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Telstra Efficient Access cost model – engineering issues

An Advisory Note to the ACCC

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1 Executive Summary

This Advisory Note refers to the engineering assumptions and calculations in the Telstra Efficient Access (TEA) model, version 1.2.

Ovum has reviewed the TEA model and the submissions from Telstra and others about it. Telstra has made significant changes to the model's database from versions 1.0 and 1.1.

We conclude that:

- The TEA model engineering modules are now producing results consistent with Telstra's originally documented intentions;
- The TEA model engineering modules are appropriate for a "scorched node" approach to estimating the quantities of outside plant and they produce quantities that include optimisation and efficiency savings from the quantities in the existing network;
- The engineering factors for terrain type and surface breakout and restoration included in the TEA model economics module remain unverified and unverifiable (while supporting a significant proportion of the overall cost result). Ovum reiterates the point that the general evidence suggests that some of these activities (and hence cost) could be avoided and hence should not be included in a forward-looking estimate.

2 Summary of Recommendations

This section provides a summary of the changes made to Ovum's recommendations as a result of our review of the submissions made by Telstra and others to the ACCC.

2.1 Optimisation and Efficiency

The TEA model, version 1.2, is now working as originally described by Telstra. The cable routes in the model database are the shortest paths within the set of actual paths used for cables.

The dimensioning of cables, ducts, pits, manholes, cable joints, cable gauges and pillars are all appropriate for a "scorched node" model of a copper access network for an efficient operator. These calculations include efficiency gains over the existing network.

2.2 Main Cable Network Engineering

In Ovum's engineering review [1], there were only two significant issues:

1. The errors in the cable data, leading to incorrect placements;
2. An undocumented feature called "Fibre T Block Demand".

Item 1 is now corrected (see section 2.1) above.

Item 2 has now been explained in Telstra's response [4] and has been implemented correctly in the TEA model.

As part of the current review, a new issue was identified – an apparent mismatch between the total services in operation ([redacted]) used in the model and the total demand present in the table used for sizing main cables. In the **MainRoutes** table, which is used for the sizing of main cables, the total demand is [redacted] services, or [redacted] if only the copper-based services are counted. Telstra has explained[1] that the difference is due to the fact that the **MainRoutes** data table contains the cables feeding building terminals, in addition to the cables required to feed pillars (DAs). Ovum accepts this explanation and accepts that suitable cables are sized in the main cable engineering module.

2.3 Distribution Network Engineering

There were no significant issues in the Distribution Network Engineering review other than the cable records and placements. These have been corrected.

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[1] In response to a query from the ACCC.

2.4 Engineering Factors used for Costing

In contrast to the other engineering items, the engineering factors used in the costing module are not directly calculated but, rather, are estimated as averages over all Band 2 ESAs.

The parameters associated with Terrain type and Surface Breakout and Reinstatement are used to estimate proportions of activities, to which costs are then applied. Telstra has provided no new data or verification of the estimates used; and there is no independent way of verifying these proportions. We note that there is general evidence that some surface breakout and reinstatement costs can be avoided. Ovum’s advice, therefore, remains unchanged: the activities are unverified and could be overestimated.

With regard to IEN duct sharing and New Estate allowance, Ovum affirms that the TEA model estimates are acceptable for an efficient operator but cannot be verified without direct data from Telstra.

3 Analysis of Original Recommendations

3.1 Overview

In this section, we note the recommendations made by Ovum in its original reports ([1], [2], [3]) and discuss what changes are necessary in light of the further information provided in the submissions to the ACCC.

Telstra, in its main submission [4], notes that the Ovum review supports the TEA model engineering designs for joints, pits and manholes; for cable sizing; and for sizing of pillars.

Ovum reiterates that, in regard to locations, a “scorched node” assumption, in which the locations of exchange buildings and pillars are set to their actual locations in the current network, is an appropriate approach for determining the costs of an efficient operator. A “modified scorched node” approach, in which only some of these locations are used in an efficient network design, may yield further efficiencies but would be a substantial undertaking and is probably not justified for the purpose of the Access Undertaking.

