

A.5 FUTURE FRIDAY AND SUNDAY TRAFFIC

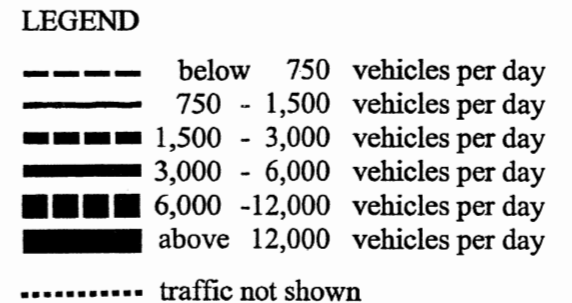
Future Friday and Sunday traffic flows were identified in 3 stages.

Firstly, the existing traffic flows shown in Figures A.3 to A.9 were reassigned to take into account the conversion of Cliff Street to 2-way, the extension of Phillimore Street into Victoria Quay, the construction of a new access road at Pakenham Street, the improved access via Gate 2, and the realignment of Victoria Quay Road.

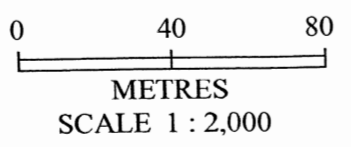
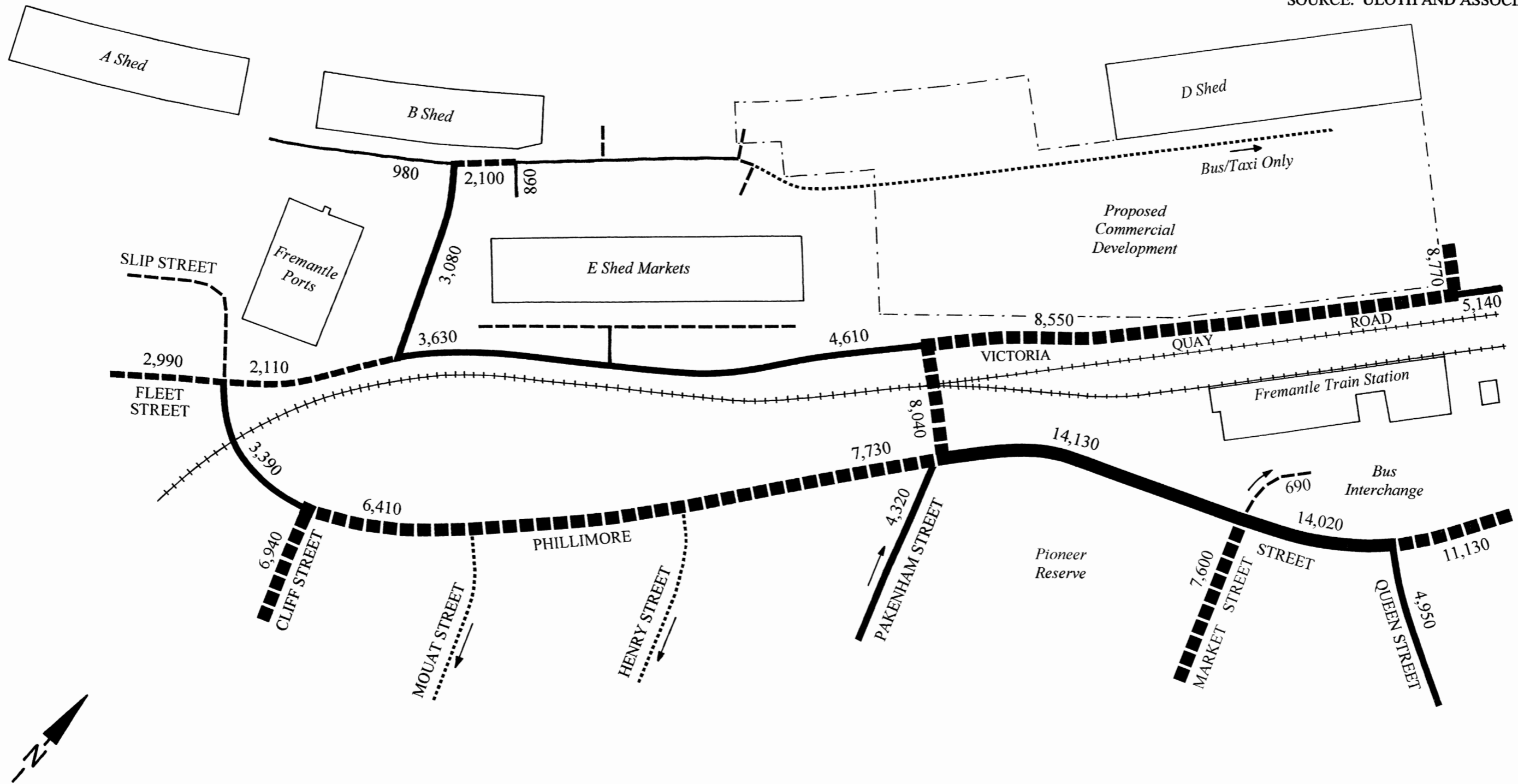
Secondly, the reassigned existing traffic flows were factored up by 10 percent, in order to take into account some growth in the existing developments, as discussed in Section A.4.2.

