971 Richmond Road, Marsden Park (NSW)

Traffic Impact Assessment Report

Client: C&S Partners Mortgage & Insurance Pty Ltd

Prepared by

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16 October 2021

1. INTRODUCTION

1.1 Purpose of this report

This report sets out an assessment of the traffic impact of the proposed development, upon the intersection of Richmond Road and South Street.

1.2 Referenced documents

This report has been based upon a number of sources and references. These include:

- Information provided by the applicant;
- Information provided by Transport for NSW and Council's Traffic Engineering department;
- Nearmap, Google maps and Melways online;
- SIDRA computer software for the intersection modelling assessment;
- Traffic Authority of NSW, Guide to Traffic Generating Developments (Oct 2002); and
- Traffic and Parking report prepared by EB Traffic Solutions, for the proposed development at 971 Richmond Rd Marsden Park, dated 11 August 2021.

2. EXISITNG OPERATING CONDITIONS

An assessment was undertaken of the existing operation of the signalised intersection at Richmond Road and South Street during the morning and late afternoon commuter peak hour.

The assessment was undertaken using the SIDRA intersection analysis computer program (Version 9). Intersection performance is generally reported by the intersection degree of saturation (x), which provides a measure of the relationship of volume to capacity for all movements at the intersection.

The relationship between level of service criteria and degree of saturation for the various intersection types are summarised in **Table 2.1.**

Table 2.1: Relationship between level of service and degree of saturation (x)

Level of Service		Intersection Degree of Saturation (x)		
		Unsignalised intersections	Roundabouts	Signalised intersections
A	Excellent	<=0.6	<=0.6	<=0.6
B	Very good	0.6 – 0.7	0.6 – 0.7	0.6 – 0.7
C	Good	0.7 – 0.8	0.7 – 0.85	0.7 – 0.9
D	Acceptable	0.8 – 0.9	0.85 – 0.95	0.9 – 0.95
E	Poor	0.9 – 1.0	0.95 – 1.0	0.95 – 1.0
F	Very poor	>=1.0	>=1.0	>=1.0

For the purpose of the modelling assessment, the intersection layout plan, traffic volume and signal phasing data corresponding to the intersection of Richmond Road and South Street was provided by the Transport for NSW for Wednesday 12 May 2021, as shown in **Attachment A**.

A summary of the intersection geometry, traffic volumes and signal phasing adopted for the late afternoon commuter peak hour (5 pm – 6 pm) are shown summarised in **Attachment B.**

For the purpose of the analysis, the number of heavy vehicles were assumed to correspond to 5 % of the total traffic volumes, a cycle length of 140 seconds and 25 pedestrians crossing on each intersection approach. In addition, the operation of the buses were factored in tot eh analysis by introducing a late start of the through movements on the Richmond Road north and south approaches.

The existing performance of the intersection was assessed using the SIDRA computer program, with the intersection layout and performance measures of critical degrees of saturation, average vehicle delay and 95 th % ile queue lengths shown in **Attachment C** and summarised in **Table 2.2**.

Table 2.2: Existing Performance: Richmond Road and South Street

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (T)	0.839	43.5	299.5	D

Note: # L Left, T Through, R Right

On the basis of the above analysis, the intersection currently operates at an acceptable level of operation during the pm commuter peak hour.

3. TRAFFIC IMPACT OF PROPOSED DEVELOPMENT

3.1 Traffic Generation Characteristics

The impact of the proposed development can be assessed having regard to the anticipated number of vehicle movements likely to be generated by the proposed development during the commuter peak periods.

Reference to the Traffic and Parking report prepared by EB Traffic Solutions, for the proposed development at 971 Richmond Rd Marsden Park, (11 August 2021) indicates that the traffic flows anticipated to be generated by the proposed development are summarised as follows:

	No. of vehicle movements	
	Entry	Exit
AM peak hour	95	75
PM peak hour	128	112

3.2 Directional Distribution

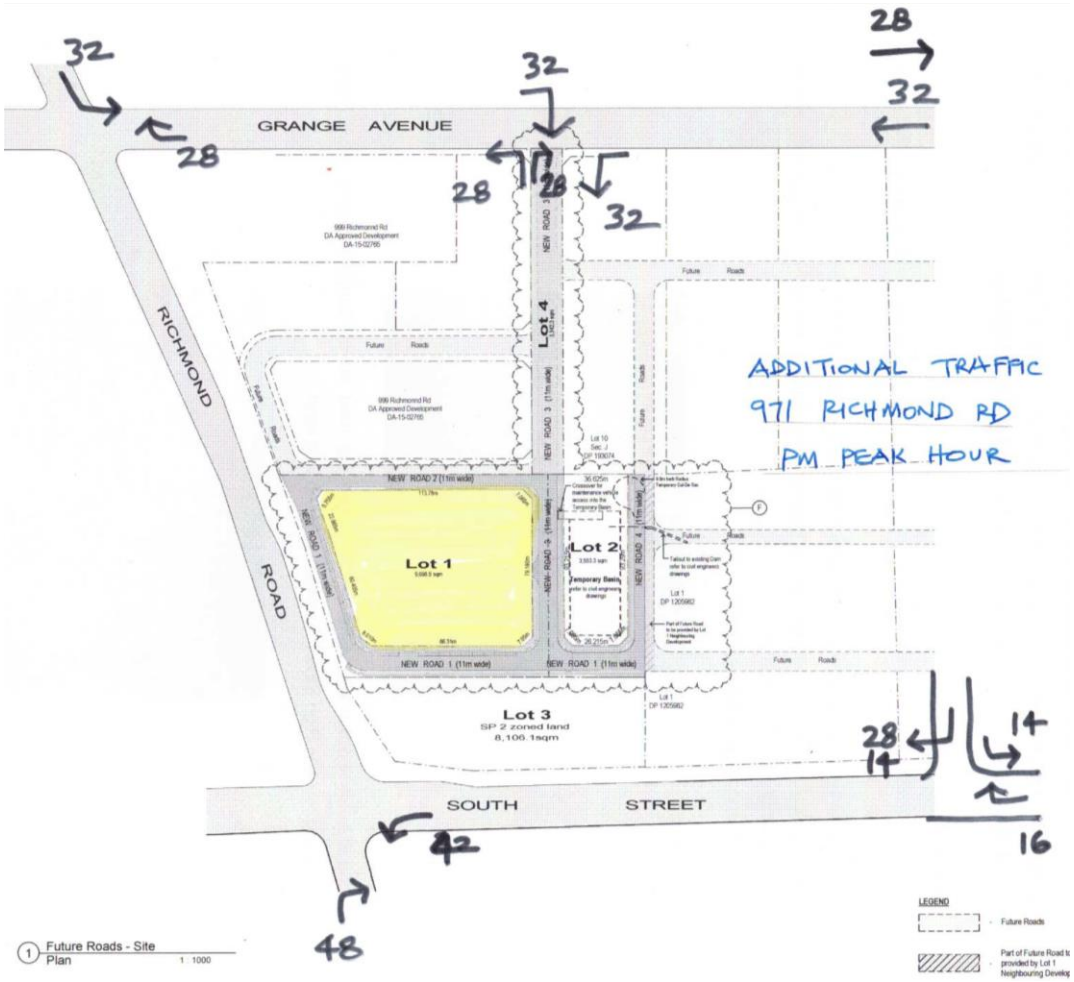
The directional distribution and assignment of traffic is derived based upon a number of factors.

This corresponds to the extent of surrounding residential development, configuration and operation of the surrounding arterial and local road network and location of access points to the proposed development.

For the purpose of the analysis, it is assumed that the level of traffic generated to and from the site is distributed equally to all surrounding quadrants, that is, 25 % to/from the north-west, 25 % to/from the north-east, 25 % to/from the south-east and 25 % to/from the south-west.

