TAGGART REALTY MANAGEMENT

November 2018

2983 Navan Road

TIA Strategy Report

PARSONS

2983 Navan Road

TIA Draft Strategy Report

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TIA Strategy Report

1. SCREENING FORM

The screening form is provided as Appendix A. The trip generation trigger was met based on the development size, the location trigger was met based on the proposed access to Spine Routes, and the safety trigger was met based on the proposed site driveway's proximity to the Navan/Brian Coburn roundabout intersection. City staff provided confirmation to proceed with Step 2 – Scoping Report on May 14th, 2018. The Screening Form and City Response are provided in Appendix A.

2. SCOPING REPORT

2.1. EXISTING AND PLANNED CONDITIONS

2.1.1. PROPOSED DEVELOPMENT

Based on the proposed Concept Plan provided by Taggart, it is our understanding that the proponent is proposing a single-phase development located at 2983 Navan Road with an expected date of occupancy in 2021. The proposed commercial development will consist of a grocery store (3,400 m^2), general retail (3,250 m^2), two sit-down restaurants (500 m^2 each), a fast-food restaurant (430 m^2) and a gas bar with a car-wash (10 fueling positions). The proposed Concept Plan shows four vehicle accesses to the site; two to Navan Road (one right-in/right-out access and one full-movement access) and two to Brian Coburn Boulevard (one full-movement signalized access and one right-in/right-out access). The site is currently a vacant lot and zoned as Development Reserve. The site will have to be rezoned prior to construction. The local context of the site is provided as Figure 1 and the proposed Concept Plan is provided as Figure 2.

Figure 1: Local Context

NORTH

NAVAN ROAD

CHAPEL HILL SOUTH PARK & RIDE
and RAPID TRANSIT STATION

BRIAN COBURN BOULEVARD

FUTURE MULTI USE PATHWAY

RESTO. B
5,400 sq.ft.
500 sq.m.

RESTO. A
5,400 sq.ft.
500 sq.m.

DRIVE THRU
4,600 sq.ft.
430 sq.m.

RETAIL
3400 sq.ft.
320 sq.m.

GAS BAR
1.05 AC
4,250 sq.m

GAS RETAIL

CAR WASH

RETAIL A
31,500 sq.ft.
2,930 sq.m.

GROCERY
36,000 sq.ft.
3,400 sq.m.

43
59
12
8
71
153
8

1.8 HIGH PRIVATE FENCE

3.0 HIGH SOUND WALL

EXISTING RESIDENTIAL

EXISTING RESIDENTIAL

EXISTING RESIDENTIAL

EXISTING RESIDENTIAL

EXISTING RESIDENTIAL

FUTURE RESIDENTIAL DEVELOPMENT

VACANT LAND

PAGE ROAD

TAGGART REALTY

NAVAN - BRIAN COBURN

HOBIN

Concept

Scale 1:1500
November 8, 2018

. It should be noted that the subject TIA has been prepared to address those issues most relevant to the rezoning application, and that further transportation study will be required at the time of Site Plan Application that is expected to follow. City planning staff have agreed to this approach given the status of the Brian Coburn Extension / Cumberland Transitway Westerly Alternative Corridor EA, which could impact the site from a transportation perspective.

2.1.2. EXISTING CONDITIONS

Area Road Network

Navan Road is a city owned, arterial roadway that extends from Innes Road in the northwest to Trim Road in the southeast. Within the study area, Navan Road has a two-lane undivided cross-section with auxiliary turn lanes provided at major intersections. The posted speed limit is 60 km/h within the study area.

Brian Coburn Boulevard is an east-west, city owned, arterial roadway that extends from Navan Road in the west to Trim Road in the east. The roadway has a two-lane undivided cross-section and will be constructed as a four-lane divided arterial in the fullness of time. Within the study area the posted speed limit is 70km/h.

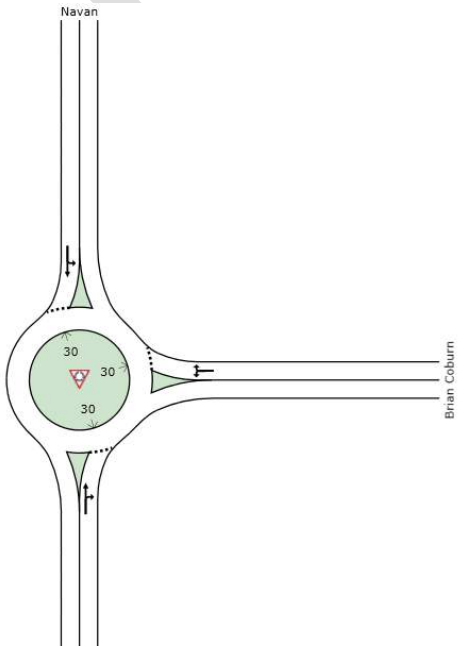
Renaud Road is an east-west, city owned, collector roadway that extends from Anderson Road in the west to Mer Bleue Road in the east. The roadway has a two-lane undivided cross-section with a posted speed limit of 50 km/h.

Pagé Road South is a north-south, city owned, collector roadway that was recently closed (cul-de-sac) at Brian Coburn Boulevard. The roadway has a two-lane undivided cross-section with a posted speed limit of 40 km/h.

Existing Study Area Intersections

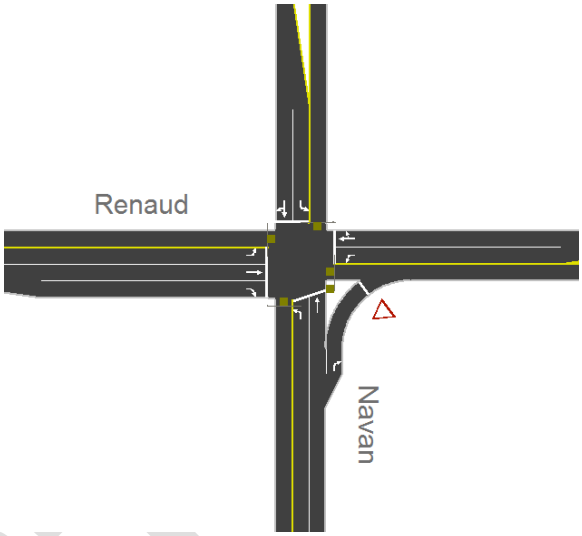
Navan/Brian Coburn

The Navan/Brian Coburn intersection is a roundabout 'T' intersection. The north, south, and westbound approaches consist of a single full movement lane. All movements are permitted at this location.



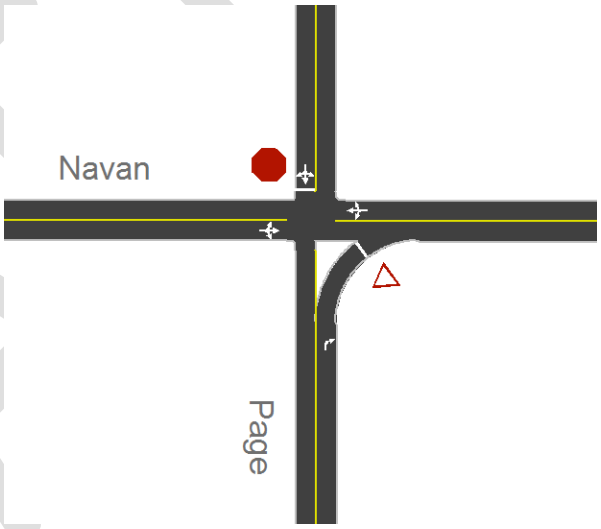
Navan/Renaud

The Navan/Renaud intersection is a signalized four-legged intersection. The northbound approach consists of a left-turn lane and a shared through/channelized right-turn lane. The south and westbound approaches consist of a left-turn lane and a shared through/right-turn lane. The eastbound approach consists of a left-turn lane, a through lane and a right-turn lane. All movements are permitted at this location.



Navan/Pagé

The Navan/Pagé intersection is a four-legged unsignalized intersection with STOP control on the southbound approach and YIELD control on the northbound approach. The north, south, east and westbound approaches consist of a single full movement lane. The northbound through and left-turn movements are prohibited at this location.



Existing Driveways to Adjacent Developments

On Navan Road there are approximately 10 private residential driveways on the northeast side of the roadway, located between the site's proposed accesses. Additionally, there are approximately 10 driveway entrances on the southwest side of Navan Road between Brian Coburn Boulevard and Pagé Road.

Along Brian Coburn Boulevard, there are currently no driveways adjacent to the site. However, a future OC Transpo Park and Ride lot is planned along the north side of Brian Coburn Boulevard with a proposed signalized access. It is the intention of the proponent to construct the fourth leg of this signalized intersection to provide full-movement access to the subject site.

Pedestrian/Cycling Network

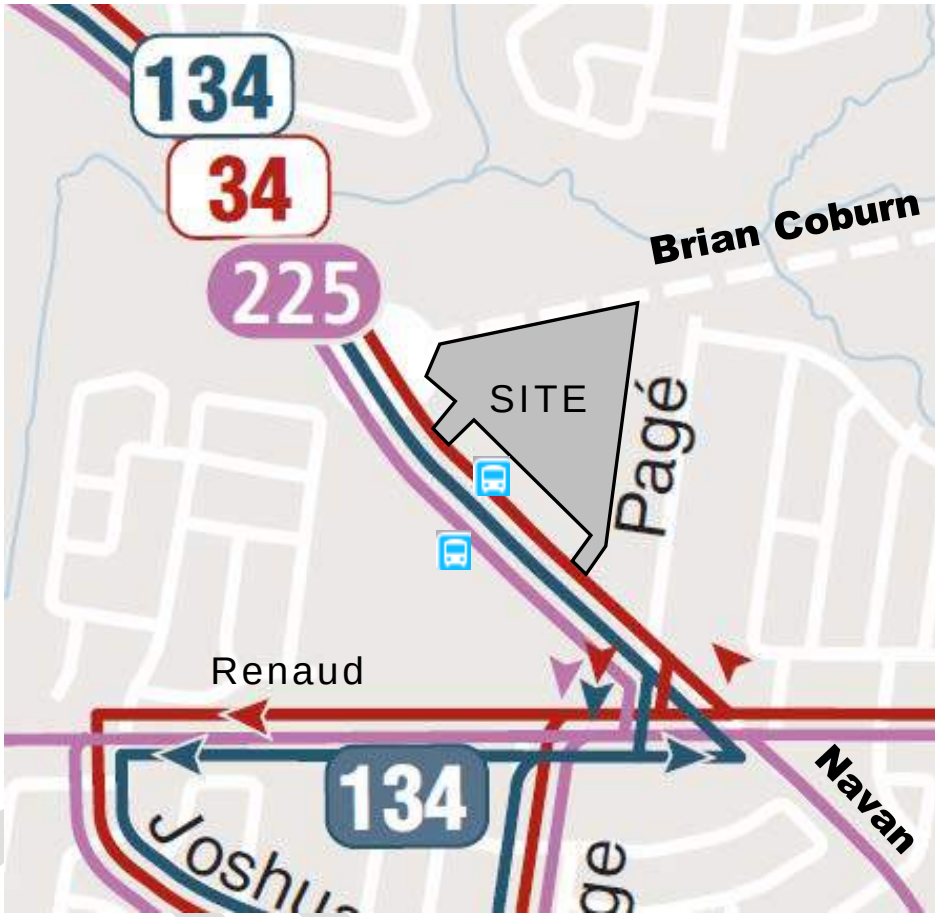
With respect to pedestrians, there are sidewalks provided on both sides of Renaud Road and a multi-use pathway (MUP) on the south side of Brian Coburn Boulevard. There are no sidewalk facilities along Navan Road or Pagé Road. Additionally, there is a pedestrian signal crossing Brian Coburn at Pagé Road.

With respect to cyclists, according to the Ottawa Cycling Plan, Navan Road and Pagé Road are classified as "Spine" cycling routes and Renaud Road is classified as a "Local" cycling route. Cycling facilities are currently provided on Brian Coburn Boulevard in the form of westbound curb-side bike lanes and a two-way MUP along the south side of the roadway.

Transit Network

Transit service within the vicinity of the site is currently provided by OC Transpo Routes #34, #134 and #225. Bus stops for these routes are located along Navan Road, adjacent to the site. Peak Hour Route #34 and Connexion Route #225 provide service during the morning and afternoon peak periods and Local Route #134 provides frequent all-day service. Figure 3 illustrates the existing transit service network within the study area.

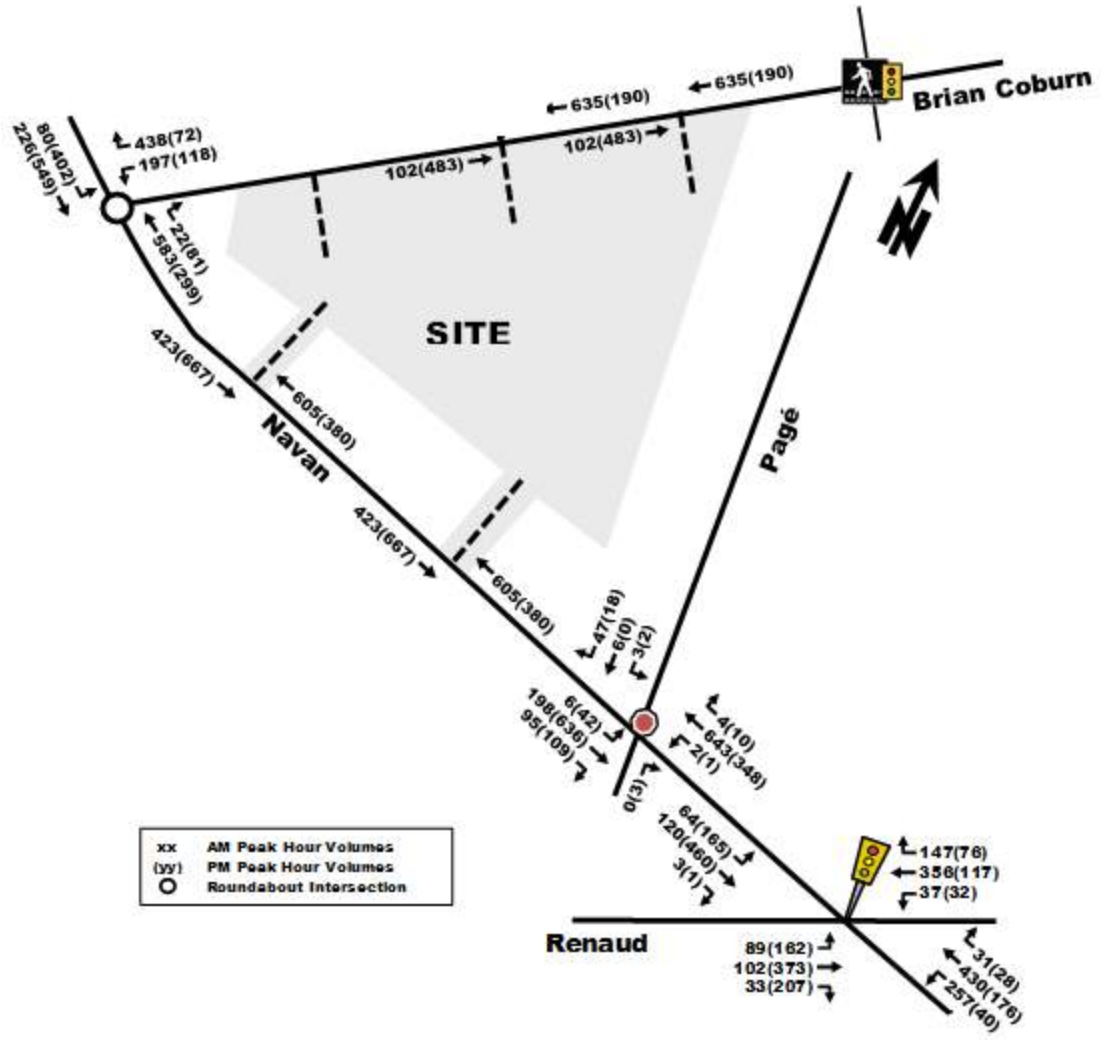
Figure 3: Area Transit Network



Peak Hour Travel Demands

Illustrated as Figure 4, are the most recent weekday morning and afternoon peak hour traffic volumes obtained from the City of Ottawa at the Pagé/Navan and Navan/Renaud intersections and collected by Parsons at the Navan/Brian Coburn intersection. These peak hour traffic volumes are included as Appendix B.

Figure 4: Existing Traffic Volumes



Existing Road Safety Conditions

Collision history for the study area intersections (2012 to 2016, inclusive) was obtained from the City of Ottawa. Most collisions (77%) involved only property damage, indicating low impact speeds, and 23% involved personal injuries. The primary causes of collisions cited by police include angle (70%) and rear end (18%) type collisions. At the signalized Navan/Renaud intersection, vehicle collisions have historically taken place at a rate of 0.54 collisions per million entering vehicles (MEV).

At the Navan/Pagé intersection, 32 collisions have been reported from 2012 to 2014, equating to approximately 10 collisions per year on average. Only 5 collisions were reported in 2015 to 2016. Modifications to the Navan/Pagé intersection on the northbound approach were implemented in 2014/2015 to prevent the northbound through and left-turn movements along Pagé Road. Based on the collision data, this intersection modification significantly decreased the amount of vehicle collisions at this location. In addition, in 2017 Pagé Road was closed at Brian Coburn Boulevard and as such, vehicle volumes along Pagé Road are expected to significantly decrease, further reducing the number of collisions at this location.

It is noteworthy that within the five-years of recorded collision data there was one collision that involved a cyclist (property damage only) and none involving pedestrians. The source collision data as provided by the City of Ottawa and related analysis is provided as Appendix C.

2.1.3. PLANNED CONDITIONS

Planned Study Area Transportation Network Changes

Transit Projects

A transit priority corridor (isolated measures) along Brian Coburn Boulevard between Navan Road and Tenth Line Road is identified in the 2031 Affordable Network. A Park and Ride is planned along the north side of Brian Coburn Boulevard, adjacent to the subject site. Along the Blackburn Bypass and the future extension of Brian Coburn Boulevard (west of Navan), a transit priority corridor (continuous lanes) is identified on the 2031 Affordable Network.

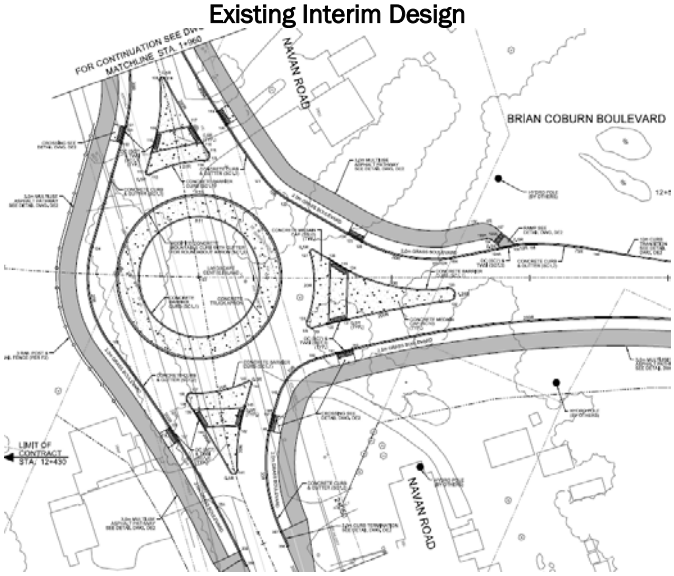
Road Projects

The following road projects have been identified within the vicinity of the site:

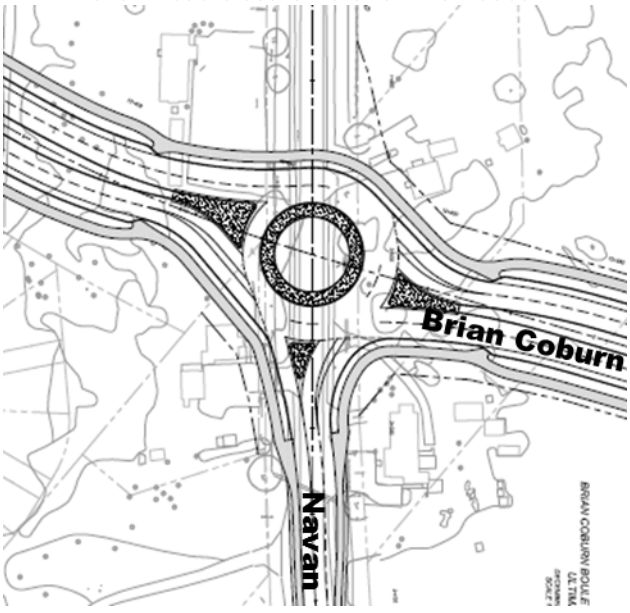
- Brian Coburn Boulevard – the extension from Navan Road to Blackburn Hamlet Bypass is identified as a Phase 2 City project (2020 – 2025) on the 2031 Affordable Network and Network Concept; ultimately Brian Coburn Boulevard will be widened from two lanes to four lanes;
    - The Environmental Assessment (EA) for the extension of Brian Coburn Boulevard to the Blackburn Hamlet Bypass shows Brian Coburn Boulevard continues west of Navan Road and heads north towards Blackburn Hamlet Bypass. The Navan/Brian Coburn roundabout intersection would be modified to a three-legged roundabout, with Navan Road being the south leg and Brian Coburn Boulevard being the east and west legs. Navan Road north of Brian Coburn Boulevard is currently proposed to be closed (cul-de-sac) at Brian Coburn Boulevard. The preliminary designs of the Brian Coburn/Navan roundabout for the interim (current) and future conditions are provided as Figure 5 below;
    - The EA study is currently re-evaluating the alignment of Brian Coburn Boulevard west of Navan Road and re-evaluating details regarding Navan Road for the future design.

