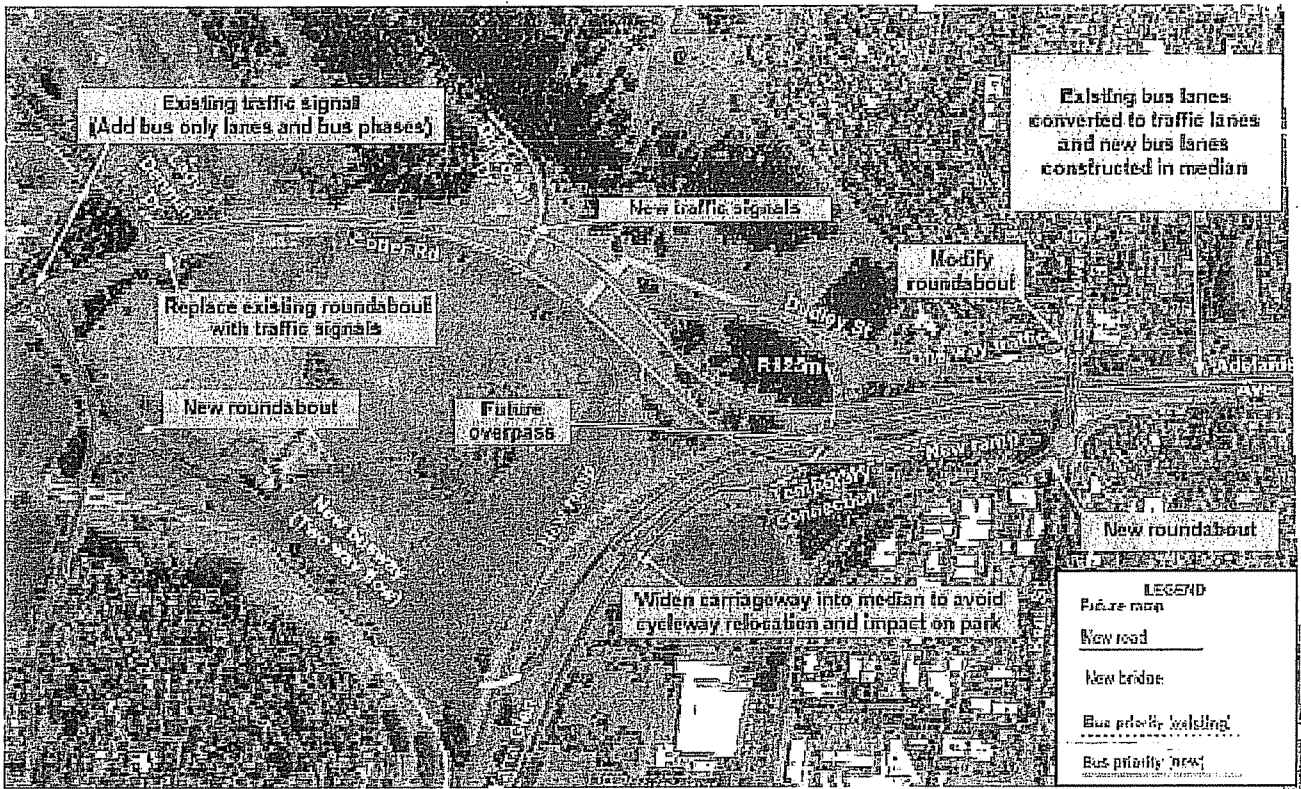


**Table 13: Description of Works Package No. 2 (Cotter Road Upgrade)**

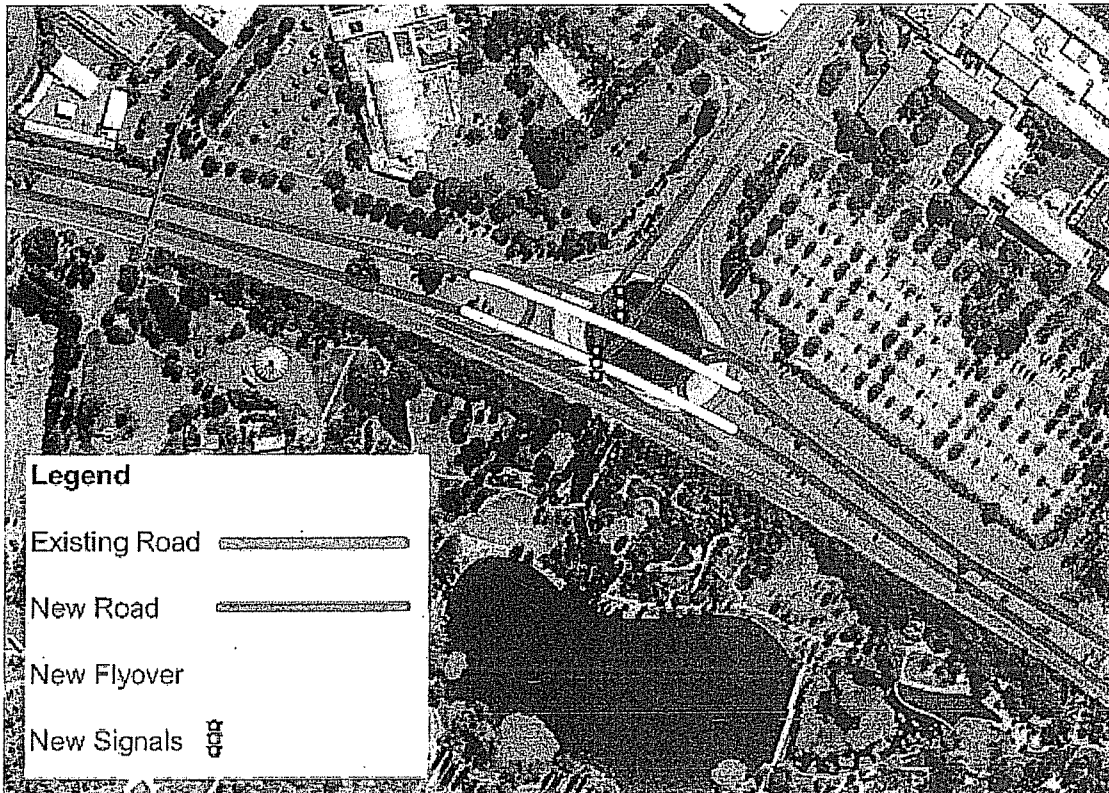
No.	Item	Description	Source
1	Streeton Dr/ Cotter Rd intersection	Major capacity upgrade	GHD PSP drawings, modified to reflect AECOM's latest analyses – see Figure 48
2	Cotter Rd/McCulloch St intersection	Capacity upgrade	AECOM SIDRA layout
3	Cotter Rd/Lady Denman Dr intersection	Capacity upgrade	AECOM SIDRA layout – see Figure 50
8	Constitution Ave duplication	London Cct - Coranderrk St & Anzac Pde West - Blamey Cres	NCA drawings & AECOM SIDRA
9	Morshead Dr/Russell Dr intersection	Reconstruct as signalised intersection	AECOM SIDRA – see Figure 44
10	Cotter Rd duplication	NS Arterial - Streeton Dr (includes couple of new bridges/culverts over creeks)	GHD PSP drawings (GHD 2009)
11	Cotter Rd duplication	Tuggeranong Pwy to Yarra Glen interchange (includes one bridge over creek & some additional intersection works)	none available
12	Cotter Rd/Yarra Glen interchange	New ramp connections and bridge	SMEC sketch – see Figure 59
13	Adelaide Ave widening	Extra lane Cotter Road - Hopetoun Circuit Eastern ramps (will need new bridge for bus lane at Hopetoun & modifications to retaining wall and barriers under the Kent Street/Novar Street bridge, which will be tight)	none available
14	Parkes Way/ Commonwealth Ave works	Remove east facing Edinburgh Avenue ramps, remove loops	AECOM and Cardno Young sketches – see Figure 11
15	Parkes Way/ Commonwealth Ave works	Relocate Parkes Way in median and construct SPI at Commonwealth Avenue	AECOM and Cardno Young sketches – see Figure 11
16	Parkes Way /Commonwealth Ave works	Build CD roads between Commonwealth Avenue and Coranderrk Street	AECOM sketches– see Figure 60
17	Parkes Way/ Coranderrk St works	Build bridge over Coranderrk Street, construct Coranderrk Street/ Parkes Way ramps and new traffic signals to replace the roundabout	AECOM sketches – see Figure 60

Figure 59: Potential Upgrade to Yarra Glen/Cotter Road Interchange



Source: SMEC (2008)

Figure 60: Potential Upgrade to Coranderrk Street/ Parkes Way



**Table 14: Description of Works Package No. 3 (Fairbairn-Northcott-Constitution Duplication)**

No.	Item	Description	Source
1	Streeton Dr/ Cotter Rd intersection	Major capacity upgrade	GHD PSP drawings, modified to reflect AECOM's latest analyses – see Figure 48
2	Cotter Rd/McCulloch St intersection	Capacity upgrade	AECOM SIDRA layout
3	Cotter Rd/Lady Denman Dr intersection	Capacity upgrade	AECOM SIDRA layout – see Figure 50
8	Constitution Ave duplication	London Cct - Coranderrk St & Anzac Pde West - Blamey Cres	NCA drawings & AECOM SIDRA
9	Morshead Dr/Russell Dr intersection	Reconstruct as signalised intersection	AECOM SIDRA – see Figure 44
14	Parkes Way/ Commonwealth Ave works	Remove east facing Edinburgh Ave ramps, remove loops	AECOM and Cardno Young sketches – see Figure 11
15	Parkes Way/ Commonwealth Ave works	Relocate Parkes Way in median and construct SPI at Commonwealth Ave	AECOM and Cardno Young sketches – see Figure 11
16	Parkes Way/ Commonwealth Ave works	Build CD roads between Commonwealth Ave and Coranderrk St	AECOM sketches – see Figure 60
17	Parkes Way/ Commonwealth Ave works	Build bridge over Coranderrk St & reconstruct Coranderrk St/Parkes Way ramps	AECOM sketches – see Figure 60
18	Constitution Ave duplication	Coranderrk St - Anzac Pde & Blamey Cres - Northcott Dr	NCA design
19	Northcott Dr duplication	Constitution Ave - Fairbairn Ave and associated intersection improvements	None available
20	Clunies Ross St duplication	Parkes Way ramps to Barry Dr and associated intersection improvements	None available
21	Clunies Ross St/ Parkes Way ramps	Build new west facing ramps and new signals on Clunies Ross	AECOM sketch
22	Minindee Dr link to Kings Ave	Build new link to Kings Ave	NCA sketch

### 6.3 Indicative Costs

Tables 11 to 13 provide a summary of probable costs for each of the packages described in Section 6.2, including the costs of the various key elements of each package.

**Table 15: Probable Cost of Works Package No. 1**

No.	Item	Cost (\$M)
1	Streeton Dr/Cotter Rd intersection	6.1
2	Cotter Rd/McCulloch St intersection	0.3
3	Cotter Rd/Lady Denman Dr intersection intersection	0.8
4	Parkes Way duplication	9.2
5	Constitution Ave Duplication	18.8
6	Morshead Dr/Russell Dr intersection	0.8
	<b>TOTAL</b>	<b>35.9</b>

**Table 16: Probable Cost of Works Package No. 2**

No.	Item	Cost (\$M)
1	Streeton Dr/Cotter Rd intersection	6.1
2	Cotter Rd/McCulloch St intersection	0.3
3	Cotter Rd/Lady Denman Dr intersection intersection	0.8
5	Constitution Ave duplication	18.8
6	Morshead Dr/Russell Dr intersection	0.8
7	Cotter Road duplication - NS Arterial to Streeton Dr	6.3
8	Cotter road duplication - Tuggeranong Pwy to Yarra Glen including new ramps	25.2
9	Adelaide Ave widening	7.7
10	Parkes Way (500m) /Commonwealth Ave works intersection	42.7
11	Parkes Way widening Edinburgh Ave to Commonwealth Ave 700m	6.0
12	Parkes Way - Commonwealth Ave to Anzac Pde (including CD roads and bridge over Coranderrk Street)	64.7
	<b>TOTAL</b>	<b>179.4</b>

**Table 17: Probable Cost of Works Package No. 3**

No.	Item	Cost (\$M)
1	Streeton Dr/Cotter Rd intersection	6.1
2	Cotter Rd/McCulloch St intersection	0.3
3	Cotter Rd/Lady Denman Dr intersection intersection	0.8
5	Constitution Ave duplication	48.1
6	Morshead Dr/Russell Dr intersection	0.8
10	Parkes Way (500m) /Commonwealth Ave works intersection	42.7
11	Parkes Way Widening - Edinburgh Ave to Commonwealth Ave 700m	6.0
12	Parkes Way - Commonwealth Ave to Anzac Pde (including CD roads and bridge over Coranderrk Street)	64.7
13	Northcott Dr duplication	6.8
14	Clunies Ross St duplication	7.4
15	Parkes way EB ramp - Clunies Ross Street	0.9
16	Minindee Dr link to Kings Ave	1.0
17	Fairbairn Av duplication – Morshead Dr to Northcott Dr	4.0
	<b>TOTAL</b>	<b>189.6</b>

## 7.0 Assessment of Infrastructure Works Packages

### 7.1 Key Processes

The assessment of each of the works packages included consideration of:

- Probable costs and transportation benefits
- Potential physical impacts
- Facilitation of public transport and minor modes
- Other potential impacts and benefits

A broad strategic assessment of these overall packages is necessary as part of this project. More detailed assessments of specific elements of each package will be required as part of future feasibility studies (eg., design and costing, environmental impacts).

