(41)

Territory and Municipal Services
ACT GOVERNMENT

COMMUNITY AND INFRASTRUCTURE SERVICES

13383

POSTED 21.8.08

Mr Robert Hogan
Department of Infrastructure
NSW and Investment Co-ordination Branch
GPO Box 594
CANBERRA CITY ACT 2601

Dear Robert

AUSLINK 2 – MEETING ACT AND DEPARTMENT OF INFRASTRUCTURE

I refer to our meeting of 11 July regarding AusLink 2 and the development of a new bilateral agreement between the Federal and ACT Governments.

I have attached business cases and some related reports to this letter for your information and note the following:

2) The project cost for the Monaro Highway Extension is greater than that announced by the Honorable Mike Kelly and Annette Ellis on 12 October 2007. The business case reflects a shared funding arrangement between the Federal and ACT Governments.

I am working with the relevant consultants to reduce the scope of the stage 1 works for this project and will keep your office informed on the progress. I did flag market pressure and inflated costs as impacting roadworks projects in the ACT and the fact that the ACT Government has already contributed more than it had originally planned to progress this important project.

I am happy to expand or clarify any aspect of the information provided and can be contacted on telephone (02) 6207 6588 and email: tony.gill@act.gov.au.

Yours sincerely

Tony Gill

Tony Gill
Director
Roads ACT

25 August 2008

Cc: File – 05/10911 (AusLink Network-Bilateral Agreement)
08/9618 (Majura Parkway Project)

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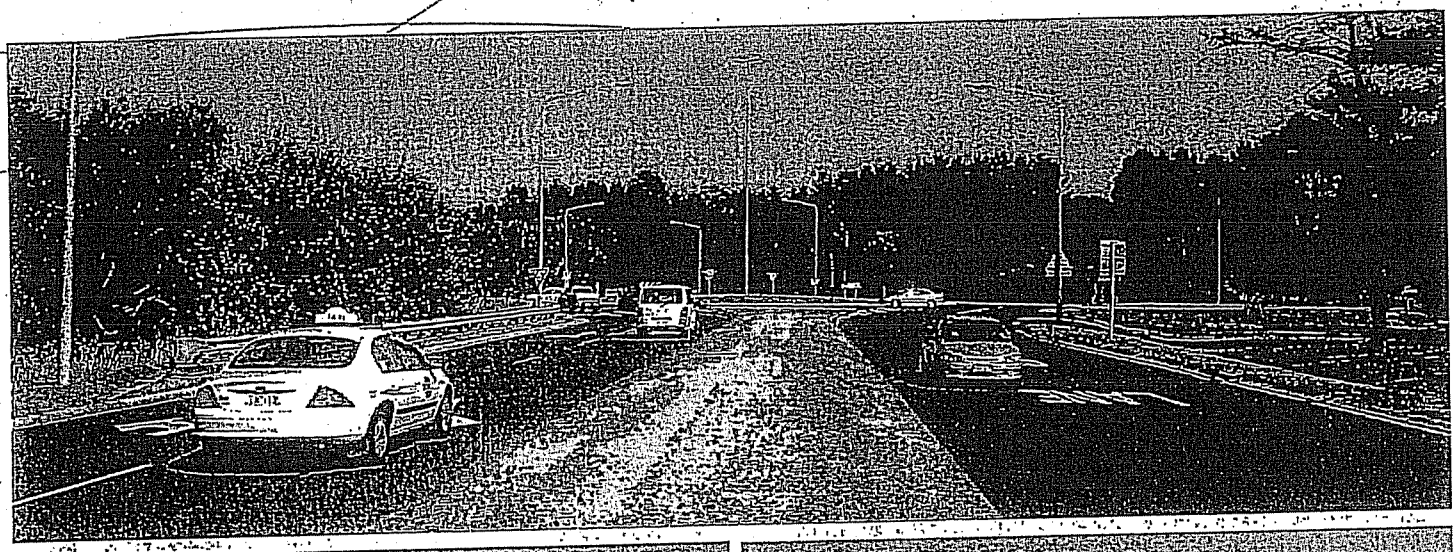
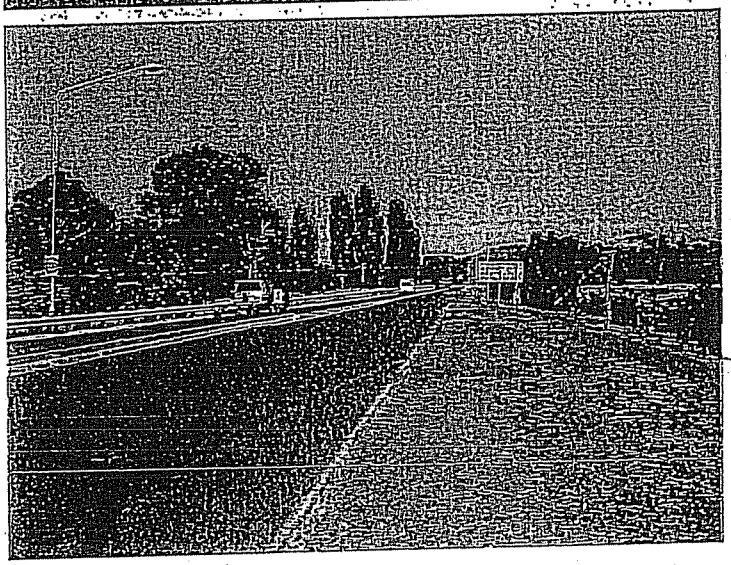
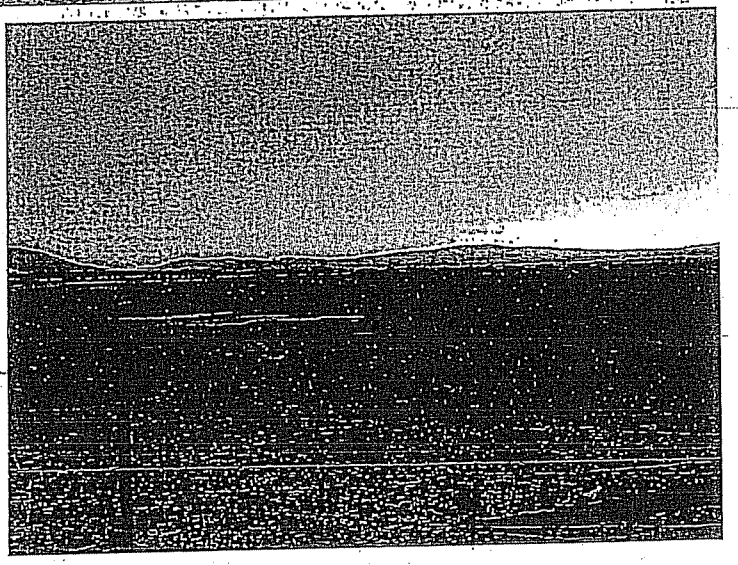
SMEC







Report

MAJURA PARKWAY / PIALLIGO AVENUE

ECONOMIC ANALYSIS REPORT

21st November 2007

Document / Report Control Form

Project Name: **Majura Parkway / Pialligo Avenue Options Review**

Project number: **3002048**

Report for: **ACT Procurement Solutions**

PREPARATION, REVIEW AND AUTHORISATION

Revision	Date	Prepared by	Reviewed by	Approval for Issue
0	20/09/2007	Khaled Abbas	Craig Sutton	Tim Hahn
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Executive Summary

Introduction

Traffic in the vicinity of the Canberra airport has increased over the last few years with the continuing growth in Gungahlin and increased employment at the airport. The roads in the vicinity of the airport play an important role for the ACT economy, the surrounding New South Wales (NSW) region and nationally given the importance of the Monaro Highway as a freight route connection to the Federal Highway.

This report presents the findings of assessing a considered road network improvement option to improve traffic flows on the road network in the area between Duntroon and the Canberra Airport. At this location five major arterials converge namely Majura Road, Pialligo Avenue, Monaro Highway, Fairbairn Avenue and Morshead Drive.

Objectives

The main objectives of this study are:

1. Update previous economic analysis which was undertaken as part of the Pialligo Avenue Options review (Feb. 2007) of alignment options. This study reflects up to date construction staging and construction cost estimates. Note, Paramics modelling was performed as part of the previous economic analysis and has **not** been revised based upon the modified construction staging...

Results

Microsimulation runs for the years 2006, 2016 and 2031 were conducted using the Paramics model for the existing road network as well as for the considered network improvement options (albeit with a slight modification to the construction staging). The overall network performance indicators for each of the micro-simulation runs are displayed. These include the amount of released vehicles and their percentage relative to demand volumes, vehicle hours travelled and vehicles kilometres travelled. The output results look logical with a reduced proportion of demand being released in future years.

Currently, most of the traffic demand can enter into the network without causing spill over to neighbouring roads. However, such traffic is operating within the network at low level of service i.e. F. If the current network remains without any intervention, it is expected that with increasing traffic demands, there will be queues at the entry points to the network and spill over to neighbouring roads. This will result into peak spreading and delays to a larger number of vehicles. This will be also accompanied by very low Level of Service (LoS) performance of traffic using the Pialligo network.

The proposed road network improvement is expected to avoid the occurrence of the first problem, namely the spill-over of traffic congestion into neighbouring roads as well as the prolonging of the peak traffic hour. However, still with expected future traffic increases, the traffic entering the network is expected to operate at low travelling speeds and hence low LOS performance.

SMEC identified the following stakeholders as potential beneficiaries to the project:

- Canberra Airport Group
- ACT Government
- ACT Government (Land Sales)
- Department of Defence
- RTA & Queanbeyan City Council
- Department of Transport & Regional Services (Auslink)
- National Capital Authority

In order to assess and compare the considered option, an analysis of the costs and benefits of this option compared to the existing road network (do nothing scenario) was undertaken over a 25 year period. An estimate of construction, annual and cyclic maintenance costs for the considered option was conducted. Benefits resulting as savings in Vehicle Operation Costs, Travel Time Costs and

Accident Costs were estimated for each option. The Net Present Value (NPV) and Benefit Cost Ratio (BCR) were then computed for each of the three options using three different discount rates namely 4, 7%, and 10%.

Conclusions

The results of the benefit cost analysis show that the considered option is economically feasible. This is based on the two obtained key performance indicators namely the Net Present Value (NPV) and the Benefit Cost Ratio (BCR). The considered option produces a NPV equating to ~ $125 million over the 25 years span life of the project at a 7% discount rate. The estimated BCR for this option is ~3.9 using a 7% discount rate.

