MOVEMENT SUMMARY

Site: 101 [AM (Ex): Pennant Hills Road - Adderton Road - Import]

Network: N101 [AM (Ex): Pennant Hills Road]

Existing Weekday Morning Peak Hour
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Adderton Road													
1	L2	25	1.0	25	1.0	0.868	50.2	LOS D	10.2	72.3	1.00	1.01	18.6
3	R2	420	1.0	420	1.0	0.868	50.3	LOS D	10.2	72.3	1.00	1.01	23.2
Approach		445	1.0	445	1.0	0.868	50.3	LOS D	10.2	72.3	1.00	1.01	23.0
East: Pennant Hills Road													
4	L2	445	1.0	445	1.0	0.893	33.4	LOS C	40.1	284.2	0.92	0.99	30.1
5	T1	1470	2.0	1470	2.0	0.893	28.0	LOS B	41.8	297.7	0.94	1.01	17.8
Approach		1915	1.8	1915	1.8	0.893	29.2	LOS C	41.8	297.7	0.94	1.01	22.1
West: Pennant Hills Road													
11	T1	1225	2.0	1209	2.0	0.441	5.1	LOS A	9.8	69.7	0.45	0.41	47.4
12	R2	100	1.0	99	1.0	0.714	49.2	LOS D	4.2	29.6	1.00	0.85	22.2
Approach		1325	1.9	1308[N1]	1.9	0.714	8.5	LOS A	9.8	69.7	0.49	0.44	41.8
All Vehicles		3685	1.7	3668[N1]	1.7	0.893	24.4	LOS B	41.8	297.7	0.79	0.80	26.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 0.1 %
Number of Iterations: 7 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	11.0	LOS B	0.1	0.1	0.53	0.53
P4	West Full Crossing	50	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		100	22.7	LOS C			0.73	0.73

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

▽ Site: 101 [AM (Ex+D): Pennant Hills Road - Tintern Avenue - Import] ⧓⧓ Network: N101 [AM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Morning Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Tintern Avenue													
1	L2	75	1.0	75	1.0	4.991	3708.9	LOS F	60.5	426.9	1.00	3.52	0.7
3	R2	25	1.0	25	1.0	4.991	3813.2	LOS F	60.5	426.9	1.00	3.52	0.2
Approach		100	1.0	100	1.0	4.991	3734.9	LOS F	60.5	426.9	1.00	3.52	0.6
East: Pennant Hills Road													
4	L2	30	1.0	30	1.0	0.380	5.6	LOS A	0.0	0.0	0.00	0.02	55.5
5	T1	1430	2.0	1430	2.0	0.380	0.0	LOS A	0.0	0.0	0.00	0.01	59.7
Approach		1460	2.0	1460	2.0	0.380	0.1	NA	0.0	0.0	0.00	0.01	59.7
West: Pennant Hills Road													
11	T1	1310	2.0	1310	2.0	0.560	0.2	LOS A	0.0	0.0	0.00	0.00	59.7
12	R2	135	1.0	135	1.0	0.454	22.9	LOS B	2.0	14.4	0.87	1.04	36.0
Approach		1445	1.9	1445	1.9	0.560	2.3	NA	2.0	14.4	0.08	0.10	54.9
All Vehicles		3005	1.9	3005	1.9	4.991	125.5	NA	60.5	426.9	0.07	0.17	13.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.1 %
Number of Iterations: 10 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101v [AM (Ex+D): Pennant Hills Road - Baker Street - Proposed Access - Import]

Network: N101 [AM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Morning Peak Hour
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Proposed Access													
1	L2	50	1.0	50	1.0	0.643	52.6	LOS D	5.5	38.6	0.99	0.92	20.8
2	T1	10	1.0	10	1.0	0.643	48.0	LOS D	5.5	38.6	0.99	0.92	26.1
3	R2	65	1.0	65	1.0	0.643	52.6	LOS D	5.5	38.6	0.99	0.92	20.8
Approach		125	1.0	125	1.0	0.643	52.2	LOS D	5.5	38.6	0.99	0.92	21.3
East: Pennant Hills Road													
4	L2	15	1.0	15	1.0	0.751	26.6	LOS B	26.4	187.7	0.84	0.77	34.5
5	T1	1380	2.0	1380	2.0	0.751	20.4	LOS B	26.4	187.7	0.80	0.73	16.4
6	R2	135	1.0	135	1.0	0.574	53.8	LOS D	7.0	49.4	0.99	0.89	17.8
Approach		1530	1.9	1530	1.9	0.751	23.4	LOS B	26.4	187.7	0.82	0.74	17.1
North: Baker Street													
7	L2	155	1.0	155	1.0	0.549	29.6	LOS C	5.9	41.6	0.96	0.79	21.0
8	T1	25	1.0	25	1.0	0.549	25.0	LOS B	5.9	41.6	0.96	0.79	33.2
9	R2	30	1.0	30	1.0	0.058	29.4	LOS C	1.0	7.4	0.75	0.69	20.7
Approach		210	1.0	210	1.0	0.549	29.0	LOS C	5.9	41.6	0.93	0.78	23.3
West: Pennant Hills Road													
10	L2	165	1.0	163	1.0	0.872	47.6	LOS D	36.6	259.9	0.99	1.01	22.3
11	T1	1170	2.0	1153	2.0	0.872	41.9	LOS C	37.0	263.4	0.99	1.01	12.9
Approach		1335	1.9	1315 [N1]	1.9	0.872	42.6	LOS D	37.0	263.4	0.99	1.01	14.4
All Vehicles		3200	1.8	3180 [N1]	1.8	0.872	32.8	LOS C	37.0	263.4	0.91	0.86	16.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.1 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	South Full Crossing	50	14.8	LOS B	0.1	0.1	0.52	0.52
P2	East Full Crossing	50	49.3	LOS E	0.1	0.1	0.95	0.95
P3	North Full Crossing	50	15.9	LOS B	0.1	0.1	0.54	0.54
P4	West Full Crossing	50	49.3	LOS E	0.1	0.1	0.95	0.95
All Pedestrians		200	32.3	LOS D			0.74	0.74

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

▽ Site: 101 [AM (Ex+D): Pennant Hills Road - Martins Lane - Import]

⊕⊕ Network: N101 [AM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Morning Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Martins Lane													
1	L2	2	1.0	2	1.0	0.011	12.7	LOS A	0.0	0.1	0.73	0.81	32.1
Approach		2	1.0	2	1.0	0.011	12.7	LOS A	0.0	0.1	0.73	0.81	32.1
East: Pennant Hills Road													
4	L2	10	1.0	10	1.0	0.500	4.3	LOS A	5.0	35.9	0.00	0.01	55.4
5	T1	1530	2.0	1530	2.0	0.500	0.0	LOS A	5.0	35.9	0.00	0.00	59.4
Approach		1540	2.0	1540	2.0	0.500	0.0	NA	5.0	35.9	0.00	0.00	59.3
West: Pennant Hills Road													
11	T1	1390	2.0	1373	2.0	0.357	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1390	2.0	1373[N1]	2.0	0.357	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		2932	2.0	2915[N1]	2.0	0.500	0.0	NA	5.0	35.9	0.00	0.00	59.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.1 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

▽ Site: 101 [AM (Ex+D): Pennant Hills Road - Charles Street - Import]

⊕⊕ Network: N101 [AM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Morning Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Charles Street													
1	L2	65	1.0	65	1.0	0.138	8.9	LOS A	0.4	2.9	0.58	0.76	36.5
Approach		65	1.0	65	1.0	0.138	8.9	LOS A	0.4	2.9	0.58	0.76	36.5
East: Pennant Hills Road													
4	L2	45	1.0	45	1.0	0.395	5.6	LOS A	0.0	0.0	0.00	0.04	55.6
5	T1	1475	2.0	1475	2.0	0.395	0.0	LOS A	0.0	0.0	0.00	0.02	58.7
Approach		1520	2.0	1520	2.0	0.395	0.2	NA	0.0	0.0	0.00	0.02	58.4
West: Pennant Hills Road													
11	T1	1390	2.0	1373	2.0	0.357	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1390	2.0	1373[N1]	2.0	0.357	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		2975	2.0	2958[N1]	2.0	0.395	0.3	NA	0.4	2.9	0.01	0.03	56.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.1 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [AM (Ex+D): Pennant Hills Road - Adderton Road - Import]

