also generally have WiFi capability, which consumers may use out of convenience.

[50] The NZCC makes the same point at 3.1312 of the Draft Reasons Paper.

relationship. This is particularly the case in the current context where the main RSPs are also the owners of mobile networks.

71. That is to say, substitution to fixed wireless in the present context can occur by RSPs moving existing customers to an alternative technology, as opposed to only occurring by winning customers from an incumbent. In this sense the large RSPs such as Spark and Vodafone, who also own mobile networks, are the "incumbents". In New Zealand, Spark has been quite explicit that it has an incentive to move customers to wireless in order to earn a higher margin, and also that 5G will result in a "step change" in their fixed wireless offering. For example, Spark CEO Jolie Hodson has recently been quoted as saying:[51]

> *These products [fixed wireless] are easy to set up and, in many cases, deliver a higher-quality experience for customers transferring from old copper lines, while lowering Spark's input costs. The future rollout of 5G will enable a step change in our fixed wireless broadband offering*

72. Spark has also stated it wants to grow wireless broadband connections by 30,000 connections over FY20.[52]

73. S&P has made the exact point we are describing in its most recent rating for Chorus:[53]

> *Nevertheless, we view the risk of wireless network substitution as meaningful.* ***Vertically-integrated mobile network operators are incentivized to bypass fixed-line wholesalers in order to capture the full value chain****. Average data usage statistics are skewed toward high-volume users, leaving a sizable addressable market available to mobile network operators, who are likely to target a sizable market segment of lower demand users in higher-density metropolitan locations.* ***We also note that mobile network operators make up the bulk of fixed network retailers who act as "gatekeepers", providing them with some flexibility to direct customers to the most profitable network. [emphasis added]***

74. Therefore, the incumbency advantage that Chorus has should not be overstated. If it exists, it will be a "technological incumbency" advantage[54] or an inability of RSPs to direct customers to their own networks. A further factor we note in this regard, which we have already mentioned above, is that if consumers are already accessing the internet over WiFi, the consumer experience of connecting to a "fixed" network is not that different from the consumer experience of connecting to a "fixed wireless network" – in either cases consumers will likely be connecting to a "wireless" network in the form of WiFi.

4.3.3. Spectrum availability

75. At [3.1383.3] the NZCC states the risk of fixed mobile substitution is low due to the "delay in delivering spectrum that facilitates 5G roll out".

76. In response to this we make two points:

    a) Following the release of the Draft Reasons Paper, the New Zealand government announced on 16 December 2019 that it will provide early access to the unused half of the country's 3.5GHz band via an auction in 2020. Winners at the auction, where 160MHz of spectrum will be open for

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[51] "Spark reports earnings on the back of mobile, wireless, cloud services and focus on productivity", CIO, 20 August, 2019. https://www.cio.com/article/3509653/spark-reports-earnings-on-the-back-of-mobile-wireless-cloud-services-and-focus-on-productivity.html.

[52] Spark, *FY19 Results Summary*, p.32.

[53] S&P Global Ratings, *Chorus*, 19 November 2019, p. 6.

[54] I.e. customers who have a fibre plan not wanting to switch to an alternative technology, particularly if it offers lower head line speeds.

bidding, will gain rights to the purchased spectrum from mid-2020 until 31 October 2022, before it switches across to long-term rights that will be gained via another auction.[55]

b) Price-quality (PQ) regulation only takes effect in 2022, and the NZCC is assessing the cumulative risk of stranding over a 10-year period following the implementation of PQ regulation. Long term rights for the 3.5Ghz band are being auctioned in 2022 and the government has stated that "as the next priority after the allocation of spectrum in the 3.5 GHz band, work will begin to allocate the millimetre wave bands for 5G."[56]

77. Therefore, delays in spectrum release are likely to be only of near-term importance and should only matter when assessing the risk over 2022-2023 to the extent that Chorus is able to gain an "incumbency advantage" in the near term.

4.3.4. Which assets will fixed wireless substitution affect in Chorus' RAB?

78. If fixed wireless substitution happens in a meaningful way, it will likely be through mmWave 5G FWA. Because of the short range of mmWave spectrum, this will require a very dense network of small cells. Because of this topology and the potential heavy capacity throughput, these networks will also require extensive fibre backhaul.

