ANNEXURE A

SUBMISSIONS IN RELATION TO PIE II MODEL

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ANNEXURE A

A PIE II MODEL

A 1 Efficient network costs

1 Telstra estimates the efficient network and associated costs using the PIE II model. A description of the PIE II model and the various assumptions on which it is based are contained in Annexure A to Telstra's submission dated 22 March 2006 titled 'Telstra's submission in support of its undertakings dated 22 March 2006' ("**March Submission**").

A 2 PIE II Model

2 The PIE II model determines, on the basis of various inputs, including traffic volumes and customer locations, the network elements which would be necessary to construct a PSTN. The PIE II model encapsulates Telstra's assumptions about the infrastructure that is required to provide the PSTN.

3 As far as is practicable, the PIE II model is flexible, allowing many of the underlying assumptions to be varied by the user. That said, some of the assumptions are fixed in the model and cannot be varied.

4 For the purposes of the present undertaking, the relevant PSTN element is the inter-exchange network (IEN). The PIE II model determines the elements necessary to build the IEN by using the network architecture which constitutes best in use technology as at 1 July 2002. Telstra submits that this technology remains best in use for the purposes of constituting an IEN for the PSTN voice services relevant to the present undertaking.

5 The model optimises the network elements necessary to build a least cost PSTN. It assumes however that where it is necessary to locate equipment (including local access switches) in a building within an Exchange Service Area ("**ESA**"), an existing Telstra equipment building is chosen.

6 The network elements necessary to build the PSTN are estimated on an individual ESA basis.

7 Once the network elements for each geographical area are determined, the PIE II model performs the following steps to derive a cost of the ESA:

(a) it costs each network element using prices which are inputs into the model to derive the capital cost for each network element category;

(b) it annualises these capital costs by applying the following annuity formula:

$$V * \frac{(1+r)^N (r-\alpha)}{(1+r)^N - (1+\alpha)^N}$$

where:

V is the total build cost of the asset,

r is the WACC,

N is the useful life of the asset, and

α is the annual change in the replacement cost of the asset,

which determines the annual costs for each network element category, after the payment of corporate tax;

(c) it applies operational and maintenance ("**O&M**") cost percentages and indirect costs percentages to each asset category;

(d) it aggregates the annualised capital costs, O&M costs and indirect costs by network element category to derive the annual cost of building the PSTN by network categories;

(e) it calculates the per unit cost of each network element.

A 3 TELRIC v TSLRIC Model

8 The PIE II model is a total element long run incremental cost ("TELRIC") model.

9 As set out in sections 3.1 and 3.2 of the report of Bridger Mitchell titled '*Appropriateness of Telstra's 2005 Cost Modelling Methodology*' ("**Mitchell Report 2005**"), a very complicated model would need to be built to determine the TSLRIC of a service. Assuming that there were 10 services, the model would need to determine the incremental cost of each service. This would need to be done by running the model 10 times with or without each service included. The difference between the total cost and the sum of the incremental costs of the 10 services would be the common costs. One would then need to determine how to allocate the common costs between the 10 services. Given that the

incremental costs of each service would be relatively small, the total price for each service would largely be determined by the choice of allocation of common costs.

10 In addition it may be that certain groups of the 10 services have common costs which are not shared with the remainder of the services. Accordingly the model would need to be run with a combination of each of the 10 services in order to determine the common costs shared between any sub-set of services. Again the allocation of the common costs would largely determine the price of the relevant service. A further complication is that it may be efficient to deliver a subset of the services using different infrastructure than the totality of the services. The model would need to accommodate such infrastructure changes. Thus a proper implementation of a TSLRIC based approach is extremely complex and inherently unreliable and therefore impractical.

11 To date, Telstra is unaware of any such TSLRIC model being built. For example, the n/e/r/a model, used by the Commission, was not a TSLRIC model.

12 Instead, TSLRIC has usually been estimated using a TELRIC model. The n/e/r/a model was such a model. A TELRIC approach simplifies the allocation of common costs. A TELRIC model determines the efficient cost of each network element used by a service. For example, if a switch is used by all 10 services, the cost of the switch is divided by the minutes of use of the switch by all 10 services. In this way, a minute of use of a switch is calculated. The routing factors are then used to add the cost of each network element used by each service in order to determine the cost of that service. This addresses the problem of deciding how to allocate the common costs by allocating those costs proportionately to the usage of each network element by the service.

13 Accordingly, for the reasons set out in paragraphs sections 3.1 and 3.2 of the Mitchell Report 2005, a TELRIC model is appropriate to estimate TSLRIC.

14 TELRIC models have been accepted in other jurisdictions as appropriate to estimate TSLRIC.

15 PIE II is a TELRIC model and has been built consistently with the above description.

A 4 Scorched Node v Scorched Earth

16 The scorched earth approach to network design determines both the number and locations of all nodes in the network as part of minimising overall costs. However, while a

scorched earth model would be able to vary the location of any equipment and thus optimise the entire network on that basis, such a modelling approach would be impractical. In order to properly model the network on a scorched earth basis, the model would need to test the practicality and cost of locating equipment in different locations. For example, locating an exchange in the tallest building in the CBD would be impractical. Locating it in other areas may be cost prohibitive. In the absence of very detailed information about the practicality and costs of locating equipment, the model will not be in a position to choose optimal locations of equipment and is likely to substantially underestimate the cost of building the network.