Network: N101 [AM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Morning Peak Hour
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Adderton Road													
1	L2	25	1.0	25	1.0	0.828	51.3	LOS D	10.9	76.6	1.00	0.95	18.4
3	R2	420	1.0	420	1.0	0.828	51.5	LOS D	10.9	76.6	1.00	0.95	22.9
Approach		445	1.0	445	1.0	0.828	51.5	LOS D	10.9	76.6	1.00	0.95	22.7
East: Pennant Hills Road													
4	L2	445	1.0	445	1.0	0.864	28.2	LOS B	39.3	278.6	0.88	0.91	32.4
5	T1	1495	2.0	1495	2.0	0.864	22.9	LOS B	41.1	292.5	0.90	0.91	20.4
Approach		1940	1.8	1940	1.8	0.864	24.1	LOS B	41.1	292.5	0.89	0.91	24.7
West: Pennant Hills Road													
11	T1	1290	2.0	1274	2.0	0.458	5.5	LOS A	11.4	81.5	0.45	0.41	46.7
12	R2	100	1.0	99	1.0	0.803	57.1	LOS E	4.8	34.2	1.00	0.90	20.4
Approach		1390	1.9	1373[N1]	1.9	0.803	9.2	LOS A	11.4	81.5	0.49	0.44	40.7
All Vehicles		3775	1.7	3758[N1]	1.7	0.864	21.9	LOS B	41.1	292.5	0.76	0.74	28.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.1 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	South Full Crossing	50	10.8	LOS B	0.1	0.1	0.49	0.49
P4	West Full Crossing	50	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		100	25.0	LOS C			0.71	0.71

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

▽ Site: 101 [PM (Ex): Pennant Hills Road - Tintern Avenue - Import]

⊕⊕ Network: N101 [PM (Ex): Pennant Hills Road]

Existing Weekday Afternoon Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Tintern Avenue													
1	L2	100	1.0	100	1.0	2.668	1577.7	LOS F	52.0	367.0	1.00	4.53	1.6
3	R2	15	1.0	15	1.0	2.668	1774.4	LOS F	52.0	367.0	1.00	4.53	0.5
Approach		115	1.0	115	1.0	2.668	1603.4	LOS F	52.0	367.0	1.00	4.53	1.5
East: Pennant Hills Road													
4	L2	55	1.0	54	1.0	0.380	5.6	LOS A	0.0	0.0	0.00	0.04	55.1
5	T1	1440	2.0	1407	2.0	0.380	0.0	LOS A	0.0	0.0	0.00	0.02	59.6
Approach		1495	2.0	1461[N1]	2.0	0.380	0.2	NA	0.0	0.0	0.00	0.02	59.5
West: Pennant Hills Road													
11	T1	1310	2.0	1310	2.0	0.340	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
12	R2	55	1.0	55	1.0	0.289	27.5	LOS B	1.0	6.9	0.90	0.99	33.9
Approach		1365	2.0	1365	2.0	0.340	1.2	NA	1.0	6.9	0.04	0.04	57.4
All Vehicles		2975	1.9	2941[N1]	1.9	2.668	63.3	NA	52.0	367.0	0.06	0.21	21.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 1.0 %
Number of Iterations: 5 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [PM (Ex): Pennant Hills Road - Baker Street - Import]

Network: N101 [PM (Ex): Pennant Hills Road]

Existing Weekday Afternoon Peak Hour
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
East: Pennant Hills Road													
5	T1	1455	2.0	1455	2.0	0.378	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
6	R2	75	1.0	75	1.0	0.297	22.1	LOS B	1.1	7.6	0.87	0.98	28.9
Approach		1530	2.0	1530	2.0	0.378	1.1	NA	1.1	7.6	0.04	0.05	52.1
North: Baker Street													
7	L2	85	1.0	85	1.0	0.147	11.9	LOS A	0.5	3.7	0.56	1.00	33.1
9	R2	40	1.0	40	1.0	6.667	5341.6	LOS F	35.2	248.8	1.00	1.41	0.2
Approach		125	1.0	125	1.0	6.667	1717.4	LOS F	35.2	248.8	0.70	1.13	0.6
West: Pennant Hills Road													
10	L2	85	1.0	84	1.0	0.343	5.6	LOS A	0.0	0.0	0.00	0.08	54.9
11	T1	1240	2.0	1231	2.0	0.343	0.0	LOS A	0.0	0.0	0.00	0.04	58.2
Approach		1325	1.9	1316[N1]	1.9	0.343	0.4	NA	0.0	0.0	0.00	0.04	57.7
All Vehicles		2980	1.9	2971[N1]	1.9	6.667	73.0	NA	35.2	248.8	0.05	0.09	7.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 1.0 %
Number of Iterations: 5 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

▽ Site: 101 [PM (Ex): Pennant Hills Road - Martins Lane - Import]

Network: N101 [PM (Ex): Pennant Hills Road]

Existing Weekday Afternoon Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Martins Lane													
1	L2	1	1.0	1	1.0	0.002	9.6	LOS A	0.0	0.0	0.63	0.65	35.2
Approach		1	1.0	1	1.0	0.002	9.6	LOS A	0.0	0.0	0.63	0.65	35.2
East: Pennant Hills Road													
5	T1	1530	2.0	1530	2.0	0.397	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1530	2.0	1530	2.0	0.397	0.0	NA	0.0	0.0	0.00	0.00	59.9
West: Pennant Hills Road													
11	T1	1325	2.0	1316	2.0	0.342	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1325	2.0	1316[N1]	2.0	0.342	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		2856	2.0	2847[N1]	2.0	0.397	0.0	NA	0.0	0.0	0.00	0.00	59.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 1.0 %
Number of Iterations: 5 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

▽ Site: 101 [PM (Ex): Pennant Hills Road - Charles Street - Import]

⊕⊕ Network: N101 [PM (Ex): Pennant Hills Road]

Existing Weekday Afternoon Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Charles Street													
1	L2	15	1.0	15	1.0	0.024	8.9	LOS A	0.1	0.7	0.58	0.68	36.6
Approach		15	1.0	15	1.0	0.024	8.9	LOS A	0.1	0.7	0.58	0.68	36.6
East: Pennant Hills Road													
4	L2	30	1.0	30	1.0	0.402	5.6	LOS A	0.0	0.0	0.00	0.02	55.8
5	T1	1515	2.0	1515	2.0	0.402	0.0	LOS A	0.0	0.0	0.00	0.01	59.1
Approach		1545	2.0	1545	2.0	0.402	0.1	NA	0.0	0.0	0.00	0.01	58.9
West: Pennant Hills Road													
11	T1	1325	2.0	1316	2.0	0.342	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1325	2.0	1316[N1]	2.0	0.342	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		2885	2.0	2876[N1]	2.0	0.402	0.1	NA	0.1	0.7	0.00	0.01	58.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 1.0 %
Number of Iterations: 5 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [PM (Ex): Pennant Hills Road - Adderton Road - Import]

Network: N101 [PM (Ex): Pennant Hills Road]

Existing Weekday Afternoon Peak Hour
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Adderton Road													
1	L2	20	1.0	20	1.0	0.825	49.8	LOS D	12.3	86.7	1.00	0.95	18.7
3	R2	490	1.0	490	1.0	0.825	50.0	LOS D	12.3	86.7	1.00	0.94	23.3
Approach		510	1.0	510	1.0	0.825	50.0	LOS D	12.3	86.7	1.00	0.94	23.1
East: Pennant Hills Road													
4	L2	380	1.0	380	1.0	0.881	32.2	LOS C	41.6	295.2	0.91	0.95	30.8
5	T1	1525	2.0	1525	2.0	0.881	26.9	LOS B	43.3	307.9	0.93	0.96	18.4
Approach		1905	1.8	1905	1.8	0.881	27.9	LOS B	43.3	307.9	0.92	0.96	22.2
West: Pennant Hills Road													
11	T1	1275	2.0	1267	2.0	0.470	6.4	LOS A	12.3	87.3	0.48	0.44	45.1
12	R2	50	1.0	50	1.0	0.404	52.2	LOS D	2.3	15.9	1.00	0.74	21.4
Approach		1325	2.0	1316[N1]	2.0	0.470	8.1	LOS A	12.3	87.3	0.50	0.45	42.3
All Vehicles		3740	1.7	3731[N1]	1.8	0.881	24.0	LOS B	43.3	307.9	0.79	0.78	26.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 1.0 %
Number of Iterations: 5 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	11.8	LOS B	0.1	0.1	0.51	0.51
P4	West Full Crossing	50	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		100	25.5	LOS C			0.72	0.72

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

▽ Site: 101 [PM (Ex+D): Pennant Hills Road - Tintern Avenue - Import] ⊕⊕ Network: N101 [PM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Afternoon Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Tintern Avenue													
1	L2	105	1.0	105	1.0	2.809	1719.3	LOS F	56.1	395.9	1.00	4.92	1.5
3	R2	15	1.0	15	1.0	2.809	1917.7	LOS F	56.1	395.9	1.00	4.92	0.5
Approach		120	1.0	120	1.0	2.809	1744.1	LOS F	56.1	395.9	1.00	4.92	1.4
East: Pennant Hills Road													
4	L2	55	1.0	55	1.0	0.394	5.6	LOS A	0.0	0.0	0.00	0.04	55.1
5	T1	1460	2.0	1460	2.0	0.394	0.0	LOS A	0.0	0.0	0.00	0.02	59.6
Approach		1515	2.0	1515	2.0	0.394	0.2	NA	0.0	0.0	0.00	0.02	59.5
West: Pennant Hills Road													
11	T1	1360	2.0	1360	2.0	0.506	0.1	LOS A	0.0	0.0	0.00	0.00	59.8
12	R2	65	1.0	65	1.0	0.231	19.8	LOS B	0.9	6.0	0.84	0.95	37.5
Approach		1425	2.0	1425	2.0	0.506	1.0	NA	0.9	6.0	0.04	0.04	57.5
All Vehicles		3060	1.9	3060	1.9	2.809	69.0	NA	56.1	395.9	0.06	0.22	20.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.9 %
Number of Iterations: 10 (maximum specified: 10)

