Final model specification for the ACCC

Developing a bottom-up cost model for voice interconnection services

James Allen, Matthew Starling, Jules Welham

July 2025

Ref: 656748795-298

Contents

Analysys Mason Limited
North West Wing, Bush House
Aldwych
London WC2B 4PJ
UK
Tel: +44 (0)20 7395 9000
enquiries@analysysmason.com
www.analysysmason.com
Registered in England and Wales No. 5177472

1 Introduction

1.1 Background

In June 2024, the Australian Competition and Consumer Commission (ACCC) commenced a public inquiry into access determinations for voice interconnection services.[1] These are wholesale services provided by mobile network operators (MNOs) or fixed network operators (FNOs) to enable subscribers from different networks to originate and terminate voice calls to each other. The three voice interconnection services of interest are:

- mobile terminating access service (MTAS)
- fixed terminating access service (FTAS)
- fixed originating access service (FOAS).

All three services are declared services under section 152AL of the Competition and Consumer Act 2010.[2] The current declarations of the voice interconnection services are in force until 30 June 2029. The ACCC may set price-related and non-price-related terms and conditions of access to a declared service by making an access determination relating to that service, which is a key objective for the public inquiry.

The ACCC has commissioned Analysys Mason Limited (Analysys Mason) to construct a cost model to derive network costs for these voice interconnection services, as an input to the setting of their regulated prices. Analysys Mason has planned a three-phase approach to achieve the project objectives:

- **Phase 1 – Model specification:** collecting data and developing a model specification to set out the approach, in co-operation with industry parties through a public consultation.
- **Phase 2 – Model development:** building and populating a draft cost model, with a supporting draft report and operating manual, undertaking top-down validation and preparing the draft cost model for consultation with industry parties.
- **Phase 3 – Model consultation:** reviewing stakeholder responses to the public consultation on the draft model and updating both the cost model and accompanying documentation accordingly.

As the final output for Phase 1, following a consultation with industry, Analysys Mason has produced this specification document to outline its intended approach to the cost model development. Separately, a data request has been issued to stakeholders in Australia (both national MNOs and FNOs) to collate relevant data to inform the inputs of the modelling and improve its accuracy.

1 See the ACCC's website here.

2 Available at https://www.legislation.gov.au/C2004A00109/latest/versions

1.2 Previous work

The previous public inquiry for the MTAS concluded on 2 October 2020.[3] In order to determine regulated prices for the MTAS within that inquiry, a bespoke benchmark was developed by Analysys Mason, adapting nine existing cost models published by other telecoms regulators to reflect the specificities of deploying national mobile networks in Australia. In this document, we refer to this past modelling exercise as the '2020 MTAS cost modelling'. The approaches taken to reflecting Australian specificities in the 2020 MTAS cost modelling are relevant points of reference within this model specification.[4]

1.3 Overview of modelling approach

The objective is to construct a cost model for voice interconnection services for the ACCC, to provide cost-based information for price regulation of the MTAS, the FTAS and the FOAS. This model will be developed using demand and network parameter information submitted by stakeholders in Australia, combined with estimates and calculations performed by Analysys Mason.

The three broad types of input that will feed into the model relate to demand volumes, network design parameters and cost assumptions, as shown in Figure 1.1 below.

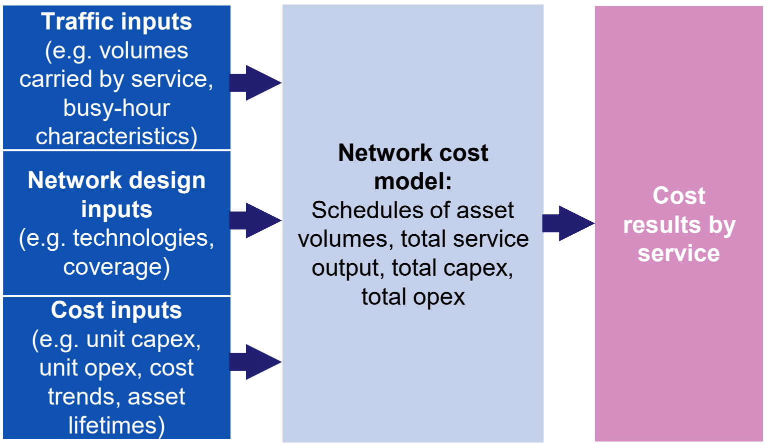


Figure 1.1: Roadmap of the cost model [Source: Analysys Mason, 2025]

A national MNO will be modelled to calculate the relevant costs of MTAS.

FTAS and FOAS are provided over fixed networks. However, the convention in cost recovery of fixed networks is that the costs of the access network infrastructure are recoverable from access line charges and the costs of core network infrastructure are recoverable from traffic-related charges (such as the FTAS and the FOAS). Therefore, only a fixed core network needs to be considered in our model. This is described further in Section 5.1.

3 See the ACCC's website here.

4 The final methodology paper for the 2020 MTAS cost modelling project ('2019 Methodology paper') can be found on the ACCC's website here.

It is anticipated that a variety of network configurations can be considered by choosing appropriate input parameters in the model. This will be achieved through sensitivity tests on different assumptions including (but not limited to) forecast demand, spectrum and coverage. For a configuration defined by a given set of inputs, the model derives the assets in a forward-looking manner and then determines the costs of these assets over a specified timeframe. These costs are then recovered by the services assumed to be conveyed over this network during its lifetime. Capital costs are determined using a weighted average cost of capital (WACC), determined by the ACCC. No remaining terminal value is applied within the model at the end of the cost recovery period.

1.4 Conceptual approach

Analysys Mason has developed a conceptual framework that it has applied in dozens of network costing projects over the last 25 years. This framework covers four dimensions, as shown in Figure 1.2 below.

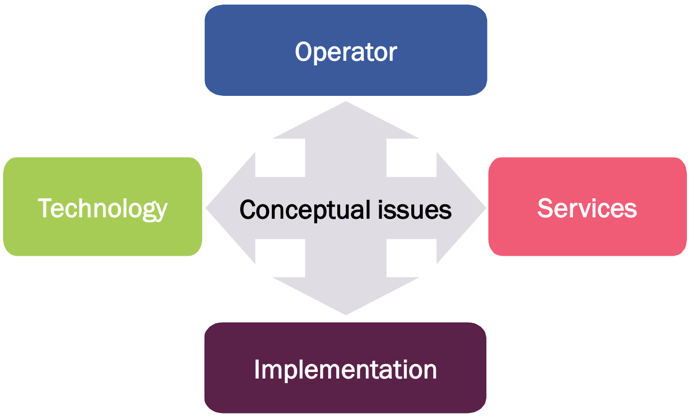


Figure 1.2: Conceptual framework [Source: Analysys Mason, 2025]

The four dimensions are outlined below:

- **Operator dimension**: defines the scale/scope of the modelled operator (e.g. should any aspect of the modelled scale and scope be hypothetical, or should actual operations be entirely reflected in the model?).
- **Technology dimension**: sets out the network technologies assumed for the modelled operator.
- **Service dimension**: considers the relevant services to be provided by the modelled operator.
- **Implementation dimension**: defines associated computational aspects (e.g. modelling period, depreciation method, use of mark-ups, approaches to modelling specific costs).

1.5 Structure of this document

The remainder of this document is laid out as follows:

- Section 2 sets out our approach to concepts concerning the modelled operator
- Section 3 sets out our approach to concepts concerning the modelled technologies
- Section 4 sets out our approach to concepts concerning the modelled services
- Section 5 sets out our approach to concepts concerning the modelling implementation.
- Annex A provides an expansion of the acronyms used in this document
- Annex B sets out the stakeholder feedback to the draft specification and our responses.

2 Concepts concerning the modelled operator

The following operator-related concepts are considered in this section.

Figure 2.1: Proposals concerning the modelled operator [Source: Analysys Mason, 2025]

Section	Concepts	Intended approach
2.1	Model structure	Build a bottom-up model
2.2	Type of operator	Develop a model of a generic hypothetical efficient operator
2.3	Network footprint and roll-out	• 4G/5G coverage roll-out in first year consistent with the coverage reported in the ACCC's most recent mobile infrastructure reporting, capturing the areas covered by at least two national MNOs • the model will also be able to test the impact on the network costs (and therefore unit costs of traffic) of including a proportion (up to 100%) of coverage corresponding to those areas where only one operator currently provides coverage • 4G coverage attained immediately and sustained in future • 5G coverage increases to 95% of population in the long term
2.4	Scale	Assume 1/N market share for the modelled operator in all years in each geotype, where N is the number of national networks covering that geotype.[5] The total market includes volumes associated with mobile virtual network operators (MVNOs) or service providers (SPs) hosted in the market, so that full-scale operations can be modelled

These concepts are considered in the context of the actual national operators present in Australia:

- Optus, Telstra and TPG Telecom are the three national MNOs in Australia.
- There are multiple operators offering fixed voice services, but the five largest are Optus, Telstra, TPG Telecom, Symbio and Vocus.[6]

2.1 Model structure

There are two structures used in the cost modelling of networks, referred to as 'top-down models' and 'bottom-up models.'

Top-down models start from an existing 'top-down' network cost base and determine 'incremental' costs. There may also be top-down efficiency adjustments and potential cost adjustments to reflect the costs of modern assets. This method can be useful for an operator to determine its own cost base,

5 This value of N must be adjusted where the model is assumed to include additional coverage (representing a proportion of those areas of Australia where only one operator currently provides coverage).

6 See Figure 17 of the ACCC 2023/24 Communications Market report, available here.

but is not necessarily the best modelling approach to determining the costs of an efficient operator for transparent regulatory purposes.

Bottom-up models are the most commonly used method for determining the costs of a hypothetical efficient operator. The network asset base is dimensioned starting with the traffic/subscribers of the operator modelled, and reflects an assumed network footprint. Therefore, only the assets required to meet this demand (in a forward-looking situation) are taken into account, excluding any inefficiencies. The level of efficiency can, however, be 'selected' through the choice of technologies modelled and assets used (for example: only modern equivalent assets such as Ethernet backhaul) and various other parameters (such as maximum utilisation factors).

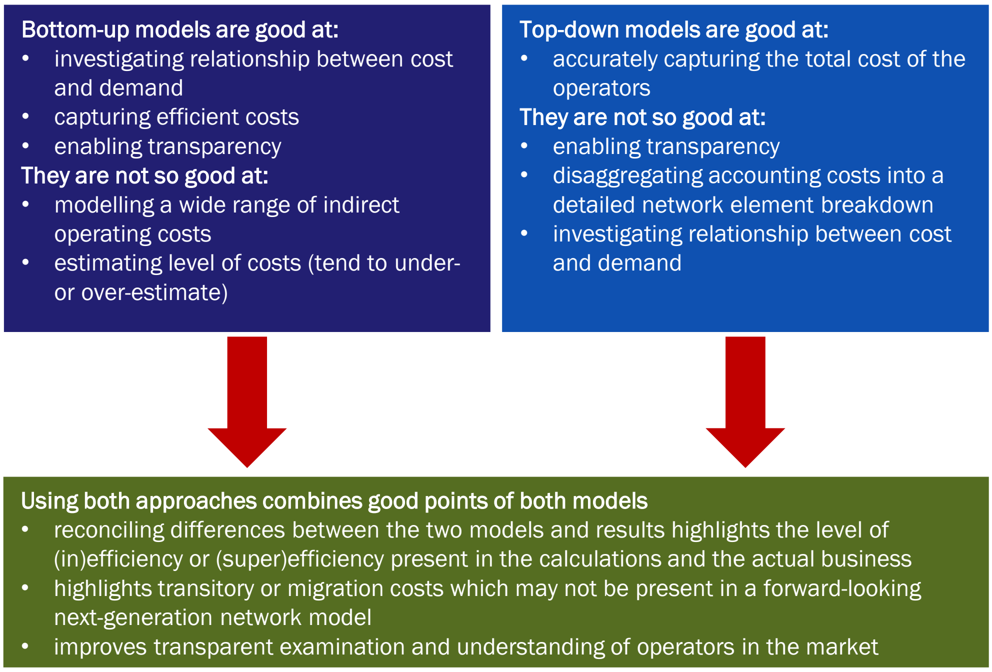
Figure 2.2 below compares the merits of the two approaches. As described in the last box, a "hybridised" approach is often used, where outputs from the bottom-up model are adjusted to align with top-down information. Such an alignment of particular asset count outputs is known as asset *calibration*, while the comparison of particular cost outputs is referred to as cost *reconciliation*. Together, this comparison process is called *top-down validation*.

A standard top-down validation approach for a bottom-up model of mobile networks involves comparing the actual base station counts of each operator to those forecast by the model based on their respective network design inputs for coverage and spectrum holdings.

While these comparisons can be made, adjustments to the bottom-up model may not be necessary as there may be explainable reasons for such divergences. For example, the difference may be due to inefficiencies in the actual operators' networks or hypothetical bottom-up assumptions that differ from the specific operator. However, adjustments are justified if the bottom-up model is producing outputs that are not reasonable: therefore, top-down validation can serve as a "reality check." Adjustments can be made to inputs concerning, for example, asset utilisation, minimum asset deployments and assumed base station coverage cell radii.

A top-down model is not necessarily required for hybridisation. Instead, the outputs of the bottom-up model can be simply compared to top-down asset counts and cost data from operators, without the need to build a top-down model to allocate costs to services.

Figure 2.2: Comparison of top-down and bottom-up models [Source: Analysys Mason, 2025]



We recommend the use of a bottom-up model, with top-down validation of the bottom-up model outputs where appropriate. Bottom-up models can be developed to parameterise hypothetical operators and can reflect efficient deployments, scale or choice of modern technologies. Top-down models are not able to demonstrate this level of flexibility.

Cost models can calculate costs for voice interconnection services for either one year or several years. In particular, the model developed can be one of the following:

- a single-year model that can only calculate output unit costs of services for one selected year
- a single-year model that can calculate output unit costs of services for one year at a time chosen from a selection of years
- a multi-year model that can simultaneously derive outputs for each year in a time series.

This choice is often linked to the depreciation method, with a multi-year model required to implement economic depreciation. The choice of depreciation method is set out in Section 5.2.

2.2 Type of operator

There are three broad choices of modelled operator, as summarised below in Figure 2.3.

Figure 2.3: Types of operator that can be modelled [Source: Analysys Mason, 2025]

Type	Description
Actual	The costs of actual market players are calculated. In particular, the model is capable of modelling the actual network and costs of a real operator (or operators). As a starting point, the technologies and assets currently used by the operator would be captured (i.e. legacy networks that have been shut down

Type	Description
	would not be included, as their costs are assumed to have already been recovered).
Average	The players in each individual market (i.e. the fixed market and the mobile market) are averaged or standardised to define a 'typical' operator. While market share, date of entry and coverage can be calculated, the technologies used by this operator must be determined based on the technologies used by the actual operators in the market (since determining an "average" technology is impossible).
Hypothetical efficient operator	An operator is defined with characteristics similar to, or derived from, the actual operators in the market, except for specific hypothetical aspects that are adjusted (e.g. date of entry, technology used). Such an operator can also be modelled as a future market entrant rather than as an existing operator (even if there is no prospect of a new entrant appearing in the market).

The modelling of either actual operators or average operators (defined based on the actual operators), can lead to the capture of past network inefficiencies and therefore is not appropriate for efficient forward-looking network costing.

We set out our intended approach for the modelled mobile and fixed core networks below.