79. It is for this reason the NZCC notes at [3.1385.2] the point made by Chorus that 5G may actually use FFLAS as an input. Specifically, what is an "access" network from the perspective of fixed broadband may be "backhaul" network from the perspective of a 5G mmWave FWA network.

80. The reliance of FWA on fibre and the portion of the network it would displace is illustrated by the below diagram from Samsung. This diagram and the accompanying discussion distinguishes between two phases of fibre deployment:

a) The "pass" in which fibre is laid from the central office through a neighbourhood; and

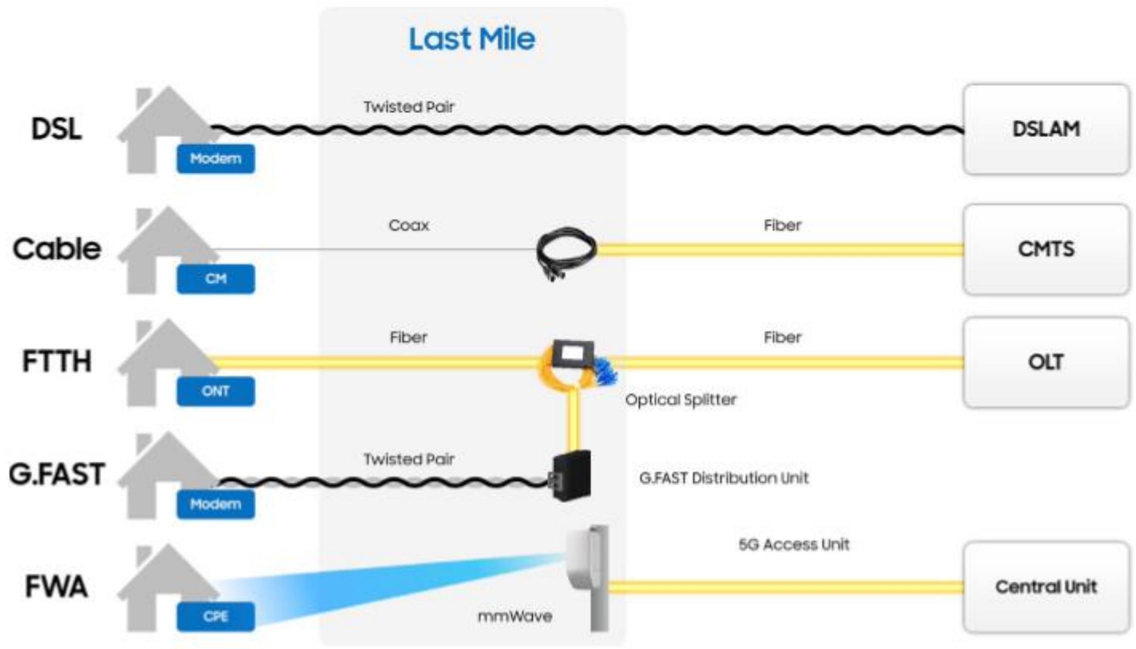
b) The "drop" or "last mile" in which a subscriber's premise is connected to the "passing" fibre.

81. As Samsung notes, FWA avoids the need for the drop and uses the passing fibre as backhaul. Or using the terminology that has developed in the New Zealand context, we might think that 5G mmWave FWA is substitute for the fibre lead-in, a portion of the "distribution fibre" and the ONT in the customer premise. It is however, unlikely to be a substitute for the communal layer 1 assets (e.g. the feeder fibre) and Layer 2 equipment in the central office (the latter to the extent mobile providers purchase active backhaul products from Chorus instead of unbundling and self-provisioning mobile backhaul).

[55] "NZ to auction early access to 5G spectrum", ZDNet, 15 December, 2019. https://www.zdnet.com/article/nz-to-auction-early-access-to-5g-spectrum/.

[56] "Allocation of radio spectrum for 5G mobile", Ministry of Business, Innovation and Employment (MBIE), p. 5, 7 January, 2019. https://www.mbie.govt.nz/dmsdocument/4610-allocation-of-radio-spectrum-for-5g-mobile.