Telstra suggests that the tone of Ovum’s engineering review “might be viewed as negative” ([4], p. 2). It was Ovum’s intention to be positive about the correct and beneficial features and to be negative about the incorrect or unwarranted features. Unfortunately, there was a calculation error in version 1.0 and database errors in versions 1.0 and 1.1 of the TEA model. These have all been corrected in version 1.2 (see below).

3.2 Optimisation and Efficiency

3.2.1 Cable routes and Distribution Areas

The analysis of cable routes and the synthesis of shortest existing paths among these routes are key to creating an efficient design. There were instances of multiple paths in the Main Cable data in both versions 1.0 and 1.1 of the TEA model. This is admitted by Telstra in [5] (p. 1):

> A small number of routing problems were overlooked in version 1.1 of the TEA model and have been cleaned up in version 1.2. The impact of this change is a reduction in cost of $0.10. Consequently, the few instances of inefficient routing that were inherent in version 1.0 of the TEA model are no longer present in version 1.2.

Ovum agrees that the routes are now populated in the model database in the way Telstra originally intended. That is, the cable paths represent the shortest paths among the existing paths present in Telstra’s cable plant records.

Telstra has provided more information [6] on the source of structure point numbers and the way in which the cable plant records have been analysed. Ovum now agrees that the same structure point numbers can appear in the cable records of abutting Distribution Areas (DAs). Ovum accepts Telstra’s assurance that DAs do not overlap (overlapping meaning that the same geographical area is served by cables in two different DAs) but only abut one another. Ovum cannot independently verify this assurance, since we do not have access to geographical cable data but only the topological layout as represented by the (DA#, Current Structure Number, Next Structure Number)-tuple in the database. Abutting DAs are, of course, common in the Australian suburbs.

Ovum did not, and does not, reject the concept of DAs abutting one another. Where structure is shared between abutting DAs, Telstra makes the following point ([4], p. 4):

> From an efficiency standpoint, the sharing of conduit segments between distribution routes reduces costs because the TEA model only counts the trenching for shared routes once for both cables.

Actually, this feature with regard to abutting DAs does not arise in the engineering module. In this module, the conduit runs are sized independently for each DA. Hence, in a common segment, conduit is placed for the cables from each DA: there is no sharing in the calculation. Instead, the proportion of trenching has been adjusted in the economics module (see [5], section A.1.2).

Telstra in its response [4] has misunderstood the point in Ovum's engineering review concerning limited redesign of DAs. The point is only, putting it in regulatory terms, that a "modified scorched node" approach may be beneficial in terms of efficiency. Ovum accepts that this would be a major undertaking and does not advocate doing it. The "scorched node" approach, in which the DAs are fixed, is satisfactory for determining the costs of an efficient operator.

In summary, the cable routes and DA data have been cleaned up in the way originally envisaged by Telstra.

The NERA report [7] raises the interesting point (p. 31) that the TEA model implements a decomposition of the overall optimization problem: first, shortest paths amongst the existing cable paths are selected and fixed; then, cable and ducts are placed on these paths as required by demand. The full optimization of cable and duct costs would involve optimizing both path lengths and placements together. The NERA report goes on (p. 32) to argue that shortest paths are in fact least cost in this case, where trench and duct costs dominate. Ovum agrees with this analysis. Nevertheless, this is further evidence that a limited redesign of DAs *based on existing cable layouts* may yield greater efficiency over and above the efficiency gains from the current engineering modules.

3.2.2 Pits and Manholes

The Ovum engineering review indicated that the layout and rules used here *may* underestimate actual placements. Telstra has provided further evidence ([8], section 4) that this is actually so.