We emphasise that the model will contain costing calculations for two separate networks (a mobile network and a fixed core network).

2.2.1 Mobile networks

We will model a hypothetical efficient operator, with radio network deployed in 2025. We think this is reasonable given the recent network developments in Australia, namely:

- the recent decommissioning of 3G radio networks during 2024
- the commencement of a mobile network infrastructure-sharing arrangement between Optus and TPG Telecom in 2025.

Such an approach can then focus on the forward-looking network costing of modern mobile radio technologies i.e. 4G and 5G. A similar view was taken in the 2020 MTAS cost modelling, which had a similar context (the recent shutdown of the 2G networks). In that case, 3G and 4G were found to be the modern radio technologies for the modelling.

2.2.2 Fixed core networks

For the modelled fixed operator, we will model a fixed core network capable of carrying voice traffic. This core network will be equivalent to the core network for the modelled MNO. Therefore, we consider that this core network can be modelled on a forward-looking basis using the same approach as for the modelled mobile core network.

2.3 Network footprint and rollout

Network footprint (or coverage) is a central aspect of network deployment. The question of what coverage level to model can be understood by answering the following questions:

- What is the current level of coverage applicable to the market today?
- Will the future level of coverage be different from today's level?
- Over how many years does coverage roll-out take place?
- What quality[7] of coverage should be provided, at each point in time?

The rate of deployment of coverage offered by a modelled operator (mobile or fixed) is a key input to the cost model. There are a number of options:

- **Option 1: Immediate scale**. In this option, the modelled operator rolls out its network to achieve full coverage just in time for launch and achieves its assumed scale immediately. This is equivalent to a full renewal of equipment over an existing site network, in terms of radio electronics and backhaul links.

- **Option 2: Assuming a hypothetical rollout and market share profile**. In this option, a time period to achieve coverage roll-out would be specified (e.g. three years) and a time period to achieve full scale would also be specified (e.g. six years).

- **Option 3: Roll-out and growth based on history**. It is possible to derive roll-out and volume growth profiles based on those of actual national MNOs. This approach would require looking back at networks in the past.

We set out our intended approach for the modelled mobile and fixed core networks below.

2.3.1 Mobile networks

At the current time, all three national MNOs in Australia are operating mature 4G networks. Our intended approach is forward-looking modelling and therefore we do not consider Option 3 to be relevant. We consider that the choice of Option 1 or Option 2 depends on the rate at which the network is deployed in the model, and to a large extent should have little impact on the cost results. Either the modelled networks are rolled out:

- immediately in full to immediately support all traffic, or
- over a specific period of time (minimally first, followed by capacity augmentation later), and it takes a specific period of time to fill up the network with existing traffic.

---

7 In the case of a fixed network, quality is related to the availability, access sharing, etc. In the case of mobile networks, the quality of coverage is determined by the density of the radio signal – within buildings, in hard-to-reach places, in special locations (e.g. airports, subways, etc.).

Modelling networks with immediate scale in 2025 means that the model can be accurately compared (in terms of asset counts) to today's actual networks, which we consider will improve the robustness of the calculation.

We have identified announcements regarding the current and near-future population coverage status for both 4G and 5G networks for the national operators, as set out in Figure 2.4 below.

Operator (date)	4G coverage	5G coverage
Telstra (year-beginning 2025)[8]	99.7%	91.0%
Telstra (end-June 2025)[8]	99.7%	95.0%
Optus and TPG (reported mid-2024)	98.5%[9]	80.5%[10] (Optus only)

Figure 2.4: Population coverage by operator and technology [Source: Analysys Mason, 2025]

As can be seen above, national operators have already achieved high levels of 4G and 5G coverage as of 2025. We note that 5G networks are still in the process of being deployed, but these will chiefly be an overlay for increased data traffic conveyance.

We will therefore model:

- a 4G network that achieves national-level coverage in 2025 (Option 1, similar to a refresh of the current network deployments) that is sustained in the future
- a 5G network that achieves significant coverage in 2025 according to the latest coverage maps, achieving parity with 4G population coverage over a longer timeframe.

We consider the assumed coverage for the mainland, other islands and major transport routes separately below.

We note the recent announcement of the Universal Outdoor Mobile Obligation (UOMO) by the Australian government for ubiquitous coverage for voice and messaging services.[11] We do not believe this causes a significant impact on the modelled radio network coverage, given that additional coverage is expected to be achieved using low-Earth-orbit (LEO) satellites. Given the lack of available information and actual deployments (planned or otherwise) in response to the announcement of UOMO, the model will not make any adjustments to its network design (e.g. in terms of increased coverage, or use of satellite services) to specifically comply with UOMO. Adjustments could be made to the model in the future once such network developments become clearer.

8 These values can be found on page 3 of Telstra's reporting here.

9 The value is indicated on page 3 of ACCC's letter to interested parties, available here. This value will be the effective coverage available to both Optus and TPG Telecom following the launch of their shared network.

10 See https://www.whistleout.com.au/MobilePhones/News/Optus-5G-coverage-reveal

11 The announcement can be found here.

Mainland and Tasmania

The ACCC publishes coverage maps of the three national MNOs (Telstra, Optus and TPG Telecom) on an annual basis, as part of its Mobile Infrastructure Report.[12] Separate maps are provided by MNO, technology and spectrum band.

We will use the most recent release of these coverage maps (the most recent version is currently 2024, but should the 2025 coverage maps become available during the model development then they will be used) to separately calculate the modelled immediate geographical coverage of the 4G and 5G networks. Our intended base case is that the modelled hypothetical efficient operator will be assumed to have covered those areas where network competition already established i.e.:

- 4G coverage where at least two of the three operators have 4G coverage (using any frequency)
- 5G coverage where at least two of the three operators have 5G coverage (using any frequency).

This will mean that the base case coverage is representative of the parts of Australia where there is coverage by competing mobile network operators.

In addition, as one of the sensitivity analyses we will test the impact on the costs of the modelled network (and the impact on the unit cost of MTAS) of including a proportion of the actual coverage currently served by only one operator. This will inform ACCC regarding the extent to which the modelled unit cost depends in detail on the assumed network coverage. In theory, the model could also be used to test further increases in network coverage (e.g. into areas where no operators are currently present), but it is not our intention to look at this case.

These geographical coverage values (in km^2) will be calculated by geotype, according to the definition of these geotypes in Section 5.3. Population coverage will also be calculated by geotype, using the Statistical Areas Level 1 (SA1) dataset from the ABS with granular population data (on the basis that if 50% of an SA1 area is covered, then 50% of its population is covered).

The areas where 4G (respectively 5G) coverage has been currently achieved by one operator will also be calculated for the model, so that the impact on the network costs of including coverage for a proportion of these areas can also be calculated.

Other islands

Based on an analysis of the Statistical Areas Level 1 dataset, there are 6622 discrete land masses within the territory of Australia (excluding the mainland itself and Tasmania).[13] The mobile infrastructure data published by the ACCC includes the radio site locations for each operator for every year between 2018 and 2024, inclusive.

[12] See https://data.gov.au/dataset/ds-dga-4b472a18-d0fa-409c-994a-ab17162bcb90/details?q=ACCC

[13] Using data available from the ABS website here.

Based on the 2024 data, 60 of these islands currently have at least one radio site and their coverage will be captured in the model. Geographical and population coverage of these 60 islands will be calculated in the same manner as the mainland/Tasmania coverage.

Given the unique backhaul requirements for sites located on these islands, we will model these sites within a separate geotype.

National transport routes

From the published coverage maps, it is clear that there are a significant number of sites deployed by operators along national roads/railways in Australia (such as the Eyre Highway and the Trans Access Road that follows the Trans-Australian Railway) even though there is little population along these routes.

We will define a separate geotype for major highways in remote/very remote areas and assume a length of road is present (rather than an area of Australia). Coverage in this geotype will be defined as a proportion of road length covered rather than area covered. We will use the major roads dataset available from the Digital Atlas of Australia as a starting point.[14]

2.3.2 Fixed core networks

The modelled fixed core network will be assumed to cover the same proportion of the population as the modelled mobile network (i.e. almost 100%).

2.4 Market share and scale

One of the main parameters that define the cost (per unit) of the modelled operator is its market share. It is therefore important to determine the market share of the operator and the period over which any market share evolution/growth takes place. The parameters chosen for defining the operator's market share over time influence the overall level of economic costs calculated. The quicker the operator grows, the lower the eventual unit (total) cost of traffic should be.

These scale assumptions relate to the concept of productive (static) efficiency, where the output is maximised using a given set of resources while maintaining an assumed level of service quality. A neutral approach to both fixed and mobile markets is to use the average number of networks in any given area (N), with 1/N being the assumed market share in that area.

2.4.1 Mobile networks

In the case of mobile radio networks, based on the coverage definition in Section 2.3, the value of N can be either 2 or 3 when calculated for 2024, depending on how many national operators have

14 https://digital.atlas.gov.au/pages/transport

coverage in a given area.[15] The value of N will be calculated for each geotype as a population-weighted average. For example, suppose in geotype 1 that:

- 70% of the population is covered by 3 operators
- 20% of the population is covered by 2 operators
- 3% of the population is covered by 1 operator but included in the modelled coverage
- 5% of the population is covered by 1 operator but not included in the modelled coverage
- 2% of the population is covered by 0 operators.

Then, the blended average value of N for geotype 1 will be calculated as:

$$N = (70\% \times 3) + (20\% \times 2) + (3\% \times 1) + (5\% \times 0) + (2\% \times 0) = 2.53$$

The value of N for a given geotype will be assumed to be static over time in each geotype.

N will be assumed to be 3 for the modelled mobile core network, since to our understanding each of the three national MNOs in Australia has a standalone core network.

Where a proportion of the coverage currently served by only one operator is included in the model, N will be assumed to be 1 in these areas (as shown above, reflecting the status quo for coverage in those areas). Since these areas will largely have a low population density, including all of this coverage for the modelled operator will increase total network costs for little additional demand (leading to an overall increase in the cost per unit of traffic). In reality, the three national MNOs each serve some of this additional coverage, rather than one MNO serving all of these areas.

In the context of future scale, this should be driven by reasonable demand forecasts of all the services assumed to be carried by that network (both from the retail and wholesale subscriber bases). These forecasts should allow reasonable economies of scope and scale to be captured, while also assuming a reasonably efficient utilisation of both modelled 4G and 5G network technologies over their lifetimes.

2.4.2 Fixed core networks

There are multiple operators offering fixed voice services, but the five largest are Optus, Telstra, TPG Telecom, Symbio and Vocus.[16] Therefore, we will assume a fixed voice market share for the modelled operator of 1/5 = 20%.

---

15 Optus and TPG Telecom have launched a shared network in certain areas of Australia, whilst each retaining some of their own standalone coverage. This shared coverage will need to be considered separately from the standalone coverage based on available data.

16 We note that Vocus acquired much of TPG Telecom's fixed business in 2024 (as announced here), but note that Vocus appears to retain a fixed-line subscriber base. The ACCC recently announced it will not oppose this merger (here).

3 Concepts concerning the modelled technology

This section discusses the following concepts, according to their relevance to mobile networks (Sections 3.1–3.4), or to both mobile and fixed core networks (Sections 3.5–3.7).

Figure 3.1: Proposals concerning the modelled technologies [Source: Analysys Mason, 2025]

Section	Concepts	Intended approach
3.1	Radio network	Model 4G and 5G technologies, deployed with capability to provide voice using VoLTE/VoNR/VoWiFi. Model a 4G/5G single-RAN deployment, with the option to vary the configuration (in terms of activated bands) by geotype
3.2	Spectrum allocations	Assume MHz allocated from each of the main bands
3.3	Spectrum payments	Use the approach from 2020 MTAS cost modelling, with updates for the year 2020 onwards
3.4	Backhaul transmission	Model a mix of leased lines, owned/dark fibre, microwave and satellite backhaul respectively, reflecting the choices and characteristics of the deployments of the actual national MNOs
3.5	Backbone transmission	Model a modern backbone transmission architecture, informed by data provided by national MNOs
3.6	Core network infrastructure	Model an IMS core
3.6	Network nodes	Apply the modified scorched-node approach for the modelled mobile network (radio, aggregation and core nodes)

3.1 Radio network

In this section, we consider the radio technologies which could be modelled. We look at 4G/5G deployments, voice-over-LTE/voice-over-NR (VoLTE/VoNR), voice-over-WiFi (VoWiFi), direct-to-device (D2D) and further radio technology upgrades in turn.

3.1.1 4G/5G deployments

Multiple generations of radio technology standards have been deployed in Australia over the last few decades, either in isolation or in combination. These have included AMPS (1G), GSM (2G), UMTS (3G), LTE (4G) and most recently NR (5G). 1G/2G/3G networks have all been decommissioned (in 2000/2019/2024 respectively[17]).

[17] The years differ by technology: click these links for the shutdown dates of 1G, 2G and 3G respectively.

It appears that 4G technology will retain a significant role in the provision of the MTAS in the near-to-medium term (i.e. certainly into the future regulatory pricing period should regulation continue), with 5G potentially playing a role in carrying MTAS traffic.

The role of 5G in providing the MTAS is currently unclear. It could be assumed that 5G is expected to be largely focused on delivering higher-rate mobile data services and therefore not delivering large volumes of wholesale mobile voice interconnection services in the short-to-medium term.

However, there are economies of scale and scope associated with deploying a 5G overlay on 4G networks, due to asset sharing. For example, 5G radio electronics can be co-located at existing radio network sites and can also share the use of the transmission networks. Based on our experience in other jurisdictions, the inclusion of 5G technologies in a mobile cost model has some impact on the costs of mobile voice interconnection services. Therefore, we believe it is appropriate to assume both technologies persist in the future as an efficient mechanism for delivering mobile services and the MTAS in particular over the coming years.

3.1.2 VoLTE/VoNR

It is necessary to include the functionality of a VoLTE platform, as the primary means of carrying mobile voice services in Australia. However, we also consider it relevant to include the 5G equivalent (commonly referred to as VoNR). This will allow the ACCC to assess the impact of considering VoNR as a means of delivering the MTAS in the next regulatory period, as the technology emerges.

In both cases, a mobile voice platform is now simpler to model than in previous technology generations, given that such a platform now comprises a relatively simple set of assets (including centralised call-server electronics and software). Data has been requested from stakeholders to better understand the costs of these voice platforms.

3.1.3 VoWiFi

All Australian national MNOs offer voice-over-Wi-Fi (VoWiFi) services in Australia. This method of calling allows voice call legs to be made over Wi-Fi networks, in which case they do not need to be carried over mobile radio networks (and therefore only use the mobile core network assets).

In principle, a proportion of mobile-originated and mobile-terminated voice call traffic should be carried as VoWiFi in the cost model, with these services having routeing factors that only use the core network assets. The extent to which VoWiFi may be used in the future is uncertain as it is dependent on the coverage, quality and commercial availability of the relevant Wi-Fi networks in Australia.

We will implement VoWiFi network services in the model, with an assumed proportion of 4G/5G voice carried over VoWiFi.

Operators have been asked to provide data on their traffic volumes carried over other access networks, such as VoWiFi.