Further, the assessment was based upon the pm peak hour as the worst case scenario given that the pm peak hour flows are anticipated to be around 30 % to 45 % greater than the flows generated during the am peak hour.

Application of the directional distribution rates to the number of vehicle movements anticipated to be generated by the proposed development during the pm peak hour, that is, 128 entry movements and 112 exit movements per hour, results in the following additional traffic flows to the surrounding road network, as shown in **Figure 2.1**.



Specifically, the additional traffic flows anticipated to be generated at the intersection of Richmond Road and South Street are summarised as follows:

- Richmond Road South approach: 48 right turners
- South Street East approach: 42 left turners

In addition, it is understood that a mixed-use development has been approved to the immediate north of the development site at 999 Richmond Road.

This development contains 861 apartments, 973.8 sqm of retail floor area and 3,939.2 sqm of commercial floor area.

Access to the main car parking area is located along Grange Avenue abutting the site's northern frontage.

Reference to RTA Guide for Traffic Generating Developments (Vers 2.2, 2002) was used to estimate the number of vehicles anticipated to be generated by the approved development, which indicated that there would be 197 entry movements and 159 exit movements at the car park accesses during the pm peak hour.

The above principles of directional distribution were applied to estimate the number of vehicle movements anticipated to be generated by this approved development upon the intersection of Richmond Road and South Street.

The analysis indicates the following number of forecast vehicle movements would be generated at the intersection of Richmond Road and South Street for the pm peak hour:

- Richmond Road North approach: 67 through vehicles
- Richmond Road South approach: 84 through vehicles

3.3 Future Operating Conditions

3.3.1 Base Case (existing + approved development @ 999 Richmond Rd)

The base case conditions can be established by superimposing the traffic volumes anticipated to be generated by the approved development (999 Richmond Road) onto the existing traffic volumes for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the approved development upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the base case, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment D** and summarised in **Table 3.1.**

Table 3.1: Base Case Performance: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (R)	0.863	76.2	159.8	E

Note: # L Left, T Through, R Right

On the basis of the above analysis, the critical movement corresponds to the right turn movement from the Richmond Street South approach and is forecast to operate at a poor level of operation for the base case during the pm peak hour.

3.3.2 Stage 1 development (Base case + proposed development)

(a) Stage 1 Base Case

Discussions with the applicant indicate that the Stage 1 (Blocks D, E and F) development is likely to be constructed within a 2 year time frame.

The Stage 1 base case can be determined by factoring the existing volumes by a growth factor of 2 % per annum for 2 years and then superimposing the traffic volumes anticipated to be generated by the approved development at 999 Richmond Road for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the Stage 1 base case upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the proposed development, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment E** and summarised in **Table 3.2**.

Table 3.2: Stage 1 Base case: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (T)	0.898	49.1	356.5	D

Note: # L Left, T Through, R Right

On the basis of the above analysis, the critical movement corresponds to the through movement from the Richmond Street South approach and is forecast to operate at an acceptable level of operation for the base case during the pm peak hour.

(b) Stage 1 (Base Case + Proposed development)

The impact of the Stage 1 development can be determined by superimposing the Stage 1 base case volumes upon the traffic volumes anticipated to be generated by the proposed development for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the Stage 1 development upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the proposed development, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment F** and summarised in **Table 3.3**.

Table 3.3: Stage 1 Base + Development case: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (T)	0.918	58.1	388.3	E

Note: # L Left, T Through, R Right

On the basis of the above, the critical movement corresponds to the through movement from the Richmond Street South approach and is forecast to operate at a poor level of operation for the base case + proposed development during the pm peak hour.

3.3.3 Stage 2 (Future) Development - (Stage 2 base case + proposed development

(a) Stage 2 Base Case

Discussions with the applicant indicate that the Stage 2 (full) development is likely to be constructed within a 4 year time frame.

The Stage 2 base case can be determined by factoring the existing volumes by a growth factor of 2 % per annum for 4 years and then superimposing the traffic volumes anticipated to be generated by the approved development at 999 Richmond Road for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the Stage 2 base case upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the proposed development, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment G** and summarised in **Table 3.4**.

Table 3.4: Stage 2 Base case: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (R)	0.932	89.0	191.4	F

Note: # L Left, T Through, R Right

On the basis of the above, the critical movement corresponds to the right turn movement from the Richmond Street South approach and is forecast to operate at a very poor level of operation for the Stage 2 base case during the pm peak hour.

(b) Stage 2 (Base Case + Proposed development)

The impact of the Stage 2 development can be determined by superimposing the Stage 2 base case volumes upon the traffic volumes anticipated to be generated by the proposed development for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the Stage 2 development upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the proposed development, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment H** and summarised in **Table 3.5**.

Table 3.5: Stage 2 Base case + Development: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (T)	0.952	69.9	443.3	E

Note: # L Left, T Through, R Right

On the basis of the above, the critical movement corresponds to the through movement from the Richmond Street South approach and is forecast to operate at a poor level of operation for the Stage 2 base case + proposed development during the pm peak hour.

3.3.3 Stage 2 development post 10 years - (Stage 2 + 10 years) base case + proposed development

(a) Stage 2 + 10 years - Base Case

The Stage 2 + 10 years base case can be determined by factoring the existing volumes by a growth factor of 2 % per annum for 14 years (4 years for completion of Stage 2 and a further 10 years as required by TfNSW) and then superimposing the traffic volumes anticipated to be generated by the approved development at 999 Richmond Road for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the Stage 2 + 10 years base case upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the proposed development, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment J** and summarised in **Table 3.6**.

Table 3.6: Stage 2 + 10 years - Base case: Richmond Road and South Street (pm peak hour)

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (T)	1.124	183.5	838.1	F
	Richmond Rd South (R)	1.09	173.7	338.0	F
	South St East (R)	1.112	189.9	310.4	F

Note: # L Left, T Through, R Right

On the basis of the above, the critical movements corresponds to the through and right turn movements from the Richmond Street South approach and the right turn movement from th e South Street East approach and are forecast to operate at a very poor level of operation for the Stage 2 post 10 years base case during the pm peak hour.

(b) (Stage 2 + 10 years) Base Case + proposed development

The impact of the Stage 2 development after a period of 10 years can be determined by superimposing the Stage 2 + 10 year base case volumes upon the traffic volumes anticipated to be generated by the proposed development for the late afternoon peak hour.

An assessment can be undertaken to assess the impact of the Stage 2 development + 10 year upon the operation of the intersection at Richmond Road and South Street during the late afternoon commuter peak hour.

The intersection of Richmond Road and South Street was assessed using the SIDRA intersection computer program having regard to the resultant traffic distributions for the proposed development, with the performance measures of critical degrees of saturation, 95 th % ile queue lengths and average delay are shown in **Attachment K** and summarised in **Table 3.7**.

Table 3.7: (Stage 2 + 10 yrs) base case + proposed development: Richmond Rd and South St (pm peak hour)

Peak Hour	Intersection Performance				
	Critical Movement #	Degree of Sat (x)	Average delay (sec/veh)	95 th % ile queue (m)	Level of Service
PM PEAK	Richmond Rd South (T)	1.146	201.1	876.1	F
	Richmond Rd South (R)	1.119	195.3	383.9	F
	South St East (R)	1.112	189.9	310.4	F

Note: # L Left, T Through, R Right

On the basis of the above analysis, the intersection is forecast to operates at a very level of operation for the Stage 2 post 10 years base case + proposed development scenario during the pm peak hour.

In the 10 years post Stage 2 base case, that is, after a period of 14 years following the completion of the approved development at 999 Richmond Road, the impact of the Stage 2 proposed development will result in the following changes to the intersection.

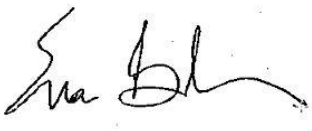
- Increase the queue length for the Richmond Road South approach through movement by 38 m; and

- Increase the queue length for the Richmond Road South approach right turn movement by 45 m.

