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29 June 2018
Project: 170260

Kaylan Edgcumbe, C.E.T.
Manager, Transportation Planning and Parking
Transportation Services Department
City of Burlington
Kaylan.Edgcumbe@burlington.ca

Dear Ms. Edgcumbe:

RE: 4880 VALERA ROAD – ROUNDABOUT FEASIBILITY INITIAL SCREENING

City of Burlington Staff requested a review of a modern single lane roundabout at the intersection of Thomas Alton Boulevard and Valera Road as part of the supportive Transportation Impact Study submitted 22 December 2017[1].

As the City of Burlington does not have standard roundabout screening procedure, we completed the analysis using the Region of Waterloo's Roundabout Feasibility Initial Screening Tool for the intersection of Thomas Alton Boulevard and Valera Road.

Roundabout Feasibility Initial Screening Tool

The intent of the screening tool is to provide a quick assessment of the feasibility of a modern single lane roundabout in comparison to other appropriate forms of traffic control or road improvements including auxiliary lanes, traffic control signals, four-way stops, etc.

1) Project Name/File Number

- City of Burlington File Number – 520-18/17

  4880 Valera Road
  Adi Development Group Inc.
  1100 Burloak Drive, PH Floor, Suite
  Burlington, ON L7L 6B2

[1] 4880 Valera Road Transportation Impact Study & Parking Study, Paradigm Transportation Solutions Limited, December 2017

2) Intersection Locations

- Thomas Alton Boulevard and Valera Road.

3) Brief Description of Intersection

- Four-legged intersection. North leg is a private driveway connecting Thomas Alton Boulevard and Palladium Way. Thomas Alton Boulevard is an east/west collector roadway with a single travel lane in both directions. On-street bicycle lanes are present in both directions. Valera Road is a north/south local roadway with a single travel lane in both directions.
- Existing AADT approximately 9,000 vehicles per day. Estimated using Existing PM peak hour[2] forecast (Year 2017 TMC data).
- The directional distribution of traffic is generally eastbound during the AM peak hour and westbound during the PM peak hour and reflects typical residential traffic patterns.
- Five-Year Horizon AADT approximately 13,500 vehicles per day. Estimated using forecast Five-Year Horizon PM Peak hour volumes[3].
- **Figure 1** (attached) details a conceptual single-lane roundabout with a 29 metre ICD. The roundabout envelope with a 2.0 metre buffer cannot fit within the existing right-of-way. Impacts to the southwest and southeast quadrants of the intersection are likely.

4) What operation problems are being experienced at this location?

- High levels of side street delay are forecast to occur on the private driveway approach (southbound) to the intersection during the PM peak hour. Background traffic delays are forecast to be in the LOS E range during the PM peak hour with a v/c ratio of less than 0.50. Total traffic delays are forecast to be in the LOS F range during the PM peak hour with a v/c ratio of less than 0.70. Delays at a private driveway onto a collector roadway (Thomas Alton Boulevard) with moderate to high volumes are not atypical. Despite the LOS F, there is still reserve capacity for the southbound movement.
- A westbound left-turn lane is warranted due to the design hour traffic volumes on Thomas Alton Boulevard. The warrant analysis[4], suggests that an auxiliary turn lane is warranted under existing and background traffic conditions. Forecast site traffic is noted to increase the amount of warranted storage for the westbound left-turn lane. **Figure 2** (attached) details the conceptual left-turn lane design.

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[2] 4880 Valera Road Transportation Impact Study & Parking Study, Paradigm Transportation Solutions Limited, December 2017 - Figure 2.4B – Entering Volumes x 10

[3] 4880 Valera Road Transportation Impact Study & Parking Study, Paradigm Transportation Solutions Limited, December 2017 - Figure 4.4B – Entering Volumes x 10

[4] MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads – June 2017

5) Is it a new intersection or is it a retrofit of an existing intersection?

- Retrofit. Impacts to the ROW on the southwest and southeast quadrants of the intersection are projected. Impacts to existing Hydro vault/lines/street lights and storm water management (catch basins) are projected. Existing on-street parking bay and/or private driveways west of study intersection are also expected to be impacted.

6) Is the intersection in the vicinity of a railroad crossing or another intersection?

- No rail crossings within 1.00 kilometre.
- Traffic Control Signal in operation 150 metres east (CL to CL) of study intersection.
- Nearest intersections:
  - Thomas Alton Boulevard at Appleby Line – Signalized intersection under the Halton Region's jurisdiction. 150 east (CL to CL) of study intersection.
  - Thomas Alton Boulevard at Columbus Drive – All-way stop controlled intersection under the City of Burlington's jurisdiction. 150 metres west (CL to CL) of study intersection.
  - Valera Road and Verdi Street – Two-way stop controlled intersection under the City of Burlington's jurisdiction. 75 metres south (CL to CL) of study intersection.
- No queuing operational issues are forecast to occur on the main line approaches of Thomas Alton Boulevard between Columbus Drive in the west and Appleby Line in the East.

7) Would the intersection be located within a coordinated signal system?

- No

8) Would the intersection be located on a Preferred Roundabout Corridor?

- No

9) Is the intersection located within a corridor that is scheduled for improvements in the 10 Year Transportation Capital Program?

- No

10) What is the collision history of the intersection over the past five years?

- Two (2) property damage only collisions are reported to have occurred.
  - One (1) angle collision; and
  - One (1) rear end.

11) Are persons with disabilities or horse and buggies frequent users of this intersection?

- Not expected.

12) What traditional road improvements are proposed for this intersection?

- Eastbound painted median/gore area (design to be determined);
- Westbound left-turn lane with 40 metres of storage; and
- Other infrastructure upgrades resulting from the widening to be confirmed by others.

13) If traffic control signals are being considered, are the traffic signal warrants met for the horizon year?

- Traffic Control Signals not considered. Volume warrants not satisfied. Intersection spacing between Appleby Line and Valera Road not ideal for signalization of both intersection.

14) What size of roundabout is being considered for this intersection?