Finally, the estimated traffic flows generated by the proposed new commercial developments were added to the reassigned existing traffic flows.

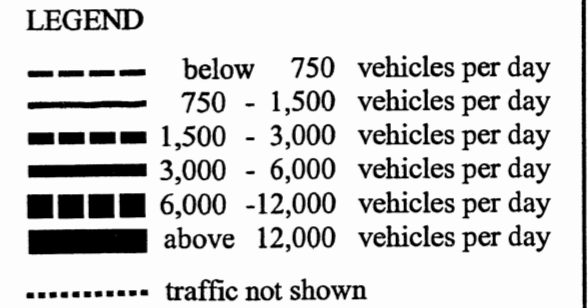
The resultant future Friday and Sunday daily traffic flows are shown in Figures A.13 and A.14, while the corresponding peak hour traffic flows are shown in Figures A.15 to A.17.



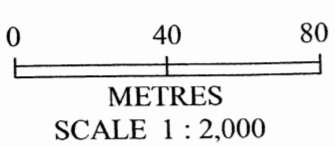
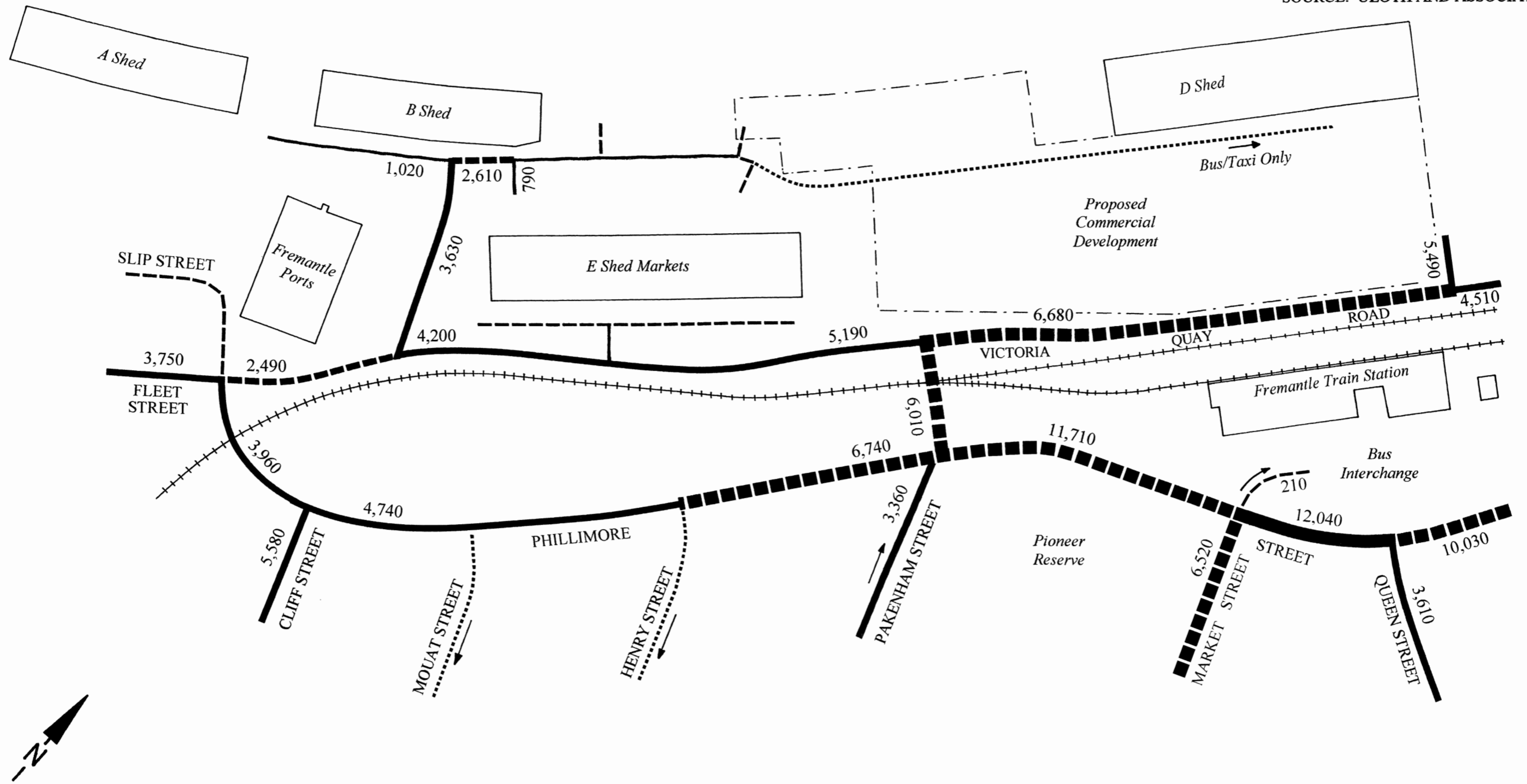
SOURCE: ULOTH AND ASSOCIATES