As a result of the above assessment, it is considered that the proposed development will have a minor **additional** impact upon the operation of the intersection of Richmond Road and South Street upon completion of the full development post 10 years in the future forecast year of 2035.

4. CONCLUSION

Having regard to the above, the additional traffic anticipated to be generated by the proposed development are considered to be relatively minor and will not unreasonably impact upon the operation of the intersection at the end of Stages 1 and 2 and after a period of 10 years following the completion of Stage 2, and on this basis, is considered to be acceptable.



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ATTACHMENT A

TFNSW SUPPLIED DATA

INTERSECTION LAYOUT, PHASING AND VOLUMES

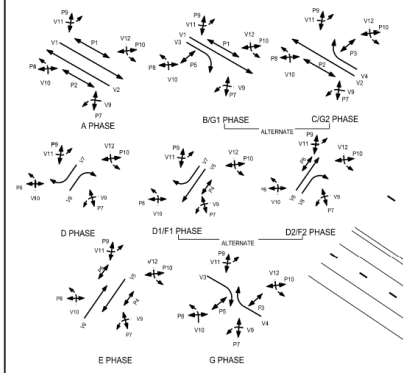
RICHMOND ROAD/SOUTH STREET

0357.040.VV.4557

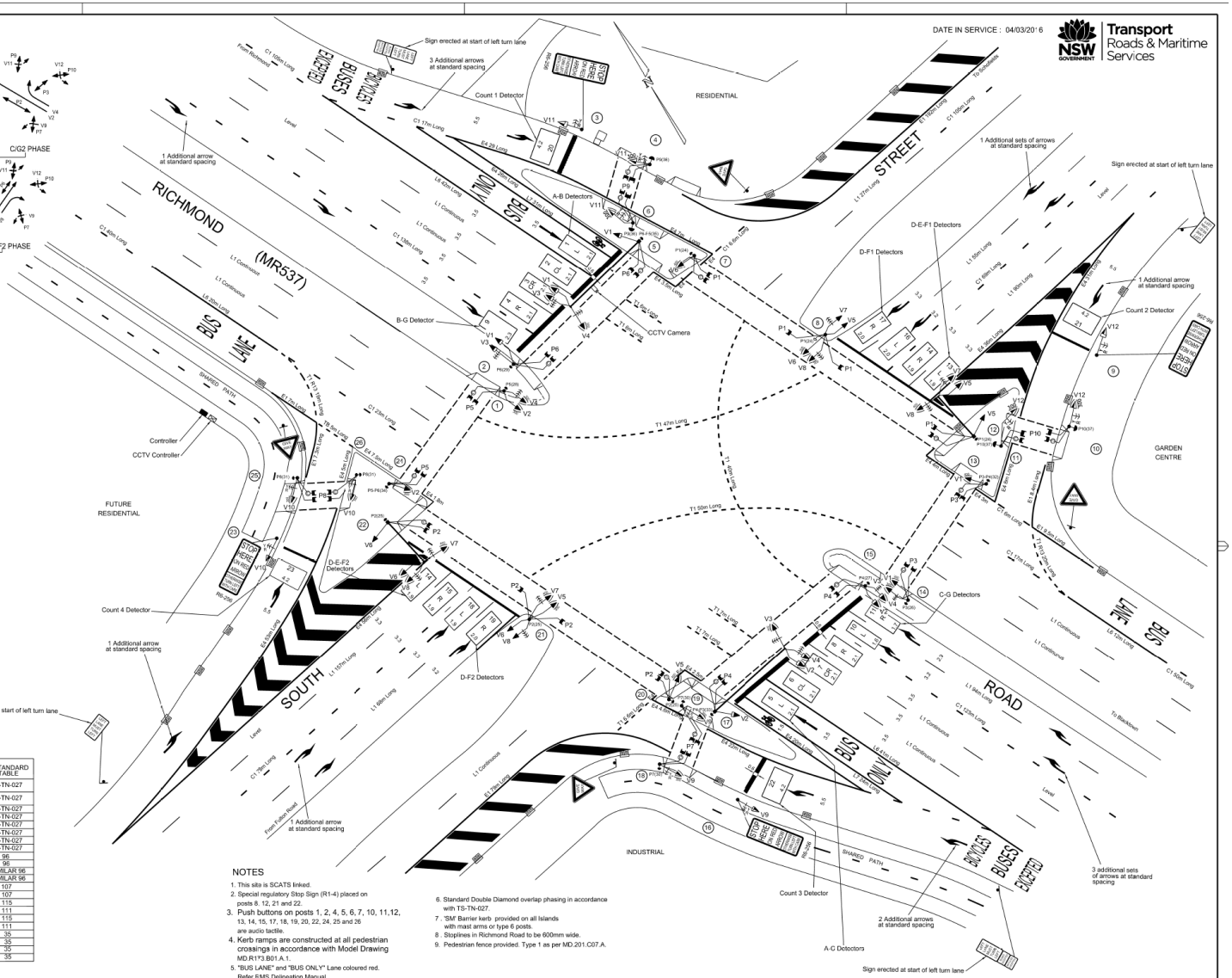
DRAWN BY CADD
DO NOT AMEND MANUALLY

DATE IN SERVICE : 04/03/20' 6

Transport Roads & Maritime Services



MOVEMENTS



POSTS

POST	TYPE	LENG'H	OFFSET	REMARKS
1	2	4.1	1.0	Existing
2	2	4.1	1.0	Existing
3	2	4.1	1.0	Existing
4	2	4.1	1.0	Existing
5	10	-	2.0	Exist(12.5m Outreach)
6	2	4.1	1.0	E XISTING
7	2	4.1	1.0	Existing
8	2	4.1	1.0	Existing
9	2	4.1	1.0	Existing
10	2	4.1	1.0	Existing
11	2	4.1	1.0	Existing
12	9	-	2.0	Existing(7m Outreach)
13	2	4.1	1.0	Existing
14	2	4.1	1.0	Existing
15	2	4.1	1.0	Existing
16	2	4.1	1.0	Existing
17	10	-	2.0	Exist(12.5m Outreach)
18	2	4.1	1.0	Existing
19	2	4.1	1.0	Existing
20	2	4.1	1.0	Existing
21	2	4.1	1.0	Existing
22	9	-	2.0	Existing(7m Outreach)
23	2	4.1	1.0	Existing
24	2	4.1	1.0	Existing
25	2	4.1	1.0	Existing
26	2	4.1	1.0	Exiteing

SIGNAL GROUP / PHASE CHART

SIGNAL GROUP	PHASE DURING WHICH GREEN DISPLAYED										OVERLAPS PERMITTED	OVERLAP CONDITIONS	STANDARD TABLE
	A	B	C	D	D1	D2	E	F1	F2	G	G1 G2		
V1	X	X								X	G1/A/B, B/A, A/G1		TS-TN-027
V2	X		X							X	G2/A/C, C/A, A/G2		TS-TN-027
V3		X							X	X	G/G1, B/G		TS-TN-027
V4		X							X	X	G/G2, C/G		TS-TN-027
V5				X		X	X	X			D1/E/F1		TS-TN-027
V6					X		X		X		D2/E/F2		TS-TN-027
V7			X	X		X					D/D1		TS-TN-027
V8			X		X		X				D/D2		TS-TN-027
V9											96		
V10											96		
V11											SIMILAR 96		
V12											SIMILAR 96		
P1	X	X								X	G1/A/B		107
P2	X		X							X	G2/A/C		107
P3		X							X	X			115
P4			X		X		X						111
P5		X							X	X			115
P6			X			X		X					111
P7	X	X	X	X	X	X	X	X	X	X			35
P8	X	X	X	X	X	X	X	X	X	X			35
P9	X	X	X	X	X	X	X	X	X	X			35
P10	X	X	X	X	X	X	X	X	X	X			35

NOTES

1. This site is SCATS linked.
2. Special regulatory Stop Sign (R1-4) placed on posts 8, 12, 21 and 22.
3. Push buttons on posts 1, 2, 4, 5, 6, 7, 10, 11,12, 13, 14, 15, 17, 18, 19, 20, 22, 24, 25 and 26 are audio tactile.
4. Kerb ramps are constructed at all pedestrian crossings in accordance with Model Drawing MD.R1T3.B01.A.1.
5. "BUS LANE" and "BUS ONLY" Lane coloured red. Refer RMS Delineation Manual.
6. Standard Double Diamond overlap phasing in accordance with TS-TN-027.
7. 'SM' Barrier kerb provided on all Islands with mast arms or type 6 posts.
8. Stoplines in Richmond Road to be 600mm wide.
9. Pedestrian fence provided. Type 1 as per MD.201.C07.A.

