Review of the TEA Model

A report prepared
for Competitive Carriers Coalition

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TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

1. Introduction and summary

Marsden Jacob Associates (MJA) has been requested by the Competitive Carriers Coalition (CCC) to review certain aspects of the Telstra Efficient Access (TEA) model version 1.0.

The comments and opinions expressed in this paper are those of MJA and do not necessarily reflect those of CCC.

For the purpose of this report, we have validated or audited certain parts of the model. We have not conducted a full audit. Instead we validated parts of the model, guided either by questionable outputs or simple sampling. We have not reviewed the Weighted Average Cost of Capital (WACC) used by Telstra. We have also where possible taken account of the recent publication of modifications to the TEA model (resulting in the publication of version 1.1). However, we have not been able to do a full review of the changes made between the two versions. Version 1.1 of the model was only delivered on 11 August.

Our findings may be summarised as follows:

- MJA is not convinced of TEA's appropriateness as a regulatory tool given the statutory requirements it must fulfil.
- The TEA model does not in MJA's view adhere to the basic principle and purpose of a total service long-run incremental cost (TSLRIC) model. While it may attempt to optimise a copper network it makes no consideration of alternative technological solutions or mixes. It makes the assumption that a copper network is the appropriate forward-looking network. Even without more detailed analysis of optimal solutions for the access network, and simply considering the debate on broadband roll-out and fibre to the node networks to date, it is clear that build out of a copper network is likely suboptimal. Even Telstra in their selection of asset life for main copper cable implicitly suggest that copper in this part of the network will be replaced. As a result, we do not believe that the TEA model as a matter of principle produces reasonable results.
- The TEA model underestimates the potential for sharing. In a TSLRIC framework sharing is possible internally within different parts of the access network, between the access network and the core network, and between the access network and other utilities. Because it is commonplace in a forward-looking perspective to assume that sharing may occur following normal build-out times and co-ordination sharing may occur both internally within other increments but also externally with third parties. MJA believes the amount of sharing should be substantially increased in the TEA model. Since trenching costs are of significant influence on the cost of unconditioned local loop service (ULLS) produced by the model, increases in sharing will likely result in a cost of ULLS that is much lower than currently estimated by Telstra.

- MJA sees merit in Telstra's approach to estimating trench costs. Taking into account different terrain types and the different construction activities related to each type is a sensible approach that when applied appropriately will yield more accurate cost estimates. That said, MJA has two concerns related to this approach. First, there must be a link between the ratios used and the cost estimates. The type of trenching used (digging, boring, ploughing) must be cost efficient. It is not clear that Telstra has conducted this analysis. Second, trenching costs must also reflect the ability to share costs (as discussed below). For example, in the denser areas and with the presence of other utilities there are likely alternatives to breakout and reinstatement of concrete pavements. To the extent that such options are available they should be taken into account in the modelling and will result in reduced costs.

- MJA does not find the annualisation approach used in the TEA model to be reasonable. Account must be taken of changes in prices over time. MJA prefers the tilted annuity approach where the tilt is based on a price trend.

- MJA is not convinced of the appropriateness of the cost factors for operating costs used by Telstra. While the model allows for easy manipulation of the cost factors, other approaches are not permitted. This is not ideal. First, the cost factors used in the TEA model contain very limited detail and are provided for very large cost categories. Second, no documentation as been provided by Telstra to support the efficiency of their costs.

- The TEA model is comparably an advanced model of the copper access network by virtue of using detailed data available from Telstra's existing network and very detailed capital costing information.

- The user manual is reasonably detailed and transparent. It provides an uninformed user with the ability to navigate and run the model. It also gives a reasonable presentation of key workings of the model. A key strength of the TEA is the availability of calculations and the ability to audit them. Use of MS Excel in particular, makes calculations more transparent and easier to follow. A weakness of the model is also one of its strengths, namely the reliance on "real" data from the Telstra network. From a transparency perspective reliance on detailed Telstra data makes evaluation of this part of the model very difficult. In our view, transparency could be improved by providing more information on Telstra specific data and how it translates to optimal outcomes.