- Single lane urban compact – 29 m ICD
- Design Vehicle – TAC I-BUS.

15) 20-Year Life Cycle Cost Estimate (Table 1)

- 10-Year AADT: 13,500 vehicles per day
- Non-injury Social Collision Cost: $5,000
- Injury Social Collision Cost: $82,000
- Fatal Social Collision Cost: $13,600,000
- Discount Rate (i): 6%

TABLE 1: ESTIMATED TWENTY YEAR LIFE-CYCLE COST COMPARISON

Item Cost	Left-Turn Lane	Roundabout
Implementation Cost	$ 250,000	$ 750,000
Injury Collision Cost (Present Value)	$ 29,248	$ 599,159
Total Life Cycle Cost	**$ 279,248**	**$ 1,349,159**

Note: Cost are estimates. Detailed design to determine actual construction costs at a later date.

Screening Tool Conclusions

- A modern single lane roundabout is a costlier traffic control solution that would only improve capacity for a private driveway approach.
- Westbound left-turn lane is warranted based on forecast traffic volumes;
- Do not proceed to Intersection Control Study, due to life-cycle cost and impacts to ROW.

Appendix A contains the supportive screen tool analysis.

Conclusions

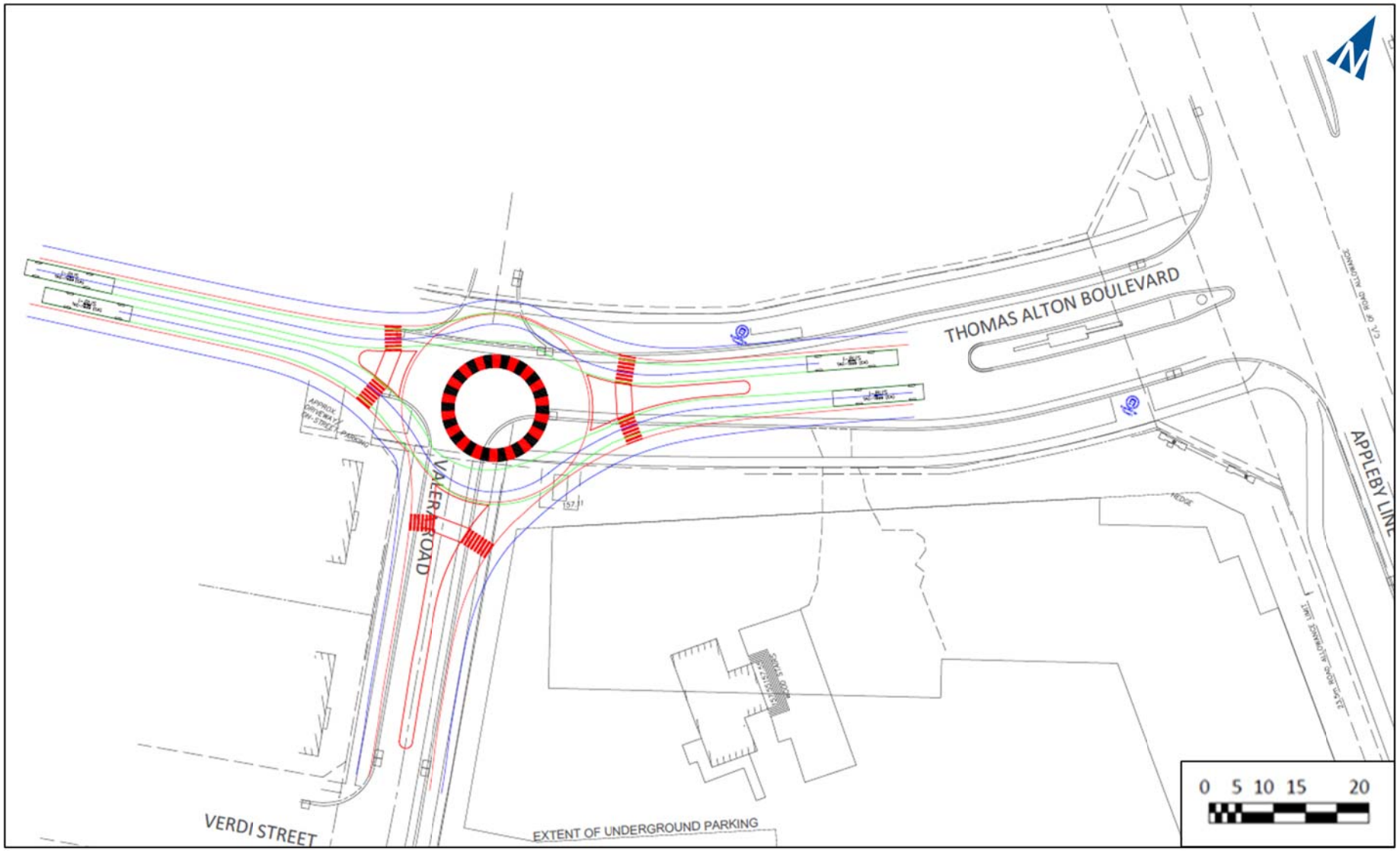
Based on the forgoing the following is concluded

- Intersection Control Study is not recommended at this time.
- A modern single lane roundabout is a costlier traffic control solution when compared to the traditional intersection improvements;
- A modern roundabout may potentially impact the following:
  - Existing Thomas Alton Boulevard right-of-way width;
  - Existing Valera Road right-of-way width;
  - Existing on-street parking bay and/or private driveways west of study intersection;
  - Existing hydro vault/lines/street lights; and
  - Existing storm water management (catch basins).
- Westbound left-turn lane is warranted based on existing and forecast traffic volumes.