A. ORIGINAL ISSUE

PUBLIC UTILITY LEGEND: HYDRANT, STOP VALVE, GAS VALVE, SEWER MANHOLE, TELECOM PIT, ELECT LIGHT POLE, POWER POLE, STAY POLE, TELEPHONE BOX, TELECOM PILLAR

REFERENCE PLANS: SYMBOLS/ABBS. VT003-8; STD POSIT VD001-5; PRES. DISTRICT VC005-17; VEH. GROUP DP TS-TN-019; DIST. LOGIC DP TS-TN-020; PED. MOVEMENT DP TS-TN-021; CABLE BIST VV4557-2; CABLE CHART VV4557-3; SURVEYOR : RMS; DATE 2012

U.S.D. Ref: Map 147 A4; U.S.D. CO-ORDS N: 284 958, E: 1 284 668; DESIGNED : CT; CHECKED : JS; CT; SITE CHECKED; RECOMMENDED

DESIGN APPROVAL: APPROVED, R. SETTLE, POSITION DIRECTOR, DATE 12.10.2015; DESIGN FINISHED BY: TRANSPORT AND TRAFFIC PLANNING ASSOCIATES

RMS ACCEPTANCE RECOMMENDED: Neil C. Leitch, POSITION N.D.T.L., DATE 13.2.15; ACCEPTED: D. Nicholson, POSITION MAN. N+S. SERVICES, DATE 16.03.15

ROADS AND MARITIME SERVICES

BLACKTOWN COUNCIL AREA
TRAFFIC SIGNALS AT THE INTERSECTION OF RICHMOND ROAD (MR537) AND SOUTH STREET
MARSDEN PARK

DESIGN LAYOUT TCS No 4557

EXISTING ☒ PROPOSED ☐

CADD FILE: VV4557_1E.dgn

SCALE (1:250)

FILE SF2014/014802 SUPERSEDES SHEET/ISSUE 1/D ISSUE E

REGN. DS2014/004934 TCS No. 4557 SHEET 1

Wednesday, 12 May 2021, 5:00:00 PM AEST to Wednesday, 12 May 2021, 5:15:00 PM AEST:

Data item	Frequency	Minimum	Maximum	Average	Total
A phase	6	55	75	64	387
D phase	7	21	30	26	184
E phase	7	17	17	17	119
G phase	6	27	35	31	186
Active cycle length	7	134	146	139	979
Actual cycle	5	125	153	139	695
Split plan 1	1	280	280	280	280
Signal group 1	6	47	67	56	339
Signal group 2	6	62	95	79	477
Signal group 3	3	8	8	8	24
Signal group 4	7	19	27	22	158
Signal group 5	7	19	37	30	212
Signal group 6	7	8	9	8	62
Signal group 7	7	13	22	18	128
Signal group 8	2	8	9	8	17

Wednesday, 12 May 2021, 5:15:00 PM AEST to Wednesday, 12 May 2021, 5:30:00 PM AEST:

Data item	Frequency	Minimum	Maximum	Average	Total
A phase	6	55	84	71	429
D phase	6	18	27	22	135
E phase	3	17	17	17	51
G phase	6	33	40	36	219
Active cycle length	6	139	146	141	851
Actual cycle	6	118	159	139	834
Signal group 1	6	47	76	63	381
Signal group 2	5	69	112	90	453
Signal group 3	4	8	9	8	33
Signal group 4	6	25	32	28	171
Signal group 5	4	14	31	19	76
Signal group 6	3	8	9	8	26
Signal group 7	6	10	19	14	87
Signal group 8	4	8	19	11	45

Wednesday, 12 May 2021, 5:30:00 PM AEST to Wednesday, 12 May 2021, 5:45:00 PM AEST:

Data item	Frequency	Minimum	Maximum	Average	Total
A phase	6	66	75	70	421
D phase	7	25	32	29	204
E phase	1	17	17	17	17
G phase	6	29	44	37	222
Active cycle length	7	134	144	139	974
Actual cycle	5	134	147	139	699
Split plan 1	1	140	140	140	140
Split plan 3	1	280	280	280	280
Split plan 4	1	140	140	140	140
Signal group 1	6	58	67	62	373
Signal group 2	6	71	111	93	561
Signal group 3	2	8	10	9	18
Signal group 4	6	21	37	29	175
Signal group 5	6	17	40	23	143
Signal group 6	1	8	8	8	8
Signal group 7	7	17	24	21	147
Signal group 8	1	20	20	20	20

Wednesday, 12 May 2021, 5:45:00 PM AEST to Wednesday, 12 May 2021, 6:00:00 PM AEST:

Data item	Frequency	Minimum	Maximum	Average	Total
A phase	6	64	84	74	446
D phase	6	24	41	32	194
E phase	2	17	17	17	34
G phase	6	27	35	30	183
Active cycle length	5	136	143	139	698
Actual cycle	6	132	151	142	857
Split plan 4	1	280	280	280	280
Signal group 1	6	56	76	66	398
Signal group 2	5	74	107	89	449
Signal group 3	3	8	9	8	25
Signal group 4	6	19	27	22	135
Signal group 5	6	12	33	21	130
Signal group 6	2	8	8	8	16
Signal group 7	6	16	33	24	145
Signal group 8	3	8	8	8	24

TfNSW Traffic Volumes

Richmond Rd/South St

Wednesday 12 May 2021

AM Peak (8-9 am)

08:05	Approach	1	0	22	49	56	0	26	43	39	1	15	18	2	1	1	1	12	11	0	0	42	34	0	3	376
08:10	Approach	1	0	28	61	72	1	26	47	36	1	21	19	1	2	1	1	18	27	0	1	53	34	2	1	453
08:15	Approach	1	1	34	62	70	0	25	37	52	1	13	17	0	0	0	2	16	22	3	0	49	36	0	5	445
08:20	Approach	1	0	25	67	72	0	31	37	41	2	17	16	1	2	1	0	12	15	3	0	40	32	0	5	419
08:25	Approach	1	0	21	64	72	0	27	45	38	0	22	18	1	0	0	0	23	22	0	0	52	46	0	6	457
08:30	Approach	1	0	33	54	79	0	22	39	39	1	13	14	0	0	0	0	18	19	1	0	56	33	1	1	423
08:35	Approach	1	0	22	59	63	0	21	37	41	0	15	20	0	1	1	2	13	12	1	1	46	23	2	2	382
08:40	Approach	1	0	25	55	68	0	29	30	35	2	22	26	1	2	0	1	10	13	4	0	53	32	1	3	412
08:45	Approach	1	0	34	58	71	0	22	42	34	1	15	14	0	1	0	0	16	19	2	2	46	25	1	1	404
08:50	Approach	1	0	26	47	61	0	28	34	42	6	13	19	1	5	0	2	11	13	0	1	45	32	0	1	387
08:55	Approach	1	0	23	65	61	0	16	39	30	2	13	17	0	0	1	0	22	19	2	0	33	47	1	1	392
09:00	Approach	1	0	14	50	56	0	20	39	31	1	13	21	0	0	1	0	20	18	1	1	28	34	2	0	350