MJA appreciates that Telstra wishes to provide a model with a thorough base in reality; indeed "reality" is required in TSLRIC modelling, to ensure the results reflect the costs that a hypothetical new entrant would incur. MJA also appreciates that there is a risk of underestimating costs in a model not based on "real" data. However, by using existing data and neglecting to optimise by considering alternative technological solutions, there is a risk of a suboptimal outcome.

Ideally, an alternative bottom-up TSLRIC model of access network should be built which would be reconciled with the TEA model. The objective of reconciliation would be to identify and explain the differences between the modelling approaches and to reveal important information on the optimality of the TEA model. Such an approach would greatly assist the ACCC in making informed decisions about the design and input parameters of the TEA model and ultimately provide a more thorough evaluation of ULLS costs.

2. Evaluation of TEA

2.1. Transparency

The TEA model is more transparent than its predecessors in certain areas, while in other it is not. Overall though, MJA has found the user manual and model documentation delivered to be of a reasonable quality.

A key strength of TEA is the availability of calculations and the ability to audit them. Use of MS Excel and MS Access make calculations more transparent and easier to follow. Accordingly, it is disappointing that Telstra has not engaged a third party to conduct an independent cell by cell audit of TEA before it was submitted in their Undertaking. While this may not have been able to prevent some of the errors identified by the ACCC, it would have allowed reviewers to more readily focus on elements of the model that are more principle in nature.

A weakness of the model is also one of its strengths, namely the reliance on “real” data from the Telstra network. From a transparency perspective reliance on detailed Telstra data makes evaluation of this part of the model very difficult. In our view, transparency could be improved by providing more information on Telstra specific data and how it translates to optimal outcomes. That said, Telstra has in our opinion supplied a reasonably comprehensive documentation to allow for an evaluation of the model mechanics and to understand and navigate the TEA model. It would, however, have been helpful with some detailed schematics of the modelled network and how the minor cost components are assembled to make up the network. In addition, a detailed step by step worked example using the default Telstra would aid in understanding how the model works.

We acknowledge that much effort has been put into the design and workings of TEA and that it, like its predecessor PIE II, is a fairly advanced cost model of the copper access network. Indeed, the TEA model operates at a level of detail that is superior to that of PIE II. However, as discussed in the following, we are not convinced of TEA’s appropriateness as a regulatory tool given the statutory requirements it must fulfil.

2.2. Reasonableness of TEA as a TSLRIC model

The main hurdle for the TEA model to pass is whether it adequately adheres to the forward-looking TSLRIC concept.

The ACCC Pricing Principles for the ULLS[1] provide that ULLS prices should be based on the efficient cost of supply, with necessary cost estimates derived from a methodology based on total service long-run incremental cost plus an allocation of indirect overhead

[1] http://www.accc.gov.au/content/index.phtml/itemId/808756

costs (TSLRIC+). Under the principles, it is only the efficient, forward-looking level of costs that are brought to account in setting ULLS monthly charges.

In MJA's view efficient cost of supply requires consideration of an array of different options in modelling the access network. In particular, new entrants are unlikely to reproduce a copper based network similar to the one that has already been rolled out by Telstra. Instead, they will roll out the technology that is most appropriate to the areas they serve (for example, using fibre in urban areas and radio in rural areas). This has been clearly evidenced by the long standing debate surrounding the building of a fibre to the node (FTTN) in different geographical areas. It is against the benchmark, i.e. the cost of designing an efficient new access network using a mix of technologies to meet demand in different areas at lowest cost, that new entrants will make their ULLS build or buy decision. In other words, the TEA model needs to be flexible enough that the design assumptions can be varied to facilitate "what-if" type analysis.

This is consistent with the ACCC Pricing Principles which indicate that the replacement cost is the cost methodology most consistent with an efficient forward-looking network and that replacement cost refers to the current cost of replacing the asset that provides the same service potential. In other words, building a network that reflects best-in-use or best commercially available technology.[2] Simply assuming that a copper network is efficient in Band 2 is not satisfactory.