3.2.3 Cables and Cable Sizing

The Ovum engineering review [1] raised some questions about the cable gauge placements in the main cable network. Telstra, in its response [4], has clarified the issues with relation to heavier gauges. Telstra indicates [5] that placement of heavier gauge closest to the exchange actually increases overall cost slightly. This somewhat surprising result must be due to larger ducts – or perhaps the way the routes are sectionalised. In any case it is of minor effect only. In summary, the cable gauges selected by the engineering module are satisfactory.

With regard to tapering in the distribution, Ovum remains of the view, agreeing with Telstra, that a non-tapered design is standard. Ovum's engineering review showed that tapering the distribution cables would only save 4% of the cost (see [1], section 4.1) but indicated that this would be outweighed by the operational benefits. Non-tapered design of the distribution cables should be used.

On the matter of fill, Ovum maintains that the standard fill for distribution cables should be 67%, not [redacted]. However, this makes very little difference to the cost. It was shown that 100% fill only reduces the cost by 1 percentage point. Hence, the default fills are satisfactory in a costing for an efficient operator.

3.2.4 Cable Jointing

Ovum conclusions remain unchanged and are supported by Telstra.

3.2.5 Pillars

Telstra has clarified [9] the operational need for a spare slot in pillars. Ovum agrees that the pillar sizing algorithm is appropriate.

3.2.6 Conclusion

With regard to optimisation and efficiency, Ovum concludes that the TEA model, version 1.2, is working as Telstra intended (and documented).

Ovum agrees that the engineering module produces a design and network quantities that are efficient within normal operational practice and are appropriate for a "scorched node" regulatory model of an efficient operator.

It is then a matter for the economics module review if the costs associated with the network quantities are appropriately estimated and applied.

3.3 Main Cable Network Engineering

3.3.1 Summary of Findings

The original errors in the database have been corrected in the TEA model, version 1.2 (see above). This corrects the placement of cables and conduit.

Ovum's engineering review [1] identified one undocumented feature then called "Fibre T Block Demand". This has now been clarified and is an appropriate feature.

Ovum also found some documentation inconsistencies. While these do not affect the calculations, they may be misleading to a user. Ovum has not reviewed any new documentation.

One new matter has been identified: a mismatch in the total demand in the table used for main cable sizing. The reason for this discrepancy has been explained satisfactorily and Ovum concludes that suitable main cable placements are calculated.

3.3.2 Demand at Fibre Fed Pillars

Telstra has clarified ([4], section B.2.2) the issue of additional fibre demand and the inclusion of demand from fibre-fed building terminals.

This feature is correctly implemented in the TEA model, version 1.2.

3.3.3 Main Module Documentation

Ovum has not reviewed any new documentation on the TEA model. Documentation errors do not affect the engineering calculations.

Ovum concedes the issue of the logic of *Cumulative .40 Gauge Cable Demand* is as described by Telstra ([4], section B.2.4).

3.3.4 Main Cable Demand

The Main Cable engineering module takes its basic data from the **MainRoutes** data table in the model's database. In this data table, the total demand is [redacted] services, or [redacted] if only the copper-based services are counted. In the rest of the model, however, the total number of services in operation is [redacted].

Telstra has explained[2] that the difference is due to the fact that the **MainRoutes** data table contains the cables feeding building terminals, in addition to the cables required to feed pillars (DAs). Ovum accepts this explanation.

3.4 Distribution Network Engineering

Ovum's engineering review [1] had no issues with the Distribution Network Engineering that were not covered in the Optimisation and Efficiency section.

Ovum concludes that the Distribution Network Engineering is appropriate, now that the database issues have been cleaned up.

3.5 Engineering Factors used for Costing

3.5.1 Summary of Findings

Ovum's engineering review [1] noted that there were several engineering parameters that were embedded in the user interface or the economic costing module. The recommendations on "Engineering Factors used for Costing" considered these matters.