Figure 5: Interim and Future Brian Coburn/Navan Roundabout Designs

Existing Interim Design



Preliminary Design for Brian Coburn Extension and Navan Road Closure North of Brian Coburn



- Navan Road – the widening of Navan Road from two lanes to four lanes from Brian Coburn Boulevard to Mer Bleue Road is identified on the 2031 Network Concept, however, it is not identified on the Affordable Network Plan; and
- Blackburn Bypass – the widening of Blackburn Bypass from four lanes to six lanes is identified on the 2031 Network Concept, however, it is not identified on the Affordable Network Plan.

Other Area Development

According to the City's development application search tool, the following developments are planned within the vicinity of the subject site which are expected to have an impact on the surrounding transportation network.

6251-6371 Renaud Road
Richcraft Group of Companies and Minto Group Inc is proposing the construction of a residential development and elementary school at the above-noted address, which is located approximately 600 m east of the subject development. The Transportation Study dated June 25, 2012 (prepared by IBI Group) projected an increase in vehicle traffic of approximately 275 veh/h and 350 veh/h during the morning and afternoon peak hours, respectively.

6211 Renaud Road
A residential development consisting of 3 single detached homes and 13 townhouse blocks (total 55 units) is proposed at the above-noted address, which is located approximately 540 m east of the subject development. A Transportation Impact Assessment has yet to be completed.

6024, 6094 and 6122 Renaud Road
An application to extend Draft Plan Approval has been submitted, which was set to lapse on July 11th 2013. The first phase was registered in 2008 as plan 4M-1370, a Draft Plan Approval extension was granted in 2010 and the second phase was registered in 2012 as plan 4M-1465. No information regarding concept plan, subdivision plan or site plan was identified during our review of the City of Ottawa application search tool.

873, 875, 877, 2705 and 2709 Contour Street
An application to rezone the properties at 2705 Pagé Road and 2709 Pagé Road from Development Reserve (DR) to Residential Third Density Zone, Subzone Z (R3Z) has been noted. The three vacant lots fronting Contour Street are proposed to be rezoned from Development Reserve (DR) to Residential Third Density Zone, Subzone Z, Exception 1743 (R3Z[1743]). The R3Z[1743] zoning is consistent with the zoning in the adjacent Richcraft Plan of Subdivision. No information regarding concept plan, subdivision plan or site plan was identified during our review of the City of Ottawa application search tool. These developments have not been constructed, according to field visits.

600 Compass Street
Richcraft Homes is proposing a residential development consisting of 91 units at the above-noted address, which is located approximately 950 m east of the subject development. The Transportation Brief (prepared by Castleglenn Consultants) projected an increase in vehicle traffic of approximately 50 veh/h and 60 veh/h during the morning and afternoon peak hours, respectively.

2.2. STUDY AREA AND TIME PERIODS

The proposed study area is outlined below and highlighted in Figure 6.

- Navan/Renaud intersection;
- Navan/Brian Coburn intersection;
- Navan/Pagé intersection;
- Navan Road– adjacent to the site; and,

- Brian Coburn Boulevard– adjacent to the site.

Note that Pagé Road has not been included as there is no direct site access to the street.

Figure 6: Study Area

2.3. EXEMPTION REVIEW

As this is a TIA in support of a Rezoning Application, we are advised by the City Transportation Project Manager that the TIA for the Rezoning Application will consist of Steps 1 to 4 of the TIA process, with a reduced Step 4 focusing solely on the Network Impact Component (see Appendix D). At the time of Site Plan, the TIA Strategy Report will be updated.

3. FORECASTING

3.1. DEVELOPMENT-GENERATED TRAVEL DEMAND

Appropriate trip generation rates for the proposed development consisting of a grocery store (36,000 ft²), general retail (32,200 ft²), two sit-down restaurants (5,400 ft² each), a fast-food restaurant (4,600 ft²) and a gas bar (10 proposed pumps) were obtained from the ITE Trip Generation Manual (10th Edition). These rates are summarized in Table 1.

Table 1: ITE Trip Generation Rates

Land Use	ITE Land Use Code	Trip Rates		
		AM Peak	PM Peak	SAT Peak
Supermarket	ITE 850	T = 3.82(X)	T = 9.24(X); Ln(X) = 0.75Ln(X) + 3.21	T = 10.34(X); Ln(T) = 0.69Ln(X) + 3.61
Shopping Centre	ITE 820	T = 0.94(X)	T = 3.81(X)	T = 4.50(X)
Quality Restaurant	ITE 931	T = 0.73(X)	T = 7.80(X)	T = 10.68(X)
Fast-Food Restaurant with Drive-Thru	ITE 934	T = 40.19(X)	T = 32.67(X)	T = 54.86(X)
Gas Station with Convenience Market	ITE 945	T = 12.47(fp); T = 19.00(fp) – 96.53	T = 13.99(fp)	T = 19.28(fp)

Notes: *T = Average Vehicle Trip Ends*
X = 1000 ft² Gross Floor Area
fp = Vehicle Fueling Position

As ITE trip generation surveys only record vehicle trips and typically reflect highly suburban locations (with little to no access by travel modes other than private automobiles), adjustment factors appropriate to the more urban study area context were applied to attain estimates of person trips for the proposed development.

To convert ITE vehicle trip rates to person trips, an auto occupancy factor and a non-auto trip factor were applied to the ITE vehicle trip rates. Based on the TIA Guidelines and our review of available literature, a combined factor of approximately 1.28 is considered reasonable to account for typical North American auto occupancy values of approximately 1.15 and combined transit/non-motorized modal shares of 10%. As such, the person trip generation for the proposed retail development is summarized in Table 2.

Table 2: Modified Person Trip Generation

Land Use	Area	AM Peak (Person Trip/h)			PM Peak (Person Trip/h)			SAT Peak (Person Trip/h)		
		In	Out	Total	In	Out	Total	In	Out	Total
Supermarket	36,000 ft²	105	71	176	237	229	466	286	275	561
Shopping Centre	34,900 ft²	26	16	42	81	89	170	104	97	201
Quality Restaurant	10,800 ft²	3	7	10	72	36	108	87	61	148
Fast-Food Restaurant	4,600 ft²	120	117	237	99	93	192	164	159	323
Gas Station with Convenience Store	10 fueling positions	61	59	120	91	88	179	123	124	247
Total Person Trips		**315**	**270**	**585**	**580**	**535**	**1,115**	**764**	**716**	**1,480**

The person trips shown in Table 2 for the proposed development were then reduced by modal share values, including a reduction for 'pass-by' trips, based on the site's location and proximity to adjacent communities, employment, shopping uses and transit availability. Given the range of services provided in the one proposed site, a 10% multi-purpose reduction was applied to the vehicle trip generation to account for trips travelling to the site and visiting more than one retail service during their trip (i.e. a driver travelling to the site to go to the grocery store and get gas). Modal share and 'pass-by' values for the supermarket/shopping center, sit-down restaurants, fast-food restaurant, and gas station are summarized in Tables 3, 4, 5, and 6, respectively. Table 7 provides a summary of potential two-way vehicle trips to/from the proposed development.

Table 3: Supermarket/Retail Modal Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/hr)			PM Peak (Person Trips/hr)			SAT Peak (Person Trips/hr)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	55%	58	40	98	131	126	257	158	152	310
Auto Passenger	15%	16	10	26	36	35	71	43	41	84
Transit	20%	21	14	35	47	46	93	57	55	112
Non-motorized	10%	10	7	17	23	22	45	28	27	55
Total Person Trips	100%	105	71	176	237	229	466	286	275	561
Less Pass-by (30%)		-15	-15	-30	-39	-39	-78	-47	-47	-94
Total 'New' Supermarket Auto Trips		**43**	**25**	**68**	**92**	**87**	**179**	**111**	**105**	**216**

Table 4: Quality Restaurant Modal Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/hr)			PM Peak (Person Trips/hr)			SAT Peak (Person Trips/hr)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	60%	2	5	7	44	22	66	53	37	90
Auto Passenger	15%	1	1	2	11	6	17	13	9	22
Transit	15%	0	1	1	10	5	15	13	9	22
Non-motorized	10%	0	0	0	7	3	10	8	6	14
Total Person Trips	100%	3	7	10	72	36	108	87	61	148
Less Pass-by (0%)		0	0	0	0	0	0	0	0	0
Total 'New' Quality Restaurant Auto Trips		**2**	**5**	**7**	**44**	**22**	**66**	**53**	**37**	**90**

Table 5: Fast-Food Restaurant Modal Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/hr)			PM Peak (Person Trips/hr)			SAT Peak (Person Trips/hr)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	55%	66	65	131	55	52	107	91	88	179
Auto Passenger	15%	18	18	36	15	14	29	25	24	49
Transit	20%	24	23	47	20	18	38	32	32	64
Non-motorized	10%	12	11	23	9	9	18	16	15	31
Total Person Trips	100%	120	117	237	99	93	192	164	159	323
Less Pass-by (50%)		-33	-33	-66	-27	-27	-54	-45	-45	-90
Total 'New' Fast-Food Restaurant Auto Trips		**33**	**32**	**65**	**28**	**25**	**53**	**46**	**43**	**89**

Table 6: Gas Station Modal Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/hr)			PM Peak (Person Trips/hr)			SAT Peak (Person Trips/hr)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	80%	49	48	97	73	71	144	99	100	199
Auto Passenger	15%	9	9	18	14	13	27	18	18	36
Transit	0%	0	0	0	0	0	0	0	0	0
Non-motorized	5%	3	2	5	4	4	8	6	6	12
Total Person Trips	100%	61	59	120	91	88	179	123	124	247
Less Pass-by (60%)		-29	-29	-58	-43	-43	-86	-60	-60	-120
Total 'New' Gasoline Station with Convenience Market Auto Trips		20	19	39	30	28	58	39	40	79

Table 7: Total Modal Site Trip Generation

Travel Mode	AM Peak (veh/hr)			PM Peak (veh/hr)			SAT Peak (veh/hr)		
	In	Out	Total	In	Out	Total	In	Out	Total
Supermarket Trip Generation	58	40	98	131	126	257	158	152	310
Shopping Centre Trip Generation	15	9	24	45	49	94	58	54	112
Quality Restaurant Trip Generation	2	5	7	44	22	66	53	37	90
Gasoline Station with Convenience Market Trip Generation	49	48	97	73	71	144	99	100	199
Fast-Food Restaurant Trip Generation	66	65	131	55	52	107	91	88	179
Supermarket Pass-by (30%)	-15	-15	-30	-39	-39	-78	-47	-47	-94
Shopping Centre Pass-by (30%)	-4	-4	-8	-14	-14	-28	-17	-17	-34
Quality Restaurant Pass-by (0%)	0	0	0	0	0	0	0	0	0
Gasoline Station with Convenience Market Pass-by (60%)	-29	-29	-58	-43	-43	-86	-60	-60	-120
Fast-Food Restaurant Pass-by (50%)	-33	-33	-66	-27	-27	-54	-45	-45	-90
Multi-purpose Trips (10%)	-11	-9	-20	-22	-20	-42	-29	-26	-55
Total 'New' Auto Trips	**98**	**77**	**175**	**203**	**177**	**380**	**261**	**236**	**497**

As shown in Table 7, the resulting number of potential 'new' two-way vehicle trips for the proposed development is approximately 175, 380, and 497 veh/h during the weekday morning, afternoon, and Saturday peak hours, respectively.

3.1.1. MODE SHARES

The existing mode shares outlined in Tables 3, 4, 5 and 6 above were derived from the 2011 OD Survey for the Orleans area, which are shown below.

Table 8: OD Survey Trips by Primary Travel Mode – Orleans

Time Period	24 Hours			AM Peak Hour			PM Peak Hour			Average	Selected Split
Mode	From District	To District	Within District	From District	To District	Within District	From District	To District	Within District		
Driver	60%	61%	55%	55%	61%	38%	64%	56%	54%	56%	55%
Passenger	15%	15%	20%	8%	13%	20%	21%	11%	23%	16%	15%
Transit	22%	22%	4%	35%	10%	7%	12%	32%	3%	16%	20%
Bike/Walk	0%	0%	13%	1%	0%	18%	0%	1%	12%	5%	10%
Other	2%	2%	8%	2%	16%	17%	3%	1%	7%	6%	-

These existing modal shares are used to calculate the projected traffic to/from the proposed development for the build-out year 2021, and five years beyond build-out, 2026. As the planned transit priority measures identified in Section 2.1.3 are not expected to be completed prior to 2026, the selected mode splits outlined in Table 8 are used for both the 2021 and 2026 horizon years.

3.1.2. TRIP DISTRIBUTION AND ASSIGNMENT

The site-generated vehicle traffic distribution was based on existing traffic volume splits and the existing road network of the surrounding area. The resultant distribution is outlined as follows:

- 25% to/from the northeast via Navan Road;
- 10% to/from the west via Renaud Road;
- 55% to/from the east via Brian Coburn Boulevard and Renaud Road; and
- 10% to/from the south via Navan Road.

Based on the foregoing distributions, 'new' and 'pass-by' 2021 projected site-generated trips (Table 7) were assigned to the study area, which are illustrated as Figure 7 and Figure 8, respectively.

Figure 7: 'New' Projected 2021 Site-Generated Traffic Volumes

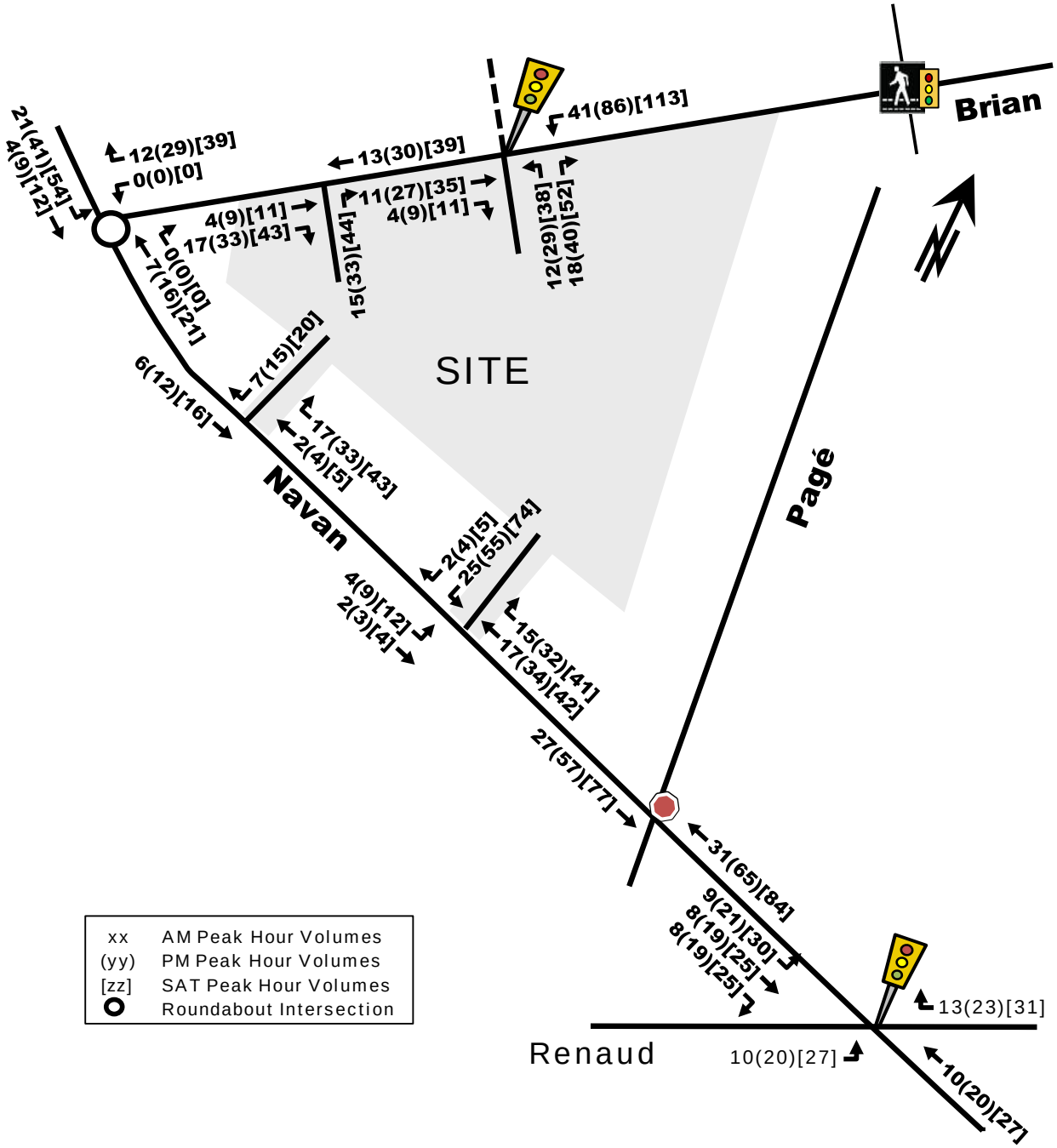
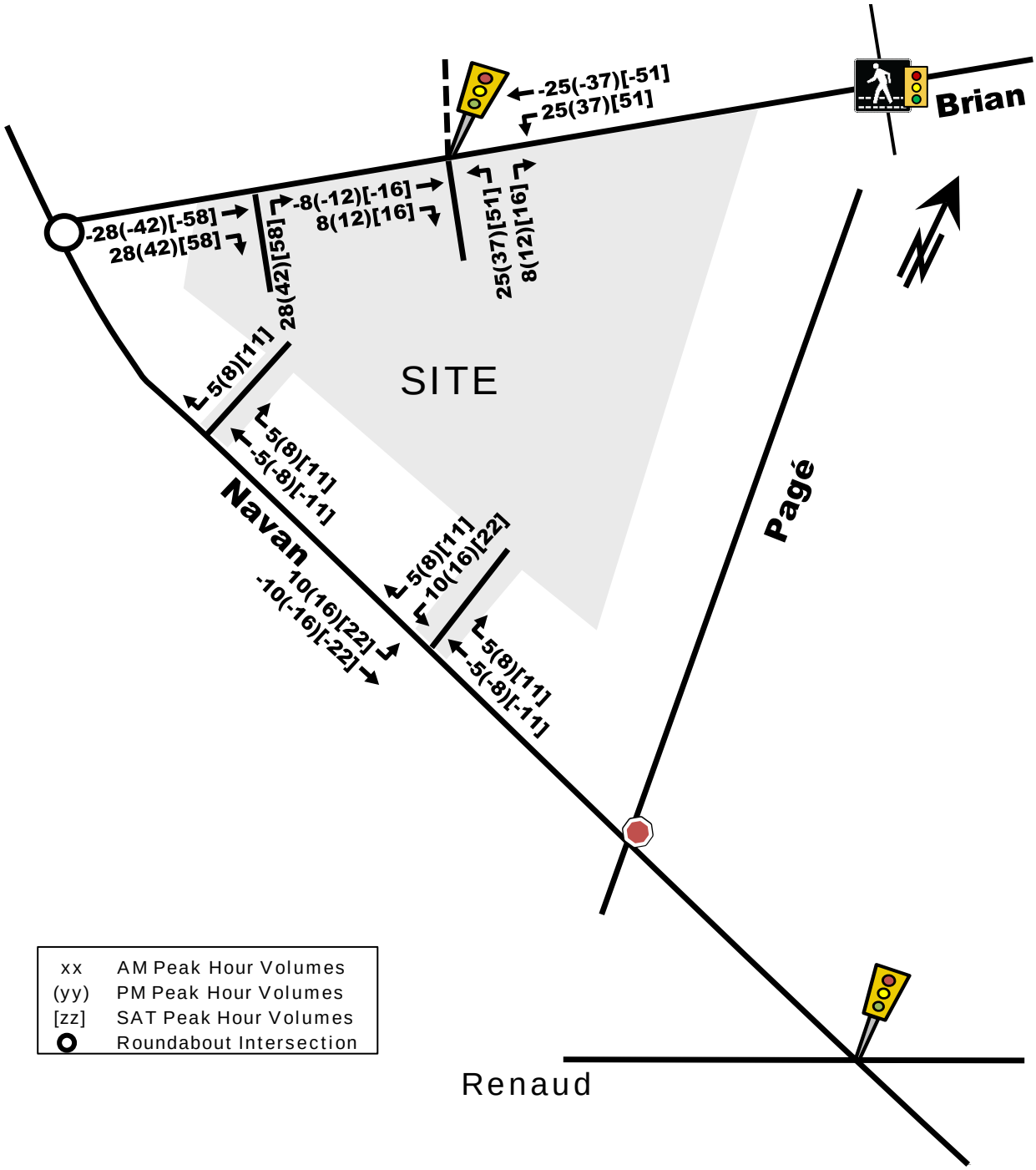
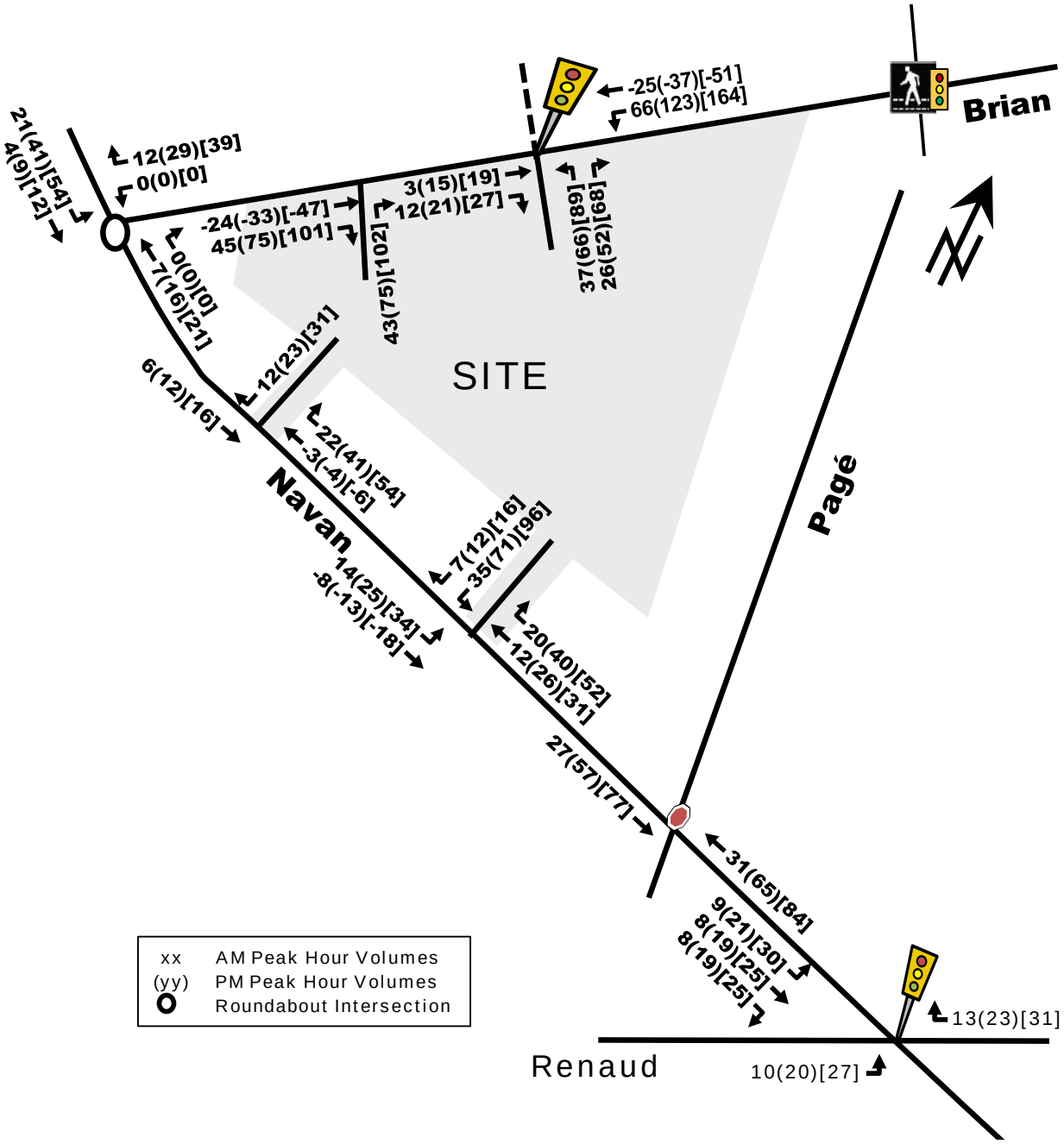