Future Friday Traffic Flows Under Recommended Plan
PHILLIMORE STREET AND VICTORIA QUAY ACCESS ROADS



SOURCE: ULOTH AND ASSOCIATES

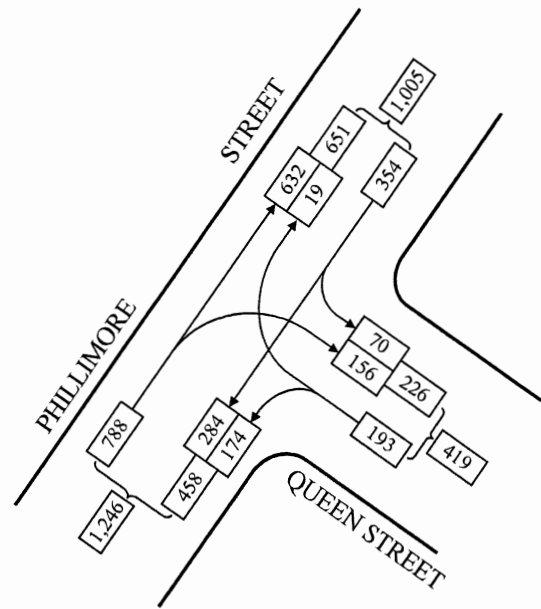
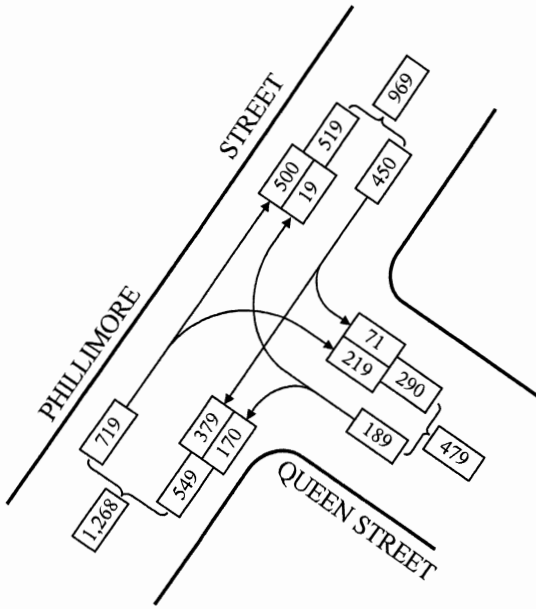


Future Sunday Traffic Flows Under Recommended Plan
PHILLIMORE STREET AND VICTORIA QUAY ACCESS ROADS

FIG. A.14

Friday
3⁰⁰ - 4⁰⁰ pm

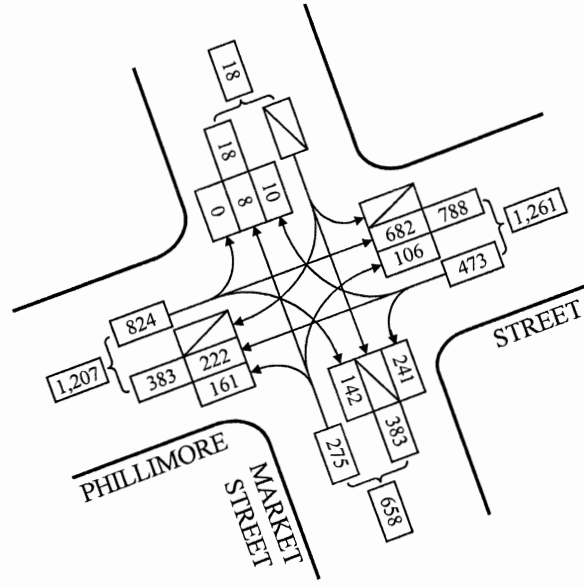
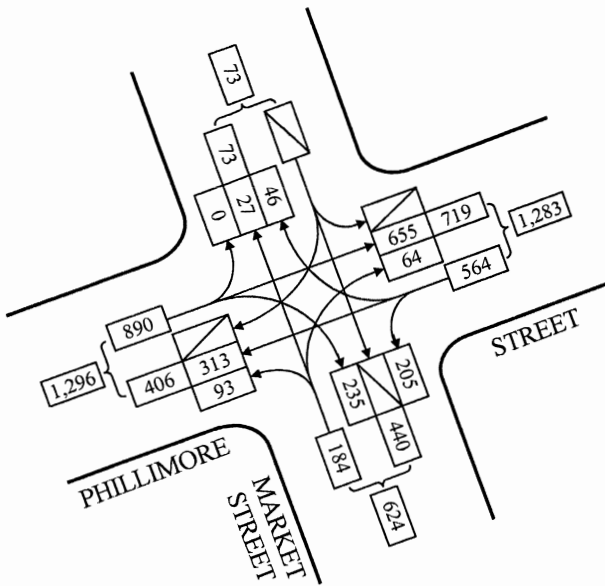
Sunday
3⁰⁰ - 4⁰⁰ pm