17 A scorched node model assumes:

(a) the locations of all switches where they are located in the incumbent's network; and

(b) that the switches deployed are those deployed by the incumbent.

18 As set out in section 4.2.4 of the Mitchell Report 2005, the scorched node approach to network design has been used in almost every TELRIC model to date because of its substantially greater simplicity.

19 In the PIE II model the local access switches can be located in fixed locations but which equipment is placed in those locations is determined and optimised by the model. Furthermore, the locations of remote switches are not fixed and are optimised by the PIE II model. Accordingly, the PIE II model is close to being a scorched earth design because information as to current locations is used to ensure that the locations of major equipment are feasible and cost effective.

20 Furthermore, in recent years Telstra has redesigned its network by reducing and rationalising its switches from some 5,000 switches previously used to [c-i-c] local access switches and [c-i-c] transit switches. Accordingly, the locations of Telstra's switches have already been, to some extent, optimised.

A 5 Architecture of the model

21 Lastly, the Commission has stated that it is far from clear that the PIE II model has the optimal architecture[1]. Telstra responds to each of the Commission's specific criticisms as follows.

Telstra's use of rectilinear distances

22 The Commission began by noting that there are a number of alternative approaches to the use of rectilinear distances (eg straight line distances)[2]. However, it goes on to neither reject Telstra's approach, nor endorse the possible alternative approaches. If the Commission considers the approach taken to be wrong, then it ought to state an alternative approach which it finds acceptable in order for Telstra and the industry to properly consider it. Moreover, the Commission's role is to assess whether the approach taken by Telstra is consistent with the statutory criteria, and not to disregard Telstra's methodology because, in the Commission's view, another approach is preferable.

Minimising the distances of trenches

23 The Commission correctly noted that the PIE II model calculates an optimal structure based on minimising total distances of trenches[3]. The Commission provided no justification as to why introducing other variables into the PIE II model (which would substantially increase the complexity and run time of the PIE II model) would achieve a more accurate measure of total costs or indeed a more efficient network design.

Use of pre-determined engineering rules

24 Telstra disagrees with the Commission's view that the use of pre-determined engineering rules does not produce an optimal network[4]. Telstra also disagrees with the Commission's claim that Telstra has provided limited justification for the engineering rules used in the PIE II model[5]. Similar to the construction of any infrastructure project (eg. gas pipeline or bridge), a base set of engineering rules are required in order to construct the infrastructure and ensure it is functional and that it adequately performs the

1 Commission, *Assessment of Telstra's undertakings for PSTN, ULLS and LCS, Final Decision*, December 2004, page 57.
2 Commission, *Assessment of Telstra's undertakings for PSTN, ULLS and LCS, Final Decision*, December 2004, page 57.
3 Commission, *Assessment of Telstra's undertakings for PSTN, ULLS and LCS, Final Decision*, December 2004, page 57.
4 Commission, *Assessment of Telstra's undertakings for PSTN, ULLS and LCS, Final Decision*, December 2004, page 60-61.
5 Commission, *Assessment of Telstra's undertakings for PSTN, ULLS and LCS, Final Decision*, December 2004, page 58.

task for which it was designed. The more appropriate question for the Commission is not whether engineering rules have been used but whether the engineering rules chosen reflect 'best in use' design principles. In this regard, the rules are based on Telstra's design principles as embodied in its planning documents.

Costs allocated to the PSTN that are not properly PSTN costs

25 The Commission contrasts TELRIC and TSLRIC models, and states that TELRIC models will tend to allocate all costs to the set of services that are modelled. Telstra does not agree that this is a point of difference between TSLRIC and TELRIC models. It also does not agree that TELRIC models (as opposed to TSLRIC models) tend to allocate costs only to services that are being modelled. Properly constructed, each model is able to cost a range of services that use the PSTN and allocate costs appropriately. Telstra took the approach in the PIE II model of sharing PSTN costs among those services that use the PSTN. The call types included in the PIE II model are set out in Appendix A. Further, Telstra is not aware of any services which are not taken into account in estimating the IEN costs but which should be taken into account.

B INPUTS INTO THE PIE II MODEL

26 Below are Telstra's submissions as to the various assumptions made in the PIE II model.

B 1 Provisioning Rules

27 The provisioning rules used by Telstra include provisioning for future demand. This is appropriate because it is less expensive to build the PSTN with sufficient capacity to satisfy future demand than it is to augment the PSTN when that extra demand eventuates. Furthermore, as demonstrated in section 5 of the Mitchell Report 2005, there are two ways to ensure that all costs incurred in building the PSTN (which includes provisioning for future demand) are recovered:

(a) include the annual cost of provisioning for future demand from the time the network is built; or

(b) exclude costs of provisioning for future demand but include the costs of provisioning for future demand incurred in previous years.

28 Otherwise the costs of building the PSTN are not recovered. Given that the latter alternative results in higher costs than the former, Telstra's approach is conservative.

B 2 Source and basis of engineering rules

29 The Commission stated that the source of the engineering rules used by Telstra is not clear, and also that it is not clear on what basis the engineering rules are determined[6].