MOVEMENT SUMMARY

Site: 101v [PM (Ex+D): Pennant Hills Road - Baker Street - Proposed Access - Import]

Network: N101 [PM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Afternoon Peak Hour
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Proposed Access													
1	L2	20	1.0	20	1.0	0.570	53.9	LOS D	2.6	18.4	1.00	0.78	20.5
2	T1	5	1.0	5	1.0	0.570	49.3	LOS D	2.6	18.4	1.00	0.78	25.8
3	R2	30	1.0	30	1.0	0.570	53.9	LOS D	2.6	18.4	1.00	0.78	20.5
Approach		55	1.0	55	1.0	0.570	53.4	LOS D	2.6	18.4	1.00	0.78	21.1
East: Pennant Hills Road													
4	L2	45	1.0	45	1.0	0.776	25.6	LOS B	26.4	187.7	0.87	0.82	34.9
5	T1	1455	2.0	1455	2.0	0.776	19.0	LOS B	26.4	187.7	0.85	0.79	17.2
6	R2	75	1.0	75	1.0	0.342	41.4	LOS C	3.1	21.7	0.95	0.76	20.9
Approach		1575	1.9	1575	1.9	0.776	20.3	LOS B	26.4	187.7	0.85	0.79	18.7
North: Baker Street													
7	L2	85	1.0	85	1.0	0.796	53.3	LOS D	7.0	49.2	1.00	0.94	14.5
8	T1	60	1.0	60	1.0	0.796	48.7	LOS D	7.0	49.2	1.00	0.94	26.3
9	R2	40	1.0	40	1.0	0.345	52.0	LOS D	1.8	12.9	1.00	0.72	14.3
Approach		185	1.0	185	1.0	0.796	51.5	LOS D	7.0	49.2	1.00	0.89	19.4
West: Pennant Hills Road													
10	L2	135	1.0	134	1.0	0.885	44.2	LOS D	33.3	236.6	1.00	1.07	23.5
11	T1	1240	2.0	1231	2.0	0.885	38.2	LOS C	33.5	238.5	1.00	1.06	13.8
Approach		1375	1.9	1365[N1]	1.9	0.885	38.8	LOS C	33.5	238.5	1.00	1.06	15.1
All Vehicles		3190	1.8	3180[N1]	1.9	0.885	30.6	LOS C	33.5	238.5	0.93	0.91	17.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.9 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue Pedestrian	Distance	Prop. Queued	Effective Stop Rate
		ped/h	sec		ped	m		per ped
P1	South Full Crossing	50	2.9	LOS A	0.0	0.0	0.26	0.26
P2	East Full Crossing	50	29.7	LOS C	0.1	0.1	0.81	0.81
P3	North Full Crossing	50	3.5	LOS A	0.0	0.0	0.28	0.28
P4	West Full Crossing	50	28.9	LOS C	0.1	0.1	0.80	0.80
All Pedestrians		200	16.2	LOS B			0.54	0.54

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

▽ Site: 101 [PM (Ex+D): Pennant Hills Road - Martins Lane - Import]

⊕⊕ Network: N101 [PM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Afternoon Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles													
Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Martins Lane													
1	L2	1	1.0	1	1.0	0.007	14.2	LOS A	0.0	0.1	0.77	0.81	30.8
Approach		1	1.0	1	1.0	0.007	14.2	LOS A	0.0	0.1	0.77	0.81	30.8
East: Pennant Hills Road													
4	L2	15	1.0	15	1.0	0.537	4.3	LOS A	0.9	6.6	0.00	0.01	55.3
5	T1	1575	2.0	1575	2.0	0.537	0.0	LOS A	0.9	6.6	0.00	0.01	59.2
Approach		1590	2.0	1590	2.0	0.537	0.1	NA	0.9	6.6	0.00	0.01	59.0
West: Pennant Hills Road													
11	T1	1355	2.0	1346	2.0	0.350	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1355	2.0	1346[N1]	2.0	0.350	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		2946	2.0	2937[N1]	2.0	0.537	0.0	NA	0.9	6.6	0.00	0.00	59.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.9 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

▽ Site: 101 [PM (Ex+D): Pennant Hills Road - Charles Street - Import]

⊕⊕ Network: N101 [PM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Afternoon Peak Hour
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Charles Street													
1	L2	15	1.0	15	1.0	0.029	9.2	LOS A	0.1	0.7	0.59	0.69	36.2
Approach		15	1.0	15	1.0	0.029	9.2	LOS A	0.1	0.7	0.59	0.69	36.2
East: Pennant Hills Road													
4	L2	35	1.0	35	1.0	0.419	5.6	LOS A	0.0	0.0	0.00	0.03	55.8
5	T1	1575	2.0	1575	2.0	0.419	0.0	LOS A	0.0	0.0	0.00	0.01	59.0
Approach		1610	2.0	1610	2.0	0.419	0.1	NA	0.0	0.0	0.00	0.01	58.7
West: Pennant Hills Road													
11	T1	1355	2.0	1346	2.0	0.350	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
Approach		1355	2.0	1346[N1]	2.0	0.350	0.0	NA	0.0	0.0	0.00	0.00	59.9
All Vehicles		2980	2.0	2971[N1]	2.0	0.419	0.1	NA	0.1	0.7	0.00	0.01	58.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.9 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

MOVEMENT SUMMARY

Site: 101 [PM (Ex+D): Pennant Hills Road - Adderton Road - Import]

Network: N101 [PM (Ex+D): Pennant Hills Road]

Existing Plus Development Weekday Afternoon Peak Hour
Signals - Fixed Time Isolated Cycle Time = 90 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total	HV	Arrival Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Average Speed
		veh/h	%	veh/h	%	v/c	sec		veh	m		per veh	km/h
South: Adderton Road													
1	L2	20	1.0	20	1.0	0.884	55.8	LOS D	13.2	93.3	1.00	1.01	17.4
3	R2	490	1.0	490	1.0	0.884	55.8	LOS D	13.2	93.3	1.00	1.01	21.9
Approach		510	1.0	510	1.0	0.884	55.8	LOS D	13.2	93.3	1.00	1.01	21.8
East: Pennant Hills Road													
4	L2	380	1.0	380	1.0	0.893	33.8	LOS C	44.6	316.5	0.92	0.97	30.1
5	T1	1590	2.0	1590	2.0	0.893	28.4	LOS B	46.3	330.0	0.94	0.98	17.7
Approach		1970	1.8	1970	1.8	0.893	29.5	LOS C	46.3	330.0	0.93	0.98	21.3
West: Pennant Hills Road													
11	T1	1305	2.0	1297	2.0	0.474	6.0	LOS A	12.2	87.1	0.47	0.43	45.8
12	R2	50	1.0	50	1.0	0.404	52.2	LOS D	2.3	15.9	1.00	0.74	21.4
Approach		1355	2.0	1346[N1]	2.0	0.474	7.7	LOS A	12.2	87.1	0.49	0.44	42.9
All Vehicles		3835	1.8	3826[N1]	1.8	0.893	25.3	LOS B	46.3	330.0	0.79	0.79	25.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Network Data dialog (Network tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Largest change in Average Back of Queue or Degree of Saturation for any lane during the last three iterations: 6.9 %
Number of Iterations: 10 (maximum specified: 10)

N1 Arrival Flow value is reduced due to capacity constraint at oversaturated upstream lanes.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	South Full Crossing	50	11.3	LOS B	0.1	0.1	0.50	0.50
P4	West Full Crossing	50	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		100	25.3	LOS C			0.72	0.72

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

APPENDIX C
RMS CORRESPONDENCE

Transport
Roads & Maritime
Services

24 March 2015

Roads and Maritime Services Ref: SYD15/00278/01
Council Ref: RZ/2/2015

The General Manager
Parramatta City Council
PO Box 32
Parramatta NSW 2124

Attention: Claire Ryan

PLANNING PROPOSAL – (AMENDMENTS TO PARRAMATTA LEP 2011) REZONING FOR HIGH DENSITY RESIDENTIAL AT NO 264-268 PENNANT HILLS ROAD, CARLINGFORD

Dear Sir / Madam,

I refer to Council's correspondence dated 27 February 2015 regarding the subject Planning Proposal which was forwarded to Roads and Maritime Services for comment prior to Council forwarding the Planning Proposal to the Department of Planning and Environment for Gateway Determination.

The proposal seeks to amend Parramatta Local Environmental Plan 2011 (Parramatta LEP 2011) to facilitate the following changes at the abovementioned site:

- Rezone land from R2 – Low Density Residential to R4 – High Density Residential,
- Increase the maximum floor space ratio on the site from 0.5:1 to 1.2:1,
- Increase the maximum height permitted on the site from 9m to 32m.