### 7.2 Economic Analysis Outcomes

The results of the economic analysis of the three works packages are given in Table 18, based on an assessment of the transport benefits of each project. It shows that each of the packages is economically feasible. A summary of the inputs and assumptions for the economic analyses are given in Appendix B.

**Table 18: Economic Analysis Results**

Economic Parameter	Package 1	Package 2	Package 3
Capital cost (\$M)	36.0	154.3	145.4
NPV (\$M)	276.8	163.5	58.2
BCR	8.7	2.1	1.3

*Note: Based on 7% discount rate*

The Parkes Way West package will provide the best economic return in terms of an economic assessment of transport benefits. However, elements of packages 2 and 3 include other benefits that cannot be quantified in this project (eg., return on land sales from land currently constrained by road infrastructure, increased). Hence, a preferred package should include elements of all works packages.

In terms of external costs, delivery of these works packages will involve some construction disruption costs. In terms of other benefits, there will be associated savings in vehicle externalities (emissions, accidents etc), as well as improved access / utility of parklands and lake. These are not quantified in the analysis.

### 7.3 Traffic Impacts of the Packages

An overall summary of the network impacts of the various packages, in terms of changes in the amount of travel and average travel speeds in the AM peak, is given in Table 19. It shows marginal overall improvements for each package, but they add up in terms of economic benefits over a 20 year or more period.

**Table 19: Changes in the Amount of Travel for the Packages**

Package	Year	Vehicle Km (Millions)		Vehicle Hours (Thousands)		Average Speed (km/h)	
		2011	2021	2011	2021	2011	2021
Parkes Way West Widening	2011	1.690	1.689	32.3	31.7	52.4	53.2
	2021	1.931	1.937	44.8	44.3	43.1	43.7
	2031	2.065	2.074	56.9	56.7	36.3	36.6
Cotter Road Duplication	2011	1.690	1.689	32.3	32.1	52.4	52.6
	2021	1.931	1.935	44.8	44.3	43.1	43.7
	2031	2.065	2.071	56.9	56.5	36.3	36.7
Fairbairn-Northcott-Constitution Duplication	2011	1.690	1.690	32.3	32.1	52.4	52.6
	2021	1.931	1.932	44.8	44.6	43.1	43.3
	2031	2.065	2.068	56.9	56.7	36.3	36.5

Note: Based on EMME model predictions for the AM peak period

More specific benefits in terms of changes in the performance of elements of the road system are evident when specific locations where improvements are proposed are examined. A good example is the widening of Parkes Way between Glenloch Interchange and Acton Tunnel; the primary works element in package one. Outputs from simulation modelling of Glenloch Interchange show marked benefits of building the extra lanes (see Figure 61). This is additional to the current improvement works at Glenloch Interchange.

However, there are concerns that widening Parkes Way would put considerable added pressures on the ramps leading to Parkes Way at Glenloch Interchange and at Clunies Ross Street. These ramps are already at capacity and the widening of Parkes Way would make them worse, as well as increasing pressures on Tuggeranong Parkway north of Cotter Road and the Acton Tunnel.

It was found that additional west-facing ramps at Clunies Ross Street/Parkes Way would have little benefit to traffic movements and may adversely impact on adjoining land-uses. Thus, these ramps are not worth further consideration.

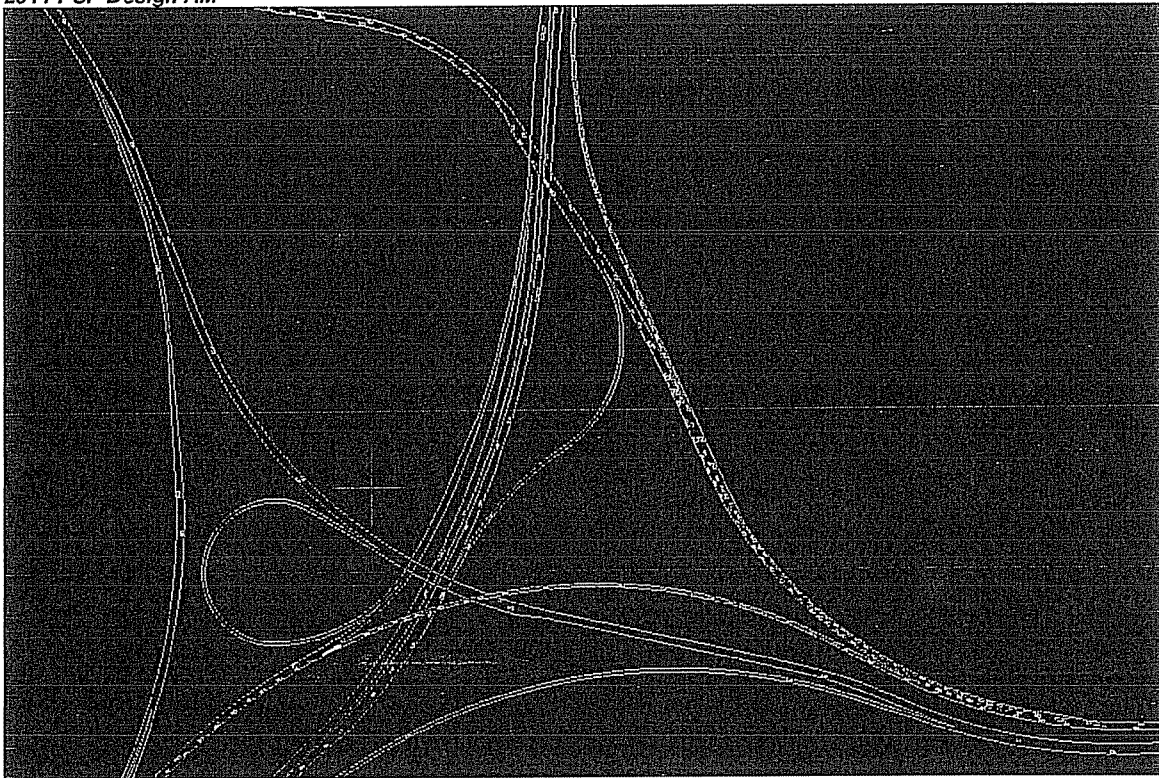
Tables 20 to 23 provide a summary of the expected change in performance due to each of the projects in each package. Changes in level of service are given in Tables 20 and 21 for intersections and mid-block/ramp locations, respectively. Changes in average vehicular delays are given in Tables 22 and 23 for intersections and mid-block/ramp locations, respectively.

The key outcomes from an examination of these results are:

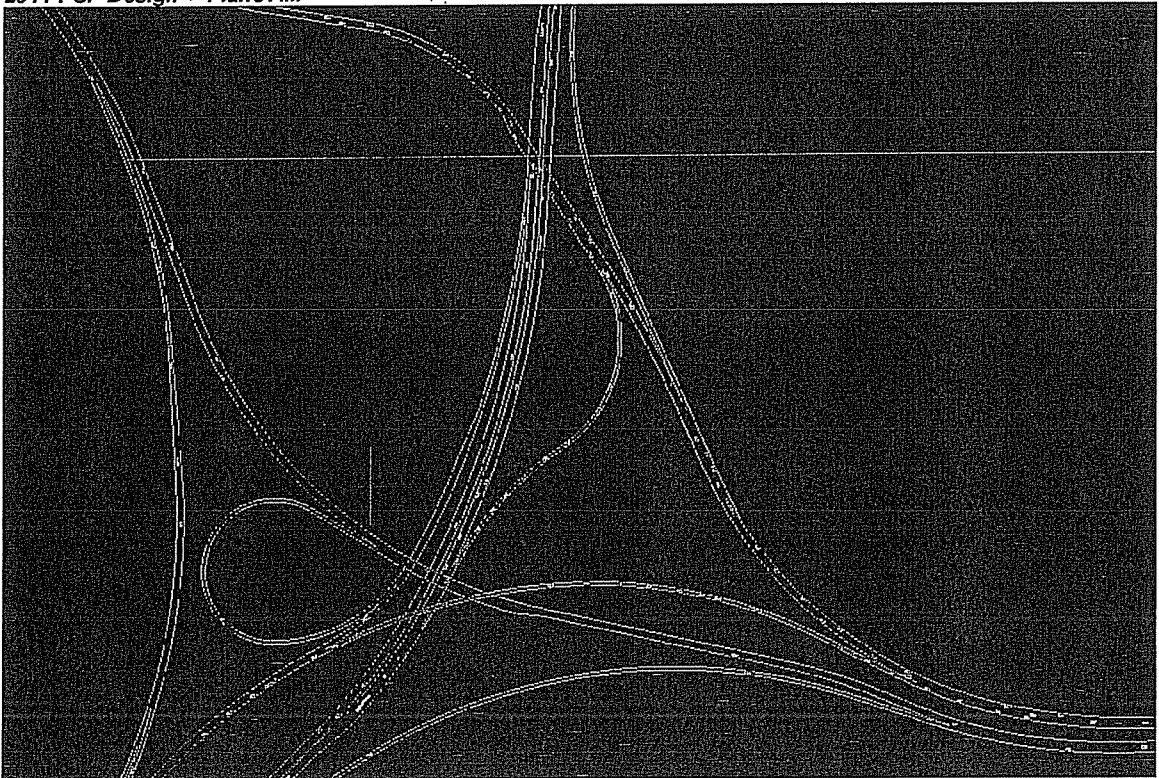
- The reconstruction of the Morshead Drive/Russell Drive junction as a signalised intersection would greatly reduce AM peak queues and delays at this intersection (from 119s/veh to 25s/veh) and would encourage City-bound traffic to use Parkes Way rather than Russell Drive, reducing pedestrian/vehicle conflicts in Russell.
- The upgrading of Fairbairn Avenue between Morshead Drive and Northcott Drive should be a priority.
- Parkes Way will still be relatively congested in peak periods, even with an extra lane around Black Mountain, particularly on approach to Acton Tunnel.

**Figure 61: Microsimulation Modelling Outputs Showing the Effect of Widening Parkes Way**

*2011 PSP Design AM*



*2011 PSP Design + 1 lane AM*



Source: AECOM AM peak Paramics model of Glenloch Interchange

Table 20: Changes in Intersection Level of Service

Intersection works		2011 LoS	2021 LoS	2031 LoS
No. Changes	Description	Do Nothing	Project	Do Nothing
Item		Do Nothing	Project	Do Nothing
1	1-3 Streeton Dr/ Cotter Rd intersection	C	N/A	F
2	1-3 Cotter Rd/McCulloch St intersection	D	C	E
3	1-3 Cotter Rd/Lady Denman Dr intersection	C	B	D
9	1-3 Morshead Dr/Russell Dr intersection	F	C	E
14	2,3 Parkes Way/Commonwealth Ave works	N/A	D	N/A
15	2,3 Parkes Way/Commonwealth Ave works	N/A	D	N/A
17	2,3 Parkes Way/ Coranderrk Street works	F	E	F
22	3 Minindee Dr link to Kings Ave	F	B	E

Table 21: Changes in Midblock and Ramp Level of Service

Midblock & Ramp Works		2011 LoS	2021 LoS	2031 LoS
		Do Nothing	Do Nothing	Do Nothing
4	1 Parkes Way widening	F	F	F
5	1 Parkes Way widening	F	F	F
6	1 Parkes Way widening	F	F	F
7	1 Parkes Way widening	C	C	C
8	1-3 Constitution Ave duplication	C	B	E
10	2 Cotter Rd duplication	F	B	F
11	2 Cotter Rd duplication	F	F	F
12	2 Cotter Rd/Yarra Glen interchange	F	C	F
13	2 Adelaide Ave widening	F	F	F
16	2-3 Parkes Way /Commonwealth Ave works	F	E	F