30 As noted in paragraph 24 above, the PIE II model is constructed on the basis of what Telstra considers to be ‘best in use’ engineering practice, which are based on Telstra’s network planning and design documents.

31 Efficient design requires a balance between the increased annual charges (interest, depreciation and maintenance) incurred by having the spare plant and the increased costs as a result of the risk that capacity will be insufficient to fulfil demand. Telstra submits that the design principles in the PIE II model provide the best compromise between installation cost and the annual charges incurred due to the necessary provision of spare plant.

C TRENCH SHARING

C 1 Trench and Duct Sharing within the Telstra Network

32 As a result of the sharing rules applied in the PIE II model, the total trench lengths calculated by the PIE II model are as follows:

(a) ducted trenches – [c-i-c] kilometres;

(b) ploughed trenches – [c-i-c] kilometres; and

(c) total trenches – [c-i-c] kilometres.

33 Telstra has conducted an analysis to determine the trench lengths one would expect having regard to the length of roads in Australia. On the basis of that analysis, Telstra submits that:

(a) a minimum of [c-i-c] kilometres of ducted trenches; and

(b) a minimum of [c-i-c] kilometres of total trenches;

would be required for the PSTN. The detailed description of this analysis is set out in Appendix B to this Submission.

34 The trench lengths estimated by the PIE II model do not exceed the minimum trench lengths estimated by analysing the road lengths. Accordingly, Telstra submits that the estimates in the PIE II model are conservative.

35 Furthermore, both the PIE II model and the road analysis estimate trench lengths assume:

(a) a flat plain; and

(b) no natural barriers or terrain difficulties.

In fact, Australia is not flat, especially in areas where the network is most teledense such as Sydney. In the US, various models[7] take account of:

(c) slopes of the terrain by marking up the trench lengths depending on that slope; and

(d) obstacles such as lakes, rivers or freeways which prevent trenches being built in a straight line[8].

For these reasons, the efficient network costs of ducts and trenches estimated by the PIE II model are substantially below those which would be incurred by an efficient PSTN operator providing PSTN OTA.

C 2 Trench and Duct Sharing with Others

36 The PIE II model assumes that:

(a) Telstra can recover [c-i-c] per kilometre of shared duct from third parties;

(b) Telstra shares [c-i-c] kilometres of ducts with Telstra Multimedia Pty Ltd;

(c) Telstra shares [c-i-c] kilometres of ducts with third parties, such as Optus, AAPT or Primus.

37 In Telstra's view, to determine the level of costs that can be recovered from sharing trench and duct space with third parties the revenue actually received by Telstra for sharing

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6 Commission, *Assessment of Telstra's undertakings for PSTN, ULLS and LCS, Final Decision*, December 2004, page 60-61.

7 For example the Hybrid Cost Proxy Model adopted by the Federal Communications Commission.

should be used. This is because the maximum level of costs that can be allocated to third parties is limited by their willingness to pay for the service.

38 Alternative approaches to reducing the trench and duct cost pool have been proposed. For example, in its final decision on Telstra's second PSTN undertaking, the Commission used a cost allocation methodology which allocated an equal share of costs to each party using the trench or duct. Another possible approach is to allocate on the basis of a hypothetical efficient level of sharing. However, the difficulty with both of these approaches is that the costs in question are allocated without regard to the willingness to pay of the third party users.

39 Telstra Multimedia Pty Ltd ("**TM**") competes in the provision of a broadband network with others. It pays the same price for facilities sharing as that which is paid by other providers of broadband networks. If it were required to pay a higher price for facilities sharing than other third parties, it would be at a competitive disadvantage. Its competitors could take the market even though TM was more efficient at providing the broadband network than them. This would not promote the efficient use of the infrastructure by means of which the declared services are provided.

C 3 Asset Lives

40 The PIE II model assumes that the asset lives of various asset categories are as set out in Appendix C. These asset lives are those estimated by Telstra having regard to the usable lives of the assets and the future technology changes which may make those assets obsolete.

C 4 Asymmetric Risk

41 The capital asset pricing model ("**CAPM**") approach to quantifying beta only recognises risks that are systematic and non-diversifiable; that is, risks that are related to movements in the market that cannot be diversified. The CAPM does not recognise asymmetric risks, even if they are non-diversifiable. Under-recognition of these asymmetric risks will generate disincentives resulting in under-provision, lack of innovation and tardy technology adoption in assets where these asymmetries exist, especially large network/infrastructure type assets. Telstra considers that these risks should be captured in the efficient costs in either the weighted average cost of capital ("**WACC**") or the notional cash flows.