PHILLIMORE STREET - QUEEN STREET

Friday
3⁰⁰ - 4⁰⁰ pm

Sunday
3⁰⁰ - 4⁰⁰ pm



SOURCE: ULOTH AND ASSOCIATES

PHILLIMORE STREET - MARKET STREET

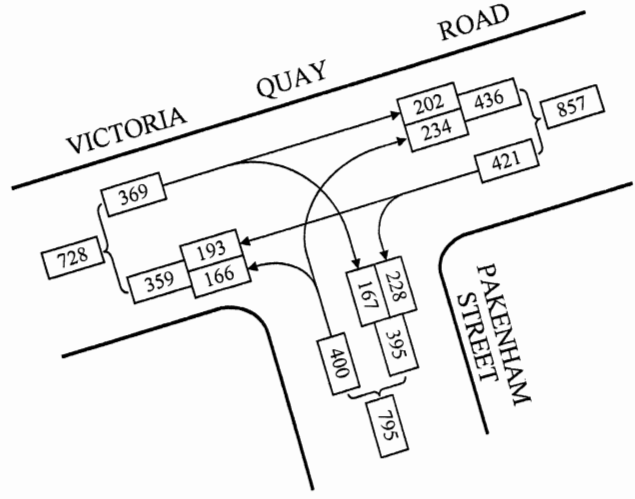
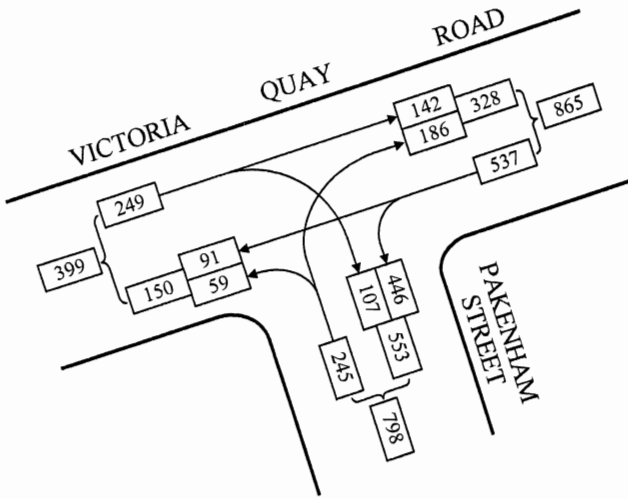
Future Friday and Sunday Pk Hr Traffic

PHILLIMORE STREET - QUEEN STREET - MARKET STREET

FIG. A.15

Friday
3⁰⁰ - 4⁰⁰ pm

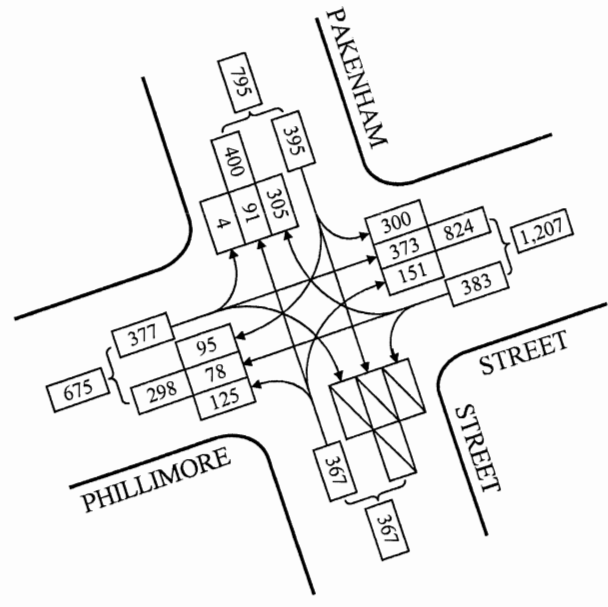
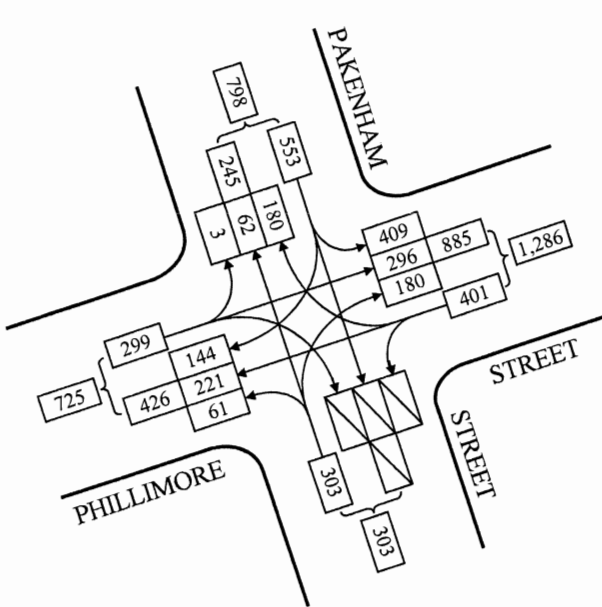
Sunday
3⁰⁰ - 4⁰⁰ pm