Yours very truly,

PARADIGM TRANSPORTATION SOLUTIONS LIMITED

Stew Elkins
BES, MITE
Vice-President



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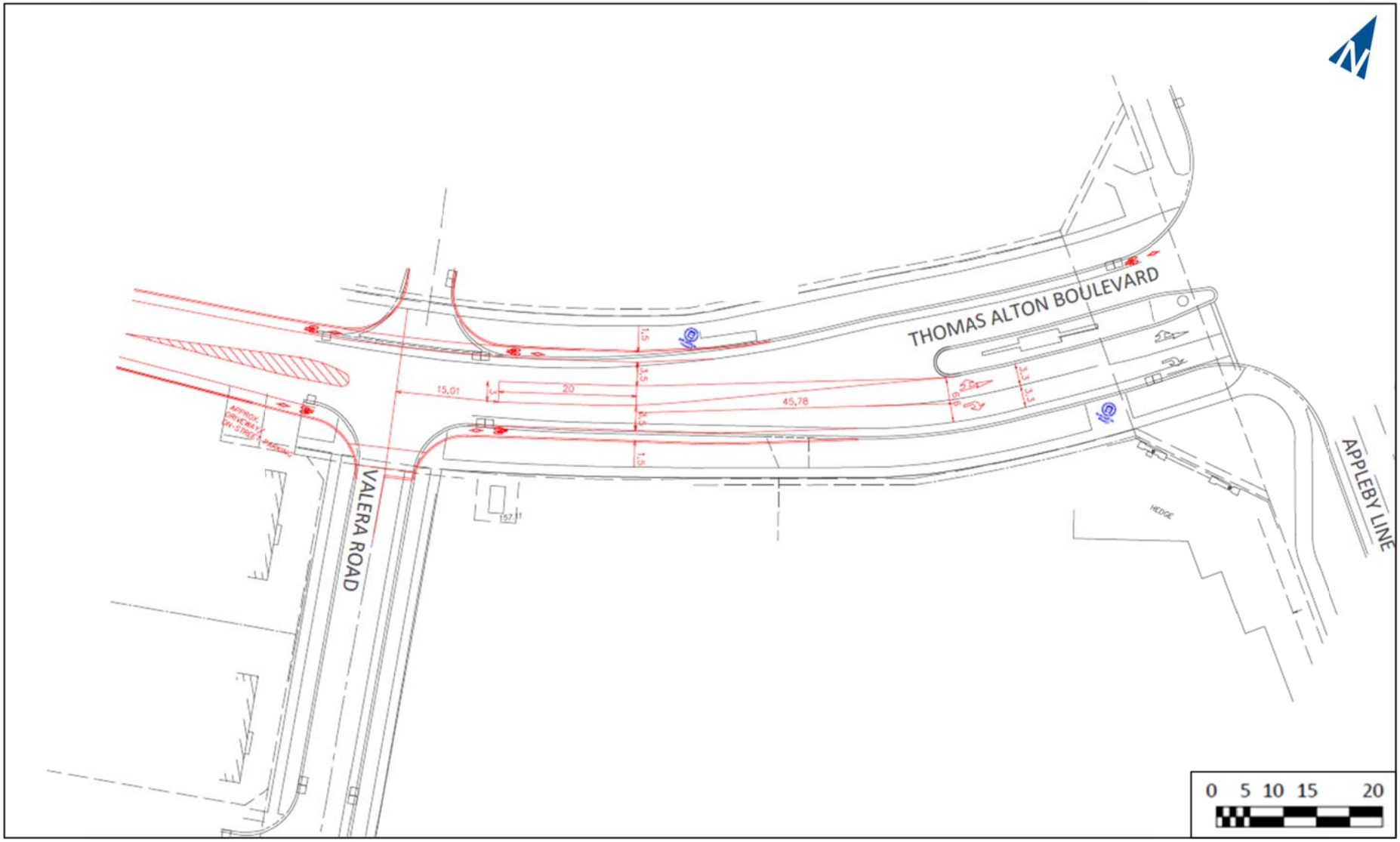
Conceptual Design – Modern Roundabout

4880 Valera Road TIS
170260

Figure 1



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Conceptual Design – Auxiliary Turn Lane