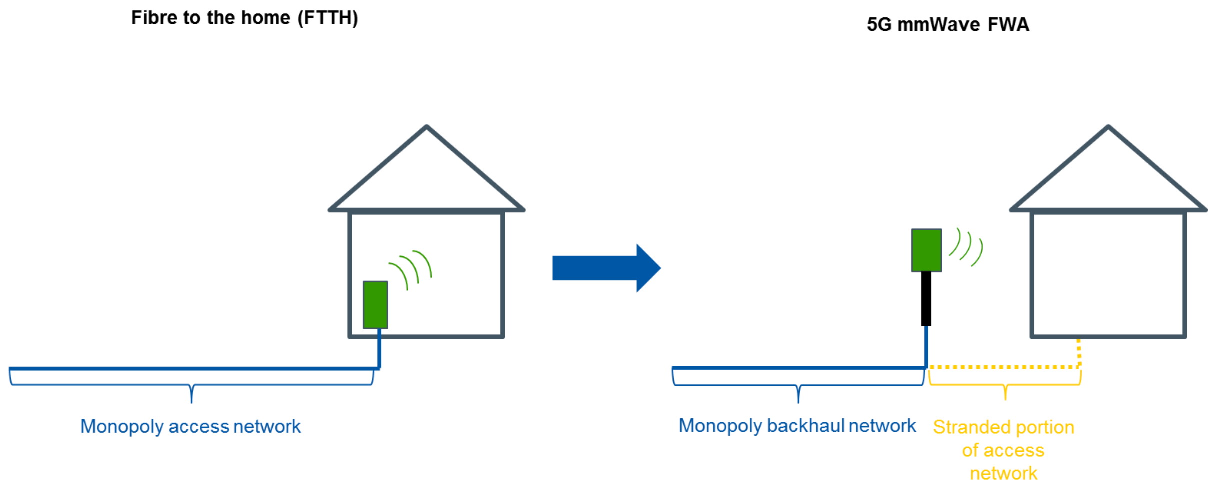
Figure 4.3: FWA is only a substitute for fibre over the "last mile"



Source: Samsung, *5G Fixed Wireless Access: Case Study Orange Romania*, 2019.

82. This potential stranding is illustrated in Figure 4.4 below:

Figure 4.4: 5G FWA would only strand a portion of the fibre access network



83. Thus, returning to the RAB categories in Table 4.1 above, we have described the impact of FWA on different parts of the RAB in Table 4.2 below.

Table 4.2: Impact of FWA on different categories in the RAB

Category	Faces stranding risk from 5G mmWave FWA	Comment
Communal L1	Yes, but only a subset of “communal assets” that are customer specific.	The majority of assets are still likely to be used in the event that 5G mmWave FWA displaces Chorus fixed products in a material way. However, some of the assets in this category (i.e. the distribution fibre from the FFP to the property boundary) could be stranded by FWA.
Fibre lead-in	Yes	For a premise that switches to an FWA product, these assets would no longer be used.
L2 equipment (excl ONT)	Minimal	Non-customer premise Layer 2 equipment would still be used to service customers with FWA connections, to the extent the MNOs purchase active (i.e. layer 2) mobile backhaul from Chorus instead of unbundling.
ONT	Yes	For a premise that switches to an FWA product, the ONT would no longer be used.
Transport	No	FWA still requires backhaul and would not itself be the trigger for transport assets being stranded.
Other	No	This category is largely common costs or assets (like buildings) with alternative uses.

84. This highlights that the key stranding risk from FWA is the fibre lead-in and customer specific fibre that is included in the “communal “category.

4.3.5. Summary of stranding risk due to fixed mobile substitution

85. In summary, the analysis of the preceding subsections suggests:

a) The risk of FWA is concentrated on the very edge of Chorus’ network (i.e. the fibre lead-in);

b) The fibre lead-in, by nature of being a customer specific asset, will no longer be used (and therefore generate revenue), if the customer in question moves to a mobile product

c) The NZCC has likely understated the impact that 5G will have on this risk;

d) However, the risk should not be overstated as fibre is likely to remain the superior technology in the future.

e) I.e. the question is whether 5G can meet consumer demands (which are growing) in a cost competitive manner and whether RSPs, who “own” the customer relationship will be able to successfully direct their customers to wireless products.

4.4. Stranding due to unbundling

86. If an RSP unbundles Chorus’ network, this involves purchasing an L1 service from Chorus between the Central Office and the customer premise. To provide a broadband service, the RSP installs its own L2 equipment which includes an ONT in the customer premise and active equipment in the central office.