Figure 8: 'Pass-by' Projected 2021 Site-Generated Traffic Volumes



The following Figure 9 illustrates the total 'new' and 'pass-by' site-generated vehicle trips expected to travel to/from the proposed retail development.

Figure 9: 'New' and 'Pass-by' Site-Generated Vehicle Trips



3.2. BACKGROUND NETWORK TRAVEL DEMANDS

3.2.1. TRANSPORTATION NETWORK PLANS

See Section 2.1.3.

3.2.2. BACKGROUND TRAFFIC GROWTH

The following background traffic growth through the immediate study area (summarized in Table 9) was calculated based on historical traffic count data (years 2010, 2013, and 2016) provided by the City of Ottawa at the Navan/Renaud intersection. Detailed background traffic growth analysis is included as Appendix E.

Table 9: Navan/Renaud Historical Background Growth (2010 – 2016)

Time Period	Percent Annual Change				
	North Leg	South Leg	East Leg	West Leg	Overall
8 hrs	4.62%	3.45%	22.22%	25.35%	**13.42%**
AM Peak	4.74%	6.40%	27.82%	33.14%	**17.86%**
PM Peak	7.44%	4.16%	17.13%	14.65%	**10.69%**

As shown in Table 9, the Navan/Renaud intersection has experienced an approximate 10% to 18% annual increase in overall vehicle traffic within recent years (calculated as a weighted average). Orleans, south of Innes, has experience significant development in recent years and will continue to grow in the future. As the surrounding area is built out, the high growth rate is unlikely to be maintained as the capacity of the roadways is reached. As such, a 2% per annum growth factor was applied to existing traffic volumes along Navan Road, Brian Coburn Boulevard, and Renaud Road to obtain background traffic volumes for the 2021 build-out horizon year and 2026 (5-years beyond site build-out). The resultant 2021 and 2026 background traffic volumes are depicted as Figure 10 and Figure 11, respectively.

The vehicle traffic along Brian Coburn Boulevard and Navan Road is in the range of 600 to 700 veh/h in the peak hours and peak direction. As the area is developed, traffic along these arterial roadways will increase and volumes will likely reach the capacity of the roadways (estimated to be between 800 to 1000 veh/h per lane). As mentioned previously, the widening of Brian Coburn Boulevard from two lanes to four is identified as a Phase 2 City project (2020-2025) and the widening of Navan Road is planned for post 2031. These widenings will allow further growth within the community.

Figure 10: 2021 Background Traffic Volumes

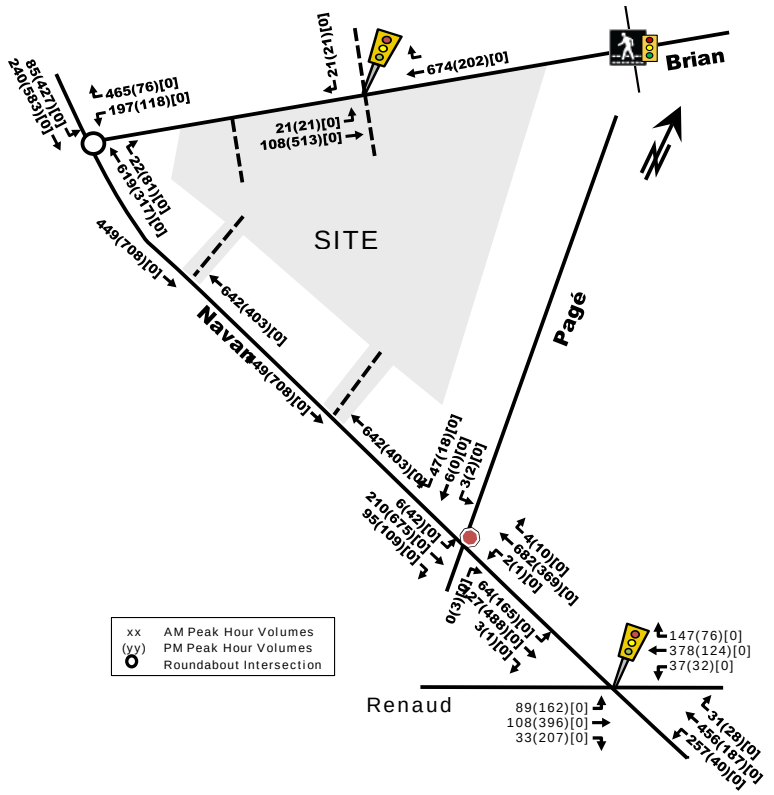
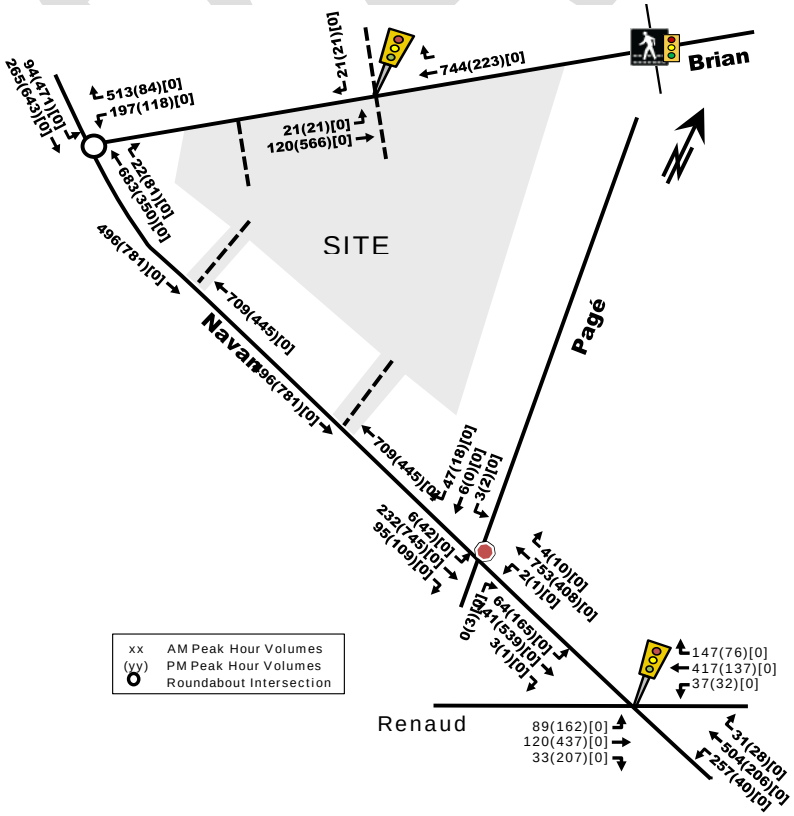


Figure 11: 2026 Background Traffic Volumes



3.2.3. OTHER DEVELOPMENTS

See Section 2.1.3.

3.3. DEMAND RATIONALIZATION

3.3.1. DESCRIPTION OF CAPACITY ISSUES

Existing Conditions

The following Table 10 provides a summary of the existing traffic operations at the study area intersection based on the SYNCHRO (v10) and SIDRA (v7) traffic analysis software. The subject intersections were assessed in terms of the volume-to-capacity (v/c) ratio and the corresponding Level of Service (LoS) for the critical movement(s). Signalized intersection were assessed 'as a whole' based on weighted v/c ratio, whereas unsignalized intersections were assessed based on the critical movement and its related level of service in terms of delay. The SYNCHRO and SIDRA model outputs of existing conditions are provided within Appendix F.

Table 10: Existing Traffic Operations

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Navan/Renaud	C(A)	0.80(0.55)	WBT(EBT)	29.0(17.5)	B(A)	0.67(0.52)
Brian Coburn/Pagé (pedestrian signal)	A(A)	0.48(0.37)	WBT(EBT)	4.9(4.0)	A(A)	0.48(0.37)
Navan/Brian Coburn (Roundabout)	E(C)	37.6(17.9)	WB(SB)	20.1(14.4)	C(B)	-
Navan/Pagé (Unsignalized)	C(B)	15.3(13.5)	SBR(NBR)	0.9(0.9)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

As shown in Table 10, the existing study area intersections 'as a whole' are operating at acceptable levels of service of LoS 'C' or better. At the Navan/Brian Coburn roundabout intersection, the westbound approach is operating at capacity (LoS 'E') during the morning peak hour. According to the SIDRA analysis, delays for this movement are approximately 37 seconds and the 95th percentile queue extends back approximately 14 vehicles (110 m). However, field observations for the westbound movement reveal average delay of approximately 10 seconds, with the longest delays being approximately 20 seconds. The westbound drivers were able to find gaps in northbound traffic to enter the roundabout when northbound drivers yielded to southbound left-turning vehicles. As such, the field observations indicate that the westbound movement is operating better than the SIDRA analysis results. All other critical movements are currently operating at an acceptable LoS 'C' or better.

Future residential growth within the area is expected to add to the westbound movement at the Brian Coburn/Navan intersection, further increasing the delays and queues. As mentioned previously, the widening of Brian Coburn Boulevard from 2-lanes to 4-lanes is identified as a City project, and the alignment of the future Brian Coburn Boulevard extension is being re-evaluated as part of the current EA. The extension of Brian Coburn Boulevard is identified as a Phase 2 City project, expected to be completed by 2025 at the latest.

Projected 2021 Background Conditions – Full Build-out

The 2021 background peak hour traffic volumes (illustrated in Figure 10) have been generated from the existing turning movement counts and the application of the growth rates discussed in Section 3.2.2. The background operations are summarized in Table 11 and the detailed SYNCHRO and SIDRA worksheets are provided in Appendix G.

Table 11: 2021 Background Traffic Operations

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Navan/Renaud	C(D)	0.80(0.83)	WBT(WBT)	29.0(31.7)	B(C)	0.67(0.72)
Brian Coburn/Pagé (pedestrian signal)	A(A)	0.48(0.51)	WBT(WBT)	4.9(5.2)	A(A)	0.48(0.51)
Navan/Brian Coburn (Roundabout)	F(D)	53.7(27.4)	WB(SB)	26.8(20.7)	D(C)	-
Navan/Pagé (Unsignalized)	C(B)	16.2(14.0)	SBR(NBR)	1.0(0.9)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

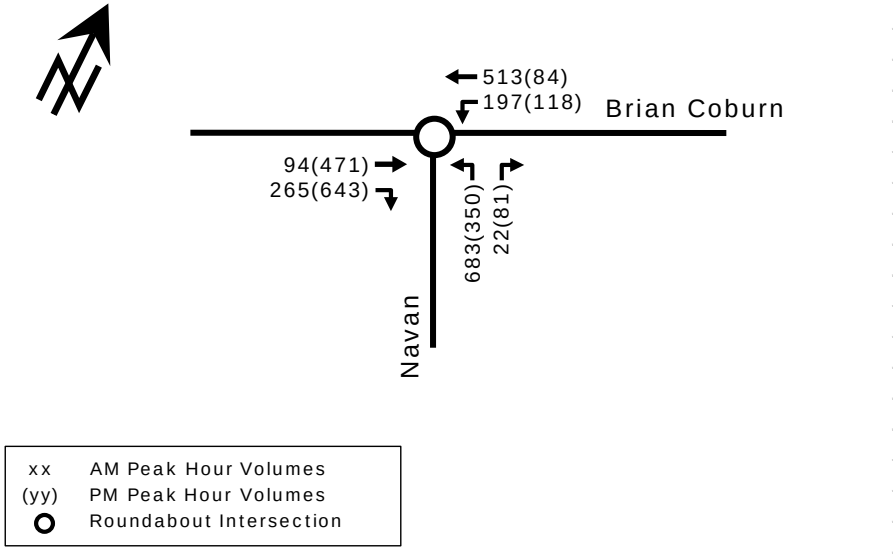
As shown in Table 11, all study area intersections are projected to operate 'as a whole' at an acceptable LoS 'D' or better during both peak hours. With regard to critical movements, all are projected to operate at LoS 'D' or better during peak hours with the exception of the westbound movement at the Navan/Brian Coburn intersection, which is projected to operate above capacity (LoS 'F').

As commuter peak hour traffic increases, the demand on the Brian Coburn/Navan roundabout intersection will increase. As there is significant residential growth planned in the area, the majority of background traffic will be travelling westbound on Brian Coburn and northbound on Navan Road during the morning commuter peak hour, and southbound on Navan Road and eastbound on Brian Coburn Boulevard during the afternoon commuter peak hour. As such, the need to widen Brian Coburn Boulevard to accommodate the anticipated commuter traffic increases for this area will likely be within the Phase 2 timeframe (2020 to 2025).

Projected 2026 Background Conditions – Five Years beyond Full Build-Out

As the extension of Brian Coburn Boulevard is planned to be complete by 2025 and the widening is expected to be required by 2025 the following analysis assumes a four-lane cross-section along Brian Coburn Boulevard and the future planned 3-legged roundabout alignment for the Brian Coburn/Navan roundabout intersection, as outlined in Figure 5, for the future 2026 condition. The traffic volumes at the Brian Coburn/Navan intersection have been re-assigned to account for the potential closure of Navan Road north of Brian Coburn Boulevard. These future projected traffic volumes are illustrated as Figure 11.

Figure 12: Re-Assigned Brian Coburn/Navan Intersection Volumes for Potential Future Roundabout Configuration



The 2026 background peak hour traffic volumes (illustrated in Figure 11) have been generated from the existing turning movement counts and the application of the growth rates discussed in Section 3.2.2. The background operations are summarized in Table 12 and the detailed Synchro and SIDRA worksheets are provided in Appendix G.

Table 12: 2026 Background Traffic Operations

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection 'as a whole'		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Navan/Renaud	D(B)	0.89(0.64)	WBT(SBT)	35.2(20.5)	C(A)	0.78(0.60)
Brian Coburn/Pagé (pedestrian signal)	A(A)	0.56(0.43)	WBT(EBT)	5.7(4.3)	A(A)	0.56(0.43)
Navan/Brian Coburn (Roundabout)	C(A)	15.1(9.5)	WBL(EBR)	10.6(8.2)	B(A)	-
Navan/Pagé (Unsignalized)	C(B)	18.3(15.0)	SBR(NBR)	1.0(1.0)	A(A)	-
Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.						

With the widening of Brian Coburn Boulevard from 2-lanes to 4-lanes by 2025 and the re-configuration of the Brian Coburn/Navan intersection, the study area intersections are projected to operate 'as a whole' at a LoS 'D' or better during both peak hours for the projected 2026 conditions.

It is noteworthy that the EA is currently re-evaluating the alignment of the Brian Coburn Boulevard extension and the Navan Road closure north of Brian Coburn Boulevard. When more information is available regarding the future plans of this study area intersection and roadway alignments, the intersection capacity results may vary from the results shown herein. At the SPA stage of development, the analysis herein will be re-assessed to include any revisions to the planned roadway network.