Appendix A

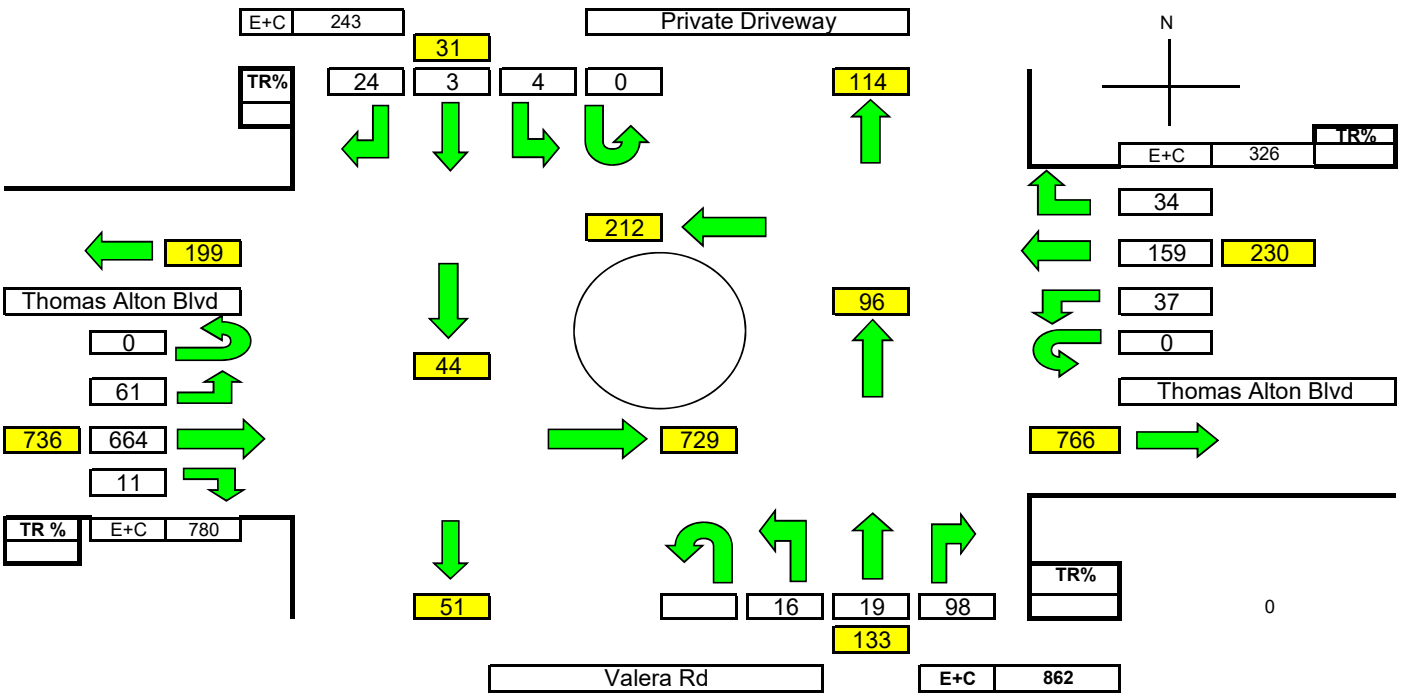
Roundabout Screening

170260 - 4880 Valera Road	
Step 1	
Base Year AADT	9,000
Five-Year Collisions (PDO)	2
Five-Year Collisions (Injury)	0
Site Specific Collision Rate (Non-Injury)	0.12
Site Specific Collision Rate (Injury)	0.00
Step 2	
Expected Non-Injury Collision Rate	0.20
Expected Injury Collision Rate	0.12
Step 3	
Non-Injury Adjustment Factor	0.61
Injury Adjustment Factor	0.00
Step 4	
Ten-Year AADT	13,500
Expected Non-Injury Collision Rate	0.17
Expected Injury Collision Rate	0.08
Apply Adjustment Factors	Yes
Adjusted Future Annual Non-Injury Collision Rate	0.10
Adjusted Future Annual Injury Collision Rate	0.00
Expected Future Annual Non-Injury Collision Frequency	0.51
Expected Future Annual Injury Collision Frequency	0.00
Step 5	
Social Collision Cost (Non-Injury)	$5,000
Social Collision Cost (Injury)	$82,000
Social Collision Cost (Fatal)	$13,600,000
Fatal Collision Ratio	0.006
Discount Rate (i)	6%
$PV_{non\ injury}$ (Non-Roundabout)	$29,248
PV_{injury} (Non-Roundabout)	$0
PV_{fatal} (Non-Roundabout)	$0
Step 6	
Expected Future Non-Injury Collision Rate (Roundabout) (Signal Rate * 2)	0.68
Expected Future Annual Non-Injury Collision Frequency (Roundabout)	3.35
Expected Future Injury Collision Rate (Roundabout) (Signal Rate * 0.25)	0.085
Expected Future Annual Injury Collision Frequency (Roundabout)	0.42
Traffic Signal Annual Injury Collision Frequency	1.675
Traffic Signal Fatal Collision Ratio	0.002
$PV_{non\ injury}$ (Roundabout)	$192,161
PV_{injury} (Roundabout)	$393,931
PV_{fatal} (Roundabout)	$13,067
PV_{total} (Non-Roundabout)	**$29,248**
PV_{total} (Roundabout)	**$599,159**

REGION OF WATERLOO
ROUNDABOUT TRAFFIC FLOW SHEET

VERSION 1.0 AUG 22, 2008

Project: 4880 Valera Rd **Drawn By:**
Project No.: 170260 **Sheet** 1 of 2
Intersection: Thomas Alton Boulevard & Valera Road
Time Period: Five-Year Horizon

