Mallesons Stephen Jaques

Estimated optic fibre cable installation costs within CBD Areas.

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List of Terms and Abbreviations

ACCC – Australian Competition & Consumer Commission

CBD – Central Business District

PoP – Point of Presence

1 INTRODUCTION

1.1 This report sets out my opinion in regard to the questions contained in a Mallesons Stephen Jaques brief dated 10 Oct 2007.

1.2 The questions I have been asked to address are as follows:

"(a) From the perspective of a competitor with a POP at or near each Telstra exchange identified below, please determine

(i) which would be the most expensive building to serve via optical fibre cable link from each POP (assuming the closest POP would be used for any building); and

(ii) the estimated cost of serving that building?

In answering these questions, you are instructed to:

(A) separately identify the cost of the cable itself from the cost of obtaining the rights to use (or create) duct space and the cost of installing the cable; and

(B) assume that the cable would be the smallest capacity cable (in terms of number of fibre strands) that would normally be commercially installed in the CBD for a transmission tail.

Further, please provide answers to these questions in relation to connecting cables to buildings in each of the CBD areas of Sydney, Melbourne, Brisbane, Adelaide, and Perth, assuming that these CBD areas are defined as follows:

(C) the Sydney CBD is the area served by the Dalley, City South, Kent, Pitt, and Haymarket exchanges;

(D) the Melbourne CBD is the area served by the Exhibition, Batman, and Lonsdale exchanges;

(E) the Brisbane CBD is the area served by the Edison, Roma Street, Spring Hill, and Charlotte exchanges;

(F) the Adelaide CBD is the area served by the Waymouth, and Flinders exchanges; and

(G) the Perth CBD is the area served by the Bulwer, Pier, and Wellington exchanges.

The boundaries of these exchange areas are set out in the maps at Annexure 2, and the address of each exchange are set out in at Annexure 3.

(b) *To the extent that you consider that the estimated cost is heavily influenced by accessibility problems for a small percentage of buildings in each CBD, what would be the 75th percentile of costs in each of these CBDs? In order to determine the 75th percentile, please conceptually rank each building in increasing order of the cost of running a new fibre tail to it from one of the nominated Telstra exchanges. The 75th percentile cost is the price for which 75% of the buildings could be cabled for that price or less."*

2 AUTHORSHIP

2.1 I, Craig Lordan, have compiled this document in response to the brief. I am an Electrical Engineer, having graduated from Central Queensland University in 1988. I have 19 years experience within the Australian telecommunications industry and my CV is at Appendix 3. Prior to my current position with Evans & Peck, I was engaged in a number of Access Network roles within Telstra from 1989 through to 2001.

2.2 During that period with Telstra, I specialised in urban and rural Customer Access Network infrastructure, including the planning, design and construction of copper, fibre and radio networks. My experience extended from hands on responsibility for individual construction projects through to long term strategic planning and budgeting.

2.3 I also completed international roles while with Telstra. These included the planning and development of customer access networks within Vietnam. Later roles with Telstra included national responsibility for the development and application of Access Network design and construction practices.

2.4 During the past six years as a consultant with Evans & Peck, I have provided advice and support to many organisations in relation to the development and implementation of telecommunication networks. Organisations that have received and implemented advice include existing telecommunication carriers, electricity utilities and government organisations. I have contributed to the Queensland electricity industries' successful implementation of commercial telecommunication service supply. Other major projects have included the completion of technical feasibility reports for the implementation of very high speed access networks on behalf of State and Local Governments.

Craig Lordan
Senior Asscociate
Evans & Peck

3 BACKGROUND

3.1 Before addressing the specific questions, I provide the following comments as background information.

3.2 For the purpose of this report, the Central Business Districts (CBD) of Brisbane, Sydney, Melbourne, Adelaide and Perth are defined as the areas covered by the Telstra exchanges list which can be found in Appendix 1. A graphical representation of the Telstra exchange boundaries was received as part of the supplied background information. The boundary information is attached in Appendix 2.

3.3 The exchange boundaries included in the brief have been overlaid onto satellite images of the relevant CBD areas. The graphical representation of the areas that have been considered can be found in Section 6.

3.4 As instructed, the location of a competitor's Point of Presence (PoP) is assumed to be the same as the Telstra exchange.

3.5 Each exchange area has been individually reviewed to identify the building which, in my opinion, is likely to have the highest cost to install new fibre infrastructure from the PoP location within that exchange area.

3.6 The costing of fibre installation assumes that the PoP is established and includes the required access to street infrastructure and the required equipment to allow for the termination of optic fibre cables. The cost associated with establishing and operating the PoP is not included in the opinion presented.

3.7 A competitor who intends to install optic fibre cable for the provision of connectivity to a potential customer has two potential construction options. The first is to install new civil infrastructure, including conduit and pits, in to which the fibre cable is installed between the customer's building and the carrier's PoP. The second option is to lease space in existing conduit infrastructure between the customer's building and the carrier's PoP.

3.8 Estimated costs have been developed for both options with the results presented in this report.

3.9 In my experience, within each exchange area the existing Telstra conduit infrastructure radiate out from one point, being the Telstra exchange building.

3.10 If a competitor selects the option of installing new civil infrastructure, it is my opinion that the existing Telstra exchange boundaries would be unlikely to have any effect on the selection of which PoP would be used to connect the customer. In my opinion, the decision would be likely to be made on the basis of the lowest cost option. This is most likely to be directly related to the length of infrastructure that must be installed.

3.11 By way of example, nominated Building 6 in the Brisbane CBD, as shown in Figure 1, is significantly closer to the Roma St PoP location than to the Edison PoP. Building 6 is located within the Edison exchange area. A competitor who has elected to install new conduit is unlikely to be constrained to the existing boundaries and will be likely to select the lowest cost installation which in my opinion will be new infrastructure from the Roma St PoP.

3.12 As instructed, estimation of the cost to install fibre infrastructure to buildings has been limited to the buildings and the PoP location within a Telstra exchange boundary. That is, even if there may be a lower cost option to service a building from an adjacent exchange area PoP, the option has not been considered.

3.13 If however the competitor intends to lease space within existing Telstra conduit, then, for the Building 6 example, it is highly likely that the Edison PoP is the more viable option as the existing conduit network will radiate from this point. In my opinion, it is unlikely that there would be a suitable existing conduit path between the Roma St PoP and Building 6.