Roads and Maritime have reviewed the submitted material and raise no objection to the abovementioned amendments to the planning controls associated with the Planning Proposal. However, the following requirements should form part of Council's Gateway report to the Department of Planning and Environment and be included as conditions within the Gateway Determination.

1. That Council consults with and satisfactorily addresses any issues raised as a result of consultation with Transport for NSW (TfNSW) and Roads and Maritime prior to the public exhibition of the Planning Proposal.

2. That the exhibited material must demonstrate that vehicular access to the site is provided as follows:

    a) Signalisation of the intersection of Pennant Hills Road / Baker Street – (to facilitate safe pedestrian accessibility to the nearby bus stops located on either side of Pennant Hills Road).
    b) The provision of a signalised vehicular access / egress to the development site (adjacent to the western boundary of the site) at the abovementioned proposed signalised intersection of Pennant Hills Road / Baker Street.

c) The signalised intersection / access arrangements listed in points a) and b) above must ensure the following:
    - Right turn movements from Pennant Hills Road into the proposed site access must not be permitted.
    - Designed to operate with diamond right turn phasing for Baker Street – Site access, or the right turn movement out of the Site access is restricted.

d) That the internal road / access arrangements are designed to ensure that it does not promote vehicle rat-running through the site.

3. That the exhibited material must provide details of the abovementioned infrastructure works and the requirements that the developer has offered to provide/construct as part of a Voluntary Planning Agreement (VPA) which would be entered into with Council.

   The VPA should also include indicative timeframes or trigger points for the provision of the VPA works.

   Note: The VPA shall be entered into (ie signed by the developer / proponent) prior to Council resolving to send the draft planning instrument to the Minister for Planning for making.

   The VPA must also ensure that any proposed changes to intersection(s) along Pennant Hills Road comply with the following requirements:

   a) Fully funded and constructed by the developer / proponent.
   b) Fund all the maintenance costs for the traffic control signals for the first ten years of operation.
   c) The developer / proponent will be required to submit detailed civil / signal design plans that are designed to meet Roads and Maritime requirements, and endorsed by a suitably qualified practitioner. The design requirements shall be in accordance with AUSTROADS and other Australian Codes of Practice. The certified copies of the civil / signal design plans shall be submitted to Roads and Maritime for consideration and approval prior to the release of the Construction Certificate by the Principal Certifying Authority and commencement of road works.

      The developer / proponent will be required to enter into a Works Authorisation Deed (WAD) with Roads and Maritime for any changes to intersection(s) along the Pennant Hills Road.

      Roads and Maritime fees for administration, plan checking, civil / signal works inspections and project management shall be paid by the developer / proponent prior to the commencement of the works.

Subject to the above matters being resolved, the following advice would be applicable:

4. The signalisation and access arrangements described within Point 2 above will require changes to be made to the 'Draft Amendment to Parramatta Development Control Plan 2011 – Section 4.5.1.4 Structure Plan'.

5. Amendments in bold italics should be made to the 'Draft Amendment to Parramatta Development Control Plan 2011 – Section 4.5 Other Precincts' as follows:

   4.5.1.5 - Specific Design Principles
   C - Traffic and Parking
   Design Controls – Martins Lane – C2

   The intersection of Pennant Hills Road and Martins Lane is to be widened to allow for left in/left out movements, ***designed in accordance with Austroads – Guide to Road Design requirements and satisfactorily accommodate the turn paths of the largest design vehicle using Martins Lane***. No right hand turns movements from Martins Lane to Pennant Hills Road or from Pennant Hills Road into Martins Lane will be permitted. Any road widening required in order to achieve left in/left out traffic movements at this intersection must be wholly contained on the subject site.

Any further enquiries in relation to this matter can be directed to the Senior Land Use Planner – Andrew Popoff on telephone 8849 2180 or via email to: Andrew.Popoff@rms.nsw.gov.au

Yours sincerely,

Greg Flynn
Manager Strategic Land Use
Network & Safety, Sydney

APPENDIX D
PREVIOUS REPORT

BAPTISTCARE AND SYDNEY PROPERTY DEVELOPMENT CONSULTANTS

TRANSPORT REPORT FOR BLOCK STUDY FOR LAND BOUNDED BY PENNANT HILLS ROAD, TINTERN AVENUE, HOMELANDS AVENUE AND MARTINS LANE, CARLINGFORD

FEBRUARY 2017

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1. INTRODUCTION

1.1 Colston Budd Rogers and Kafes Pty Ltd has been commissioned by BaptistCare and Sydney Property Development Consultants to prepare a report examining the transport implications of a block study for land bounded by Pennant Hills Road, Tintern Avenue, Homelands Avenue and Martins Lane at Carlingford. The study area is shown in Figure 1.

1.2 The site is occupied by an aged care development (the BaptistCare site at 264-268 Pennant Hills Road) and other low-medium density residential development. A planning proposal has been lodged by BaptistCare for its site, to permit higher density residential development. We prepared a report[1] in support of that planning proposal.

1.3 A planning proposal has also been lodged for an adjacent site (the Sydney Property Development Consultants site at 258-262 Pennant Hills Road and 17 and 20 Azile Court) to permit higher density residential development.

1.4 In the context of these planning proposals, as well as another planning proposal north-east of the precinct at 241 Pennant Hills Road, council requested that a block study be undertaken to examine the potential for redevelopment of the precinct bounded by Pennant Hills Road, Tintern Avenue, Homelands Avenue and Martins Lane. The brief for the study includes the following:

[1] Transport Aspects of Planning Proposal for Proposed Residential Development, Pennant Hills Road & Martins Lane, Carlingford, February 2015.

- *Review background material (Council reports, material lodged with the Planning Proposals, RMS letter dated 24 March 2015).*

- *Allowance for attendance at the following meetings:*

    - *Inception meeting with proponents, Council and proponents' planning consultants.*

    - *Two progress meetings with proponents and proponents' planning consultants during the course of the study.*

    - *A community consultation meeting with the proponents and landowners within the precinct when the first draft of the block study is presented. It is anticipated that this session would occur approximately one month into the study.*

    - *A meeting with proponents, Council and proponents' planning consultants at the presentation of the final draft of the block study.*

    - *Co-ordination with the Urban Designer in terms of potential density.*

    - *Allowance for discussions with RMS and Transport for NSW.*

    - *Quantify the extent to which availability of public transport affects traffic generation/traffic impacts and propose traffic generation rates for use in the assessment of the impact of the development.*

    - *Undertake a review of traffic generation rates within a catchment area agreed to by Council and RMS.*

- *Undertake an assessment of cumulative traffic generation based on the development potential that might be achieved based on the block analysis. This assessment must also take into account any known or mooted development proposals. Council will be able to provide advice in this regard.*

- *Identify impacts on local and state roads and intersections that might be affected by development of the precinct proceeding in accordance with the urban design analysis.*

- *Develop treatments to ameliorate impacts. This might entail a change to the densities recommended in the block analysis where suitable treatments cannot be proposed.*

- *Propose funding mechanisms including trigger points to facilitate implementation of recommended treatments.*

- *Assess the RMS requirement for signalisation of the intersection of Baker Street and Pennant Hills Road having regard to development within the precinct proceeding in accordance with the urban design analysis and also having regarding to Council's recommendation to create a fourth leg to this intersection. Consider also development on the northern side of Pennant Hills Road, including possible redevelopment at 241 Pennant Hills Road, Carlingford.*

- *Assess the impact of Council's proposal to create a fourth leg to the Baker Street/Pennant Hills Road intersection including its signalisation, factoring in the potential for the developments on 264-268 Pennant Hills Road (the BaptistCare site) and 258-262 Pennant Hills Road and 17 & 20 Azile Court being accessed from the new fourth leg of the intersection.*

- *Subject to the outcome of the investigations above, provide options for the alignment of the fourth leg to the Baker Street/Pennant Hills Road intersection including its signalisation. (i.e. Azile Court.*

- *Provide options for the delivery of the proposed road pattern including the fourth leg to the Baker Street/Pennant Hills Road intersection including its signalisation.*

- *Assess the impact of and need for the Council's suggestion for the widening of Martins Lane 12m wide streets with double carriageway for 2-way movement, footpath on western side and capacity for on-street car parking. This will need to be co-ordinated with the urban designer and ecologist.*

- *Propose the staging of the future public road network if BaptistCare site is developed first.*

- *Propose a network that encourages the safety, convenience and amenity of pedestrians accessing various transport options.*

1.5 The analysis undertaken by the architect/urban designer has identified the potential for some 800 to 900 dwellings in the precinct. This report therefore assesses the transport implications of potential redevelopment of the precinct for this scale of development, including addressing the above matters in the study brief. The assessment is set down through the following chapters:

- Chapter 2 - describing the existing conditions; and

- Chapter 3 - assessing the traffic implications of the proposed development.