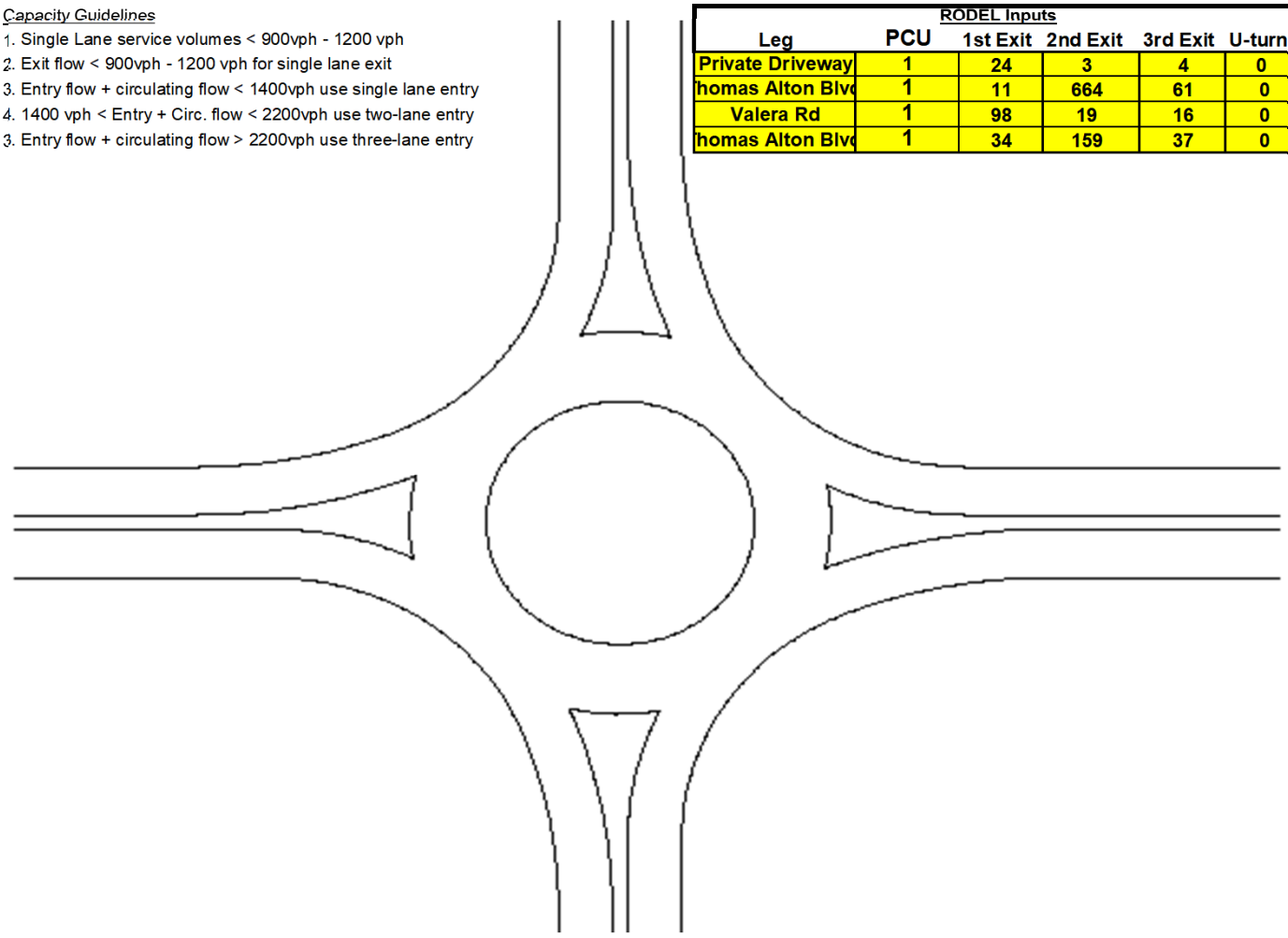


Capacity Guidelines

1. Single Lane service volumes < 900vph - 1200 vph
2. Exit flow < 900vph - 1200 vph for single lane exit
3. Entry flow + circulating flow < 1400vph use single lane entry
4. 1400 vph < Entry + Circ. flow < 2200vph use two-lane entry
3. Entry flow + circulating flow > 2200vph use three-lane entry

RODEL Inputs

Leg	PCU	1st Exit	2nd Exit	3rd Exit	U-turn
Private Driveway	1	24	3	4	0
Thomas Alton Blvd	1	11	664	61	0
Valera Rd	1	98	19	16	0
Thomas Alton Blvd	1	34	159	37	0



REGION OF WATERLOO
ROUNDABOUT TRAFFIC FLOW SHEET

VERSION 1.0 AUG 22, 2008

Project: 4880 Valera Rd **Drawn By:**
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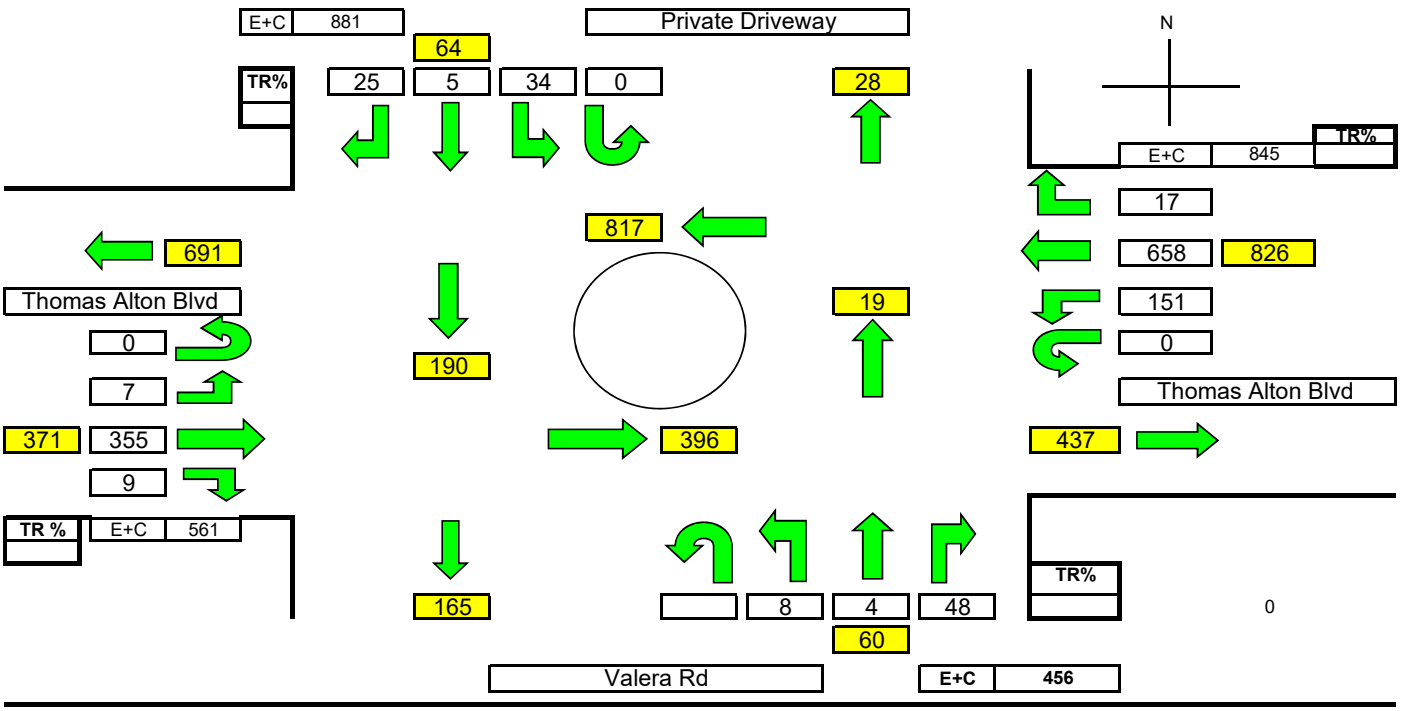