3.1.4 D2D

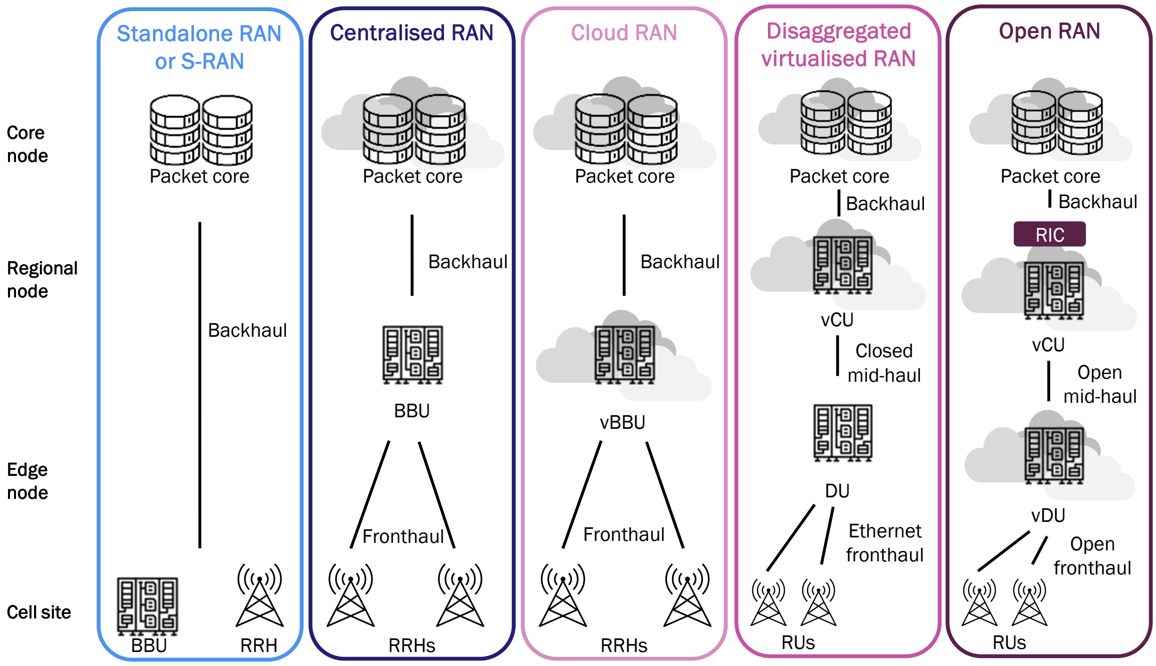
D2D technology is conceptually similar to VoWiFi in that the terrestrial mobile radio network does not carry the traffic. Instead, voice is carried via satellite.

D2D has only been recently launched in Australia by one operator (Telstra[18]), but may be deployed more extensively in the future. However, given the uncertainty in the development of D2D services by the operators, this technology will not be considered in the model. Adjustments could be made to the model in the future once D2D network developments become clearer.

3.1.5 Further RAN upgrades

In the past, separate radio generations would exist in a network as standalone equipment. In recent years, however, vendors have developed numerous enhancements in base station technology to improve the efficiency of RAN equipment. Examples are set out in Figure 3.2.

Figure 3.2: Recent enhancements in RAN architecture [Source: Analysys Mason, 2025]



The key aspects of each enhancement are outlined below: each enables efficiency benefits through the pooling of resources. We have identified which types are being used by Australian national MNOs.

18 https://www.telstra.com.au/exchange/telstra-launch-satellite-messaging

Figure 3.3: Examples of potential RAN enhancements [Source: Analysys Mason, 2025]

Technology	Description	Examples in Australia
Single-RAN (S-RAN)	Combined base stations that provide functionality of multiple radio technologies (4G/5G in this case)	
Centralised RAN	Baseband units (BBUs) are separated from remote radio heads (RRHs)	
Cloud RAN	BBUs are deployed on generic cloud hardware: up to two dozen cell sites share a virtual BBU (vBBU)	Announced by Telstra in 2023 for its 5G network
Virtualised RAN	Radio functions are virtualised for more efficient network management. Multiple functions are moved to the cloud and split between centralised units (vCU) and distributed units (vDU)	In 2021, TPG Telecom trialled a virtualised 5G RAN
Open RAN	This form of virtualised RAN uses open interfaces, rather than proprietary interfaces. Requires deployment of a RAN Intelligent Controller (RIC)	Optus has deployed Open RAN over several years. Telstra announced an Open RAN to be built by 2029
5G Advanced	Various improved network capabilities (e.g. ultra-reliable, low-latency communication (URLLC)), enabling new user applications	Optus was trialling in 2024. Telstra announced its own upgrades starting in 2025

Whilst Australian operators have indicated an intention to deploy Open RAN technology, very little network has actually been deployed and the technology is not currently properly established at this time. Therefore, the focus of this model will be on S-RAN deployments as an established technology, although there will be unused "spare" assets in relevant parts of the model to allow future modelling of Open RAN technologies should it mature and be widely deployed.

5G Advanced technology is also currently less established in Australia. Given its lack of maturity (and also the fact it is more likely to enhance data-related services rather than voice-related services), we will not capture it within the model.

3.2 Spectrum allocations

A large number of spectrum bands are currently in use for mobile networks in Australia. Their key characteristics are summarised below in Figure 3.4. Some bands are used for other purposes, or by companies other than the three national MNOs.

Figure 3.4: Spectrum bands relevant to the model [Source: ACMA, 2025]

Band	Range (MHz)	Type	FDD/TDD[19]	Total MHz
700MHz	703–748/758–803	National	FDD	2×45
850MHz (expansion)	814–825/859–870	National	FDD	2×11
850MHz (original)	825–845/870–890	Regional	FDD	2×20
900MHz	890–915/935–960	National	FDD	2×25
1800MHz	1710–1785/1805–1880	Regional	FDD	2×75

19 Frequency division duplex/time division duplex.

Band	Range (MHz)	Type	FDD/TDD[19]	Total MHz
2.1GHz	1920–1980/2110–2170	Regional	FDD	2×60
2.3GHz	2302–2400	Regional	TDD	1×98
2.5GHz	2500–2570/2620–2690	National	FDD	2×70
3.4GHz	3400–3575	Regional	TDD	1×175
3.6GHz	3575–3700	Regional	TDD	1×125
3.7GHz	3700–3800	Regional	TDD	1×100
26GHz	25 100–27 500	Regional	TDD	1×2400

ACMA has released and licensed additional spectrum, designated as area-wide apparatus licences (AWLs).[20] We consider these AWL spectrum allocations to fall outside the scope of the model.

While some spectrum licences are assigned on a national basis in Australia, many are allocated regionally. Regions are defined using the Australian spectrum map grid (ASMG). This is a hierarchical subdivision of the country, with the Level 4 ('L4') subdivision of the country illustrated in Figure 3.5 below ('3 degree cells').

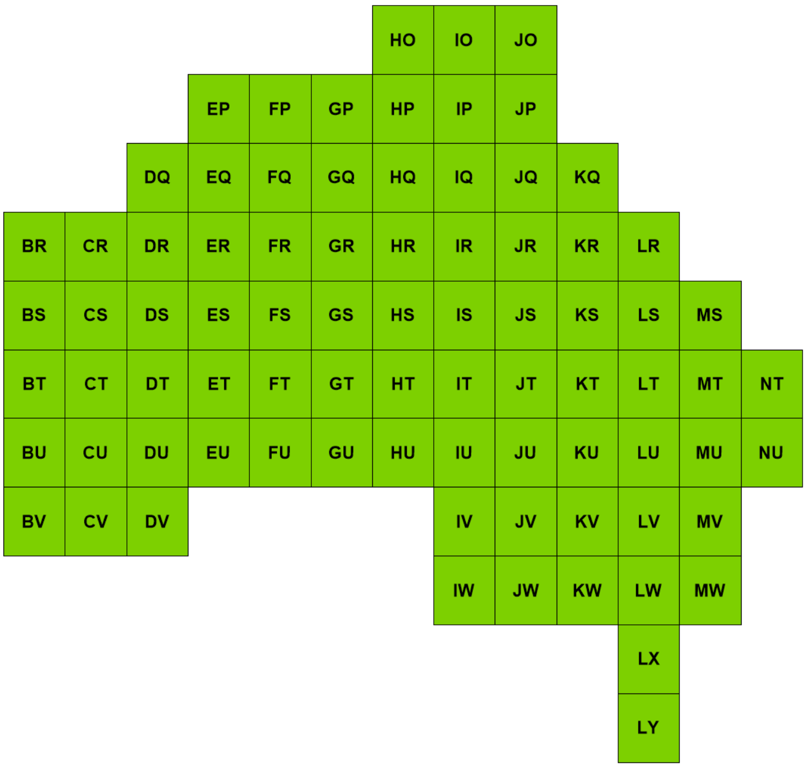


Figure 3.5: Level 4 (L4) subdivision of Australia using the ASMG [Source: ACMA[21], 2025]

The grid squares above can be further subdivided. Using the square 'JS' as an example:

- the L4 square labelled JS divides into 9 L3 squares ('1-degree cells', labelled JS1–JS9)
- the L3 square labelled JS5 divides into 16 L2 squares ('15-minute cells', labelled JS5A–JS5P)

20 See the announcement by ACMA here.

21 Geographical data on the ASMG is available here.

- the L2 square labelled JS5G divides into 9 L1 squares ('5-minute cells', labelled JS5G1–JS5G9).

The areas corresponding to regional licences are then defined using a set of Level 1/2/3/4 squares.

An example of the regions used for the 3.4GHz spectrum bands auctioned in 2023 is shown below in Figure 3.6.

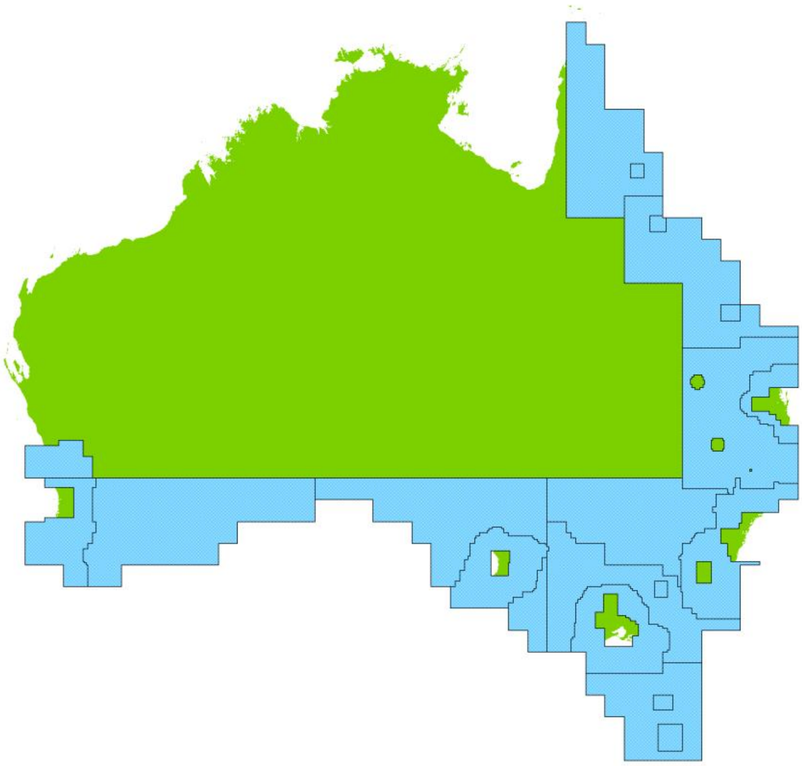


Figure 3.6: Regions used for spectrum licences in the 3.4GHz auction [Source: Analysis of ACMA spectrum auction information,[22] 2025]

We will analyse the regional allocations by operator and band across the relevant mobile spectrum bands. We will also calculate the maximum population/area coverage achievable in each geotype, separately for each band, based on these regional licences. This will be a cross-check to ensure that the assumed coverage of any given band does not exceed the maximum coverage based on the assumed spectrum holdings.

Our assumed MHz allocations are set out by band in Figure 3.7. Values assumed in the 2020 MTAS cost modelling are shown in bold and will be retained in the first instance. The new allocations are based on the average MHz allocated per licence across the three national MNOs.

Band	Technologies used by actual operators[23]	Assumed MHz across the licensed regions
700MHz	Primarily 4G (some 5G)	**2×10**
850MHz	Both 4G and 5G	**2×5**
900MHz	Both 4G and 5G	**2×10**

Figure 3.7: Assumed allocations by band [Source: ACMA, 2025]

22 Data on regional licences for the 3.4GHz auction is derived from the documents published here.

23 Derived using the coverage maps published by the ACCC's infrastructure reporting for 2024.

1800MHz	Primarily 4G (some 5G)	2×15
2.1GHz	Both 4G and 5G	2×10
2.5GHz	Primarily 4G (some 5G)	2×20
3.4GHz	5G	1×30
3.6GHz	5G	1×40
3.7GHz	5G	1×40
26GHz	5G	1×750

It will be possible to sensitivity test these assumed spectrum allocations in the model.

We will not include an allocation for the 2.3GHz band by default since, to our understanding, it is only used in a limited fashion for mobile networks in Australia (by one operator in metro areas). However, the model will be able to test the impact of including an allocation of this band as additional spectrum holdings (assumed to be a 98MHz allocation limited to the major cities).

3.3 Spectrum payments

The 2020 MTAS cost modelling allocated spectrum costs calculated based on the assumed spectrum holdings for the modelled operator. The key aspects of this approach are set out below in Figure 3.8.

Figure 3.8: Main aspects of the approach to modelling spectrum costs in the 2020 MTAS cost modelling [Source: Analysys Mason, 2025]

Aspect of approach	Description of approach
One-off payments (modelled as capex)	• Historic auction payments for active licences • Renewal fees
Recurring payments (modelled as opex)	• 900MHz spectrum fees • Spectrum licence tax (SLT) • Fees for the Enhanced Electromagnetic Energy (EME) program
Depreciation method	Economic depreciation
Allocation key	Radio traffic of the modelled operator, based on the demand forecasts
Allocation approach	Allocate spectrum costs to the traffic of the network technologies using the spectrum e.g. if a spectrum band is assumed to be used only for 4G traffic, then its costs are allocated only to 4G traffic

We will use the aspects of the 2020 MTAS cost modelling approach described above for the new cost model as a starting point. As a minimum, the following adjustments will be made:

- all licences that have expired in or before 2024 will be assumed to have been fully recovered
- 900MHz spectrum fees no longer apply following the 2021 auction of the 850MHz expansion and 900MHz bands: these past costs will be assumed to have been fully recovered
- the assumed demand will be updated from 2020 onwards, but the demand forecast for the years up to 2019 from the 2020 MTAS cost modelling will be retained (as actuals).

The forthcoming proposals by ACMA regarding the renewal of multiple spectrum licences between 2028 and 2032 will be captured. ACMA's draft proposals will be captured in the draft new cost model (using the midpoint of the spectrum price ranges proposed) and ACMA's final approach in the final cost model.[24] A sensitivity test assuming the upper bound of each spectrum price range will also be included in the model.

3.4 Backhaul transmission

Last-mile access (LMA) backhaul is required from radio network sites back to a transmission hub. Typical solutions for providing such backhaul include:

- leased lines (Ethernet, 100Mbit/s or higher)
- self-provided Ethernet microwave links
- leased Ethernet microwave links
- satellite
- own-build fibre or leased dark fibre.

The choice of mobile network transmission varies among the actual national MNOs and can change over time. An operator today would most likely adopt a scalable and futureproof Ethernet-based transmission network, although the specific technologies (and whether or not it chooses to lease network elements will depend on the prevailing preferences of the operator).