PAKENHAM STREET - VICTORIA QUAY ROAD

Friday
3⁰⁰ - 4⁰⁰ pm

Sunday
3⁰⁰ - 4⁰⁰ pm



PHILLIMORE STREET - PAKENHAM STREET

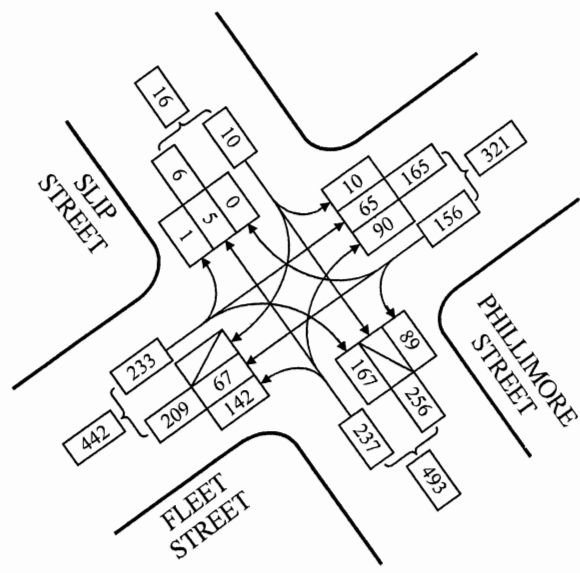
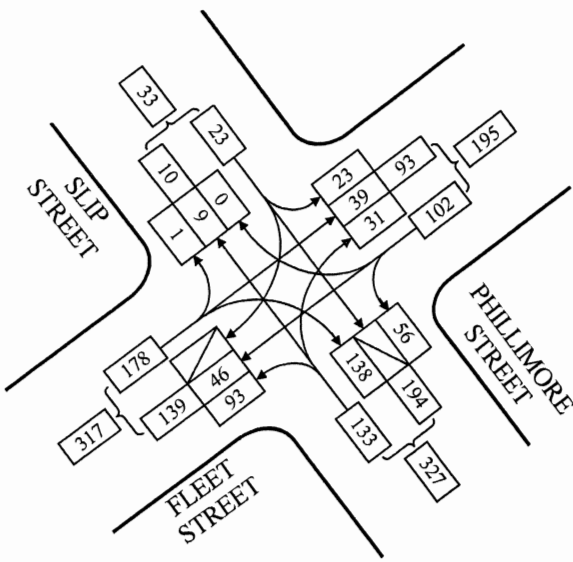
SOURCE: ULOTH AND ASSOCIATES

Future Friday and Sunday Pk Hr Traffic
PHILLIMORE STREET - PAKENHAM STREET - VICTORIA QUAY ROAD

FIG.
A.16

Friday
3⁰⁰ - 4⁰⁰ pm

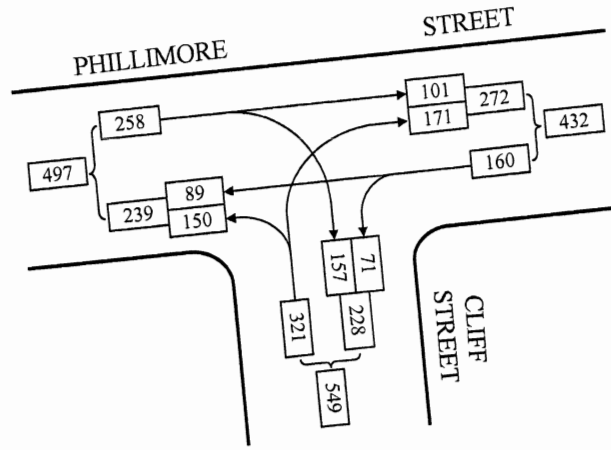
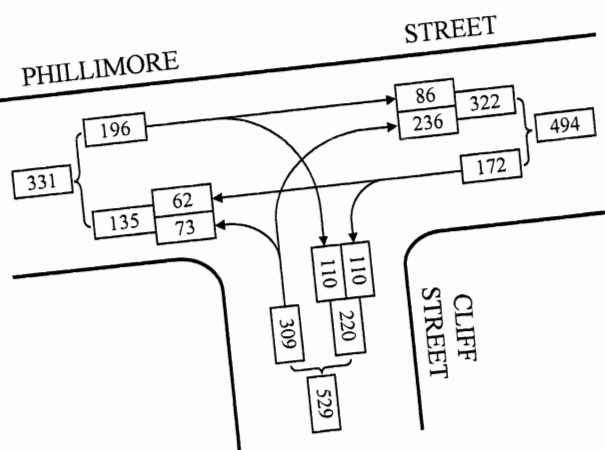
Sunday
3⁰⁰ - 4⁰⁰ pm