In all cases, the TEA model uses averages over all Band 2 ESAs for these parameters, except for surface breakout and reinstatement costs. In the latter case, the calculation is based on the "density zone" calculated for each DA. This

[2] In response to a query from the ACCC.

section of engineering parameters contrasts strongly with the engineering modules themselves. In the engineering modules, placements and quantities are calculated based on a careful analysis of efficient design. For the engineering parameters in the economics module, only broad averages are used and any consideration of efficiency must have been undertaken in preprocessing the data to be entered in the model.

For terrain type ("rock"), there is no change. The parameter is used to apportion costs. The resulting average costs are a matter for the economics review.

For surface breakout and reinstatement, Ovum remains concerned that the estimates of activities based on DA demand density are open to doubt and cannot be independently verified. Telstra has not provided new information on this matter.

For IEN duct sharing, Ovum affirms that the TEA model figure is appropriate for an efficient operator.

For New Estates, Telstra has provided some new data on proportion of new estates in Band 2 areas. Ovum agrees that the current approach is suitable for estimating costs.

3.5.2 Terrain type

The terrain type is just the proportion of "rock" in the ESA and is set everywhere to an overall average. This proportion is used to calculate the costs of underground structure.

Ovum is not able independently to verify the proportion of "rock" in the land covered by Band 2 ESAs. The average costs used for underground structure are a matter for consideration in the economics review.

3.5.3 Surface Breakout and Restoration Costs

Ovum's engineering report [1] supported the view that all outside plant in Band 2 should be underground. Further consideration, however, suggests that this is not entirely so. For suburban ESAs, underground construction is to be preferred. Band 2, however, includes some regional centres: in the TEA Model data, at least [redacted] of services are in regional ESAs. In some regional centres (e.g. Geelong), there have been moves to permit aerial plant for other operators such as Neighbourhood Cable. This suggests that an efficient operator would have the opportunity to use aerial outside plant in some portion of Band 2 ESAs. This should be taken into account.

Telstra in its response [4] has not responded to the Ovum suggestion that the surface type (or type of plant, whether aerial, buried or underground) could be obtained from the cable plant records. This would then provide a direct way of estimating installation quantities and type based on actual segment data.

In the absence of a direct method, the TEA model uses demand density in each DA as a proxy for the plant/surface mix in a DA and then applies proportions of breakout and reinstatement activities based on density. This is an appropriate indirect method, as Ovum's review affirmed.

However, this leaves open the question of estimating the proportions of each breakout and reinstatement activity based on DA demand density. There is no independent method of estimating these proportions. The numbers must come from Telstra operational records or sampling of outside-plant projects. Telstra's response [4] sheds no new light on the necessary data analysis, only asserting (p. 13):

> The TEA model avoids concrete surface breakout and reinstatement cost through heavy reliance on boring and trenching through turf where possible.

Ovum concludes that the estimation of activities remains unverified and that the actual quantities of surface breakout and reinstatement activities are uncertain. The costs associated with these activities are an issue for the economics review.

3.5.2 IEN Duct Sharing

Telstra notes ([4], section B.4.4) that it will consider a direct method of estimating duct sharing with the IEN in a future release of the TEA model.

The current proportion used in the TEA model is satisfactory for an efficient operator. This proportion could be supported directly from Telstra's data.

3.5.2 New Estates – or Open Trench Placements

In the earlier versions of the TEA model, there was a specific parameter for new estates. In version 1.2, this has been replaced by a broader parameter named *Cable Placed in an Open Trench.*

Telstra has provided new data ([4], section B.4.5) on the average proportion of new estates in Band 2 for 2006/2007 and suggests that the model overestimates the proportion of trench sharing and hence underestimates the cost. The Telstra data is that, in 2006/2007, there was 1% of new lines in new estates in 2006/2007 and only [redacted] of new lines in new estates in Band 2 ESAs.