A charge based on the costs of reproducing a copper network which is essentially what TEA does, is useful only to calculate the costs of ULLS based on copper. It is not necessarily capable of providing any useful signals to encourage efficient entry into the access network. To do so the TEA model must make appropriate technological choices, which it does not.

Interestingly, this view is consistent with the choice of asset lives in the TEA model. Telstra has chosen to shorten the asset life main network copper cable (i.e. cable running from the exchange to the pillar). From an economic depreciation perspective this makes sense if there is an expectation of a replacement of copper in this part of the network, i.e. a migration to FTTN. However, this also suggests that a copper network is unlikely to be optimal and hence that some other technological solution should be adopted looking forward. There are two solutions to this problem, 1) allow the modelling of more efficient technology or 2) depart from principle of economic depreciation and use asset lives that are consistent with a longer cost recovery profile. Strict adherence to the TSLRIC would dictate option 1.

While we appreciate that Telstra with the TEA model wishes to provide an estimate of ULLS costs using "real" data, the limitation of the choice of technology to copper only, means it fails the basic test inherent in the TSLRIC concept. In this respect, TEA's predecessor PIE II was actually a better model in that it encompassed a series of technology options.

[2] ACCC, Access Pricing Principles - Telecommunications, a guide, July 1999, pp.42-3.

2.3. Engineering rules and network design

There are essentially two approaches that could be used to model the access network. The first of these involves developing a theoretical structure reflecting the network within certain geographic areas and using geo-coded data, electronic maps and network design rules to develop the cost of a hypothetical network. The second approach, which is the approach followed by the TEA model, is to develop access network costs based using inputs directly from the Telstra network allowing for certain amounts of optimisation.

There are advantages and disadvantages to each of these approaches. The approach relying on a theoretical structure is closer in spirit to a bottom-up model and will – by nature of being independent of the existing network – not be influenced by any inefficiency that might be present in Telstra's network. On the other hand, the theoretical approach will necessarily utilise fairly strong assumptions that could lead to in erroneous results. A model using information derived from Telstra's network is unlikely to suffer these problems, but may – depending on the use of the information – incorporate inefficiencies. Clearly, Telstra has sought to remedy this problem by allowing for optimisation of distribution and main cable routes, but, as discussed, we have reservations about the adequacy of the optimisation performed.

According to Telstra:[3]

> *it is assumed that the following components of the existing network are to be retained:*
>
> - *The Telephone Exchange location;*
> - *Distribution Area boundaries;*
> - *Pillar locations;*
> - *Customer locations;*
> - *Distribution and Main Cable routes are to be an optimized subset of the existing main cables and conduit routes from the exchange to the pillars using the existing right of ways, and the existing cables and conduit routes from the pillar to the customer premises using the existing right of ways.*

MJA largely agrees with these assumptions except for retaining the existing pillar locations. The scorched node assumption typically used in TSLRIC modelling fixes the exchange location, but it allows other aspects of the network (cables, trench, duct etc.) to be variable and subject to optimisation. In access network modelling it is also sensible to retain customer locations to reflect the line demand structure. While using the distribution area boundaries may in some cases retain certain inefficiencies in the