87. Because of this, unbundling only poses a stranding risk to Chorus’ L2 infrastructure. Using the same RAB disaggregations as above, Table 4.3 below sets out the impact of unbundling on different categories of the RAB.

Table 4.3: Impact of unbundling on different categories in the RAB

Category	Faces stranding risk from unbundling	Comment
Communal L1	None	Providing an unbundled service relies on Chorus' layer 1 network.
Fibre lead-in	None	Providing an unbundled service relies on Chorus' layer 1 network.
L2 equipment (excl ONT)	Yes	If an RSP unbundles Chorus network, it installs its own Layer 2 equipment. This equipment is however non-customer specific so can be repurposed.
ONT	Yes	If an RSP unbundles Chorus' network it installs its own Layer 2 equipment, including an ONT. This equipment is customer specific so can't be repurposed, or the costs of repurposing are likely to render it uneconomic.
Transport	No	Chorus' transport network would be used by both L1 and L2 services.
Other	No	This category is largely common costs or assets (like buildings) with alternative uses.

88. We note the NZCC quotes Vodafone [3.1385.4] in support of the point that Layer 2 investments are not irreversible "since they can be redeployed or sold". We understand from Chorus that this is not necessarily the case with respect to the ONT as the costs of decommissioning the ONT and retrieving it from the customer premise would exceed any resale value. Similarly, the ONT is not available to the unbundling RSP so it cannot be resold in-situ.

89. Regarding the probability of stranding of this nature occurring, because Chorus is constrained to charge geographically averaged prices, this creates a "cherry picking" risk between low cost and high cost areas. Therefore, in certain low cost areas, which would be areas with above average fibre uptake and therefore Layer 2 asset utilisation, widespread unbundling could be quite likely. Therefore, stranding risk in these areas could be quite high. Ideally, to understand the proportion of the RAB at threat from unbundling, we would disaggregate the RAB geographically. In the time available for this report we have not been able to obtain information on the geographic distribution of the Layer 2 RAB. However, we note the NZCC's statement at [3.1385.4] that Layer 1 infrastructure is likely to form the bulk of the RAB. Therefore, this risk will likely have a small impact on the calculated allowance. This however means that an allowance calculated using the aggregated Layer 2 RAB will overstate the required compensation, not that no allowance should be allowed for.

4.5. Stranding due to fixed network bypass

90. The final risk that Chorus faces is that the fibre network itself is stranded due to competition from an alternative network that directly displaces the Chrous' network. This could occur in a number of ways:

a) An existing alternative fixed network competes with Chorus, such as Vodafone's cable network;

b) Satellite technologies such as Low Earth Orbit (LEO) and High Altitude Platform Station (HAPS) that do not rely on the fixed access network become widespread and are able to offer sufficient speeds/capacity to meet consumer demand; and

c) Mobile network operators (MNOs) may decide to overbuild Chorus' network to self-provision backhaul to their mobile sites.

91. Any of these scenarios would result in bypass of Chorus' L1 network. On the former, this is largely only an issue for Chorus's network in Wellington/Kapiti (where Vodafone has an HFC network) [57] and the Hawkes Bay where Unison has partnered with Spark to build a fibre network.[58] Notably, according to Chorus' most recent connections data, Chorus fibre take-up is lowest in Kapiti, Wellington and Napier/Hastings.[59] In theory, this proportion of Chorus' RAB could be analysed separately, but information on the make-up of Chorus' RAB is not yet available. For the latter two points, the incumbency advantage of Chorus' having already incurred sunk costs could materially mitigate the probability of either occurring. However, the business case for either is uncertain and will only become clear over time. In this regard, one cannot rule out the risk entirely and either scenario could have a material impact on Chorus ability to recover the RAB given the NZCC's point that L1 networks are likely to make up the majority of the RAB.

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[57] Vodafone also has an HFC network in Christchurch, but Chorus is not the UFB provider in Christchurch.

[58] "Spark Partners with UnisonFibre for Home and Small Business Fibre Installations", Unison, 1 February, 2017. https://www.unison.co.nz/tell-me-about/news/article/2017/01/31/spark-partners-with-unisonfibre-for-home-and-small-business-fibre-installations

[59] Chorus, *Q2 FY20 Connections Update*, 17 January 2020, p.9.