3.14 In my experience, a competitor supplying fibre connectivity to buildings within the CBD would be unlikely to use the technique of a single fibre sheath installed from PoP to customer building, as described within the brief. A competitor would normally endeavour to maximise the potential number of buildings that could be connected whilst minimising their total infrastructure costs.

3.15 Although the initial cost may be higher, it is my experience that the infrastructure installation strategy of a competitor is likely to allow for the connection of additional buildings along or adjacent to the fibre path during the initial installation. This would be achieved by installing significant surplus fibre capacity in excess of known requirements and installing joints at strategic positions to cater for later access to the spare fibres.

3.16 It is more likely that a competitor would install high fibre count cables, possibly constructed as a tapering network. Tapering is where the number of fibres within the cable closest to the PoP is significantly greater than the final sections of the cable. Additionally, a number of joints would be installed in the cable at strategic locations for future access.

3.17 In response to the specific requirements of the brief, I have not included the provision of tapering fibre count cable, or the installation of joints for future access.

3.18 The cost estimates presented in this report are based on market rates for the supply and installation of telecommunication infrastructure which are combined with available information relating to the physical environment and estimated cable route length. Due to the nature of underground construction and working in difficult environments, it is likely that the actual cost to construct a specific fibre installation, following a detailed design, will exhibit a level of variation from the values presented in this report.

4 BASIS OF COSTING

4.1 The fibre network infrastructure construction cost estimates presented in this report have been developed on the basis of my experience of the industry, unit construction benchmark rates and validation with a number of construction suppliers.

4.2 In order to generate the costs as requested in the brief, a number of assumptions have been made as described in the following paragraphs.

4.3 In order to provide a response to the questions in the brief, a non-tapering, minimum fibre count of 12 fibres has been assumed. I would consider 12 fibres as the minimum cable size that is likely to be used for a commercial installation.

4.4 There has been no allowance for the installation of additional joints to cater for future opportunities to connect buildings as would be expected within a competitor network. An optic fibre joint to cater for hauling and installation practices has been included if the distance between the PoP and the building is greater than 1000m.

4.5 As described in paragraph 3.7, the costs for two fibre installation options between a competitor's PoP and a customer location have been estimated. The first option considers the competitor installing new conduit and fibre for the entire route, and the second option is installing new fibre in leased space within an existing conduit. The leased option requires the payment of an ongoing lease fee, which is also included.

4.6 Space in an existing conduit may be leased from Telstra, other carriers, utilities and, in limited cases, other infrastructure owners, such as local councils. In my experience, the rates and willingness to provide access to other entities vary significantly between the suppliers. For example, in some regions, electricity utilities embrace the concept of gaining additional unregulated income by leasing access to surplus capacity within conduits, whilst other utilities take the position of deterring access by the application of very high prices.

4.7 Telstra is the owner of the largest telecommunication conduit network within Australia. Typically, the existing conduit network within an exchange area radiates from the PoP locations proposed for this analysis. The estimation of costs for the use of existing conduit presented in this report has used Telstra

lease rates as the benchmark. Other suppliers may offer lower rates in competition but, in my opinion, the market rates are likely to be similar to those charged by Telstra. The Telstra rate information, used in the development of cost estimates, was received via Malleson's email dated 22 Nov 07. The key rates used for the Telstra lease conduit are:

- $6.95 per metre per annum;
- $556 per annum per joint or loop placed in Telstra manhole or pit; and
- Indicative initial cost of [redacted] to [redacted] per request for feasibility study, inspections and database updates.

4.8 As part of the technical specifications for the lease of space within a Telstra conduit, a protective subduct must be installed within an existing 100 mm conduit prior to the installation of the optic fibre cable. My experience is that the majority of non-Telstra conduit capacity lease arrangements also require the installation of subduct prior to the installation of optic fibre cable.

4.9 Distances to the buildings which I have identified as being the likely highest cost examples for each exchange area have been developed using map studies of each of the exchange areas. The length of network required to access up to 75% of buildings within an exchange area has been developed using the same methodology.

4.10 In my opinion, the dominant factor in selecting the most expensive building to connect in each exchange area is distance from the PoP. Other factors do impact on the cost of installation, but none are considered to be as important as the distance of infrastructure to be installed.

4.11 The estimated costs include the supply, installation, jointing and testing of optic fibre infrastructure from the PoP to the customer building's main communication room. The installation, or provision, of fibre connections from the main communication room to other locations or floors within the building is not included in the cost estimates.

4.12 Before a carrier could provide a service to a customer, additional equipment would need to be installed. The supply and installation of suitable active electronic equipment to allow the transport of telecommunication data across the installed fibre infrastructure is not included within the estimated costs.

4.13 In my experience, two primary construction methods are available for the installation of conduit, directional boring and open trenching. Directional boring may be considered to have lower impact on property owners and is often favoured by carriers in order to minimise disruption to customers and the public. In my experience, directional boring is more expensive than open trenching, with the exception of areas where the cost of surface reinstatement is very high.

4.14 A significant cost in the CBD environment is the reinstatement of the footpath and road surfaces. In my experience, the exact process for reinstatement of the CBD footpath is variable, depending on the rules and regulations of the responsible local authority. In some council areas the local council mandates

that it will complete the surface reinstatement to ensure uniformity throughout the CBD. This cost is then charged back to the constructor or the owner of the infrastructure.

4.15 The costs of reinstatement may vary significantly, depending on the surface which is to be removed and replaced. CBD footpaths generally vary from bitumen, to pavers, to more expensive solutions such as patterned concrete or, in some cases, expensive materials such as granite.

4.16 The development of the estimated costs assumes a mix of bitumen and paving for each CBD area. The proportion of each is assumed for each CBD area.

4.17 In my experience, CBD environments are difficult locations to install underground infrastructure. In most situations there are numerous existing underground services perpendicular to the alignment into which the new conduit is to be installed. The other underground services include existing telecommunication, water, electricity, sewerage, storm water and gas infrastructure. The risk of damaging other infrastructure is significantly higher within densely serviced areas, such as a CBD.

4.18 The use of directional boring also requires significant excavation to enable the use of a directional boring machine. The setup of the boring machine and subsequent excavation will be required at each change of direction or at the limit of the bore distance capability. It is my opinion that the base cost for directional boring within the CBD environment may be approximately $10 to $15 per metre lower than open trenching when a paved / bitumen surface is to be traversed.