2. EXISTING CONDITIONS

Site Location and Road Network

2.1 The study area is bounded by Pennant Hills Road, Tintern Avenue, Homelands Avenue and Martins Lane, as shown in Figure 1. Part of the area is occupied an aged care development (the BaptistCare site at 264-268 Pennant Hills Road which provides some 240 beds). There is a site on the corner of Pennant Hills Road and Tintern Avenue which has recently been redeveloped to provide 10 dwellings. The remainder of the study area provides some 35 to 40 dwellings in low-medium density residential development. Vehicular access to individual lots/sites in the precinct is provided from Pennant Hills Road, Homelands Avenue, Martins Lane, Tintern Avenue and Azile Court.

2.2 Surrounding land use includes a number of schools to the north and west, some commercial uses along Pennant Hills Road, areas of open space and other low to medium density residential development. Carlingford railway station is within some 750 metres walking distance to the north-east and Telopea station is a similar distance to the south.

2.3 Pennant Hills Road provides a major link in Sydney's road network, connecting Parramatta in the south-west with Hornsby the north-east. In the vicinity of the site it provides a four lane undivided carriageway with two traffic lanes in each direction and a 60 kilometre per hour speed limit. Clearways operate for southbound traffic during weekday peak periods. There are bus stops on both sides of the road, close to the site. There is a right turn bay in Pennant Hills Road for turns into Baker Street along the site frontage.

2.4 Pennant Hills Road has unsignalised t-intersections with Tintern Avenue, Baker Street, Martins Lane and Charles Street. West of Charles Street, Pennant Hills Road has a signalised intersection with Adderton Road.

2.5 Turns at the Pennant Hills Road/Martins Lane intersection are restricted to left turns only from Martins Lane onto Pennant Hills Road. Martins Lane provides a carriageway width of some 5.5 metres, with a wider carriageway at its southern end. It provides for two-way traffic, although in practice, the turning restrictions at Pennant Hills Road mean that most traffic in the lane is northbound. No parking is provided along its length. Some angle parking is provided adjacent to Martins Lane, within the BaptistCare site.

2.6 Homelands Avenue runs along the southern side of the precinct, connecting Adderton Road in the east with Grace Street in the west. It provides for two-way traffic, with parking permitted, and a 50 kilometre per hour speed limit. It provides access to residential development. The intersection of Homelands Avenue with Martins Lane is an unsignalised t-intersection with all turns permitted. There is a landscaped median in Martins Lane at the intersection. The intersections of Homelands Avenue with Grace Street and Adderton Road are unsignalised t-intersections.

2.7 East of the precinct, Homelands Avenue has a four-way intersection with Charles Street, controlled by stop signs. Charles Street connects to Pennant Hills Road to the north at an unsignalised t-intersection. Turns at the intersection are restricted to left in/left out. Charles Street provides for two-way traffic with parking generally permitted on both sides, with a 50 kilometre per hour speed limit. South of Homelands Avenue Charles Street becomes Telopea Street which connects to Adderton Road to the south, providing access to residential development, open space and Telopea railway station.

2.8 Baker Street runs north from Pennant Hills Road. It provides access to a school and residential areas. North of Pennant Hills Road it connects to Felton Road at a roundabout. East of Baker Street, Felton Road is a dead end and provides access to residential properties and the rear of 241 Pennant Hills Road which has been rezoned to permit mixed use residential development.

2.9 Azile Court runs north from the intersection of Homelands Avenue with Grace Street. It is a dead end and provides access to a number of residential properties within the precinct.

Traffic Flows

2.10 Traffic generated by redevelopment in the precinct will have its greatest effects during weekday morning and afternoon peak hours when it combines with commuter traffic on the surrounding road network. In order to gauge traffic conditions, counts were undertaken during weekday morning and afternoon peak periods at the following intersections:

- Pennant Hills Road/Tintern Avenue;
- Pennant Hills Road/Baker Street;
- Pennant Hills Road/Martins Lane;
- Pennant Hills Road/Charles Street;
- Pennant Hills Road/Adderton Road;
- Homelands Avenue/Grace Street;
- Homelands Avenue/Charles Street;
- Homelands Avenue/Adderton Road;
- Baker Street/Felton Road; and
- Telopea Street/Adderton Road.

2.11 The results of the surveys are shown in Figures 2 and 3, and summarised in Table 2.1.

Table 2.1: Existing two-way (sum of both directions) peak hour traffic flows

Road	Location	Morning peak hour	Afternoon peak hour
Pennant Hills Road	West of Tintern Avenue	2,870	2,905
	West of Baker Street	2,730	2,820
	West of Charles Street	2,840	2,855
	West of Adderton Road	2,820	2,870
	East of Adderton Road	3,560	3,670
Baker Street	North of Pennant Hills Road	470	285
	North of Felton Road	450	210
Felton Road	East of Baker Street	270	75
	West of Baker Street	235	150
Charles Street	South of Pennant Hills Road	110	45
	North of Homelands Avenue	125	105
Telopea Street	South of Homelands Avenue	145	90
	North of Adderton Road	160	145
Adderton Road	South of Pennant Hills Road	990	940
	South of Homelands Avenue	955	940
	South of Telopea Street	1,120	970
Tintern Avenue	South of Pennant Hills Road	250	225
Homelands Avenue	East of Grace Street	25	10
	West of Charles Street	40	35
	West of Adderton Road	65	110
Martins Lane	South of Pennant Hills Road	5	1
Azile Court	North of Homelands Avenue	15	5
Grace Street	South of Homelands Avenue	20	10

2.12 Table 2.1 shows that Pennant Hills Road carried some 2,750 to 3,700 vehicles per hour two-way during the surveyed morning and afternoon peak hours. Adderton Road carried lower flows of some 950 to 1,150 vehicles per hour two-way.

2.13 Baker Street carried some 200 to 500 vehicles per hour two-way during the surveyed peak hours. Flows on Felton Road, Charles Street, Telopea Street and Tintern Avenue were in the range 50 to 300 vehicles per hour two-way.

2.14 Homelands Avenue carried less than 150 vehicles per hour two-way, with flows decreasing toward the west. Martins Lane, Grace Street and Azile Court carried low flows of some 20 vehicles per hour or less.

Intersection Operations

2.15 The capacity of the road network is largely determined by the capacity of its intersections to cater for peak traffic flows. The surveyed intersections have been analysed using the SIDRA 7 Network computer program for the traffic flows shown in Figures 2 and 3.

2.16 SIDRA provides a number of performance measures. The most useful measure provided is average delay per vehicle expressed in seconds per vehicle. Based on average delay per vehicle, SIDRA estimates the following levels of service (LOS):

- For traffic signals, the average delay per vehicle in seconds is calculated as delay/(all vehicles), for roundabouts the average delay per vehicle in seconds is selected for the movement with the highest average delay per vehicle, equivalent to the following LOS:

0 to 14	=	"A"	Good
15 to 28	=	"B"	Good with minimal delays and spare capacity
29 to 42	=	"C"	Satisfactory with spare capacity
43 to 56	=	"D"	Satisfactory but operating near capacity
57 to 70	=	"E"	At capacity and incidents will cause excessive delays. Roundabouts require other control mode.
>70	=	"F"	Unsatisfactory and requires additional capacity

- For give way and stop signs, the average delay per vehicle in seconds is selected from the movement with the highest average delay per vehicle, equivalent to following LOS:

0 to 14	=	"A"	Good
15 to 28	=	"B"	Acceptable delays and spare capacity
29 to 42	=	"C"	Satisfactory but accident study required
43 to 56	=	"D"	Near capacity and accident study required
57 to 70	=	"E"	At capacity and requires other control mode
>70	=	"F"	Unsatisfactory and requires other control mode

2.17 It should be noted that for roundabouts, give way and stop signs, in some circumstances, simply examining the highest individual average delay can be misleading. The size of the movement with the highest average delay per vehicle should also be taken into account. Thus, for example, an intersection where all movements are operating at a level of service A, except one which is at level of service E, may not necessarily define the intersection level of service as E if that movement is very small. That is, longer delays to a small number of vehicles may not justify upgrading an intersection unless a safety issue was also involved.

2.18 The analysis found that signalised intersection of Pennant Hills Road with Adderton Road operates with average delays of less than 35 seconds per vehicle during weekday morning and afternoon peak hours. This represents level of service C, a satisfactory level of service.

2.19 The intersections of Pennant Hills Road with Baker Street and Tintern Avenue experience delays for vehicles turning right onto Pennant Hills Road. Observations made during site inspections indicate that vehicles turns to and from Pennant Hills Road when there are gaps in the traffic stream created by the upstream traffic signals. The number of vehicles turning right from Tintern Avenue is relatively low, and alternative routes are available for this traffic. As noted in the RMS advice, the intersection of Pennant Hills Road/Baker Street would be signalized in association with redevelopment of the precinct. This is discussed further on the following chapter.

2.20 The unsignalised intersections of Adderton Road with Homelands Avenue and Telopea Street are operating with average delays for the highest delayed movements of less than 20 seconds per vehicle during peak periods. This represents level of service B, a reasonable level of service.