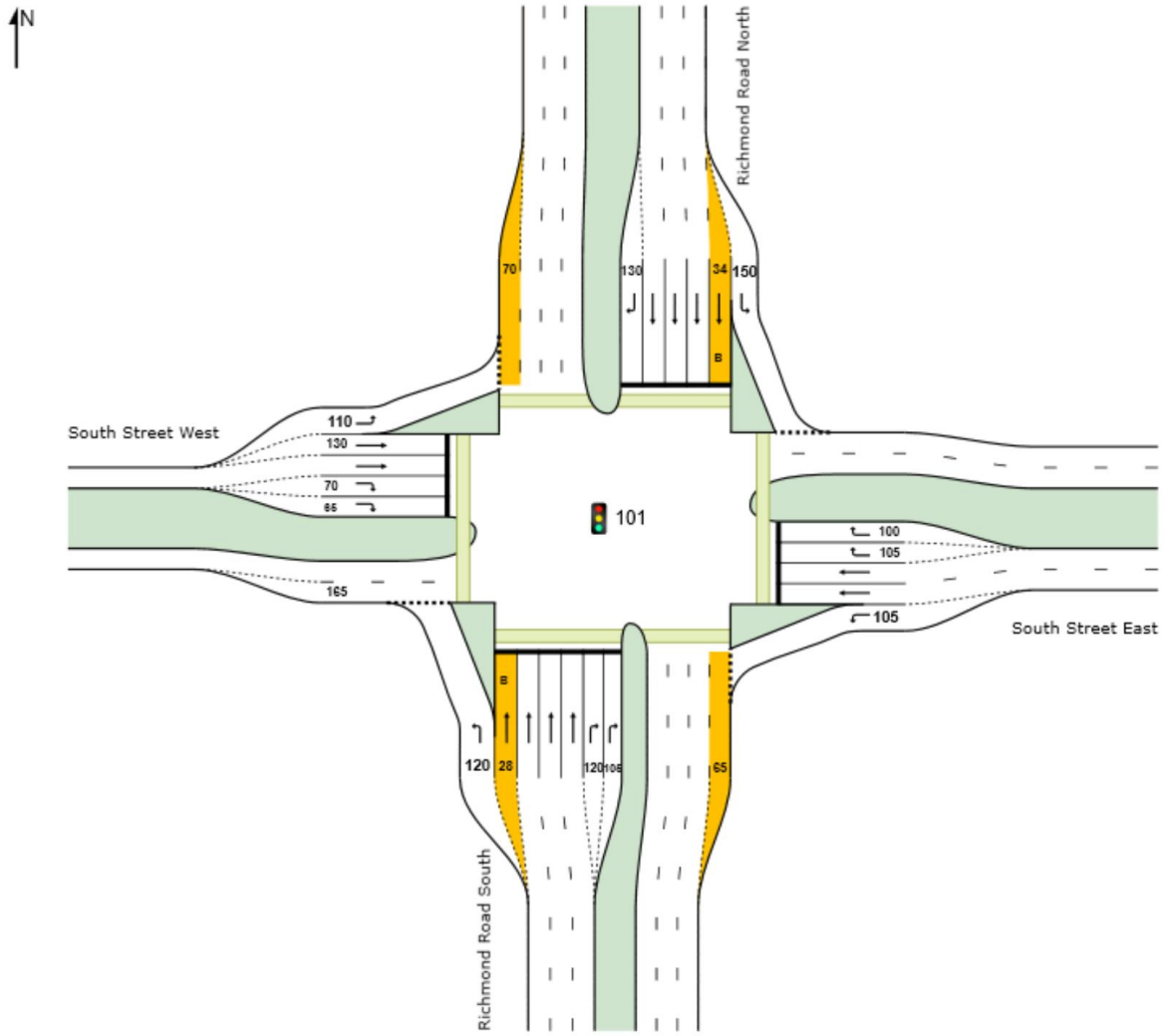
PM peak (5-6 pm)

17:05	Approach	1	0	21	38	34	0	20	59	40	1	20	17	0	0	0	2	25	25	2	0	43	22	2	5	376
17:10	Approach	1	0	16	39	41	0	40	66	50	1	24	23	0	2	0	3	25	24	1	1	38	25	0	1	420
17:15	Approach	1	0	28	43	48	0	39	74	49	1	24	29	0	0	2	0	21	19	1	0	44	45	0	7	474
17:20	Approach	1	0	24	46	48	0	36	65	51	3	28	23	1	0	1	1	15	14	2	1	45	20	0	1	425
17:25	Approach	1	0	24	62	55	0	31	73	50	2	22	27	0	0	1	1	16	15	1	1	37	33	0	3	454
17:30	Approach	1	0	22	69	73	0	24	76	52	1	22	21	0	0	0	0	13	18	0	0	40	27	0	1	459
17:35	Approach	1	0	15	48	50	0	29	74	43	2	25	25	0	1	0	0	23	22	0	0	30	33	0	2	422
17:40	Approach	1	0	16	31	37	0	19	68	49	1	26	24	1	0	1	1	27	23	0	0	33	26	0	1	384
17:45	Approach	1	0	12	37	44	0	34	65	44	1	26	27	0	0	0	0	26	30	1	0	37	25	1	1	411
17:50	Approach	1	1	16	47	46	0	26	65	42	0	22	23	0	2	0	2	14	13	2	0	38	31	2	2	394
17:55	Approach	1	0	22	54	63	1	27	64	45	1	17	21	1	1	0	0	23	23	0	0	77	28	1	2	471
18:00	Approach	1	0	18	44	34	0	25	72	46	2	20	24	3	3	0	0	27	24	1	2	42	28	1	1	417