42 Telstra submits that there are asymmetric risks that are relevant to the PSTN. For example:

(a) as the Productivity Commission emphasizes in its reports on the telecommunications access regime[9] and on the national access regime, access providers are exposed to asymmetric risk from the mere fact that access is sought and used to those facilities that are commercially attractive while not being equally sought and used to those facilities whose commercial opportunities are limited. For access providers who undertake a range of investments (as is plainly the case for Telstra), this has the effect of truncating the upside associated with investment in declared or potentially declared services, while leaving them fully exposed to the downside;

(b) the risk associated with extreme events where the downside of negative events is borne fully by the access provider and where the benefits of positive events are shared more broadly, including with access seekers;

(c) the risk that assets will become stranded, that is, to the extent that asset lives are over-estimated, technological advances may mean that the assets currently deployed by Telstra (or the notional PSTN provider) to deliver telecommunications services will become redundant and cannot be sold;

(d) Telstra (and the notional stand-alone PSTN provider) also faces a number of demand related risks:

(i) one of these relates to the difficulty in accurately forecasting future demand in a rapidly changing environment; and hence problems with dimensioning the network appropriately for the future. This problem arises because prices are based on per-unit charges, which are established by unitising forecast costs over forecast traffic levels. If the demand forecast is too low, actual costs will exceed forecast costs by more than the additional, un-forecast traffic multiplied by forecast average cost. This is because the access provider will need to increase the capacity of its network on an incremental basis at a higher cost than if the network had been provisioned from the outset for that level of demand and the access

[9] Productivity Commission, '*Telecommunications Competition Regulation, Inquiry Report*', 21 December 2001.

provider not recover its costs. As a result the access provider will not recover its costs. On the other hand, if the demand forecast is too high, and unit charges have been set by apportioning the costs of the PSTN over the forecast traffic, then those charges will not enable Telstra to recover the costs of the PSTN;

(ii) another risk is a move to a different, more technology intensive product mix (eg IP telephony) that may bypass the PSTN. To the extent that the risk of bypass is not factored into estimated lives of the relevant assets, a similar risk emerges where there is a potential for end customers to alter their consumption patterns or for competitors to change their strategies in respect of build-buy decisions;

(e) the risk that regulatory oversight and intervention will skew strategic/technology decisions by Telstra in ways that prove to be commercially unsound. Regulatory arrangements typically allow the regulator considerable discretion on material issues since this is easier than prescribing a complete set of rules which may then require regular legislative amendment to adapt to changing circumstances. Given the regulator's relative distance from the commercial market place, the Regulator is likely to favour technological solutions that in practice differ from those that would be adopted in an unregulated and workably competitive market. As a result, there is a consistently greater risk that regulated firms will be induced to adopt solutions which are inefficient and which they would not otherwise have taken.

43 These are non-systematic but non-diversifiable risks, and ought to be priced in to those facilities for which access is sought. Indeed, were a competitive tender being held for the right to provide the facility at issue, that risk would be priced in.

44 Telstra believes that, following the recommendations of the Productivity Commission, and in line with its approach to the gas industry[10], the Commission should set out an approach that it views as acceptable for the costing of asymmetric risk. This is all the more important as the recent decision in *Re Epic Energy (WA) Nominees Pty Ltd*[11] highlights the link between the legitimate interests of access providers and ensuring that

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[10] Final Decision, *GasNet Australia Access Arrangement Revisions for the Principal Transmission*, 13 November 2002.

[11] [2002] WASCA 231.

all costs, including those associated with the bearing of risk, are fully recovered, even when the regulator has some uncertainties with respect to those costs. In Telstra's view, it is incumbent on the Commission to provide clear methodologies in this respect, as it has done in terms of costing approaches more generally. These methodologies ought to be capable of general application, as the issues involved are not specific to the present undertakings.

45 Telstra considers there are four alternative approaches to dealing with non-diversifiable asymmetric risk.

46 First, the cash flows (expenses recognised for costing the PSTN) could be augmented by an actuarially valid estimate of the costs of self-insurance for these risks. There is little empirical guidance on this aspect as there is no commercial market for insuring these types of risk. Nevertheless, it is clear that, if an insurance market did exist for these types of risks, the PSTN provider would likely effect that coverage and the cost would be captured as a legitimate expense. This reinforces the legitimacy of these costs.

47 Secondly, a margin above the CAPM-based WACC could be identified. There is unfortunately limited empirical evidence for such an approach, although the logic of real options is promising. Theoretically, the ad hoc adjustment should be commensurate with the actuarially valid insurance cost (such that the extra return resulting from the heightened WACC is equivalent to the cost burden of insurance if such were available).

48 Thirdly, the beta estimate (component of the CAPM-based WACC) could err on the high side of a separately determined plausible range. This approach has previously been adopted by the Commission in the gas context and therefore has regulatory precedent. This approach is extremely ad hoc. However, it has the partial justification that it is attempting to adjust the CAPM parameter that specifically captures risk, when it is the under-recognition of risk that is the central defect which requires remedying. In Telstra's view, it is extremely unlikely that the range of beta estimates derived within the normal confines of the theoretical CAPM would reliably and adequately capture these risks in any but the most marginal of circumstances.

49 Fourthly, the downside costs can be borne by the access provider as they occur. This seems most plausible in respect of extreme events, such as disasters, catastrophic break-downs or completely unanticipated costs such as those borne in dealing with Y2K concerns. In a regulatory context, this would require that the extra capital and/or

operating expenses caused by the extreme event are subsequently included in the regulated asset base at the next review. Given the lumpiness of this effect, this would likely result in some price volatility (both to access seekers and to end users).

50 Turning from these events to the risks associated with stranded assets, the regulator could enforce a commitment not to exclude stranded assets from the regulatory base for a set period (usually matched to the expected life of the relevant assets)[12]. It is not clear how these arrangements could be enforced in the PSTN context given the loose nature of the regulatory regime overseeing third party access to the PSTN.