5. Translating the stranding risks to an allowance

92. On the evidence set out above, our view is that the NZCC's estimate of an, at most, 10% probability of stranding due to fixed-mobile substitution is an understatement. We consider that the probability of this form of stranding will be greater than assessed by the NZCC. A more plausible estimate is therefore likely to be in the range of 10-20%, with this risk being concentrated at the edge of Chorus' network (the fibre lead-ins).

93. However, as discussed earlier, concentration of stranding risk due to fixed mobile substitution in the fibre lead-in does not imply that the remaining assets in the RAB have a zero probability of stranding. In Table 5.1 we set out our views on the likelihood of stranding in respect of the different asset categories making up the RAB. As noted, our main view is that the most likely assets to face stranding risk (the fibre lead-in and ONT) will face a risk of stranding in the range of 10-20%.

94. For the communal network, the main risk of stranding arises in respect of the roll-out of alternative fixed networks. This is likely to be relatively low risk, with at most a 5% risk of stranding. Similarly, L2 equipment (excluding the ONT) faces a relatively low risk of stranding, although because that risk arises in respect of both alternative fixed networks and unbundling it may be slightly higher (than for the communal network), so we have assessed it as a 0-10% probability.

Table 5.1: Assessment of stranding risk for different asset categories

Asset category	Stranding risks	Likelihood of stranding
Communal L1 network	Alternative fixed networks	Low (0-5%)
Other (buildings etc…)	None/Immaterial	N/A (0%)
Fibre lead-in	Mobile substitution, alternative fixed networks	Low – Medium (10-20%)
L2 Equipment excluding ONT	alternative fixed networks, unbundling	Low (0-10%)
ONT	Mobile substitution, alternative fixed networks, unbundling	Low – Medium (10-20%)
Transport	None/immaterial	N/A (0%)

95. Based on the application of the Dixit and Pindyck/NZCC model described in Section 3, we could apply the probabilities of stranding in Table 5.1 to determine the relevant asset specific stranding allowance. We could then weight that stranding allowance by the proportion of the RAB applying to the particular asset category and sum the RAB weighted stranding allowances to get an overall estimate of the stranding allowance applicable to the entire RAB.

96. However, Chorus' RAB and the relative weights of each asset category in the RAB have not been determined. Once the RAB has been determined this calculation can be performed with more granularity and precision.

97. In the interim, we have used the illustrative range of the RAB reported by the NZCC at Table 3.13 the Draft Reasons paper, of $3b-$6b. We have taken the mid-point of this range (of $4.5b) for the purpose of our illustrative calculation.[60] We also use publicly available information on UFB capital expenditure from Chorus's annual reports to perform an illustrative calculation of the proportions of the RAB attributable to the lead-in and the communal networks and the resulting stranding allowances. Details on our derivation of these proportions is contained in Appendix A. However, we

[60] We note that this mid-point is a similar order of magnitude to analysts estimates of Chorus' RAB in 2022.

note these calculations are purely illustrative and should not be considered a substitute for performing a similar analysis when the composition of Chorus' RAB is known.

98. Table 5.2 sets out this calculation which treats the "UFB communal" capex category as being equivalent to the Communal L1 Network category and "UFB connections and L2" capex category as being equivalent to the "Fibre lead-in" asset category.

Table 5.2: Illustrative calculation of stranding allowance using public information

Asset Category	$m	%	Stranding Risks	Probability of stranding	Asset allowance	Weighted allowance
UFB Communal*	1942	43%	Alternative fixed networks	0-5%	0-51 bp	0-22 bp
UFB connections and L2*	1307	29%	Mobile substitution, alternative fixed networks, unbundling***	10-20%	105-223 bp	31 - 65 bp
Residual	1251	28%	None/immaterial	0%	0 bp	
Total RAB**	4500					
Overall stranding allowance						**31-87 bp**

*NERA calculations of rolled forward capex using Chorus annual reports (2012-2019) and October 2019 Investor Presentation
** Calculated as the average of the NZCC estimated RAB in Table 3.13 of the Draft Reasons Paper.
*** Note that unbundling risk only applies to the layer 2 electronics in this category. Given the illustrative nature of this calculation, we have not attempted to separate out L2 capex