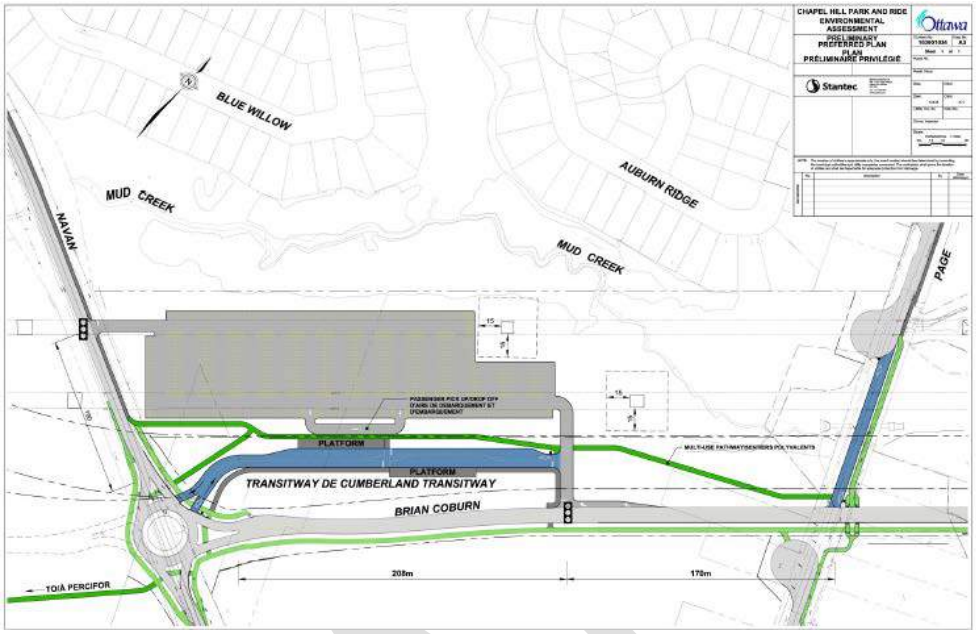
Existing Zoning

As mentioned previously, the existing zoning for the subject site is Development Reserve (DR), and the proponent is applying for Zoning By-Law Amendment. Given the proposed retail land uses, the site is expected to generate more persons trips than it would under the current permitted uses. However, given the planned adjacent area development, the proposed retail land uses will serve the local residents of the existing and future neighbourhoods and is not expected to attract trips from outside the surrounding neighbourhoods. As such, the distribution of the person and vehicle trips is not projected to add to the predominant movements at study area intersections which represents the heavy commuter traffic traveling to/from the west. In brief, the proposed land uses are expected to generate more trips than the permitted land uses, however, it is understood that there is sufficient roadway capacity to support this increase in traffic as the 'new' trips will not significantly contribute to the heavy commuter traffic travelling to/from the urban core.

3.3.2. PROPOSED PARK AND RIDE SIGNAL

An interim Park & Ride within Chapel Hill South is being constructed to help increase ridership in Chapel Hill South and Orleans until the Transitway is constructed. The Chapel Hill Park & Ride is being constructed in advance of the Cumberland Transitway, which is part of the 2031 Network Concept, and will include a transit station, one signalized access to Brian Coburn, along the frontage of the subject site, and one signalized access to Navan Road (see Figure 13). As part of the approval process for the Park & Ride, it was envisioned that the traffic signal would accommodate all bus movements and only the WBR movement for automobiles entering the site from Brian Coburn.

Figure 13: Chapel Hill Park and Ride Concept



The proposed development includes the construction of a south leg at this intersection. The City/Community has expressed concerns over potential traffic delays, transit delays and queueing back to the adjacent Brian Coburn/Navan roundabout associated with the construction of the south leg of the intersection. In response, a preliminary operational analysis was completed at the proposed traffic signal assuming site traffic from both the P&R facility and commercial site, as well as pedestrian demand between the P&R facility and adjacent MUP (south side of Brian Coburn) and commercial development. The analyses, included as Appendix H, was reviewed by Traffic Services at the City of Ottawa and the conclusion was that **operational and safety issues are not anticipated** as a result of adding the south leg. Consideration could be given to providing dual northbound left-turn lanes once Brian Coburn is widened to have two westbound receiving lanes, and that the signalized intersection be operated with protected north and southbound left-turns. The implication, however, is a wider driveway, which may not be desirable.

4. ANALYSIS

4.1. TRANSPORTATION DEMAND MANAGEMENT

As discussed in Section 3.1, the 2983 Navan Road development is projected to generate approximately 585 to 1,480 person-trips during the weekday morning, afternoon and Saturday peak hours. Given the location of the development, travel demand to and from this site is expected to be primarily auto-oriented. However, considering the planned Cumberland Transitway and the adjacent Chapel Hill Park & Ride and transit station, optional TDM-supportive design, infrastructure and post-occupancy measures, such as peak period shuttle connections to the Park & Ride/Transitway, will be identified at the time of SPA.

4.2. NEIGHBOURHOOD TRAFFIC MANAGEMENT

Park & Ride Signalized Intersection
Primary access routes to 2983 Navan Road development will include Navan Road and Brian Coburn, which are both designated arterial roads. Considering the planned adjacent Chapel Hill Park & Ride and Transit Station, it is recommended that the Park & Ride access on Brian Coburn be operated as a bus-only approach, with the exception of westbound right-turn vehicles. This would prevent additional delays to transit vehicles accessing/exiting the Chapel Hill transit station and to west and eastbound vehicles on Brian Coburn.

Right-In/Right-Outs
To mitigate impacts to the Brian Coburn / Navan Roundabout, it is recommended that the north site-access on Navan Road and the west site-access on Brian Coburn be operated as right-in/right-out only. This will eliminate the possibility of queues backing up to the Brian Coburn / Navan Roundabout due to vehicles trying to access the development by doing a southbound left-turn on Navan Road.

To mitigate impacts at the Park & Ride signalized intersection on Brian Coburn, it is recommended that the west site-access on Brian Coburn be also operated as right-in/right-out, to eliminate the possibility of queues backing up to the signalized intersection due to vehicles trying to access the development by doing a westbound left-turn on Brian Coburn.

4.3. TRANSIT

4.3.1. ROUTE CAPACITY

Figure 14 depicts the location of nearby eastbound, westbound, northbound and southbound transit stops and Table 13 summarizes the estimated Phase 1 demanded seats on-vehicle for the corresponding transit stops.

Figure 14: Nearby Transit Stops Locations

Table 13: Transit Capacity at Adjacent Transit Stops

Stop	Direction	Average Frequency (Buses/Hr)		Total Capacity (Seats/hr)	Development-generated Transit Trips (%)
2653	Northbound	PM	3	165	45
2655	Southbound	PM	3	165	135
2653	Northbound	SAT	2	110	59
2655	Southbound	SAT	2	110	178
(1) Bus capacity is assumed to be 55 seats for a single bus.					

As outlined within Section 3, the forecasted 'new' two-way transit trips are estimated to be approximately 20% of the total site-generated person-trips, which equates to 180 trips (93 in, 87 out) during the PM peak and 237 trips (122 in, 115 out) during the Saturday peak. This demand is significantly larger than current transit route capacities, especially during the Saturday peak. Considering the future transit station at the Chapel Hill Park & Ride and the projected bus frequencies at this station (21 buses/h), it is anticipated that sufficient transit capacity will exist to serve the proposed development. As such, the additional forecasted transit trips can be accommodated on the adjacent transit network.

4.3.2. TRANSIT PRIORITY

The proposed Development will use a proposed private approach connecting to the Brian Coburn/Park and Ride signalized intersection. As discussed in Section 3.3.2, it is recommended that the signalized intersection be operated with protected north and southbound left-turns. In addition, it is recommended that signal priority with transit indicator be explored at this location to minimize delays to buses entering/exiting the Park & Ride at this location. No additional transit priority measures are identified for the proposed development.

4.4. REVIEW OF NETWORK CONCEPT

The closest screenlines are SL 45 (Mer-Bleue Road), SL 46 (Trim-Wall-Navan), and SL 47 (Innes-Blackburn Bypass) and are illustrated below in Figure 15. Screenline SL46 and SL47 provide limited information for the impact of the development as minimal trips are anticipated to travel south and west trips may not cross Innes Road to be captured in SL-47. Since Brian Coburn is a relatively new corridor and, for the purposes of this study, a screenline SL45 will be assessed at Brian Coburn, as summarized in Table 14.

Figure 15: Adjacent Screenlines

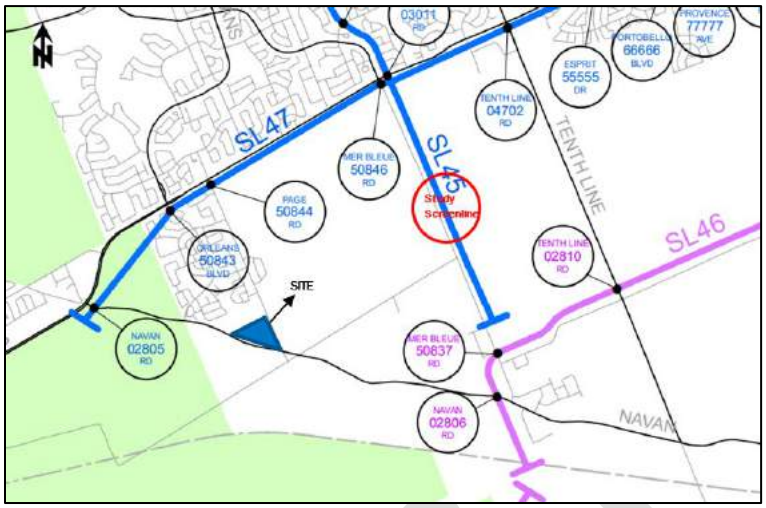


Table 14: Adjacent Screenline Analysis

Screenline #45 - Bilberry Creek			Direction	Direction	Peak	Total Vehicles	v/c
Station	# lanes	Assumed Capacity*					
Brian Coburn	1	1,000	Inbound	Inbound	AM	801	0.80
				Inbound	PM	317	0.32
			Outbound	Outbound	AM	156	0.16
				Outbound	PM	623	0.62
** Assumed capacity of 1000 veh/h*							

As shown in Table 14, the projected total volumes on Brian Coburn Boulevard are below the screenline SL-45 capacity. Considering Brian Coburn Boulevard will ultimately be widened to 4 lanes and extended west to connect with the Blackburn Hamlet Bypass; while Navan Road — north of Brian Coburn — will be closed and a Cul-De-Sac will be installed at the Navan/ Brian Coburn roundabout, no issues are anticipated at adjacent screenlines. As such, no changes to the TMP concepts of adjacent road and transit networks are required.

4.5. INTERSECTION DESIGN

Included in Appendix I are very preliminary sketches of the anticipated design at each of the candidate site driveway connections to the arterial road network. These functional sketches, used as the basis to inform the initial Concept Plan (Figure 2) and identify potential property implications, will evolve as the planning for this development continues.

At this time, reviewing the operations associated with the intersection design is not appropriate. This more detailed analysis will be provided as part of the updated TIA to be completed in support of the future Site Plan Application.

5. CONCLUSIONS

Based on the results summarized herein the following conclusions are offered:

Proposed Site

- The commercial development will consist of a grocery store (3,400 m2), commercial retail (3,000 m2), two site-down restaurants (500 m2 each), a fast-food restaurant with drive-through (430 m2), and a gas bar (10 fueling positions);
- The proposed development will consist of one phase, with an estimated date of occupancy in 2021;
- The proposed development is projected to generate 'new' two-way vehicle volumes of approximately 175, 370, and 497 veh/h during the weekday morning, afternoon, and Saturday peak hours, respectively;
- The accesses to the development are proposed at two new connections to Navan Road (one right-in/right-out and one full-movement) and two new connections to Brian Coburn Boulevard (one right-in/right-out and one signalized full-movement);
- For the proposed right-in/right-out connections to Brian Coburn Boulevard and Navan Road, centre medians will be proposed to ensure driver compliance. At the Brian Coburn signalized access and the Navan Road unsignalized full-movement access, appropriate turn lanes will be provided. Preliminary drawings of the modifications to the public roadway at the site accesses are provided on the Figure 2 Site Plan. Details regarding these roadway modifications for the proposed accesses will be included at the SPA stage of development;

Intersection Operations

- The signalized study area intersections are currently operating overall with acceptable levels of service during the morning and afternoon peak hours. The critical movements are operating at an acceptable LoS 'D' or better, with the exception of the westbound movement at the Brian Coburn/Navan roundabout, which is operating at capacity (LoS 'E');
- Given the anticipated development in the area, a 2% per annum growth rate was applied to the existing traffic volumes to account for future background growth;
- Based on the projected 2021 background traffic, by the expected build-out year of 2021, the study area intersections are projected to operate with acceptable levels of service of LoS 'D' or better during the peak hours. The critical movements are projected to operate at acceptable levels of service with the exception of the westbound movement at the Brian Coburn/Navan roundabout (LoS 'F');
- The extension of Brian Coburn Boulevard west of Navan Road is planned as a Phase 2 City project (2020-2025). As such, at 5-years beyond site build-out (year 2026), assuming the current EA intersection configuration, the Brian Coburn/Navan intersection is projected to operate with acceptable levels of service (LoS 'D' or better) for all movements based on the projected background volumes;
    - The EA is re-evaluating the alignment of Brian Coburn west of Navan Road and re-evaluating the Navan Road closure north of Brian Coburn. As more information becomes available regarding the planned alignment, updated traffic analysis can be completed and included in the TIA for the SPA stage of development;
- The addition of the south leg to the Brian Coburn/Park&Ride intersection does not increase the delay to the EBLT or SB transit movement. As the 95th percentile queues do not reach the roundabout with Navan Road, safety issues at the roundabout due to eastbound queuing are not anticipated;
- Given the anticipated growth in the area, particularly residential, the background traffic conditions represent the forecasted increase in commuter traffic travelling from the east to the west in the morning and from the west to the east in the afternoon peak hours. The subject site is proposed to serve the residents within the neighbourhood and as such is not expected to significantly increase traffic volumes to the critical movements at study area intersections. The trips travelling to/from the proposed retail development will be local traffic from the surrounding neighbourhoods and pass-by traffic travelling to/from their employment.

- Given the planned widening of the Brian Coburn corridor and that the majority of site-generated traffic would use this corridor to/from the northeast and to/from the west, no issues were anticipated at adjacent intersections when total projected volumes were assigned. The significant majority of intersections are projected to operate at an acceptable LoS 'C' or better for total 2021 projected volumes and at an acceptable LoS 'D' or better for total 2026 projected volumes.

Transit

- Considering the future transit station at the Chapel Hill Park & Ride and the projected bus frequencies at this station (21 buses/h), it is anticipated that sufficient transit capacity will exist to serve the proposed development;
- It is recommended that the Brian Coburn/Park and Ride signalized intersection be operated with protected north and southbound left-turns. In addition, it is recommended that signal priority with transit indicator be explored at this location to minimize delays to buses entering/exiting the Park & Ride at this location; and

Network Concept

- Considering Brian Coburn Boulevard will ultimately be widened to 4 lanes and extended west to connect with the Blackburn Hamlet Bypass; while Navan Road — north of Brian Coburn — will be closed and a Cul-De-Sac will be installed at the Navan/ Brian Coburn roundabout, no issues are anticipated at adjacent screenlines. As such, no changes to the TMP concepts of adjacent road and transit networks are required.

Based on the foregoing conclusions, the Zoning By-Law Amendment for the proposed development is recommended from a transportation perspective. Additional transportation analyses, consistent with Step 4 of the TIA process, will be completed to support the subsequent Site Plan Approval application.

Prepared By:	Reviewed By:
André Sponder, P.Eng. Transportation Engineer	Mark Baker, P.Eng Senior Transportation Engineer/Project Manager

Appendix A

Screening Form

PARSONS

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City of Ottawa 2017 TIA Guidelines

TIA Screening Form

Date 4/26/2018
Project Taggart - Navan Development
Project Number 476713-01000

Results of Screening	Yes/No
Development Satisfies the Trip Generation Trigger	Yes
Development Satisfies the Location Trigger	Yes
Development Satisfies the Safety Trigger	Yes

Module 1.1 - Description of Proposed Development	
Municipal Address	2983 Navan Road
Description of location	Triangle land parcel bounded by Brian Coburn Blvd., Navan Rd., and Pagé Rd.
Land Use	Currently unoccupied
Development Size	Grocery Store - 3,400 sq. m Retail A - 3,000 sq. m Retail B - 1,000 sq. m Restaurants A & B - 500 sq. m each Gas Bar - 5,150 sq. m
Number of Accesses and Locations	Two (2) on Navan: One (1) right-in/right-out access approx. 100m south of Brian Coburn and one (1) full-movement access approx. 150m northwest of Pagé. Three (3) on Brian Coburn: One (1) full-movement signalized access approx. 220m east of Navan, and two (2) right-in/right-out accesses approx. 110m and 310m east of Navan
Development Phasing	None
Buildout Year	Assumed 2021
Sketch Plan / Site Plan	See Figure 2

Module 1.2 - Trip Generation Trigger		
Land Use Type	Gas Station or Convenience Market	
Development Size	5,150	sq. m
Trip Generation Trigger Met?	Yes	

Module 1.3 - Location Triggers	
Development Proposes a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit, or Spine Bicycle Networks (See Sheet 3)	Yes
Development is in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone. (See Sheet 3)	No
Location Trigger Met?	Yes

Module 1.4 - Safety Triggers		
Posted Speed Limit on any boundary road	<80	km/h
Horizontal / Vertical Curvature on a boundary street limits sight lines at a proposed driveway	No	
A proposed driveway is within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions) or within auxiliary lanes of an intersection;	Yes	
A proposed driveway makes use of an existing median break that serves an existing site	No	
There is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development	No	
The development includes a drive-thru facility	No	
Safety Trigger Met?	Yes	

Appendix B

Turning Movement Counts

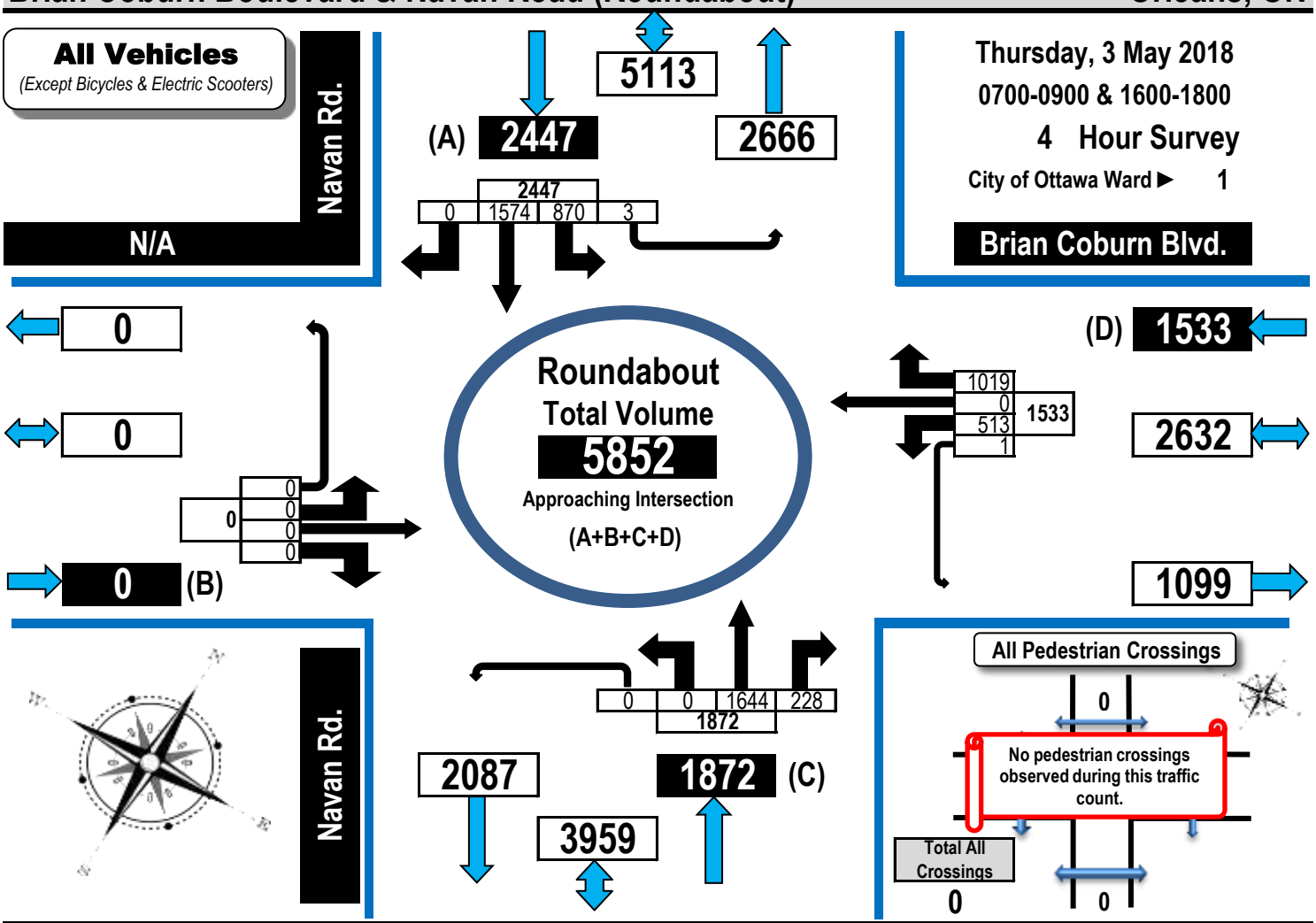
Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams

Automobiles, Taxis, Light Trucks, Vans, SUV's, Motorcycles, Heavy Trucks, Buses, and School Buses