The overall new estates proportion for 2006/2007 quoted by Telstra is roughly in line with the national statistics. The Australian Bureau of Statistics gives 35,425 new dwelling starts[3] in the September quarter 2008 compared with an estimate of a total dwellings of 8,334,100 (high estimate[4]) in 2008. Hence, the annual growth in dwellings is, conservatively, 1.7%. The reduction to the Telstra number is explained by: not all dwellings are in new estates; not all new facilities are copper (perhaps only a minority); not all new dwellings have fixed telephone lines; and Telstra is not always the preferred supplier of facilities. The proportion of lines in new estates *could*, therefore, be as low as 1% per annum.

The new estates allowance of 1% is part of the parameter named *Cable Placed in an Open Trench* and is used to reduce the incidence of trenching. The overall

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[3] http://www.abs.gov.au/ausstats/abs@.nsf/mf/8750.0, accessed 20 Jan 2009.

[4] http://www.ausstats.abs.gov.au/ausstats/subscriber.nsf/0/DF2989BFFA7392E1CA256EB6007D63F4/$File/32360_2001%20to%202026.pdf, accessed 20 Jan2009.

allowance is [redacted]%. This allowance includes provision for new estates, trench sharing between DAs (see section 3.2.1 above) and other trench-sharing opportunities. A calculation of this number from basic operational or plant data has not been provided. Ovum has noted that this allowance is lower than the proportion calculated by the ACCC in 2006 ([10], section B.4.5). In that instance, the overall proportion was calculated as 13%.

Without further publicly available information, Ovum is unable to come to a definitive view but agrees that an overall allowance of [redacted]% in the TEA model for cables placed in open trenches is a satisfactory estimate for the situation faced by an efficient operator. The number, however, should be supported directly from Telstra's operational data. Ovum also notes that an efficient operator would seek to maximize the use of open trench in coordinating its activities both internally and with other trench users, such as utility companies.

3.6 Operability of the TEA Model

Telstra stresses (see, for example, [4], sections B.4.1 and B.4.2) that the TEA model is used for costing Telstra's Undertaking for all Band 2 ESAs. Ovum agrees.

A model user should therefore be warned that, while it is possible to select a subset of ESAs for study, the costs produced do not necessarily estimate the costs in the selected ESAs.

This is not a matter for regulatory concern.

4 References

The following submissions and other documents have been used in compiling this Advisory Note.

[1] Ovum, “Review of the network design and engineering rules of the Telstra Efficient Access cost model”, *A Report to the ACCC*, 6 August 2008.

[2] Ovum, “Review of the economic principles, capital cost and expense calculations of the Telstra Efficient Access cost model”, *A Report to the ACCC*, 1 August 2008.

[3] Ovum, “Review of the operability of the Telstra Efficient Access cost model”, *A Report to the ACCC*, 6 August 2008.

[4] Telstra Corporation Limited, *Telstra’s Ordinary Access Undertaking for the Unconditioned Local Loop Service: Response to Ovum’s Submissions,* Confidential Version, 5 December 2008.

[5] Telstra Corporation Limited, *Telstra’s Ordinary Access Undertaking for the Unconditioned Local Loop Service: Modifications in v1.2 of the TEA model,* 10 September 2008.

[6] Hatzenbuehler, Frank, “TEA model route optimisation process”, Annexure A to *Statement of Frank Hatzenbuehler,* 18 November 2008.

[7] NERA Economic Consulting, *Does Telstra’s TEA Model Provide a Reasonable Estimate of the TSLRIC+ of Supplying ULLS?,* 16 January 2009.

[8] Telstra, “Measure of TEA Model Efficiency: ULLS Band 2”, *Procedure Document* No. TAF0001-366515, Issue 1, 8 September 2008.

[9] [redacted], *Statement of* [redacted]*,* August 2008.

[10] Australian Competition & Consumer Commission, “Assessment of Telstra’s ULLS monthly charge undertaking”, *Final Decision* (Public version), August 2006.