In addition, this option allows the ACT government to immediately fund the construction of the Majura Parkway Stage 1 and to seek a shared funding with Auslink for the grade separation to be opened by the year 2013 or before with a 1 year design period and a 2 year construction period.

1 Introduction

Traffic in the vicinity of the Canberra airport has increased over the last few years with the continuing growth in Gungahlin and increased employment at the airport. The roads in the vicinity of the airport play an important role for the ACT economy, the surrounding New South Wales (NSW) region and nationally given the importance of the Monaro Highway as a freight route connection to the Federal Highway.

This report presents the findings of assessing a considered road network improvement option to improve traffic flows on the road network in the area between Duntroon and the Canberra Airport. At this location five major arterials converge namely Majura Road, Pialligo Avenue, Monaro Highway, Fairbairn Avenue and Morshead Drive. The study area is shown in Figure 1. As stated, the current road network at this point of convergence experiences considerable traffic congestion during peak periods and has been highlighted by a number of previous studies as requiring upgrading. In addition, further increase in traffic volumes is expected when Gungahlin is fully established, further development has taken place in the surrounding NSW region and the employment at the airport reaches levels as outlined in its master plan. In this context, the provision of relieving measures for the increased traffic in the vicinity of the airport is an important initiative that will benefit the region. A road network option capable of accommodating the ultimate traffic generated would include a future Majura Parkway and an upgraded Pialligo Avenue.

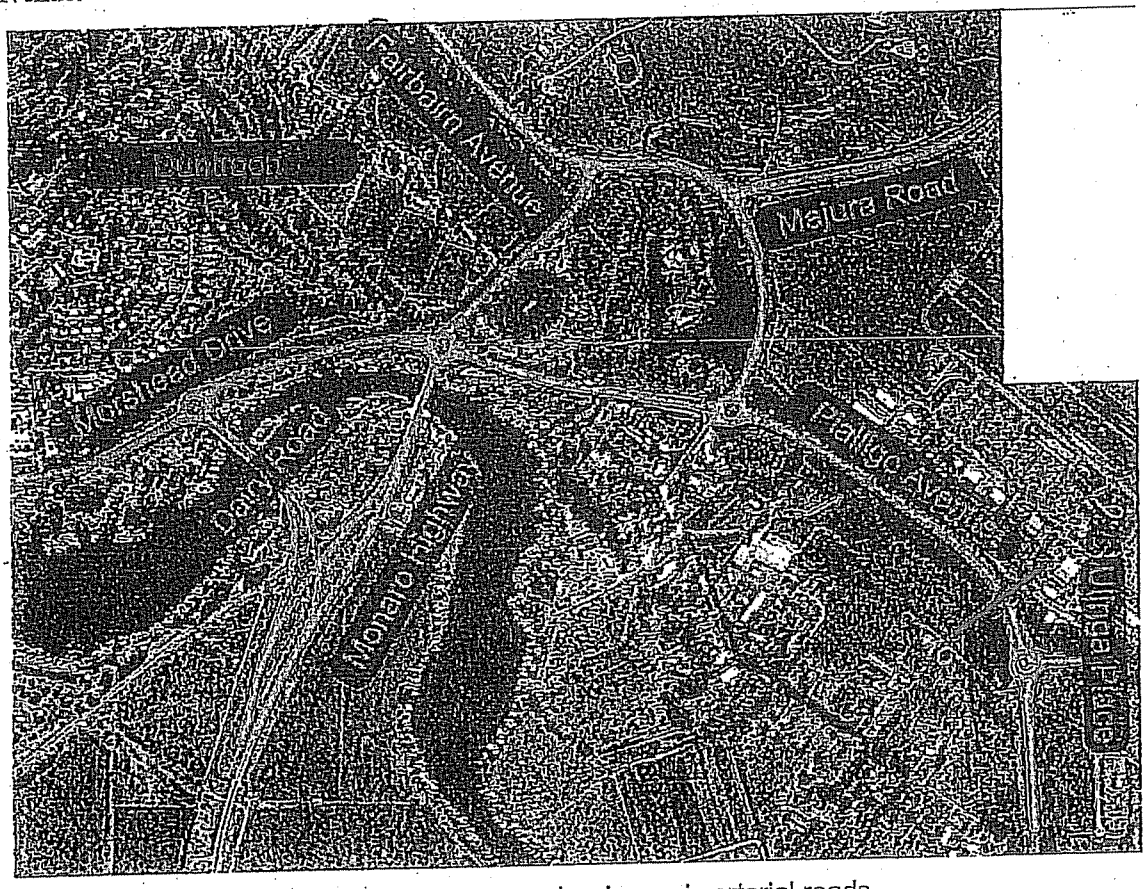


Figure 1 – Study area showing main arterial roads

1.1 Background

Prior to this option review, SMEC Australia was commissioned by the ACT Government to design the following roadworks:

- Duplication of Morshead Drive from Dairy Road to Pialligo Avenue; and
- Duplication of Pialligo Avenue from Morshead Drive to Ulinga Place.

During execution of the above works, SMEC was also commissioned to conduct an economic analysis for the considered road network improvement.

During the Preliminary Sketch Plan (PSP) phase of this project, traffic modelling suggested that an alternative scope of works would result in a greater alleviation of traffic congestion for the region. A Preliminary Sketch Plan submission was subsequently completed for this alternative scope of works which included:

- Single eastbound bypass lane at Dairy Road/Morshead Drive roundabout, thus enhancing the capacity of the roundabout. This will be accompanied (in its ultimate configuration) by part time signals at the roundabout;
- Duplication Morshead Drive between Dairy Road and Monaro Highway;
- Three phase traffic signals at Monaro Highway/Morshead Drive with banned right turns from Morshead to Monaro and from Pialligo to Morshead. This will replace the current roundabout;
- Widening of Morsehead Drive between Pialligo Ave and Fairbairn Ave;
- Duplication of Fairbairn Avenue between Morshead Drive and Majura Road (including a new bridge over Woolshed Creek.

A separate project being undertaken by Hughes Trueman relates to this work and includes:

- Duplication of Pialligo Ave between Fairbairn Ave/Beltana Road intersection and a new airport access (Currently at Ulinga Place)

After completion of the PSP design, a number of events occurred that have instigated the need to re-assess the priority and scope of works to be undertaken in the study area. These events include:

- Further development of the design of the proposed Majura Parkway
- An increase in traffic due to developments occurring at the Canberra Airport and Gungahlin; and
- Working Group Meeting in September 2006

1.2 Scope

This study documents an economic analysis of the considered option for the area. In agreement with ACT Procurement Solutions one option was assessed relative to the continuation of the existing condition.

1. **Base:** The existing road network to be taken as the Base to which comparisons will be made, see Figure 2.

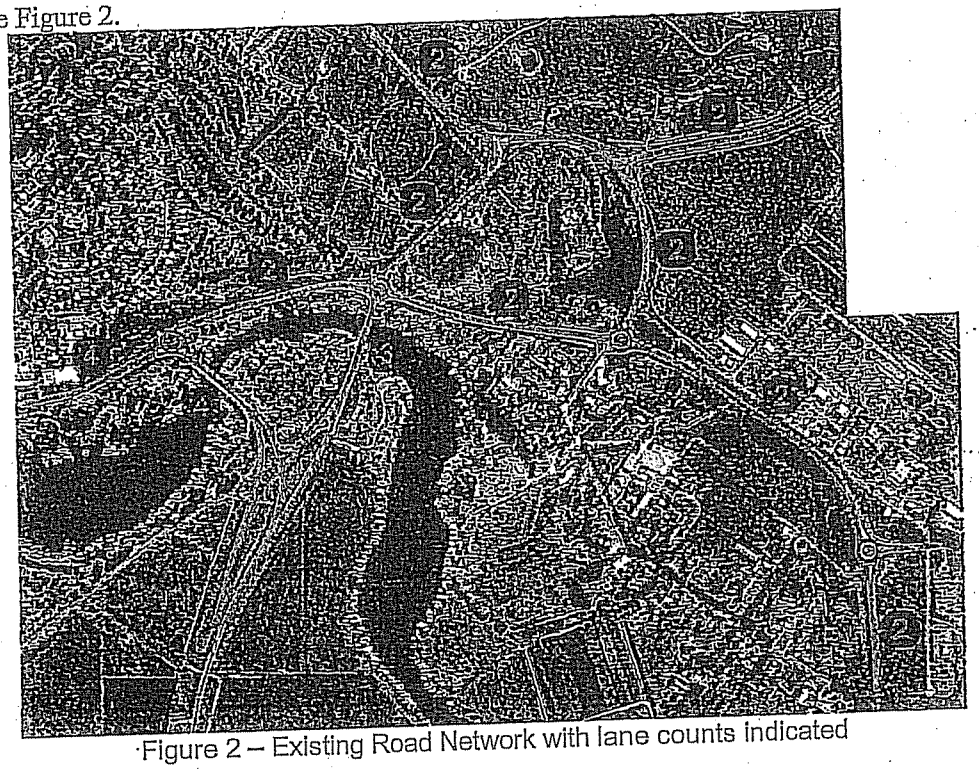


Figure 2 – Existing Road Network with lane counts indicated

2. **Considered option:** This option is a three phase option.

Phase I

Phase I incorporates the Pialligo Ave Stage 1a and 1b works and the Airport Works to be undertaken during 2008 (completed by 2009) and includes:

- Pialligo Stage 1a - Bypass lane for the Dairy Road/Morshead Drive roundabout;
- Pialligo Stage 1a - Duplication of Morshead Drive between Dairy Road and Monaro Hwy.
- Pialligo Stage 1a - Widening of Pialligo Ave between the Monaro Hwy and Woolshed Creek.
- Pialligo Stage 1a - The replacement of the Monaro Highway/Morshead Drive/Pialligo Avenue roundabout with a traffic signal;
- Pialligo Stage 1a - Widening of the Monaro Hwy on the southern side to Silvia Curley Bridge plus 5 lanes over Sylvia Curley Bridge;
- Pialligo Stage 1a - Widening of Morsehead Drive between Pialligo Ave and Fairbairn Ave.
- Pialligo Stage b - Duplication of Fairbairn Avenue (including the provision of a second bridge over Woolshed Creek) between Morshead Drive and Majura Road plus intersection works at Majura Road;
- Airport Works – Duplication of Pialligo Ave between the Beltana Road Roundabout and Brindabella circuit, including a grade separated intersection for airport access.