Midblock & Ramp works		2011 LoS			2021 LoS			2031 LoS		
No	Priority	Item	Description	Do Nothing	Project	Do Nothing	Project	Do Nothing	Project	Do Nothing
18	3	Constitution Ave duplication	Coranderrk St - Anzac Pde & Blamey Cres - Northcott Dr	C	B	E	D	E	D	D
19	3	Northcott Dr duplication	Constitution Ave - Fairbairn Ave and associated intersection improvements	E	B	E	B	E	B	B
20	3	Clunies Ross St duplication	Parkes Way ramps to Barry Dr and associated intersection improvements	F	C	F	C	F	C	C
21	3	Clunies Ross St/ Parkes Way ramps	Build new west facing ramps and new signals on Clunies Ross	C	C	C	C	C	C	C
23	3	Fairbairn Ave duplication	Morshead Dr - Northcott Dr	F	B	F	D	F	D	D

Table 22: Changes in Intersection Delay

		Intersection works				2011 Ave Delay				2021 Ave Delay				2031 Ave Delay			
Item	Priority	Description	Do Nothing	Do Project	Do Nothing	Do Project	Do Nothing	Do Project	Do Nothing	Do Project	Do Nothing	Do Project	Do Nothing	Do Project	Do Nothing	Do Project	
1	1-3	Streeton Dr/ Cotter Rd intersection	32.5	N/A	201.7	20.8	631.2	22.8									
2	1-3	Cotter Rd/McCulloch St intersection	49.7	30.1	63.8	20.5	82.6	33.6									
3	1-3	Cotter Rd/Lady Denman Dr intersection	40.9	28.1	42.7	21.7	22.5	21.7									
9	1-3	Morshead Dr/Russell Dr intersection	118.5	25.1	60.6	20	368.3	38.6									
14	2-3	Parques Way/ Commonwealth Ave works	565.3	44.3	N/A	N/A	N/A	N/A									
15	2-3	Parques Way/ Commonwealth Ave works	565.3	44.3	N/A	N/A	N/A	N/A									
17	2-3	Parques Way/ Coranderrk Street works	96.1	61.9	88	26	77	58.8									
22	3	Minindee Dr link to Kings Ave	118	25	61	20	368	39									

Table 23: Changes in Midblock and Ramp Volume to Capacity Ratio

Midblock & Ramp works		2011 V/C	2021 V/C	2031 V/C
4	1	1.26	1.39	1.46
5	1	1.26	1.39	1.46
6	1	1.1	1.18	1.22
7	1	0.36	0.36	0.46
8	1-3	0.48	0.93	0.61
10	2	0.8	1.7	2.4
11	2	2.2	2	2.1
12	2	1.6	1.8	1.9
13	2	0.83	0.98	0.95
16	2-3	1.33	1.45	1.54

Midblock & Ramp works		2011 V/C	2021 V/C	2031 V/C
Item	Description	Do Nothing	Project	Do Nothing
18	3 Constitution Ave duplication	0.48	0.32	0.91
	Coranderk St - Anzac Pde & Blamey Cres - Northcott Dr	0.93	0.61	0.6
19	3 Northcott Dr duplication	0.77	0.37	0.83
	Constitution Ave - Fairbairn Ave and associated intersection improvements	0.78	0.37	0.39
20	3 Clunies Ross St duplication	1.4	0.51	1.5
	Parkes Way ramps to Barry Dr and associated intersection improvements	1.6	0.52	0.53
21	3 Clunies Ross St/ Parkes Way ramps	0.36	0.36	0.46
	Build new west facing ramps and new signals on Clunies Ross	0.36	0.36	0.46
23	3 Fairbairn Ave duplication	1.4	0.42	2.1
	Morshead Dr - Northcott Dr	2.1	0.63	0.65

## 7.4 Other Factors

Table 24 provides an outline of other potential impacts and benefits of the works packages.

**Table 24: Other Potential Impacts and Benefits**

Impact/ Benefit	Package 1	Package 2	Package 3
Physical and construction impacts	<ul style="list-style-type: none"> <li>• The widening of Parkes Way can be done in the median with some reduction in average travel speeds during construction, but no adverse environmental impacts.</li> <li>• Bridge widening will be necessary over Clunies Ross Street and Sullivans Creek; the latter to maintain the cyclepath connection. The construction activity may impact on the creek and traffic flows.</li> <li>• The widening of Constitution Avenue will impact traffic movements during construction and some of the existing trees.</li> <li>• The replacement of roundabouts with traffic signals at the intersections of Cotter Road/Kirkpatrick Street, Cotter Road/Lady Denman Drive and Morshead Drive/Russell Drive will have a significant impact on traffic during construction.</li> </ul>	<ul style="list-style-type: none"> <li>• The duplication of Cotter Road will require the construction of some new bridges over Weston Creek and Yarralumla Creek, which could impact on the local environment, but are likely to have little impact on traffic flows.</li> <li>• The widening of Adelaide Avenue will affect traffic operations during construction. Construction noise, vibration and dust may also be an issue in the vicinity of existing development in Deakin and Yarralumla.</li> <li>• The reconstruction of the Commonwealth Avenue/ Parkes Way interchange will have a significant impact on the operations of Commonwealth Avenue and access to/from London Circuit. Detailed investigations are needed to develop options for staging these works.</li> <li>• Similar impacts to Package 1 on Constitution Avenue and for the roundabouts being reconstructed.</li> </ul>	<ul style="list-style-type: none"> <li>• The duplication of Fairbairn Avenue and Northcott Drive will require the construction of some new bridges, which could impact on the local environment, but are likely to have little impact on traffic flows.</li> <li>• The construction of new west facing ramps on Parkes Way connecting to Clunies Ross Street could impact on Black Mountain. More detailed investigations are required to determine possible impacts.</li> <li>• Similar impacts to Package 2 for the reconstruction of the Commonwealth Avenue/ Parkes Way interchange.</li> <li>• Similar impacts to Package 1 on Constitution Avenue and for the roundabouts being reconstructed, although the impacts on Constitution Avenue will be more extensive.</li> </ul>

Impact/ Benefit	Package 1	Package 2	Package 3
Traffic redistribution and congestion	<ul style="list-style-type: none"> <li>The main change in traffic flows would be about 1,100/1,400 more vehicles per AM peak hour on Parkes Way in 2021/2031 and 350 veh per hour less on the adjacent section of Lady Denman Drive (a 35% reduction). There would also be increased traffic on Tuggeranong Parkway, GDE and William Hovell Drive attracted to Parkes Way. An additional 500-650 veh per hour on the ramps from both GDE and Tuggeranong Parkway to Parkes Way would create increased delays and queueing on these ramps.</li> <li>In 2031, the Acton tunnel would be highly congested, with 6,200 veh/hr with widening of Parkes Way and 5,400 veh/hr without the widening.</li> </ul>	<ul style="list-style-type: none"> <li>The main change in traffic flows would be 1,200 to 1,500 more vehicles per AM peak hour on Cotter Road in 2021 to 2031 (about 50 to 75% more traffic in the peak direction). There would also be increased traffic on Tuggeranong Parkway attracted to Cotter Road, but a reduction of 200 to 250 veh per hour on the northbound ramp from Cotter Road to Tuggeranong Parkway. There would also be a reduction in traffic on Yarra Glen (about 300 to 350 veh per hour), but very little change in traffic using McCulloch Street.</li> <li>There would be little change in traffic using Parkes Way, but traffic conditions would be much improved near City.</li> </ul>	<ul style="list-style-type: none"> <li>The main change in traffic flows would be 550 more vehicles per AM peak hour on Fairbairn Avenue in 2021 to 2031 (about 35% more traffic in the peak direction). There would also be increased traffic on Monaro Highway attracted to Fairbairn Avenue from Morshead Drive (250 veh per hour less traffic on Morshead Drive).</li> <li>There would be some increase in traffic on Parkes Way in the vicinity of Black Mountain (about 200 veh per hour in both directions), due to the new Clunies Ross Street ramps. There would also be some increases in traffic on GDE and Tuggeranong Parkway, but the increased flows on the ramps leading to Parkes Way would be small.</li> </ul>
Road safety	<ul style="list-style-type: none"> <li>The widening of Parkes Way would provide an opportunity to address road alignment problems adjacent to Black Mountain, one of the worst mid-block accident locations in Canberra.</li> </ul>	<ul style="list-style-type: none"> <li>The duplication of Cotter Road and improvements to Adelaide Avenue and Parkes Way would greatly improve road safety in these sections of road.</li> </ul>	<ul style="list-style-type: none"> <li>The duplication of Fairbairn Avenue, Northcott Drive and Constitution Avenue would greatly improve road safety in these sections of road. Improvements to Parkes Way would also improve road safety.</li> </ul>
Heritage	<ul style="list-style-type: none"> <li>No impacts if the Anzac Pde median is not changed</li> </ul>	<ul style="list-style-type: none"> <li>No impacts if the Anzac Pde median is not changed</li> </ul>	<ul style="list-style-type: none"> <li>No impacts if the Anzac Pde median is not changed</li> </ul>

Impact/ Benefit	Package 1	Package 2	Package 3
Flora and fauna impacts	<ul style="list-style-type: none"> <li>No impacts likely as proposed works are within the road reserve</li> </ul>	<ul style="list-style-type: none"> <li>No impacts likely as proposed works are within the road reserve</li> </ul>	<ul style="list-style-type: none"> <li>Proposed Clunies Ross Street ramps with Parkes Way would trigger the need for an environmental study, but there are no recorded threatened species in this area</li> </ul>

## 8.0 Recommendations and Conclusions

### 8.1 Traffic Flows and Growth

Key roads in the EW corridor are some of the busiest roads in Canberra. The high volumes through Glenloch Interchange are most notable.

The results of the traffic modelling showed consistent growth in traffic on Parkes Way, Morshead Drive, Pialligo Avenue, Monaro Highway-Majura Road corridor and Cotter Road west of Tuggeranong Parkway. This growth will generally be higher than growth elsewhere in Canberra and is predicted to remain relatively high for the next 10 years, then it is predicted to flatten off.

The highest growth in the next 10 years will be roads near the airport and Molonglo. The new development in Molonglo is predicted to generate about 40,000 vehicle per day in the Cotter Road and Tuggeranong Parkway corridors, via two new arterial roads that will be built to service Molonglo.

The construction of Majura Parkway and new development in Gungahlin, the Majura Valley and in Queanbeyan will generate significant additional traffic on Monaro Highway, Morshead Drive and Pialligo Avenue. There would also be some growth on Fairbairn Avenue, although this is restricted by its limited capacity.

### 8.2 Existing Deficiencies

#### 8.2.1 Road Safety Deficiencies

There are a number of locations in the EW road corridor that have relatively high crash rates<sup>13</sup>, including:

- The Kings Avenue/Parkes Way roundabout – crashes will be reduced by the construction of the proposed single-point interchange here
- Coranderrk Street/Parkes Way roundabout
- Parkes Way adjacent to Black Mountain
- Lady Denman Drive intersection near Lakeside Interchange – traffic signals recently installed
- Anzac Parade/ Parkes Way roundabout
- Tuggeranong Parkway between Cotter Road and Lakeside Interchange

#### 8.2.2 Physical Freeway Ramp Deficiencies

An examination of the existing road network in the EW corridor identified a number of deficient road elements. An assessment of ramp spacings identified the following sections to be deficient:

- Entry/exit ramps between Novar Street/ Kent Street and Hopetoun Circuit (both directions)
- Eastbound entry ramp from Hopetoun Circuit and the Empire Circuit intersection
- Westbound entry ramp from State Circle and exit ramp to Hopetoun Circuit
- The westbound exit ramp to Kent Street and the exit ramp to Cotter Road
- Lakeside interchange ramps and Glenloch interchange ramps
- Successive entry/exit ramps eastbound on Parkes Way between Edinburgh Avenue and Commonwealth Avenue
- Westbound entry ramp from Commonwealth Avenue to Parkes Way and the Lawson Crescent exit

<sup>13</sup> Locations with high accident occurrence in ACT in the 7 year period from 2001 to 2007 - amongst the highest 100 intersections and highest 50 mid-block locations in ACT (TAMS 2008).

In addition, the following ramps are considered to have inadequate length or have sight distance restraints:

- Eastbound entry ramp from Cotter Road to Adelaide Avenue
- The entry and exit ramps to/from Novar Street, Kent Street and Hopetoun Circuit
- Northbound entry ramp from Cotter Road onto Tuggeranong Parkway
- The Lakeside interchange ramps
- The entry and exit ramps to/from Commonwealth Avenue, Edinburgh Avenue and Lawson Crescent
- The proposed entry/exit ramps on Morshead Drive at the future Kings Avenue interchange and the Morshead Drive/Russell Drive roundabout

### **8.2.3 Freeway Ramp Capacity Deficiencies**

The results of the AM peak hour ramp analyses indicated that the following ramps are in most need of attention in future:

- Southbound merge from GDE to Parkes Way
- Northbound from Tuggeranong Parkway to Parkes Way
- Eastbound from Clunies Ross Street to Parkes Way
- Northbound from Cotter Road to Tuggeranong Parkway
- Eastbound from Cotter Road to Adelaide Avenue
- Eastbound from Novar Street to Adelaide Avenue
- Southbound from Parkes Way/London Circuit to Commonwealth Avenue

An analysis of weaving movements indicated that weaving movements greatly affect the operation of Parkes Way between Clunies Ross Street and Coranderrk Street. This section should be a priority for improvements.