In the 2020 MTAS cost modelling, data received from the national MNOs and the ACCC was used to derive a 10%:70%:20% split for leased lines, owned/dark fibre and microwave backhaul respectively, reflecting the choices of actual Australian national MNOs.

For the development of this model, data has been requested from operators and the ACCC so that:

- the split of backhaul can be revisited, particularly given the impact of 5G deployments on the network requirements
- the average length of each type of link can be determined, since the costs of backhaul are heavily dependent on the length of the link and its location (i.e. whether it is metro/regional/remote)
- the average costs of each type of backhaul link can be quantified.

3.5 Backbone transmission

Other transmission between mobile network nodes falls potentially into two types:

- transmission hubs to core network sites, if these nodes are not co-sited
- between core network sites.

Consistent with a forward-looking approach, we consider it reasonable to model a modern backbone transmission architecture. This implies a national fibre network for collecting and carrying traffic

24 See https://www.acma.gov.au/expiring-spectrum-licences

back to the main core network sites and carrying traffic between these sites, equipped with IP interfaces. The choice between leasing managed services and self-supply of transmission equipment, as well as the mix of leased line/microwave/satellite/fibre-based transmission is likely to vary depending on the strategic decisions and partnerships of each national MNO. Based on information received from the national MNOs, a reasonable forward-looking architecture will be modelled. It will be possible for the modelled mix of backbone transmission to be assumed to be different from the backhaul transmission layer.

3.6 Core network infrastructure

We will model an IMS core to switch and route the modelled voice traffic between core network locations. A diagram of the planned architecture for the modelled mobile network is shown below in Figure 3.9, although this will be revisited based on data received from industry stakeholders (for example, if any additional network elements are required to support VoWiFi).

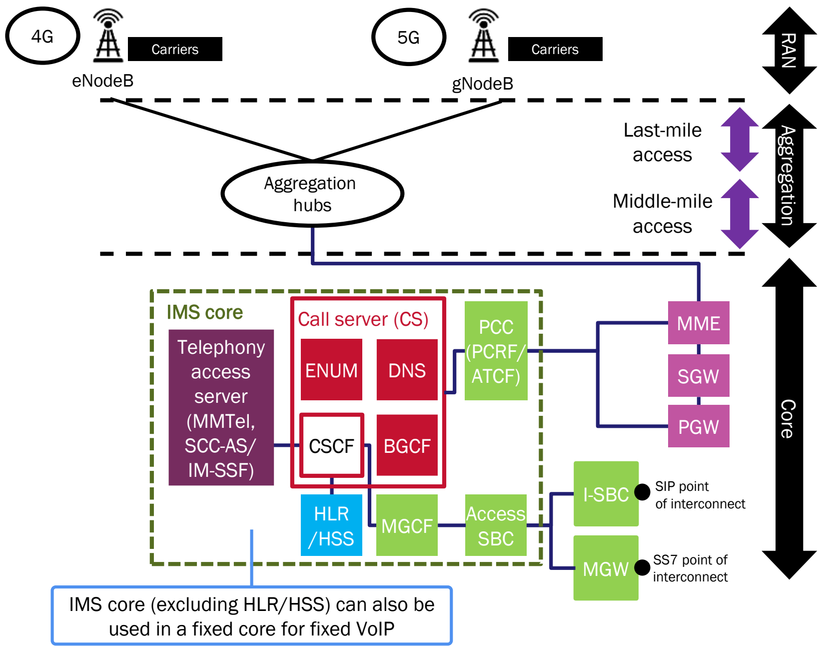


Figure 3.9: Assumed core network architecture [Source: Analysys Mason, 2025]

The IMS core will also be used as the basis for the modelled fixed core network to provide fixed voice-over-IP (VoIP) services. This is a platform dedicated to voice services and therefore should be recoverable only by voice services, through the principle of cost causation.

We will also model a 5G standalone core, since our understanding is that all three national MNOs in Australia have deployed, or are in the process of deploying, this 5G core network technology.[25]

The contribution to the FTAS and the FOAS from other parts of the fixed core network is minimal, as usage of these assets by voice traffic is negligible compared to both usage by data traffic and dedicated capacity set aside for transmission services. Therefore, other parts of the fixed core

25 See these announcements for Optus, Telstra and TPG Telecom respectively.

network (including inter-node infrastructure and other switching/routeing equipment) will not be modelled explicitly.

3.7 Network nodes

Both mobile and fixed core networks can be considered as a series of nodes (with different functions) and links between them. When developing a deployment algorithm for these nodes, it is necessary to consider whether the algorithm accurately reflects the actual number of nodes deployed. Specification of the degree of network efficiency is an important costing issue. When modelling an efficient network using a bottom-up approach, several options are available:

Actual network — This approach implements the exact deployment of the real operator without any adjustment to the number, location or performance of network nodes.

Scorched-node approach — This approach assumes that the historical locations of the actual network node buildings are fixed, and that the operator can choose the best technology to configure the network at and between these nodes to meet the optimised demand of an efficient operator. For example, this could mean replacing legacy equipment with best-in-service equipment.

The scorched-node approach, therefore, determines the efficient cost of a network that provides the same services as the incumbent network, taking as given the current location and function of the incumbent's nodes.

Modified scorched-node approach — The scorched-node principle can be reasonably modified in order to replicate a more efficient network topology than that currently in place. Consequently, this approach takes the existing topology and eliminates inefficiencies. In particular, it can mean:

- simplifying the switching hierarchy (e.g. reducing the number of switching nodes, or replacing smaller switches with a larger switch)
- changing the functionality of a node (e.g. reducing a small exchange to the equivalent of a remote multiplexer, upgrading a picocell base station location to be for a macrocell base station instead[26]).

Scorched-earth approach — The scorched-earth approach determines the efficient cost of a network that provides the same services as actual networks, without placing any constraints on its configuration, such as the location of the network nodes. This approach models what an entrant would build if no network existed, based on a known location of customers and forecasts of demand for services.

26 A macrocell is a standard radio network base station, whereas a picocell is a smaller base station that is deployed, for example, to provide extra capacity to a traffic hotspot.

This approach gives the lowest estimate of cost, because it removes all inefficiencies due to the historical development of the network, and assumes that the network can be redesigned perfectly to meet current criteria.

In the case of modelled mobile networks, a modified scorched-node approach dimensions a hypothetical network comparable to actual operator node counts (including radio sites, aggregation hubs and core nodes), while ensuring that the network design is modern and reasonably efficient. This should reflect, for example, the modern approach to deploying equipment functionality at different nodes in the network. This calibration to actual node counts can be achieved using the ACCC's mobile infrastructure reporting (for the radio layer), supplemented by requested operator data concerning aggregation nodes and core nodes.

As described in Section 3.6, the modelled fixed core network will be assumed to have the same number of core nodes as the modelled mobile core network.

4 Concepts concerning the modelled services

The following concepts are considered in this section.

Figure 4.1: Proposals concerning the modelled services [Source: Analysys Mason, 2025]

Section	Concepts	Intended approach
4.1	Service set	Provide all the commonly available voice and non-voice services
4.2	Traffic volumes	Apply a market-average profile to the modelled 1/N operator
4.3	Points of interconnect (PoI)	Model an appropriate efficient number of PoI locations (and interconnect protocols used) based on operator data received
4.4	Wholesale versus retail demarcations	Include only network-attributable costs in the cost model

4.1 Service set

Economies of scope and scale, arising from the provision of both voice and data services across a single infrastructure, will reduce the unit cost for voice and data services. This is particularly true for networks built on modern architectures, where voice and data services can be delivered via a single platform.

As a result, a full list of services must be included in the cost model, as a proportion of network costs will need to be allocated to these services. This also implies that both end-user and wholesale voice services need to be modelled, so that the voice platform is correctly dimensioned and costs are fully recovered from the applicable traffic volumes.

Some of the non-voice services are proven services (particularly services like SMS on mobile networks). However, other non-voice services, such as future 5G data volumes on mobile networks, can give rise to forecast uncertainty when they affect the regulated prices for voice. It is necessary to understand the implications for voice costs of the forecast made for such uncertain non-voice services – and as a result, the cost model will be capable of considering a range of forecast scenarios to maximise understanding of the sensitivity of the model results to the forecast volumes of these services.

We set out the service set for the modelled mobile networks and fixed core networks below. Our proposals reflect the definitions of the MTAS, FTAS and FOAS services.[27]

[27] See Section 3 of the ACCC's discussion paper here.

4.1.1 Mobile networks

The services that we consider for the mobile network are listed in Figure 4.2. Where we state that a subscriber is hosted by the modelled operator, we mean the subscriber is within either the retail or wholesale (MVNO/SP) subscriber bases of the operator, or is an inbound roamer on the network.

Figure 4.2: Mobile network traffic services [Source: Analysys Mason, 2025]

Service	Explanation
On-net mobile calls	Voice calls between two subscribers hosted by the modelled operator
Outgoing mobile calls to other destinations	Voice calls from a subscriber hosted by the modelled operator to either: • a mobile subscriber of another domestic mobile operator • a fixed-line subscriber (including non-geographic numbers, etc.) • an international destination
Domestic incoming mobile voice (part of MTAS)	Voice terminated to a subscriber hosted by the modelled operator from: • a mobile subscriber of another domestic mobile operator • a fixed destination • an international destination
Outgoing VoWiFi	Voice calls originated from subscribers hosted by the modelled operator using either a Wi-Fi network or satellite
Incoming VoWiFi (part of MTAS)	Voice calls terminated to subscribers hosted by the modelled operator using either a Wi-Fi network or satellite
On-net SMS/MMS	SMS/MMS between two subscribers hosted by the modelled operator
Outgoing SMS/MMS	SMS/MMS from a subscriber hosted by the modelled operator to another mobile operator
Incoming SMS/MMS	SMS/MMS received from another mobile operator and terminated to a mobile subscriber hosted by the modelled operator
Packet data	Megabytes of data (excluding IP overheads) transferred to/from a mobile subscriber hosted by the modelled operator

The services set out above are also modelled separately for each radio technology (i.e. 4G and 5G), in order to capture the different levels of resources consumed per unit of traffic on each technology.

4.1.2 Fixed core networks

The voice services that we consider for the modelled IMS core for fixed network services are listed in Figure 4.2 below. This will assume the fixed-line subscribers in question each have a geographic number assigned to them.

Figure 4.3: Fixed core network voice traffic services [Source: Analysys Mason, 2025]

Service	Explanation
Retail on-net fixed voice	Voice calls between two fixed-line subscribers of the modelled operator
Outgoing off-net fixed voice (includes FOAS)	Voice calls from a fixed-line subscriber served by the modelled operator to another subscriber (e.g. domestic mobile operator, any fixed operator, non-geographic number, international destination)
Incoming fixed voice (FTAS)	Voice calls received from any other operator and terminated to a fixed-line subscriber of the modelled operator

4.2 Traffic volumes

A holistic approach to forecasting traffic evolution is required, for consistency in the forecasting of voice between the fixed and mobile networks in Australia. Consequently, the voice forecasts used in the cost models developed for costing FTAS/FOAS/MTAS will need to be aligned (for example the fixed-to-mobile and mobile-to-fixed voice volumes should be consistent, after adjusting for market share if required).

The volume of traffic associated with the subscribers of the modelled hypothetical efficient operator is the main driver of costs in the network, and the measure by which economies of scale and scope can be exploited.

Given our decision to adopt an operator with 1/N scale in Section 2.4, this market share assumption is applied to the total volumes applicable to the market (i.e. to all retail services).

It will also be possible to sensitivity test the demand forecasts assumed, by changing the future usage assumptions.

4.3 Points of interconnect

Interconnection to mobile networks is typically offered at a national level, because the interconnecting operator typically does not know where the mobile subscriber is, so it is sometimes necessary to route a call across the mobile network when the handset is in another region of the country.

Data has been requested from both MNOs and FNOs as to the number of PoI present in their network and whether they use SS7 protocol, SIP or other protocols. Based on this information, a forward-looking number of PoI locations will be modelled for both the modelled mobile core network and modelled fixed core network.

4.4 Wholesale versus retail demarcations

The costs of a business's retail activities can be assumed to be either integrated or separated within the business, as illustrated in Figure 4.4 below.

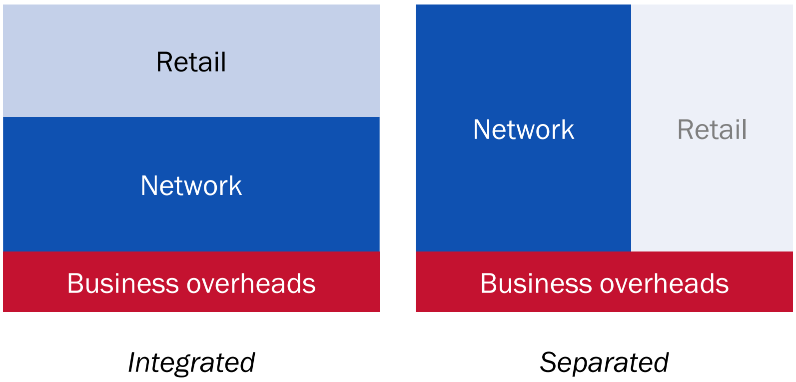


Figure 4.4: Options for consideration of retail costs [Source: Analysys Mason, 2025]

In the *integrated* case, retail costs are considered integral to network services and included in service costs through a mark-up, along with business overheads.

In the *separated* case, network services (such as traffic) are costed separately from retail activities (such as handset subsidy or brand marketing). Business overheads are then marked up between network and retail activities, and the wholesale cost of supplying voice interconnection services is only concerned with the costs of the network plus a share of business overheads attributable to the network.

As part of the inquiry, the ACCC has undertaken analysis of both retail and wholesale markets. However, voice interconnection is a set of wholesale services between operators, meaning that retail costs should not be attributable. Therefore, the vertically separated case is the most appropriate.

Costs that are common to network and retail activities (such as corporate overhead costs) can be recovered from both wholesale network services and retail services. In average incremental costing, such common costs are treated as a mark-up to the network incremental costs. We will analyse top-down expenditure data provided by operators to calculate an appropriate mark-up.

5 Concepts concerning the modelling implementation

The following concepts are considered in this section.

Figure 5.1: Proposals concerning the modelled technologies [Source: Analysys Mason, 2025]

Section	Concepts	Intended approach
5.1	Increment approaches	Model total service incremental costs based on an average incremental cost approach
5.2	Depreciation method	Use economic depreciation
5.3	Geotyping	Define geotypes using SA2 areas, split according to the remoteness areas developed by the Australian Bureau of Statistics (ABS). Potentially subdivide according to spectrum licensing areas. Include a separate geotype for island sites
5.4	Modelling timeframe	Model 2020–2070
5.5	WACC	To be calculated by the ACCC
5.6	Routeing factors	Convert service volumes into voice-equivalent minutes
5.7	Opex modelling	Use operator data and benchmarks to tailor bottom-up approaches to calculate the efficient opex associated with different modelled assets
5.8	Mark-up mechanism	Use an equi-proportionate mark-up

5.1 Increment approaches

Several choices of increment can be used for calculating the costs of voice interconnect services on telecoms networks. We consider the following issues:

- treatment of access-related costs
- size of increment.