4.19 My experience indicates that directional boring within the CBD environment is problematic and the potential of striking and damaging other infrastructure is very high. If damage does occur to other parties' infrastructure, the installing party will be responsible for the cost of repair. The cost of repair will vary, but is likely to be in the range of many thousands to many tens of thousands of dollars dependent on the service, location and difficulty of the subsequent repair. Damage also causes delay to the conduit installation workforce.

4.20 Using open trenching techniques in the CBD environment significantly minimises the risk of damage to other services. For example, one damaged piece of infrastructure may cost a total of $10,000 to repair. The cost of repair to other infrastructure has the potential to seriously reduce any savings made by using

directional boring. By way of example, a value of $10,000 is likely to be equivalent to the saving made by the use of directional boring for approximately 700 m of CBD conduit.

4.21 In my opinion, the risk of damage to other infrastructure by boring is either accepted or mitigated by increasing the effort expended in the design phase or by performing additional small excavations along the route to identify service locations. Both of the potential risk mitigation options increase the cost of delivery, and in my opinion this negates the potential lower cost of directional boring.

4.22 I have chosen to limit the use of directional boring techniques in the development of the estimated costs due to the reasons described in paragraphs 4.13 to 4.21, but it is my opinion that the choice between directional boring and open trenching has minimal impact on the value of the estimated cost.

4.23 Based on my industry experience, the assumed use of directional boring within each exchange area has been limited to a proportion of the total conduit installed. For the remainder of the conduit installation, the option of open trenching technique, rather than directional boring, has been chosen.

4.24 If the installation of conduit has to pass through an area with a very expensive surface, my suggestion is that directional boring would be substituted for open trenching in the specific areas. In my opinion, the impact on the total installation cost of delivery would be minimal in those circumstances.

4.25 Due to the CBD location, I have assumed that the work would be conducted outside of normal business hours. It is my understanding that it is normal practice to restrict excavation activity within the CBD during business hours, due to the disruptions caused. The impact of this assumption on the estimated costs is that the labour cost component of any activity is higher than it would be if this activity was possible during business hours.

4.26 Each estimated cost is based on a number of inputs and assumptions. Table 1 below describes the key inputs.

4.27 Each of the input variables listed below has been assumed following a review of each exchange area, the location of the PoP, route, and the buildings to be serviced.

Inputs	Description
Total Distance	The estimated cable and route length for either the proposed most expensive building or the distance calculated to reach 75% of the buildings within the exchange area.
Percentage Bore	The percentage of directional boring which has been assumed for each route. Predominantly, only included for routes with longer distances out of high rise area or where it is assumed that the footpath surface is very high cost.
Percentage Road	For the each route, the proportion of road versus footpath is entered. The distances for each cost element are calculated using the percentage and the route distance.
Percentage Footpath	
Pits	By review of each route, the number of pits expected to be required to cater for hauling and joint installations is entered.
Footpath %	By review of the exchange area and route to be installed, the proportion of bitumen and paved footpath has been assumed. The output is used as an input to the reinstatement cost calculation. For very high density areas the higher cost paved footpath option is favoured.
Paved %	

Table 1 Inputs to Cost Development

5 COST DEVELOPMENT METHODOLOGY

5.1 The estimated cost of each installation has been developed using industry benchmark unit rates, as described in paragraph 5.10, and assumptions. The input assumptions are described in section 4.

5.2 The costing of the installation includes benchmark rates for the activities as described in Table 2 and Table 3. Based on my experience of industry rates there is no significant variation of activity rates, for work in metropolitan environments, between the regions reviewed in this report.

5.3 The estimation of costs for the two options, the new conduit and fibre installation or the fibre installed in leased conduit, were completed as two separate exercises.

5.4 The unit elements used for the estimation of cost for both the most expensive building in an exchange and the cost to connect up to 75% of the buildings within the exchange area are shown in Table 2.

Unit Rate	Description
Design Fixed Cost	Costs relating to the design of the Network. This element includes the activity of a telecommunication designer, field visiting the site, sourcing available records, producing construction drawings, material requirements and issuing notices to the relevant authorities. All installations up to a construction cost of $75,000 are assumed to have a fixed design cost to reflect the common activities which are not dependent on the size of the project.
Design Variable Cost	Costs relating to the design of the Network where the total cost of construction is greater than $75000. Once a project exceeds a construction value of $75,000, I have assumed additional design resource activity is required due to the length and complexity of the potential installation.
Cut Surface Road	Cost of cutting bitumen or dry concrete in preparation for open trenching.
Cut Surface Footpath	Costs of cutting footpath surface in preparation for trenching.
Trench	Digging of open trench and removal of spoil suitable for the installation of conduit. This element includes refilling of trench with the exception of surface reinstatement.
Directional Bore	Cost of directional boring and installing conduit. The unit of the rate is per metre bored.
Install Conduit	Cost of supply and installation of a 100mm conduit in a previously excavated trench.

Unit Rate	Description
Install Pit	Cost of materials and labour to install a pit where the angular direction is too tight to accommodate the specified safe bending radius of the fibre.
Reinstate Road Surface	The costs associated with resurfacing the road to its pre construction state.
Reinstate Bitumen Footpath	The costs associated with reinstating the footpath to its pre construction state, materially and aesthetically.
Reinstate Paved Footpath	The costs associated with materially and aesthetically reinstating a paved footpath to its pre construction state.
Lead-in and Building Entry	The provision of entry into the building communications room / utility room either through an existing duct or through a wall structure where access to the building has to be provided.
Rod & Rope Conduit	The installation of rope in preparation for fibre hauling.
Supply and Haul Optic Fibre	The material and labour costs, including the provision of a winching truck required to haul the fibre though the conduit.
Joint Optic Fibre	The cost of the joint enclosure and the labour to join each fibre.
Install OF Termination Panel	The provision of a suitable panel within the building communication room where the fibre is terminated.
Terminate Fibres	The cost of labour terminating the fibres onto the panel.
Test and Commission	The labour costs associated with ensuring the fibre cable will operate according to specification, e.g. a power meter test and or an optical time domain reflectometer test.
Traffic mgmt /day	The provision of personnel to manage vehicle and pedestrian traffic to ensure the safety of the construction staff and the public.
Indirect Competitor Admin o/h	The cost incurred by the Principal of the contract in administering and managing the contract.

Table 2 Cost Elements New Conduit and Fibre

5.5 The major contributors to the total estimated installation cost for new conduit and fibre are surface cutting, trenching, directional boring, surface reinstatement and the indirect admin overhead.

5.6 The second option analysed was the installation of new fibre infrastructure into existing conduits under a leasing arrangement with the owner of the conduit. The cost elements used to develop the costs are shown in Table 3.