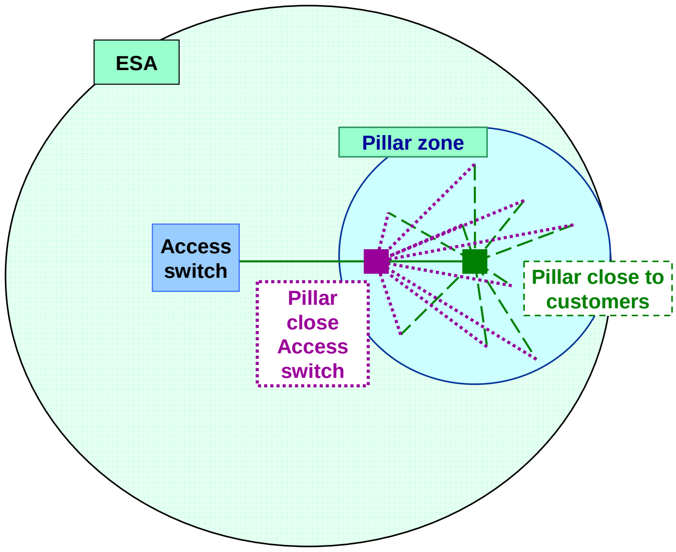
3 Access Network Dimensioning Rules, Long run incremental costing model input, Telstra Corporation Limited, ABN 33 - 051 775 556, undated. Available here [viewed 4 August 2008]:

http://www.accc.gov.au/content/item.phtml?itemId=812449&nodeId=8b95bf704cfc3eedff2347a7c30a3928&fn=Telstra%20submission%20-%20Engineering%20rules%20-%2003.03.2008.pdf

structure of the network MJA does not regard these to be significantly material to warrant closer examination. For pillar location, however, MJA believes there may significant cost efficiencies in allowing these to vary. As is evidenced by the output of the current version of the TEA model, it is cost of duct, trenching and cable that largely dictate the cost of the ULLS.

For example, if the pillar is placed close to customers, then total cable-km is minimised. Alternatively, if the pillar is placed close to the telephone exchange then the total-pair km is minimised. In practice, a strategy between these two options is probably optimal. Figure 1 shows the two different alternatives.

Figure 1: Optimisation of Pillar Placement



Source: MJA analysis

The TEA model would not appear to consider the use of poles for Lead-in cables or indeed in the distribution part of the access network. Cable feeds would appear to rely solely on the provision of ducts. MJA finds this aspect of the model to be problematic. Typically the use of poles has the effect of reducing street digging cost, eliminating the cost of duct and associated trench, increase cable cost per meter (as cable on poles may be more expensive) and shorter cable lengths (especially for lead-ins) as cables may avoid obstacles in the ground.

The efficient use of poles reflects the mix of terrain types and may in some case be constrained by local planning and other network design considerations. However, to disregard the use of poles altogether is unlikely to yield a cost efficient result.

2.4. Cost inputs and ratios

MJA has reviewed certain cost inputs and ratio, but has not systematically reviewed every single input. There are also aspects of the model, where MJA does not have data available to evaluate the inputs used. The TEA model is in certain areas very detailed and would require additional information from Telstra to evaluate their accuracy. Alternatively, for some input detailed geographical studies could assist in, for example, evaluating the ratios for the type of trenching or ploughing activity that would be required when placing conduit in certain areas, however, such analysis is outside the scope of our brief.

Observations in the Default Cost sheet include:

- In the Default Cost sheet the width of trench-road crossing for 8 x 100mm conduit is wider than for the equivalent 12 x 100mm conduit. MJA suggests that 8 x 100mm be aligned with 12 x 100mm.

- The cost per metre for placing conduit runs using boring in rock for footpaths and drives is approximately twice as costly as trenching for footpaths and drives. Given this price difference, a logical question is when would it be optimal to bore? Similarly the cost of boring in normal soil for footpaths and drives is nearly twice as expensive as trenching under similar circumstances. More generally, it is unclear to MJA if Telstra, in their estimation of ratios for either boring or trenching, has considered the large costs differences. Based on a review of the ratios of the amount of each type of conduit placement activity, boring rocky soils would appear to have been disregarded as an option. However, boring in normal soils appears underutilised as an option. While there may be constraints in using one or the other, a TSLRIC model should be driven by assumptions that minimise cost.

- The multiplexing systems cost appears to be manufacturer specific. While MJA has not been able to evaluate the cost input used, we note that the supplier used should be the least cost option and be based on normal volume discounts for an operator the size of Telstra.