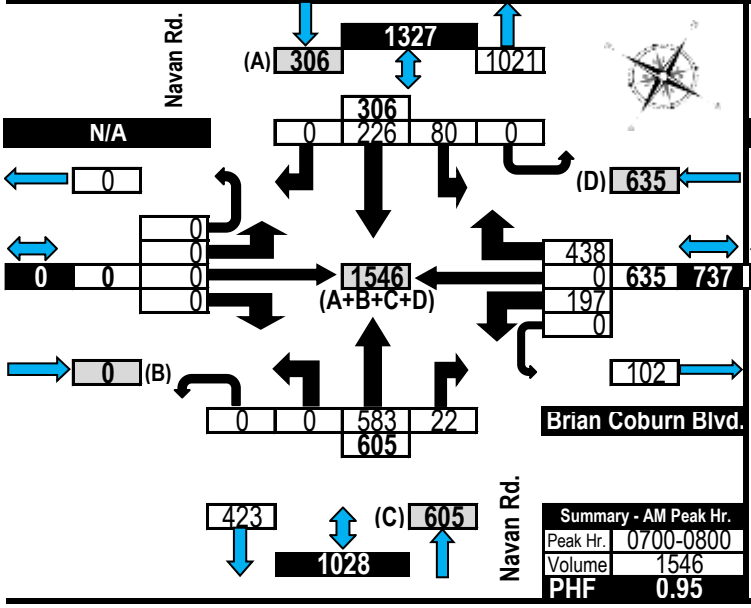
Brian Coburn Boulevard & Navan Road (Roundabout) — Orléans, ON

All Vehicles
(Except Bicycles & Electric Scooters)

Thursday, 3 May 2018
0700-0900 & 1600-1800
4 Hour Survey
City of Ottawa Ward ▶ 1

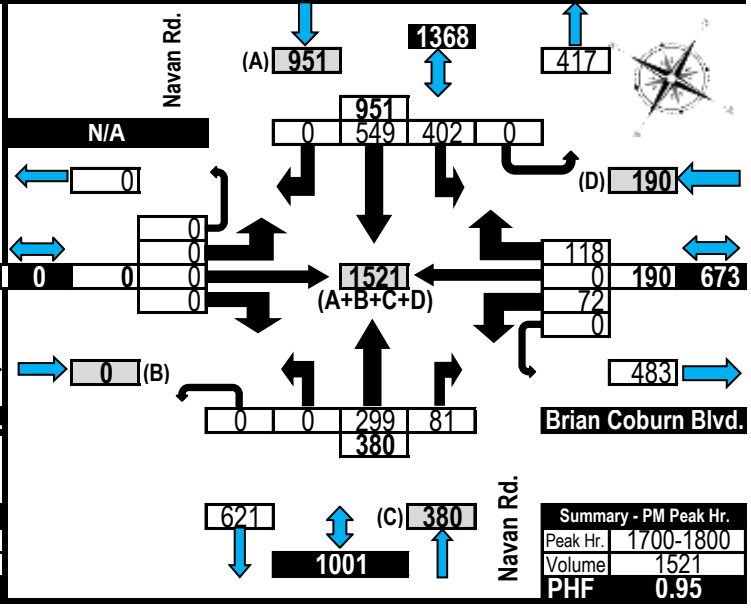


AM Peak Hour Flow Diagram



Summary - AM Peak Hr.	
Peak Hr.	0700-0800
Volume	1546
PHF	0.95

PM Peak Hour Flow Diagram



Summary - PM Peak Hr.	
Peak Hr.	1700-1800
Volume	1521
PHF	0.95

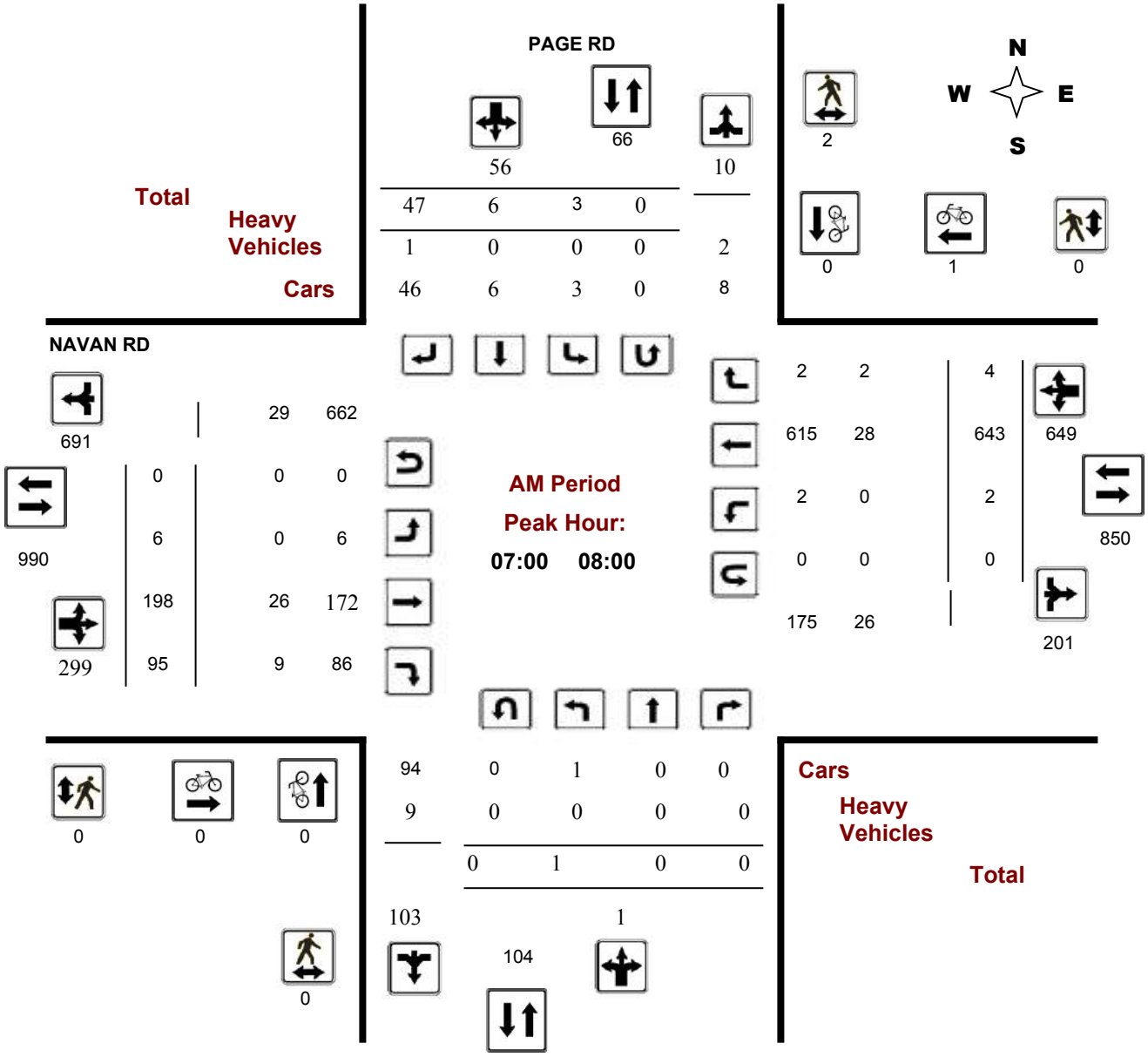
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

NAVAN RD @ PAGE RD

Survey Date: Thursday, May 25, 2017
Start Time: 07:00

WO No: 37064
Device: Miovision



Comments

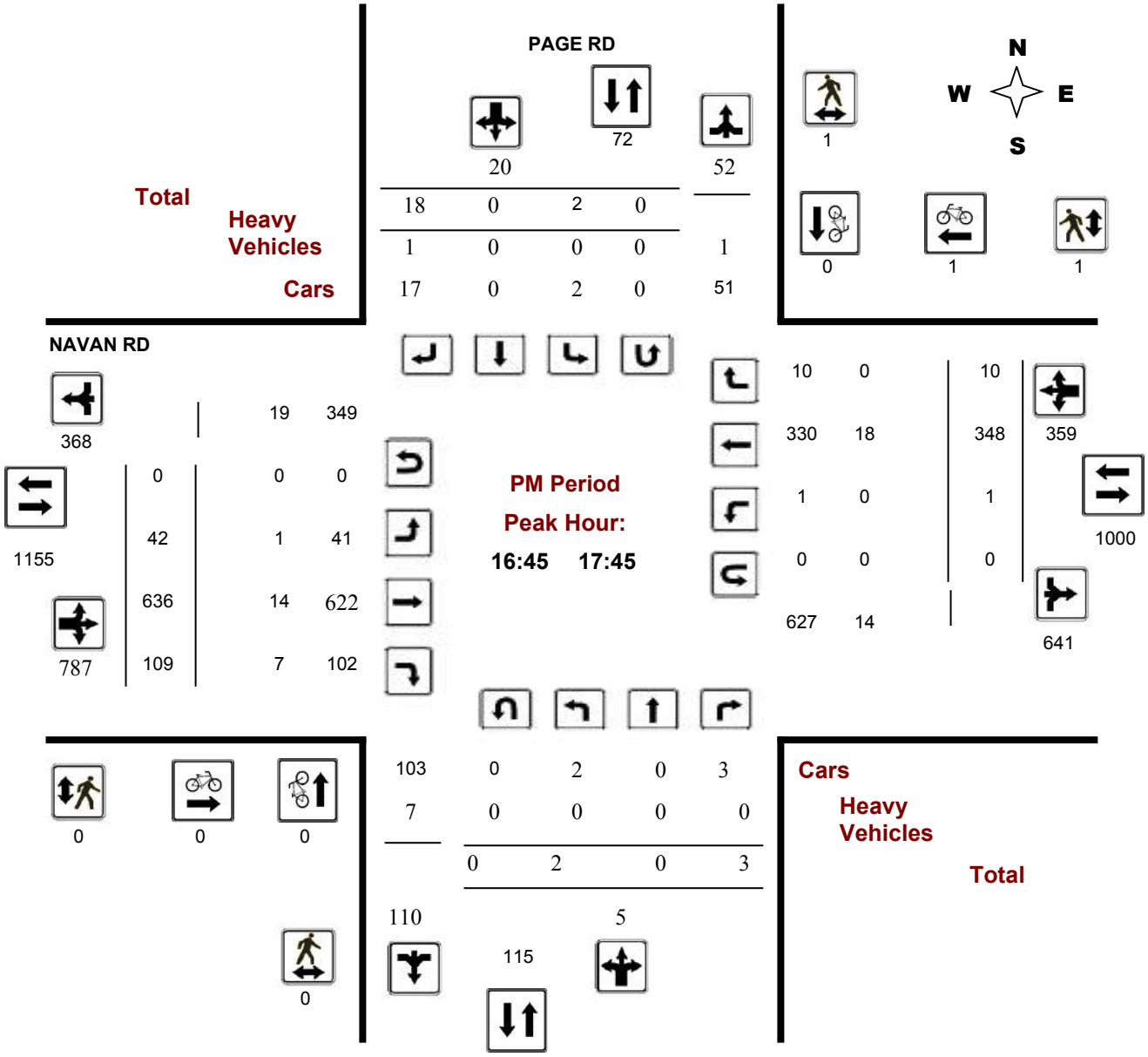
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

NAVAN RD @ PAGE RD

Survey Date: Thursday, May 25, 2017 **WO No:** 37064

Start Time: 07:00 **Device:** Miovision



Comments

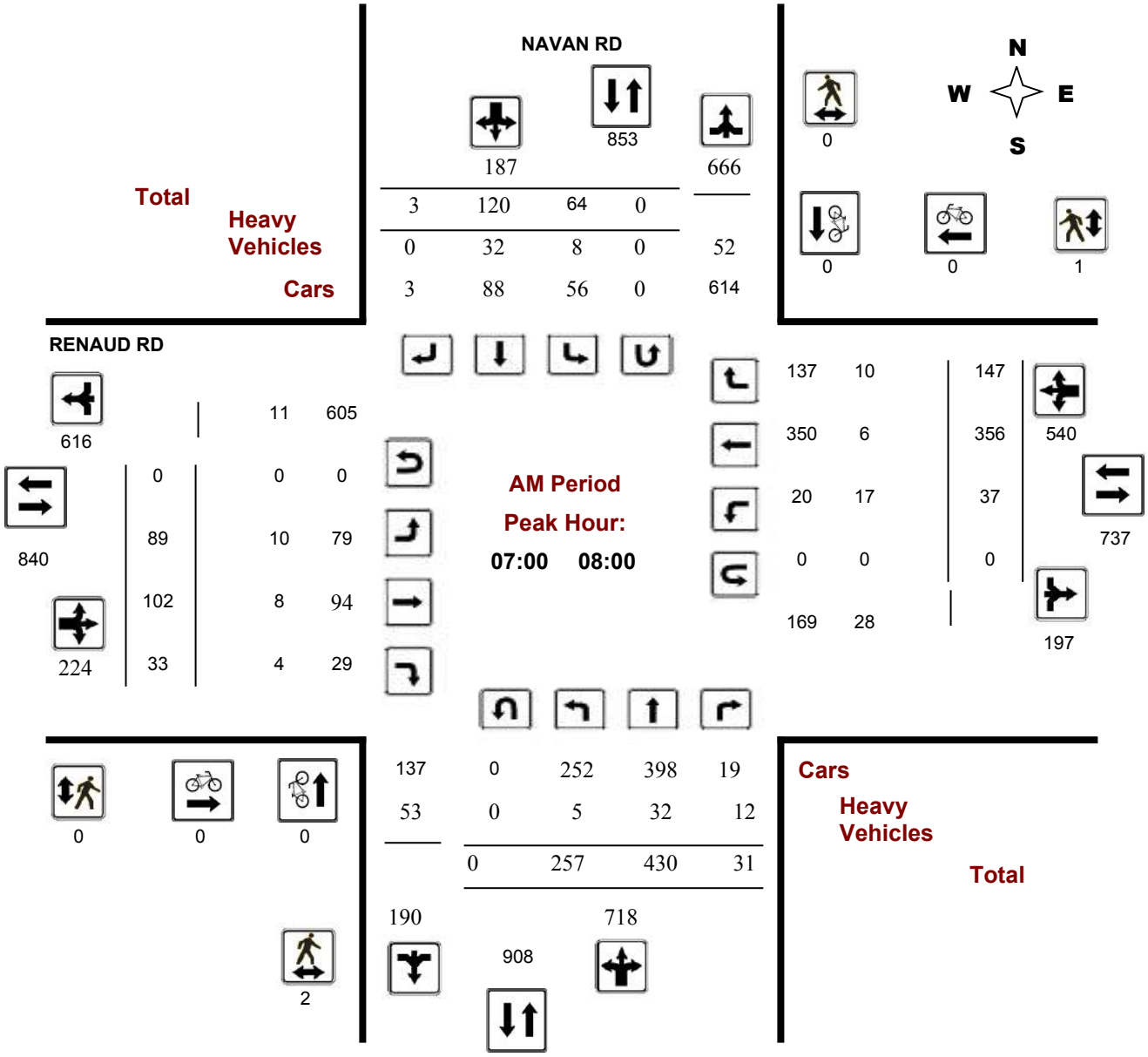
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

RENAUD RD @ NAVAN RD

Survey Date: Wednesday, June 08, 2016 **WO No:** 35962

Start Time: 07:00 **Device:** Miovision



Comments

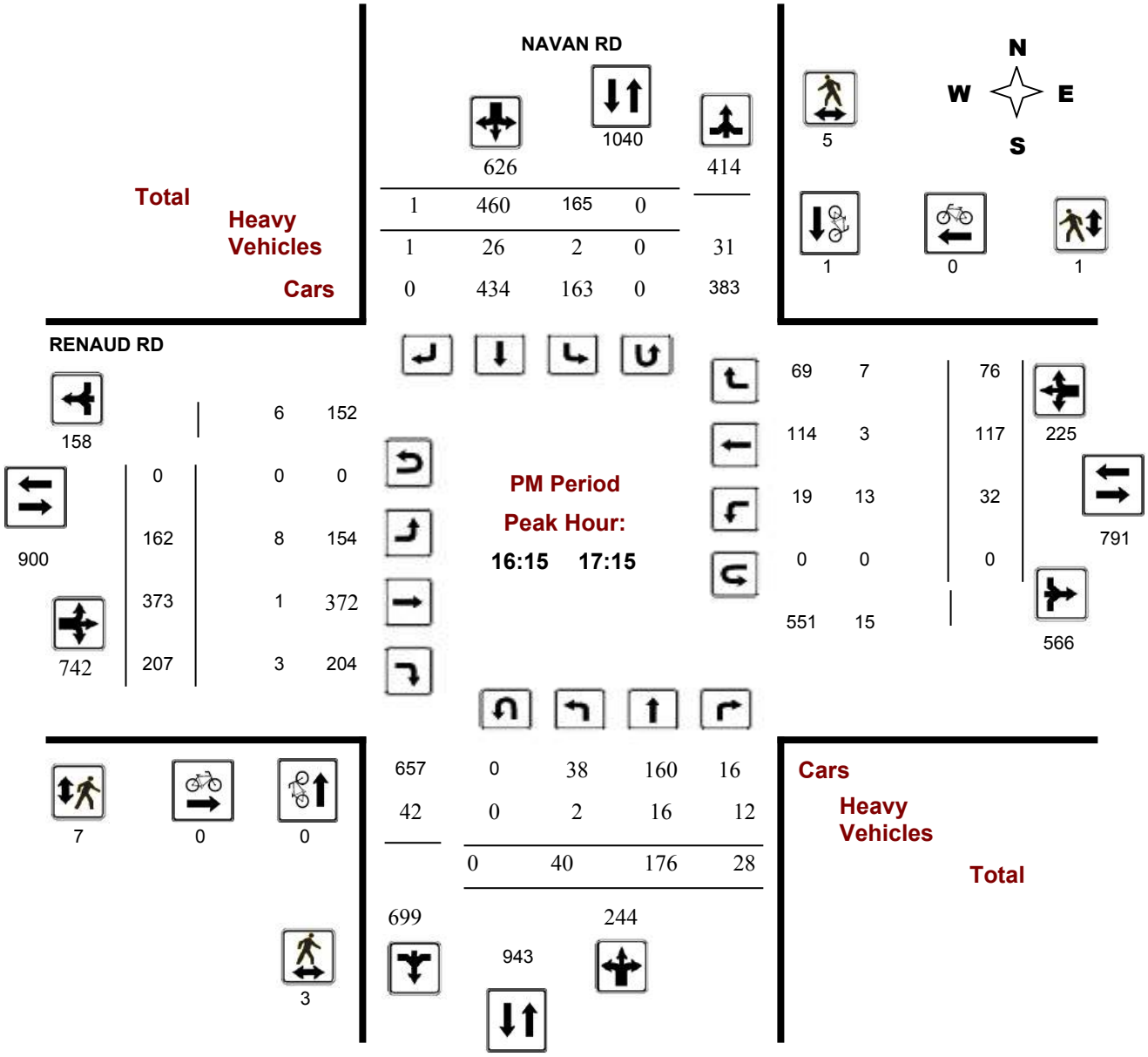
Transportation Services - Traffic Services

Turning Movement Count - Full Study Peak Hour Diagram

RENAUD RD @ NAVAN RD

Survey Date: Wednesday, June 08, 2016 **WO No:** 35962

Start Time: 07:00 **Device:** Miovision



Comments

Appendix C

Collision Data and Analysis

Total Area

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	8	0	1	31	0	3	0	0	43	77%
Non-fatal injury	2	2	0	8	1	0	0	0	13	23%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**10**	**2**	**1**	**39**	**1**	**3**	**0**	**0**	**56**	100%
	#2 or 18%	#4 or 4%	#5 or 2%	#1 or 70%	#5 or 2%	#3 or 5%	#7 or 0%	#7 or 0%		

NAVAN RD / RENAUD RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2012-2016	16	16,280	1825	**0.54**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	5	0	0	5	0	2	0	0	12	75%
Non-fatal injury	2	1	0	1	0	0	0	0	4	25%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**7**	**1**	**0**	**6**	**0**	**2**	**0**	**0**	**16**	100%
	44%	6%	0%	38%	0%	13%	0%	0%		

NAVAN RD / PAGE RD

Years	Total # Collisions	24 Hr AADT Veh Volume	Days	Collisions/MEV
2012-2016	37	n/a	1825	**n/a**

Classification of Accident	Rear End	Turning Movement	Sideswipe	Angle	Approaching	Single Vehicle (other)	Single vehicle (Unattended vehicle)	Other	Total	
P.D. only	1	0	0	26	0	1	0	0	28	76%
Non-fatal injury	0	1	0	7	1	0	0	0	9	24%
Non reportable	0	0	0	0	0	0	0	0	0	0%
Total	**1**	**1**	**0**	**33**	**1**	**1**	**0**	**0**	**37**	100%
	3%	3%	0%	89%	3%	3%	0%	0%		