5.7 The cost estimates for the use of lease conduit capacity assume that there is sufficient surplus duct capacity along the entire route.

Unit Rate	Description
Design Fixed Cost	Costs relating to the design of the Network. This element includes the activity of a telecommunication designer, field visiting the site, sourcing available records, producing construction drawings, material requirements and issuing notices to the relevant authorities. All installations up to a construction cost of $50,000 are assumed to have a fixed design cost to reflect the common activities which are not dependent on the size of the project.
Design Variable Cost	Costs relating to the design of the Network where the total cost of construction is greater than $50,000. Once a project exceeds a construction value of $50,000, I have assumed additional design resource activity is required due to the length and complexity of the potential installation.
Application & Design review	The costs incurred by the provider of the duct in administering the lease and reviewing the lessee design.
Duct space lease	The cost per linear duct route occupancy that the lessor charges for the use of its duct.
Supply & install subduct	The material and labour costs of install a subduct within the existing conduit.
Distance from Nearest Pit	The distance from the lessor's nearest pit to the building to which the lessee is going to provide service. This determines the length of the lead-in cable and conduit that is required to provide services to the building.
Cut Surface Road	Costs of cutting cold asphalt or dry concrete in preparation for trenching
Cut Surface Footpath	Costs of cutting two sides of footpath in preparation for trenching
Trench	Digging of open trench and removal of spoil suitable for the installation of conduit includes refilling trench with the exception of surface reinstatement. It is likely that, when leasing conduit space from a third party, a short length of conduit from the nearest existing pit to the building may be required. This installation would normally not require the crossing of roadways and therefore traffic management costs has not been included.
Install Conduit	Cost of supply and installing a 100mm conduit in a previously excavated trench.
Reinstate Road Surface	The costs associated with resurfacing the road to its pre construction state.
Reinstate Bitumen Footpath	The costs associated with reinstating the footpath to its pre construction state , materially and aesthetically
Reinstate Paved Footpath	The costs associated with materially and aesthetically reinstating the footpath, where it was previously paved, to its pre construction state.
Lead-in and Building Entry	The provision of entry into the building communications room / utility room either through an existing duct or through a wall structure where access to the building has to be provided.
Rod & Rope Conduit	The installation of rope in preparation for fibre hauling.

Unit Rate	Description
Supply and Haul Fibre	The material and labour costs including the provision of a winching truck required to haul the fibre though the conduit.
Joint Optic Fibre	The cost of the joint enclosure and the labour to join each fibre.
Lease Joint space	The cost charged by the lessor for the use of its pits to house the joints.
Install Termination Panel	The provision of a suitable panel within the building communication room where the fibre is terminated.
Terminate Fibres	The cost of labour terminating the fibres onto the panel.
Test and Commission	The labour costs associated with ensuring the fibre cable will operate according to specification, e.g. a power meter test and or an optical time domain reflectometer test.
Indirect Competitor Admin o/h	The cost incurred by the Principal of the contract in administering and managing the contract

Table 3 Cost Elements Lease Conduit and New Fibre

5.8 For the conduit lease option, the trenching, conduit installation and reinstatement rates are only applied to the potential installation of conduit from the nearest provider pit to the customer building if suitable conduit is not available. The estimated costs have assumed that suitable conduit is not available between the nearest pit and customer building.

5.9 The major contributors to the total estimated installation cost for new fibre in leased conduit are application and design review, supply and installation of subduct, supply and install optic fibre cable, indirect admin overhead and the ongoing lease fee.

5.10 The benchmark costs have been developed from my industry experience of construction company rates and validation with a number of companies that are currently providing these services within the telecommunications sector.

5.11 The costs include the constructor's margin and are indicative of what a telecommunications service provider or carrier would expect to pay to provide fibre links from their PoP to a customer's building within the CBD environment.

5.12 All costs used and presented in this report are exclusive of GST.

5.13 The indirect competitor administration overhead cost is the cost that is incurred by the competitor in administration of the design and construction contract.

5.14 This cost includes the cost of contract managers, field inspectors, financial business analysts or officers, a proportion of human resource managers and pay roll staff and, often, a technical component to provide a technical risk assessment of the constructor's design and construction plans.

5.15 It has been assumed that the competitor has a low overhead cost associated with these activities. In my experience, for a small to medium size telecommunication carrier, the overhead ranges from 25% to 45% of the total design and construction costs when calculated using an activity based costing methodology.

6 OPINIONS

a. Which would be the most expensive building to serve via optical fibre cable link from each POP (assuming the closest POP would be used for any building)?

6.1 The cost model and inputs have been tested to determine the sensitivity of the total estimated cost to changes in unit cost or key inputs. Other than the route distance of the installation, I have not identified any other factor that, when subjected to a moderate variation of its value, substantially impacts the total estimated installation cost.

6.2 For example, the cost to install the entry to either an easy building to access a difficult building to access can vary by up to $5,000.

6.3 Based on the costing elements of installing conduit and fibre in the CBD that have been used in this analysis, the value of $5,000 is equivalent to a conduit installation route length of approximately 40 m.

6.4 The majority of other cost elements, including design, are all in some way dependent on the route distance of the network to be installed.

6.5 The highest cost building for each exchange area has been selected as the building that is the most distant from the PoP. Small residential buildings and park type areas have not been considered as potential fibre termination points.

6.6 Each of the supplied CBD exchange areas was reviewed and the most distant building identified. Each building identified as the highest cost for the five CBD areas has been marked and given a number between 1 and 18. Although there are only 17 exchange areas considered, an additional building has been identified within the Adelaide CBD.