A diagrammatic representation of these works can be seen in Figure 3 below.

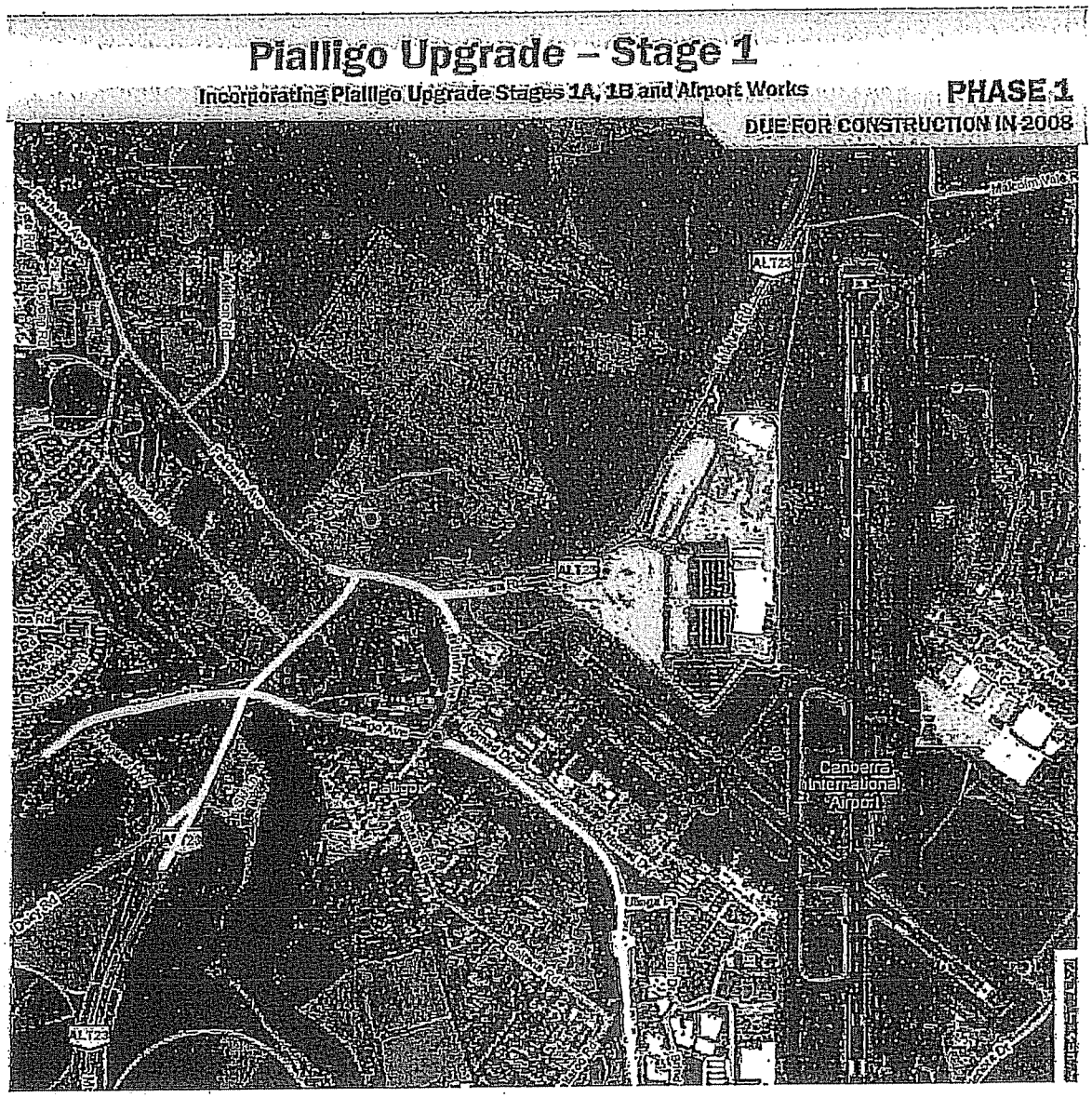


Figure 3: Phase I works – Pialligo Ave Stage 1a, 1b and Airport Works.

Phase II

Phase II incorporates Pialligo Ave Stage 1c works to be undertaken during 2009 (completed by 2010) and includes:

- Pialligo Stage 1c - duplication of Pialligo Avenue (including the provision of a second bridge over Woolshed Creek) between Stage 1a works Airport works including the signalisation of the Beltana Road intersection (currently a roundabout).

A diagrammatic representation of these works can be seen in Figure 4 below.

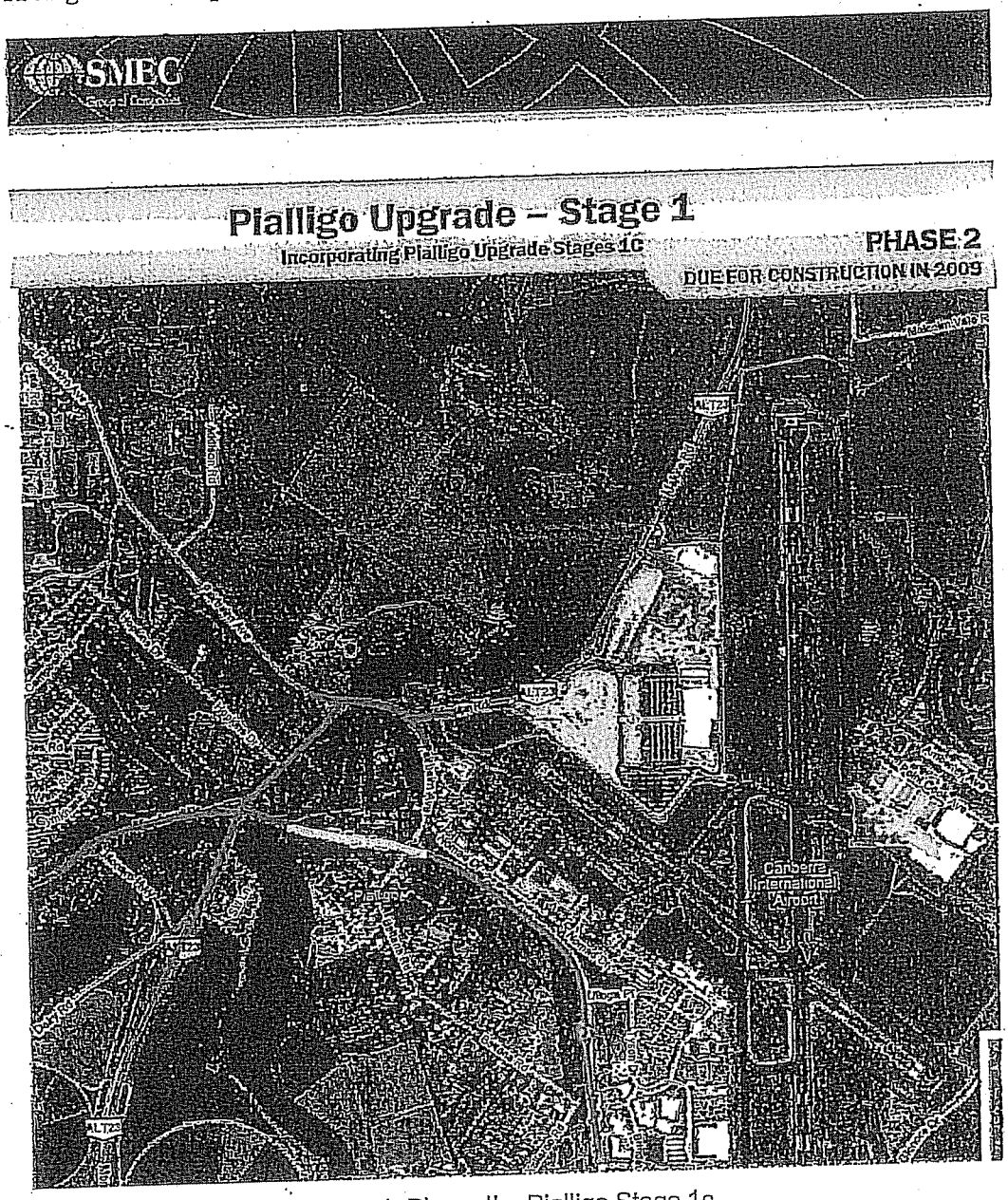


Figure 4: Phase II – Pialligo Stage 1c

Phase III

Phase III incorporates Majura Parkway Stage 1 works to be constructed during 2010 and 2011 (completed by 2012) and includes:

- The first carriageway Majura Parkway construction across the Molonglo River, through RMC land adjacent to Morshead Drive, across Fairbairn Ave, and head north until verging to the East to connect to Majura Road.
- Majura Road intersection works with Majura Parkway (configuration currently unknown).
- Exit ramp from the Majura Parkway northbound onto what is currently referred to as 'Dairy Road Bridge'.
- Exit ramp from the Majura Parkway northbound onto Fairbairn avenue

A diagrammatic representation of these works can be seen in Figure 5 below.