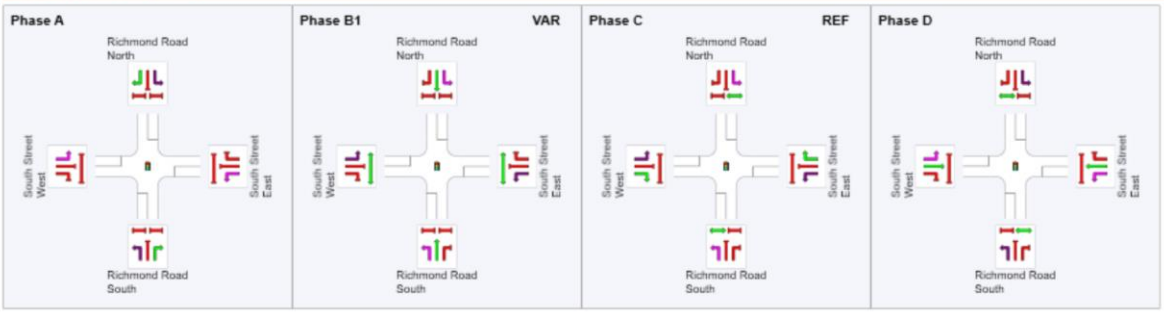
ATTACHMENT B

EXISTING GEOMETRY, PHASING AND LAYOUT OF INTERSECTION

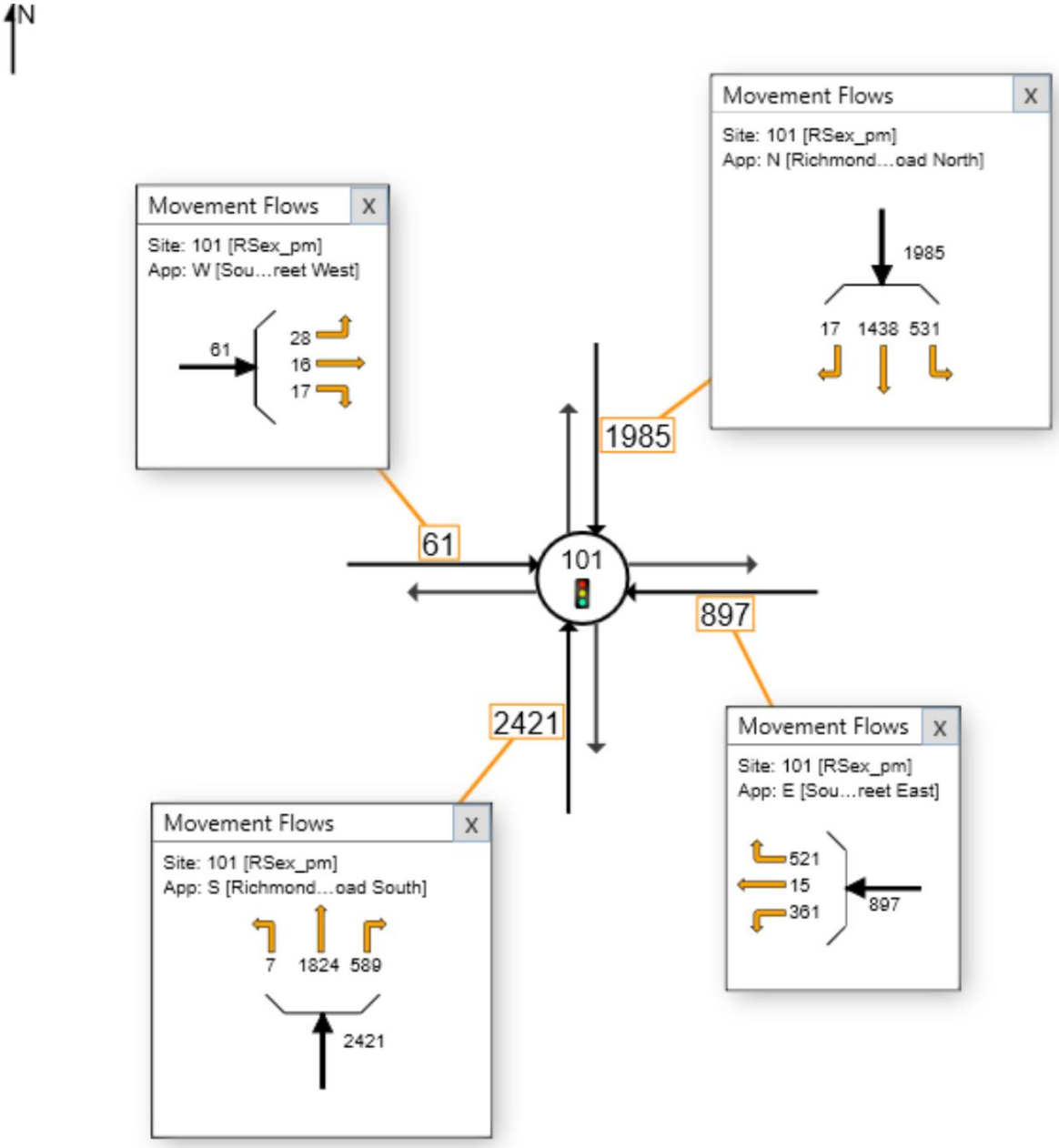
RICHMOND ROAD/SOUTH STREET



Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



ATTACHMENT C

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

EXISTING

MOVEMENT SUMMARY

Site: 101 [RS_ex_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Existing
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	7	0	7	5.0	0.005	8.2	LOS A	0.0	0.3	0.14	0.62	0.14	60.7
2	T1	1733	89	1824	5.2	*0.839	43.5	LOS D	41.0	299.5	0.95	0.90	1.01	41.2
3	R2	560	28	589	5.0	*0.833	72.2	LOS E	21.1	154.2	1.00	0.91	1.15	29.8
Approach		2300	118	2421	5.1	0.839	50.4	LOS D	41.0	299.5	0.96	0.90	1.04	37.7
East: South Street East														
4	L2	343	17	361	5.0	0.332	14.6	LOS B	8.5	62.2	0.43	0.71	0.43	55.1
5	T1	14	1	15	5.0	0.091	72.7	LOS E	0.5	3.7	0.99	0.65	0.99	29.7
6	R2	495	25	521	5.0	*0.816	72.0	LOS E	18.4	134.6	1.00	0.90	1.14	29.6
Approach		852	43	897	5.0	0.816	48.9	LOS D	18.4	134.6	0.77	0.82	0.85	36.3
North: Richmond Road North														
7	L2	504	25	531	5.0	0.388	12.6	LOS B	12.0	87.7	0.40	0.72	0.40	56.5
8	T1	1366	71	1438	5.2	0.628	35.8	LOS D	25.9	189.3	0.86	0.76	0.86	45.1
9	R2	16	1	17	5.0	0.046	55.8	LOS E	0.9	6.7	0.84	0.70	0.84	34.3
Approach		1886	97	1985	5.1	0.628	29.8	LOS C	25.9	189.3	0.74	0.75	0.74	47.5
West: South Street West														
10	L2	27	1	28	5.0	0.037	26.6	LOS C	1.0	7.1	0.56	0.68	0.56	46.8
11	T1	15	1	16	5.0	*0.098	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.7
12	R2	16	1	17	5.0	0.026	57.4	LOS E	0.5	3.4	0.85	0.67	0.85	33.7
Approach		58	3	61	5.0	0.098	47.0	LOS D	1.0	7.1	0.75	0.67	0.75	37.2
All Vehicles		5096	260	5364	5.1	0.839	42.5	LOS D	41.0	299.5	0.84	0.83	0.89	40.6

ATTACHMENT D

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

BASE CASE (EXISTING VOLUMES + 999 RICHMOND RD)

MOVEMENT SUMMARY

Site: 101 [RS_b_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Base Case (exisitng + 999 R)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	7	0	7	5.0	0.005	8.2	LOS A	0.0	0.3	0.14	0.62	0.14	60.7
2	T1	1817	89	1913	4.9	*0.854	43.8	LOS D	44.1	321.4	0.95	0.91	1.02	41.1
3	R2	560	28	589	5.0	*0.863	76.2	LOS E	21.9	159.8	1.00	0.93	1.20	28.9
Approach		2384	118	2509	4.9	0.863	51.3	LOS D	44.1	321.4	0.96	0.91	1.06	37.4
East: South Street East														
4	L2	343	17	361	5.0	0.339	15.1	LOS B	8.8	64.5	0.44	0.72	0.44	54.7
5	T1	14	1	15	5.0	0.091	72.7	LOS E	0.5	3.7	0.99	0.65	0.99	29.7
6	R2	495	25	521	5.0	*0.850	75.7	LOS E	19.1	139.2	1.00	0.93	1.20	28.8
Approach		852	43	897	5.0	0.850	51.2	LOS D	19.1	139.2	0.77	0.84	0.89	35.5
North: Richmond Road North														
7	L2	504	25	531	5.0	0.386	12.5	LOS B	11.9	87.1	0.40	0.72	0.40	56.6
8	T1	1433	71	1508	4.9	0.635	34.6	LOS C	26.9	196.5	0.85	0.76	0.85	45.7
9	R2	16	1	17	5.0	0.048	56.7	LOS E	0.9	6.8	0.84	0.70	0.84	34.0
Approach		1953	97	2056	4.9	0.635	29.1	LOS C	26.9	196.5	0.74	0.75	0.74	48.0
West: South Street West														
10	L2	27	1	28	5.0	0.039	28.5	LOS C	1.0	7.5	0.59	0.68	0.59	45.8
11	T1	15	1	16	5.0	*0.098	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.7
12	R2	16	1	17	5.0	0.027	58.3	LOS E	0.5	3.5	0.86	0.67	0.86	33.4
Approach		58	3	61	5.0	0.098	48.2	LOS D	1.0	7.5	0.76	0.67	0.76	36.8
All Vehicles		5247	260	5523	5.0	0.863	43.0	LOS D	44.1	321.4	0.85	0.84	0.91	40.3