99. Thus, our illustrative calculation gives a range of 31-87 basis points, compared to the NZCC range of 5-40.

100. Regarding the point in the range that should be selected, the NZCC's general approach when choosing a point in a range is to use the mid-point as the starting point and consider whether there are arguments for justifying a departure from the mid-point.[61] We note the NZCC's primary logic for taking the low end of its range was that it considered the assets would continue to be used.[62] This logic arguably only applies to stranding in relation to L2 assets, whereas the NZCC has noted the majority of the RAB is likely to be L1. The same logic does not apply to the customer specific edge of the network (i.e. the fibre lead-in). If these assets are stranded, they will no longer be used, and therefore no revenue will be earned by these assets except in the circumstances where that premise returns to a fibre connection in the future.

101. The NZCC also mentions (at [3.1388.2]) mitigations to the risks, for which it cross-references [3.1383] to [3.1385.5] being the factors it discusses in relation to the probability of stranding and the

[61] For example, with respect to the cost of capital, at 3.1099 of the Draft Reasons Paper the NZCC notes that the consideration of the WACC percentile asks the "fundamental question" of "*Is there any reason to depart from the mid-point i.e., the best parameter-based estimate we have of the cost of capital?*". Similarly, when conducting international benchmarking, the NZCC has taken a similar approach. For example, in the 2013 UBA price determination, the NZCC states "*To determine our price point selection from within the two country benchmark set, we have started with the median of the benchmark set, and then considered whether we should move above or below the median due to any other additional factors*." Commerce Commission, *Unbundled Bitstream Access Service Price Review: Final* Determination, NZCC 20, 5 November 2013, para.202.

[62] *Draft Reasons Paper*, 3.1388.1.

proportion of the RAB that would be stranded. We have already discussed the majority of the factors which the NZCC is referring to in our specific discussion of the different stranding risks in Section 4 above. The NZCC's point is also somewhat tautological: that is, the NZCC uses these arguments that the risk is low to define the bounds for the range, but then cites the same factors as arguments for choosing the point in the range. In some sense this is a form of double counting.

102. The key "mitigating factor" that the NZCC refers to appears to be at [3.1385.3], which is essentially that Chorus will be able to raise prices to remaining users to recover any lost revenue. This point has some merit under revenue cap regulation, however the mitigating effect may be dampened in the present context:

   a) Raising prices may encourage further substitution away from Chorus' network;[63] and

   b) It is not clear the extent to which Chorus would be able to materially raise prices in the framework for fibre. The presence of anchor products, and the ability for the NZCC to set "cost based" prices,[64] may place a further limit on the ability of Chorus to recover lost revenue by raising charges to existing users. The NZCC makes this same point at [3.1311.2]. In essence, this depends on how the NZCC defines "cost" in a future price determination.

103. In our view, an appropriate point to select in the range is the mid-point. Based on the illustrative RAB proportions described earlier, this gives an ex ante allowance of 59 basis points. This illustrative calculation is above the top end of the NZCC's range in the Draft Reasons Paper (5-40 basis points) and therefore by definition also above the mid-point of the NZCC range (23 basis points). Our illustrative calculation is also above the allowance the NZCC has provided gas distributors for systematic stranding risk (40 basis points).[65]

[63] At 3.1385.3 the NZCC notes that "It is also likely to be the case that the highest value end-users are those that value the superior speeds and capabilities of a regulated FFLAS network, and are least likely to switch". This is likely correct. However, we do not know what proportion of the customer base fits this description, and customers who do not demand the "superior speeds and capabilities of fibre" would be likely to switch if Chorus raised prices.

[64] 206 (6) (b) of the Act sets out that if the NZCC recommends a change to the anchor product price after the start of the first regulatory period, the maximum price must be "cost based". 209 (5) of the Act similarly proscribes that if the NZCC sets a maximum price for an unbundled fibre service or a direct fibre access service, this price must be "cost-based".

[65] *Draft Reasons Paper*, 3.1392.

Appendix A. Illustrative calculation of RAB proportions

104. In this Appendix we set out how we have calculated the proportions of the RAB attributable to the lead-in and the communal networks and the resulting stranding allowances.

105. We start by using publicly available data on the categories of Chorus' fibre capital expenditure, sourced from its annual accounts for the fiscal years ended 2012 through to 2019, as shown in Table A1. Note that these categories do not directly correspond to the RAB categories used earlier in this report.