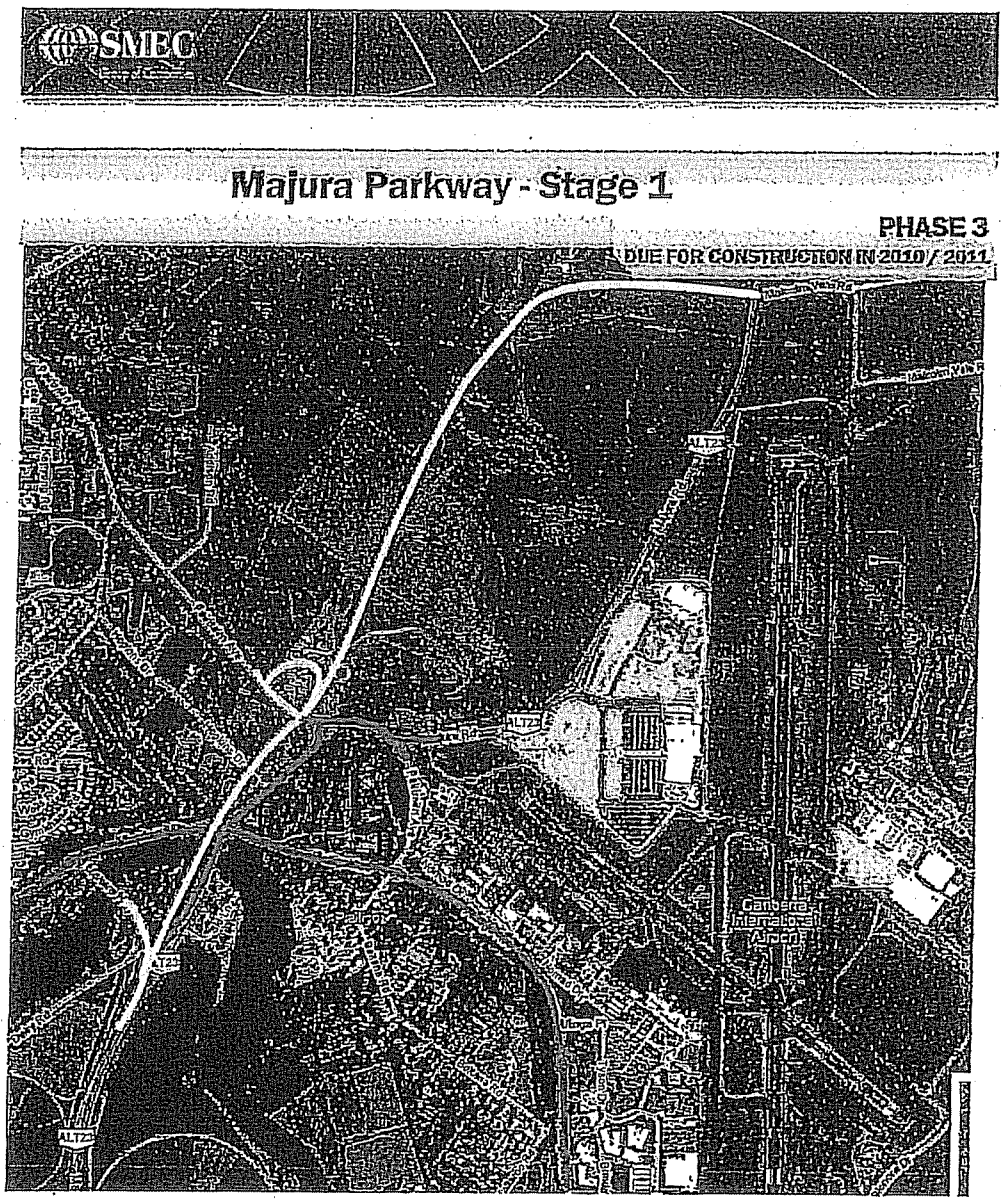


Figure 5: Phase III –Majura Parkway Stage 1.

Phase IV (excluded)

There is a Phase IV component to the ultimate Majura Parkway project, however this component has not been included as part of this revised economic assessment. The Phase IV component includes:

- Duplication of the Majura Parkway which was constructed in Phase III plus associated ramps;
- Extension of the Majura Parkway to the Federal Highway and associated ramps;
- Construction of the Northcott Drive Link Road (Kowen Link Road) and associated ramps;
- Construction of Majura Road and Local Access Road connections in the northern section of the Parkway.
- Signalisation of the Pialligo Ave / Dairy Road Roundabout plus modification to the Monaro Hwy / Pialligo Ave intersection to suit the parkway on ramp provisions.

A diagrammatic representation of these works can be seen in Figure 6 below.

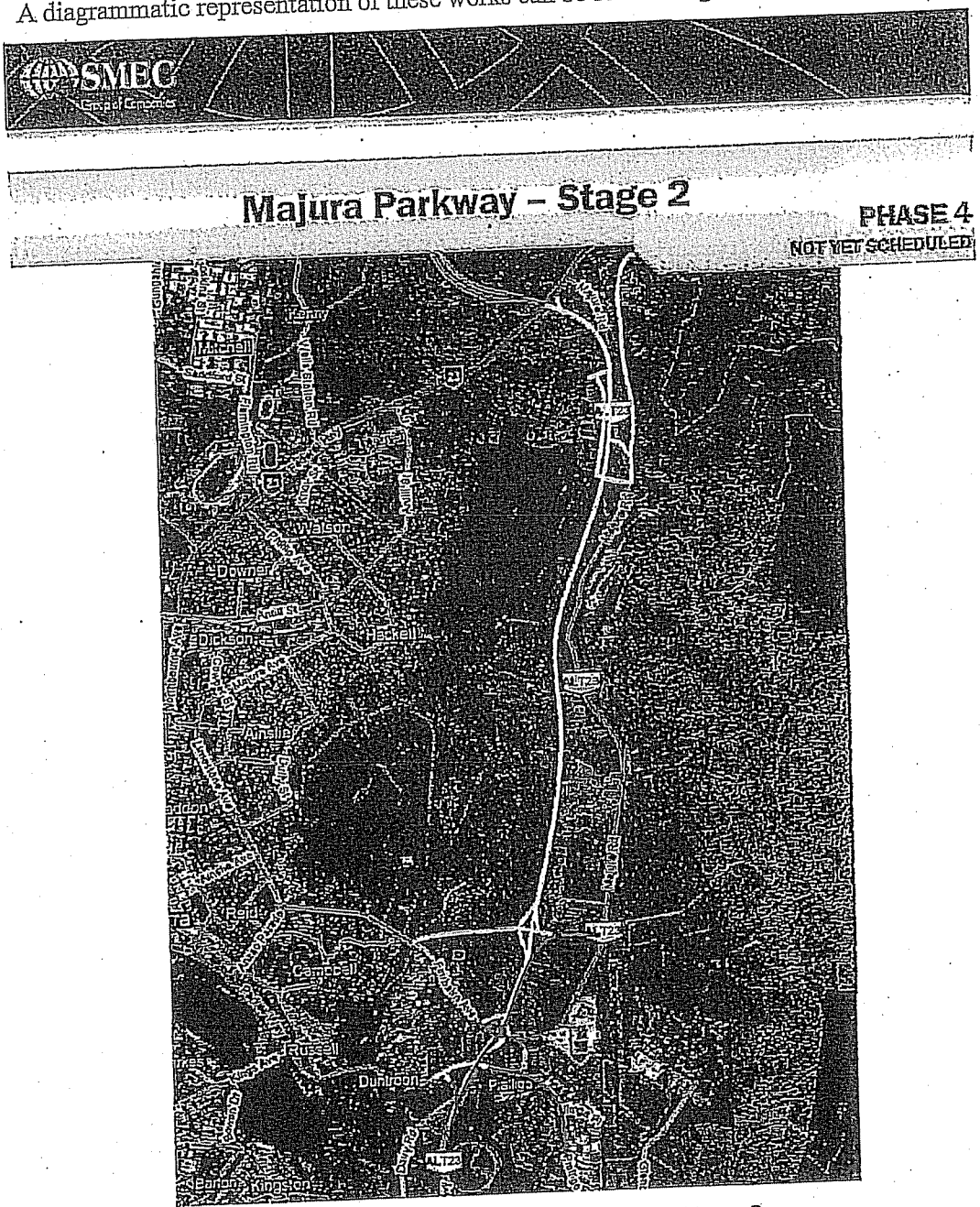


Figure 6: Phase IV - Majura Parkway Stage 2

Ultimate Configuration

All of the above construction stages form part of the ultimate configuration. A diagrammatic representation of these works can be seen in Figure 7 below.

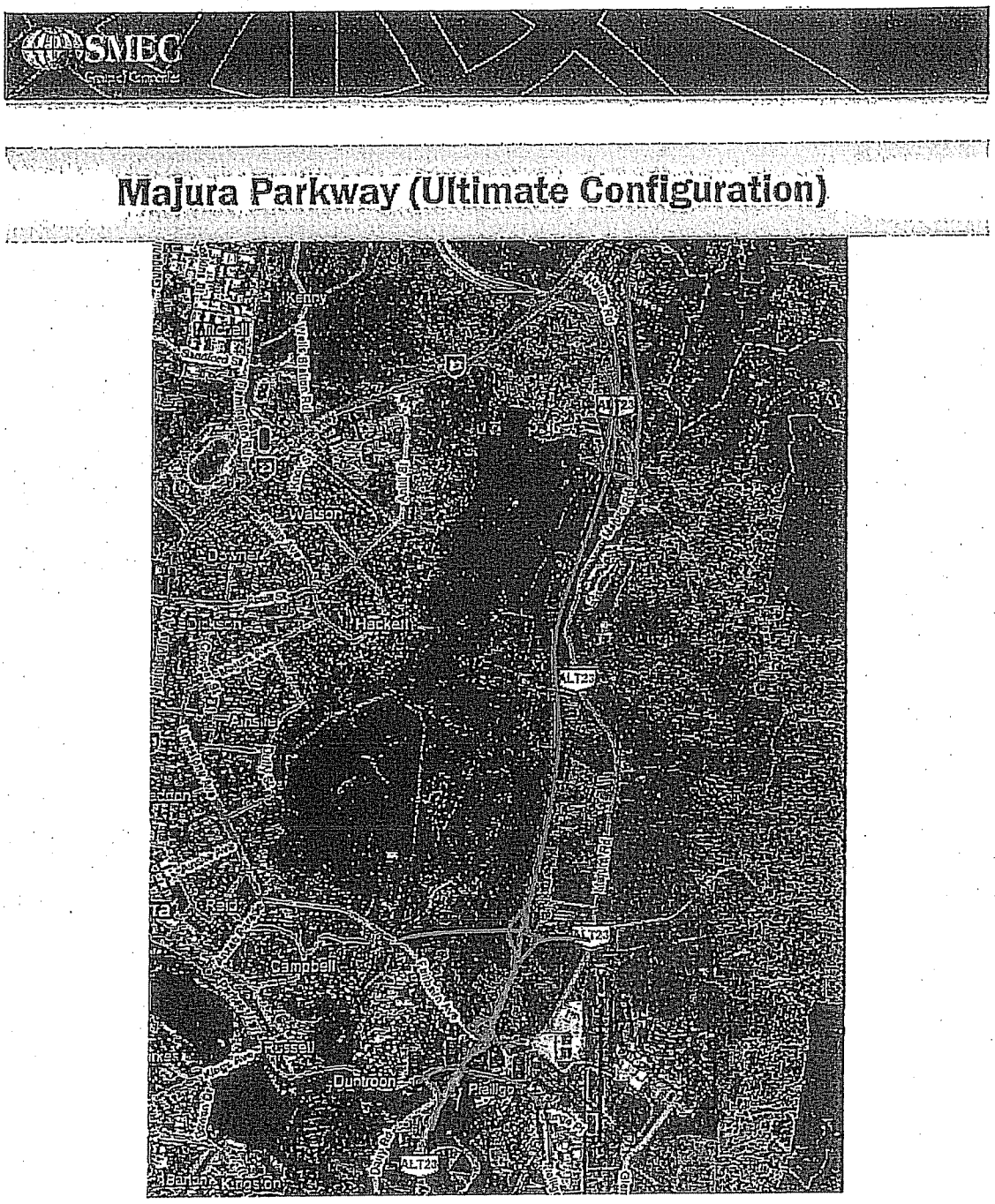


Figure 7: Ultimate Configuration

The tasks in this study are:

1. Update previous economic analysis which was undertaken as part of the Pialligo Avenue Options review (Feb. 2007) of alignment options. This study reflects up to date construction staging and construction cost estimates for Phase I, II and III as presented above. Note, Paramics modelling was performed as part of the previous economic analysis and has **not** been revised based upon the modified construction staging.