PHILLIMORE STREET - FLEET STREET - SLIP STREET

Friday
3⁰⁰ - 4⁰⁰ pm

Sunday
3⁰⁰ - 4⁰⁰ pm



PHILLIMORE STREET - CLIFF STREET

SOURCE: ULOTH AND ASSOCIATES

Future Friday and Sunday Pk Hr Traffic
PHILLIMORE STREET - CLIFF STREET - FLEET STREET - SLIP STREET

FIG. A.17

A.6 INTERSECTION OPERATIONAL ANALYSES

Tables A.7 to A.12 show the future peak hour intersection operational characteristics for the various critical intersections along Phillimore Street and within Victoria Quay. The operational analyses are based on the traffic flows shown in Figures A.15 to A.17, and the integrated concept plan shown in Figures 2 and 3 in Chapter 3 Recommendations.

A.6.1 MARKET STREET AND QUEEN STREET

Table A.7 shows the future Friday and Sunday peak hour intersection operational characteristics for the Phillimore Street - Market Street intersection, which incorporates both the modified Bus Entry to Fremantle Train Station and the provision of a full pedestrian phase to allow pedestrians to cross in all directions, as discussed in Section 2.4.7. The cycle times shown have been selected to match the cycle times at Pakenham Street, under the assumption that these signals will be coordinated.

TABLE A.7
OPERATIONAL CHARACTERISTICS FOR SIGNALISED PHILLIMORE STREET - MARKET STREET - BUS ENTRY INTERSECTION – FUTURE FRIDAY AND SUNDAY PEAK HOURS

ITEMS	OPERATIONAL CHARACTERISTICS											
	Friday Peak Hour						Sunday Peak Hour					
No. of Approach Lanes: N E S W	- 2 2 2						- 2 2 2					
No. of Phases	5						5					
Cycle Time (sec)	80						90					
Flow Ratio (Y)	0.532						0.344					
Avrge Delay (sec)	28.2						26.6					
Level of Service	C						C					
Approach	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.
			Veh.	m					Veh.	m		
Phillimore Street - east	LT	0.763	15.5	118	37.2	D	LT	0.462	11.6	84	31.4	C
	TR	0.763	10.9	92	39.4	D	TR	0.462	9.8	73	33.2	C
Market Street - south	L	0.187	2.5	18	20.7	C	L	0.288	4.7	34	21.5	C
	TR	<u>0.806</u>	5.7	51	52.5	D	TR	0.676	7.1	53	53.6	D
Phillimore Street - west	LT	0.764	17.2	122	15.2	B	LT	<u>0.706</u>	16.2	115	17.1	B
	TR	0.764	13.6	97	27.7	C	TR	<u>0.706</u>	14.1	100	25.3	C

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

It can be seen in Table A.7 that the signalised intersection will operate at an overall Level of Service C during both the Friday and Sunday peak hours, indicating satisfactory operating conditions with average delays. However, it is important to note that 2 through lanes will be required in both directions along Phillimore Street, and as a result it will be necessary to also carry 2 lanes in each direction through the adjacent Queen Street junction, as indicated in Figure 3 in Chapter 3 Recommendations.

The recommended traffic signal phasing for the Phillimore Street - Market Street - Bus Entry intersection is shown in Figure 7 in Chapter 3 Recommendations.

Table A.8 shows the future Friday and Sunday peak hour intersection operational characteristics for the Phillimore Street - Queen Street unsignalised junction, taking into account the recommended modifications shown in Figure 3 in Chapter 3 Recommendations.

It can be seen in Table A.8 that the proposed unsignalised junction (with no median) will operate at Level of Service D during the critical peak hours, indicating poor but manageable operating conditions, with long traffic delays.

However, it must also be noted that this analysis does not take into account the additional gaps that will occur in traffic along Phillimore Street as a result of the proposed traffic signals and full pedestrian phase at the Phillimore Street - Market Street intersection. Neither does it take into account the queuing in Phillimore Street from the adjacent signalised intersections, which could block the Queen Street junction.