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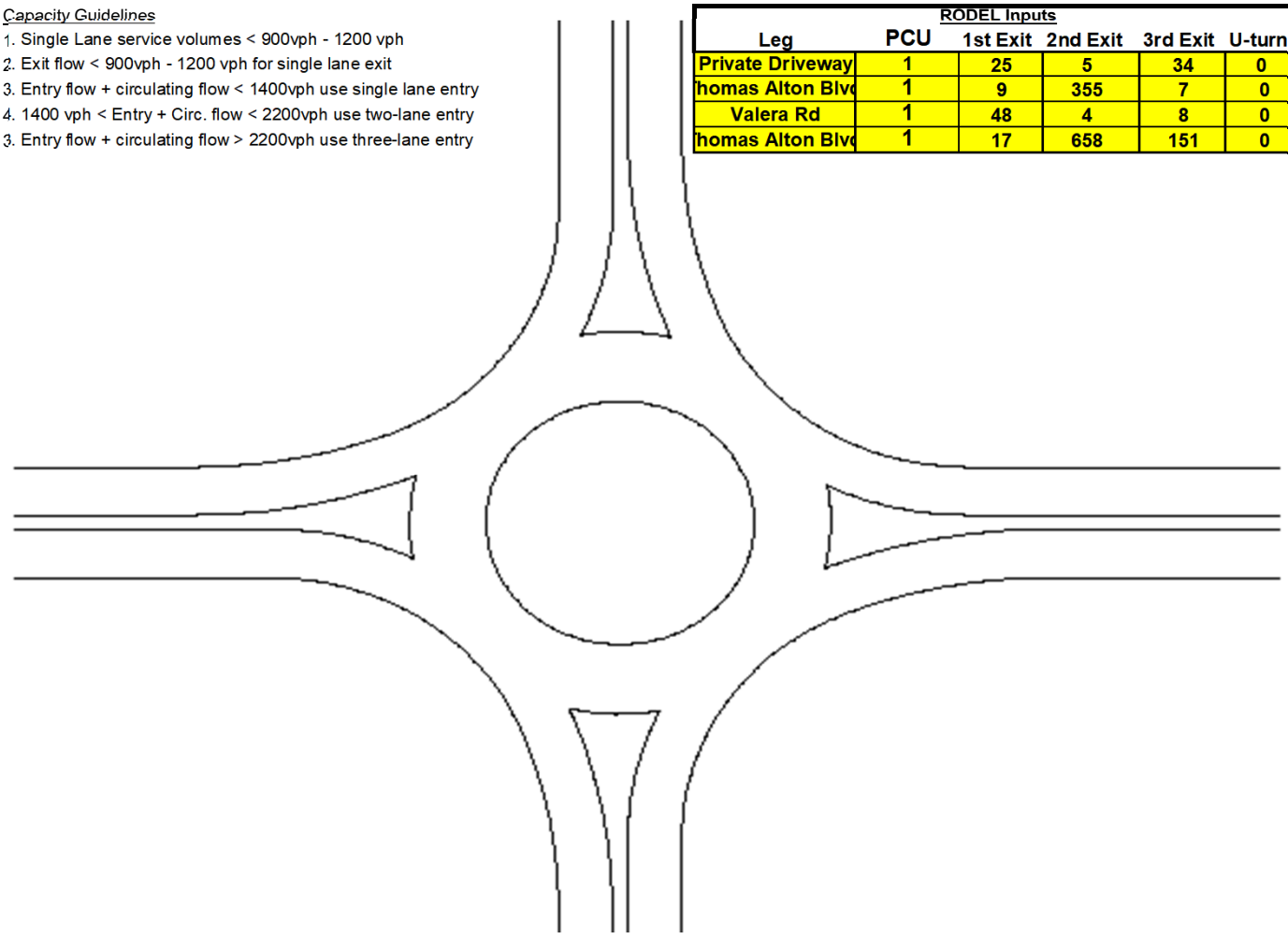
4. 1400 vph < Entry + Circ. flow < 2200vph use two-lane entry
3. Entry flow + circulating flow > 2200vph use three-lane entry

RODEL Inputs

Leg	PCU	1st Exit	2nd Exit	3rd Exit	U-turn
Private Driveway	1	25	5	34	0
Thomas Alton Blvd	1	9	355	7	0
Valera Rd	1	48	4	8	0
Thomas Alton Blvd	1	17	658	151	0



Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.5.523 [19102,19/06/2015]

Filename: Thomas Alton & Valera.arc8
Path: C:\Users\Matt\OneDrive - Paradigm Transportation Solutions Limited 1\Projects\Arcady Projects\170185 Thomas Alton & Valera
Report generation date: 07-Sep-17 2:53:58 PM

Summary of intersection performance

	AM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 5 Year Total						
Leg North	0.03	~1	3.09	0.03	A	7.07	A
Leg West	2.02	3.00	8.47	0.67	A		
Leg South	0.17	~1	5.18	0.14	A		
Leg East	0.26	~1	3.79	0.21	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 5 Year Background, AM" model duration: 8:00 AM - 9:30 AM
"D2 - 5 Year Background, PM" model duration: 4:00 PM - 5:30 PM
"D3 - 5 Year Total, AM " model duration: 8:00 AM - 9:30 AM
"D4 - 5 Year Total, PM" model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.5.523 at 07-Sep-17 2:53:58 PM

File summary

Title	Thomas Alton Blvd & Valera Rd
Location	
Site Number	
Date	30-Aug-17
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	Matt
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

(Default Analysis Set) - 5 Year Total, AM

Data Errors and Warnings

No errors or warnings

Analysis Set Details

Name	Roundabout Capacity Model	Description	Locked	Network Flow Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY			100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Single Time Segment Only	Locked
5 Year Total, AM	5 Year Total	AM		ONE HOUR	08:00	09:30	90	15		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East			7.07	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Private Driveway SB	
West	West	Thomas Alton Blvd EB	
South	South	Valera Rd NB	
East	East	Thomas Alton Blvd WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
North	0.00	99999.00
West	0.00	99999.00
South	0.00	99999.00
East	0.00	99999.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	4.50	30.00	20.00	30.00	25.00	
West	3.50	4.50	30.00	20.00	30.00	25.00	