ATTACHMENT E

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

STAGE 1 BASE CASE = EXISTING VOLS GROWTH 2 YEARS + 999 RICHMOND RD

MOVEMENT SUMMARY

Site: 101 [RS_St1b_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Base Case (existing growth 2 yrs + 999 R)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	7	0	7	5.0	0.005	8.2	LOS A	0.0	0.3	0.14	0.62	0.14	60.7
2	T1	1887	89	1986	4.7	*0.886	49.1	LOS D	49.0	356.5	0.97	0.96	1.08	38.8
3	R2	583	28	614	4.8	*0.898	81.3	LOS F	23.9	173.9	1.00	0.96	1.27	27.8
Approach		2477	118	2607	4.8	0.898	56.5	LOS E	49.0	356.5	0.98	0.96	1.13	35.5
East: South Street East														
4	L2	357	17	376	4.8	0.358	16.1	LOS B	9.8	71.6	0.47	0.73	0.47	54.1
5	T1	15	1	16	4.7	0.097	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.7
6	R2	515	25	542	4.8	*0.883	79.7	LOS E	20.6	150.0	1.00	0.96	1.26	27.9
Approach		887	43	934	4.8	0.883	54.0	LOS D	20.6	150.0	0.79	0.86	0.93	34.7
North: Richmond Road North														
7	L2	524	25	552	4.8	0.404	13.1	LOS B	12.8	93.5	0.41	0.73	0.41	56.2
8	T1	1488	71	1566	4.7	0.659	35.1	LOS D	28.4	206.5	0.87	0.77	0.87	45.5
9	R2	17	1	18	4.7	0.051	56.8	LOS E	1.0	7.2	0.84	0.70	0.84	34.0
Approach		2029	97	2136	4.8	0.659	29.6	LOS C	28.4	206.5	0.75	0.76	0.75	47.7
West: South Street West														
10	L2	28	1	29	4.8	0.041	31.0	LOS C	1.1	8.2	0.61	0.68	0.61	44.5
11	T1	16	1	17	4.7	*0.104	72.9	LOS E	0.6	4.2	0.99	0.66	0.99	29.7
12	R2	17	1	18	4.7	0.029	58.3	LOS E	0.5	3.7	0.86	0.67	0.86	33.4
Approach		61	3	64	4.8	0.104	49.6	LOS D	1.1	8.2	0.78	0.67	0.78	36.3
All Vehicles		5454	260	5741	4.8	0.898	46.0	LOS D	49.0	356.5	0.86	0.87	0.95	39.1

ATTACHMENT F

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

STAGE 1 BASE CASE + PROPOSED DEVELOPMENT

MOVEMENT SUMMARY

Site: 101 [RS_St1b+devt_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Base Case (existing growth 2 yrs + 999 R) + proposed devt
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	7	0	7	5.0	0.005	8.2	LOS A	0.0	0.3	0.14	0.62	0.14	60.7
2	T1	1887	89	1986	4.7	*0.918	58.1	LOS E	53.3	388.3	0.98	1.02	1.16	35.5
3	R2	631	28	664	4.4	*0.902	80.9	LOS F	26.0	188.6	1.00	0.96	1.27	27.9
Approach		2525	118	2658	4.7	0.918	63.6	LOS E	53.3	388.3	0.98	1.00	1.18	33.2
East: South Street East														
4	L2	399	17	420	4.3	0.395	17.0	LOS B	11.7	85.2	0.50	0.74	0.50	53.6
5	T1	15	1	16	4.7	0.097	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.7
6	R2	515	25	542	4.8	*0.883	79.7	LOS E	20.6	150.0	1.00	0.96	1.26	27.9
Approach		929	43	978	4.6	0.883	52.7	LOS D	20.6	150.0	0.78	0.86	0.93	35.1
North: Richmond Road North														
7	L2	524	25	552	4.8	0.412	14.0	LOS B	13.4	97.7	0.44	0.74	0.44	55.4
8	T1	1488	71	1566	4.7	0.682	36.9	LOS D	29.1	211.8	0.89	0.79	0.89	44.5
9	R2	17	1	18	4.7	0.048	54.9	LOS D	1.0	7.1	0.83	0.70	0.83	34.6
Approach		2029	97	2136	4.8	0.682	31.1	LOS C	29.1	211.8	0.77	0.78	0.77	46.8
West: South Street West														
10	L2	28	1	29	4.8	0.041	31.6	LOS C	1.1	8.3	0.62	0.68	0.62	44.1
11	T1	16	1	17	4.7	*0.104	72.9	LOS E	0.6	4.2	0.99	0.66	0.99	29.7
12	R2	17	1	18	4.7	0.029	58.3	LOS E	0.5	3.7	0.86	0.67	0.86	33.4
Approach		61	3	64	4.8	0.104	49.9	LOS D	1.1	8.3	0.78	0.67	0.78	36.2
All Vehicles		5544	260	5836	4.7	0.918	49.8	LOS D	53.3	388.3	0.87	0.89	0.98	37.6

ATTACHMENT G

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

STAGE 2 BASE CASE = EXISTING VOLS GROWTH 4 YEARS + 999 RICHMOND RD

MOVEMENT SUMMARY

Site: 101 [RS_St2b_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Stage 2 Base Case (existing growth 4 yrs + 999 R)
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Slop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	8	0	8	4.4	0.005	8.2	LOS A	0.1	0.4	0.14	0.62	0.14	60.9
2	T1	1960	89	2063	4.6	*0.919	57.0	LOS E	55.3	401.8	0.98	1.02	1.15	35.8
3	R2	606	28	638	4.6	*0.932	89.0	LOS F	26.3	191.4	1.00	1.00	1.35	26.3
Approach		2574	118	2709	4.6	0.932	64.4	LOS E	55.3	401.8	0.98	1.01	1.20	33.0
East: South Street East														
4	L2	371	17	391	4.6	0.376	16.8	LOS B	10.7	77.9	0.49	0.73	0.49	53.6
5	T1	15	1	16	4.7	0.097	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.7
6	R2	536	25	564	4.6	*0.918	86.0	LOS F	22.5	164.0	1.00	1.00	1.34	26.6
Approach		922	43	971	4.6	0.918	58.0	LOS E	22.5	164.0	0.79	0.88	0.99	33.4
North: Richmond Road North														
7	L2	546	25	575	4.6	0.423	13.8	LOS B	13.4	97.6	0.43	0.74	0.43	55.7
8	T1	1546	71	1627	4.6	0.684	35.6	LOS D	29.9	217.4	0.88	0.79	0.88	45.2
9	R2	17	1	18	4.7	0.051	56.8	LOS E	1.0	7.2	0.84	0.70	0.84	34.0
Approach		2109	97	2220	4.6	0.684	30.1	LOS C	29.9	217.4	0.76	0.77	0.76	47.4
West: South Street West														
10	L2	29	1	31	4.7	0.044	33.1	LOS C	1.2	8.9	0.64	0.69	0.64	43.5
11	T1	16	1	17	4.7	*0.104	72.9	LOS E	0.6	4.2	0.99	0.66	0.99	29.7
12	R2	17	1	18	4.7	0.029	58.3	LOS E	0.5	3.7	0.86	0.67	0.86	33.4
Approach		62	3	65	4.7	0.104	50.3	LOS D	1.2	8.9	0.79	0.67	0.79	36.1
All Vehicles		5667	260	5965	4.6	0.932	50.4	LOS D	55.3	401.8	0.87	0.90	1.00	37.3