51 Telstra's preference is to adjust the WACC in such a way as to specifically cover the implicit insurance costs of the various asymmetric risks. Telstra has currently set this value at 0%. Plainly the value set at 0% is extremely conservative and unrealistic, and understates the costs for the purposes of the WACC.

C 5 Grossing up for tax

52 The application of the post-tax "vanilla" WACC to the efficient new-build cost of the relevant PSTN assets using the formula set out above establishes an annual capital cost (or revenue requirement) after the payment of corporate tax.

53 However, any access price established in this process must be expressed in pre-tax terms to enable the access provider to meet ongoing taxation liabilities. This requires that the tax burden be explicitly recognised. The annual capital cost therefore needs to be "grossed up" to include the relevant tax burden for each year.

54 The following formula is used to calculate the annual capital cost inclusive of the net tax burden:

$$\Phi V_{pre\text{-}tax} = [\Phi V_{post\text{-}tax} - (V/N+I)*T_c*(1-\gamma)]/(1-T_c*(1-\gamma))$$

where:

$\Phi V_{pre\text{-}tax}$ = the grossed-up (pre-tax) annual capital cost;

$\Phi V_{post\text{-}tax}$ = the annual capital cost using the post-tax "vanilla" WACC;

V = the total build cost of the asset,

N = the useful life of the asset;

12 Even this may be too short given that these adverse events may occur only once in a decade or even less frequently.

T_c	=	the statutory corporate tax rate,
γ	=	the imputation factor;
I	=	D*V*i and represents interest expense deductible for tax purposes;
D	=	the debt ratio;
i	=	the interest rate applicable to the relevant debt.

55 The gross-up equation effectively calculates the pre-tax amount of revenue required such that, after payment of tax, the access provider receives a residual amount commensurate with the required return to capital providers. In doing this, the gross-up equation specifically recognises:

(a) the tax deductibility of interest;

(b) the tax deductibility of depreciation (assumed for these purposes to be straight-line);

(c) the benefit of imputation.

56 The tax rate which is used in this gross-up equation is the statutory corporate tax rate.

57 One of the matters that has been taken into account in the formula used is that under the dividend imputation arrangements operative in Australia, equity investors receive a credit for tax paid at the corporate level when determining their individual personal tax. This effectively reduces some portion of company tax to a pre-payment of individual level tax. Under the post-tax "vanilla" WACC approach this benefit is reflected in the notional cash flows (i.e. as a reduction in the recognised tax burden at the corporate level) and not in the WACC. Telstra submits that the value of the imputation factor for inclusion in the tax gross-up equation is the same as that applicable in WACC estimates.

58 The tax rate which should be used in this gross-up equation is clearly the statutory tax rate. This is because the tax benefit of depreciation (i.e. its deductibility for tax purposes) is specifically captured in the gross-up equation (V/N represents straight-line depreciation). This is different from the typical conversion of a post-tax WACC to a pre-tax WACC where the tax rate itself, arguably, has to compound the effect of the deductibility of depreciation.

C 6 Operational and Maintenance Costs

59 The PIE II model uses operational and maintenance ("**O&M**") cost and network planning cost percentages which are applied to the capital costs for each asset category to determine the operational maintenance costs for each asset category. The O&M percentages and network planning percentages used are those set out in Appendix D.

60 Those percentages are derived using Telstra's audited general ledger accounts. In summary, the process is as follows:

(a) the accounts are already divided into activities by business units. An example of an activity might be the maintenance cost of a certain asset;

(b) each of the activities, except those incurred by the corporate centre business unit, are classified into various asset categories, such as "access" or "switching" or "mobiles" or "CPE" or "directories";

(c) all of the O&M costs for each of the relevant asset categories are added up across all business units except the corporate centre business unit. This gives the O&M costs by asset category;

(d) by dividing each of those O&M costs by the capital value of the asset category in the accounts, the percentages are derived.

A detailed description of how this is done is set out in Appendix E.

C 7 Indirect Costs

61 The indirect costs calculated by the PIE II model are:

(a) indirect O&M costs; and

(b) indirect capital costs.

Indirect O&M Costs

62 The indirect O&M costs are O&M costs incurred by the corporate centre business unit. The corporate O&M costs are allocated into each of the business units which have caused those costs to be incurred. They are then divided into the asset categories as set out above

to derive the indirect O&M costs. To derive the percentages, the indirect O&M costs calculated are divided by the direct O&M costs in each asset category.

63 The indirect O&M percentages are set out in Appendix D with the detailed method for deriving those percentages being set out in Appendix E.

64 The indirect O&M costs are estimated by the PIE II model for 2002/03 are [c- i-c]. The actual indirect O&M costs incurred by Telstra for the PSTN in 2001/02 were [c-i-c] as set out in Appendix F. Given that Telstra's indirect O&M costs exceed the O&M costs calculated in the PIE II model, the indirect O&M costs calculated by the PIE II model are conservative.

Indirect capital costs

65 Indirect capital costs are those incurred by the corporate centre business unit. The corporate assets are allocated across the business units and across the asset categories in each business unit as set out above. The indirect capital costs are divided by the capital costs in each asset category to derive the percentages. The indirect capital costs percentages are set out in Appendix D with the detailed description of the method for deriving those percentages being set out in Appendix E.