TABLE A.8
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED PHILLIMORE STREET - QUEEN STREET JUNCTION – FUTURE FRIDAY AND SUNDAY PEAK HOURS

ITEMS	OPERATIONAL CHARACTERISTICS											
	Friday Peak Hour						Sunday Peak Hour					
No. of Approach Lanes: N E S W	2 2 2 -						2 2 2 -					
Approach	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.
			Veh.	m					Veh.	m		
Phillimore Street - north	LT	0.138	0.0	0	3.2	A	LT	0.100	0.0	0	3.5	A
	T	0.138	0.0	0	0.0	A	T	0.100	0.0	0	0.0	A
Queen Street - east	L	<u>0.250</u>	1.0	8	11.3	B	L	0.200	0.8	6	9.7	A
	R	0.136	0.5	4	30.5	D	R	0.120	0.4	3	27.8	D
Phillimore Street - south	T	0.245	0.0	0	0.0	A	T	<u>0.238</u>	0.0	0	0.0	A
	TR	0.245	1.7	12	9.1	A	TR	<u>0.238</u>	2.0	14	5.3	A

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

A.6.2 PAKENHAM STREET

Tables A.9 and A.10 show the future Friday and Sunday intersection operational characteristics for the Phillimore Street - Pakenham Street signalised intersection, and the unsignalised junction of Pakenham Street extension with the realigned Victoria Quay Road.

It can be seen in Table A.9 that the signalised intersection will operate at overall Levels of Service C and D during the future Friday and future Sunday peak hours, respectively. (Level of Service C indicates satisfactory operating conditions with average delays, while Level of Service D indicates poor but manageable operating conditions with long traffic delays).

It can also be seen in Table A.9 that 2 approach lanes will be required within Phillimore Street both east and west of Pakenham Street, as also reflected in Figures 2 and 3 in Chapter 3 Recommendations.

It is therefore recommended that 2 traffic lanes should be provided in each direction along Phillimore Street, between Pakenham Street and Market Street.

TABLE A.9
OPERATIONAL CHARACTERISTICS FOR SIGNALISED PHILLIMORE STREET - PAKENHAM STREET INTERSECTION – FUTURE FRIDAY AND SUNDAY PEAK HOURS

ITEMS	OPERATIONAL CHARACTERISTICS											
	Friday Peak Hour						Sunday Peak Hour					
No. of Approach Lanes: N E S W	2 2 2 2						2 2 2 2					
No. of Phases	4						4					
Cycle Time (sec)	80						90					
Flow Ratio (Y)	0.290						0.417					
Avrge Delay (sec)	34.9						40.9					
Level of Service	C						D					
Approach	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.
			Veh.	m					Veh.	m		
Pakenham Street - north	L	0.685	15.3	110	29.5	C	L	0.432	10.8	77	25.0	C
	R	0.418	6.9	50	39.3	D	R	0.309	5.3	38	43.8	D
Phillimore Street - east	T	0.324	8.2	59	19.2	B	T	0.096	3.0	21	15.4	B
	R	<u>0.760</u>	9.6	69	48.3	D	R	0.756	15.3	110	45.8	D
Pakenham Street - south	LT	0.380	6.0	43	34.9	C	LT	<u>0.769</u>	12.0	87	47.3	D
	R	0.522	8.5	61	40.1	D	R	0.492	8.2	59	45.3	D
Phillimore Street - west	LT	0.508	9.1	66	47.1	D	LT	0.722	11.5	83	54.7	D
	T	0.508	7.5	54	34.2	C	T	0.722	10.6	76	42.7	D

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

Table A.10 shows that the unsignalised junction at Pakenham Street extension and Victoria Quay Road will operate at acceptable Levels of Service B and C, indicating good and satisfactory operating conditions.

TABLE A.10
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED PAKENHAM STREET - VICTORIA QUAY ROAD JUNCTION – FUTURE FRIDAY AND SUNDAY PEAK HOURS

ITEMS	OPERATIONAL CHARACTERISTICS											
	Friday Peak Hour						Sunday Peak Hour					
No. of Approach Lanes: N E S W	- 1 1 1						- 1 1 1					
Approach	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.
			Veh.	m					Veh.	m		
Victoria Quay Rd - east	LT	<u>0.543</u>	4.3	31	9.7	A	LT	0.564	5.0	36	12.7	B
Pakenham Street - south	LR	0.142	0.0	0	8.5	A	LR	0.231	0.0	0	8.5	A
Victoria Quay Rd - west	TR	0.392	2.3	17	12.5	B	TR	<u>0.606</u>	5.0	36	15.2	C

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

A.6.3 CLIFF STREET

Table A.11 shows the future Friday and Sunday peak hour intersection operational characteristics for the proposed Phillimore Street - Cliff Street junction, which is shown in Figure 2 in Chapter 3 Recommendations.

It can be seen in Table A.11 that the unsignalised junction will operate at high Levels of Service A and B during the critical peak hours, indicating good operating conditions with short traffic delays.

It can also be seen that the single approach lane in Cliff Street south will only experience 95th percentile queues of 25 metres and 24 metres during the Friday and Sunday peak hours, respectively.

Table A.12 shows that the new intersection at Phillimore Street - Fleet Street - Slip Street will also operate at high Levels of Service A and B during the critical Friday and Sunday peak hours.