2.21 The roundabout at Baker Street/Felton Road, and the unsignalised intersections of Pennant Hills Road with Charles Street and Martins Lane, and of Homelands Avenue with Charles Street/Telopea Street and Grace Street/Azile Court, are operating with average delays for the highest delayed movements of less than 15 seconds per vehicle during peak periods. This represents level of service A/B, a good level of service.

Public Transport

2.22 The precinct is within some 10 minutes' walking distance of Carlingford and Telopea railway stations. Both stations are on the Carlingford Line (Carlingford to Clyde).

2.23 Services on the Carlingford Line operate on a 60 minute headway in each direction.

2.24 The Parramatta Light Rail project is planned to provide a light rail connection to Carlingford, replacing the existing heavy rail line, and connecting to Parramatta via Telopea, Dundas and Rydalmere. Construction of the light rail is expected to commence in 2018. It will provide a high frequency service in both directions along the route.

2.25 Local bus services are provided by Sydney Buses and Hillsbus. As previously discussed, there are bus stops on Pennant Hills Road close to the site.

2.26 Route 625 operates along Pennant Hills Road and connects Parramatta with Pennant Hills via Carlingford. It operates on a 60 minute headway in each direction, Monday to Saturday, with a limited Sunday service. During weekday peak hours, services are more frequent.

2.27 Route M54 is a cross regional service connecting Parramatta, Carlingford, Epping and Macquarie Park. It operates on a 10 minute headway in each direction during peak periods, a 15 minute headway in each direction during weekday off-peak and a 20 minute headway in each direction in the evening and on weekends.

2.28 A number of other bus services connect to Carlingford station and Carlingford Court shopping centre.

2.29 There are good pedestrian links between the site and surrounding areas. Traffic signals on Pennant Hills Road east and west of the site (at Adderton Road and outside Cumberland High School respectively) provide for pedestrians to cross Pennant Hills Road, including to reach bus stops on the other side of the road.

2.30 There is a bicycle route along Telopea Street and Wilkinson Lane, south of the site. The site therefore has good access to regular public transport services.

3. IMPLICATIONS OF PROPOSED DEVELOPMENT

3.1 The analysis undertaken by the architect/urban designer has identified the potential for some 800 to 900 dwellings in the precinct. Vehicular access could potentially be provided from a number of roads, including Tintern Avenue, Homelands Avenue, Azile Court, Martins Lane and a new road connecting to Pennant Hills Road opposite Baker Street, with traffic signals at this intersection.

3.2 This chapter assesses the implications of potential redevelopment of the precinct through the following sections:

- public transport;
- access and internal layout;
- traffic generation and effects;
- matters raised in brief;
- summary.

Public Transport

3.3 As previously discussed, bus services operate along Pennant Hills Road, adjacent to the site. They provide links to surrounding areas, including Parramatta, Epping and Macquarie Park. A new light rail line is proposed to replace the Carlingford rail line, with regular two-way services between Carlingford, Telopea, Dundas, Rydalmere and Parramatta.

3.4 The site is therefore accessible by public transport and will benefit further from future improved public transport services. The proposed development will therefore be readily accessible by public transport, walking and cycling.

3.5 To support accessibility by bicycles, appropriate bicycle parking, in accordance with council's controls, should be provided.

3.6 As discussed below in the section on access, provision of traffic signals at the intersection of Pennant Hills Road with Baker Street, with a fourth signalized approach for access to the precinct, will improve pedestrian connectivity between areas north and south of Pennant Hills Road. Pedestrian connectivity would also be provided through the precinct, along internal roads and other pathways connecting to Martins Lane, Azile Court and Pennant Hills Road.

3.7 The proposed development will therefore satisfy government objectives and the planning principles of:

- enabling residents to readily access rail and bus services close to the site, reducing the need for private car travel;
- providing an appropriate level of on-site parking, with reference to appropriate council and RMS requirements, to encourage greater public transport use and increase the proportion of trips by public transport;
- being readily connected to Parramatta and Macquarie Park; and
- providing for an increase in population living within 30 minutes by public transport of a city or major centre in the metropolitan area.

Access and Internal Layout

3.8 As noted in previous RMS correspondence (appended), vehicular access to the precinct would be provided via a new connection to Pennant Hills Road, opposite Baker Street. The intersection of Pennant Hills Road, Baker Street and the new access road would be signalized. In accordance with RMS correspondence, right turns from Pennant Hills Road into the site would not be permitted. A concept layout for the intersection is shown in Figure 4.

3.9 The existing driveways to the precinct from Pennant Hills Road would be closed, to the benefit of the operation of Pennant Hills Road.

3.10 The new internal precinct road would provide access to individual development lots in the precinct. Other access points to future development sites in the precinct would also be possible from Tintern Avenue, Homelands Avenue, Azile Court and Martins Lane. The future access locations would be subject to a final future amalgamation pattern.

3.11 The urban design concept includes public pedestrian connections through the site, connecting to Martins Lane, Pennant Hills Road, Azile Court and Homelands Avenue. The design includes provision for emergency and service vehicles.

3.12 Martins Lane would be widened on the eastern side of the precinct, to provide a six metre carriageway, suitable for two-way traffic. At its intersection with Pennant Hills Road, Martins Lane could be widened to provide for left in/left out movements. Currently left turns from Pennant Hills Road to Martins Lane are not permitted. Parking could be provided on one side of the road, in indented bays.

3.13 The new road connection from Pennant Hills Road would also provide for two-way traffic, with the potential for on-street parking where appropriate.

3.14 To ensure that through traffic movements are not created between the new road and areas to the south, it is not considered desirable for the new road to connect to other existing roads such as Azile Court, Martins Lane or Homelands Avenue. However, as noted above, widening of Martins Lane to provide for two-way traffic would improve connectivity between Pennant Hills Road and areas to the south.

3.15 Parking for the development will be provided within basement parking levels, under the buildings. Within parking areas, parking space dimensions, aisle widths, ramp grades, transitions, column locations and height clearances should be provided in accordance with AS 2890.1:2004 and AS 2890.2 – 2002.

Traffic Generation and Effects

3.16 Traffic generated by the potential development will have its greatest effects during weekday morning and afternoon peak periods when it combines with other traffic on the surrounding road network.

3.17 Surveys undertaken by RMS include the following traffic generation rates:

- 0.15 to 0.19 vehicles per hour per apartment for high density residential apartments (Sydney average); including

- some 0.25 – 0.4 vehicles per hour per apartment for locations in Liberty Grove and Parramatta.

3.18 With the introduction of the high frequency light rail service to Carlingford, we would expect the proposed development to have a traffic generation rate similar to or lower than Liberty Grove.

3.19 RMS has indicated that it would like Journey to Work data taken into account in the estimation of appropriate traffic generation rates. For the two travel zones in which the majority of the Carlingford precinct is located, the proportion of people using car (driver + passengers) for journey to work is 77 per cent. This compares to Liberty Grove where the proportion is 57 per cent. As noted above, with the introduction of high density apartments and a closer high frequency light rail service, we would expect a similar or lower mode split and traffic generation to Liberty Grove for the Carlingford precinct.

3.20 We have therefore assessed a traffic generation of 0.3 vehicles per hour per apartment two-way at peak times.

3.21 On this basis, a redeveloped precinct would generate some 270 vehicles per hour two-way during weekday morning and afternoon peak hours.

3.22 The additional traffic has been assigned to the road network. Existing peak hour flows plus the additional development traffic are shown in Figures 2 and 3, and summarised in Table 3.1.

3.23 Traffic increases on Pennant Hills Road would be some 75 to 100 vehicles per hour two-way at peak times. In the short section of Baker Street, between Pennant Hills Road and Felton Road, traffic increases would be some 65 to 130 vehicles per hour two-way. Increases on other roads would generally be less than 50 vehicles per hour two-way.

Table 3.1: Existing two-way peak hour traffic flows plus development traffic					
Road	**Location**	**Morning peak hour**		**Afternoon peak hour**	
		Existing	**Plus development**	**Existing**	**Plus development**
Pennant Hills Road	West of Tintern Avenue	2,870	+90	2,905	+95
	West of Baker Street	2,730	+75	2,820	+80
	West of Charles Street	2,840	+75	2,855	+80
	West of Adderton Road	2,820	+75	2,870	+85
	East of Adderton Road	3,560	+100	3,670	+100
Baker Street	North of Pennant Hills Road	470	+65	285	+130
	North of Felton Road	450	+25	210	+20
Felton Road	East of Baker Street	270	-	75	-
	West of Baker Street	235	-	150	-
Charles Street	South of Pennant Hills Road	110	-	45	+5
	North of Homelands Avenue	125	-	105	+5
Telopea Street	South of Homelands Avenue	145	+30	90	+30
	North of Adderton Road	160	+30	145	+30
Adderton Road	South of Pennant Hills Road	990	+25	940	+15
	South of Homelands Avenue	955	-	940	-
	South of Telopea Street	1,120	+30	970	+30
Tintern Avenue	South of Pennant Hills Road	250	+15	225	+15
Homelands Avenue	East of Grace Street	25	+35	10	+35
	West of Charles Street	40	+55	35	+45
	West of Adderton Road	65	+25	110	+15
Martins Lane	South of Pennant Hills Road	5	+10	1	+15
Azile Court	North of Homelands Avenue	15	+55	5	+55
Grace Street	South of Homelands Avenue	20	+20	10	+20

3.24 The intersections previously analysed in Chapter 2 have been re-analysed with SIDRA 7 Network for the additional development traffic flows shown in Figures 2 and 3. The analysis has included traffic from the potential development at 241 Pennant Hills Road. The analysis has also included the traffic signals at the intersection of Pennant Hills Road with Baker Street/new precinct access road, as requested by RMS and council.