2 Traffic Modelling

2.1 Introduction

Micro-simulation modelling using Paramics was undertaken by SMEC in a previous assessment of options (Refer Pialligo Avenue Options Review - Feb. 2007). The reassessment of the economic analysis has not incorporated revised traffic modelling. The modified construction staging will have an affect on the calculated traffic modelling results and SMEC recommends that this study be extended to include a revision of the models.

The previous assessment has been used to assess the performance of the existing network and the considered network option. The results of the modelling were used as input into the economic analysis to assist in estimating the Net Present Value and Benefit Cost Ratio for the considered option compared to the existing network.

The remainder of the discussion in this chapter refers to the previous traffic modelling that was undertaken.

2.2 Model Calibration

The existing Paramics model was calibrated by adjusting the default parameters in the standard behavioural models contained in the micro-simulation software to local conditions. This relied mainly on the RTA default Paramics input files.

2.3 Matrix Estimation

In order to estimate future travel time and vehicle operating cost benefits for each of the improvement options, origin/destination matrices for traffic flows for 2016 and 2031 were taken from SMEC's TransCAD model of Canberra. These were used to factor up the 2006 Paramics matrix to produce corresponding matrices for use in Paramics runs for 2016 and 2031. Refinement of the demand matrices was done using PARAMICS Estimator to achieve a close match to the observed flows. PARAMICS Estimator is an origin/destination matrix estimation package specifically designed to operate at the microscopic level. The traffic volumes together with the OD count ("seed") matrix were entered into Paramics Estimator to derive the 2006 OD matrices for use in Paramics.

For the purposes of the analysis, it is assumed that Majura Parkway is not constructed during the evaluation period. Also Kowen link was included in the 2031 road network. The following key population figures provided/interpolated based on the ACTPLA land use and socio-economic forecasts were used in the 2016 and 2031 TransCAD Strategic Model.

Population		
	Year	
Area	2016	2031
Gungahlin	40499	62781
Kowen	0	1321

2.4 Model Validation

The resulting OD matrices produced flows that were a close fit to the traffic counts, in line with traffic engineering best practice of at least 85% of the counts having a GEH of less than 5, and 100% of the counts having a GEH of less than 10. The GEH Statistic is a formula used in traffic engineering, traffic forecasting, and traffic modelling to compare two sets of traffic volumes. The GEH Statistic gets its name from Geoffrey E. Havers, who invented it in the 1970s while working as a transport planner in London, England. Although its mathematical form is similar to a chi-

squared test, is not a true statistical test. Rather, it is an empirical formula that has proven useful for a variety of traffic analysis purposes. The formula for the "GEH Statistic" is:

$$GEH = \sqrt{\frac{(M-C)^2}{(0.5\times(M+C))}}$$

Where M is the traffic volume from the traffic model (or new count) and C is the real-world traffic count (or the old count).

The existing Paramics network was validated against 2006 AM peak traffic count and OD data and adjusted to match the observed traffic queues and network behaviour. The AM peak counts were undertaken in February 2006 for Capital Airport Group. Traffic signals were coded according to data supplied by the ACT Government Traffic Signals Unit.

2.5 Intersection Modelling

Analysis of 2006 and 2016 AM peak flows using aaSIDRA was undertaken for the intersection of Monaro Highway and Pialligo Avenue to determine the level of service for the PSP. The intersection is controlled by traffic signals with automatically calculated phase times. Detailed results of the aaSIDRA analysis are given in **Appendix A.** A summary of the results is given in Table 1.

Table 1 – Levels of Service – Monaro Highway/Pialligo Avenue Intersection

	2006		2016	
	Level of Service	Average Delay (sec)	Level of Service	Average Delay (sec)
PSP – Three lanes on Bridge (no Right Turns)	B	18	C	21

2.6 Micro-simulation in Paramics

Two assignment runs were conducted for the existing road network and the considered network option as listed in Table 2. Network layouts are shown in Figure 8 through Figure 9. Appendix B contains colour coded count plots from the Paramics simulation, the colour scale ranges linearly between 0vph (blue) and 3500vph (red). The models all extend to the North to encompass the proposed Airport Northern Access on Majura Rd, and include Brindabella Dr on Pialligo Ave to the South.

Table 2 – Paramics Runs

	2006	2016	2031
Existing Network	✓	✓	✓
Considered Option including two phase Staging	✓	✓	✓

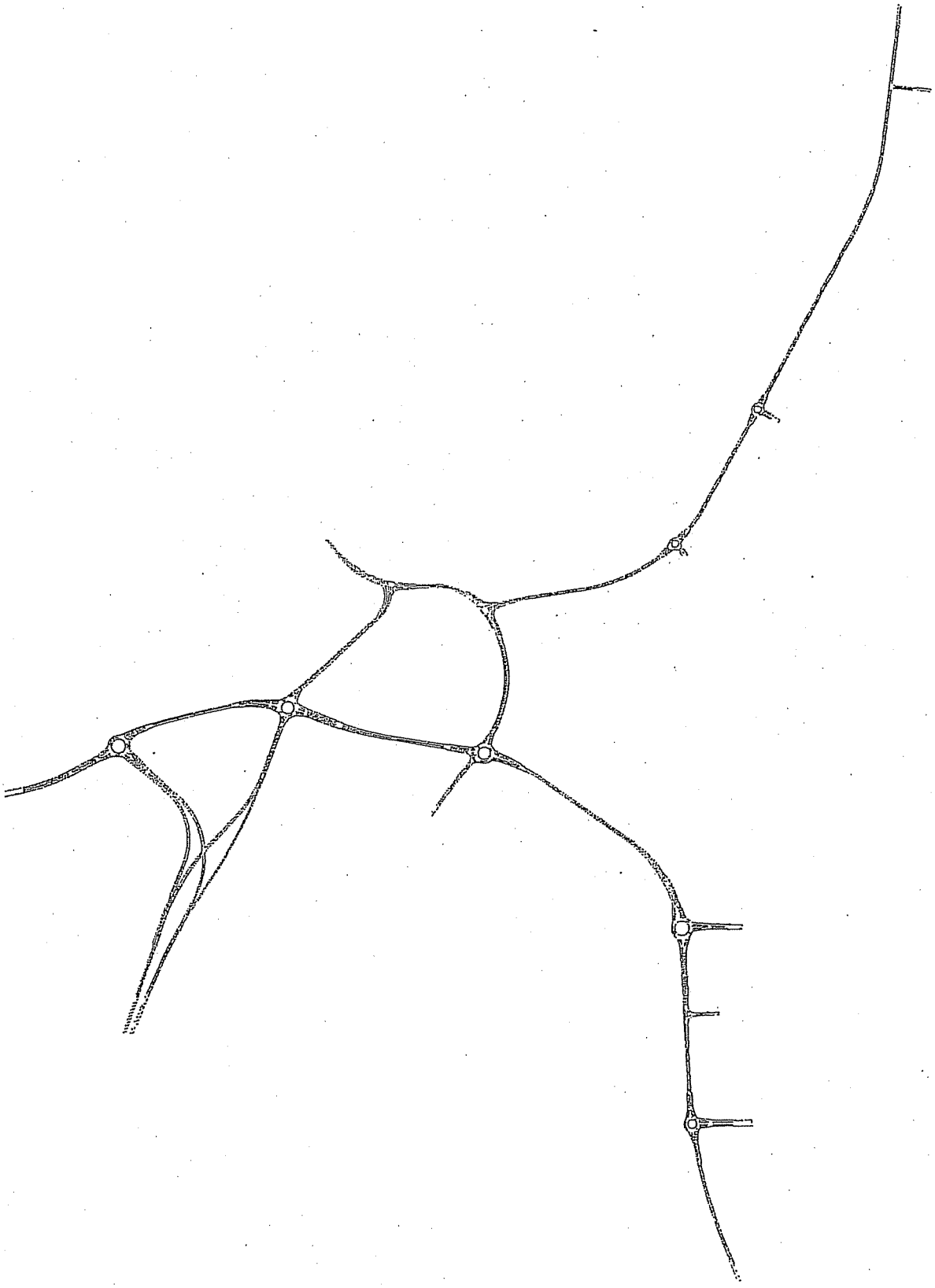
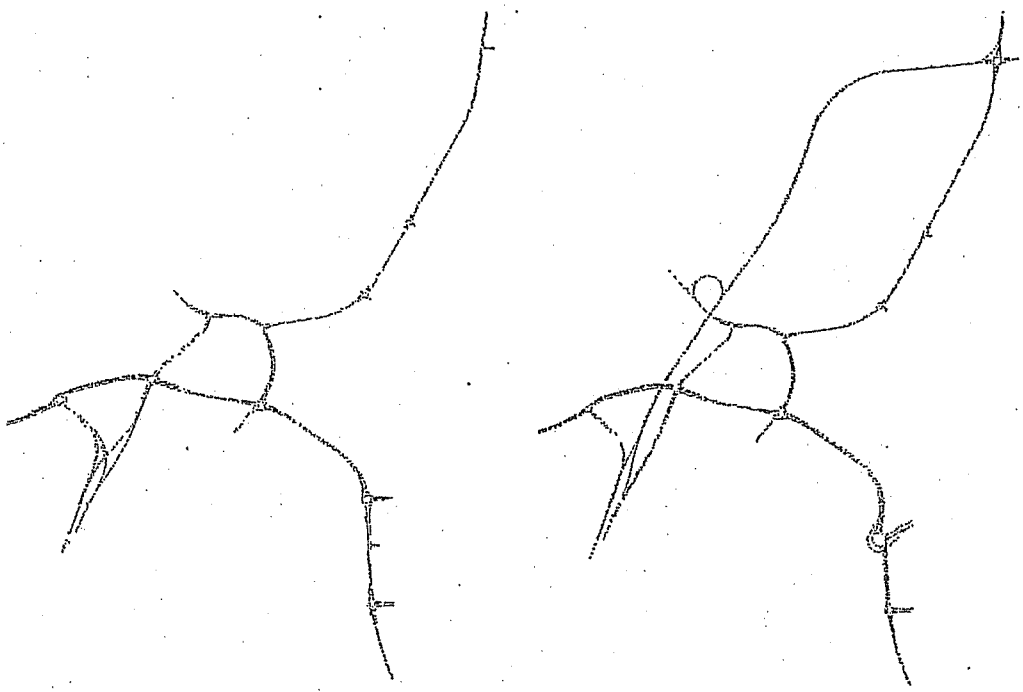