- The cost of manholes (for example, normal and rocky placement of a PF28) is increasing on per square metre basis. This is also the case of pits. It is unclear to MJA, why this would be the case. It seems plausible that the cost driver of a manhole or pit is linked to a measure of size and would decrease or remain constant on per square metre basis.[4]

- Same comments as above apply to Pit Costs-Main and Distribution.

- While the material cost of copper and fibre is broadly consistent on a per pair-metre basis, MJA notes that the cost of 400 pair normal Gauge .40 mm copper cable is relatively more expensive on a per pair metre basis than the other alternative cable sizes. The cost of 48 pair fibre on a per pair metre basis also appears excessive relative to the adjacent fibre sizes.

[4] A better driver could be cubic metres. However, MJA is unaware of any information that has been provided showing the depth of the different manholes and pits.

2.5. Trench cost

When estimating costs, the TEA model takes account of various different cost elements including the cost of:

- digging;
- boring
- ploughing
- breaking, back filling and re-instating the surface

In addition, account is taken of the gradient of the terrain within an Exchange Service Area (ESA).

MJA sees much merit in Telstra's approach to estimating trench costs. Taking into account different terrain types and the different construction activities related to each type is a sensible approach that, when applied appropriately, will yield accurate cost estimates. That said, MJA has two concerns of a principle nature related to this approach. First, as noted above, there must be a link between the ratios used and the cost estimates. The type of trenching used (digging, boring, ploughing) must be cost efficient. It is not clear that Telstra has conducted this analysis. Second, trenching costs must also reflect the ability to share costs (as discussed below). For example, in the CBD with the presence of other utilities there are likely alternatives to breakout and reinstatement of concrete pavements. To the extent that such options are available they should be taken into account in the modelling.

2.6. Sharing of costs

The TEA model explicitly includes three types of trench sharing:

- sharing between the inter-exchange and distribution network. Telstra has used a default value of 5 per cent;
- sharing with utilities in new estates. Telstra has used a default value of 1 per cent; and
- sharing of trenching and conduit between fibre main cable and copper main cable by deducting the demand at fibre fed pillars from the total demand in the exchange.

While MJA agrees that sharing will occur in all these instances MJA believes the amount of sharing in the TEA model is likely understated. When trench sharing is understated the cost of ULLS will be overstated.

TSLRIC modelling often assumes that the network from a technical perspective is built overnight (or instantaneously), but all input parameters (trench sharing, equipment prices, etc.) are verifiable and reflect the costs of actual networks built over time. This means that equipment prices may follow from normal operator purchases and sharing may reflect normal planning and construction activity where co-ordination of trench sharing and co-diggings may be planned years ahead with other operators and utilities. To only allow for sharing with utilities in new estates is clearly in violation of this principle. Sharing with other utilities should be allowed in the entire access network.

In addition to the above, sharing will also occur in other parts of the access network. For example, Telstra applies a factor of 95% to entrance facility costs to account for vault and racks sharing, i.e. the amount of these costs that should be assigned to the Customer Access Network (CAN). However, there do not appear to be other explicit sharing factors included in the TEA model. That said, in the Telstra letter to the ACCC regarding errors in TEA, Telstra submits that one half of the cost of ironwork for the main distribution frame (MDF) block should be assigned to the CAN as opposed to assigning the full cost to the CAN.[5]

MJA submits that sharing may also occur between distribution network trench and inter-exchange trench although to a much lesser degree than between main cable trench and inter-exchange trench. Other potential candidates for sharing include manholes. This is especially the case of manholes that are placed on routes that share trench with the inter-exchange network.

2.7. Annualisation of capital costs

TEA basically uses standard annuities to annualise costs.[6] While it would appear that the straight-line depreciation is used, the model calculates annualisation factors based on the PMT function in Excel.

MJA does not find this to be a reasonable approach, since the simple annuity formula does not take account of two developments that would normally occur during the economic lifetime of an asset.