### **8.2.4 Mid-block Road Capacity Deficiencies**

An analysis of midblock capacities and level of service indicated that most of the roads in the EW corridor are and will continue to be congested in peak hours. Key observations from the results of these analyses are:

- New arterial roads accessing Molonglo from Cotter Road and Tuggeranong Parkway are likely to ultimately require a 4-lane divided cross-section
- Cotter Road should desirably be widened to a 4-lane divided cross-section in future, between the proposed new access to Molonglo and Yarra Glen interchange
- Tuggeranong Parkway may need to be widened to 6 lanes between Cotter Road and Parkes Way in future
- Pialligo Avenue should desirably be widened to a 4-lane divided cross-section in future, between the airport access and the NSW border
- Fairbairn Avenue will need to be upgraded east of Northcott Drive and desirably duplicated through to Treloar Crescent
- The capacity of Parkes Way and Morshead Drive needs to be increased, possibly by widening these roads or improving intersection/interchange operation
- The roads around Russell will require additional capacity

### 8.2.5 Intersection Capacity Deficiencies

The analyses of key intersection in the EW corridor identified the need for the following works:

- Morshead Drive/Russell Drive – reconstruction of the existing roundabout as a signalised intersection should be considered within the next 5 years, with restricted (left-in/left-out) access into Minindee Drive in future when an alternative access is provided via Kings Avenue
- Parkes Way/Anzac Parade – Parkes Way will need to be tunnelled under the existing roundabout and ramp connections provided to the roundabout within the next 10 years
- Anzac Parade/Constitution Avenue – the box turn arrangement at this intersection has limited capacity and affects road safety, but there are limited options for improvements here so increases in traffic demand through this intersection need to be restricted by providing alternative routes to new development along Constitution Avenue
- Parkes Way/Coranderrk Street – reconstruction of the existing roundabout as a signalised intersection should be considered within the next 5 to 10 years, with provision in the design for Parkes Way to flyover this intersection in the longer-term future; in the short-term, an investigation of the implementation of signal metering of right turns from Parkes Way East to Coranderrk Street should be investigated
- Constitution Avenue/Coranderrk Street – an upgrade of the capacity of this intersection is required as soon as possible to reduce the likelihood of queueing back into the Parkes Way roundabout
- Cotter Road/Streeton Drive – a major upgrade in capacity within the next 5 to 10 years to accommodate traffic from Molonglo
- Cotter Road/McCulloch Street – extra capacity in the next 5 years by extending the length of the eastbound through lane
- Bindubi Street/William Hovell Drive – extra capacity within the next 5 years and should be grade-separated when the Molonglo distributor road connection is built here
- Cotter Road/Lady Denman Drive – reconstruction of the existing roundabout as a signalised intersection within the next 5 to 10 years
- Cotter Road/Kirkpatrick Street – reconstruction of the existing roundabout as a signalised intersection when access via a fourth leg is needed to North Weston

### 8.2.6 Trunk Cycling and Walking Path Deficiencies

There are a number of gaps in the trunk cycling and walking path network. A recent study by CBRE identified priorities for improvements to the Trunk Cycling and Walking Network. Key works worthy of consideration as part of proposed roadworks in the corridor include:

- Cotter Road 1 – Streeton Drive to Yarralumla Creek (\$310k)
- Cotter Road 2 (\$350k)
- Cotter Road 3 (\$730k)
- Constitution Ave
- Russell Drive

Some of these works are currently being progressed.

### 8.2.7 Bridge Deficiencies

The strength, width and vertical clearance of bridges are key elements that affect vehicle access on the major road network. Bridges requiring strengthening in the EW corridor include:

- Cotter Road bridge over Weston Creek
- Cotter Road bridge over Tuggeranong Parkway
- Tuggeranong Parkway bridge over Molonglo River

- Adelaide Avenue bridges over Hopetoun Circuit
- Parkes Way bridges over Clunies Ross Street
- Commonwealth Avenue bridges over Parkes Way

Key bridges with width or vertical clearance deficiencies include:

- Cotter Road bridge over Weston Creek
- Cotter Road bridge over Tuggeranong Parkway
- Tuggeranong Parkway bridge over Molonglo River
- Kent Street bridge over Adelaide Avenue
- Adelaide Avenue bridges over Hopetoun Circuit
- Parkes Way bridges over Clunies Ross Street
- Edinburgh Avenue bridge over Parkes Way
- Commonwealth Avenue bridges over Parkes Way
- Pedestrian footbridges over Parkes Way near City (vertical clearance)
- Parkes Way bridges over Wendouree Drive
- Pialligo Avenue over Woolshed Creek

## **8.3 Road Infrastructure Improvement Packages**

### **8.3.1 A Description of the Packages**

Three generic infrastructure packages that include a range of projects for consideration in the short- to long-term were developed and evaluated. They represented strategies with different geographic foci. In summary, the packages were:

1. Parkes Way West Widening – includes an additional lane in the median of Parkes Way between Glenloch Interchange and Acton Tunnel, duplication of parts of Constitution Avenue and key intersection improvements
2. Cotter Road Duplication – includes the duplication of Cotter Road between Tuggeranong Parkway and Adelaide Avenue, new ramps at the Yarra Glen interchange, widening of Adelaide Avenue between Yarra Glen and State Circle, a single point interchange at Commonwealth Avenue/ Parkes Way, duplication of parts of Constitution Avenue and key intersection improvements
3. Fairbairn-Northcott-Constitution Duplication – includes the duplication of Fairbairn Avenue between Morshead Drive and Northcott Drive, duplication of Northcott Drive, duplication of Constitution Avenue, new ramps at the Clunies Ross Street Interchange, duplication of Clunies Ross Street, a single point interchange at Commonwealth Avenue/ Parkes Way, the extension of Minindee Drive to Kings Avenue and key intersection improvements

### **8.3.2 Costs and Benefits of the Packages**

A summary of the probable capital costs and economic return of each of the packages is summarised in Table 25, based on an assessment of the transport benefits of each project. It shows that each of the packages is economically feasible. The Parkes Way West package will provide the best economic return in terms of an economic assessment of transport benefits. However, elements of packages 2 and 3 include other benefits that cannot be quantified in this project (eg., return on land sales from land currently constrained by road infrastructure, increased).

### 8.3.3 Traffic Impacts of the Packages

An overall summary of the network impacts of the various packages, in terms of changes in the amount of travel and average travel speeds in the AM peak, is given in Table 26. It shows marginal overall improvements for each package, but they add up in terms of economic benefits over a 20 year or more period.

**Table 25: Economic Costs and Benefits of Packages**

Package	Cost	Net Present Value	Benefit Cost Ratio
1. Parkes Way West Widening	\$36.0M	\$276.8M	8.7
2. Cotter Road Duplication	\$154.3M	\$163.5M	2.1
3. Fairbairn-Northcott-Constitution Duplication	\$145.4M	\$58.2M	1.4

*Note: Based on a 7% discount rate, a 20 year evaluation period and constant 2009 prices*

**Table 26: Changes in the Amount of Travel for the Packages**

Package	Year	Vehicle Km (Millions)		Vehicle Hours (Thousands)		Average Speed (km/h)	
		Do Nothing	Project	Do Nothing	Project	Do Nothing	Project
Parkes Way West Widening	2011	1.690	1.689	32.3	31.7	52.4	53.2
	2021	1.931	1.937	44.8	44.3	43.1	43.7
	2031	2.065	2.074	56.9	56.7	36.3	36.6
Cotter Road Duplication	2011	1.690	1.689	32.3	32.1	52.4	52.6
	2021	1.931	1.935	44.8	44.3	43.1	43.7
	2031	2.065	2.071	56.9	56.5	36.3	36.7
Fairbairn-Northcott-Constitution Duplication	2011	1.690	1.690	32.3	32.1	52.4	52.6
	2021	1.931	1.932	44.8	44.6	43.1	43.3
	2031	2.065	2.068	56.9	56.7	36.3	36.5

*Note: Based on EMME model predictions for the AM peak period*

More specific benefits in terms of changes in the performance of elements of the road system are evident when specific locations where improvements are proposed are examined. A good example is the widening of Parkes Way between Glenloch Interchange and Acton Tunnel; the primary works element in package-one. Outputs from simulation modelling of Glenloch Interchange show marked benefits of building the extra lanes.

However, there are concerns that widening Parkes Way would put considerable added pressures on the ramps leading to Parkes Way at Glenloch Interchange and at Clunies Ross Street. These ramps are already at capacity and the widening of Parkes Way would make them worse, as well as increasing pressures on Tuggeranong Parkway north of Cotter Road and the Acton Tunnel.

It was found that additional west-facing ramps at Clunies Ross Street/Parkes Way would have little benefit to traffic movements and may adversely impact on adjoining land-uses. Thus, these ramps are not worth further consideration.

Another high priority work that could be beneficial from a traffic perspective is the reconstruction of the Morshead Drive/Russell Drive junction as a signalised intersection. This would greatly reduce AM peak queues and delays at this intersection (from 119s/veh to 25s/veh) and would encourage City-bound traffic to use Parkes Way rather than Russell Drive, reducing pedestrian/vehicle conflicts in Russell. A feasibility study should also be instigated to investigate the extension of Minindee Drive to Kings Avenue, so that access at Morshead Drive can be restricted to left-in/left-out in future to extend the life of a signalised intersection at this location.

#### 8.3.4 Other Future Works and Investigations

There are strong reasons to examine more closely improvements to Parkes Way between Edinburgh Avenue and Anzac Parade, as this section of road is possibly the most congested in the EW corridor. A feasibility study should be instigated to examine the engineering options and economic impacts of the reconstruction of the Commonwealth Avenue/Parkes Way interchange as a single-point interchange.

Other possible improvements on Parkes Way that are worth more detailed consideration for implementation in the short-term are:

- Reconstruction of the Coranderrk Street/Parkes Way intersection as signals. This should be built in conjunction with capacity improvements to the Coranderrk Street/Constitution Avenue intersection.
- New traffic signals to control the movements of vehicles and queueing on the Parkes Way exit ramp to Commonwealth Avenue and conflicts with traffic from London Circuit. This would need to ensure that bus movement delays are minimised via transponders in buses influencing signal green times.
- Extending the west-bound off-ramp from Parkes Way to Commonwealth Avenue to form an add lane, so that traffic can merge at speed.

Furthermore capacity improvements to key intersections along Cotter Road, Constitution Avenue and at Morshead Drive/Russell Drive identified in this report should be investigated in more detail. In particular, studies should be instigated to develop PSP designs for improvements at these locations. GHD are already developing a PSP design for the Streeton Drive/Cotter Road intersection, using recommendations from this study.