South	3.50	4.50	30.00	20.00	30.00	25.00	
East	3.50	4.50	30.00	20.00	30.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.593	1357.445
West		(calculated)	(calculated)	0.593	1357.445
South		(calculated)	(calculated)	0.593	1357.445
East		(calculated)	(calculated)	0.593	1357.445

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	36.00	100.000
West	ONE HOUR	✓	790.00	100.000
South	ONE HOUR	✓	105.00	100.000
East	ONE HOUR	✓	224.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.000	29.000	4.000	3.000
	West	56.000	0.000	14.000	720.000
	South	5.000	19.000	0.000	81.000
	East	31.000	167.000	26.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.00	0.81	0.11	0.08
	West	0.07	0.00	0.02	0.91
	South	0.05	0.18	0.00	0.77
	East	0.14	0.75	0.12	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	1.000	1.000	1.000	1.000
	West	1.030	1.000	1.150	1.030
	South	1.000	1.160	1.000	1.000
	East	1.000	1.120	1.000	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	West	South	East
From	North	0.0	0.0	0.0	0.0
	West	3.0	0.0	15.0	3.0
	South	0.0	16.0	0.0	0.0
	East	0.0	12.0	0.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS
North	0.03	3.09	0.03	~1	A
West	0.67	8.47	2.02	3.00	A
South	0.14	5.18	0.17	~1	A
East	0.21	3.79	0.26	~1	A

Main Results for each time segment

Main results: (08:00-08:15)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	27.10	27.01	158.99	0.00	1252.87	0.022	0.02	2.936	A
West	594.75	591.42	24.75	0.00	1300.96	0.457	0.83	5.051	A
South	79.05	78.70	583.19	0.00	973.00	0.081	0.09	4.022	A
East	168.64	168.00	59.91	0.00	1211.43	0.139	0.16	3.448	A

Main results: (08:15-08:30)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	32.36	32.34	190.43	0.00	1232.19	0.026	0.03	2.999	A
West	710.19	708.76	29.64	0.00	1298.15	0.547	1.19	6.093	A
South	94.39	94.28	698.90	0.00	904.30	0.104	0.12	4.444	A
East	201.37	201.22	71.79	0.00	1204.58	0.167	0.20	3.587	A

Main results: (08:30-08:45)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS

North	39.64	39.61	233.18	0.00	1204.07	0.033	0.03	3.090	A
West	869.80	866.59	36.30	0.00	1294.33	0.672	1.99	8.352	A
South	115.61	115.41	854.54	0.00	811.90	0.142	0.16	5.167	A
East	246.63	246.39	87.81	0.00	1195.35	0.206	0.26	3.793	A

Main results: (08:45-09:00)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	39.64	39.64	233.41	0.00	1203.92	0.033	0.03	3.091	A
West	869.80	869.70	36.33	0.00	1294.31	0.672	2.02	8.473	A
South	115.61	115.60	857.59	0.00	810.08	0.143	0.17	5.183	A
East	246.63	246.63	88.07	0.00	1195.20	0.206	0.26	3.794	A

Main results: (09:00-09:15)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	32.36	32.39	190.82	0.00	1231.93	0.026	0.03	3.002	A
West	710.19	713.37	29.70	0.00	1298.12	0.547	1.23	6.188	A
South	94.39	94.59	703.43	0.00	901.61	0.105	0.12	4.461	A
East	201.37	201.60	72.19	0.00	1204.36	0.167	0.20	3.592	A

Main results: (09:15-09:30)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	27.10	27.12	159.76	0.00	1252.36	0.022	0.02	2.939	A
West	594.75	596.25	24.87	0.00	1300.90	0.457	0.85	5.119	A
South	79.05	79.16	587.95	0.00	970.18	0.081	0.09	4.042	A
East	168.64	168.80	60.36	0.00	1211.18	0.139	0.16	3.456	A

Queue Variation Results for each time segment

Queue Variation results: (08:00-08:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.02	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.83	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.09	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:15-08:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.03	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.19	0.00	0.00	2.00	3.00			N/A	N/A
South	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:30-08:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.03	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.99	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.26	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (08:45-09:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.03	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	2.02	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.17	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.26	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:00-09:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.03	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	1.23	0.00	0.00	2.00	2.00			N/A	N/A
South	0.12	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.20	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (09:15-09:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.02	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.85	0.00	0.00	1.00	2.00			N/A	N/A
South	0.09	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.16	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.5.523 [19102,19/06/2015]

Filename: Thomas Alton & Valera.arc8
Path: C:\Users\Matt\OneDrive - Paradigm Transportation Solutions Limited 1\Projects\Arcady Projects\170185 Thomas Alton & Valera
Report generation date: 07-Sep-17 2:53:04 PM

Summary of intersection performance

	PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	A1 - 5 Year Total						
Leg North	0.08	~1	4.77	0.07	A	7.08	A
Leg West	0.48	1.00	4.50	0.33	A		
Leg South	0.05	~1	3.42	0.04	A		
Leg East	2.13	3.00	8.55	0.68	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - 5 Year Background, AM" model duration: 8:00 AM - 9:30 AM
"D2 - 5 Year Background, PM" model duration: 4:00 PM - 5:30 PM
"D3 - 5 Year Total, AM" model duration: 8:00 AM - 9:30 AM
"D4 - 5 Year Total, PM " model duration: 4:00 PM - 5:30 PM

Run using Junctions 8.0.5.523 at 07-Sep-17 2:53:03 PM

File summary

Title	Thomas Alton Blvd & Valera Rd
Location	
Site Number	
Date	30-Aug-17
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	Matt
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

(Default Analysis Set) - 5 Year Total, PM

Data Errors and Warnings

No errors or warnings

Analysis Set Details

Name	Roundabout Capacity Model	Description	Locked	Network Flow Scaling Factor (%)	Reason For Scaling Factors
(Default Analysis Set)	ARCADY			100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Single Time Segment Only	Locked
5 Year Total, PM	5 Year Total	PM		ONE HOUR	16:00	17:30	90	15		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Intersection Delay (s)	Intersection LOS
1	(untitled)	Roundabout	North,West,South,East			7.08	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
North	North	Private Driveway SB	
West	West	Thomas Alton Blvd EB	
South	South	Valera Rd NB	
East	East	Thomas Alton Blvd WB	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
North	0.00	99999.00
West	0.00	99999.00
South	0.00	99999.00
East	0.00	99999.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
North	3.50	4.50	30.00	20.00	30.00	25.00	
West	3.50	4.50	30.00	20.00	30.00	25.00	