Figure 8 – Paramics network of the existing roads



Network Expected as of 2008 Network Expected as of 2016

Figure 9 – Considered Option Paramics network

2.7 Paramics Modelling Results (Performance Indicators)

Microsimulation runs for the years 2006, 2016 and 2031 were conducted using the Paramics model for the existing road network as well as for the considered network improvement option. The overall network performance indicators for each of the micro-simulation runs are displayed in Table 3 and Table 4. These include the amount of released vehicles and their percentage relative to demand volumes, vehicle hours travelled and vehicles kilometres travelled. The output results look logical with a reduced proportion of demand being released in future years. It can be also noted that there are no significant changes in released demand between 2016 and 2031. This can be attributed to two reasons. The first is that the network is reaching its saturation level in 2016 and beyond. The second is that the increase in travel demand between 2016 and 2031 is minimal according to the provided ACTPLA land use data. As expected, the demand in future years increases leading to an increase in congestion, higher average travel times and hence an increase in vehicle hours travelled.

Table 3 – Micro-simulation measured performance factors (network based)

Model	Released Vehicles			Vehicle Hours Travelled			Vehicle Kilometres Travelled		
	2006	2016	2031	2006	2016	2031	2006	2016	2031
Existing Road Network	7606 (95%)*	6693 (60%)	6603 (60%)	791	1582	1558	16101	14330	13630
Considered Option including two Phase Staging	7207 (95%)	9903 (90%)	9841 (90%)	690	894	891	16875	23733	23668
Total Demand	~8000	~10800	~11100						

(*) Percentage of Demand Met Within Peak Hour = Released Vehicles/Demand Volumes
Paramics model is constrained by capacity of modelled network. In this context, the Paramics model is not able to release demand flows that are in excess of the road network capacity during the peak modelled hour.

Table 4 – Micro-simulation calculated performance (Network Based)

Model	Average Vehicle Travel	Average Vehicle Speed

	Time (min)			(km/h)		
	2006	2016	2031	2006	2016	2031
Existing Road Network	6	14	14	20	9	9
Considered Option including two Phase Staging	5	5	5	24	27	27

2.7.1 Traffic Issues

In terms of traffic, two issues are considered:

1. Ability of traffic demand to enter the network without being delayed and hence causing spill over of delay to surrounding roads and entry points.
2. Once traffic entered into the network, the ability of the current network configuration to accommodate traffic with an acceptable level of service.

2.7.2 Existing Condition

Currently, most of the traffic demand can enter into the network without causing spill over to neighbouring roads. However, such traffic is operating within the network at low level of service i.e. F. If the current network remains without any intervention, it is expected that with increasing traffic demands, there will be queues at the entry points to the network and spill over to neighbouring roads. This will result into peak spreading and delays to a larger number of vehicles. This will be also accompanied by very low Level of Service (LoS) performance of traffic using the Pialligo network.

2.7.3 Expected Effect of Proposed Improvement

The proposed improvement is expected to avoid the occurrence of the first problem, namely the spill-over of traffic congestion into neighbouring roads as well as the prolonging of the peak traffic hour. However, still with expected future traffic increases, the traffic entering the network is expected to operate at low travelling speeds and hence low LOS performance. The considered option results in a substantial improvement in every year in terms of the number of vehicles being able to enter the network during the peak hour as well as in terms of the big reductions in vehicle hours travelled demonstrating significant time savings.

2.7.4 Assessment of LoS for Urban Arterials in the Study Area

SMEC identified two main urban arterial journeys within the Pialligo network. These are as follows and are shown in Figure 10:

- North-South direction starting from the intersection of Majura Road and the proposed Airport northern access road and finishing at the Water Ski Club Entrance on the Monaro Highway.
- East-West movement starting from the Ulinga Place Roundabout on Pialligo Avenue and finishing at a point on Morshead drive between Dairy Road and Plant Road

In accordance with the Highway Capacity Manual (HCM) the main two urban arterials constituting the Pialligo network, namely the North-South and the East west directions were classified as urban streets class I, where typical Free Flow Speeds (FFS) are 80 km/hr. In order to assess LOS for urban arterials it is necessary to obtain the average vehicle travel time and hence the average journey speeds during the peak periods, see Table 5 and Table 6. Based on this data, the LOS for these two urban arterial directions were determined both for the existing do nothing situation as well as for the considered ultimate option, see Table 7 and Table 8.

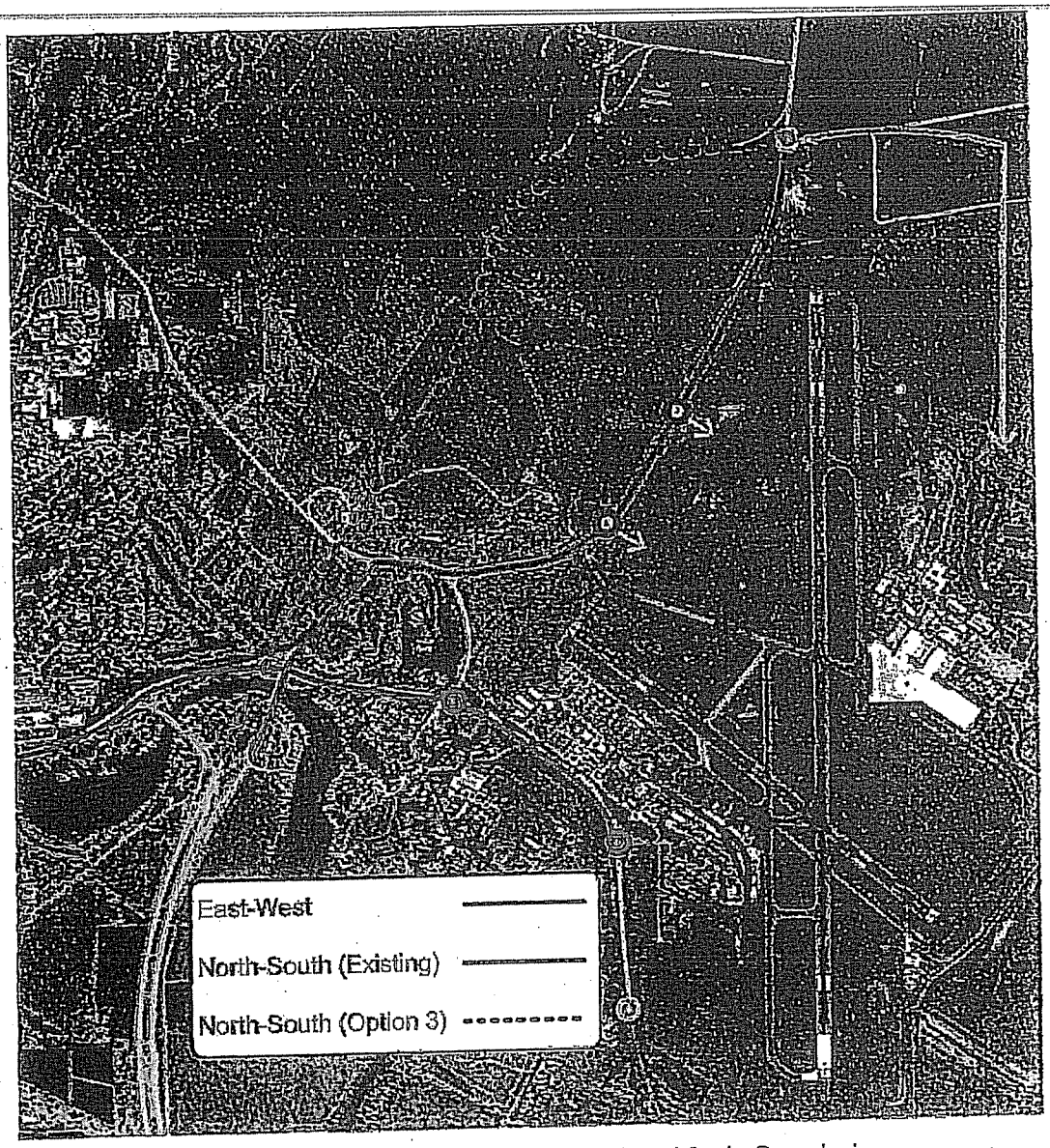


Figure 10 - Main arterial routes considered for LoS analysis

Table 5 – Micro-simulation Average Travel Time and Average Speed (North-South Direction)

Model	North to South (~30km) Average Vehicle Travel Time (minutes)			North to South (~30km) Average Vehicle Speed (km/hr)		
	2006	2016	2031	2006	2016	2031
Existing Road Network	8	24	24	28	10	10
Considered Option including two Phase Staging	6	3	3	34	73	75

Table 6 – Micro-simulation Average Travel Time and Average Speed (East-West direction)

Model	East to West (~30km) Average Vehicle Travel Time (minutes)			East to West (~30km) Average Vehicle Speed (km/hr)		
	2006	2016	2031	2006	2016	2031
Existing Road Network	8	16	16	23	12	12
Considered Option including two Phase Staging	3	7	9	56	26	22

Table 7 – LOS for North-South Direction (Do Nothing versus Considered Option including two Phase Staging)

	North-South Direction					
	Existing (Do Nothing)			Considered Option including two Phase Staging		
Year	Travel Time (AM Peak)	Average Speed (AM Peak)	LOS (AM Peak)	Travel Time (AM Peak)	Average Speed (AM Peak)	LOS (AM Peak)
2006	8 minutes	28 km/hr	E	6 minutes	34 km/hr.	D
2016	24 minutes	10 km/hr	F	3 minutes	73 km/hr.	A
2031	24 minutes	10 km/hr	F	3 minutes	75 km/hr.	A

Table 8 – LOS for East-West Direction (Do Nothing versus Considered Option including two Phase Staging)

	East-West Direction					
	Existing (Do Nothing)			Considered Option including two Phase Staging		
Year	Travel Time (AM Peak)	Average Speed (AM Peak)	LOS (AM Peak)	Travel Time (AM Peak)	Average Speed (AM Peak)	LOS (AM Peak)
2006	8 minutes	23 km/hr	F	3 minutes	56 km/hr.	B
2016	16 minutes	12 km/hr	F	7 minutes	26 km/hr.	E
2031	16 minutes	12 km/hr	F	9 minutes	22 km/hr.	F

The results demonstrates the significant expected future improvement in LOS for the North-South direction, where LOS can change from being F to A in the years 2016 and 2031. It has to be also noted that the expected LOS improvement in the east-west direction is not significant over the medium and long term.