### 8.4 Works Priorities

An assessment of existing conditions and potential works packages identified a list of priorities for future investigations, design and construction in the EW corridor. These are shown in Table 27 and they largely include works from Package 1 but also other works considered important from other packages or investigations. In summary, the probable costs<sup>14</sup> for the works identified in the EW corridor are as follows:

- 2009-2011: \$0.5M
- 2011-2014: \$21.4M
- 2014-2019: \$52.5M
- 2019+: \$20.0M
- Total \$94.3M

<sup>14</sup> In 2009 dollars

**Table 27: EW Corridor Works Priorities**

Item	Location	Description of Works	Cost (\$k)	Timing (years)
1	Commonwealth Ave bridges over Parkes Way	Investigation study	50	0-2
2	Constitution Ave - London Cct to Blamey Cres	Study & PSP design of duplication	200	0-2
3	EB Parkes Way exit ramp to Commonwealth Ave	Study & PSP design for ramp metering signals	50	0-2
4	NB on Tuggeranong Pwy between Cotter Rd and Glenloch interchange	Study to investigate potential road widening	100	0-2
5	Parkes Way bridges over Clunies Ross St	Investigation study	50	0-2
6	Parkes Way EB between Clunies Ross Street and Edinburgh Ave	Investigation study	50	0-2
7	Widening of Parkes Way - Acton Tunnel to Kings Ave	Feasibility study	250	0-2
8	Yarra Glen and Adelaide Avenue between Carruthers St and Coronation Dr	Study to investigate interchange capacity improvement strategy	100	2-5
9	Anzac Pde/Constitution Ave	Redesign and capacity upgrade (refer 5.3)	250	2-5
10	Constitution Ave/Coranderk St	Redesign and capacity upgrade (refer 5.3)	1000	2-5
11	Cotter Rd - McCulloch St to Yarra Glen	Road widening and upgrade	1800*	2-5
12	Cotter Rd - Streeton Dr to Yarra Glen	On-road cycle paths	310	2-5
13	Cotter Rd/Kirkpatrick St	Reconstruct existing roundabout as signals (refer 5.3)	4000	2-5
14	Cotter Rd/Lady Denman Dr	Reconstruct existing roundabout as signals (refer 5.3)	800	2-5
15	Cotter Rd/McCulloch St	Redesign and capacity upgrade (refer 5.3)	250	2-5
16	Cotter Rd/Streeton Dr	Redesign and capacity upgrade (refer 5.3)	6100	2-5
17	Dixon Dr/Streeton Dr	Construct 2-lane roundabout	3600	2-5
18	East-West Arterial link from Tuggeranong Parkway to Lady Denman Dr	Feasibility study for new road	100	2-5

Item	Location	Description of Works	Cost (\$k)	Timing (years)
19	Fairbairn Ave between Majura Rd and Northcott Dr	Road widening and upgrade	9300	2-5
20	Kings Ave (CBRE)	On-road cycle paths	200	2-5
21	Morshead Dr and Pialligo Ave between Kings Ave and the NSW border	Study to investigate alternative route and upgrading options	150	2-5
22	Minindee Dr link to Kings Av	Design investigation study	50	2-5
23	Morshead Dr/Russell Dr	Design and reconstruct existing roundabout as signals	800	2-5
24	Northcott Dr	Study to investigate road widening and safety upgrade	50	2-5
25	Widening of Parkes Way - Glenloch interchange to Acton Tunnel	Design study to investigate adding another lane	100	2-5
26	Parkes Way/Anzac Pde	Grade separation of Parkes Way under Anzac Pde roundabout	40000	5-10
27	Parkes Way/Coranderrk St	Design and reconstruct existing roundabout as signals	2000+	5-10
28	Russell Dr (CBRE)	On-road cycle paths	250	5-10
29	Bindubi St/William Hovell Dr	Grade separation with addition of new road from Molonglo	20000	10-20

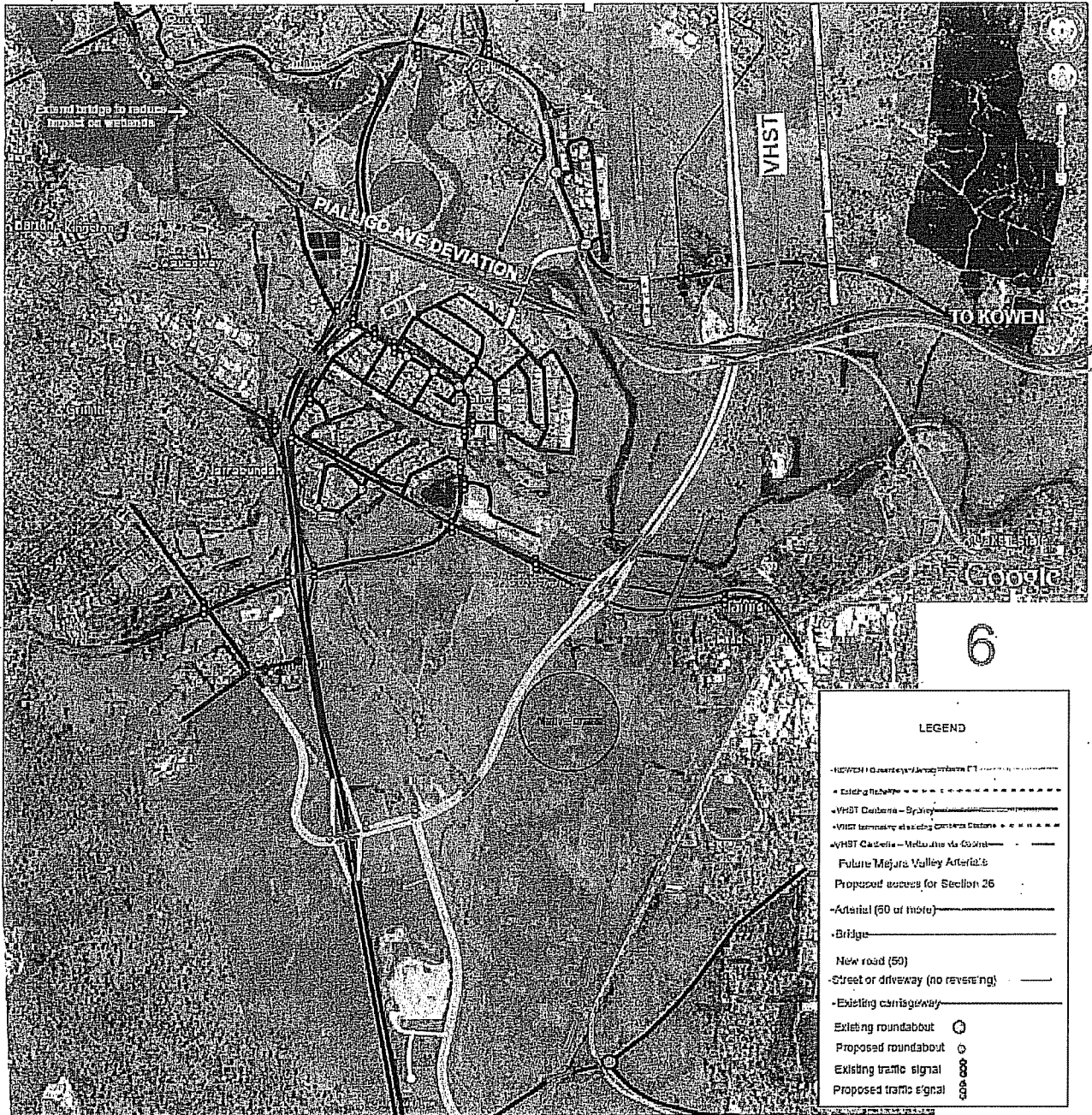
\* Approximate, as some works are currently being done on Cotter Road  
+ Includes an allowance of \$1M for a new pond/GPT

The eastern end of the corridor has already seen significant road improvement activity and this will continue with the announcement of funds for the first stage works of Majura Parkway. However, issues still remain in this part of the corridor that will need to be addressed to cater for increased traffic from continued growth around the airport, Queanbeyan, Majura Valley and Kowen in future. The main problems that will remain to be addressed in the eastern part of the corridor are:

- At-grade intersections and local accesses on Morshead Drive and on Pialligo Avenue east of the new airport access;
- The tight alignment of Morshead Drive near Duntroon and Pialligo Avenue near the NS runway;
- The future alignment of the Very High Speed Train;
- The future extension of the NS runway; and
- The development of a future parallel NS runway and possible new roads and terminal.

There are no easy solutions. One option to consider is illustrated in Figure 62. A study needs to be instigated to examine long-term options for major road improvements in the eastern part of the corridor, including future connections to Kowen and the proposed Queanbeyan Northern Bypass.

**Figure 62: Potential Pialligo Avenue Deviation**



Source: SMEC (2009)

# Appendix A Outline of Paramics Micro-simulation Models

## Appendix A Outline of Paramics Micro-simulation Models

Paramics micro-simulation models were created for the east-west corridor, covering all key roads in the corridor as shown in Figure 63. The models were created for the AM peak hour for 2006 (base calibration year), 2011 and 2021. A base case and project case model were created for 2011 and 2021. The base case included expected and committed works for each year, whilst the project case included proposed works that form part of the recommended works package.

### Base Year (2006) Model Development and Calibration

The network geometry was identified based on topographical CAD drawings, as well as the aerial photos. The network attributes, such as the number of lanes, lane widths and lengths, turn bans, stop locations, lane markings and speed limits, were modelled based upon the aerial photos provided by TAMS and site visits.

Traffic data from various sources have been incorporated as a stream of inputs to the Paramics models. The relevant traffic inputs included:

- Recent AM peak hour traffic counts from various sources, including previous projects, SCATS data and TAMS publications – these were factored to 2006 estimates using assumed growth rates
- A set of AM peak OD data from the 2006 Canberra EMME model
- Traffic signals data from SCATS

In order to ensure accurate representation of the existing network in Paramics, calibration of base year model is required. Calibration is the process through which various parameters within the program are fine tuned to improve the operation of the simulation without undermining the accuracy of the input data.

The calibration of the model included (but was not limited to) the following adjustments:

- Moderate alterations to the signal timing, in order to avoid the vehicles in front of the stop line queuing back to the main roads;
- Driver reaction and vehicle headway factors were modified to reflect the high level of traffic throughput along Parkes Way;
- Visibility distance was increased to 15m at each arriving approach of roundabouts;
- Gap acceptance parameter was adjusted to 1.0; and
- Network geometry optimization (e.g. stopline location, lane alignment) was made to properly model the merging and diverging movements of vehicles.

In order to test the stability of the Paramics models, "Random Seed Analysis" is applied to represent different release patterns of trips. With different random seeds, the trip matrix, network geometry, signal operations remain the same, while the release of individual vehicles onto network varies.

To be able to demonstrate the accuracy of the simulation models, model output results need to be compared with on street measurements. The Table 28 indicates the relevant target set out in the UK Design Manual for Roads and Bridges (DMRB):

The following tables show the flow difference and GEH between the modelled and observed flows during the AM and PM Peak periods. Tables 29 to 32 summarise the results over the calibration criteria. The overall results indicate that there is a good model calibration based on the match with traffic flows.

The models have been verified internally. All the necessary actions have been taken and the outcomes meet the satisfaction of the verifier.

Figure 63: Extent of East West Paramics Model

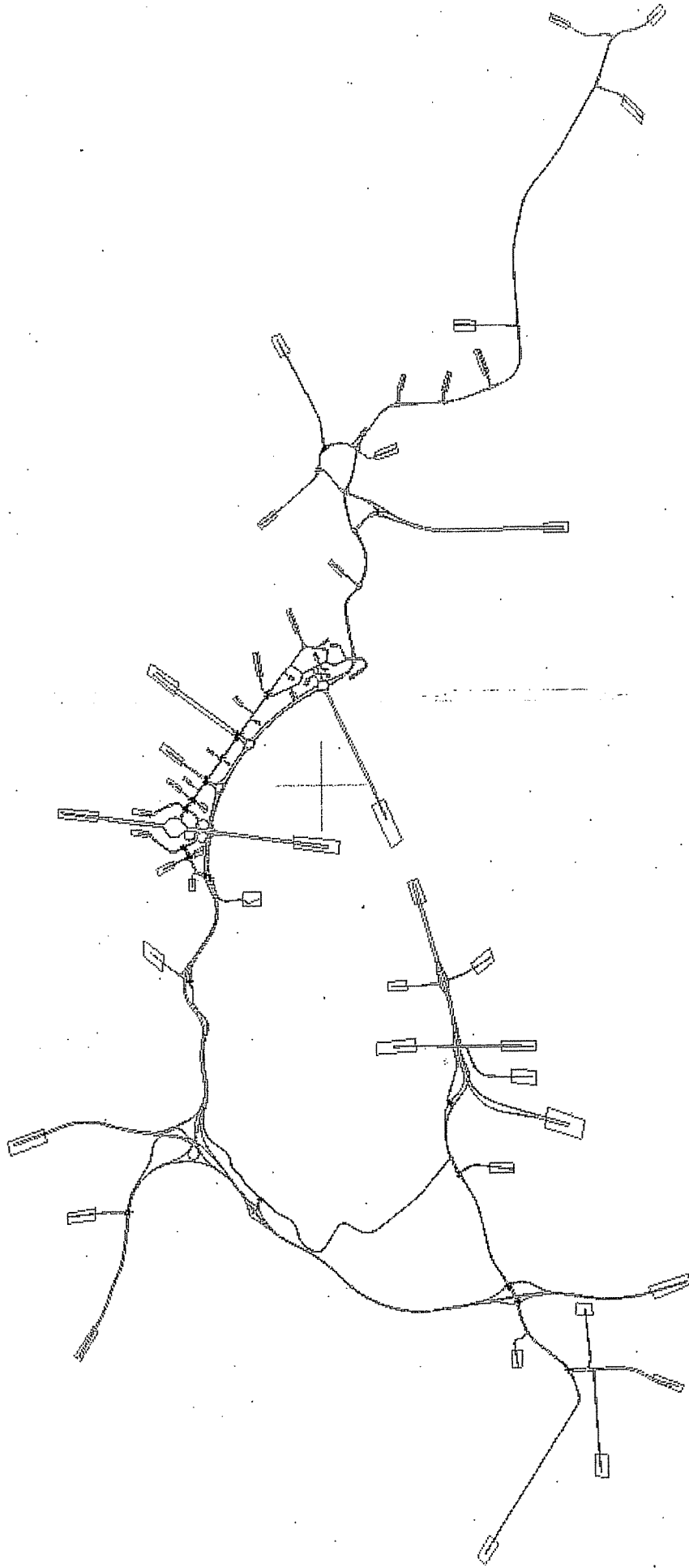


Table 28: Paramics Model Calibration Criteria

Criteria and Measurements for Individual Link Flows	Calibration Acceptable Targets
Within 15%, for 700veh/h < Flow < 2700veh/h	>85% of cases
Within 100veh/h, for Flow < 700veh/h	>85% of cases
Sum of all link flows difference	< 5%
GEH Statistics < 5 for individual link flows	>85% of cases