66 The indirect capital costs are estimated by the PIE II model for 2002/03, as [c-i-c]. The actual indirect capital costs incurred by Telstra for the PSTN in 2001/02 were c-i-c]. Given that Telstra's indirect capital costs exceed the indirect capital costs calculated in the PIE II model, the indirect capital cost percentages calculated by the PIE II model are understated and conservative.

C 8 Network Planning Costs

67 Network planning costs are the costs of designing the PSTN. Any efficient operator building the PSTN would need first to design it. The costs of doing so would be substantial. Telstra has attempted to estimate those costs. It has included planning costs estimated on the basis of the on going planning costs it incurs in expanding and/or maintaining the PSTN. Accordingly, the estimate of planning costs substantially under-estimates the planning costs which would be incurred by an efficient operator of the PSTN who had to rebuild the PSTN.

68 The methodology used to estimate planning costs is set out in Appendix E.

69 The inclusion of network planning costs in the PSTN cost pool is consistent with the TSLRIC concept. According to the Commission's 1997 Pricing Principles for Telecommunications:

> "*TSLRIC represents the costs the firm necessarily incurs in providing the service and captures the value of society's resources used in its production".*

Further, the Commission states:

> *"An access price based on TSLRIC is consistent with the price that would prevail if the access provider faced effective competition, and usually best promotes the long-term interests of end-users."*

In a competitive market, the price that would prevail would be equal to the cost that would be incurred by an efficient service provider. Given the Commission's definition of TSLRIC, Telstra submits that an efficient access provider could not avoid the costs associated with network planning. Even in a competitive market, an efficient service provider would necessarily incur network planning costs and would need to price its services to recover these costs.

70 Using a scorched node approach (as opposed to scorched earth) to TSLRIC does not change the position. Network planning involves far more than the location of LASs. For example, there is the placement of cables and trenches, consideration and determination of the technology to be used, the identification and determination of the location and types of LAUs and trunk switches, etc. Planning is necessary in relation to a whole raft of issues in order to efficiently deploy the network. The importance of network planning and designing in a scorched node TSLRIC network is further outlined in the Mitchell Report 2005.

71 Further, Telstra notes that network planning costs have traditionally been recognised by TELRIC models in the form of the application of an "uplift factor" to the cost of each individual network component.

72 Telstra also does not understand how the inclusion of network planning costs could be inconsistent with a scorched node approach to TSLRIC. The scorched node approach is adopted as a practical modelling methodology and involves modelling the efficient network architecture given the location of nodes as in the legacy network. Such a methodology, used for the purposes of practical implementation, has no implications for

the inclusion of network planning costs which, as discussed above, are consistent with the costs that would be incurred by an efficient operator. Excluding these costs from PSTN OTA prices would result in prices below that which would prevail in a competitive market.

73 Telstra urges the Commission to change its view on network planning costs, and allow for such costs in determination of an efficient TSLRIC.

C 9 Routing Factors

74 The routing factors used in the PIE II are based on a study of traffic through each type of Telstra switch conducted by Telstra network engineers in March 2000.

APPENDIX A - CALL TYPES INCLUDED IN PIE II

The following call types are included in PIE II model:

[c-i-c]

APPENDIX B - TRENCH LENGTHS

1 This annexure outlines Telstra's estimate of the required amount of PSTN trenching, based on the actual road lengths in Australia, for a comparison with the outputs of the PIE II model.

Ducted Trenches

2 For this purpose, Telstra has used road distance information captured in Mapinfo. That information is classified into the following categories:

(a) national highways;

(b) major roads;

(c) sealed roads; and

(d) unsealed roads.

3 Telstra has divided Australia into approximately 5,000 Exchange Service Areas ("**ESAs**"). The ESAs are classified into the following four classifications:

(a) Urban - which covers CBD, metro and large provincial areas;

(b) Major Rural - which covers small provincial areas;

(c) Minor Rural - which covers rural areas; and

(d) Remote - which covers remote rural areas.

4 In order to estimate the length of trenching in each ESA, Telstra imposed ESA boundary data onto the Mapinfo 1996 street database. This resulted in lengths of major roads, national highways, sealed roads and unsealed roads in each of the four types of ESAs as follows:

	Major Roads (kms)	**National Highway (kms)**	**Sealed Road (kms)**	**Unsealed Road (kms)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

Rural				
Minor Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

5 In determining the estimated trench distances Telstra made the following assumptions regarding the likely proportion of national highways that would need to have CAN and IEN ducted trenching along them:

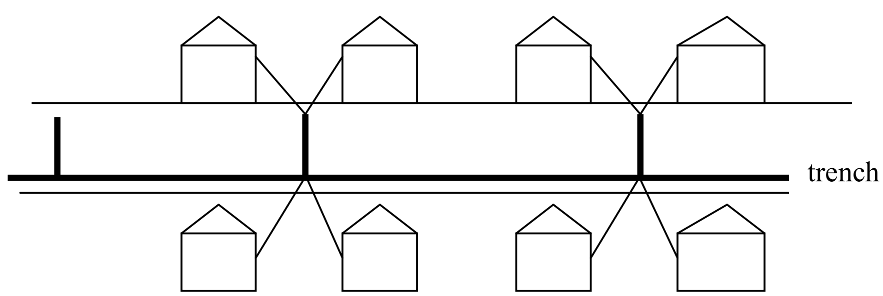
(a) [c-i-c]% of national highways in urban areas;

(b) [c-i-c]% of national highways in major rural areas; and

(c) [c-i-c]% of national highways in minor rural and remote areas.