6.7 The buildings assumed to be the most expensive buildings to service in the Brisbane CBD are shown in Figure 1.

6.8 The high cost buildings proposed for the Brisbane CBD relate to the PoP locations as shown below.

Charlotte St	Building 5
Edison	Building 6
Roma St	Building 4
Spring Hill	Building 7

Figure 1 Brisbane CBD

6.9 The assumed most expensive buildings to service in the Sydney CBD are shown in Figure 2.

6.10 The high cost buildings proposed for the Sydney CBD relate to the PoP locations as shown below.

City South	Building 11
Dalley	Building 9
Haymarket	Building 12
Kent	Building 10

Pitt St Building 8

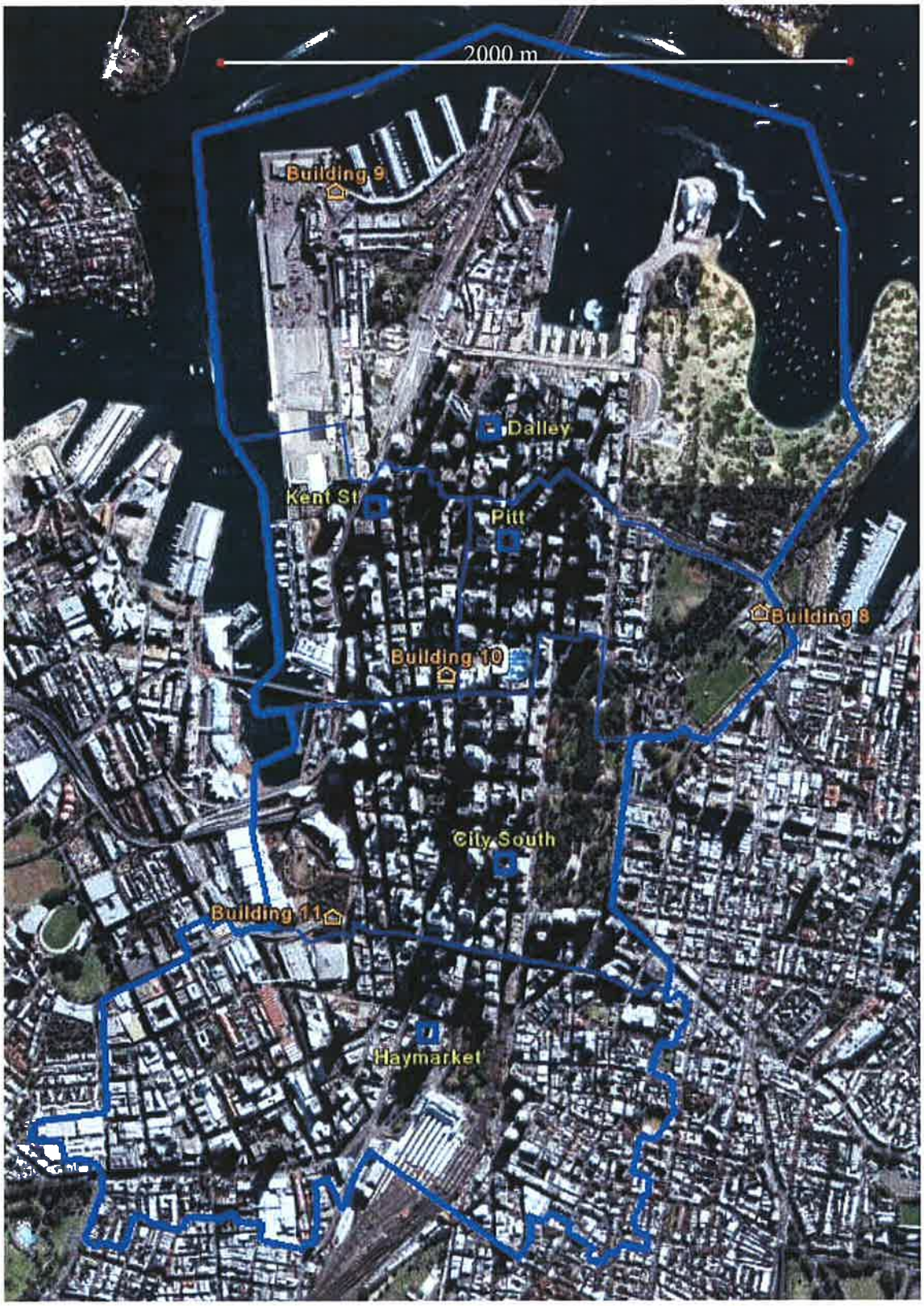

Figure 2 Sydney CBD

6.11 The assumed most expensive buildings to service in the Melbourne CBD are shown in Figure 3.

6.12 The high cost buildings proposed for the Melbourne CBD relate to the PoP locations as shown below.

Batman	Building 14
Exhibition	Building 15
Lonsdale	Building 13

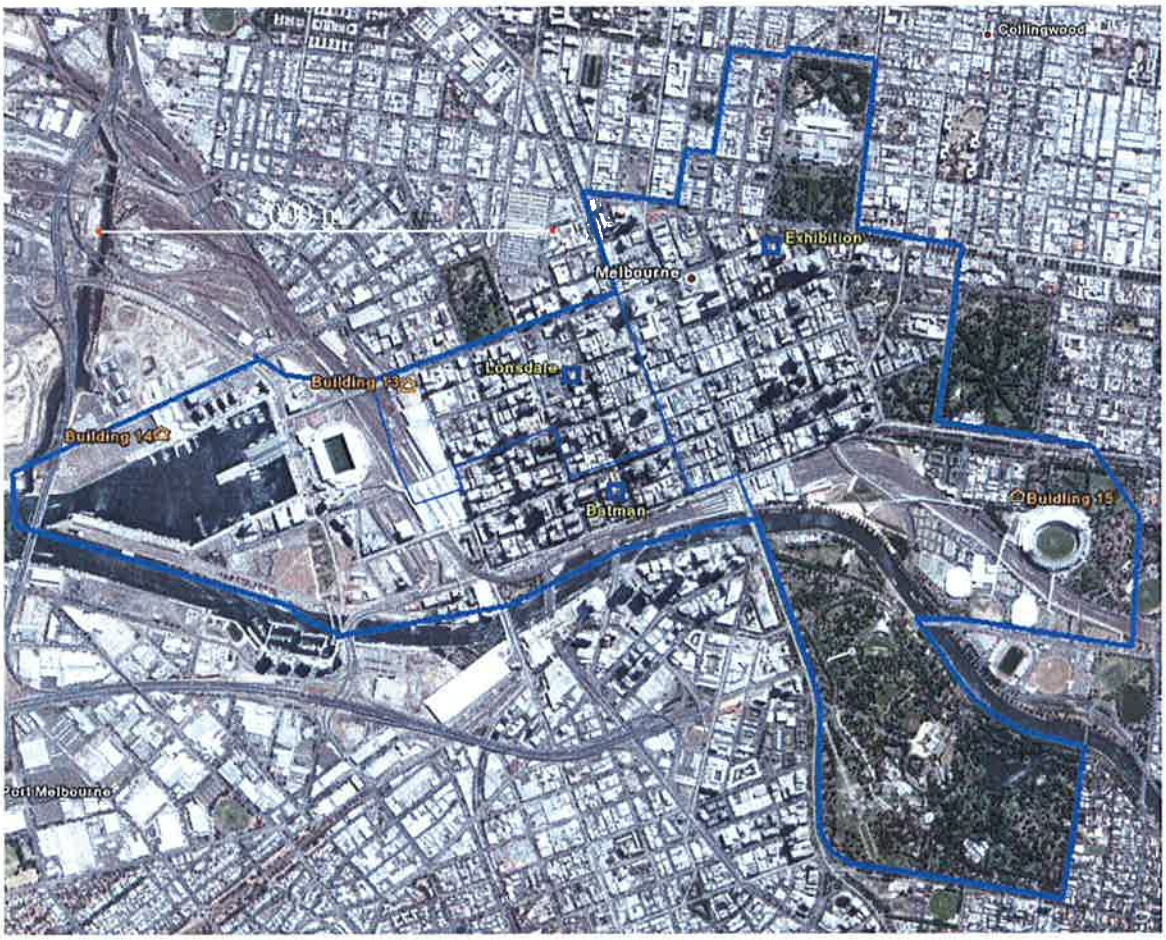

Figure 3 Melbourne CBD

6.13 The assumed most expensive buildings to service in the Adelaide CBD are shown in Figure 4.

6.14 The high cost buildings proposed for the Adelaide CBD relate to the PoP locations as shown below.

Flinders	Building 16

Waymouth	Building 17
Waymouth	Building 18

6.15 Two high cost buildings have been proposed and costed for the Waymouth exchange area as the area in which Building 17 is located could be considered as an anomaly. In my opinion, Building 18 may be more representative of the high cost building in what could be defined as the CBD.

Figure 4 Adelaide CBD

6.16 The assumed most expensive buildings to service in the Perth CBD are shown in Figure 5.

6.17 The high cost buildings proposed for the Perth CBD relate to the PoP locations as shown below.

Bulwer	Building 3
Pier	Building 1
Wellington	Building 2

Figure 5 Perth CBD

b. The estimated cost of serving the most expensive building in the CBD?

6.18 A map based review of each exchange area has been conducted.

6.19 A fibre route has been chosen for each Building that I have identified as likely to be the highest cost to connect with optic fibre cable, based on the assumptions outlined in previous sections of this report. The selection of the route is based on experience of installation practices and the street layout of the area.

6.20 For each proposed route, the distance between the PoP and the most distant building has been measured using aerial maps. The cost to install optic fibre to each building has been calculated using the map measured distance, the assumptions discussed in section 4 and the cost model as described in section 5.

6.21 For each building, two costs have been estimated:

a) installation of new conduit and optic fibre cable between the PoP; and
b) installation of new optic fibre cable in leased conduit space.

6.22 The estimated cost to install optic fibre cable in leased conduit is presented on the assumption that surplus capacity is available and is supplied by an owner of conduit infrastructure.

6.23 The estimated costs for connecting the proposed highest cost buildings in the Brisbane CBD are;

Brisbane CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Charlotte St	Building 5	$176,000	$16,000	$191,000
Edison	Building 6	$187,000	$16,000	$202,000
Roma St	Building 4	$197,000	$20,000	$217,000
Spring Hill	Building 7	$345,000	$30,000	$375,000

Brisbane CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Charlotte St	Building 5	$48,000	$7,000