Source: UK Design Manual for Roads and Bridges (Vol 12a, Chapter 4)

Table 29: Calibration Results Summary

Measurements	Target	Total Counts Considered	No. of Counts Meet the Criteria	Percent of Counts Meet the Criteria
Flow difference within 15% or 100	>85%	98	86	88%
GEH < 5	>85%	98	86	88%
Sum of all link flow difference	<5%	Modelled sum of all link flow difference: 1%		

Table 30: Internal Zones Calibration Summary

	Internal Zones (Carpark/Commercial Areas)	Observed	Modelled	GEH	Observed	Modelled	GEH
48	North of Consitution Ave & between Binara St and	211	211	0.0	838	713	4.5
49	North of Consitution Ave & between Anzac Pde an	62	60	0.2	1,276	1138	4.0
50	North of Constitution Ave & east of Anzac Pde	151	159	0.7	139	177	3.0
51	South of Constitution Ave & east of Anzac Pde	5	3	1.0	18	23	1.1
52	South of Consitution Ave & between Anzac Pde an	130	123	0.6	198	151	3.6
53	South of Russell Dr & west of Kings Ave	118	120	0.2	542	455	3.9
54	North of Parkes Way & east of Kings Ave	48	49	0.2	226	245	1.3
55	North of Russell Dr & west of Kelliher Dr	100	119	1.8	350	334	0.9
56	North of Russell Dr & west of Vivian Bullinkel Way	63	52	1.5	228	204	1.6
57	North of Parkes Way & west of Kings Ave	29	19	2.0	134	138	0.4
58	South of Russeell Dr & east of Kings Ave	42	38	0.6	199	232	2.2
59	South of Constitution Ave & west of Reg Saunders	18	19	0.1	87	97	1.1
60	North of Sellheim Ave	5	6	0.3	25	22	0.6
	Total	982	978	0.1	4261	3929	3.2

Table 31: External Zones Calibration Summary

External Zones	Origin			Destination			
	Observed	Modelled	GEH	Observed	Modelled	GEH	
1	Pialligo Ave west of Yass Rd and Sutton Rd	1,160	1,147	0.4	850	882	1.1
2	William Hovell Dr (near Bindubi St)	2,778	2,749	0.6	1,070	982	2.7
3	Adelaide Ave (near Empire Cct)	995	1,033	1.2	3,782	3,660	2.0
4	Cotter Rd (near Settlement Dr)	478	543	2.9	243	283	2.5
5	Tuggeranong Pkwy (towards Cotter Rd)	2,847	2,873	0.5	1,560	1,443	3.0
6	Caswell Dr	1,811	1,914	2.4	1,362	1,375	0.4
7	Monaro Hwy	2,295	2,386	1.9	1,607	1,658	1.3
8	Majura Rd (meeting Fairbairn Ave)	1,081	1,137	1.7	370	377	0.4
9	Streeton Dr (to Streeton Dr near Heysen St)	1,667	1,662	0.1	505	553	2.1
10	Vernon Cir	2,172	2,173	0.0	2,182	2,124	1.2
11	Commonwealth Ave	4,213	4,266	0.8	4,462	4,312	2.3
12	Unwin Pl	208	286	5.0	231	226	0.4
13	Kirkpatrick St	20	10	2.6	80	76	0.5
14	Hopetoun Cct (near Gawler Cres)	284	329	2.5	221	158	4.6
15	Yarra Glen	2,559	2,463	1.9	900	931	1.0
16	Clunies Ross St	674	704	1.1	628	698	2.7
17	Lawson Cres	102	116	1.3	70	97	3.0
18	Hales St	0			250	276	1.6
19	Marcus Clarke St (near Gordon St)	191	230	2.7	850	882	1.1
20	Dixon Dr (to Streeton Dr)	385	427	2.1	111	92	1.9
21	Allara St	96	121	2.4	385	389	0.2
22	Marcus Clarke St (near Capital Tower)	41	47	0.9	101	80	2.2
23	London Cct (near Nangari St)	492	542	2.2	739	813	2.7
24	Coranderrk St	911	968	1.9	937	918	0.6
25	Anzac Pde	1,058	1,159	3.0	553	495	2.5
26	Kings Ave	2,123	2,101	0.5	1,622	1,543	2.0
27	Blamey Cres	334	308	1.5	157	116	3.5
28	Northcott Dr	274	277	0.2	255	197	3.9
29	Menindee Dr	10	11	0.3	15	12	0.8
30	Staff Cadet Ave	230	212	1.2	280	270	0.6
31	McCulloch St	441	467	1.2	441	474	1.5
32	Fairbairn Ave (meeting Moreshed Dr)	602	627	1.0	1,130	1,071	1.8
33	Beltana Rd	30	22	1.6	34	24	1.8
34	Novar St (near Kintore Cres)	182	246	4.4	262	236	1.6
35	Nomad Dr	111	98	1.2	111	95	1.6
36	Ulinga Pl	446	464	0.8	936	878	1.9
37	Brindebella Cct	270	266	0.2	268	212	3.6
38	Brindebella Cct	178	192	1.0	178	156	1.7
39	Glenora Dr	89	69	2.3	89	76	1.5
40	Oaks Estate Rd	402	468	3.2	153	160	0.6
41	Hopetoun Cct (near Hampton Cct)	109	113	0.4	50	63	1.7
42	Denison St	42	50	1.2	154	109	4.0
43	Bindubi St	780	816	1.3	680	659	0.8
44	Carpark access to Cnr of London Cct & Constitution	49	61	1.6	453	381	3.5
45	London Cct (near Gordon St)	107	103	0.4	1,218	1,135	2.4
46	Binara St	237	296	3.6	183	239	3.9
47	Kent St	409	432	1.1	710	699	0.4



### **Future Year Model Assumptions**

The base year (2006) model was updated to 2011 and 2021 models using different road network and trip assumptions. The assumed road improvements included in each of the future year models is summarised in Figures 64 to 67. The assumed zonal traffic growths were derived from EMME model forecasts for 2006, 2011 and 2021, using the latest land-use assumptions for Canberra/Queanbeyan (September 2009).

Table 33 summarises key observations from the model runs. It confirms many of the findings contained in this report, illustrates the benefits of some key road improvements and emphasises the needs to investigate solutions to increasing congestion on Parkes Way, Cotter Road, Tuggeranong Parkway, William Hovell Drive, Pialligo Avenue and Adelaide Avenue.

The data from the Paramics runs is available on CD.