Collision Main Detail Summary

OnTRAC Reporting System

FROM: 2012-01-01 TO: 2013-01-01

NAVAN RD & PAGE RD

Former Municipality: **Gloucester** Traffic Control: **Stop sign** Number of Collisions: **13**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
1	2012-01-23	Mo	11:12	Clear	Daylight	Angle	P.D. only	V1 S	Wet	Going ahead	Pick-up truck	Other motor vehicle	0
								V2 E	Wet	Going ahead	Pick-up truck	Other motor vehicle	
2	2012-01-27	Fri	16:17	Snow	Daylight	Angle	P.D. only	V1 N	Packed snow	Slowing or	Automobile, station	Skidding/Sliding	0
								V2 W	Packed snow	Going ahead	Pick-up truck	Other motor vehicle	
3	2012-02-17	Fri	11:54	Clear	Daylight	Angle	P.D. only	V1 N	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Going ahead	Automobile, station	Other motor vehicle	
4	2012-04-08	Sun	20:28	Clear	Dark	Angle	P.D. only	V1 N	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Going ahead	Automobile, station	Other motor vehicle	
5	2012-05-07	Mo	10:34	Clear	Daylight	Angle	Non-fatal	V1 S	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Going ahead	Truck and trailer	Other motor vehicle	
6	2012-05-11	Fri	17:15	Clear	Daylight	Angle	P.D. only	V1 S	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 E	Dry	Going ahead	Automobile, station	Other motor vehicle	
7	2012-05-20	Sun	11:28	Clear	Daylight	Angle	Non-fatal	V1 S	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 E	Dry	Going ahead	Car and trailer	Other motor vehicle	
8	2012-06-04	Mo	11:47	Clear	Daylight	Angle	Non-fatal	V1 N	Dry	Going ahead	Pick-up truck	Other motor vehicle	0
								V2 E	Dry	Going ahead	Truck - dump	Other motor vehicle	
								V3 W	Dry	Going ahead	Truck and trailer	Other motor vehicle	
9	2012-06-12	Tue	09:09	Rain	Daylight	Angle	P.D. only	V1 N	Wet	Going ahead	Pick-up truck	Other motor vehicle	0
								V2 W	Wet	Going ahead	Automobile, station	Other motor vehicle	
								V3 S	Wet	Stopped	Automobile, station	Other motor vehicle	
10	2012-08-17	Fri	17:40	Clear	Daylight	Angle	P.D. only	V1 N	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 W	Dry	Going ahead	Automobile, station	Other motor vehicle	
11	2012-09-03	Mo	11:00	Clear	Daylight	Angle	P.D. only	V1 S	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 E	Dry	Going ahead	Pick-up truck	Other motor vehicle	

(Note: Time of Day = "00:00" represents unknown collision time

12	2012-09-13	Thu	07:34	Clear	Daylight	Angle	P.D. only	V1	S	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2	E	Dry	Going ahead	Automobile, station	Other motor vehicle	
13	2012-12-07	Fri	12:28	Clear	Daylight	Angle	P.D. only	V1	N	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2	W	Dry	Going ahead	Automobile, station	Other motor vehicle	

(Note: Time of Day = "00:00" represents unknown collision time

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2012 **To:** December 31, 2016

Location: NAVAN RD @ PAGE RD

Traffic Control: Stop sign

Total Collisions: 24

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Feb-12, Wed,10:45	Clear	Angle	P.D. only	Dry	South	Going ahead	Pick-up truck	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	
2014-Mar-04, Tue,19:00	Clear	Angle	P.D. only	Wet	North	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2014-Apr-16, Wed,06:45	Clear	Angle	P.D. only	Dry	South	Going ahead	Municipal transit bus	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	
2014-Apr-26, Sat,23:22	Rain	Angle	P.D. only	Wet	South	Going ahead	Passenger van	Other motor vehicle	
					East	Going ahead	Pick-up truck	Other motor vehicle	
2014-Apr-30, Wed,16:31	Rain	Angle	P.D. only	Wet	West	Going ahead	Automobile, station wagon	Other motor vehicle	
					North	Going ahead	Pick-up truck	Other motor vehicle	
2014-Apr-30, Wed,17:03	Rain	Rear end	P.D. only	Wet	East	Going ahead	Automobile, station wagon	Other motor vehicle	

					East	Going ahead	Automobile, station wagon	Other motor vehicle
2014-Oct-07, Tue,06:27	Rain	Angle	Non-fatal injury	Wet	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle
2014-Oct-08, Wed,06:44	Rain	Angle	Non-fatal injury	Wet	South	Going ahead	Pick-up truck	Other motor vehicle
					West	Going ahead	Automobile, station wagon	Other motor vehicle
2014-Nov-07, Fri,12:28	Clear	Angle	P.D. only	Dry	South	Going ahead	Pick-up truck	Other motor vehicle
					East	Going ahead	Passenger van	Other motor vehicle
2014-Oct-23, Thu,14:50	Clear	Angle	Non-fatal injury	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Truck - dump	Other motor vehicle
2014-Oct-22, Wed,06:35	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle
2014-Nov-18, Tue,20:10	Snow	Angle	P.D. only	Loose snow	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Mar-23, Mon,15:01	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle

2014-Dec-16, Tue,06:00	Clear	Angle	P.D. only	Dry	West	Turning left	Unknown	Other motor vehicle
					North	Going ahead	Automobile, station wagon	Other motor vehicle
2015-Mar-25, Wed,12:06	Clear	SMV other	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Pole (sign, parking meter)
2016-Jun-16, Thu,20:07	Clear	Angle	P.D. only	Dry	West	Going ahead	Pick-up truck	Other motor vehicle
					South	Going ahead	Automobile, station wagon	Other motor vehicle
2016-Jan-25, Mon,16:46	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Unknown	Unknown	Other motor vehicle
2016-Nov-02, Wed,16:09	Clear	Turning movement	Non-fatal injury	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					East	Overtaking	Automobile, station wagon	Other motor vehicle
2013-Jan-12, Sat,14:20	Clear	Angle	P.D. only	Wet	North	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Going ahead	Passenger van	Other motor vehicle
2013-Jan-02, Wed,07:29	Clear	Approaching	Non-fatal injury	Loose snow	West	Going ahead	Pick-up truck	Other motor vehicle
					East	Stopped	Automobile, station wagon	Other motor vehicle
2013-Jan-02, Wed,07:12	Clear	Angle	Non-fatal injury	Loose snow	North	Turning left	Passenger van	Other motor vehicle

					West	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Oct-03, Thu,11:22	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Going ahead	Automobile, station wagon	Other motor vehicle
2013-Oct-28, Mon,13:54	Clear	Angle	P.D. only	Dry	South	Going ahead	Passenger van	Other motor vehicle
					East	Going ahead	Truck - dump	Other motor vehicle
2013-Dec-15, Sun,18:39	Clear	Angle	P.D. only	Loose snow	South	Going ahead	Pick-up truck	Other motor vehicle
					East	Going ahead	Pick-up truck	Other motor vehicle

Location: NAVAN RD btwn ORLEANS BLVD & PAGE RD

Traffic Control: No control **Total Collisions:** 3

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2016-Feb-17, Wed,18:40	Snow	Rear end	P.D. only	Ice	West	Going ahead	Pick-up truck	Other motor vehicle	
					West	Stopped	Pick-up truck	Other motor vehicle	
2016-Dec-05, Mon,18:40	Snow	Rear end	P.D. only	Packed snow	East	Going ahead	Automobile, station wagon	Other motor vehicle	
					East	Turning left	Automobile, station wagon	Other motor vehicle	
2013-May-07, Tue,17:19	Clear	Sideswipe	P.D. only	Dry	West	Going ahead	Pick-up truck	Cyclist	
					West	Going ahead	Bicycle	Other motor vehicle	

Location: NAVAN RD btwn RENAUD RD & MER BLEUE RD

Traffic Control: No control

Total Collisions: 5

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Jul-07, Mon,11:39	Clear	SMV other	P.D. only	Dry	East	Going ahead	Motorcycle	Ran off road	
2014-Aug-29, Fri,15:48	Clear	SMV other	P.D. only	Dry	East	Going ahead	Passenger van	Animal - wild	
2015-Apr-13, Mon,10:00	Clear	Other	P.D. only	Dry	North	Going ahead	Automobile, station wagon	Debris falling off vehicle	
					North	Going ahead	Unknown	Other	
2015-Sep-03, Thu,08:13	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	
2015-Aug-12, Wed,17:40	Clear	SMV other	P.D. only	Dry	East	Turning left	Automobile, station wagon	Ditch	

Location: RENAUD RD @ NAVAN RD

Traffic Control: Traffic signal

Total Collisions: 9

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-Mar-10, Mon,22:19	Snow	SMV other	P.D. only	Loose snow	North	Turning right	Pick-up truck	Skidding/sliding	
2014-Apr-28, Mon,05:42	Clear	Rear end	P.D. only	Dry	West	Going ahead	Pick-up truck	Other motor vehicle	
					West	Stopped	Pick-up truck	Other motor vehicle	
2014-Apr-22, Tue,16:50	Clear	Rear end	P.D. only	Dry	North	Going ahead	Passenger van	Other motor vehicle	

					North	Turning right	Passenger van	Other motor vehicle
2015-Feb-04, Wed,10:37	Snow	SMV other	P.D. only	Loose snow	North	Turning right	Automobile, station wagon	Skidding/sliding
2015-Mar-04, Wed,07:29	Clear	Rear end	P.D. only	Slush	North	Going ahead	Automobile, station wagon	Other motor vehicle
					North	Stopped	Pick-up truck	Other motor vehicle
2015-Apr-14, Tue,12:35	Clear	Angle	P.D. only	Dry	East	Turning left	Automobile, station wagon	Other motor vehicle
					South	Going ahead	Pick-up truck	Other motor vehicle
2016-Jan-05, Tue,18:41	Clear	Angle	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Turning left	Pick-up truck	Other motor vehicle
2015-Oct-05, Mon,17:25	Clear	Rear end	Non-fatal injury	Dry	East	Turning right	Automobile, station wagon	Other motor vehicle
					East	Turning right	Pick-up truck	Other motor vehicle
2016-Jan-07, Thu,16:17	Clear	Rear end	P.D. only	Dry	East	Slowing or stopping	Automobile, station wagon	Other motor vehicle
					East	Slowing or stopping	Pick-up truck	Other motor vehicle

Location: RENAUD RD btwn NAVAN RD & WHITE ST

Traffic Control: No control

Total Collisions: 7

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2014-May-30, Fri,08:00	Clear	SMV other	P.D. only	Dry	West	Going ahead	Pick-up truck	Animal - wild	

2014-Nov-12, Wed,05:49	Clear	Rear end	P.D. only	Wet	East	Stopped	Automobile, station wagon	Skidding/sliding
					East	Going ahead	Pick-up truck	Other motor vehicle
2015-Feb-18, Wed,10:31	Clear	Angle	Non-fatal injury	Wet	South	Turning left	Pick-up truck	Other motor vehicle
					East	Going ahead	Delivery van	Other motor vehicle
2015-Jun-23, Tue,14:20	Clear	Other	P.D. only	Dry	East	Reversing	Delivery van	Other motor vehicle
					West	Stopped	Passenger van	Other motor vehicle
2015-Apr-16, Thu,10:34	Clear	SMV unattended vehicle	P.D. only	Dry	South	Reversing	Truck-other	Unattended vehicle
2016-Jun-14, Tue,18:59	Clear	Rear end	P.D. only	Dry	East	Going ahead	Pick-up truck	Other motor vehicle
					East	Slowing or stopping	Pick-up truck	Other motor vehicle
2016-Jul-07, Thu,06:17	Rain	SMV other	P.D. only	Wet	East	Going ahead	Pick-up truck	Animal - wild

Collision Main Detail Summary

OnTRAC Reporting System

FROM: 2012-01-01 TO: 2014-01-01

NAVAN RD, MER BLEUE RD to RENAUD RD

Former Municipality: **Gloucester** Traffic Control: **No control** Number of Collisions: **6**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
1	2012-04-10	Tue	16:08	Clear	Daylight	Rear end	P.D. only	V1 E	Dry	Slowing or	Pick-up truck	Other motor vehicle	0
								V2 E	Dry	Slowing or	Delivery van	Other motor vehicle	
2	2012-04-11	We	14:25	Clear	Daylight	Other	P.D. only	V1 N	Dry	Going ahead	Truck - dump	Other Events	0
								V2 S	Dry	Going ahead	Automobile, station	Debris falling off	
3	2012-04-23	Mo	22:30	Rain	Dark	Single vehicle	P.D. only	V1 W	Wet	Turning left	Automobile, station	Ran off road	0
4	2012-11-21	We	16:21	Clear	Dusk	Rear end	P.D. only	V1 E	Dry	Going ahead	Automobile, station	Other motor vehicle	0
								V2 E	Dry	Slowing or	Automobile, station	Other motor vehicle	
5	2013-12-17	Tue	08:07	Clear	Daylight	Single vehicle	Non-fatal	V1 W	Ice	Going ahead	Pick-up truck	Ran off road	0
6	2013-12-17	Tue	07:15	Clear	Dawn	Other	P.D. only	V1 W	Ice	Going ahead	Pick-up truck	Steel guide wall	0
								V2 E	Ice	Going ahead	Automobile, station	Ran off road	

NAVAN RD & RENAUD RD

Former Municipality: **Gloucester** Traffic Control: **Traffic signal** Number of Collisions: **7**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR	SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
7	2012-05-02	We	16:17	Clear	Daylight	Turning	Non-fatal	V1 S	Dry	Turning left	Automobile, station	Other motor vehicle	0
								V2 N	Dry	Going ahead	Automobile, station	Other motor vehicle	
8	2012-08-11	Sat	18:37	Clear	Daylight	Angle	Non-fatal	V1 W	Dry	Going ahead	Passenger van	Other motor vehicle	0
								V2 N	Dry	Going ahead	Automobile, station	Other motor vehicle	
								V3 S	Dry	Turning right	Pick-up truck	Other motor vehicle	
9	2013-01-06	Sun	14:00	Snow	Daylight	Angle	P.D. only	V1 E	Ice	Slowing or	Automobile, station	Other motor vehicle	0
								V2 S	Ice	Going ahead	Pick-up truck	Other motor vehicle	
10	2013-04-02	Tue	08:48	Clear	Daylight	Angle	P.D. only	V1 E	Dry	Turning left	Municipal transit bus	Other motor vehicle	0
								V2 N	Dry	Turning left	Pick-up truck	Other motor vehicle	

(Note: Time of Day = "00:00" represents unknown collision time

11	2013-05-29	We	09:24	Clear	Daylight	Rear end	P.D. only	V1	N	Dry	Slowing or	Automobile, station	Other motor vehicle	0
								V2	N	Dry	Stopped	Pick-up truck	Other motor vehicle	
12	2013-10-23	We	17:47	Clear	Dusk	Rear end	Non-fatal	V1	E	Dry	Going ahead	Pick-up truck	Other motor vehicle	0
								V2	E	Dry	Slowing or	Pick-up truck	Other motor vehicle	
								V3	E	Dry	Slowing or	Pick-up truck	Other motor vehicle	
								V4	E	Dry	Stopped	Pick-up truck	Other motor vehicle	
13	2013-12-24	Tue	13:00	Clear	Daylight	Angle	P.D. only	V1	N	Dry	Turning left	Pick-up truck	Other motor vehicle	0
								V2	E	Dry	Going ahead	Passenger van	Other motor vehicle	

RENAUD RD, NAVAN RD to WHITE ST

Former Municipality: **Gloucester** Traffic Control: **No control** Number of Collisions: **2**

	DATE	DAY	TIME	ENV	LIGHT	IMPACT TYPE	CLASS	DIR		SURFACE COND'N	VEHICLE MANOEUVRE	VEHICLE TYPE	FIRST EVENT	No. PED
14	2012-08-28	Tue	16:59	Clear	Daylight	Sideswipe	P.D. only	V1	E	Dry	Overtaking	Pick-up truck	Other motor vehicle	0
								V2	E	Dry	Going ahead	Automobile, station	Other motor vehicle	
15	2013-06-12	We	18:15	Clear	Daylight	Single vehicle	P.D. only	V1	W	Dry	Going ahead	Automobile, station	Ran off road	0

(Note: Time of Day = "00:00" represents unknown collision time

Appendix D

Step 4 Reduced Scope

From: Giampa, Mike <Mike.Giampa@ottawa.ca>
Sent: Wednesday, November 07, 2018 3:17 PM
To: Nahas, Rani <Rani.Nahas@parsons.com>; Baker, Mark <Mark.Baker@parsons.com>
Cc: Pena-cabra, Andres <Andres.Pena-cabra@parsons.com>
Subject: RE: Navan TIA - Brian Coburn/Park & Ride Signal Analysis

Hi Mark,
I agree that a full Strategy Report submission is not appropriate for this particular rezoning application (though I wouldn't apply that reasoning to all rezoning). I also understand that the EA process is still in progress and certain options would have a significant impact on the site.

I think that a strategy report focusing solely on the **network impact component** is the best way to proceed. Once your site plan is ready, a full (revised) TIA report can be submitted. During that time, I'm hopeful that the EA and Transit signal issues can be resolved.

Regards,
Mike

From: Nahas, Rani <Rani.Nahas@parsons.com>
Sent: Tuesday, November 06, 2018 1:47 PM
To: Giampa, Mike <Mike.Giampa@ottawa.ca>
Cc: Baker, Mark <Mark.Baker@parsons.com>; Pena-cabra, Andres <Andres.Pena-cabra@parsons.com>
Subject: FW: Navan TIA - Brian Coburn/Park & Ride Signal Analysis

Hi Mike,

Please see the response from Signals below regarding the south leg of the future Brian Coburn/Park & Ride intersection.

Cheers,
Rani

From: Pach, Jon <Jon.Pach@ottawa.ca>
Sent: Friday, November 02, 2018 11:25 AM
To: Nahas, Rani <Rani.Nahas@parsons.com>
Cc: Ha, Leng <Leng.Ha@ottawa.ca>; Baker, Mark <Mark.Baker@parsons.com>
Subject: RE: Navan TIA - Brian Coburn/Park & Ride Signal Analysis

Hi Rani,

I've had a look at your latest analysis. A couple of points to mention:

1. The 2026 Horizon analysis shows that the westbound AM queuing is worse without the south leg. This seems contrary to what I would expect considering there are less movements occurring. Can you verify this result?
2. Your 2026 AM with south leg model has a different amber interval than the rest of the models.

I appreciate you looking at the various scenarios for 2031. Since the 95th percentile queues do not reach the roundabout with Navan Road, we do not anticipate safety issues at the roundabout due to eastbound queuing. It looks like split phasing results in the worst performance of the intersection, so we would likely operate with conventional protected lefts for north-south. We would recommend that the south leg be constructed with a dual northbound left once Brian Coburn is widened to have two westbound receiving lanes since it will be fully protected anyway. This will help with storage.

If you can let us know what you find with regarding to point 1 above I'd appreciate it. Otherwise, based on the analysis, we don't see an operational or safety issue with constructing the south leg at this intersection.

Regards,
Jon

From: Nahas, Rani <Rani.Nahas@parsons.com>
Sent: October 19, 2018 12:56 PM
To: Pach, Jon <Jon.Pach@ottawa.ca>
Cc: Ha, Leng <Leng.Ha@ottawa.ca>; Baker, Mark <Mark.Baker@parsons.com>
Subject: RE: Navan TIA - Brian Coburn/Park & Ride Signal Analysis

Hi Jon,

Thanks for your input. I have made the modifications and included the updated results below.

Based on the results shown below, the addition of the south leg below does not increase the delay to the EBLT or SB transit movement. However, the analysis indicates queueing in the EB direction starts to become an issue when Brian Coburn is widened from two lanes to four lanes post 2031.