5.1.1 Treatment of access-related costs

Regulatory practice in other countries (including those in the European Union) is for the costs of the fixed access network to be excluded from the costs of wholesale voice services. In particular, costs related to the fixed access network are recovered through subscription charges, while costs related to the core network are recovered through traffic charges. The rationale for this segregation is that recovery of access costs from traffic (or vice versa) leads to cross-subsidy. This not only hinders non-access-based competition, but it can also lead to allocatively inefficient consumption (too many lines which do not cover their costs and/or too few calls).

The fundamental principle that voice interconnection costs should not include non-traffic-related costs (including local loop) was well expressed by the European Commission (EC) in its 1998 recommendation:[28]

It follows from the principle of cost orientation that since the provision of interconnection does not lead to any cost increase in the dedicated components of the local loop of the terminating network, the calculation of interconnection charges should not include any component relating to the direct cost of the subscriber-dedicated components of the local loop. The cost of those components in the un-switched local loop that are dedicated to a particular customer should therefore be recovered from that customer through a subscriber line charge, or as a combination of this and revenue from other services, to the extent that competition permits.

This distinction between traffic-related and non-traffic-related costs was made when EU Member States used large average increments, whereby some common costs (both network-related and non-network-related) were assumed to be attributable to the traffic-related component. More recently, the 2009 EC Recommendation on termination rates[29] retains the traffic-related and non-traffic-related distinction, stating that:

A distinction needs to be made between traffic-related costs and non-traffic-related costs, whereby the latter should be disregarded for the purpose of calculating wholesale termination rates.

It should be noted that the 2009 EC Recommendation uses a pure increment, which means that only costs that are avoidable with termination are included (this then excludes common costs).

We are proposing to use average increments rather than pure increments, but the implication of these principles is still that the fixed access network (which is non-traffic-related) is not relevant for the costing of the FTAS and the FOAS.

5.1.2 Size of increment

First of all, we do not consider fully allocated or short-run incremental costing to be relevant options for setting prices, since they do not present adequate long-term incentives for economic efficiency and efficient operations.[30]

We also reject fully allocated costing on the basis that it is not best practice for voice interconnection services, and relies upon the unspecified (and debatable) choices of separate cost allocation rules for all of an operator's top-down activities.

---

[28] 98/195/EC: Commission Recommendation of 8 January 1998 on interconnection in a liberalised telecommunications market (Part 1 - Interconnection pricing). See here.

[29] 2009/396/EC: Commission Recommendation of 7 May 2009 on the Regulatory Treatment of Fixed and Mobile Termination Rates in the EU.

[30] For example, fully-allocated costing rules may not fully reflect the timing of cost recovery between different voice and data services over the lifetime of the network assets; short-run costs may be unusually high or unusually low, depending on network evolution during a capacity expansion phase.

Incremental costing is therefore the robust and best-practice way to identify costs associated with voice interconnection services, in a transparent and justifiable way.

In particular, long-run incremental costs (LRIC) reflect expenditures that would occur in a competitive or contestable market in which an operator provides services:

- **Competition** ensures that operators achieve a normal profit and normal return over the lifetime of the investment timeframe of the business (i.e. the long run)
- **Contestability** ensures existing operators charge prices for services that reflect the costs of supply in a market that can be entered by new entrant operators using modern technology.

Both of these criteria taken together ensure inefficiently incurred costs are not recoverable.

The ACCC has already taken a clear pricing position where it considers the appropriate approach to voice interconnection costing to be a total service long-run incremental cost approach plus an allowance for common costs (TSLRIC+).[31] This is equivalent to a long-run average incremental costing (LRAIC+) methodology in our model. This considers a large increment (e.g. all traffic services provided by the network) and allocates the incremental cost of traffic between the volumes of these services, using 'average traffic routeing factors.' Each service, including voice interconnection services, therefore receives a share of intra-traffic network common costs. One or more mark-ups are applied to the network costs to capture other common costs (e.g. business overheads).

This contrasts with the "pure" incremental costing approach mandated for voice call termination by the European Commission, where the costs attributable to a wholesale voice call termination service are calculated as the difference between the total long-run costs of an operator providing its full range of services and the total long-run costs of that operator providing all services excluding the wholesale voice call termination service. As a result, only traffic-related costs avoided in the absence of the wholesale voice call termination service are allocated to the termination service.[32] As a result, network common costs are not allocated to the voice termination service in the EU, since they do not vary with traffic volumes.

5.2 Depreciation method

There are four main types of depreciation method for obtaining recovery of capital investments over time in cost models, as described in Figure 5.2 below.

31 See https://www.accc.gov.au/by-industry/regulated-infrastructure/regulatory-projects/voice-interconnection-services-access-determination-inquiry/discussion-paper

32 DIRECTIVE (EU) 2018/1972 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2018, establishing the European Electronic Communications Code (available here, Annex III).

Figure 5.2: Types of depreciation [Source: Analysys Mason, 2025]

Type	Subtype	Description
Historical cost accounting (HCA)	–	The capex recorded in the fixed asset register (the gross book value, GBV) is depreciated over the defined financial lifetime of the asset, often with a constant depreciation charge per annum ("straight line")
Current cost accounting (CCA)	Operating capital maintenance (OCM)	Seeks to maintain the operating or output capacity of the asset
	Financial capital maintenance (FCM)	Seeks to maintain the value of the original capital investment
Annuities	Standard annuity (SA)	An annualised cost is derived to allow full recovery of both the investment and the capital employed, at a constant level per annum (like a "mortgage").
	Tilted annuity (TA)	An annualised cost is derived to allow for full recovery of both the investment and the capital employed, with the recovery tilted according to the forecast price trend of the asset
	Modified tilted annuity (MTA)	An annualised cost is derived to allow for full recovery of both investment and capital employed, with the recovery tilted according to the forecast price trend of the asset, adjusted to reflect constant changes in economic output over time
Economic depreciation (ED)	–	Takes into account all the underlying factors that influence economic value, i.e.: • projected trends in the opex of the asset • projected trends in replacing the asset with its modern equivalent asset (MEA) unit cost • the output generated by the asset (i.e. demand)

Figure 5.3 demonstrates that only economic depreciation considers all potentially relevant factors.

Figure 5.3: Factors considered by each depreciation method [Source: Analysys Mason, 2025]

Aspect	HCA	CCA	SA	TA	MTA	ED
Cost recovery in net present value (NPV) terms[33]	✓	✓	✓	✓	✓	✓
MEA cost today		✓	✓	✓	✓	✓
Financial asset lifetime	✓	✓	✓	✓	✓	✓[34]
Economic asset lifetime			✓	✓	✓	✓
Forecast MEA cost				✓	✓	✓
Output of network over time					✓[35]	✓

33 The net-present value is obtained using a discount factor based on the percentage weighted average cost of capital (WACC), which reflects a reasonable rate of return for an operator in (in this case) Australia.

34 Economic depreciation can use financial asset lifetimes, although strictly it should use economic lifetimes (which may be shorter, longer or equal to financial lifetimes).

35 An approximation for output changes over time (with a compound annual growth rate of x%) can be applied in a tilted annuity by assuming an additional output tilt factor of x% per annum.

Although some methods do not reflect all aspects of economic depreciation, they do recover the original investment incurred in NPV terms. Figure 5.4 illustrates the capital charge for a AUD1 million investment over a 10-year lifetime, assuming a constant positive year-on-year cost trend and a constant positive year-on-year increase in demand. All of these methods recover exactly AUD1 million in NPV terms over the period, but the profile of year-by-year depreciation charges varies considerably.

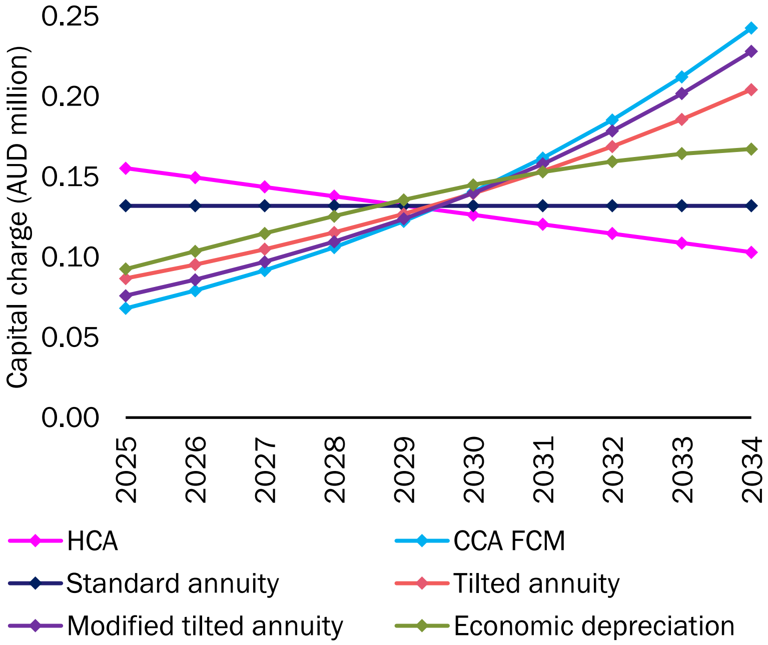


Figure 5.4: Illustration of the annual cost recovery of a AUD1 million investment over 10 years using different depreciation methods [Source: Analysys Mason, 2025]

With a constant year-on-year change in output (in this context, traffic and subscriber volumes) and forecast MEA cost, modified tilted annuity and economic depreciation lead to the same cost recovery profile. However, economic depreciation can consider more complex cases (that might occur in reality) where the year-on-year change in output/forecast MEA cost is not constant and/or varies between different services. The line for ED above is assuming that both the change in output and the MEA cost trend are falling each year. This leads to a reduction in the tilt of the curve over time.

Since economic depreciation can determine a cost recovery that is economically rational, reflecting both underlying production costs through MEA price trends and lifetimes and the output of network assets over the long run, it is the recommended approach.

Our implementation of economic depreciation is based on the principle that *all (efficiently) incurred costs should be fully recovered, in an economically rational way*. Full recovery of all (efficiently) incurred costs is ensured by checking that the NPV of actual expenditure incurred equals the NPV of economic costs recovered, or alternatively, that the NPV of cost recovery minus expenditure is zero. An allowance for return on capital employed specified by the WACC, is also included in the resulting costs.

5.3 Geotyping

A key input to a cost model of mobile networks is the way in which the network in areas with different geodemographic characteristics is modelled. Areas are commonly grouped into one of a number of classes of area with “similar” geodemographics, referred to as ‘geotypes.’ Geotypes are often defined based on a set of sub-regions of the country, ordered by population density.

A single national geodemographic dataset (i.e. a tiling of Australian land) is required. The model developed by Analysys Mason for the Australian Communications and Media Authority (ACMA) was based on approximately 2200 statistical local areas level 2 (SA2).[36] The 2020 MTAS cost modelling also used SA2 areas.

We will therefore use SA2 areas as the starting point for the geotypes in the new cost model.[37] However, we have split these areas based on the ABS definition of remoteness areas.[38] Remoteness areas are scored using an index called the Accessibility/Remoteness Index of Australia Plus (ARIA+) with ABS documenting that it has made some adjustments to ensure contiguous areas. The classification of areas according to this index is shown below in Figure 5.5.

Remoteness area name	Range of values for ARIA+
Major cities of Australia	0.00–0.20
Inner Regional Australia	0.20–2.40
Outer Regional Australia	2.40–5.92
Remote Australia	5.92–10.53
Very Remote Australia	Greater than 10.53

Figure 5.5: Definition of remoteness areas classes [Source: ABS, 2025]

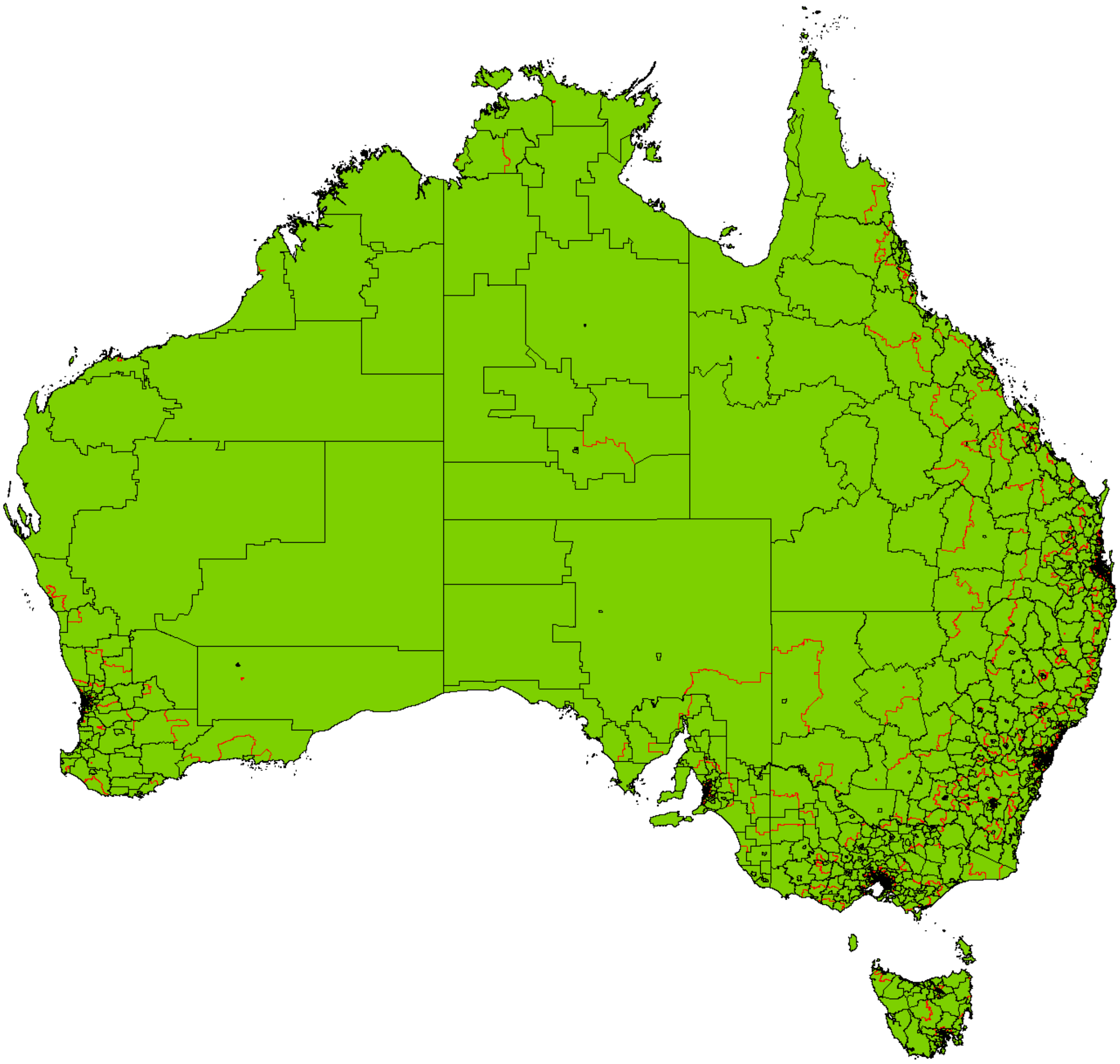
The resulting tiling is illustrated below in Figure 5.6.