Edison	Building 6	$49,000	$7,000
Roma St	Building 4	$52,000	$9,500
Spring Hill	Building 7	$72,000	$16,000

6.24 The estimated costs for connecting the proposed highest cost buildings in the Sydney CBD are;

Sydney CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
City South	Building 11	$190,000	$16,000	$206,000
Dalley	Building 9	$232,000	$20,000	$252,000
Haymarket	Building 12	$276,000	$23,000	$299,000
Kent	Building 10	$161,000	$14,000	$175,000
Pitt St	Building 8	$272,000	$22,000	$294,000

Sydney CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
City South	Building 11	$49,000	$7,000
Dalley	Building 9	$55,000	$10,000
Haymarket	Building 12	$59,000	$11,500
Kent	Building 10	$45,000	$6,000
Pitt St	Building 8	$58,000	$11,000

6.25 The estimated costs for connecting the proposed highest cost buildings in the Melbourne CBD are;

Melbourne CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Batman	Building 14	$452,000	$38,000	$489,000
Exhibition	Building 15	$337,000	$29,000	$366,000
Lonsdale	Building 13	$151,000	$14,000	$165,000

Melbourne CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Batman	Building 14	$84,000	$21,000
Exhibition	Building 15	$72,000	$15,500
Lonsdale	Building 13	$45,000	$6,000

6.26 The estimated costs for connecting the proposed highest cost buildings in the Adelaide CBD are;

Adelaide CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Flinders	Building 16	$313,000	$29,000	$341,000
Waymouth	Building 17	$491,000	$48,000	$539,000
Waymouth	Building 18	$306,000	$28,000	$334,000

Adelaide CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Flinders	Building 16	$69,000	$15,000
Waymouth	Building 17	$99,000	$27,000
Waymouth	Building 18	$66,000	$14,500

6.27 The estimated costs for connecting the proposed highest cost buildings in the Perth CBD are;

Perth CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Bulwer	Building 3	$359,000	$31,000	$389,000
Pier	Building 1	$408,000	$33,000	$441,000
Wellington	Building 2	$294,000	$26,000	$320,000

Perth CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Bulwer	Building 3	$73,000	$16,500
Pier	Building 1	$76,000	$17,500
Wellington	Building 2	$62,000	$13,000

c. To the extent that you consider that the estimated cost is heavily influenced by accessibility problems for a small percentage of buildings in each CBD, what would be the 75th percentile of costs in each of these CBDs? In order to determine the 75th percentile, please conceptually rank each building in increasing order of the cost of running a new fibre tail to it from one of the nominated Telstra exchanges. The 75th percentile cost is the price for which 75% of the buildings could be cabled for that price or less?

6.28 For the purpose of this report, each exchange has been reviewed and I have estimated the total area, excluding parks and open spaces, of the exchange. Based on the total area, I have estimated the area required to encompass 75% of the buildings within each exchange area.

6.29 Depending on the location of PoP, and the proximity of the buildings, the virtual 75% area has been assumed. The buildings which would fall within this area are assumed as the lowest 75% cost buildings to connect with fibre from the PoP.

6.30 The buildings, contained within the virtual area described above, which are the most distant from the PoP have been used to estimate the distance required for installation. The premise is that the other buildings within the area will have a lower cost to connect.