TABLE A.11
OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED PHILLIMORE STREET - CLIFF STREET JUNCTION – FUTURE FRIDAY AND SUNDAY PEAK HOURS

ITEMS	OPERATIONAL CHARACTERISTICS											
	Friday Peak Hour						Sunday Peak Hour					
No. of Approach Lanes: N E S W	- 1 1 2						- 1 1 2					
Approach	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.	Move-ment	X-Value	Max. Queue		Avrge Delay (sec)	Level of Serv.
			Veh.	m					Veh.	m		
Phillimore Street - east	LT	0.097	0.0	0	5.3	A	LT	0.090	0.0	0	3.7	A
Cliff Street - south	LR	<u>0.479</u>	3.6	25	12.6	B	LR	<u>0.472</u>	3.4	24	12.3	B
Phillimore Street - west	T	0.048	0.0	0	0.0	A	T	0.055	0.0	0	0.0	A
	R	0.075	0.4	3	9.1	A	R	0.106	0.6	5	9.1	A

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
Underlined X-values denote maximum values.

Source: Uloth and Associates

TABLE A.12
 OPERATIONAL CHARACTERISTICS FOR UNSIGNALISED PHILLIMORE STREET - FLEET
 STREET - SLIP STREET - VICTORIA QUAY ROAD INTERSECTION
 FUTURE FRIDAY AND SUNDAY PEAK HOURS

ITEMS	OPERATIONAL CHARACTERISTICS											
	Friday Peak Hour						Sunday Peak Hour					
No. of Approach Lanes: N E S W	1 1 1 2						1 1 1 2					
Approach	Move- ment	X- Value	Max. Queue		Avrge Delay (sec)	Level of Serv.	Move- ment	X- Value	Max. Queue		Avrge Delay (sec)	Level of Serv.
			Veh.	m					Veh.	m		
Slip Street - north	L	0.021	0.1	1	8.5	A	L	0.011	0.0	0	8.8	A
Victoria Quay Rd - east	LTR	0.112	0.5	3	8.7	A	LTR	0.185	0.8	6	9.3	A
Phillimore Street - south	LTR	0.078	0.0	0	7.8	A	LTR	0.137	0.0	0	8.2	A
Fleet Street - west	L	0.003	0.0	0	8.5	A	L	0.003	0.0	0	8.6	A
	TR	<u>0.187</u>	1.0	7	9.3	A	TR	<u>0.279</u>	1.5	11	10.1	B

Notes: Level of Service calculations are based on Average Delay and Degree of Saturation.
 Underlined X-values denote maximum values.

Source: Uloth and Associates

A.7 CROSS-SECTION REQUIREMENTS FOR ON-STREET CYCLE LANES

The Main Roads WA Policy for Cycling Infrastructure states (in Section 2.1.2.1): “*New roads will be constructed with an edgeline separated sealed shoulder (which may be kerbed), in accordance with the desirable standards within Austroads Guide to Traffic Engineering Practice “Bicycles” Part 14, 1999, Section 4.4.1. This sealed width may adjoin but not form part of roadside parking space and as such, allowance shall be included to accommodate opening car doors in accordance with Austroads Part 14, Section 4.4.2.*”

The Austroads guide, however, only makes recommendations of ‘Desirable Standards’ for roads with speeds of 60 kilometres per hour or 80 kilometres per hour.

Since Phillimore Street has a posted speed of just 40 kilometres per hour, it is therefore necessary to take into account the ‘Acceptable Range’ specified by Austroads, but use professional judgement to specify a recommended width.

A.7.1 EXCLUSIVE CYCLE LANES

Table 4-1 in Section 4.4.1 of the Austroads guide recommends a ‘Desirable’ cycle lane width of 1.5 metres for a road speed of 60 kilometres per hour, but with an acceptable range of 1.2 to 2.5 metres. Figure 4-4 then shows how a 1.0 metre cycle lane can work with an adjacent 3.0 metre wide traffic lane, where the speed environment is less than 60 kilometres per hour.

Although a cycle lane width of 1.0 metres may be acceptable in areas of low traffic flows, it is recommended that the minimum width for exclusive cycle lanes along Phillimore Street should be 1.2 metres. However, it is also recommended that cycle lane widths of 1.5 metres should be provided where possible.

A.7.2 SHARED CYCLE/PARKING LANES

Table 4-2 in Section 4.4.2 of the Austroads guide recommends a ‘Desirable’ overall facility width for shared cycle/parking lanes of 4.0 metres for a road speed of 60 kilometres per hour, but with an acceptable range of 3.7 to 4.5 metres.

The minimum width of 3.7 metres consists of a 2.1 metre parking lane, a 0.4 metre ‘safety strip’ and a 1.2 metre cycle lane.

On the basis of this breakdown, it is recommended that all shared cycle/parking lanes along Phillimore Street should provide a minimum width of 3.7 metres.

A.7.3 RECOMMENDED LAYOUTS

The recommended cycle lane treatments for Phillimore Street between Cliff Street and Queen Street are reflected in the overall concept plan in Figures 2 and 3 in Chapter 3 Recommendations.

Detailed layouts of typical situations along Phillimore Street, incorporating both exclusive cycle lanes and shared cycle/parking lanes, are shown in Figures 4 and 5.