Both the National Capital and Canberra Spatial Plans identify the airport as a major employment node and describe the importance of considering the Majura Parkway as a future major road. In a regional planning context the road plan provides improved access from and to Queanbeyan and the wider NSW region via the Monaro Highway. In terms of the National road network, constructing the Majura Parkway will provide better connections with the Federal Highway. In summary, the road plan presented has a strategic context and is important to support the current and the future development of Canberra and the surrounding NSW region.

The considered road network as well as being utilized by several groups of road users is of interest to several stakeholder organizations at different levels. Table 9, demonstrates the potential beneficiaries to any improvements occurring for this road network.

Table 9 – Beneficiaries from Road Network Improvements

Road Users (Beneficiaries)	Organisations (Beneficiaries)	Level
Canberra Airport Traffic (Passengers)	Canberra Airport Group	Local
Canberra Airport Traffic (Freight)	Canberra Airport Group	Local
Canberra Airport Traffic (Employees)	Canberra Airport Group	Local
Canberra Airport Traffic (Passengers)	ACT Government	Local
Canberra Airport Traffic (Freight)	ACT Government	Local
Canberra Airport Traffic (Employees)	ACT Government	Local
Gungahlin Commuter Traffic	ACT Government (Land Sales)	Local
Traffic Related to Headquarters Joint Operational Command	Department of Defence	Local
Queanbeyan Through Traffic*	RTA & Queanbeyan City Council	Regional
Better Connections with the Federal Highway**	Department of Transport & Regional Services (Auslink)	Federal
Politicians, Parliament Members & Canberra Visitors	National Capital Authority	Federal

** Regional traffic from NSW either on Pialligo Avenue and or the Federal Highway represent a high proportion of daily travel on the roads in the vicinity of the airport particularly on the section of Pialligo Avenue past the airport where almost 90% is generated in Queanbeyan and the surrounding NSW regions.*

*** Commercial traffic on the Monaro Highway and Majura Road represent some 16% of the total traffic presently with the connection between the Monaro Highway, Majura Road and the Federal Highway an important freight route within the ACT but also for regional NSW.*

4 Construction Cost

4.1 Phase I

The construction cost associated with Stage 1a and 1b of the project was taken from the PSP Report (SMEC August 2007). An estimated Construction cost estimate for the airport works is based upon information available through recent media releases. This estimate is summarised in Table 10.

Stage	Description	Cost (ex GST)
1a	Construction Cost Estimate (including 20% contingency plus design costs)	$5,960,000
1b	Construction Cost Estimate (including 20% contingency plus design costs)	$2,530,000
Airport Works	Construction Cost Estimate (including estimated design costs)	$13,000,000
	Total	$21,490,000

Table 10: Phase I Construction Cost

These results have been input into the economic analysis base on a 1 year construction period commencing in 2008.

4.2 Phase II

The construction cost associated with Stage 1c of the project was taken from the PSP Report (SMEC August 2007). This estimate is summarised in Table 11.

Stage	Description	Cost (ex GST)
1c	Construction Cost Estimate (including 20% contingency plus design costs)	$2,790,000
	Total	$2,790,000

Table 11: Phase II Construction Cost

These results have been input into the economic analysis base on a 1 year construction period commencing in 2009.

4.3 Phase III

The construction cost associated with Phase III of the project was estimated based on preliminary design performed to date by SMEC. The estimate is summarised in Table 14.

Item	Cost (ex GST)
Preliminaries	$ 1,155,000
Earthworks for Bridge Embankments	$ 4,800,000
Pavement South of Molonglo River	$ 1,431,750
Pavement Between the Molonglo River and Fairbairn Av	$ 948,750
Pavement North of Fairbairn Av	$ 3,776,250
Concrete K&G	$ 525,000
Road Furniture	$ 1,225,000
Streetlighting	$ 630,000
Landscape	$ 1,050,000
Road Signs	$ 105,000
Pavement Marking	$ 175,000
Underpass	$ 900,000
Bridge Over Fairbairn Avenue (2lane)	$ 1,441,000
Bridge Over Morshead Drive and Molonglo River (2lane)	$ 6,270,000
Brand Depot single bridge off ramp over Woolshed Creek	$ 170,000
Culverts (2x1.8m and 1x1.5m)	$ 320,000
Reinstate Oval	$ 1,500,000
Sub Total	**$ 26,422,750**
Contingencies (40%)	**$ 10,569,100**
Design	**$ 300,000**
Total	**$ $37,291,850**

Table 12: Phase III Construction Cost

These results have been input into the economic analysis base on a 2 year construction period commencing in 2010. The cost was split evenly between the 2 year construction period.

4.4 Phase IV – Majura Parkway Stage 2

Although not part of the economic analysis, a review has been undertaken of the Phase 3 construction cost as follows:

Item		Total
Preliminaries	$	3,300,000
Earthworks for Bridge Embankments	$	1,500,000
Pavement Duplication of Stage 1	$	8,715,750
Pavement Northcott Road	$	7,374,900
Pavement Maruja Parkway	$	31,521,000
Concrete K&G	$	1,500,000
Road Furniture	$	3,500,000
Streetlighting	$	1,800,000
Landscape	$	3,000,000
Road Signs	$	300,000
Pavement Marking	$	500,000
Bridge Over Fairbairn Avenue (2lane)	$	1,441,000
Bridge Over Morshead Drive and Molonglo River (2lane)	$	6,270,000
Northcott Road Bridge over Majura Parkway	$	3,165,000
Northcott Road twin bridge over Woolshed Creek	$	520,000
Majura Parkway Underpass CH6900	$	940,000
Majura Parkway Underpass CH8430	$	1,026,000
Majura Parkway Bridge CH9770	$	1,800,000
Culverts	$	1,665,000
Sub Total	$	79,838,650
Contingencies (40%)	$	31,935,460.00
Design	$	600,000
Total	$	112,374,110.0

SMEC recommends that the economic analysis and the traffic modelling be updated to include the Phase IV works.

5 Economic Analysis

5.1 Introduction

In order to assess and compare the three considered options, an analysis of the costs and benefits of each option compared the existing road network (do nothing scenario) was undertaken over a 25 year period. The Net Present Value (NPV) and Benefit Cost Ratio (BCR) were estimated for each of the three options.

5.2 Construction and Maintenance Costs

For the Base Case (do nothing) and for each of the improvement options, capital construction costs and maintenance life costs were estimated.

Table 13 below indicates an initial approximate estimate of construction costs for the various options. Although these estimates are subject to further detailed design they provide a broad order of magnitude cost which is considered appropriate for comparison purposes of the options at this stage.

Table 13 – Initial Construction Costs (ex GST)

	Existing Road Network (Do Nothing)	Phase I 2009	Phase II 2010	Phase III 2011	Phase III 2012
Construction Cost	$0	~ 21.5 Million	~ 2.8 Million	~ 18.7 Million	~ 18.7 Million

A simplified maintenance cost was also calculated for the analysis. The cyclic maintenance was assumed to occur every 5 years from the year of work completion and opening to traffic. The cyclic maintenance cost was estimated as a 0.5% of the construction cost for the first application and then for the remaining 3 applications was estimated as a 1% of the construction cost. As for annual maintenance, its cost was estimated as 0.25% of the initial construction cost. In case cyclic maintenance is applied, no annual maintenance is applied.

5.3 Travel Related Costs

Several indicators of travel are obtained as output from the Paramics runs in the AM peak, namely the number of Vehicle Kilometres Travelled (VKT), the number of Vehicle Hours Travelled (VHT) as well as the mean speed. These are obtained for the years 2006, 2016 and 2031. The annual stream of VKT and VHT were estimated over a 25 year period with annual values interpolated between estimated values in 2006, 2016 and 2031. These are used to estimate the benefits for the existing condition continuing as well as fir the considered network improvement option. For each, the following travel related costs were estimated:

- Vehicle Operating Costs (VOC): - this is dependent on the number of vehicle-kilometres travelled (VKT) as well as on the Vehicle Operating Cost per km (VOC/km) obtained from the RTA Economic Analysis Manual
- Time Costs (TC): - this is dependent on the Vehicle-Hours Travelled (VHT) as well as on the vehicle composition, average vehicle occupancy and value of travel time obtained from the RTA Economic Analysis Manual
- Accident Costs (AC): - this is dependent on the VKT as well as on the accident rate per Million Vehicle-Kilometres Travelled (MVKT) obtained from the RTA Economic Analysis Manual

The following sections detail the exact methodology used for estimating each of these costs:

5.3.1 Vehicle Operating Cost

Vehicle operating cost (VOC) is a function of kilometres travelled and VOC/Km. According to the RTA Economic Appraisal Manual, the VOC/km varies with the operating speed and the vehicle type. This study considered two types of vehicles, namely used private cars and rigid trucks. For both types of vehicles the study used different models for computing the VOC/km depending on the journey speed. This is included in Table 14. These models are based on the recently updated Appendix B: economic parameters for 2005 produced by the RTA.

Table 14 – Models for Computing VOC/Km According to Type of Vehicle and Journey Speed

	Journey Operating Speed	
Vehicle Type	≤ 60 Km/Hr	≥ 60 Km/Hr
Private Car (Used)	C = 25.28 + 95.69/V	C = 28.35 -0.068V + 0.00051 V2
Rigid Truck	C = 69.3 + 476.20/V	C = 80.85 -0.408V + 0.00280 V2

C = VOC (cents/km), V = journey speed (km/hr).