The first is that asset/equipment prices change over time. This will change the costs that new entrants will face in the future, i.e. when input prices are falling any new entrant will have a lower cost base in the future. As a result, the existing operator will only invest in the market today if it can recover more of its capital costs in the early periods, because it knows it will face a lower cost entrant in the future. In other words, with decreasing

5 Telstra to ACCC re TEA Model Errors, 15.07.2008, p. 6

6 A standard annuity calculates the charge that, after discounting, recovers the asset's purchase price and financing costs in equal annual sums. In the beginning of an asset's lifetime the annualisation charge will consist more of capital charges and less of depreciation charges; this reverses over time resulting in an upward sloping depreciation schedule. The increase in the depreciation charge over time exactly counterbalances the decrease in the capital charge with the result that the annualisation charge is constant over time.

A tilted annuity takes account of price changes. This results in front-loading if prices are expected to fall and back-loading if they are expected to increase.

prices, costs should reflect the need to recover capital costs now rather than later. Alternatively, when input prices are rising, the opposite is the case.

The second is that, for a part of its economic lifetime, an asset may be under-utilised and only be fully used as service volumes grow. However, this feature is likely less pronounced for the ULLS. Nevertheless both these factors change the value of the installed equipment of an operator today and needs to be taken into account in pricing decisions. In more advanced cost models economic depreciation is used. However, such an approach also suffers from limitations. Accordingly, for the TEA model, MJA prefers the tilted annuity approach where the tilt is based on price trends.

In this regard MJA emphasises that price trends should be forward-looking, indicating the expected future development in prices. Using the historic development in prices as a proxy may often be the best way to estimate future price changes. Such a methodology can only be used, however, if the past development is believed to continue in the future. In MJA's view, the impact of technology and improved efficiencies in manufacturing processes, is likely to lead to decreases in telecommunications equipment. On the other hand, inputs requiring significant labour input like trenching and ducting are likely to increase. Copper cable has also been subject to large increases in prices in the past 10 years and would appear to continue with a slight upward trend. As noted above when prices are increasing the cost recovery profile of a tilted annuity suggests that annual costs should be lower than using a standard annuity.

Accordingly, it is important that the TEA model applies price changes at the minor cost category level to capture the different trends on equipment and labour costs. While it is possible to combine price trends (i.e. use composite trends), having separate inputs is more transparent.

If input prices are expected to change at a rate of p percent per year, the cost of capital is i, the asset life is t and RR is the "recovery requirement" needed in order to recover the total costs of the investment then the following condition must hold, where $PV(RR)$ is the present value of the recovery requirement (or present value the levelised cost factor):

(1) $$PV(RR) = \frac{C}{1+i} + \frac{C(1+p)}{(1+i)^2} + \ldots + \frac{C(1+p)^{t-1}}{(1+i)^t}$$

Let $a = (1+p)/(1+i)$ and $b = (1+i)^{-1}$, then (1) may be re-written as:

(2) $$PV(RR) = Cb(1 + a + a^2 + \ldots + a^{t-1})$$

Multiplying both sides by a yields:

(3) $$PV(RR) \times a = Cb(a + a^2 + a^3 + \ldots + a^t)$$

Subtracting (3) from (2):

(4) $$PV(1-a)=Cb(1-a^{t})$$

Finally, substituting *a* and *b* into equation (4) and solving for C:

(5) $$C=\frac{\left(PV(RR)\left[\frac{1-\left(\frac{1+p}{1+i}\right)}{1-\left(\frac{1+p}{1+i}\right)^{t}}\right]\right)}{(1+i)^{-1}}$$

C is the first-year value of a series that meets the conditions that it changes at a rate of *p* per cent per year, and the present value of the series equals the present value of the recovery requirement. By inserting the levelised cost factor used in the TEA model in *RR* (i.e. calculating its present value using the asset life and WACC) and making appropriate price trend assumptions will yield the tilted first-year annual cost factor to be applied to the investment cost.

2.8. Operating expenses

MJA agrees with Telstra that the expenses included in the calculation of the cost factors should be ongoing operating and maintenance expenses only, as these are the expenses relevant to the ongoing ULLS monthly charge.