Figure 64: Base Case Year 2011 Paramics Model Road Upgrade Inclusions

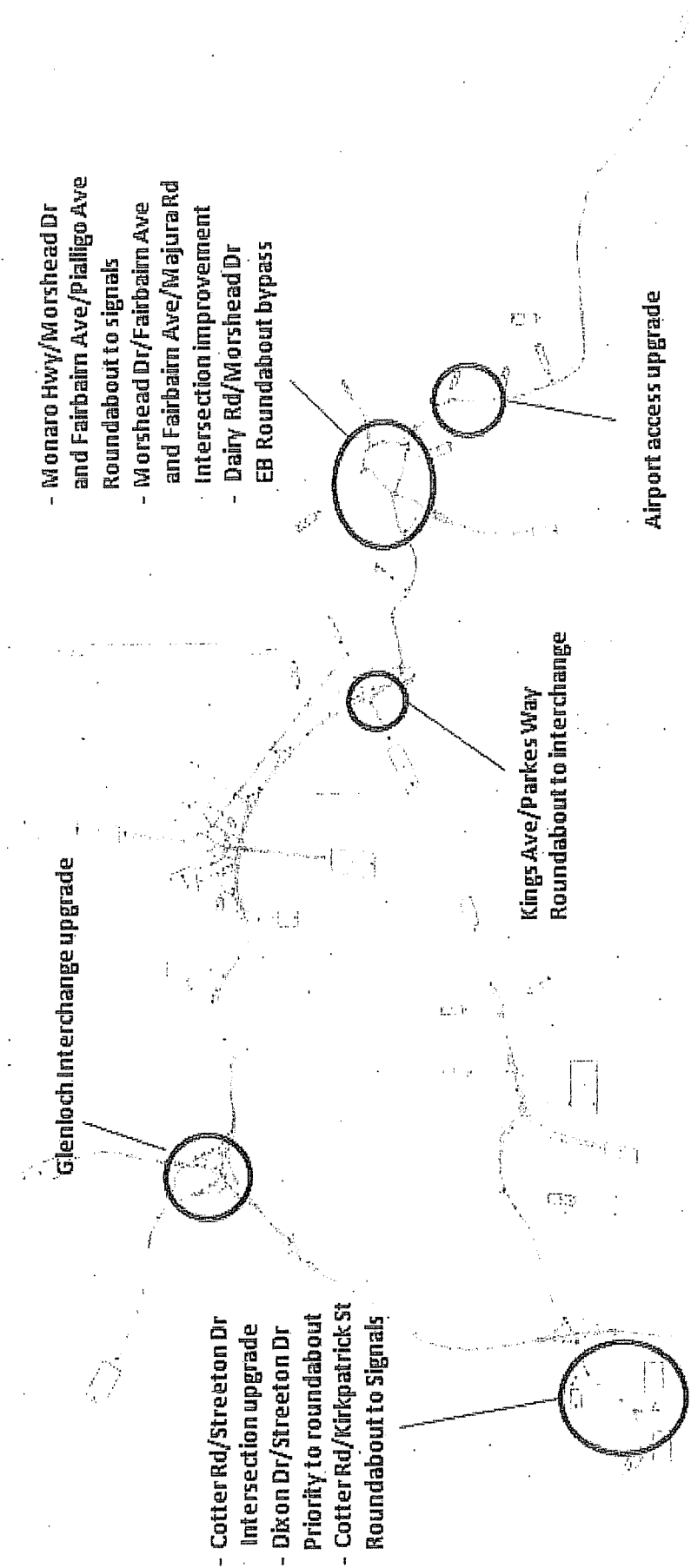


Figure 65: Project Case Year 2011 Paramics Model Road Upgrade Inclusions

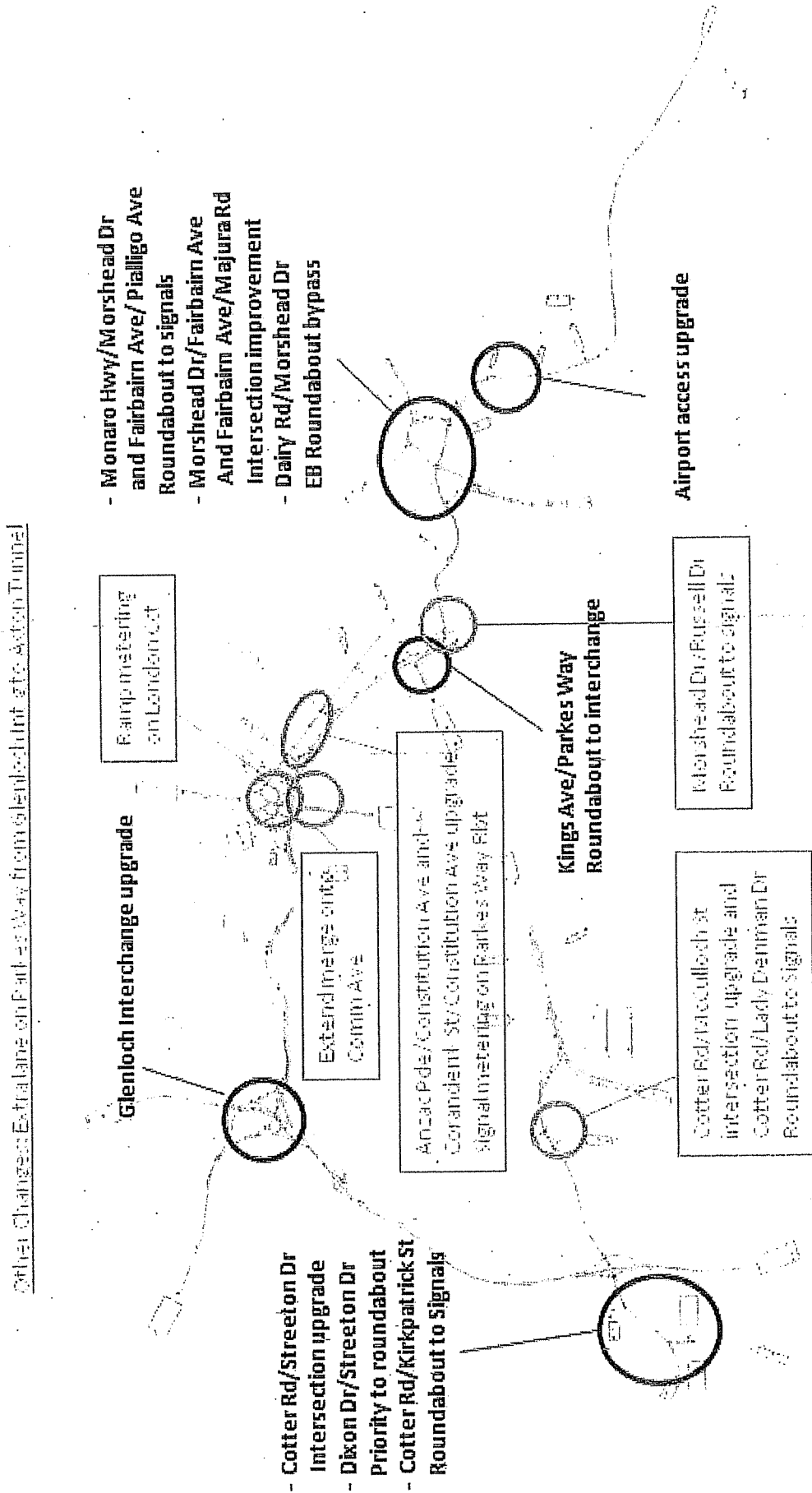
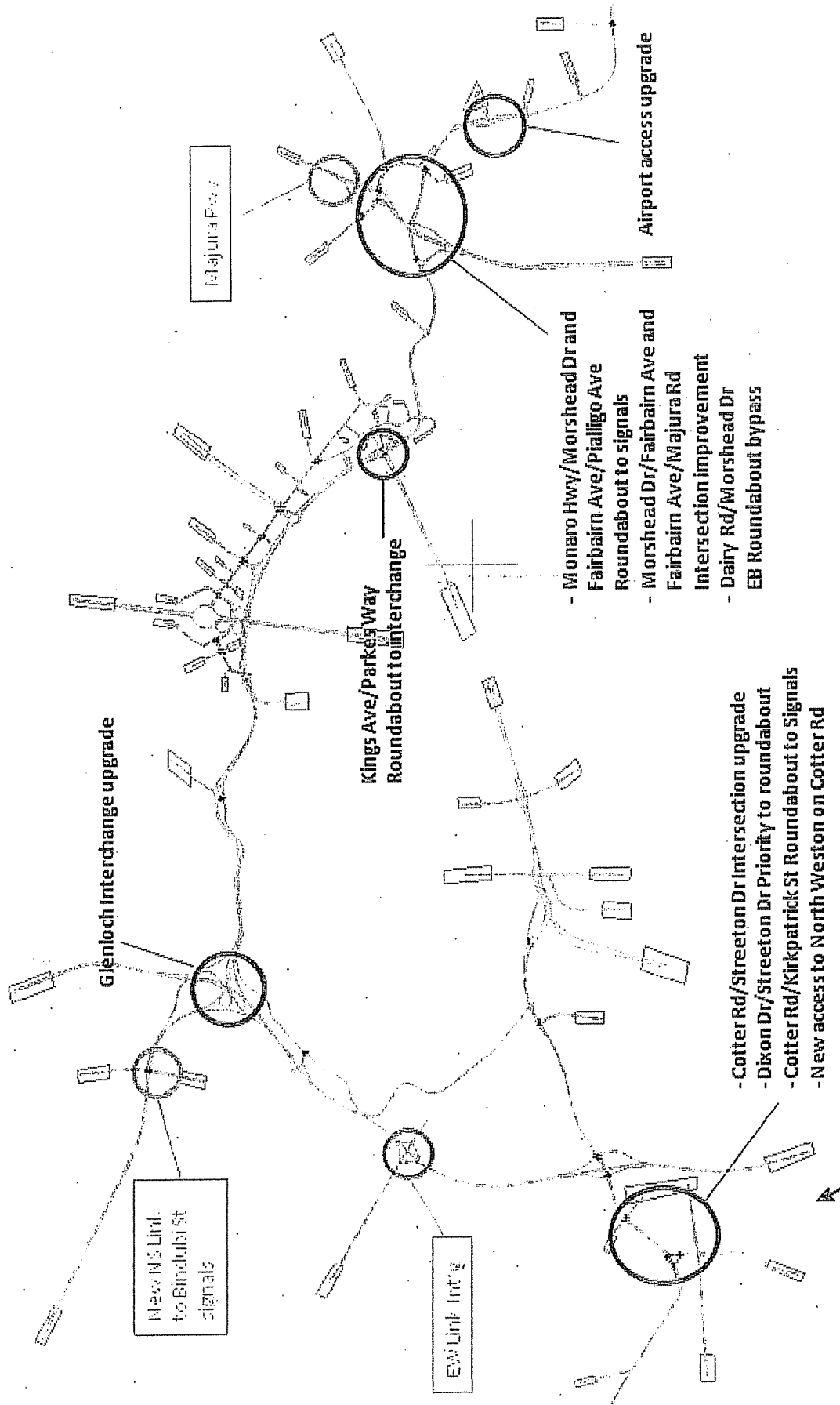
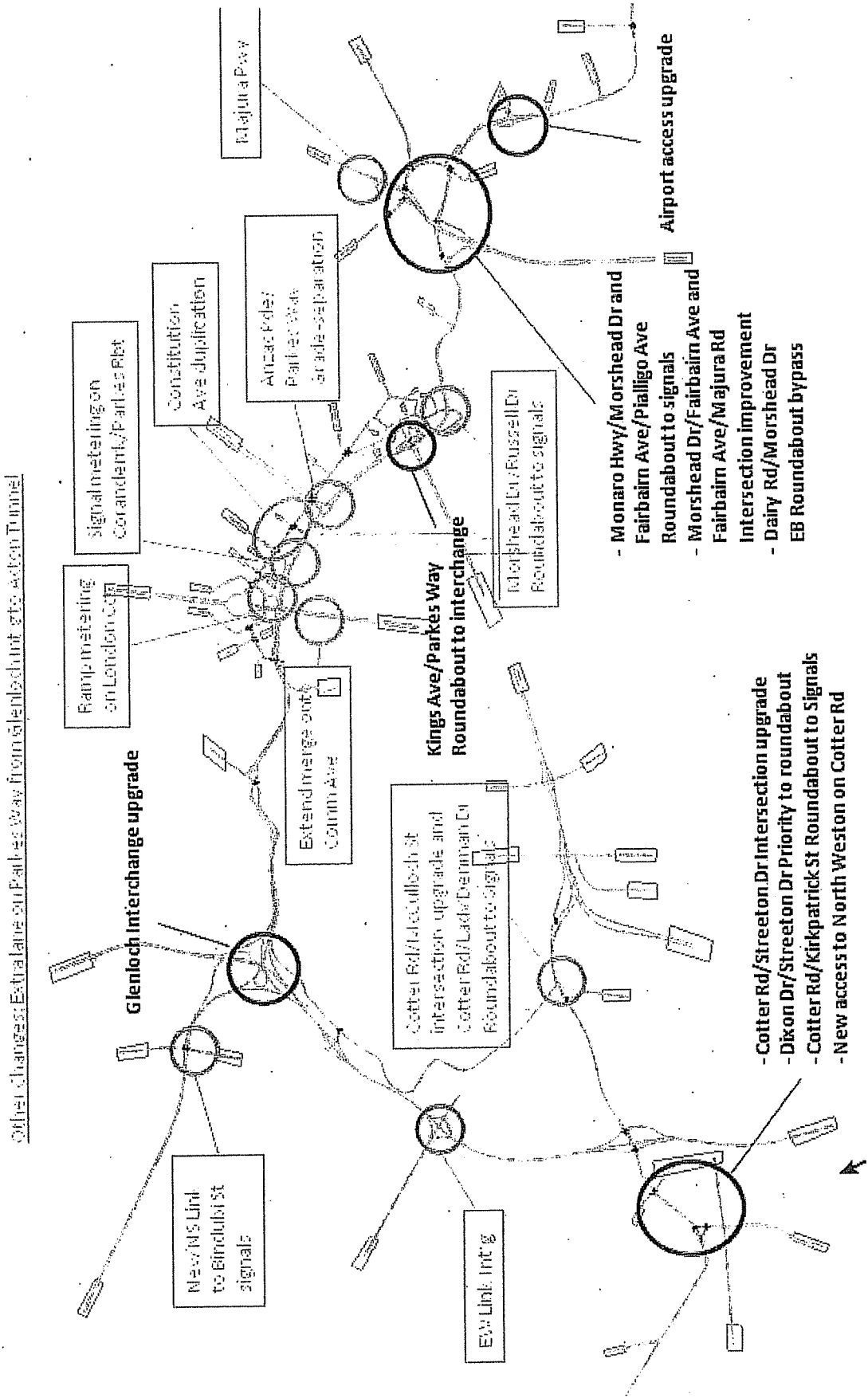


Figure 66: Base Case Year 2021 Paramics Model Road Upgrade Inclusions



**Figure 67: Project Case Year 2021 Paramics Model Road Upgrade Inclusions**



- Cotter Rd/Streeton Dr Intersection upgrade
- Dixon Dr/Streeton Dr Priority to roundabout
- Cotter Rd/Kirkpatrick St Roundabout to signals
- New access to North Weston on Cotter Rd

- Monaro Hwy/Morshead Dr and Fairbairn Ave/Pialligo Ave Roundabout to signals
- Morshead Dr/Fairbairn Ave and Fairbairn Ave/Majura Rd Intersection improvement
- Dairy Rd/Morshead Dr EB Roundabout bypass

Table 33: Summary Observations of Paramics Model Runs

Location	Case						Comment
	2006	2011 Base	2011 Project	2021 Base	2021 Project	2021 Project	
Cotter Road North Weston	OK	Good	Good	Good	Good	Good	Improvements needed in 2021, but less lane capacity than provided in the model
Cotter Road Curtin	Good	OK	OK	Poor	OK	OK	Intersection capacity improvements needed between 2011 and 2021; signals at LD helps
Cotter Road Yarralumia	Good	OK	OK	Poor	Poor	Poor	Congestion back from Yarra Glen and at merge near GG's
Yarra Glen/Adelaide Ave	OK	OK	OK	Poor	Poor	Poor	Merges not working in this section of road in 2021 and some congestion in 2011
Tuggeranong Pwy	OK	OK	OK	Poor	Poor	Poor	Causes queuing back along Cotter Rd and Yarra Glen
Glenloch Interchange	Poor	OK	Good	OK	Good	Good	Needs widening to 3 lanes before 2021 with EW Link Interchange Congestion at ramp merges in 2011+, but much worse in 2021
William Hovell Dve	Poor	Poor	Poor	Poor	Poor	Poor	Delays getting onto Parkes Way at merge in 2011 base
Parkes Way Black Mountain	OK	OK	Good	Good	Good	Good	Congestion on Tuggeranong Pwy and William Hovell in 2021 metering traffic into Glenloch
Parkes Way Acton Tunnel	OK	Poor	OK	OK	OK	OK	Large delays and queues at Bindubi, increase more in 2021 with NS Arterial connection
Parkes Way City	Poor	Poor	OK	Poor	OK	OK	Significant queues back from Acton Tunnel in 2011 base
Parkes Way Russell	Poor	Good	Good	OK	OK	OK	Congestion upstream on Tuggeranong Pwy and William Hovell reduce traffic and delays in this section of road
London Cct	Good	Good	Good	OK	OK	OK	Congestion upstream on Tuggeranong Pwy, William Hovell and Acton Tunnel reduce traffic and delays in this section of road
Constitution Ave	Good	Good	Good	Good	Good	Good	Congestion upstream on Tuggeranong Pwy, William Hovell and Acton Tunnel reduce traffic and delays in this section of road; worse in 2011 base
Russell Dr	Good	Good	Good	Good	Good	Good	London Cct signal ramp metering effective; moroseo with increased flows in 2021
Morshead Dr	OK	Good	Good	Good	Good	Good	Delays at Coranderk St Rbt less than expected so benefits of signal metering not obvious
Fairbairn Av	OK	OK	OK	OK	OK	OK	Kings Av ramp merges busy at times and Anzac Pde Rbt in 2021 base
Pialligo Av Airport	Poor	Good	Good	Good	Good	Good	Increasing delays at Edinburgh Av and Constitution Av intersections
Pialligo Av Brindabella Park	OK	OK	OK	Poor	Poor	Poor	Traffic growth seems to be less than expected from EMME
Monaro Hwy	OK	OK	OK	Poor	Poor	Poor	Traffic growth seems to be less than expected from EMME
							Benefits of signals at Russell Dr not obvious, but delays seem to be less than expected
							Morshead/Pialligo improvements very effective
							Gets busier in 2021, but minimal delays at intersections
							Airport roadworks very effective
							Increasing congestion due to traffic growth, but low delays at intersections
							Some delays back from Morshead roundabout in 2006 & 2011, but OK in 2021
							Increasing congestion on Monaro Hwy when Majura Pwy built pointing to possible future (2021+) need for 3 lanes between airport and Fyshwick; SB merge a particular problem

Note: Good indicates a level of service of about C or better; OK a level of service D or E; and Poor a level of service F based on observations of the model runs.