The VOC is a product of multiplying VKT by the appropriate C value. The formulation for this computation is as follows:

$$VOC_{option} = VKT_{(option,Used\ PrivateCar)} \times C_{(PrivateCar)} + VKT_{(Option,RigidTruck)} \times C_{(RigidTruck)}$$

5.3.2 Travel Time Costs

The Paramics model produces the amount of VHT. This is multiplied by the value of time to produce the travel time costs for each option. According to the RTA manual, the average time cost per vehicle hour is $22.04 in December 2005 prices. The formulation for the computation of Travel Time Costs (TTC) is as follows:

$$TTC_{option} = VHT_{(option)} \times VOT$$

5.3.3 Accident Costs

The expected number of accidents by type is a function of kilometres travelled. It is a known phenomenon that the more travelling, the more is the propensity of getting involved in an accident. In this context, average rates for accident occurrence were computed based on the 2004 accident statistics. These are included in Table 15. The table also shows the cost of accidents as reported in the RTA manual.

Table 15 – Adopted Accident Rates and Costs

Type of Accident	Rate Based on ACT 2004 Accident Statistics (Per 100 Million Vehicle Kilometres Travelled)	Generic Costs Based on RTA Manual Update, December 2005
Fatal Injury	0.34 Fatal Person/100 MVKT	$1,572,820
Serious Injury	4.72 Seriously Injured Person/100 MVKT	$391,890
Other Injury	13.26 Other Injured Person/100 MVKT	$15,930
Property Damage Only	260.1 PDO/100 MVKT	$6,995

The Accident Costs (AC) is a summation of all the costs expected to be incurred as a result of occurrence of different types of accidents. The formulation for this computation is as follows:

$$AC_{option} = \frac{VKT_{(option)}}{100MVKT} \times (Rate_{(Fatal)} \times Cost_{(Fatal)} + Rate_{(S.Injury)} \times Cost_{(S.Injury)} + Rate_{(Injury)} \times Cost_{(Injury)} + Rate_{(PDO)} \times Cost_{(PDO)})$$

$$AC_{option} = \frac{VKT_{(option)}}{100MVKT} \times (0.34 \times \$1{,}572{,}820 + 4.72 \times \$391{,}890 + 13.26 \times \$15{,}930 + 260.1 \times \$6{,}995)$$

It is to be noted that with the considered option (grade separation) some intersection related accidents are also avoided. These were also taken into account.

5.3.4 Annualisation Factor

An annual expansion factor of 1825 was applied to the AM peak VOC, TTC and AC in order to estimate the annual incurred costs over the evaluation period. The expansion factor is estimated by applying the existing peak hour to daily flow ratio. Recent 24 hour traffic count data collected for Canberra Airport Group along Majura Road provides a basis for estimating the peak hour to daily traffic flow ratio.

$$AnnualCosts_{option} = (VOC_{(option)} + TTC_{(option)} + AC_{(option)}) \times 1825$$

5.4 Option Benefits

The expected benefits for the considered option are computed. This is based on obtaining the savings of the considered option as compared to the base option (existing do nothing) in terms of VOC savings, TTC savings and AC savings. Values of such savings for each option are depicted in **Appendix C**. The formulation for this computation is as follows:

$$Benefits_{option} = (VOC_{(option)} - VOC_{(base)}) + (TTC_{(option)} - TTC_{(base)}) + AC_{(option)} - AC_{(base)})$$

5.5 Benefit Cost Ratio

In order to compare the costs and benefits of the proposed option relative to the existing road network over the evaluation period, the change in monetary values over time needs to be accounted for. This is achieved by discounting the annual costs and benefits of the project to the present year using a range of discount rates (4%, 7%, and 10%). The normal indicators of the worth of a project, the NPV and BCR for each option are estimated for each of these discount rates. The analysis results are summarised in Table 16.

Table 16 – Results of Economic Analysis

	Considered Option	
Discount Rates	NPV (000)	BCR
4%	$201,588	4.90
7%	$125,236	3.86
10%	$79,815	3.13

If the discounted present value of the benefits exceeds the discounted present value of the costs, then the project is worthwhile. This is equivalent to the condition that the net benefit must be positive. Another equivalent condition is that the ratio of the present value of the benefits to the present value of the costs must be greater than one. In this context, it is obvious from the table that all of the considered option is producing positive NPVs as well as BCRs > 1. A detailed spreadsheet of the output of the cost benefit analysis is included in **Appendix C**.

6 Conclusions

The pre-design study has considered the costs, benefits and the economic feasibility for providing an alternative road network improvement option. This option is meant to address the traffic congestion problem and its travel cost consequences on the considered Pialligo Avenue and Majura Road network. The considered options include:

- Construction of Pialligo Ave Stage 1a, 1b and Airport works in 2008, followed by construction of Pialligo Ave Stage 1c in 2009 and Majura Parkway Stage 1 in 2010.

Micro-simulation modelling was used to demonstrate the severity of the current peak traffic congestion problems and the expected future further deterioration of the traffic conditions in this network. The current LOS for the North-South direction starting from Majura Road Roundabout to Water Ski Club Entrance is E and expected to deteriorate to F by 2016. As for the East-West direction starting from Ulinga Place Roundabout to Staff Cadet Roundabout, the current LOS is already F. The micro-simulation results demonstrate the significant expected future improvement in LOS for the North-South direction, where LOS can change from being F to A in the years 2016 and 2031. It has to be also noted that the expected LOS improvement in the east-west direction is not significant over the medium and long term. However, it is expected that the PSP will bring a significant instant improvement to the current east-west direction changing the LOS from F to B.

The micro-simulation modelling was also used to obtain key performance indicators including number of vehicle kilometres travelled as well as number of vehicle hours travelled both for the existing road network as well as for the considered option in the years 2006, 2016 and 2031. These were used in accordance with RTA economic Analysis Manual to estimate travel-related costs for each option including Vehicle Operation Costs. Travel Time Costs and Accident Costs. Capital construction costs, contingency, design, supervision costs were also estimated for each option. Annual and cyclic maintenance costs were also considered for each option.

Travel benefits for the considered option were determined by subtracting the travel related costs of the improvement option from those travel related costs of the do nothing scenario i.e. the existing road network staying as it is with no future intervention.

The results of the benefit cost analysis show that the improvement option can be considered as economically feasible. This is based on the two obtained key performance indicators namely the Net Present Value (NPV) and the Benefit Cost Ratio (BCR). The considered option produces a NPV equating to ~ $125 million over the 25 years span life of the project at a 7% discount rate. The estimated BCR for this option is ~3.9 using a 7% discount rate. In addition, this option allows the ACT government to immediately fund the construction of the Majura Parkway Stage 1 and to seek a shared funding with Auslink for the grade separation to be opened by the year 2013 or before with a 1 year design period and a 2 year construction period.

Appendix A aaSIDRA Results

A.1 Movement Summaries

A.1.1 Morshead Dr - Pialligo Ave Signalised with Banned Right Turns, 2006 AM

Mov No	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Monaro Highway (S)										
2	T	708	8.2	0.499	28.2	LOS C	113	0.85	0.73	33.8
Approach		**709**	**8.2**	**0.499**	**28.2**	**LOS C**	**113**	**0.85**	**0.73**	**33.8**
Pialligo Avenue (E)										
4	L	532	4.7	0.573	10.3	LOS B	66	0.38	0.71	46.9
5	T	1077	3.1	0.462	15.0	LOS B	122	0.66	0.59	42.5
Approach		**1608**	**3.6**	**0.573**	**13.4**	**LOS B**	**122**	**0.57**	**0.63**	**43.9**
Morshead Drive (N)										
6	L	1	0.0	0.003	10.4	LOS B	0	0.29	0.61	46.7
7	T	495	10.9	0.354	26.6	LOS C	82	0.80	0.67	34.7
Approach		**496**	**10.9**	**0.354**	**26.6**	**LOS C**	**82**	**0.80**	**0.67**	**34.7**
Morshead Drive (W)										
10	L	87	4.6	0.096	10.1	LOS B	10	0.28	0.66	47.1
11	T	1152	3.1	0.495	15.3	LOS B	132	0.68	0.60	42.2
Approach		**1239**	**3.2**	**0.495**	**15.0**	**LOS B**	**132**	**0.65**	**0.61**	**42.5**
All Vehicles		**4052**	**5.2**	**0.573**	**18.1**	**LOS B**	**132**	**0.67**	**0.64**	**40.1**

A.1.2 Morshead Dr - Pialligo Ave Signalised with Banned Right Turns, 2016 AM

Mov No	Turn	Dem Flow (veh/h)	%HV	Deg of Satn (v/c)	Aver Delay (sec)	Level of Service	95% Back of Queue (m)	Prop. Queued	Eff. Stop Rate	Aver Speed (km/h)
Monaro Highway (S)										
2	T	981	8.2	0.690	30.7	LOS C	159	0.92	0.81	32.6
Approach		**981**	**8.2**	**0.691**	**30.7**	**LOS C**	**159**	**0.92**	**0.81**	**32.6**
Pialligo Avenue (E)										
4	L	736	4.8	0.813	16.9	LOS B	130	0.59	0.85	41.2
5	T	1492	3.0	0.640	17.2	LOS B	183	0.76	0.69	40.8
Approach		**2227**	**3.6**	**0.813**	**17.1**	**LOS B**	**183**	**0.70**	**0.74**	**40.9**
Morshead Drive (N)										
6	L	1	0.0	0.005	13.4	LOS B	0	0.39	0.61	43.9
7	T	685	10.9	0.491	28.1	LOS C	112	0.84	0.72	33.8
Approach		**687**	**10.9**	**0.491**	**28.1**	**LOS C**	**112**	**0.84**	**0.72**	**33.8**
Morshead Drive (W)										
10	L	121	5.0	0.154	12.4	LOS B	20	0.38	0.68	45.0
11	T	1595	3.1	0.684	17.8	LOS B	201	0.79	0.72	40.3
Approach		**1715**	**3.2**	**0.684**	**17.5**	**LOS B**	**201**	**0.76**	**0.71**	**40.6**
All Vehicles		**5610**	**5.2**	**0.813**	**20.9**	**LOS C**	**201**	**0.78**	**0.74**	**38.1**