36 See the *GEO* worksheet of the Excel file published here.

37 The population and area for each SA2 area is available here.

38 See the ABS website here.

Figure 5.6: SA2 areas (black outlines) with additional splits by remoteness (red lines) [Source: Analysis of ABS data, 2025]



The five remoteness area types are the starting point for our geotypes in the model. As indicated in Section 2.3.1, a separate geotype will be modelled for islands requiring coverage (other than Tasmania) and major transport routes (based on a measure of road length). The regional aspect of spectrum allocations will be reflected in a maximum population/area coverage by geotype for each spectrum band, calculated for the model.

In the model, the split SA2 areas will be ranked within a geotype based on population density, so that an assumed population coverage can then be converted into an area coverage by geotype.

5.4 Modelling timeframe

The period of years across which demand and asset volumes are calculated in the model is a necessary (explicit or implicit) input to the calculation. A long time series:

- allows the consideration of all costs over time, providing the greatest clarity within the model as to the implications of adopting economic depreciation
- provides greater clarity as to the recovery of costs incurred from the services
- provides a wider range of information with which to understand how the costs of the modelled networks vary over time and in response to changes in demand or network evolution.

The time series should be considered equivalent to the "lifetime" of the operator, allowing full cost recovery over the entire lifetime of the business. However, the lifetime of an operator is impractical to identify. The time series should be at least as long as the longest asset lifetime used in the model. In the case of mobile networks, the longest-lived assets will be owned radio sites, whose lifetime could be up to 25 years. The modelled operator can be assumed to implicitly still exist after 2070, but it is the case that the capex and opex are only assumed to be incurred up until 2070 at the latest.

As discussed in Section 2.3, the modelled network will be deployed from 2025. Therefore, we will use a calculation timeframe from 2020 to 2070. A model duration that starts prior to the deployment of the network allows us to capture planning periods, during which assets are purchased ahead of their installation/activation.

The long modelling period ensures that there is no need to consider terminal values in the resulting costs. This is because any future costs (both capex and opex) incurred beyond 2070 would be discounted so heavily that they would only contribute a negligible amount to the net present value of future cashflows. This approach may lead to a small over-estimate of costs recovered as some capital assets have their costs recovered in a shortened lifetime if their purchase occurs within one asset lifetime of 2070.[39]

5.5 Weighted average cost of capital

The bottom-up model will require a pre-tax WACC as an input which can be sensitivity tested in the model. The ACCC will calculate a pre-tax WACC for this purpose.

5.6 Routeing factors

Routeing factors are used to allocate costs calculated by asset between the modelled service volumes in a neutral way. The routeing factors most commonly used in cost models of telecoms networks are average traffic routeing factors. The factors convert all service volumes into an equivalent traffic measure using appropriate technical conversion factors. The (sourced) inputs and derivation of these conversion factors will be included in the model.

We will convert all modelled service volumes into voice-equivalent minutes, which will form the basis of the allocation.

---

39 For example, if an asset must be replaced every 10 years, then the model purchases the asset five times (2025, 2035, 2045, 2055, 2065) but recovers these costs across 45 years rather than 50 years.

The demand-weighted asset output will be calculated for each asset and used to split total costs between all service volumes using the formula below:

$$Cost(Service_k) = \sum_{assets} cost\_per\_unit\_output(asset_i) \times RouteingFactor(asset_i, service_k)$$

5.7 Opex modelling

Operating expenditures (opex) are those ongoing costs required for operation and maintenance (O&M) of the network business. They include rentals, power, staffing, maintenance and other costs associated with an asset once it is active in the network. In a bottom-up cost model, there are several options for calculating opex, as summarised in Figure 5.7 below. Often, a model can use a combination of these approaches, by using different approaches for the opex associated with different network elements.

Figure 5.7: Approaches to calculating opex in a bottom-up cost model [Source: Analysys Mason, 2025]

Calculation approach	Description
Bottom-up opex as a proportion of capex	This ascribes an opex to each asset in the modelled networks, based on unit opex as an assumed proportion of the asset unit capex
Bottom-up events-based calculation	This requires an assumed list of events that, when they occur in the network, incur costs. For each event, its assumed frequency and the cost per event are then multiplied together to get a level of events-driven opex. For example, site power costs can be calculated as the product of average annual power cost per site and number of sites
Bottom-up functional area calculation	Opex is determined based on a bottom-up calculation of staff requirements for different business-related functions, which is then combined with assumptions of the total cost per full-time equivalent member of staff (FTE). This opex by functional area is then allocated to the modelled assets. This can be done in a variety of ways e.g. in proportion to an estimate of opex derived by an opex as a proportion of capex calculation
Benchmarking	Opex mark-ups used in the models developed in other countries could be gathered and analysed to estimate a mark up

We will request relevant operating expenditure data from national operators that would enable the application of the bottom-up approaches described above to derive efficient levels of network opex. Benchmarks from a range of other public models could be used to fill any gaps. The model outputs can be compared to top-down operator data to validate the cost levels.

The treatment of opex overheads, as a common cost, is considered below.

5.8 Mark-up mechanism

Common costs (costs which are not incremental costs) will be included in the final cost result of voice interconnection services, according to the different increment definitions discussed in Section 5.1. These can include:

- network common costs – parts of the deployed network that are common to all network services (e.g. spectrum licence fees, payments of the telecommunications industry levy (TIL))
- non-network common costs, or 'business overheads,' common to network and retail services – cost components that are common to all functions of the business (e.g. the CEO's salary).

Part of the common costs is included within the cost boundary under the LRAIC+ approach. When common costs cannot be directly allocated, an alternative allocation mechanism is required if these costs are to be included in the final cost results. Two methods are commonly discussed:

Equi-proportionate mark-up (EPMU)	In this method, the incremental cost of all increments is increased by the same percentage. The percentage is calculated as the ratio of total common costs to total incremental costs. Applying an EPMU is straightforward, and results in a uniform treatment of all the service costs in the business, as well as not requiring any supporting information.
Ramsey pricing, and its variants	In Ramsey pricing, the common costs are marked up using a calculation that relies upon the elasticities of the various services consumed. By marking up common costs in proportion to inverse elasticities, these costs are loaded onto inelastic services, leaving more sensitive services to bear a lower burden of common costs. Ramsey pricing can also be defined to consider cross-elasticities and externality benefits. Economically, this approach therefore aims to maximise service consumption. The application of Ramsey pricing requires additional aspects of the calculation to be specified: the precise method for calculating the mark-up and relevant price elasticities, and possibly also welfare externality parameters.

However, despite its theoretical appeal, in practice Ramsey pricing is infeasible due to the complex and dynamic information requirements regarding demand elasticities. Moreover, the use of an EPMU for the mark-up of common costs in the modelling of telecoms networks is often supported by regulators and practitioners because it is fair, objective and easy to implement. It is therefore also consistent with regulatory practice used predominantly in many countries.

Thus, we will use an EPMU approach for those common costs not allocated using routing factors.

Annex A Expansion of acronyms

Figure A.1 provides a single point of reference for all the acronyms referenced in this report.

Figure A.1: Expansion of acronyms [Source: Analysys Mason, 2025]

Acronym	Expansion	Acronym	Expansion
1G	First generation of mobile telephony	ED	Economic depreciation
2G	Second generation of mobile telephony	EIR	Equipment identity register
3G	Third generation of mobile telephony	EME	Enhanced electromagnetic energy
4G	Fourth generation of mobile telephony	eNodeB	4G equivalent of a base station
5G	Fifth generation of mobile telephony	ENUM	Electronic numbering mapping system
ABS	Australian Bureau of Statistics	EPMU	Equi-proportionate mark-up
ACMA	Australian Communications and Media Authority	FAC	Fully-allocated cost
AMPS	Advanced Mobile Phone System	FCM	Financial capital maintenance
ASMG	Australian spectrum map grid	FDD	Frequency division duplex
ATCF	Access transfer control function	FNO	Fixed network operator
ATM	Asynchronous transfer mode	FOAS	Fixed originating access service
AUC	Authentication centre	FTAS	Fixed terminating access service
AUD	Australian dollar	GBV	Gross book value
AWL	Area-wide apparatus licence	GHz	Gigahertz
BBU	Baseband unit	gNodeB	Denotes the 5G equivalent of a base station
BGCF	Border gateway control function	GPRS	General packet radio system
BHCA	Busy-hour (BH) call attempts	GSM	Global system for mobile communications
BHE	Busy-hour Erlangs	GSN	Gateway serving node
CCA	Current cost accounting	HCA	Historical cost accounting
CEO	Chief executive officer	HEO	Hypothetical efficient operator
CPI	Consumer price index	HLR	Home location register
CS	Call server	HSS	Home subscriber server
CSCF	Call session control function	IMS	IP multimedia subsystem
CU	Centralised unit	IM-SSF	IP multimedia service switching function
DNS	Domain name system	IN	Intelligent network
DU	Distribution unit	IP	Internet Protocol
EC	European Commission	I–SBC	Interconnect session border controller

Acronym	Expansion	Acronym	Expansion
LEO	Low-Earth orbit	RIC	RAN intelligent controller
LMA	Last-mile access	RRH	Remote radio head
LRAIC	Long-run average incremental cost	RU	Remote unit
LRIC	Long-run incremental cost	SA	Statistical area / standard annuity
LTE	Long-term evolution	SAU	Simultaneously attached users
MEA	Modern equivalent asset	SBC	Session border controller
MGCF	Media gateway control function	SCC-AS	Service centralisation and continuity application server
MGW	Media gateway	SGW	Serving gateway
MHz	Megahertz	SIM	Subscriber identity module
MME	Mobility management entity	SIP	Session initiation protocol
MMS	Multimedia message service	SMS	Short message service
MMSC	MMS centre	SMSC	SMS centre
MMTel	Multimedia telephony service	S-RAN	Single radio access network
MNO	Mobile network operator	SLT	Spectrum licence tax
MNP	Mobile number portability	SP	Service provider
MSC	Mobile switching centre	SS7	Signalling system 7
MSP	Mobile service provider	TA	Tilted annuity
MSS	MSC server	TDD	Time division duplex
MTA	Modified tilted annuity	TSLRIC	Total service long-run incremental cost
MTAS	Mobile terminating access services	UMTS	Universal mobile telecommunications systems
MVNO	Mobile virtual network operator	UOMO	Universal Outdoor Mobile Obligation
NMC	Network management centre	URLLC	Ultra-reliable, low-latency communication
NodeB	UMTS equivalent of a base station	vBBU	Virtual baseband unit
NPV	Net present value	vCU	Virtual centralised unit
NR	New Radio	vDU	Virtual distributed unit
OCM	Operating capital maintenance	VMS	Voicemail system
PCC	Policy and charging control	VoIP	Voice over internet protocol
PCRF	Policy and charging rules function	VoLTE	Voice over LTE
PGW	Packet data network gateway	VoNR	Voice over new radio
PoI	Point of interconnect	VoWiFi	Voice over Wi-Fi
PV	Present value	WACC	Weighted average cost of capital
RAN	Radio access network	Wi-Fi	Wireless fidelity (a wireless LAN standard)

Annex B Stakeholder feedback

Stakeholder feedback related to the draft model specification are included in this annex, to the extent that the stakeholder disagrees with the position proposed in the draft model specification. This annex contains the responses from:

- Optus (Annex B.1)
- Symbio (Annex B.2)
- Telstra (Annex B.3)
- TPG Telecom (Annex B.4).

Information that is considered confidential within this annex is indicated by the use of square brackets and the scissor symbol '✂.' It will be redacted from public versions of this document.

B.1 Optus

B.1.1 Concern regarding approach for to the fixed network modelling (pages 9–10)

Optus is concerned that the same amount of rigour is not being adopted for fixed voice services, compared to mobile services. Notably, the cost modelling exercise for fixed voice services, only attempts to leverage off the mobile assumptions while discarding the reality of the fixed voice services market due to the significant variance in terms of scale and market position on the basis "it would not be possible for the hypothetical operator to reflect all of these differences".

Optus is concerned that these assumptions demonstrate that the focus is only on mobile, without the same rigour applied for consideration towards the different cost inputs for fixed voice services. We agree with the ACCC's preliminary view that "not modelling other fixed core network assets that are used for both voice and data traffic is a reasonable practical approach" insofar that the same approach is extended to the mobile cost modelling exercise. Put simply, we do not see value in undertaking a cost modelling exercise for setting price terms for the MTAS service.

Analysys Mason response

We disagree that a lower level of rigour is being applied to the fixed network modelling. The modelling is being undertaken on a pragmatic basis, since the focus should be on the assets and cost elements that are primarily used for providing fixed voice services. As fixed data volumes outstrip voice volumes by an order of magnitude more than for the mobile network, assets that are attributable to both voice and data services will only contribute a negligible amount of cost to the fixed voice services.

One reason the mobile network modelling appears to have greater scope is that the mobile radio access network is partly attributable to the cost of MTAS, whilst the fixed access network is not attributable to the cost of FTAS/FOAS. This is described in Section 5.1.1.

B.2 Symbio

B.2.1 Model reflecting a hypothetical efficient operator (page 2)

Symbio notes that the ACCC will seek to calculate the costs of a hypothetical efficient operator, rather than the actual costs of any specific operator. Nevertheless, the assumptions about the hypothetical operator and its characteristics need to be approached with some care. As noted above, this should not extend to requirement (or assumption) that the hypothetical operator would have a business model based on providing both voice and mobile services.

Analysys Mason response

For the avoidance of doubt, the hypothetical operator is not assumed to provide both (fixed) voice and mobile services. The model calculates the costs associated with two networks:

- An MNO providing mobile services over its RAN and core network (including a voice platform)
- A voice platform providing fixed voice services.

B.2.2 Model based on 4G/5G technologies in the case of mobile services (page 3)

Symbio accepts that these are the appropriate technologies that should be included in the modelling of mobile service costs. In the case of 5G, it is widely accepted that MNOs have invested in capabilities which are not currently being fully exploited or promoted in the market. Examples include network slicing and 5G standalone capabilities. Undoubtedly these capabilities will be better utilised at some stage, but likely considerably later in the 5G life-cycle than envisaged when initial investments were planned. The point is that these costs are not necessary for voice service and should be removed from the claimed costs in the early years of the model – that is, the years with most impact on the MTAS charges arising from the current review.

Analysys Mason response

The service costing approach allocates all annualised network asset costs between all network services using routeing factors (described in Section 5.6). Annualised costs are derived using economic depreciation, which effectively attributes all asset costs incurred over all modelled years between those years based on the assumed asset cost trend and the service volumes across all those years (described in Section 5.2).

Regarding 5G standalone networks, these are being modelled as they are currently being actively deployed in Australia. However, 5G standalone primarily concerns core network equipment and therefore will not have a significant impact on the calculated costs of MTAS. Moreover, since the

5G standalone core is used by both voice and data services, only a very small proportion of the costs of that core network will be allocated to current and forecast voice volumes.

As described in Section 3.1, we are modelling a 4G/5G single-RAN and are modelling neither 5G Advanced nor Open RAN/virtualised RAN technologies, as they remain emergent at this point in time.

B.2.3 Network footprint and rollout (page 3)

Symbio notes that, at page 25 of the Discussion Paper, that "Analysys Mason proposes to calculate the immediate 4G and 5G coverage based on the coverage maps provided by the national mobile network operators as of 31 January 2024. The hypothetical efficient operator is assumed to have coverage (for 4G and 5G respectively) where at least two of the three operators have coverage using any frequency based on these coverage maps (the Coverage Definition). Geographic and population coverage will then be calculated by geotype."

Symbio has no objection to this approach for determining mobile coverage for the hypothetical operator being modelled.