6.31 The costs presented in this document to represent the 75th percentile cost are the estimated costs to connect the most distant building within the assumed 75% of each exchange area.

6.32 I have assumed that the 75th percentile result is the cost of cable installation that is capable of reaching 75% of the buildings within an exchange area. The majority of the buildings that fall within the assumed 75% would have a lower cost to connect than the value provided.

6.33 As discussed in section **Error! Reference source not found.**[sp1], the dominant input factor to the cost of fibre cable installation between the PoP and building in which the fibre is to terminate is the distance between the two locations.

6.34 To provide an estimated maximum cost to connect the lowest 75% of cost buildings, the area and geometry of each exchange area has been reviewed. Based on this review, a conceptual view of the maximum route distance to

connect the closest 75% has been developed. Using the aerial maps, the route distance to the most distant building of the 75% has been estimated.

6.35 The 75th percentile calculation is limited to analysis of each exchange area in isolation and does not take into account the potential opportunity of installing cable to a building from a neighbouring PoP that is outside the defined exchange area.

6.36 Due to the geometry of some exchange areas, the calculated distance to reach the 75% percentile of the buildings within the exchange is greater than 75% of the distance to the most distant building.

6.37 I have assumed the cost of building entry for the 75th percentile calculation to be significantly lower than the worst case entry figure that has been assumed for the highest cost building.

6.38 Both the new conduit option and the use of leased conduit have been estimated and presented in the following tables.

6.39 For each exchange area in the Brisbane CBD the estimated cost to reach 75% of the buildings is shown below.

Brisbane CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Charlotte St	75th Percentile	$111,000	$12,000	$122,000
Edison	75th Percentile	$94,000	$10,000	$104,000
Roma St	75th Percentile	$143,000	$15,000	$158,000
Spring Hill	75th Percentile	$165,000	$16,000	$181,000

Brisbane CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Charlotte St	75th Percentile	$26,000	$4,500
Edison	75th Percentile	$25,000	$3,500
Roma St	75th Percentile	$33,000	$6,500
Spring Hill	75th Percentile	$35,000	$7,000

6.40 For each exchange area in the Sydney CBD the estimated cost to reach 75% of the buildings is shown below.

Sydney CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
City South	75th Percentile	$113,000	$12,000	$124,000
Dalley	75th Percentile	$113,000	$12,000	$124,000
Haymarket	75th Percentile	$184,000	$16,000	$199,000
Kent	75th Percentile	$113,000	$12,000	$124,000
Pitt St	75th Percentile	$96,000	$10,000	$106,000

Sydney CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
City South	75th Percentile	$27,000	$4,500
Dalley	75th Percentile	$27,000	$4,500
Haymarket	75th Percentile	$35,000	$7,000
Kent	75th Percentile	$27,000	$4,500
Pitt St	75th Percentile	$25,000	$3,500

6.41 For each exchange area in the Melbourne CBD the estimated cost to reach 75% of the buildings is shown below.

Melbourne CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Batman	75th Percentile	$169,000	$16,000	$184,000
Exhibition	75th Percentile	$198,000	$18,000	$216,000
Lonsdale	75th Percentile	$90,000	$10,000	$100,000

Melbourne CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Batman	75th Percentile	$35,000	$7,000
Exhibition	75th Percentile	$38,000	$8,500
Lonsdale	75th Percentile	$24,000	$3,500

6.42 For each exchange area in the Adelaide CBD the estimated cost to reach 75% of the buildings is shown below.

Adelaide CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Flinders	75th Percentile	$241,000	$24,000	$264,000
Waymouth	75th Percentile	$205,000	$21,000	$225,000

Adelaide CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Flinders	75th Percentile	$46,000	$12,000
Waymouth	75th Percentile	$42,000	$10,000

6.43 For each exchange area in the Perth CBD the estimated cost to reach 75% of the buildings is shown below.

Perth CBD		New Conduit and Fibre Installation		
Exchange	Termination	CIVIL	FIBRE	TOTAL INSTALL
Bulwer	75th Percentile	$301,000	$27,000	$328,000
Pier	75th Percentile	$347,000	$29,000	$376,000
Wellington	75th Percentile	$250,000	$23,000	$272,000

Perth CBD		Lease Conduit and New Fibre	
Exchange	Termination	Total Install	Annual Lease
Bulwer	75th Percentile	$53,000	$14,000
Pier	75th Percentile	$55,000	$15,000
Wellington	75th Percentile	$45,000	$11,000

7 SUMMARY AND CONCLUSIONS

7.1 In order to develop the estimated costs of fibre cable installation as requested in the brief, each nominated Telstra exchange area has been analysed in terms of the PoP location, geometric layout and the conditions that may be encountered in the construction activity.

7.2 For each Telstra exchange area, a review has been conducted to identify the building within that area which, in my opinion, is most likely to be the highest cost to connect with a single cable from the PoP located within that exchange area.

7.3 The proposed highest cost buildings for each area are described graphically in Section 4.

7.4 Also, for each exchange area, additional analysis has been conducted to form an opinion in relation to what is the distance of cable installation required in order to be able to connect the 75% of buildings deemed as the lowest cost within each exchange area.

7.5 A cost model has been developed which, based on my experience, includes the required cost elements to manage, supply and install optic fibre cable between two locations within a CBD environment.

7.6 The estimated costs used have been developed through industry experience, and both the base costs and elements included have been validated through discussion with a number of telecommunication industry construction organisations.

7.7 The distances ascertained from map studies of the exchange areas have been combined with the cost elements to develop estimated costs for the installation of a single optic fibre cable between PoP and customer building.

7.8 The estimated cost to connect the proposed highest cost building using a single fibre cable from the nominated PoP can be found in Section 6.

7.9 The estimated cost of being able to connect up to 75% of the buildings within each exchange area has been calculated and can be found in Section 6.

7.10 The costs are estimates based on a number of assumptions which are described within this report, and some level of variation would be expected.

Appendix 1 Telstra CBD Exchanges

The list of Telstra Exchanges that was received to define the Central Business District Areas is shown in the Table below.