While MJA also agrees that the estimation of operating costs and support costs using cost ratios is a widely accepted approach, its acceptance also requires an adjustment for inefficiencies. While Telstra suggests it overall has reduced these costs by 10% compared with its existing costs, this is not in MJA's view sufficient grounds for accepting them. The TEA model should only include efficiently incurred costs. Telstra does not provided documentation to support the assumption that the use of the Regulatory Accounting Framework (RAF) is appropriate in this regard. For example, to the knowledge of MJA, Telstra's RAF is not able to distinguish between efficiently and inefficiently incurred operating costs. There can be several reasons for incurring inefficient costs, including:

- using an asset which is not the modern equivalent asset. This could be moving from copper to fibre, but also newer copper cables. The copper lines in the existing Telstra network are unlikely to be of similar quality to those assumed in the TEA model and subsequently less faults and reparation should be expected; and
- inefficient processes to deal with faults and repairs.

MJA is not convinced of the appropriateness of the cost factors for operating costs used by Telstra. While the model allows for easy manipulation of the cost factors, other approaches are not permitted. This is not ideal. First, the cost factors used in the TEA model contain very limited detail and are provided for very large cost categories. Second, as noted above, it is unlikely that the cost factors reflect efficient costs.

One alternative is to calculate operating costs in a 'pure' bottom-up manner. However, this is a difficult and potentially time consuming task requiring, for example, time and motion studies of maintenance activities. However, Telstra's detailed understanding of their network would greatly assist in such an analysis.

2.9. Indirect costs and support costs

Like operating costs, indirect costs are difficult to estimate in a 'pure' bottom-up manner. It is therefore not uncommon to use mark-ups sourced from operator accounts to estimate these costs. While our review of the information provided does not suggest there to be any fundamental problem with the methodology employed, a detailed review of the cost factors is not possible without more detailed information from Telstra.

First, no information is provided on the deductions made by Telstra to indirect asset factors and the rules used to share costs are common or shared between the ULLS and other services. Second, no information is provided on the categories used at the type of minor cost category included. For example, it is unclear why building improvements are relevant from the perspective of TSRLIC.

The cost factors related to support assets also suffer from similar limitations, in particular in relation to transparency and the share of these costs allocated to the CAN. However, whereas indirect costs are difficult to model in an accurate fashion, the support assets like buildings, land, power etc. are easier to model from first principles. An alternative would be to use cost-volume relationships (CVR) in the analysis to allocate non-network costs, noting that where these costs are fully variable to the volume increment, it would not be necessary to develop a CVR.

The TEA model also contains an input specifically to account for network management, materials handling and purchasing and other construction related costs that Telstra claims are required to capitalise. These costs are termed "Loading Factors for Indirect Overheads" and are fairly significant. While MJA can appreciate that some of the cost categories mentioned by Telstra should be included, Telstra's description of these costs is unnecessarily vague and should not be accepted without further documentation. Costs of this nature are easily double counted either by including them within the capital cost estimates or by including them in the more general indirect costs.

2.10. Other observations on Excel modules

Calc-Engine spreadsheet, tab Cost Calculator Distribution:

- Width Of Breakout and Reinstatement for Footpaths and Drives is calculated using weights in formula. Should be made explicit. Has no effect on results

- I296 = Z6 should be Z4, has no effect on results.

Calc-Engine spreadsheet, tab Results Distribution-Qtys:

- It is unclear to MJA how Telstra has determined that the number of Lead-ins is not equal to Demand (number of lines).

Calc-Engine spreadsheet, tab Results Distribution-Costs

- There is an error in CF21: “=CF$15*'Results Distribution-Qtys'!CD21” should be “CF$15*'Results Distribution-Qtys'!CF21”. Has only very minor impact on costs.

The length of the Lead-in can have fairly significant effect on costs. The TEA model uses an average length for those lead-ins for which there is a specific length included in the base data. No documentation has been provided by Telstra to assess the reasonability of this averaging approach. Clearly, for averaging to be reasonable the sample should be representative of that particular area considered.