3.25 The analysis found that the intersection of Pennant Hills Road with Adderton Road would operate with average delays of less than 35 seconds per vehicle during weekday morning and afternoon peak hours. This represents level of service C, a satisfactory level of service.

3.26 With traffic signals at the intersection of Pennant Hills Road/Baker Street/new precinct access road, the intersection would operate with average delays of less than 35 seconds per vehicle during peak periods. This represents level of service C, a satisfactory level of service.

3.27 The analysis found that the additional traffic would not change the operation of the intersection of Pennant Hills Road with Tintern Avenue. The minor additional flows through this intersection would not have significant effects on its operation. As previously discussed, alternative routes are available. The new signals at Baker Street would also create gaps in which traffic will be able to turn.

3.28 The unsignalised intersections of Adderton Road with Homelands Avenue and Telopea Street would continue to operate with average delays for the highest delayed movements of less than 20 seconds per vehicle during peak periods. This represents level of service B, a reasonable level of service.

3.29 The roundabout at Baker Street/Felton Road, and the unsignalised intersections of Pennant Hills Road with Charles Street and Martins Lane, and of Homelands Avenue with Charles Street/Telopea Street and Grace Street/Azile Court, would continue to operate with average delays for the highest delayed movements of less than 15 seconds per vehicle during peak periods. This represents level of service A/B, a good level of service.

3.30 Therefore, with the measures proposed, the road network will be able to cater for the additional traffic from the proposed development.

Matters Raised in Brief

3.31 The matters raised in the study brief are discussed below.

- *Review background material (Council reports, material lodged with the Planning Proposals, RMS letter dated 24 March 2015).*

- *Allowance for attendance at the following meetings:*

    - *Inception meeting with proponents, Council and proponents' planning consultants.*

    - *Two progress meetings with proponents and proponents' planning consultants during the course of the study.*

    - *A community consultation meeting with the proponents and landowners within the precinct when the first draft of the block study is presented. It is anticipated that this session would occur approximately one month into the study.*

    - *A meeting with proponents, Council and proponents' planning consultants at the presentation of the final draft of the block study.*

3.32 A series of meetings has been held between the landowners, council officers and the consultant team through the study period. A consultation session was also held with landowners in the study area.

- *Co-ordination with the Urban Designer in terms of potential density.*

- *Allowance for discussions with RMS and Transport for NSW.*

- *Quantify the extent to which availability of public transport affects traffic generation/traffic impacts and propose traffic generation rates for use in the assessment of the impact of the development.*

- *Undertake a review of traffic generation rates within a catchment area agreed to by Council and RMS.*

3.33 The densities assessed in the study are consistent with those identified by the study urban designer. The traffic generation rates have been discussed with council and RMS officers during preparation of the study.

- *Undertake an assessment of cumulative traffic generation based on the development potential that might be achieved based on the block analysis. This assessment must also take into account any known or mooted development proposals. Council will be able to provide advice in this regard.*

- *Identify impacts on local and state roads and intersections that might be affected by development of the precinct proceeding in accordance with the urban design analysis.*

- *Develop treatments to ameliorate impacts. This might entail a change to the densities recommended in the block analysis where suitable treatments cannot be proposed.*

3.34 Traffic generation, its effects and mitigation measures are discussed in paragraphs 3.16 to 3.30.

- *Propose funding mechanisms including trigger points to facilitate implementation of recommended treatments.*

3.35 It is expected that these matters would form part of a voluntary planning agreement or be incorporated in a section 94 plan for the precinct. We note that the traffic signals at Pennant Hills Road/Baker Street would:

- improve conditions for existing traffic using the intersection;
- cater for traffic from the potential development at 241 Pennant Hills Road; and
- cater for traffic from redevelopment of the subject precinct.

3.36 It would therefore be reasonable that the cost of the traffic signals be split between these components in appropriate proportions.

- *Assess the RMS requirement for signalisation of the intersection of Baker Street and Pennant Hills Road having regard to development within the precinct proceeding in accordance with the urban design analysis and also having regarding to Council's recommendation to create a fourth leg to this intersection. Consider also development on the northern side of Pennant Hills Road, including possible redevelopment at 241 Pennant Hills Road, Carlingford.*

- *Assess the impact of Council's proposal to create a fourth leg to the Baker Street/Pennant Hills Road intersection including its signalisation, factoring in the potential for the developments on 264-268 Pennant Hills Road (the BaptistCare site) and 258-262 Pennant Hills Road and 17 & 20 Azile Court being accessed from the new fourth leg of the intersection.*

- *Subject to the outcome of the investigations above, provide options for the alignment of the fourth leg to the Baker Street/Pennant Hills Road intersection including its signalisation. (i.e. Azile Court.*

- *Provide options for the delivery of the proposed road pattern including the fourth leg to the Baker Street/Pennant Hills Road intersection including its signalisation.*

3.37 These matters are discussed in paragraphs 3.8, 3.10, 3.13, 3.14, 3.24 and 3.26.

- *Assess the impact of and need for the Council's suggestion for the widening of Martins Lane 12m wide streets with double carriageway for 2-way movement, footpath on western side and capacity for on-street car parking. This will need to be co-ordinated with the urban designer and ecologist.*

3.38 This matter is discussed in paragraph 3.12.

- *Propose the staging of the future public road network if BaptistCare site is developed first.*

- *Propose a network that encourages the safety, convenience and amenity of pedestrians accessing various transport options.*