Table A1: Chorus fibre capex by category, FY12-FY22

Fibre capex ($m)											
Fibre capex category	**FY12**	**FY13**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**FY19**	**FY20**	**FY21**	**FY22**
UFB communal	162	362	338	236	194	183	231	245	180	93	62
UFB connections and fibre layer 2	13	31	74	169	205	258	294	308	270	32	22
Fibre products and systems	7	27	38	26	18	17	17	17			
Other fibre connections and growth	33	53	63	34	47	45	65	65			
RBI	59	106	53	39	22	0	13	29			
Total fibre capex	**274**	**579**	**566**	**504**	**486**	**503**	**620**	**664**			

Source: Chorus annual reports. Data for FY12 is for 7 months only, as Chorus commenced operations in December 2011.
Note: NERA projections are shaded in grey.

106. Since PQ regulation comes into effect post 2022, to estimate the proportion of the RAB attributable to the lead-in and communal networks we require a forecast of Chorus' capital expenditure through to 2022, with these forecasts also shown in Table A1. We do this as follows:

a) For 2020, we use Chorus' forecasts of its UFB communal and connections/fibre layer 2 capex, sourced from its Investor Roadshow report, dated 9 October 2019 (at p.32);[66]

b) For 2021 and 2022, we calculate UFB communal capex using Chorus' forecast cost per premises passed for 2020 (as 2021 and 2022 forecasts were not available), of $1,550,[67] multiplied by Chorus' estimates of the premises passed of 60,000 for 2021 and 40,000 for 2022;[68] and

c) For 2021 and 2022, we calculate UFB connections and fibre layer 2 capex using Chorus' forecast cost per premises connected for 2020 (as 2021 and 2022 forecasts were not available), of

[66] Available at: https://company.chorus.co.nz/file-download/download/public/2025, where we use the mid-point of the numbers reported.

[67] Chorus Investor Roadshow, 9 October 2019, at p.42, where we use the mid-point of the numbers reported.

[68] Chorus Investor Roadshow, 9 October 2019, at p.32, where the numbers are estimated based on the graph shown.

$1,075,[69] multiplied by Chorus' estimates of the premises passed of 60,000 for 2021 and 40,000 for 2022,[70] and multiplied by 50% assuming this uptake for premises passed.[71]

107. Having determined capital expenditure for FY12 through to FY22, we then calculate total rolled forward capex across this entire period. To do this we incorporate depreciation of capex over this period, assuming straight line depreciation and an asset life for communal capex of 39 years[72] and for fibre lead-in capex of 20 years.[73] We note that we have not accounted for revaluations (e.g., inflation indexing) of this capex over the period, on the basis of the NZCC's statement at [3.63] of the Draft Reasons Paper that s177(1)(b) of the Telecommunications Act directs it to ignore such revaluations. Over the FY12-FY22 period, the sum of the depreciated capex for the UFB communal category is $1,942m, while for the UFB connections and fibre layer 2 category it is $1,307m.

108. We then calculate each of these capex categories as a share of the RAB. For the latter we use the illustrative figures for the RAB of $3b-$6b used by the NZCC in the Draft Reasons Paper (at Table 3.13), and we take the mid-point of this range (of $4.5b). [74]

109. The resulting proportions of the RAB that we use in our indicative calculation of the stranding allowance are therefore:

a) UFB communal: $1,942m/$4,500m = 43%; and

b) UFB fibre connections and layer 2: $1,307m/$4,500m = 29%.

[69] Chorus Investor Roadshow, 9 October 2019, at p.42, where we use the mid-point of the numbers reported.

[70] Chorus Investor Roadshow, 9 October 2019, at p.32, where the numbers are estimated based on the graph shown.

[71] Chorus Investor Roadshow, 9 October 2019, at p.10 reports average uptake of 55% for the year September 2019.

[72] Chorus' Annual Report 2019, at p.24, notes that this is the average asset lifetime for communal infrastructure.

[73] Chorus' Annual Report 2019, at p.24, notes that the estimated life for the "fibre cables" asset category is 20 years.

[74] We note that the low point of this range, $3b, is less than the value of the rolled forward capex for the UFB communal and UFB connections and L2 categories that we estimate.

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