Appendix E

Background Traffic Growth

Navan / Renaud
8 hrs

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2010	Wednesday 4 August	2233	2191	2086	2248	616	685	619	430	11108
2013	Thursday 4 July	1786	2372	1697	1793	1337	1509	2112	1258	13864
2016	Wednesday June 8	2497	3209	2484	2732	2088	2263	2865	1730	19868

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2010	2191	2233	4424	11108				
2013	2372	1786	4158	13864	8.3%	-20.0%	-6.0%	24.8%
2016	3209	2497	5706	19868	35.3%	39.8%	37.2%	43.3%

Regression Estimate	2010	2082	2040	4122
Regression Estimate	2016	3100	2304	5404
Average Annual Change		**6.86%**	**2.05%**	**4.62%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2010	619	430	1049	11108				
2013	2112	1258	3370	13864	241.2%	192.6%	221.3%	24.8%
2016	2865	1730	4595	19868	35.7%	37.5%	36.4%	43.3%

Regression Estimate	2010	742	489	1232
Regression Estimate	2016	2988	1789	4778
Average Annual Change		**26.13%**	**24.12%**	**25.35%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2010	685	616	1301	11108				
2013	1509	1337	2846	13864	120.3%	117.0%	118.8%	24.8%
2016	2263	2088	4351	19868	50.0%	56.2%	52.9%	43.3%

Regression Estimate	2010	697	611	1308
Regression Estimate	2016	2275	2083	4358
Average Annual Change		**21.80%**	**22.68%**	**22.22%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2010	2086	2248	4334	11108				
2013	1697	1793	3490	13864	-18.6%	-20.2%	-19.5%	24.8%
2016	2484	2732	5216	19868	46.4%	52.4%	49.5%	43.3%

Regression Estimate	2010	1890	2016	3906
Regression Estimate	2016	2288	2500	4788
Average Annual Change		**3.24%**	**3.65%**	**3.45%**

Navan / Renaud
AM Peak

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2010	Wednesday 4 August	138	524	520	133	163	26	12	150	1666
2013	Thursday 4 July	107	452	417	101	340	45	97	363	1922
2016	Wednesday June 8	187	666	718	190	540	197	224	616	3338

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2010	524	138	662	1666				
2013	452	107	559	1922	-13.7%	-22.5%	-15.6%	15.4%
2016	666	187	853	3338	47.3%	74.8%	52.6%	73.7%

Regression Estimate	2010	476	120	596
Regression Estimate	2016	618	169	787
Average Annual Change		**4.44%**	**5.89%**	**4.74%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2010	12	150	162	1666				
2013	97	363	460	1922	708.3%	142.0%	184.0%	15.4%
2016	224	616	840	3338	130.9%	69.7%	82.6%	73.7%

Regression Estimate	2010	5	143	148
Regression Estimate	2016	217	609	826
Average Annual Change		**87.46%**	**27.28%**	**33.14%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2010	26	163	189	1666				
2013	45	340	385	1922	73.1%	108.6%	103.7%	15.4%
2016	197	540	737	3338	337.8%	58.8%	91.4%	73.7%

Regression Estimate	2010	4	159	163
Regression Estimate	2016	175	536	711
Average Annual Change		**89.02%**	**22.44%**	**27.82%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2010	520	133	653	1666				
2013	417	101	518	1922	-19.8%	-24.1%	-20.7%	15.4%
2016	718	190	908	3338	72.2%	88.1%	75.3%	73.7%

Regression Estimate	2010	453	113	566
Regression Estimate	2016	651	170	821
Average Annual Change		**6.23%**	**7.05%**	**6.40%**

Navan / Renaud
PM Peak

Year	Date	North Leg		South Leg		East Leg		West Leg		Total
		SB	NB	NB	SB	WB	EB	EB	WB	
2010	Wednesday 4 August	492	194	186	569	61	235	316	57	2110
2013	Thursday 4 July	453	324	152	468	158	436	613	148	2752
2016	Wednesday June 8	626	414	244	699	225	566	742	158	3674

North Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2010	194	492	686	2110				
2013	324	453	777	2752	67.0%	-7.9%	13.3%	30.4%
2016	414	626	1040	3674	27.8%	38.2%	33.8%	33.5%

Regression Estimate	2010	201	457	657
Regression Estimate	2016	421	591	1011
Average Annual Change		**13.13%**	**4.38%**	**7.44%**

West Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2010	316	57	373	2110				
2013	613	148	761	2752	94.0%	159.6%	104.0%	30.4%
2016	742	158	900	3674	21.0%	6.8%	18.3%	33.5%

Regression Estimate	2010	344	71	415
Regression Estimate	2016	770	172	942
Average Annual Change		**14.37%**	**15.97%**	**14.65%**

East Leg

Year	Counts				% Change			
	EB	*WB*	*EB+WB*	*INT*	*EB*	*WB*	*EB+WB*	*INT*
2010	235	61	296	2110				
2013	436	158	594	2752	85.5%	159.0%	100.7%	30.4%
2016	566	225	791	3674	29.8%	42.4%	33.2%	33.5%

Regression Estimate	2010	247	66	313
Regression Estimate	2016	578	230	808
Average Annual Change		**15.23%**	**23.13%**	**17.13%**

South Leg

Year	Counts				% Change			
	NB	*SB*	*NB+SB*	*INT*	*NB*	*SB*	*NB+SB*	*INT*
2010	186	569	755	2110				
2013	152	468	620	2752	-18.3%	-17.8%	-17.9%	30.4%
2016	244	699	943	3674	60.5%	49.4%	52.1%	33.5%

Regression Estimate	2010	165	514	679
Regression Estimate	2016	223	644	867
Average Annual Change		**5.15%**	**3.83%**	**4.16%**

Appendix F

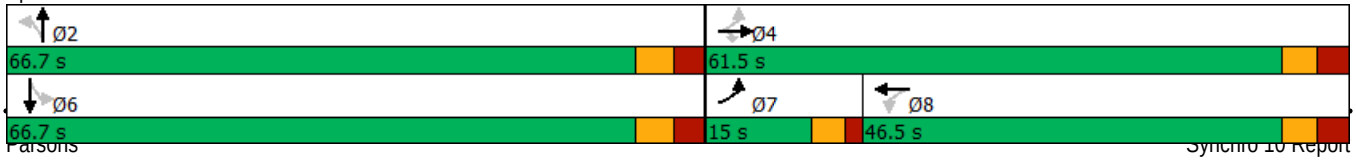
Existing Synchro and SIDRA Analysis

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	89	102	33	37	356	257	430	64	120
Future Volume (vph)	89	102	33	37	356	257	430	64	120
Lane Group Flow (vph)	94	107	35	39	530	271	486	67	129
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	7	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	35.0	35.0	35.0	35.0
Minimum Split (s)	10.0	24.5	24.5	24.5	24.5	41.7	41.7	41.7	41.7
Total Split (s)	15.0	61.5	61.5	46.5	46.5	66.7	66.7	66.7	66.7
Total Split (%)	11.7%	48.0%	48.0%	36.3%	36.3%	52.0%	52.0%	52.0%	52.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7	3.7
All-Red Time (s)	1.7	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-1.0	-2.5	-2.5	-2.5	-2.5	-2.7	-2.7	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag				
Lead-Lag Optimize?	Yes			Yes	Yes				
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	49.5	49.5	49.5	38.3	38.3	42.0	42.0	42.0	42.0
Actuated g/C Ratio	0.50	0.50	0.50	0.38	0.38	0.42	0.42	0.42	0.42
v/c Ratio	0.32	0.12	0.05	0.08	0.80	0.54	0.65	0.32	0.17
Control Delay	16.7	14.1	5.0	22.7	38.1	28.6	29.5	27.3	20.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.7	14.1	5.0	22.7	38.1	28.6	29.5	27.3	20.7
LOS	B	B	A	C	D	C	C	C	C
Approach Delay		13.8			37.1		29.2		23.0
Approach LOS		B			D		C		C
Queue Length 50th (m)	8.4	9.6	0.0	4.7	85.6	43.3	81.9	9.5	17.0
Queue Length 95th (m)	21.0	23.3	5.4	13.6	#167.8	69.6	118.3	21.4	29.6
Internal Link Dist (m)		296.6			239.6		254.0		140.8
Turn Bay Length (m)	130.0		40.0	40.0		70.0		35.0	
Base Capacity (vph)	306	1054	910	536	755	765	1139	324	1147
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.31	0.10	0.04	0.07	0.70	0.35	0.43	0.21	0.11

Intersection Summary

Cycle Length: 128.2
Actuated Cycle Length: 99.7
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 29.0 Intersection LOS: C
Intersection Capacity Utilization 106.1% ICU Level of Service G
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Navan & Renaud



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	198	95	2	643	4	0	0	0	3	6	47
Future Volume (Veh/h)	6	198	95	2	643	4	0	0	0	3	6	47
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	208	100	2	677	4	0	0	0	3	6	49
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					165							
pX, platoon unblocked	0.79						0.79	0.79		0.79	0.79	0.79
vC, conflicting volume	681			308			1005	955	258	953	1003	679
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	461			308			872	809	258	806	870	459
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	99	97	90
cM capacity (veh/h)	867			1253			186	246	781	235	227	475

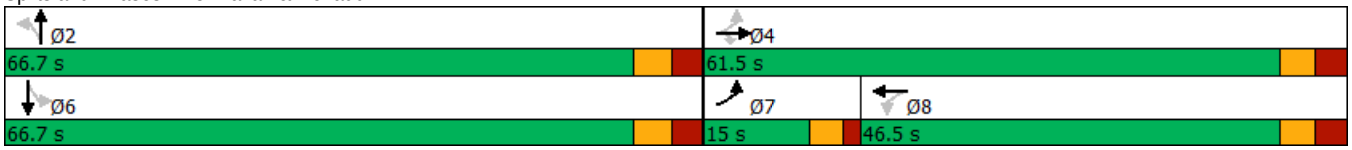
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	314	683	0	58
Volume Left	6	2	0	3
Volume Right	100	4	0	49
cSH	867	1253	1700	407
Volume to Capacity	0.01	0.00	0.00	0.14
Queue Length 95th (m)	0.2	0.0	0.0	3.7
Control Delay (s)	0.3	0.0	0.0	15.3
Lane LOS	A	A	A	C
Approach Delay (s)	0.3	0.0	0.0	15.3
Approach LOS			A	C

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	47.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	162	373	207	32	117	40	176	165	460
Future Volume (vph)	162	373	207	32	117	40	176	165	460
Lane Group Flow (vph)	171	393	218	34	203	42	214	174	485
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	7	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	35.0	35.0	35.0	35.0
Minimum Split (s)	10.0	24.5	24.5	24.5	24.5	41.7	41.7	41.7	41.7
Total Split (s)	15.0	61.5	61.5	46.5	46.5	66.7	66.7	66.7	66.7
Total Split (%)	11.7%	48.0%	48.0%	36.3%	36.3%	52.0%	52.0%	52.0%	52.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7	3.7
All-Red Time (s)	1.7	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-1.0	-2.5	-2.5	-2.5	-2.5	-2.7	-2.7	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag				
Lead-Lag Optimize?	Yes			Yes	Yes				
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	31.3	31.3	31.3	16.6	16.6	38.7	38.7	38.7	38.7
Actuated g/C Ratio	0.40	0.40	0.40	0.21	0.21	0.50	0.50	0.50	0.50
v/c Ratio	0.42	0.55	0.31	0.17	0.54	0.13	0.25	0.33	0.55
Control Delay	18.9	21.3	5.3	27.2	29.2	13.4	12.5	15.0	17.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.9	21.3	5.3	27.2	29.2	13.4	12.5	15.0	17.3
LOS	B	C	A	C	C	B	B	B	B
Approach Delay		16.3			28.9		12.7		16.7
Approach LOS		B			C		B		B
Queue Length 50th (m)	16.0	42.3	3.5	4.1	22.8	3.1	16.1	14.4	46.1
Queue Length 95th (m)	30.8	72.4	16.5	11.8	44.2	10.0	33.6	32.5	86.0
Internal Link Dist (m)		296.6			239.6		254.0		140.8
Turn Bay Length (m)	130.0		40.0	40.0		70.0		35.0	
Base Capacity (vph)	413	1321	1170	518	931	511	1415	869	1441
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.41	0.30	0.19	0.07	0.22	0.08	0.15	0.20	0.34

Intersection Summary			
Cycle Length: 128.2			
Actuated Cycle Length: 78			
Natural Cycle: 80			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.55			
Intersection Signal Delay: 17.5		Intersection LOS: B	
Intersection Capacity Utilization 100.7%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 3: Navan & Renaud



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	636	109	1	348	10	0	0	3	2	0	18
Future Volume (Veh/h)	42	636	109	1	348	10	0	0	3	2	0	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	44	669	115	1	366	11	0	0	3	2	0	19
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					165							
pX, platoon unblocked	0.98						0.98	0.98		0.98	0.98	0.98
vC, conflicting volume	377			784			1207	1194	726	1188	1246	372
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	356			784			1202	1188	726	1182	1241	350
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	99	99	100	97
cM capacity (veh/h)	1181			834			150	178	424	158	165	680

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	828	378	3	21
Volume Left	44	1	0	2
Volume Right	115	11	3	19
cSH	1181	834	424	517
Volume to Capacity	0.04	0.00	0.01	0.04
Queue Length 95th (m)	0.9	0.0	0.2	1.0
Control Delay (s)	1.0	0.0	13.5	12.3
Lane LOS	A	A	B	B
Approach Delay (s)	1.0	0.0	13.5	12.3
Approach LOS			B	B

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	78.1%	ICU Level of Service	D
Analysis Period (min)	15		

MOVEMENT SUMMARY

Site: [Navan/Brian Coburn]

Existing AM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Navan											
8	T1	614	3.0	0.519	8.7	LOS A	3.9	30.2	0.38	0.20	51.5
18	R2	23	3.0	0.519	8.7	LOS A	3.9	30.2	0.38	0.20	50.1
Approach		637	3.0	0.519	8.7	LOS A	3.9	30.2	0.38	0.20	51.4
East: Brian Coburn											
1	L2	207	3.0	0.906	37.6	LOS E	14.2	110.9	1.00	1.46	36.1
16	R2	461	3.0	0.906	37.6	LOS E	14.2	110.9	1.00	1.46	35.3
Approach		668	3.0	0.906	37.6	LOS E	14.2	110.9	1.00	1.46	35.6
North: Navan											
7	L2	84	3.0	0.299	6.3	LOS A	1.5	12.0	0.43	0.30	52.4
4	T1	238	3.0	0.299	6.3	LOS A	1.5	12.0	0.43	0.30	52.1
Approach		322	3.0	0.299	6.3	LOS A	1.5	12.0	0.43	0.30	52.2
All Vehicles		1627	3.0	0.906	20.1	LOS C	14.2	110.9	0.64	0.74	43.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [Navan/Brian Coburn]

Existing PM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Navan											
8	T1	315	3.0	0.466	10.1	LOS B	2.7	21.1	0.66	0.65	53.0
18	R2	85	3.0	0.466	10.1	LOS B	2.7	21.1	0.66	0.65	51.6
Approach		400	3.0	0.466	10.1	LOS B	2.7	21.1	0.66	0.65	52.7
East: Brian Coburn											
1	L2	76	3.0	0.208	5.8	LOS A	0.9	7.3	0.48	0.38	54.7
16	R2	124	3.0	0.208	5.8	LOS A	0.9	7.3	0.48	0.38	53.1
Approach		200	3.0	0.208	5.8	LOS A	0.9	7.3	0.48	0.38	53.7
North: Navan											
7	L2	423	3.0	0.809	17.9	LOS C	11.9	92.5	0.69	0.37	46.5
4	T1	578	3.0	0.809	17.9	LOS C	11.9	92.5	0.69	0.37	46.5
Approach		1001	3.0	0.809	17.9	LOS C	11.9	92.5	0.69	0.37	46.5
All Vehicles		1601	3.0	0.809	14.4	LOS B	11.9	92.5	0.66	0.44	48.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix G

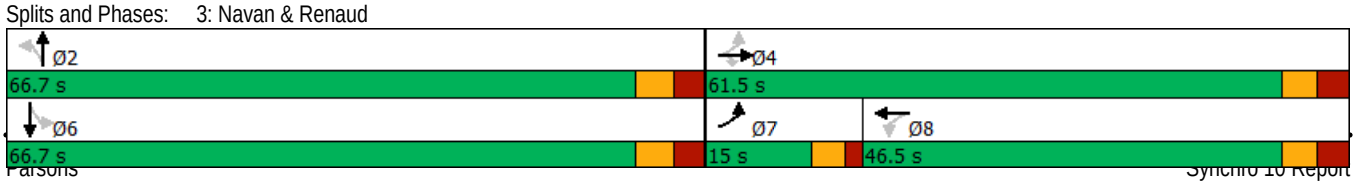
Background Synchro and SIDRA Analysis

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	89	108	33	37	378	257	456	64	127
Future Volume (vph)	89	108	33	37	378	257	456	64	127
Lane Group Flow (vph)	94	114	35	39	553	271	513	67	137
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	7	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	35.0	35.0	35.0	35.0
Minimum Split (s)	10.0	24.5	24.5	24.5	24.5	41.7	41.7	41.7	41.7
Total Split (s)	15.0	61.5	61.5	46.5	46.5	66.7	66.7	66.7	66.7
Total Split (%)	11.7%	48.0%	48.0%	36.3%	36.3%	52.0%	52.0%	52.0%	52.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7	3.7
All-Red Time (s)	1.7	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-1.0	-2.5	-2.5	-2.5	-2.5	-2.7	-2.7	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag				
Lead-Lag Optimize?	Yes			Yes	Yes				
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	54.7	54.7	54.7	40.4	40.4	42.6	42.6	42.6	42.6
Actuated g/C Ratio	0.52	0.52	0.52	0.38	0.38	0.40	0.40	0.40	0.40
v/c Ratio	0.34	0.12	0.04	0.08	0.83	0.58	0.72	0.39	0.19
Control Delay	17.6	14.6	5.3	23.5	41.9	30.5	32.9	30.7	21.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.6	14.6	5.3	23.5	41.9	30.5	32.9	30.7	21.2
LOS	B	B	A	C	D	C	C	C	C
Approach Delay		14.4			40.7		32.1		24.4
Approach LOS		B			D		C		C
Queue Length 50th (m)	8.5	10.3	0.0	4.7	92.1	44.4	90.2	10.0	18.5
Queue Length 95th (m)	22.0	25.8	5.5	14.2	#188.0	70.2	126.5	22.4	31.1
Internal Link Dist (m)		296.6			239.6		254.0		140.8
Turn Bay Length (m)	130.0		40.0	40.0		70.0		35.0	
Base Capacity (vph)	290	981	850	496	704	697	1061	258	1068
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.32	0.12	0.04	0.08	0.79	0.39	0.48	0.26	0.13

Intersection Summary

Cycle Length: 128.2
Actuated Cycle Length: 105.4
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 31.7 Intersection LOS: C
Intersection Capacity Utilization 107.3% ICU Level of Service G
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Navan & Renaud



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	210	95	2	682	4	0	0	0	3	6	47
Future Volume (Veh/h)	6	210	95	2	682	4	0	0	0	3	6	47
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	221	100	2	718	4	0	0	0	3	6	49
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					165							
pX, platoon unblocked	0.76						0.76	0.76		0.76	0.76	0.76
vC, conflicting volume	722			321			1059	1009	271	1007	1057	720
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	478			321			921	855	271	853	918	476
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	99	97	89
cM capacity (veh/h)	825			1239			165	223	768	211	205	449

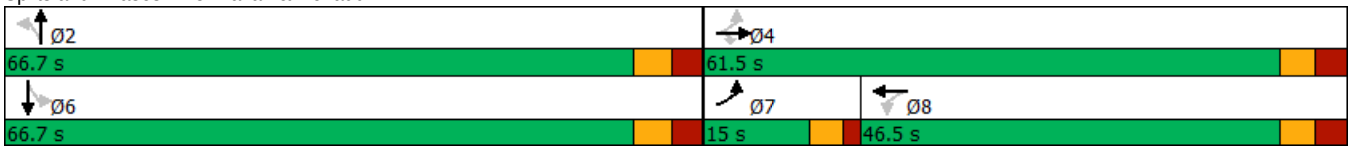
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	327	724	0	58
Volume Left	6	2	0	3
Volume Right	100	4	0	49
cSH	825	1239	1700	380
Volume to Capacity	0.01	0.00	0.00	0.15
Queue Length 95th (m)	0.2	0.0	0.0	4.1
Control Delay (s)	0.3	0.0	0.0	16.2
Lane LOS	A	A	A	C
Approach Delay (s)	0.3	0.0	0.0	16.2
Approach LOS			A	C