6 In urban areas, major roads and sealed roads would need to have CAN ducted trenching along their entire length because customer dwellings are generally located along these types of roads. For the purpose of this analysis, it has been assumed that there is only one trench along these roads although, in reality, there are also likely to be IEN trenches along the roads, which would not necessarily be co-located with the CAN trenching.

7 In urban areas, the length of trenches along major and sealed roads has to be increased by [c-i-c]% to [c-i-c]% to take into account street crossings, which are trenches running in a perpendicular direction to the trenches along a street and are necessary to connect houses on both sides of the street. Below is a diagram depicting street crossings:



8 The calculation of this percentage allowance for street crossings is as follows:

[c-i-c]

9 The estimation of trenches in urban areas, based on road lengths, is therefore:

	Road length (km)	% road trenching included	Length of trench (km)	% for street crossings	Trench length, including street crossings (km)
Major road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
National highway	[c-i-c]	[c-i-c]	[c-i-c]		

totalling between [c-i-c] to [c-i-c] km.

10 In major rural areas, major roads and sealed roads would need to have CAN ducted trenches along 50% of their length with the other 50% having directly buried network cabling. The estimation of trench lengths in major rural areas is therefore:

	Road length (km)	% Road trenching included	Length of trench (km)
Major road	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road	[c-i-c]	[c-i-c]	[c-i-c]
National highway	[c-i-c]	[c-i-c]	[c-i-c]
		Total	[c-i-c]

11 In minor rural and remote areas, the major roads and sealed roads would need to have CAN ducted trenches along 10% to 20% of their length. The calculation of trench lengths in minor rural areas is as follows:

	Road length (km)	% road trenching included	Length of trench (km)
Major road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Major road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]

National highway	[c-i-c]	[c-i-c]	[c-i-c]

totalling between [c-i-c] and [c-i-c] km, and in remote areas is:

	Road length (km)	% road trenching included	Length of trench (km)
Major road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Major road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]
National highway	[c-i-c]	[c-i-c]	[c-i-c]

totalling between [c-i-c] and [c-i-c] km.

12 Street crossings in major rural, minor rural and remote areas are not taken into account because the length of house frontages and frequency of street crossing are harder to estimate. Consequently, the ducted trench lengths estimated for major rural, minor rural and remote areas are conservative.

13 Using the estimates set out above, the total trenching based on road lengths is calculated as follows:

	Lower bound (km)		Upper bound (km)
Total urban trenching	[c-i-c]	or	[c-i-c]
Total major rural trenching	[c-i-c]		[c-i-c]
Total minor rural trenching	[c-i-c]	or	[c-i-c]
Total remote trenching	[c-i-c]	or	[c-i-c]
Total	[c-i-c]		[c-i-c]

14 These calculations do not take into account the fact that Telstra's services have grown approximately [c-i-c]% per annum since 1996. The growth of services in operation includes increases in services in new areas requiring new trenching as well as infill increases in services in established areas which do not require new trenching. Telstra assumes that there was a [c-i-c]% per annum growth in trenching in new urban and major rural areas. This [c-i-

c]% growth per annum represents a compounded growth of [c-i-c]% to 1 July 2002. Applying these growth percentages to the 1996 data, the estimate of the length of the trenches as at 1 July 2002 is between [c-i-c] and [c-i-c] km.

15 These results are conservative because the classification of various roads into urban, major rural, minor rural and remote only captures 76% of the total street data due to the limitations of the software used. The 24% of data not captured is comprised of [c-i-c] km of major roads, [c-i-c] km of national highway, [c-i-c] km of sealed roads and [c-i-c] km of unsealed roads. It has been assumed that the uncaptured road distances would be allocated in the same proportions as the captured data for each ESA category within each road type.

16 Using this methodology, new adjusted road lengths including the initial non-captured data were calculated as follows:

(a) the road lengths based on Mapinfo are:

Based on ESA matching to Mapinfo (76% of Mapinfo data captured)				
	Major road (km)	**National highway (km)**	**Sealed road (km)**	**Unsealed road (km)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Total	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

(b) the percentages of each road category in each area are as follows:

Based on ESA matching to Map info				
	Major road (km)	**National highway (km)**	**Sealed road (km)**	**Unsealed road (km)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**

(c) the data not captured is:

	Major road	**National**	**Sealed road**	**Unsealed road**

	(km)	highway (km)	(km)	(km)
Map Info data not captured	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

(d) the extra road distance to be included is:

Extra distance to be included for gap in Mapinfo data captured				
	Major road (km)	**National highway (km)**	**Sealed road (km)**	**Unsealed road (km)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Total	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

(e) the adjusted road distances are:

Adjusted Mapinfo data				
	Major road (km)	**National highway (km)**	**Sealed road (km)**	**Unsealed road (km)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Total	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

17 The trench length estimates based on the new adjusted road lengths and using the assumptions set out above were calculated as follows:

(a) in urban areas:

	Road length (km)	**% road trenching included**	**Length of trench (km)**	**% for street crossings**	**Trench lengths including street crossing (km)**
Major road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

(upper bound)					
National highway	[c-i-c]	[c-i-c]	[c-i-c]		

totalling between [c-i-c] and [c-i-c] kms;

(b) in major rural areas:

	Road length (km)	% road trenching included	Length of trench (km)
Major road	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road	[c-i-c]	[c-i-c]	[c-i-c]
National highway	[c-i-c]	[c-i-c]	[c-i-c]
		Total	[c-i-c]

(c) in minor rural areas:

	Road length (km)	% road trenching	Length of trench (km)
Major road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Major road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]
National highway	[c-i-c]	[c-i-c]	[c-i-c]

totalling between [c-i-c] and [c-i-c] kms;

(d) in remote areas:

	Road length (km)	% road trenching	Length of trench (km)
Major road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Major road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (lower bound)	[c-i-c]	[c-i-c]	[c-i-c]
Sealed road (upper bound)	[c-i-c]	[c-i-c]	[c-i-c]
National highway	[c-i-c]	[c-i-c]	[c-i-c]

totalling between [c-i-c] and [c-i-c] km;

(e) in total:

	Lower bound		Upper bound
Total urban trenching	[c-i-c]	or	[c-i-c]

Total major rural trenching	[c-i-c]		[c-i-c]
Total minor rural trenching	[c-i-c]	or	[c-i-c]
Total remote trenching	[c-i-c]	or	[c-i-c]
Total	[c-i-c]	or	[c-i-c]

(f) to reflect the state of the network in July 2002, the urban and major rural figures should be increased by a factor of [c-i-c] as follows:

	Lower bound		**Upper bound**
Total urban trenching	[c-i-c]	or	[c-i-c]
Total major rural trenching	[c-i-c]		[c-i-c]
Total minor rural trenching	[c-i-c]	or	[c-i-c]
Total remote trenching	[c-i-c]	or	[c-i-c]
Total	[c-i-c]		[c-i-c]

18 As a result of these calculations, the trench lengths based on the new adjusted road lengths were calculated to be between [c-i-c] and [c-i-c] km as at 1 July 2002.

19 It is reasonable to assume that the lower bound of the trench lengths should, at the minimum, include the captured data from Mapinfo and that the upper bound should include the data which was not originally captured from Mapinfo. Therefore, the length of trenches which would be required by a new PSTN operator as at 1 July 2002 is between [c-i-c] and [c-i-c] km.

Total Trenches

20 To establish total trench distances (which include both ducted and ploughed trenches) a similar analysis was performed to that above.

21 Road distances sourced from Mapinfo as at 1996 are:

	Major Roads (kms)	**National Highways (kms)**	**Sealed Roads (kms)**	**Unsealed Roads (kms)**	**Total Road Length (kms)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Totals	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

22 Assuming [c-i-c]% growth per annum, the road lengths as at 2002 are:

	Major Roads (kms)	National Highways (kms)	Sealed Roads (kms)	Unsealed Roads (kms)	Total Road Length (kms)
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Totals	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

23 By assuming that trenching will be along:

(a) [c-i-c]% of urban national highways to discount for freeways;

(b) [c-i-c]% of urban unsealed roads;

(c) [c-i-c]% of major rural major & sealed roads;

(d) [c-i-c]% of non urban national highways;

(e) [c-i-c]% of major rural unsealed roads;

(f) [c-i-c]% of minor rural and remote sealed roads; and

(g) [c-i-c]% of minor rural and remote unsealed roads;

and that [c-i-c]% to [c-i-c]% uplift factor is needed for road crossings in urban and major rural areas along major and sealed roads as set out above, the expected trench length distance is as follows:

	Major Roads (kms)	National Highways (kms)	Sealed Roads (kms)	Unsealed Roads (kms)	Total Trench Length (kms)
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor Rural	[c-i-c]	[c-i-c]		[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Totals	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

24 Given that this data only covers approximately 76% of the areas covered by the ESAs in the PIE II model, using the same methodology set out above the road lengths become:

	Major Roads (kms)	**National Highways (kms)**	**Sealed Roads (kms)**	**Unsealed Roads (kms)**	**Total Road Length (kms)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Totals	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

25 Assuming [c-i-c]% growth per annum, the road lengths as at 2002 would become:

	Major Roads (kms)	**National Highways (kms)**	**Sealed Roads (kms)**	**Unsealed Roads (kms)**	**Total Road Length (kms)**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Totals	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

26 Using the same assumptions set out above, the trench lengths are:

	Major Roads Kms	**National Highways Kms**	**Sealed Roads Kms**	**Unsealed Roads Kms**	**Total Trench Length**
Urban	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Major Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Minor Rural	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Remote	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]
Totals	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]	[c-i-c]

27 Thus the expected length of trenches in Australia is between [c-i-c] and [c-i-c] km.

APPENDIX C - ASSET LIVES

[c-i-c]

APPENDIX D - O&M & INDIRECT COST PERCENTAGES

[c-i-c]

APPENDIX E - DETERMINATION OF O&M AND INDIRECT COSTS

[c-i-c]

APPENDIX F - TELSTRA'S INDIRECT O&M COSTS

[c-i-c]