CODE	SITE_NAME	STATE	No	To	STREET	TYPE	LOCALITY_NAME	POST CODE
BATM	BATMAN	VIC	376	380	FLINDERS	LANE	MELBOURNE	3000
BWER	BULWER	WA	199		BULWER	ST	PERTH	6000
CHLT	CHARLOTTE	QLD	20	26	CHARLOTTE	ST	BRISBANE	4000
CYSH	CITY SOUTH	NSW	225		CASTLEREAGH	ST	SYDNEY	2000
DALL	DALLEY	NSW	4		DALLEY	ST	SYDNEY	2000
EDSN	EDISON	QLD	280	284	ELIZABETH	ST	BRISBANE	4000
EXHN	EXHIBITION	VIC	300		EXHIBITION	ST	MELBOURNE	3000
FLNF	FLINDERS	SA	111	139	FLINDERS	ST	ADELAIDE	5000
HMKT	HAYMARKET	NSW	15	33	PARKER	ST	HAYMARKET	2000
KNST	KENT STREET EXCHANGE	NSW	242	246	KENT	ST	SYDNEY	2000
LONS	LONSDALE	VIC	447	453	LONSDALE	ST	MELBOURNE	3000
PIER	PIER	WA	98		PIER	ST	PERTH	6000
PITT	PITT	NSW	76	78	PITT	ST	SYDNEY	2000
RASH	ROMA STREET 1	QLD	171		ROMA	ST	BRISBANE	4000
SGHL	SPRING HILL	QLD	152		BOWEN	ST	SPRING HILL	4000
WAYM	WAYMOUTH	SA	67		WAYMOUTH	ST	ADELAIDE	5000
WLTE	WELLINGTON	WA	625		WELLINGTON	ST	PERTH	6000

Appendix 2 Assumed Exchange Boundaries

Appendix 3 Craig Lordan CV

POSITION: Senior Associate

QUALIFICATIONS:
B.E. (Electrical) Central Queensland University
GCM Southern Cross University

EXPERIENCE SUMMARY:
19 years in the Telecommunications Industry in Australia and Vietnam

EXPERIENCE HISTORY:

EVANS & PECK

2001 – Present

Position: Senior Associate

Role: Specialist consulting assignments in the Tele-communications and Infrastructure fields including assessment of commercial issues, procurement, bidding strategies and strategic advice

Assignments:
- Feasibility Analysis for the construction of a capital city wide very high-speed open access telecommunications
- Procurement of telecommunication capacity for major corporate users within Queensland
- Establishment of Telecommunications Network and Commercial Operation for Queensland Government Owned Corporations
- Detail analysis of NSW Government Department work management performance in response to claim made by major contractor
- Technology application strategy advice and customer engagement policy formulation for major local government body
- Cause Analysis of failed Mobile Network Rollout for legal proceedings
- Activity pricing analysis for prominent Telecommunications Constructor during contract negotiation
- Project Management of Proposal Development for the construction of Townsville Gas Fired Power Station
- Facilitation of Post Implementation Review for a major Intelligent Traffic System installation project
- Strategic advice to a Queensland Government GOC Utility regarding the commercial opportunity to enter the telecommunications industry

GLOBAL CONNECT CONTRACTS, TELSTRA

2000 – 2001

Position: National Operation Improvement Manager

Role:
- Leadership of the National Operations team responsible for high level analysis of existing process, contractor relationships, tender submissions, IT System Strategy and performance measurement for Global Connects Contracts
- Introduction of an improved work management and scheduling system, increased linkage between capital investment plan and day to day operations, and the development of a revised contract management strategy

Assignments: Tender analysis including ongoing price negotiations and introduction of the present Access Network Contractors and the redevelopment of GCC Communication Process

ACCESS RENEWAL, TELSTRA

1999

Position: National Strategy Development Manager

Role: The primary responsibility of this position was, with a small team, develop strategies improving the efficiency of capital expenditure in the Telstra Access network and manage IT System improvements. Major achievements, via business analysis, were introduced of new processes and project management tools for managing the investment program, development of previously lacking process reporting measures and the recommendation of improved structures for the next financial year

	Assignments:	Development of an innovative, efficient National System to identify Network, which is substandard either due to maintenance or insufficient capacity, to facilitate a $250M capital investment program.

TELSTRA

1998 - 1999	**Position:**	National Reporting Manager CAN2001
	Role:	The initial requirement of this position was to contribute to the development of the business case for submission to the Telstra Board for additional funding to rehabilitate Telstra's Customer Access Network. After approval of the project I was responsible for the national reporting of progress against the Business Case to Telstra Senior Management and delivery of operational reports to allow management of the project. While occupying this position I also complete an information exchange program with NTT in Japan
	Assignments:	Development of dynamic solutions for capturing contractor performance information

TELSTRA

1997 – 1998	**Position:**	Expert Decision System Development
	Role:	Through analysis of a number of Telstra Customer Access Design centres a high degree of variation in network build solutions was identified as a major issue for the company. To overcome this problem an approach was developed to provide a universally consistent design result. To solve this problem, a software based Expert Design tool from initial concept through the project management of the system build was developed. The IT Solution (CANDO), delivered standard solutions, process improvement via automated data acquisition, improved in process measurement and network investment efficiency
1994 – 1996	**Position:**	Central Vietnam Plan and West HCMC Business Plan
	Role:	As part of a three person team, a 10 Year Telecommunication Network Development Plan for the Central Vietnam Region was developed and presented to the Vietnam Telecommunication Department (VNPT). The plan covered all facets of developing the Telecommunication Network with my prime responsibility being the Customer Access Network, Customer Radio, Local Switch and Transmission plan. The second major task that I was involved in was the planning and costing of the customer access section of a bid by Telstra to build the network for half of Ho Chi Minh City. This work involved the development of a network strategy, developing a project plan and costing of the bid
	Assignments:	10 Year Telecommunication Network Development Plan for the Central Vietnam Region Customer access section of a bid by Telstra to build the network for half of Ho Chi Minh City
1992 – 1994	**Position:**	Senior Engineer Area Planning and Development (N&ITI)
	Role:	Responsibilities included the planning and project management of the Customer Access and Local Switch Network for Central Queensland. This involved the planning of conduit, copper, optic fibre and both internal and external switch technology. Investments were justified on a financial basis and operation within a fiscal budget with limited supervision was required. The planning and project management of several large commercial projects for the supply of infrastructure within coal mine developments was also completed
1989 –1991	**Position:**	Engineer Customer Access Network Design
	Role:	The primary responsibility of this role was to design network augmentation projects to be built. Design roles included rural customer radio, copper

cable and conduit design, optic fibre, transmission, RIM and pair gain systems design. A period of time was also spent in the Lines Practices group working on the development of field practices and quality measurement projects

Appendix 4 Inputs and Assumptions [c-i-c]