However, Symbio does have concerns about the next sentence: "Analysys Mason also proposes to assume that the modelled fixed core network covers the same proportion of the population as the modelled mobile network." It is not clear why this assumption is being made, other than perhaps for pure convenience resulting from the use of a single model. In principle, Symbio considers that the population being served by fixed operators should be based on the actual service populations of the operators who have been asked to provide information by the ACCC. Since the ACCC does not intend to include the costs of the fixed access network in the fixed model, it is not at all clear why there needs to be an assumption on population served, unless it is to set an upper limit on demand growth in some way. We would appreciate some clarification on this matter.

Analysys Mason response

4G mobile networks serve almost 100% of the population, meaning that the modelled fixed core network will also be assumed to serve almost 100% of the population. We do not think that is an unreasonable assumption, since a centralised fixed core network can still serve most of the country.

As Symbio have speculated, the purpose of this assumption is to calculate the modelled demand using a similar calculation to the subscribers served by the modelled mobile network (i.e. population × penetration × market share).

B.2.4 Market share and scale (page 3)

Symbio has no objection to the preliminary views that the ACCC has expressed on the market share and scale assumptions for mobile operators in the model, as set out at page 26 of the Discussion Paper.

The ACCC's preliminary view on market share and scale for the hypothetical fixed operator in the model is set out at page 27: "For the purpose of the ACCC's Division 12 Record Keeping Rules, Optus, Telstra, TPG Telecom and Vocus are the four operators that provide information relating to fixed voice services. For this reason, the ACCC considers that a simple assumption of market share based on four operators in Australia (i.e. 25%) is a reasonable starting point and welcomes stakeholder feedback on whether this assumption is appropriate."

The ACCC's proposal to use a 25% market share based on the number of operators providing information relating to fixed voice services pursuant to the Record Keeping Rules is arbitrary. Symbio was not required to submit information under these Rules. ✂ Hence we would request that the ACCC review this matter and if, our assumption is valid, the market share for the modelled efficient voice operator should be based on five operators (not four) or 20%.

Analysys Mason response

Given that we understand that Symbio does carry material voice traffic volumes, we have amended the market share to be 20% (1/5) rather than 25% (1/4).

B.2.5 Modelled radio technology (page 4)

Symbio has no objection to the three radio technologies proposed to be used, however, the assumption that these will be the appropriate technologies for the whole of the modelling horizon (and especially for the next five years) may be questioned. 5G Advanced and 6G technologies are expected to improve the efficiency of radio networks in that period.

Analysys Mason response

This is a recurring issue with these models, but future technologies cannot be feasibly modelled if they are not being deployed by operators in the country and (as a result) network design parameters are not available.

Whilst we agree that 5G Advanced technology could be present in Australia by the end of the decade, we doubt that 6G technology will be available until the next decade.

Usually, the assumption taken is that future traffic growth is forecast assuming the modelled technologies continue in perpetuity. Were future technologies such as 6G to be modelled, this would lead to further future traffic growth above what is currently captured. The traffic forecast will be set conservatively so as to not rely on the presence of technologies that are not modelled.

B.2.6 Core network infrastructure (page 4)

Symbio considers that all core network components that contribute to the cost of fixed voice traffic, and which are necessary for the provision of voice service, should be included in the model, contrary to the approach outlined at page 30 of the Discussion Paper that refers only to the "IMS core". In its response to the ACCC's request for cost data, Symbio has delineated all the elements of its network that contribute to its core network infrastructure, and these elements and their costs need to be included.

Analysys Mason response

The Symbio data submission will be considered during the model as a very useful set of datapoints concerning its direct network costs, indirect network costs and corporate overheads. We note Symbio's position as a provider of voice services, but caveat from its own website that it also provides services related to messaging, number porting and various enterprise services.[40] Therefore, Symbio is not a voice-only provider and some of its costs will be attributable to these other services.

However, we have already stated our position that, for our hypothetical fixed operator, we will not model the inter-node infrastructure and other switching/routeing equipment as usage of these assets by voice traffic is negligible compared to the assumed usage by data services and dedicated capacity set aside for transmission services of our modelled hypothetical fixed operator. However, Symbio's cost submission can still be used to inform the assumed mark-ups for indirect network costs and corporate overheads attributable to the modelled assets.

B.2.7 Network nodes (page 4)

At page 31 of the Discussion Paper, the ACCC says: "The fixed core network will be assumed to have the same number of core nodes as the modelled mobile core network." No rationale or other justification is offered for this assumption and it appears to be arbitrary. We would request that the ACCC review this assumption to ensure it is realistic for a fixed core network.

Analysys Mason response

Symbio indicates in its own submission that it has ✂ nodes in its fixed core network: we fully expect our modelled core network to have a comparable number of nodes.

40 https://www.symbio.global/australia

B.2.8 Modelled fixed service set (page 4)

At page 32 of the Discussion Paper the modelled fixed services are stated to include retail on-net fixed voice, outgoing off-net fixed voice and incoming fixed voice. Symbio believes that the ACCC and AM should clarify whether these services comprise the complete set of modelled fixed services, or not. [Symbio believes that they probably are a complete set.].

Analysys Mason response

We consider that these are a complete set of fixed voice services, since they capture all origins and destinations for voice users within these broad categories.

B.2.9 Points of Interconnection (page 4)

Page 32 of the Discussion Paper states: "Analysys Mason proposes to model a forward-looking number of Points of Interconnection locations. We have sought information from operators on the number of Points of Interconnection locations in the network as well as the interconnection protocol they use which will inform this issue." Symbio agrees, but is concerned about how an efficient number of POIs will be determined for a hypothetical efficient fixed operator. The paper offers no clarification on this point. In Australia, networks have tended to be structured on a State-by-State basis by the major operators such as Telstra and Optus, and hence POIs tend to be positioned on a State basis. We consider this should be included in the modelling approach.

Analysys Mason response

Our modelled approach will assume PoI locations in each mainland state (New South Wales, Victoria, Queensland, Western Australia, South Australia): this approach is supported by our review of operator data.

B.2.10 Routeing factor (page 5)

Symbio agrees that all traffic should be converted to voice minute equivalents. The ACCC proposed to use average routeing factors, but has provided no information on how the averages will be derived.

Analysys Mason response

As described in Section 5.6, the traffic volumes will be converted into voice-equivalent radio minutes using technical conversion factors. These conversion factors will be used to allocate costs between services, by converting service volumes (minutes for voice, messages for SMS/MMS, megabytes for data) into voice-equivalent minutes.

The (sourced) inputs and derivation of these conversion factors will be included in the model.

B.2.11 Modelling of operating expenditures (page 5)

Symbio recognises that operating expenditures that are specific to particular assets and for specific services will need to be accounted for differently to general OPEX and that a combination of specific allocation and general mark-up will likely be required..

Analysys Mason response

To clarify on this point, the model will likely differentiate between three different types of costs:

- Direct network opex: Expressed as an opex per unit (to cover costs such as vendor costs), which can vary by asset
- Indirect network opex: Expressed as a mark-up on direct network opex to cover indirect network costs (such as network staff costs)
- Overhead opex: Expressed as a single EPMU (described in Section 5.8).

The values for the assumptions will be informed by operator data wherever possible and supplemented by appropriate benchmarks.

B.3 Telstra

B.3.1 Single cost-model (page 3)

The development of a single cost-model that can produce cost estimates for all voice interconnection services is not necessarily inconsistent with the foregoing. However, in developing a single TSLRIC+ model for both fixed and mobile interconnection services, several adjustments need to be made to ensure the model accurately reflects the differences in the costs that would be incurred by a hypothetical efficient operator in each case.

These adjustments should include not only accounting for obvious technology differences but also:

Cost Allocation: The model must accurately allocate costs between fixed and mobile services. This includes distinguishing between shared and service-specific costs to avoid double-counting or misallocation.

Traffic Patterns: Fixed and mobile networks have different traffic patterns and usage characteristics. The model must account for these differences to reflect the true cost of handling traffic on each type of network.

Service Quality and Capacity Constraints: The model should consider the quality of service and capacity constraints unique to each network type. For example, mobile networks typically have higher costs due to capacity constraints and the need for more frequent upgrades. Also, as the ACCC has correctly observed in its Position and Consultation Paper, whereas for a fixed line network there is no incremental cost on the customer access network (CAN) to carry additional terminating voice traffic, the capacity of a mobile radio access network (RAN) does have to increase in response to additional terminating voice traffic (such as by deploying more spectrum or building more sites).

Market Dynamics: The competitive dynamics of fixed and mobile markets can differ significantly. The model should reflect these differences to ensure that interconnection charges promote fair competition and efficient investment in both markets.

Without the making of these adjustments, there is a high risk the model could produce an output higher or lower than the true efficient cost of the relevant access service, causing any regulated price terms in the FAD based on the model to distort market outcomes and investment incentives to the detriment of end-users.

Analysys Mason response

We make the following clarifications regarding the modelling approach with respect to these comments:

- For the avoidance of doubt, the model will have the functionality to dimension and cost *separate* voice platforms for a fixed network and a mobile network, with separate inputs for dimensioning and costing. Therefore, differences in traffic patterns and usage characteristics can be parameterised
- The network design for the mobile network will include separate calculations for coverage and capacity layers in the radio network. This calculation will dimension network asset requirements based on the assumed spectrum holdings, meaning that the model will deploy additional sites in addition to the coverage layer in those geotypes where the assumed capacity cannot serve the assumed demand.

B.3.2 Areas where there is only one MNO should be included in the modelling (page 4)

The Model Specification paper proposes to exclude areas covered by either no operator or only one operator, with the exception of 60 islands that currently have at least one radio site. We do not support the approach of excluding areas covered by only one MNO from the model. Given Australia's vast geography and low population density, many regions, particularly remote areas, are served by only one MNO. Over the seven years to the end of FY24, Telstra has invested $11.8 billion nationally in our mobile network, with $4.3 billion of this invested in regional areas. Many of these regional areas, at this time, are served only by Telstra. However, the ACCC's Mobile Infrastructure Report finds that the level of co-location declines across all MNOs as their site locations move from Major Cities to less populated Regional and Remote areas.

We suggest that a more appropriate approach for modelling a hypothetical efficient provider in the Australian context should reflect the largest network reach. It could then either assume that a second competitor would build to that level, or alternatively that 100% market share in these parts of Australia is hypothetically efficient. Ignoring parts of the mobile network that have coverage from only a single operator will produce results that are harmful to the LTIE of the regional and remote Australian end-users who rely on this coverage. To promote the LTIE of Australian mobile users, the model must account for the costs associated with providing mobile coverage throughout Australia (where at least one MNO has currently invested in terrestrial 4G or 5G coverage), including in regional and remote areas. We are concerned that the proposed approach will set up an active barrier to investment in regional Australia and further exacerbate issues regarding the digital divide and access to services.

Our suggested approach aligns with the LTIE requirements, which include promoting competition, achieving any-to-any connectivity, and encouraging the economically efficient use of, and investment in, infrastructure. By ensuring that the model reflects the costs of providing coverage in all areas, we can promote competition by encouraging investment in underserved regions, thereby enhancing any-to-any connectivity. Additionally, this assessment supports the economically efficient use of infrastructure by recognising the unique challenges and costs associated with Australia's geographic and demographic characteristics and allowing providers to recover these costs. This approach would also allow for a more comprehensive cost assessment across Australia, encourage investment incentives that might otherwise be discouraged, and ensure regulatory fairness.

Analysys Mason response

We recognise that this assumption is important to the model in terms of capturing incentives to make network investments.

The model will be able to capture a proportion of the coverage (and demand) arising from those areas served by only operator. The ACCC can then use the model to test the variation in cost per minute of MTAS if this proportion is varied between 0% (only areas served by multiple national MNOs are deployed to by the hypothetical operator) to 100% (all areas served by at least one national MNO are deployed to by the hypothetical operator).

In order to capture the demand of the areas of additional coverage, they will be assumed to have a 100% market share of the demand in those additional areas, given that only one network operator is actually present in those areas.

B.3.3 Satellite to Mobile related costs should be included in the modelling (page 5)

In the coming years, significant advancement in connectivity with the upcoming launch of low Earth orbit satellite (LEO) Satellite to Mobile (STM) coverage is expected to occur. We consider it is important to include STM related costs (spectrum costs and satellite payments) in the cost model for the voice interconnection services, given the expected significance in the future of this technology and the fact that it is likely to be an important driver of relevant incremental costs in the provision of voice services. Including STM costs in the model for the voice interconnection services aligns with the LTIE criteria for several reasons:

Promoting Competition: Incorporating STM costs into the TSLRIC model ensures that all relevant costs are considered, fostering a competitive environment. This helps prevent any unfair advantage and encourages investment in innovative technologies like LEO satellites, ultimately benefiting end-users through improved services.

Encouraging Efficient Investment: Recognising STM costs in the TSLRIC model provides incentives for continued investment in modern LEO satellite infrastructure, benefiting end-users through improved network coverage and redundancy. ✂

Ensuring Any-to-Any Connectivity: Including STM costs supports the integration of LEO satellite technology with existing terrestrial networks. This integration is essential for maintaining seamless connectivity across different network types, ensuring that endusers (sic) can communicate effectively regardless of their location.

Efficient and fair cost recovery: Including STM costs in the model ensures the model will reflect the true costs of providing advanced communication services to end-users over the modelled period, thus supporting the setting of fair and reasonable interconnection charges.

Analysys Mason response

Following consideration of the feedback from stakeholders and the ACCC, the modelling approach will be revised with respect to STM (i.e. D2D) services. Network deployments to provide STM coverage are, at time of writing, too speculative to capture in the model. Therefore, the model will not directly consider the costs of STM-related equipment and services and will assume no demand is carried using D2D. It will be possible for the model to include appropriate network assets at some point in the future, at which time suitable demand, network and cost parameters can be derived using operator information on actual deployments.

Moreover, the model will make no assumption as to the pricing mechanism for voice traffic carried using D2D services, which also remain unclear at this time.

B.3.4 Impact of UOMO (page 6)

Furthermore, the Government's policy regarding universal mobile coverage (UOMO) which applies to all MNOs must be factored in the modelling. The UOMO (Universal Outdoor Mobile Obligation) is expected to require all Australian mobile network operators to provide their customers with access to basic voice and SMS coverage throughout Australia from 2027, which is relevant and should be factored into the model.

We disagree with Analysys Mason's view that "*We do not believe this [UOMO] causes a significant impact on the modelled radio network coverage, given that additional coverage is expected to be achieved using low-Earth-orbit (LEO) satellites. We assume that any impact of the UOMO will instead focus on upgrades to the core layer.*"

The UOMO is expected to require the three MNOs to invest in expanding their current mobile coverage to an additional 5 million square kilometres of Australia's geographic expanse, including over 37,000 kilometres of regional roads, regardless of any lack of commercial return from so doing. Mobile operators will need to invest heavily in expanding their capability to meet the UOMO requirements, including investment in emerging satellite to mobile technology. The cost of complying with this expanded coverage obligation is expected to be significant, impacting both spectrum costs and payments to LEO satellite providers, and should be included in the model.

In complying with the UOMO, it is very possible the MNOs will incur network costs a hypothetical efficient mobile operator would not incur. Nevertheless, we strongly believe it is in the LTIE for these costs to be factored into the model. Adopting such an approach would be akin to the approach taken by the ACCC in its final decision on NBN Co's proposed variation to its Special Access Undertaking (SAU). In that case, the ACCC acknowledged the consistency with the LTIE statutory criteria of including certain costs that may not be considered efficient under typical market conditions but are necessary due to government policy decisions, noting such costs must be recoverable to ensure the ongoing viability and sustainability of the NBN.