## Appendix B Summary Economics Data

## Appendix B Summary Economics Data

### Package 1: Parkes Way West Widening

DISCOUNTED CASH FLOW ANALYSIS TABLE FOR MEDIUM TERM TIME HORIZON						
Discount Rates		7.0%	4.0%	10.0%		
In-vehicle time cost			\$15.44 per hour	Maintenance	2.0%	
Vehicle operating cost			5.2c per stop	\$0.28 per km		
Traffic growth for accident cost savings			2.0% per cent per year			
YEAR	COSTS (shown as -ve)		BENEFITS (shown as +ve)		TOTALS	
	Current Prices		Current Prices		Current Prices	
	CAPITAL COSTS	RECURRENT Annual Maintenance	Network Cost Savings	Intersection Cost Savings		
2011	(\$9,200,000)	\$0	\$9,962,192	\$27,704,770	\$28,466,963	
2012	(\$7,150,000)	(\$184,000)	\$9,305,850	\$27,457,373	\$29,429,223	
2013	(\$800,000)	(\$327,000)	\$8,649,508	\$27,209,975	\$34,732,483	
2014	(\$18,800,000)	(\$343,000)	\$7,993,165	\$26,962,578	\$15,812,743	
2015	\$0	(\$719,000)	\$7,336,823	\$26,715,180	\$33,333,003	
2016	\$0	(\$719,000)	\$6,680,480	\$26,467,783	\$32,429,263	
2017	\$0	(\$719,000)	\$6,024,138	\$26,220,385	\$31,525,523	
2018	\$0	(\$719,000)	\$5,367,795	\$25,972,988	\$30,621,783	
2019	\$0	(\$719,000)	\$4,711,453	\$25,725,590	\$29,718,043	
2020	\$0	(\$719,000)	\$4,055,111	\$25,478,193	\$28,814,303	
2021	\$0	(\$719,000)	\$3,398,768	\$25,230,795	\$27,910,563	
2022	\$0	(\$719,000)	\$3,307,153	\$23,048,606	\$25,636,759	
2023	\$0	(\$719,000)	\$2,976,438	\$20,743,746	\$23,001,183	
2024	\$0	(\$719,000)	\$2,678,794	\$18,669,371	\$20,629,165	
2025	\$0	(\$719,000)	\$2,410,914	\$16,802,434	\$18,494,348	
2026	\$0	(\$719,000)	\$2,169,823	\$15,122,191	\$16,573,013	
2027	\$0	(\$719,000)	\$1,952,841	\$13,609,971	\$14,843,812	
2028	\$0	(\$719,000)	\$1,757,557	\$12,248,974	\$13,287,531	
2029	\$0	(\$719,000)	\$1,581,801	\$11,024,077	\$11,886,878	
2030	\$0	(\$719,000)	\$1,423,621	\$9,921,669	\$10,626,290	
2031	\$0	(\$719,000)	\$2,482,616	\$3,408,906	\$5,172,522	
<b>Total</b>	<b>(\$35,950,000)</b>	<b>(\$13,077,000)</b>	<b>\$96,226,839</b>	<b>\$435,745,554</b>	<b>\$482,945,393</b>	
<b>PRESENT VALUES</b>						
PV @ 7%	(\$29,838,686)	(\$6,044,654)	\$61,288,415	\$251,379,476	\$276,784,551	
PV @ 4%	(\$32,238,247)	(\$8,231,089)	\$73,029,720	\$312,046,776	\$344,607,160	
PV @ 10%	(\$27,714,432)	(\$6,177,754)	\$52,558,955	\$207,629,857	\$226,296,626	
<b>Discount Rate</b>						
	<b>4.0%</b>	<b>7.0%</b>	<b>10.0%</b>			
<b>NPV</b>	\$344,607,160	\$276,784,550	\$227,903,082			
<b>BCR</b>	9.52	8.71	7.68			

Note:

1. Network cost savings include travel time and operating cost savings derived from AM peak modelling of the whole Canberra network using EMME, for the years 2011, 2021 and 2031.
2. Intersection cost savings include travel time and operating cost savings derived from AM peak modelling of proposed intersection improvements in each package using SIDRA.

Package 2: Cotter Road Duplication

DISCOUNTED CASH FLOW ANALYSIS TABLE FOR MEDIUM TERM TIME HORIZON						
Discount Rates		7.0%	4.0%	10.0%		
In-vehicle time cost				\$15.44 per hour	Maintenance	2.0%
Vehicle operating cost				5.2c per stop	\$0.28 per km	
Traffic growth for accident cost savings				2.0% percent per year		
YEAR	COSTS (shown as -ve)		BENEFITS (shown as +ve)		TOTALS	
	Current Prices		Current Prices		Current Prices	
	CAPITAL COSTS	RECURRENT Annual Maintenance	Network Cost Savings	Intersection Cost Savings		
2011	(\$7,150,001)	\$0	\$7,941,060	\$23,563,858	\$24,354,916	
2012	(\$26,031,368)	(\$143,000)	\$7,983,623	\$23,730,551	\$5,539,807	
2013	(\$50,465,711)	(\$663,627)	\$8,026,187	\$23,897,245	(\$19,205,907)	
2014	(\$70,660,997)	(\$1,672,942)	\$8,068,750	\$24,063,939	(\$40,201,249)	
2015	\$0	(\$3,086,162)	\$8,111,314	\$24,230,633	\$29,255,785	
2016	\$0	(\$3,086,162)	\$8,153,877	\$24,397,326	\$29,465,042	
2017	\$0	(\$3,086,162)	\$8,196,441	\$24,564,020	\$29,674,299	
2018	\$0	(\$3,086,162)	\$8,239,004	\$24,730,714	\$29,883,557	
2019	\$0	(\$3,086,162)	\$8,281,568	\$24,897,408	\$30,092,814	
2020	\$0	(\$3,086,162)	\$8,324,131	\$25,064,101	\$30,302,071	
2021	\$0	(\$3,086,162)	\$8,366,695	\$25,230,795	\$30,511,328	
2022	\$0	(\$3,086,162)	\$7,876,873	\$23,048,606	\$27,839,318	
2023	\$0	(\$3,086,162)	\$7,089,186	\$20,743,746	\$24,746,770	
2024	\$0	(\$3,086,162)	\$6,380,267	\$18,669,371	\$21,963,477	
2025	\$0	(\$3,086,162)	\$5,742,241	\$16,802,434	\$19,458,513	
2026	\$0	(\$3,086,162)	\$5,168,016	\$15,122,191	\$17,204,045	
2027	\$0	(\$3,086,162)	\$4,651,215	\$13,609,971	\$15,175,025	
2028	\$0	(\$3,086,162)	\$4,186,093	\$12,248,974	\$13,348,906	
2029	\$0	(\$3,086,162)	\$3,767,484	\$11,024,077	\$11,705,399	
2030	\$0	(\$3,086,162)	\$3,390,736	\$9,921,669	\$10,226,243	
2031	\$0	(\$3,086,162)	\$3,468,478	\$3,408,906	\$3,791,222	
<b>Total</b>	<b>(\$154,308,077)</b>	<b>(\$54,944,315)</b>	<b>\$141,413,239</b>	<b>\$412,970,535</b>	<b>\$345,131,382</b>	
<b>PRESENT VALUES</b>						
PV @ 7%	(\$124,521,038)	(\$24,929,605)	\$79,141,334	\$233,772,206	\$163,462,897	
PV @ 4%	(\$136,207,613)	(\$34,246,022)	\$99,407,632	\$292,490,237	\$221,444,234	
PV @ 10%	(\$114,191,575)	(\$25,417,655)	\$64,705,813	\$191,664,846	\$116,761,429	
<b>Discount Rate</b>						
	<b>4.0%</b>	<b>7.0%</b>	<b>10.0%</b>			
<b>NPV</b>	\$221,444,234	\$163,462,897	\$123,511,116			
<b>BCR</b>	2.30	2.09	1.84			

Note:

1. Network cost savings include travel time and operating cost savings derived from AM peak modelling of the whole Canberra network using EMME, for the years 2011, 2021 and 2031.
2. Intersection cost savings include travel time and operating cost savings derived from AM peak modelling of proposed intersection improvements in each package using SIDRA.

Package 3: Fairbairn-Northcott-Constitution Duplication

DISCOUNTED CASH FLOW ANALYSIS TABLE FOR MEDIUM TERM TIME HORIZON						
Discount Rates		7.0%	4.0%	10.0%		
In-vehicle time cost			\$15.44 perhour		Maintenance	2.0%
Vehicle operating cost			5.2c perstop		\$0.28 perkm	
Traffic growth for accidentcostsavings			2.0% percentperyear			
YEAR	COSTS (shown as -ve) Current Prices		BENEFITS (shown as +ve) Current Prices		TOTALS	
	CAPITAL COSTS	RECURRENT Annual Maintenance	Network Cost Savings	Intersection Cost Savings	Current Prices	
2011	(\$7,150,000)	\$0	\$1,917,419	\$16,240,893	\$11,008,312	
2012	(\$48,933,437)	(\$143,000)	\$2,379,349	\$16,339,203	(\$30,357,885)	
2013	(\$70,660,997)	(\$1,121,669)	\$2,841,279	\$16,437,513	(\$52,503,874)	
2014	(\$18,606,453)	(\$2,534,889)	\$3,303,209	\$16,535,823	(\$1,302,310)	
2015	\$0	(\$2,907,018)	\$3,765,139	\$16,634,133	\$17,492,254	
2016	\$0	(\$2,907,018)	\$4,227,069	\$16,732,443	\$18,052,494	
2017	\$0	(\$2,907,018)	\$4,688,999	\$16,830,752	\$18,612,734	
2018	\$0	(\$2,907,018)	\$5,150,929	\$16,929,062	\$19,172,974	
2019	\$0	(\$2,907,018)	\$5,612,859	\$17,027,372	\$19,733,214	
2020	\$0	(\$2,907,018)	\$6,074,789	\$17,125,682	\$20,293,454	
2021	\$0	(\$2,907,018)	\$6,536,720	\$17,223,992	\$20,853,694	
2022	\$0	(\$2,907,018)	\$6,173,885	\$15,773,093	\$19,039,960	
2023	\$0	(\$2,907,018)	\$5,556,497	\$14,195,784	\$16,845,262	
2024	\$0	(\$2,907,018)	\$5,000,847	\$12,776,205	-\$14,870,034	
2025	\$0	(\$2,907,018)	\$4,500,762	\$11,498,585	\$13,092,329	
2026	\$0	(\$2,907,018)	\$4,050,686	\$10,348,726	\$11,492,395	
2027	\$0	(\$2,907,018)	\$3,645,617	\$9,313,854	\$10,052,453	
2028	\$0	(\$2,907,018)	\$3,281,056	\$8,382,468	\$8,756,506	
2029	\$0	(\$2,907,018)	\$2,952,950	\$7,544,221	\$7,590,154	
2030	\$0	(\$2,907,018)	\$2,657,655	\$6,789,799	\$6,540,437	
2031	\$0	(\$2,907,018)	\$2,908,375	\$2,715,003	\$2,716,360	
<b>Total</b>	<b>(\$145,350,887)</b>	<b>(\$53,218,859)</b>	<b>\$87,226,092</b>	<b>\$283,394,606</b>	<b>\$172,050,952</b>	
<b>PRESENT VALUES</b>						
PV @ 7%	(\$121,297,798)	(\$24,626,759)	\$43,695,746	\$160,424,012	\$58,195,201	
PV @ 4%	(\$130,838,956)	(\$33,527,052)	\$57,573,870	\$200,703,176	\$93,911,038	
PV @ 10%	(\$112,737,968)	(\$25,157,046)	\$34,081,849	\$131,547,679	\$27,734,514	
<b>Discount Rate</b>						
	<b>4.0%</b>	<b>7.0%</b>	<b>10.0%</b>			
<b>NPV</b>	\$93,911,038	\$58,195,201	\$34,272,237			
<b>BCR</b>	1.57	1.40	1.20			

Note:

1. Network cost savings include travel time and operating cost savings derived from AM peak modelling of the whole Canberra network using EMME, for the years 2011, 2021 and 2031.
2. Intersection cost savings include travel time and operating cost savings derived from AM peak modelling of proposed intersection improvements in each package using SIDRA.