3.39 These matters are discussed in paragraphs 3.10 and 3.11.

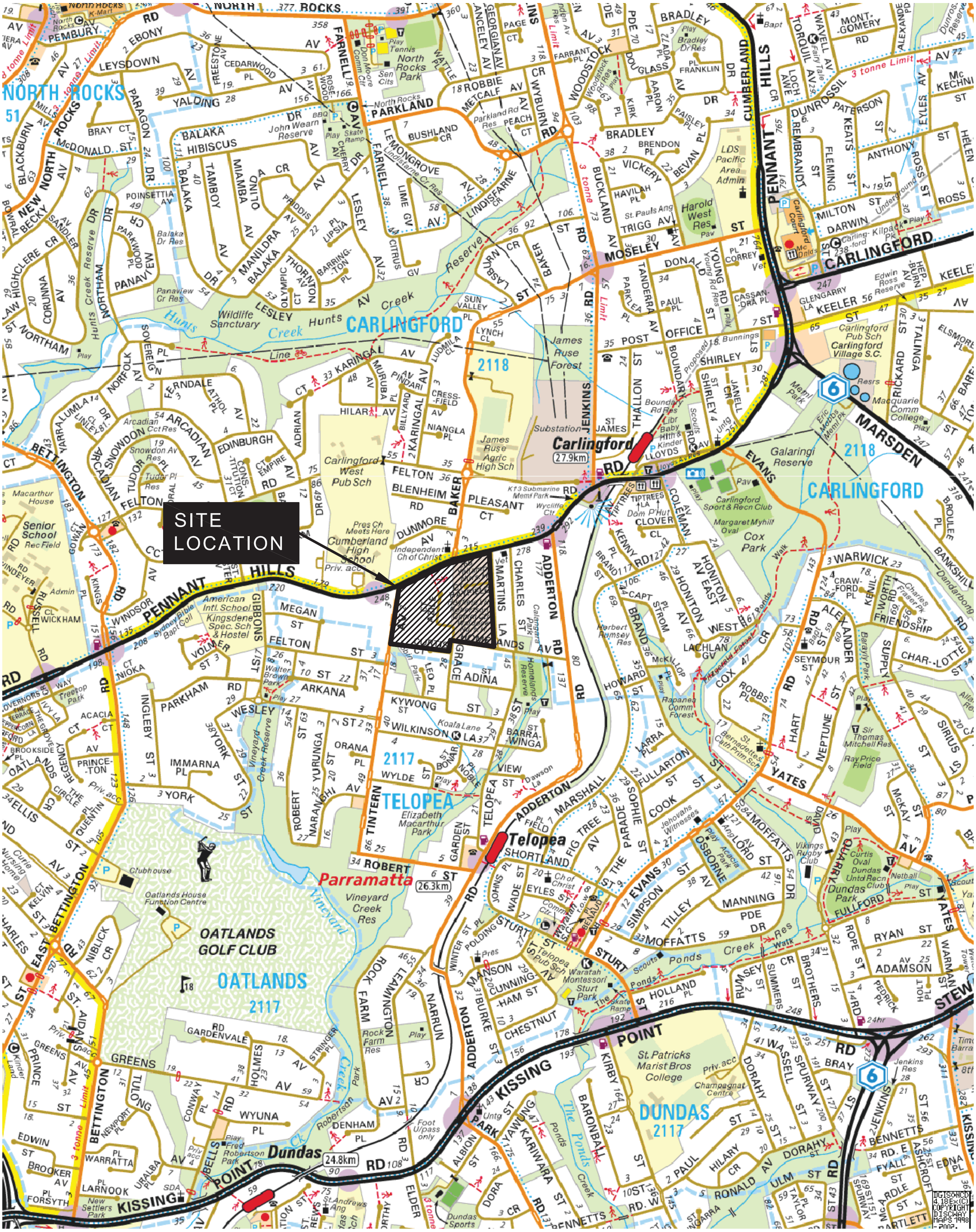
Summary

3.40 In summary, the main points relating to the traffic implications of the proposed development are as follows:

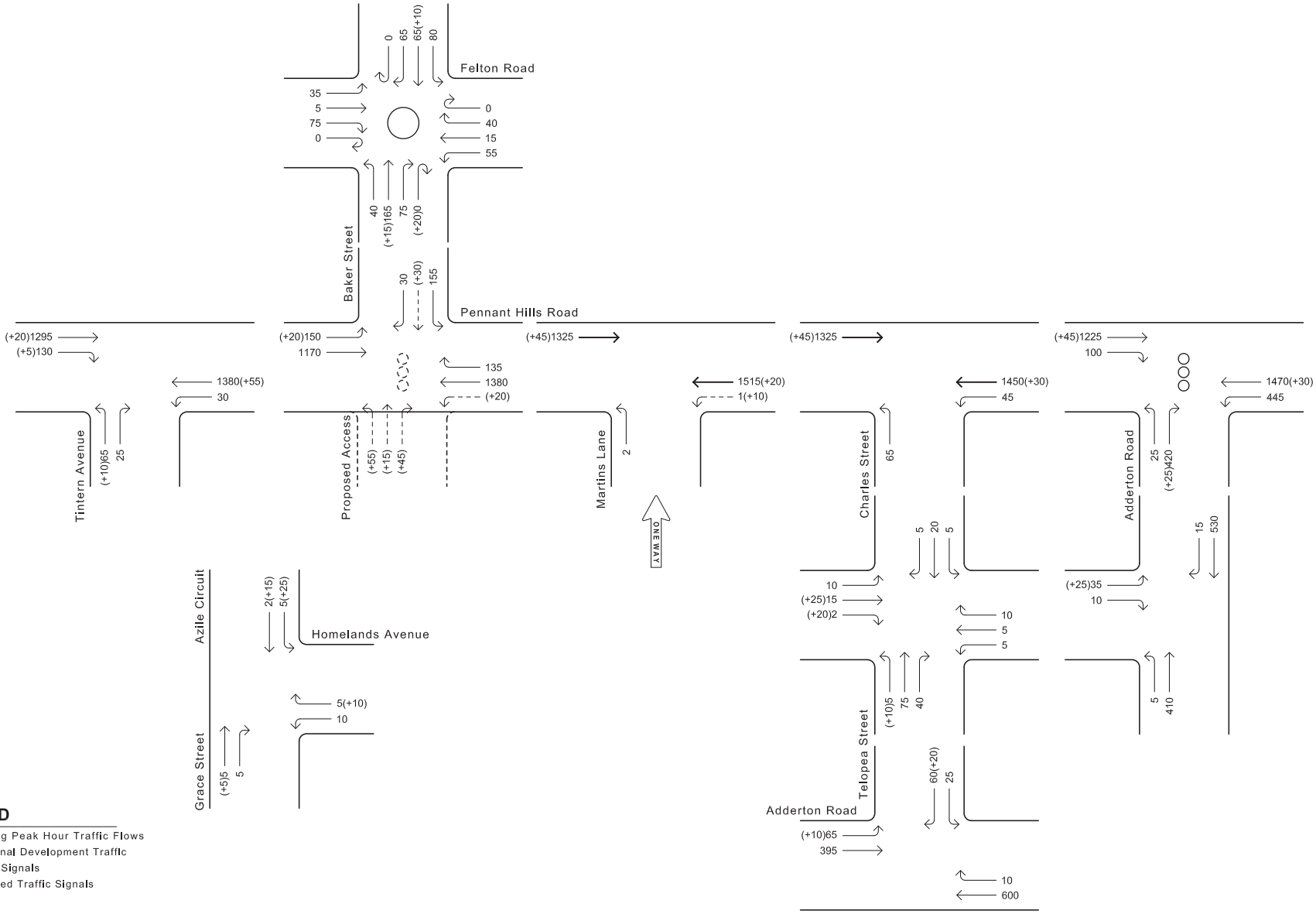
i) the proposed development will be accessible by existing bus services and future high frequency light rail services;

ii) new traffic signals will be provided on Pennant Hills Road at Baker Street for access to the precinct; and

iii) with the measures proposed, the road network will be able to cater for the additional traffic from potential redevelopment of the precinct.



Location Plan



Existing plus development weekday morning peak hour traffic flows

Colston Budd Rogers & Kafes Pty Ltd

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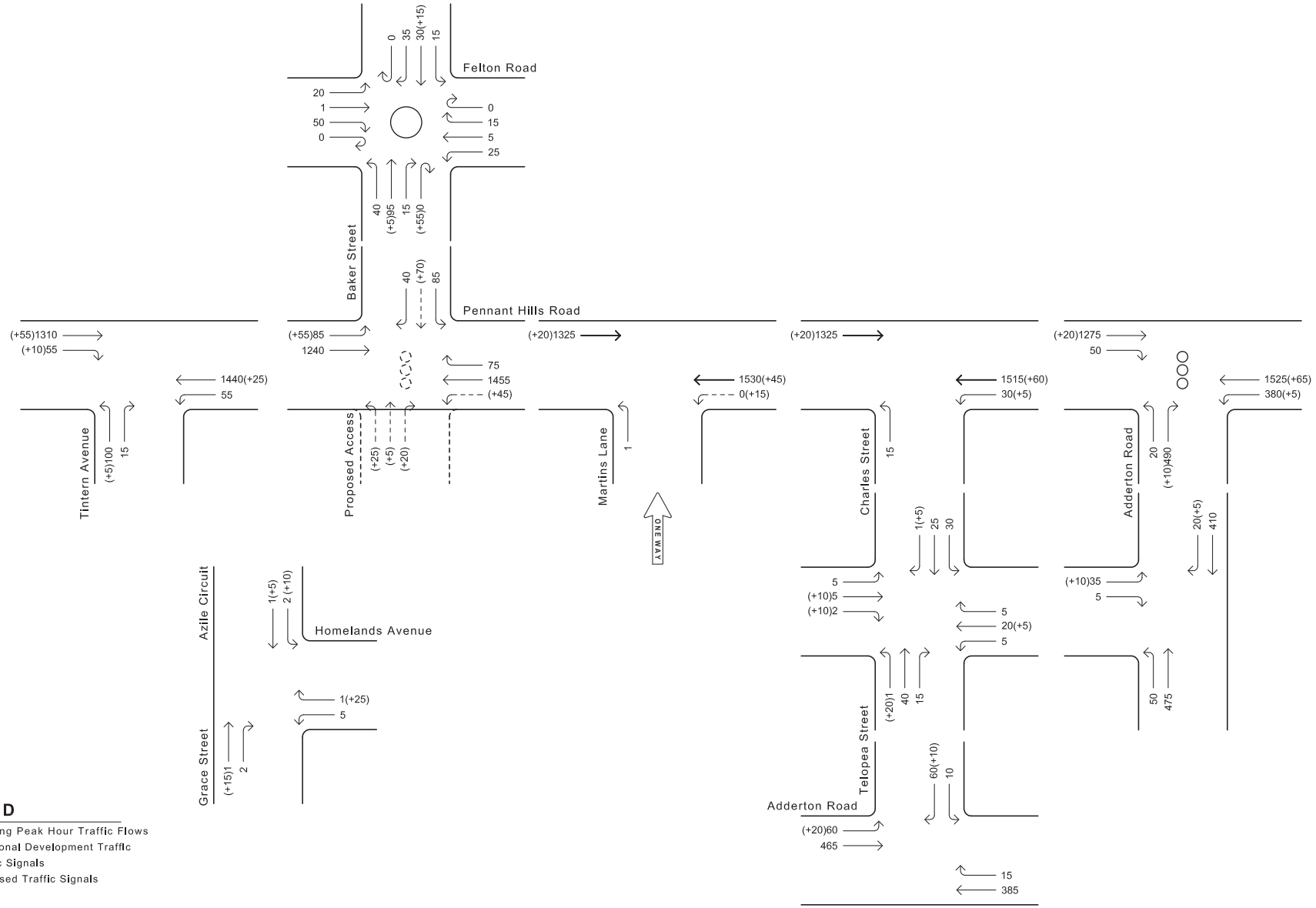
Figure 2



Existing plus development weekday afternoon peak hour traffic flows

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Figure 3