The ACCC's final decision on NBN Co's Special Access Undertaking (SAU) variation discusses several specific cost objectives that may be considered prudent and efficient due to government directed projects. These include:

Costs associated with providing services in regional and remote areas: These areas often require significant investment due to their geographic and demographic challenges.

Costs related to the deployment and maintenance of infrastructure mandated by government policies: This includes the rollout of fibre-to-the-node (FTTN) and other copper-based technologies to ensure a comprehensive national broadband network.

Costs incurred from meeting specific service standards and regulatory obligations: these standards are set by the government to ensure high-quality service delivery across all regions.

In it's (sic) submission in support of its SAU variation, NBN Co explained:

"*For nbn to be a sustainable commercial business it must be clear how Government policy projects are to be funded. It is reasonable for the SAU to recognise that nbn must comply with Government policy and the directions / policies issued to nbn… Where the Government considers a project to be commercial, or overall a project is consistent with Government policy for the telecommunications industry generally and/or in relation to nbn specifically that the costs are recovered from users of nbn's services, it is in the LTIE that such decisions are transparent and certain. The Government Policy Project Notice provisions ensure this transparency, and provide nbn with greater certainty that the ACCC will not prevent it recovering the efficient costs of such projects. This, in turn, promotes investment certainty that supports efficient investment in the nbn™ network and other infrastructure.*"

The ACCC's final decision recognises that costs, which arise from the unique requirements and obligations imposed on NBN Co by the government, should be recoverable by NBN Co. As noted in the final decision, in situations where NBN Co is directed to deliver a government directed project "the ACCC must treat the expenditures associated with elements of the project that are specified in the notice as prudently incurred." Any further expenditure aligns with a general assessment of prudency and efficiency. This approach aligns with the broader regulatory framework and the LTIE by ensuring that NBN Co can continue to invest in and maintain the infrastructure necessary to provide high-quality broadband services across Australia, including in underserved and remote areas. We submit the same is true regarding recovery of the MNO's costs of complying with the UOMO to the benefit of end-users in parts of Australia currently without terrestrial mobile coverage.

Analysys Mason response

Following consideration of the feedback from stakeholders and the ACCC, the modelling approach will be revised with respect to the UOMO, which is related to some extent to STM services. The UOMO has only just been announced and the associated obligations and framework have yet to be specified in any detail. Therefore, operators have not yet set deployments (or even planned deployments) in place to address the UOMO. The model will therefore not make any direct assumptions as to how a hypothetical operator might adhere to the UOMO, nor to how wholesale calls sent/received calls by end-users under the UOMO might be charged.

It will be possible for the model to include appropriate network assets at some point in the future, at which time suitable demand, network and cost parameters can be derived using operator information on actual deployments and the pricing mechanisms are established.

B.3.5 Core network infrastructure IMS assumptions (page 7)

The model proposes modelling an IMS core for voice traffic and a 5G standalone core for mobile networks. We support the proposed modelling of an IMS core for voice traffic and a 5G standalone core for mobile network. The hypothetical fixed core network needs to be efficient for the capacity requirements to carry fixed only voice traffic (and connect to fixed POIs) – which is not necessarily aligned with what is efficient to carry mobile voice traffic.

Telstra's IMS platform is a core network element designed specifically for voice traffic, handling real-time voice data. As Telstra is a provider of both fixed and mobile services and our network uses IMS, this platform is designed and scaled to accommodate both mobile and fixed traffic. However, not all fixed operators have an IMS. Accordingly, the efficient cost and capacity assumptions for a standalone fixed network need to be carefully considered by Analysis Mason.

Analysys Mason response

As described in our response in Annex B.3.1, the model will be able to calculate the costs of separate voice platforms (one to serve mobile voice subscribers within the mobile network and one to serve fixed voice subscribers). The cost and capacity assumptions for the voice platform assets in the model will be informed by operator data and other benchmarks where appropriate.

B.4 TPG Telecom

B.4.1 Unavoidable inefficient costs (page 2)

TPG Telecom is concerned the proposed modelling approach may not reflect the costs of providing mobile voice termination on a mobile network in Australia. While we acknowledge the cost model should not account for imprudent investment on the part of mobile network operators (MNOs), some investments, which could be considered inefficient in another market, have been incurred for reasons outside the control of MNOs. A cost model that does not reflect this reality would not be just nor efficient in the Australian market.

Some examples of cost impacts outside of TPG Telecom’s control include:

- TPG Telecom and Optus incurred substantial costs replacing Huawei equipment due to Government policy. ✂ This additional cost was not necessary from an economic perspective. TPG Telecom would not have been required to replace these network elements absent regulatory intervention. Nor could TPG Telecom have reasonably predicted the equipment would be subject to regulatory intervention at the time it was deployed.
- Telstra enjoys substantial legacy benefits from public ownership and various government programs. Competing MNOs face lower returns on investment and higher unit costs for voice termination due to inferior scale relative to Telstra.

As a result of the regulatory and policy environment Telstra is the only MNO achieving returns in excess of its WACC, while Optus and TPG Telecom are not achieving returns on invested capital above their WACC in recent years and are unlikely to do so in the near future. This context is important because a ‘take the average’ approach to selecting model parameters to determine MTAS would likely unfairly disadvantage smaller operators like TPG Telecom.

[…]

Where there is a significant conflict between cost levels determined by the bottom-up modelling and top-down verification, the determination should favour the top-down approach. This accounts for inefficiencies due to factors outside MNO control. MNOs are operating in a competitive environment which inherently imposes discipline on investment decisions.

Analysys Mason response

The derivation of the WACC is to be undertaken as part of a separate process by the ACCC, so is not considered further here.

Whilst we recognise the point raised on premature replacement of assets through regulatory intervention, this was unrelated to the MTAS service. Moreover, the model is a forward-looking cost model of efficient mobile operations (as described in Section 5.1.2) and these costs would not have been incurred by an operator building a network today. Therefore, they will not be included in the model.

B.4.2 Market share (page 3)

The methodology described in the Analysys Mason paper for determining market share for the hypothetical operator will likely lead to an MTAS rate lower than TPG Telecom's true costs for terminating a call on its mobile network.

Under the proposed approach, the hypothetical mobile operator will have a higher market share than TPG Telecom (and Optus). TPG Telecom's own mobile network covers up to 81.6 per cent of the population (post the MOCN implementation in regional Australia with Optus), and Optus' mobile network covers up to 98.4 per cent. Telstra claims that its mobile network covers up to 99.7 per cent of the population. Per the proposed market share formular (sic), this would deliver a market share input of:

$$(81.6\% \times 3) + (16.8\% \times 2) + (1.3\% \times 0) = 2.78$$

$$\text{Market share} = 1 / 2.78 = 35.9\%$$

This is well in excess of the market share of each of TPG Telecom and Optus. The latest ACCC Internet Activity Report shows Telstra has a 42.4 per cent market share of mobile SIOs, Optus 28.5 per cent, and TPG Telecom 17 per cent. As the ACCC acknowledges, market share is a key parameter in determining per unit costs. A market share that is too high will understate unit costs for smaller providers.

[…]

[The] Market share for the hypothetical operator should be set no higher than TPG Telecom's actual market share.

[There should be a] Clearer definition of 'national-level coverage' and the implications of such coverage for the end outputs of the cost model.

Analysys Mason response

We would observe that the market shares quoted above do not add up to 100%, as they are retail market shares only. In contrast, the model will be making an assumption of market share at the *network* level (this will include wholesale hosted subscribers as well as retail subscribers, as stated in Figure 2.1). As a result, the comparisons above should consider higher values than 42.4%/28.5%/17%.

In any case, assuming the market share is equal to that of the operator with the lowest value is not considered an appropriate approach in mobile termination costing and pricing, as it does not give incentives for any of the market operators to try and grow their market share (all market operators already achieve the modelled scale).

Conversely, assuming an excessive market share (e.g. at or near the scale of the largest operator) is also unreasonable, since this implies a level of efficiency that cannot be achieved by all the operators since the total market share would exceed 100%).

The neutral approach that we are taking is that, in those areas where there is network competition, we assume the hypothetical operator has the average market share of the operators present. Put another way, if there are 3 operators present in a given area, then the market share of the hypothetical operator in that area is 1/3 = 33.3%.[41]

B.4.3 Core network architecture (page 4)

The proposed modelled core network architecture does not capture the full extent of a viable core network.

[…]

The core network model should account for the functions and infrastructure to support voice services, including IP switching, routing, load balancing, and firewalling. These cannot be assumed to be negligible.

Provision should be made for anti-scam systems and teams. A voice network overrun by fraudulent activity is of limited utility to end-users. Controlling such activity imposes a real cost on network operators.

41 In the event that a proportion of the area served by only one operator is also captured in the model (as described in Annex B.3.2), then the consistent approach would be to assume network competition in those areas i.e. a second network is deployed in those areas, with a market share of 50% in those areas.

Include number portability requirements in shared common costs. These are an integral part of mobile services in Australia.

Analysys Mason response

The cost elements set out above can be captured in principle in the model, but evidence must be provided to the ACCC as to the materiality of these costs.

This can include, for example, a breakdown of capex incurred for the necessary equipment/systems and the opex incurred to operate and maintain the equipment/systems.

This evidence must also describe and demonstrate that these costs are indeed related to the provision of voice services specifically and not all services.

B.4.4 Spectrum requirements (page 4)

[The model has] Lack of a mechanism to account for future growth in spectrum requirements, and exclusion of the 2300 MHz band despite being in use.

[…]

TPG Telecom concurs with the ACCC's conclusion that capacity of a mobile access network would need to increase in response to additional traffic volumes. Whilst voice traffic is a declining portion of mobile traffic, it is inescapable that demand for mobile voice traffic will not be zero. Mobile network capacity constraints will necessitate increasing spectrum deployment and/or network densification. This means future cost increases should be accounted for in the calculation of a MTAS rate.

Research conducted by Coleago Consulting confirmed current spectrum allocations are likely to be insufficient by 2030. While voice termination is not the primary driver of this requirement, provision of voice termination is inextricably linked to the provision of all wireless services, and the need for spectrum. Not accounting for future spectrum requirements will likely understate the true cost of MTAS.

[The model should] Account for future growth in spectrum requirements, for example 600 MHz and 6 GHz bands, and include 2300 MHz spectrum in cost modelling.

Analysys Mason response

For the avoidance of doubt, a bottom-up mobile network design can respond to increased traffic and/or spectrum scarcity. However, the standard approach is to assume certain spectrum holdings for the modelled operator (potentially varying over time) and to then model the network requirements based on those holdings to serve the assumed demand.

As a rule, no forecast is made for future spectrum assignments given the lack of visibility on the future fees and spectrum packaging.

However, if future spectrum is not assumed to be available, then for the same traffic volumes the network design will deploy more RAN equipment to carry the traffic (increasing the modelled capex and opex). Therefore, not accounting for future spectrum requirements should not significantly understate the true cost of the mobile network deployments. Instead, it will give rise to a different combination of network-related costs.

The 2300MHz band will be included in the model as a sensitivity test option to test the input of its inclusion/exclusion.

B.4.5 Radio network modelling (page 4)

[The model is going to] Provision for cost efficiencies resulting from Open RAN deployment, despite limited evidence of such cost efficiencies, and extremely limited uptake.

[…]

[The model should] Use an actual network or scorched node approach for node deployment to account for node deployment which was rational given the information available at the time of deployment, or done to satisfy factors outside of network control (e.g. regulatory requirements), but nevertheless inefficient in retrospect.

Open RAN solutions, and any hypothetical efficiency gains should not be included. Analysys Mason has not provided evidence of realised cost savings from Open RAN deployment. This is evidenced by the low and declining uptake of Open RAN. A recent Deloitte report found Open RAN comprises less than 2 per cent global market share, with no new deployments expected.

Strand Consult furthermore found the global market share of Open RAN systems declined in 2024. This indicates Open RAN initiatives have failed to deliver the promised efficiency gains.

Analysys Mason response

Following due consideration of the data responses from stakeholders, as well as feedback from stakeholders and the ACCC, the modelling approach for the RAN will be revised. Deployment of Open RAN (or even planned deployments) are limited in Australia at time of writing. Therefore, the model will not make any direct assumptions as to whether the hypothetical operator might deploy Open RAN or similar technologies. Instead, a 4G/5G single-RAN architecture will be modelled.

It will be possible for the model to include appropriate network assets for Open RAN at some point in the future, at which time suitable demand, network and cost parameters can be derived using operator information on actual deployments.

B.4.6 Concepts concerning the modelled services (page 5)

TPG Telecom considers the modelled service set is an accurate reflection of the market for termination services. However, we believe an integrated approach to retail costs should be adopted. Retail service provision is deeply intertwined with voice termination. Much backend infrastructure (e.g. billing systems) is utilised for both retail and wholesale services, hence an integrated approach captures the true cost of delivering voice termination. We have the following recommendations regarding modelled services:

Ensure a wholistic approach to modelling common costs to network and retail activities (including corporate overheads). These should include items such as IT provisioning, and billing systems necessary for provision of voice termination services..

Analysys Mason response

As described in Section 4.4, retail costs are not applicable to MTAS, which is a wholesale service. Therefore, there is no need to model retail costs.

With respect to billing systems, only a portion of wholesale-related billing costs should be attributable to MTAS (which will invariably be a small proportion of all billing costs). A cost for wholesale termination billing will be assumed in the model.

With respect to costs that are common to network and retail activities, a mark-up will be calculated that assumes these common costs are attributed between both network and retail activities (as described in Section 5.8.

B.4.7 Concepts concerning the modelling implementation (page 5)

TPG Telecom supports the TSLRIC+/LRAIC+ approach given the inclusion of common costs, in line with our feedback to the Discussion Paper. However, we query the extension of the modelling period to 2070. This is well beyond the useful lifespan of any relevant infrastructure. To assist with our understanding of the modelling approach, it would be helpful if the ACCC could confirm:

- How are asset lifetime values proposed to be modelled?
- What assumptions will be made regarding future generations of mobile infrastructure, and the rollout of upgrades?

Generations of mobile infrastructure have followed an approximate 10-year life cycle to date. We are unsure how this is accounted for in the model.

Analysys Mason response

To clarify, the model uses an equipment replacement algorithm to purchase new assets at the end of their assumed lifetime (on top of assets required in-year for network growth). Each asset type can have its own unique lifetime which is assumed to apply for the whole model duration.

For example, if 100 base stations are purchased in 2025, with a lifetime of 5 years, and the network grows in size by 100 base stations a year until 2034 (with no growth thereafter), then the model will purchase:

- 100 base stations in each of 2025, 2026, 2027, 2028 and 2029 (100 new each year)
- 200 base stations in each of 2030, 2031, 2032, 2033 and 2034 (100 new plus 100 replacements)
- 200 base stations each year from 2035 thereafter (200 replacements each year).

It is clearly not possible to model future generations/upgrade cycles of mobile infrastructure, since their design is not currently known. Conventionally, the modelled demand is assumed to stabilise over time so that the modelled network is assumed to reach an equilibrium of asset replacement. Assumptions can also be made on future capex and opex cost trends.

It should be emphasised that the costs incurred in future years are discounted using the assumed WACC, meaning that their impact on the final result reduces for future years.