South	3.50	4.50	30.00	20.00	30.00	25.00	
East	3.50	4.50	30.00	20.00	30.00	25.00	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
North		(calculated)	(calculated)	0.593	1357.445
West		(calculated)	(calculated)	0.593	1357.445
South		(calculated)	(calculated)	0.593	1357.445
East		(calculated)	(calculated)	0.593	1357.445

The slope and intercept shown above include any corrections and adjustments.

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
North	ONE HOUR	✓	55.00	100.000
West	ONE HOUR	✓	350.00	100.000
South	ONE HOUR	✓	45.00	100.000
East	ONE HOUR	✓	826.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	0.000	23.000	3.000	29.000
	West	3.000	0.000	4.000	343.000
	South	1.000	5.000	0.000	39.000
	East	15.000	668.000	143.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	0.00	0.42	0.05	0.53
	West	0.01	0.00	0.01	0.98
	South	0.02	0.11	0.00	0.87
	East	0.02	0.81	0.17	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	1.000	1.000	1.000	1.000
	West	1.000	1.000	1.000	1.050
	South	1.000	1.000	1.000	1.000
	East	1.000	1.020	1.000	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		North	**West**	**South**	**East**
From	**North**	0.0	0.0	0.0	0.0
	West	0.0	0.0	0.0	5.0
	South	0.0	0.0	0.0	0.0
	East	0.0	2.0	0.0	0.0

Results

Results Summary for whole modelled period

Leg	Max V/C Ratio	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS
North	0.07	4.77	0.08	~1	A
West	0.33	4.50	0.48	1.00	A
South	0.04	3.42	0.05	~1	A
East	0.68	8.55	2.13	3.00	A

Main Results for each time segment

Main results: (16:00-16:15)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	41.41	41.23	610.91	0.00	989.13	0.042	0.04	3.797	A
West	263.50	262.40	131.05	0.00	1219.93	0.216	0.27	3.757	A
South	33.88	33.76	281.15	0.00	1183.05	0.029	0.03	3.131	A
East	621.86	618.39	6.75	0.00	1331.90	0.467	0.87	5.022	A

Main results: (16:15-16:30)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	49.44	49.39	732.09	0.00	916.08	0.054	0.06	4.153	A
West	314.64	314.33	157.03	0.00	1205.24	0.261	0.35	4.040	A
South	40.45	40.43	336.79	0.00	1148.54	0.035	0.04	3.248	A
East	742.56	741.05	8.08	0.00	1331.13	0.558	1.24	6.084	A

Main results: (16:30-16:45)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS

North	60.56	60.47	895.06	0.00	817.82	0.074	0.08	4.753	A
West	385.36	384.85	192.03	0.00	1185.45	0.325	0.48	4.493	A
South	49.55	49.50	412.33	0.00	1101.67	0.045	0.05	3.420	A
East	909.45	906.01	9.90	0.00	1330.07	0.684	2.10	8.419	A

Main results: (16:45-17:00)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	60.56	60.55	898.32	0.00	815.86	0.074	0.08	4.765	A
West	385.36	385.35	192.66	0.00	1185.09	0.325	0.48	4.501	A
South	49.55	49.55	412.88	0.00	1101.34	0.045	0.05	3.421	A
East	909.45	909.33	9.91	0.00	1330.06	0.684	2.13	8.550	A

Main results: (17:00-17:15)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	49.44	49.53	736.91	0.00	913.17	0.054	0.06	4.170	A
West	314.64	315.14	157.96	0.00	1204.71	0.261	0.36	4.050	A
South	40.45	40.50	337.66	0.00	1147.99	0.035	0.04	3.249	A
East	742.56	745.96	8.10	0.00	1331.12	0.558	1.28	6.189	A

Main results: (17:15-17:30)

Leg	Total Demand (Veh/hr)	Entry Flow (Veh/hr)	Circulating Flow (Veh/hr)	Pedestrian Demand (Ped/hr)	Capacity (Veh/hr)	V/C Ratio	End Queue (Veh)	Delay (s)	LOS
North	41.41	41.46	615.89	0.00	986.13	0.042	0.04	3.813	A
West	263.50	263.81	132.05	0.00	1219.36	0.216	0.28	3.770	A
South	33.88	33.91	282.66	0.00	1182.11	0.029	0.03	3.137	A
East	621.86	623.44	6.78	0.00	1331.89	0.467	0.88	5.092	A

Queue Variation Results for each time segment

Queue Variation results: (16:00-16:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.27	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.03	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.87	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:15-16:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.06	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.35	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.24	0.00	0.00	2.00	3.00			N/A	N/A

Queue Variation results: (16:30-16:45)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.48	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.05	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	2.10	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (16:45-17:00)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.08	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.48	0.00	0.00	0.00	1.00			N/A	N/A
South	0.05	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	2.13	?	?	?	?	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A

Queue Variation results: (17:00-17:15)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.06	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.36	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	1.28	0.00	0.00	2.00	3.00			N/A	N/A

Queue Variation results: (17:15-17:30)

Leg	Mean (Veh)	Q05 (Veh)	Q50 (Veh)	Q90 (Veh)	Q95 (Veh)	Percentile Message	Marker Message	Probability Of Reaching Or Exceeding Marker	Probability Of Exactly Reaching Marker
North	0.04	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
West	0.28	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
South	0.03	~1	~1	~1	~1	Percentiles could not be calculated. This may be because the mean queue is very small or very big.		N/A	N/A
East	0.88	0.00	0.00	1.00	2.00			N/A	N/A