ATTACHMENT H

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

STAGE 2 BASE CASE + PROPOSED DEVELOPMENT

MOVEMENT SUMMARY

Site: 101 [RS_St2b+devt_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Stage 2 Base Case (existing growth 4 yrs + 999 R) + proposed devt
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	8	0	8	4.4	0.005	8.2	LOS A	0.1	0.4	0.14	0.62	0.14	60.9
2	T1	1960	89	2063	4.6	*0.952	69.9	LOS E	61.0	443.3	0.98	1.09	1.25	31.8
3	R2	654	28	688	4.3	*0.934	88.6	LOS F	28.5	206.8	1.00	1.00	1.35	26.4
Approach		2622	118	2760	4.5	0.952	74.4	LOS E	61.0	443.3	0.99	1.07	1.27	30.3
East: South Street East														
4	L2	413	17	435	4.2	0.414	17.8	LOS B	12.7	92.3	0.52	0.74	0.52	53.1
5	T1	15	1	16	4.7	0.097	72.8	LOS E	0.5	4.0	0.99	0.65	0.99	29.7
6	R2	536	25	564	4.6	*0.918	86.0	LOS F	22.5	164.0	1.00	1.00	1.34	26.6
Approach		964	43	1015	4.4	0.918	56.6	LOS E	22.5	164.0	0.79	0.88	0.98	33.9
North: Richmond Road North														
7	L2	546	25	575	4.6	0.432	14.8	LOS B	14.0	102.0	0.45	0.76	0.45	54.9
8	T1	1546	71	1627	4.6	0.708	37.4	LOS D	30.7	222.9	0.90	0.80	0.90	44.2
9	R2	17	1	18	4.7	0.048	54.9	LOS D	1.0	7.1	0.83	0.70	0.83	34.6
Approach		2109	97	2220	4.6	0.708	31.7	LOS C	30.7	222.9	0.78	0.79	0.78	46.4
West: South Street West														
10	L2	29	1	31	4.7	0.043	34.4	LOS C	1.3	9.1	0.65	0.68	0.65	42.8
11	T1	16	1	17	4.7	*0.104	72.9	LOS E	0.6	4.2	0.99	0.66	0.99	29.7
12	R2	17	1	18	4.7	0.029	58.3	LOS E	0.5	3.7	0.86	0.67	0.86	33.4
Approach		62	3	65	4.7	0.104	50.9	LOS D	1.3	9.1	0.79	0.67	0.79	35.9
All Vehicles		5757	260	6060	4.5	0.952	55.5	LOS E	61.0	443.3	0.88	0.93	1.04	35.5

ATTACHMENT J

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

STAGE 2 + 10 YRS BASE CASE = EXIST VOLS GROWTH 14 YEARS + 999 RICH RD

MOVEMENT SUMMARY

Site: 101 [RS_St2+10 yrs_b_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Stage 2 + 10 yrs Base Case = Exist vols growth 14 yrs + 999 R
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	9	0	9	3.9	0.006	8.3	LOS A	0.1	0.5	0.15	0.63	0.15	60.9
2	T1	2371	89	2496	3.8	*1.124	183.5	LOS F	116.0	838.1	1.00	1.64	1.95	15.8
3	R2	739	28	778	3.8	*1.090	173.7	LOS F	46.8	338.0	1.00	1.23	1.91	16.1
Approach		3119	118	3283	3.8	1.124	180.6	LOS F	116.0	838.1	1.00	1.54	1.94	15.9
East: South Street East														
4	L2	453	17	477	3.8	0.495	25.0	LOS C	18.5	133.7	0.66	0.79	0.66	48.5
5	T1	18	1	19	3.9	0.116	73.0	LOS E	0.7	4.7	0.99	0.66	0.99	29.6
6	R2	653	25	687	3.8	*1.112	189.9	LOS F	43.0	310.4	1.00	1.31	2.02	14.9
Approach		1124	43	1183	3.8	1.112	121.5	LOS F	43.0	310.4	0.86	1.09	1.45	20.8
North: Richmond Road North														
7	L2	665	25	700	3.8	0.524	16.7	LOS B	16.8	121.7	0.50	0.80	0.50	53.5
8	T1	1869	71	1967	3.8	0.872	47.2	LOS D	46.4	335.0	0.97	0.95	1.06	39.6
9	R2	21	1	22	3.8	0.061	56.0	LOS E	1.2	8.8	0.84	0.71	0.84	34.3
Approach		2555	97	2689	3.8	0.872	39.4	LOS D	46.4	335.0	0.85	0.91	0.91	42.4
West: South Street West														
10	L2	36	1	38	3.8	0.059	40.5	LOS D	1.7	12.5	0.71	0.68	0.71	40.2
11	T1	20	1	21	3.8	*0.129	73.1	LOS E	0.7	5.3	0.99	0.67	0.99	29.6
12	R2	21	1	22	3.8	0.036	58.4	LOS E	0.6	4.5	0.86	0.68	0.86	33.5
Approach		77	3	81	3.8	0.129	53.9	LOS D	1.7	12.5	0.82	0.68	0.82	35.0
All Vehicles		6875	260	7237	3.8	1.124	117.0	LOS F	116.0	838.1	0.92	1.22	1.47	22.0

ATTACHMENT K

INTERSECTION PEFORMANCE

RICHMOND ROAD/SOUTH STREET: PM PEAK (5-6 PM)

STAGE 2 + 10 YRS BASE CASE + PROPOSED DEVELOPMENT

= EXIST VOLS GROWTH 14 YEARS + 999 RICHMOND RD + PROPOSED DEVT

MOVEMENT SUMMARY

Site: 101 [RS_St2+10 yrs_b+devt_pm (Site Folder: Richmond Rd South St)]

Richmond Rd/South St
PM peak (5-6 pm)
Stage 2 + 10 yrs Base Case + devt = Exist vols growth 14 yrs + 999 R + proposed development
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site User-Given Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Richmond Road South														
1	L2	9	0	9	3.9	0.006	8.3	LOS A	0.1	0.5	0.15	0.63	0.15	60.9
2	T1	2371	89	2496	3.8	*1.146	201.1	LOS F	121.3	876.1	1.00	1.70	2.05	14.6
3	R2	787	28	828	3.6	*1.119	195.3	LOS F	53.2	383.9	1.00	1.28	2.02	14.6
Approach		3167	118	3334	3.7	1.146	199.1	LOS F	121.3	876.1	1.00	1.59	2.03	14.6
East: South Street East														
4	L2	495	17	521	3.5	0.538	26.7	LOS C	21.5	154.9	0.70	0.80	0.70	47.5
5	T1	18	1	19	3.9	0.116	73.0	LOS E	0.7	4.7	0.99	0.66	0.99	29.6
6	R2	653	25	687	3.8	*1.112	189.9	LOS F	43.0	310.4	1.00	1.31	2.02	14.9
Approach		1166	43	1227	3.7	1.112	118.8	LOS F	43.0	310.4	0.87	1.08	1.44	21.2
North: Richmond Road North														
7	L2	665	25	700	3.8	0.530	17.3	LOS B	17.2	124.4	0.52	0.81	0.52	53.1
8	T1	1869	71	1967	3.8	0.897	52.6	LOS D	49.7	358.8	0.98	0.99	1.12	37.4
9	R2	21	1	22	3.8	0.058	55.1	LOS E	1.2	8.7	0.83	0.71	0.83	34.6
Approach		2555	97	2689	3.8	0.897	43.5	LOS D	49.7	358.8	0.86	0.94	0.96	40.5
West: South Street West														
10	L2	36	1	38	3.8	0.058	39.7	LOS D	1.7	12.4	0.70	0.68	0.70	40.5
11	T1	20	1	21	3.8	*0.129	73.1	LOS E	0.7	5.3	0.99	0.67	0.99	29.6
12	R2	21	1	22	3.8	0.036	58.4	LOS E	0.6	4.5	0.86	0.68	0.86	33.5
Approach		77	3	81	3.8	0.129	53.5	LOS D	1.7	12.4	0.82	0.68	0.82	35.1
All Vehicles		6965	260	7332	3.7	1.146	126.9	LOS F	121.3	876.1	0.92	1.26	1.53	20.7