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	49.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	162	396	207	32	124	40	187	165	488
Future Volume (vph)	162	396	207	32	124	40	187	165	488
Lane Group Flow (vph)	171	417	218	34	211	42	226	174	515
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	7	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	35.0	35.0	35.0	35.0
Minimum Split (s)	10.0	24.5	24.5	24.5	24.5	41.7	41.7	41.7	41.7
Total Split (s)	15.0	61.5	61.5	46.5	46.5	66.7	66.7	66.7	66.7
Total Split (%)	11.7%	48.0%	48.0%	36.3%	36.3%	52.0%	52.0%	52.0%	52.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7	3.7
All-Red Time (s)	1.7	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-1.0	-2.5	-2.5	-2.5	-2.5	-2.7	-2.7	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag				
Lead-Lag Optimize?	Yes			Yes	Yes				
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	32.2	32.2	32.2	17.5	17.5	39.7	39.7	39.7	39.7
Actuated g/C Ratio	0.40	0.40	0.40	0.22	0.22	0.50	0.50	0.50	0.50
v/c Ratio	0.42	0.58	0.31	0.17	0.54	0.14	0.26	0.33	0.58
Control Delay	19.5	22.5	5.9	27.9	30.0	14.1	13.1	15.5	18.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.5	22.5	5.9	27.9	30.0	14.1	13.1	15.5	18.5
LOS	B	C	A	C	C	B	B	B	B
Approach Delay		17.4			29.7		13.2		17.7
Approach LOS		B			C		B		B
Queue Length 50th (m)	16.0	45.6	4.4	4.1	24.1	3.2	17.5	14.6	50.9
Queue Length 95th (m)	33.7	84.8	18.9	12.4	49.1	10.6	37.7	34.3	98.5
Internal Link Dist (m)		296.6			239.6		254.0		140.8
Turn Bay Length (m)	130.0		40.0	40.0		70.0		35.0	
Base Capacity (vph)	408	1296	1147	496	915	465	1388	834	1413
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.42	0.32	0.19	0.07	0.23	0.09	0.16	0.21	0.36

Intersection Summary	
Cycle Length: 128.2	
Actuated Cycle Length: 80	
Natural Cycle: 80	
Control Type: Semi Act-Uncoord	
Maximum v/c Ratio: 0.58	
Intersection Signal Delay: 18.5	Intersection LOS: B
Intersection Capacity Utilization 102.0%	ICU Level of Service G
Analysis Period (min) 15	

Splits and Phases: 3: Navan & Renaud



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	675	109	1	369	10	0	0	3	2	0	18
Future Volume (Veh/h)	42	675	109	1	369	10	0	0	3	2	0	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	44	711	115	1	388	11	0	0	3	2	0	19
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					165							
pX, platoon unblocked	0.96						0.96	0.96		0.96	0.96	0.96
vC, conflicting volume	399			826			1271	1258	768	1252	1310	394
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	355			826			1262	1248	768	1242	1302	349
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	99	99	100	97
cM capacity (veh/h)	1157			805			133	160	401	140	149	667

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	870	400	3	21
Volume Left	44	1	0	2
Volume Right	115	11	3	19
cSH	1157	805	401	491
Volume to Capacity	0.04	0.00	0.01	0.04
Queue Length 95th (m)	0.9	0.0	0.2	1.0
Control Delay (s)	1.0	0.0	14.0	12.7
Lane LOS	A	A	B	B
Approach Delay (s)	1.0	0.0	14.0	12.7
Approach LOS			B	B

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	81.5%	ICU Level of Service	D	
Analysis Period (min)	15			

MOVEMENT SUMMARY

Site: [Navan/Brian Coburn]

2021 AM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Navan											
8	T1	652	3.0	0.553	9.3	LOS A	4.4	33.9	0.41	0.22	53.7
18	R2	23	3.0	0.553	9.3	LOS A	4.4	33.9	0.41	0.22	52.2
Approach		675	3.0	0.553	9.3	LOS A	4.4	33.9	0.41	0.22	53.6
East: Brian Coburn											
1	L2	207	3.0	0.983	53.7	LOS F	21.2	164.9	1.00	1.73	32.2
16	R2	489	3.0	0.983	53.7	LOS F	21.2	164.9	1.00	1.73	31.6
Approach		697	3.0	0.983	53.7	LOS F	21.2	164.9	1.00	1.73	31.8
North: Navan											
7	L2	89	3.0	0.317	6.5	LOS A	1.7	13.0	0.44	0.31	54.8
4	T1	253	3.0	0.317	6.5	LOS A	1.7	13.0	0.44	0.31	54.7
Approach		342	3.0	0.317	6.5	LOS A	1.7	13.0	0.44	0.31	54.7
All Vehicles		1714	3.0	0.983	26.8	LOS D	21.2	164.9	0.66	0.85	42.1

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [Navan/Brian Coburn]

2021 PM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Navan											
8	T1	334	3.0	0.501	11.1	LOS B	3.1	24.1	0.69	0.72	52.3
18	R2	85	3.0	0.501	11.1	LOS B	3.1	24.1	0.69	0.72	50.9
Approach		419	3.0	0.501	11.1	LOS B	3.1	24.1	0.69	0.72	52.0
East: Brian Coburn											
1	L2	124	3.0	0.216	5.9	LOS A	1.0	7.7	0.49	0.40	53.6
16	R2	80	3.0	0.216	5.9	LOS A	1.0	7.7	0.49	0.40	52.1
Approach		204	3.0	0.216	5.9	LOS A	1.0	7.7	0.49	0.40	53.0
North: Navan											
7	L2	449	3.0	0.904	27.4	LOS D	20.4	158.8	1.00	0.72	41.6
4	T1	614	3.0	0.904	27.4	LOS D	20.4	158.8	1.00	0.72	41.6
Approach		1063	3.0	0.904	27.4	LOS D	20.4	158.8	1.00	0.72	41.6
All Vehicles		1686	3.0	0.904	20.7	LOS C	20.4	158.8	0.86	0.68	45.0

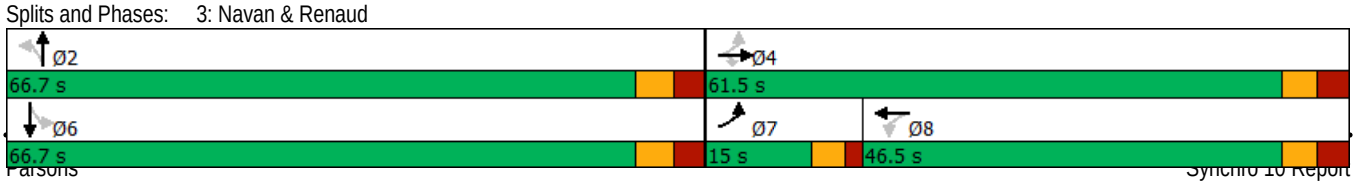
Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	89	120	33	37	417	257	504	64	141
Future Volume (vph)	89	120	33	37	417	257	504	64	141
Lane Group Flow (vph)	94	126	35	39	594	271	564	67	151
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	7	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	35.0	35.0	35.0	35.0
Minimum Split (s)	10.0	24.5	24.5	24.5	24.5	41.7	41.7	41.7	41.7
Total Split (s)	15.0	61.5	61.5	46.5	46.5	66.7	66.7	66.7	66.7
Total Split (%)	11.7%	48.0%	48.0%	36.3%	36.3%	52.0%	52.0%	52.0%	52.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7	3.7
All-Red Time (s)	1.7	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-1.0	-2.5	-2.5	-2.5	-2.5	-2.7	-2.7	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag				
Lead-Lag Optimize?	Yes			Yes	Yes				
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	57.1	57.1	57.1	42.8	42.8	46.0	46.0	46.0	46.0
Actuated g/C Ratio	0.51	0.51	0.51	0.39	0.39	0.41	0.41	0.41	0.41
v/c Ratio	0.39	0.14	0.04	0.08	0.89	0.58	0.77	0.46	0.21
Control Delay	20.9	16.6	6.0	26.0	49.4	30.4	35.5	34.7	21.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.9	16.6	6.0	26.0	49.4	30.4	35.5	34.7	21.0
LOS	C	B	A	C	D	C	D	C	C
Approach Delay		16.7			47.9		33.9		25.2
Approach LOS		B			D		C		C
Queue Length 50th (m)	9.6	13.0	0.0	5.2	112.7	44.8	103.5	10.4	20.6
Queue Length 95th (m)	24.1	30.8	6.0	15.3	#225.8	70.3	143.3	24.2	33.4
Internal Link Dist (m)		296.6			239.6		254.0		140.8
Turn Bay Length (m)	130.0		40.0	40.0		70.0		35.0	
Base Capacity (vph)	253	930	807	465	670	642	1007	201	1012
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.14	0.04	0.08	0.89	0.42	0.56	0.33	0.15

Intersection Summary

Cycle Length: 128.2
Actuated Cycle Length: 111.1
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 35.2 Intersection LOS: D
Intersection Capacity Utilization 110.3% ICU Level of Service H
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Navan & Renaud



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	232	95	2	753	4	0	0	0	3	6	47
Future Volume (Veh/h)	6	232	95	2	753	4	0	0	0	3	6	47
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	6	244	100	2	793	4	0	0	0	3	6	49
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					165							
pX, platoon unblocked	0.73						0.73	0.73		0.73	0.73	0.73
vC, conflicting volume	797			344			1157	1107	294	1105	1155	795
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	532			344			1028	959	294	956	1025	530
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			100	100	100	98	96	88
cM capacity (veh/h)	752			1215			131	185	745	171	169	399

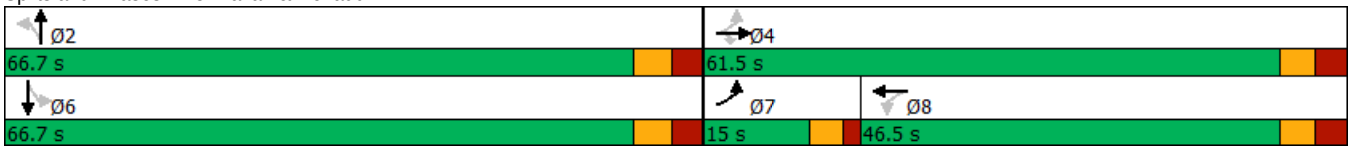
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	350	799	0	58
Volume Left	6	2	0	3
Volume Right	100	4	0	49
cSH	752	1215	1700	330
Volume to Capacity	0.01	0.00	0.00	0.18
Queue Length 95th (m)	0.2	0.0	0.0	4.8
Control Delay (s)	0.3	0.0	0.0	18.2
Lane LOS	A	A	A	C
Approach Delay (s)	0.3	0.0	0.0	18.2
Approach LOS			A	C

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	53.4%	ICU Level of Service	A	
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	162	437	207	32	137	40	206	165	539
Future Volume (vph)	162	437	207	32	137	40	206	165	539
Lane Group Flow (vph)	171	460	218	34	224	42	246	174	568
Turn Type	pm+pt	NA	Perm	Perm	NA	Perm	NA	Perm	NA
Protected Phases	7	4			8		2		6
Permitted Phases	4		4	8		2		6	
Detector Phase	7	4	4	8	8	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	10.0	10.0	10.0	10.0	35.0	35.0	35.0	35.0
Minimum Split (s)	10.0	24.5	24.5	24.5	24.5	41.7	41.7	41.7	41.7
Total Split (s)	15.0	61.5	61.5	46.5	46.5	66.7	66.7	66.7	66.7
Total Split (%)	11.7%	48.0%	48.0%	36.3%	36.3%	52.0%	52.0%	52.0%	52.0%
Yellow Time (s)	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7	3.7
All-Red Time (s)	1.7	3.2	3.2	3.2	3.2	3.0	3.0	3.0	3.0
Lost Time Adjust (s)	-1.0	-2.5	-2.5	-2.5	-2.5	-2.7	-2.7	-2.7	-2.7
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead			Lag	Lag				
Lead-Lag Optimize?	Yes			Yes	Yes				
Recall Mode	None	None	None	None	None	Min	Min	Min	Min
Act Effct Green (s)	34.6	34.6	34.6	19.6	19.6	42.3	42.3	42.3	42.3
Actuated g/C Ratio	0.41	0.41	0.41	0.23	0.23	0.50	0.50	0.50	0.50
v/c Ratio	0.43	0.63	0.31	0.17	0.55	0.17	0.28	0.35	0.64
Control Delay	20.8	25.1	7.3	29.0	31.5	15.9	14.3	16.9	21.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.8	25.1	7.3	29.0	31.5	15.9	14.3	16.9	21.1
LOS	C	C	A	C	C	B	B	B	C
Approach Delay		19.7			31.2		14.6		20.1
Approach LOS		B			C		B		C
Queue Length 50th (m)	16.0	51.9	5.9	4.1	26.5	3.4	20.3	15.4	61.1
Queue Length 95th (m)	38.5	109.6	23.9	13.5	57.9	12.4	47.4	39.7	129.6
Internal Link Dist (m)		296.6			239.6		254.0		140.8
Turn Bay Length (m)	130.0		40.0	40.0		70.0		35.0	
Base Capacity (vph)	401	1240	1100	456	878	384	1329	767	1352
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	0.37	0.20	0.07	0.26	0.11	0.19	0.23	0.42

Intersection Summary			
Cycle Length: 128.2			
Actuated Cycle Length: 85.1			
Natural Cycle: 80			
Control Type: Semi Act-Uncoord			
Maximum v/c Ratio: 0.64			
Intersection Signal Delay: 20.5		Intersection LOS: C	
Intersection Capacity Utilization 105.1%		ICU Level of Service G	
Analysis Period (min) 15			

Splits and Phases: 3: Navan & Renaud



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	42	745	109	1	408	10	0	0	3	2	0	18
Future Volume (Veh/h)	42	745	109	1	408	10	0	0	3	2	0	18
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	44	784	115	1	429	11	0	0	3	2	0	19
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)					165							
pX, platoon unblocked	0.93						0.93	0.93		0.93	0.93	0.93
vC, conflicting volume	440			899			1385	1372	842	1366	1424	434
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	355			899			1376	1361	842	1355	1417	349
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			100			100	100	99	98	100	97
cM capacity (veh/h)	1114			756			107	131	364	113	122	643

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	943	441	3	21
Volume Left	44	1	0	2
Volume Right	115	11	3	19
cSH	1114	756	364	444
Volume to Capacity	0.04	0.00	0.01	0.05
Queue Length 95th (m)	0.9	0.0	0.2	1.1
Control Delay (s)	1.1	0.0	15.0	13.5
Lane LOS	A	A	B	B
Approach Delay (s)	1.1	0.0	15.0	13.5
Approach LOS			B	B

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	87.5%	ICU Level of Service	E	
Analysis Period (min)	15			

MOVEMENT SUMMARY

Site: [Navan/Brian Coburn]

2026 AM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Navan											
3	L2	742	3.0	0.589	9.8	LOS A	4.3	33.3	0.40	0.23	49.5
18	R2	23	3.0	0.019	3.2	LOS A	0.1	0.5	0.21	0.08	56.6
Approach		766	3.0	0.589	9.6	LOS A	4.3	33.3	0.40	0.22	49.7
East: Brian Coburn											
1	L2	207	3.0	0.559	15.1	LOS C	3.1	24.2	0.75	0.83	47.8
6	T1	558	3.0	0.559	14.3	LOS B	3.1	24.2	0.74	0.81	49.5
Approach		765	3.0	0.559	14.5	LOS B	3.1	24.2	0.74	0.82	49.0
West: Brian Coburn											
2	T1	102	3.0	0.095	4.2	LOS A	0.4	2.8	0.32	0.20	57.9
12	R2	288	3.0	0.251	5.4	LOS A	1.1	8.4	0.36	0.24	54.9
Approach		390	3.0	0.251	5.1	LOS A	1.1	8.4	0.35	0.23	55.7
All Vehicles		1921	3.0	0.589	10.6	LOS B	4.3	33.3	0.52	0.46	50.5

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: [Navan/Brian Coburn]

2026 PM
Roundabout

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Navan											
3	L2	380	3.0	0.432	9.3	LOS A	2.1	16.4	0.61	0.63	49.8
18	R2	85	3.0	0.106	5.5	LOS A	0.4	3.0	0.50	0.44	54.6
Approach		466	3.0	0.432	8.6	LOS A	2.1	16.4	0.59	0.59	50.6
East: Brian Coburn											
1	L2	124	3.0	0.126	4.8	LOS A	0.5	3.6	0.43	0.34	53.1
6	T1	91	3.0	0.100	4.9	LOS A	0.4	2.9	0.44	0.35	57.3
Approach		216	3.0	0.126	4.8	LOS A	0.5	3.6	0.43	0.34	54.7
West: Brian Coburn											
2	T1	512	3.0	0.439	7.7	LOS A	2.5	19.6	0.36	0.22	54.9
12	R2	699	3.0	0.565	9.5	LOS A	3.9	30.0	0.42	0.26	51.8
Approach		1211	3.0	0.565	8.7	LOS A	3.9	30.0	0.40	0.24	53.1
All Vehicles		1892	3.0	0.565	8.2	LOS A	3.9	30.0	0.45	0.34	52.6

Site Level of Service (LOS) Method: Delay & v/c (HCM 6). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: Same as Sign Control.
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 6).
Roundabout Capacity Model: US HCM 6.
HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.
Gap-Acceptance Capacity: Traditional M1.
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix H

Park and Ride Signalized Intersection Analysis and Correspondence

From: Nahas, Rani
To: Mike.Giampa@ottawa.ca
Cc: Baker, Mark; Pena-cabra, Andres
Subject: FW: Navan TIA - Brian Coburn/Park & Ride Signal Analysis
Date: Tuesday, November 06, 2018 1:47:06 PM
Attachments: image007.png
image009.png
image010.png
image011.png
image012.png
image013.png
image014.png

Hi Mike,

Please see the response from Signals below regarding the south leg of the future Brian Coburn/Park & Ride intersection.

Cheers,
Rani

From: Pach, Jon <Jon.Pach@ottawa.ca>
Sent: Friday, November 02, 2018 11:25 AM
To: Nahas, Rani <Rani.Nahas@parsons.com>
Cc: Ha, Leng <Leng.Ha@ottawa.ca>; Baker, Mark <Mark.Baker@parsons.com>
Subject: RE: Navan TIA - Brian Coburn/Park & Ride Signal Analysis

Hi Rani,

I've had a look at your latest analysis. A couple of points to mention:

1. The 2026 Horizon analysis shows that the westbound AM queuing is worse without the south leg. This seems contrary to what I would expect considering there are less movements occurring. Can you verify this result?
2. Your 2026 AM with south leg model has a different amber interval than the rest of the models.

I appreciate you looking at the various scenarios for 2031. Since the 95th percentile queues do not reach the roundabout with Navan Road, we do not anticipate safety issues at the roundabout due to eastbound queuing. It looks like split phasing results in the worst performance of the intersection, so we would likely operate with conventional protected lefts for north-south. We would recommend that the south leg be constructed with a dual northbound left once Brian Coburn is widened to have two westbound receiving lanes since it will be fully protected anyway. This will help with storage.

If you can let us know what you find with regarding to point 1 above I'd appreciate it. Otherwise, based on the analysis, we don't see an operational or safety issue with constructing the south leg at this intersection.

Regards,
Jon

From: Nahas, Rani <Rani.Nahas@parsons.com>
Sent: October 19, 2018 12:56 PM
To: Pach, Jon <Jon.Pach@ottawa.ca>
Cc: Ha, Leng <Leng.Ha@ottawa.ca>; Baker, Mark <Mark.Baker@parsons.com>
Subject: RE: Navan TIA - Brian Coburn/Park & Ride Signal Analysis

Hi Jon,

Thanks for your input. I have made the modifications and included the updated results below.

Based on the results shown below, the addition of the south leg below does not increase the delay to the EBLT or SB transit movement. However, the analysis indicates queueing in the EB direction starts to become an issue when Brian Coburn is widened from two lanes to four lanes post 2031.

Looking forward to your comments.

Cheers,
Rani

Assumptions –

2026 Horizon:

- Two-lane cross-section
- Auxiliary left-turn lanes
- 1.0 m/s walking speed
- Fully protected EBLT required due to Transit
- Fully protected WBLT required due to MUP crossing on south leg
- Traffic volumes as predicted in Navan TIA for 2026 Horizon

2031 Horizon:

- Four-lane cross-section + 5m median
- Auxiliary left-turn lanes
- 1.0 m/s walking speed
- Fully protected EBLT required due to Transit
- Fully protected WBLT required due to MUP crossing on south leg
- Traffic volumes as predicted in Stantec Report for 2031 Horizon (attached)

Synchro Results –

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
2026 Horizon						
Brian Coburn/P&R (with south leg)	A(B)	0.53(0.64)	WBT(EBT)	13.7(19.8)	A(A)	0.50(0.59)

Brian Coburn/P&R (without south leg)	A(A)	0.55(0.45)	WBT(EBT)	8.3(3.2)	A(A)	0.53(0.45)
2031 Horizon						
Brian Coburn/P&R (with south leg) *FP N/S Left-turns*	A(B)	0.51(0.70)	WBT(EBT)	4.5(19.5)	A(B)	0.51(0.66)
Brian Coburn/P&R (with south leg) *Split Phase*	A(C)	0.52(0.75)	EBT(EBT)	16.9(22.9)	A(B)	0.50(0.70)
Brian Coburn/P&R (without south leg)	A(A)	0.42(0.43)	WBT(WBT)	5.4(5.3)	A(A)	0.41(0.42)
Note: Analysis of signalized intersections assumes a PHF of 1.00 and a saturation flow rate of 1,800 veh/h/lane. 80 sec cycle length assumed for 2026 Horizon, 90s cycle length assumed for 2031 horizon						

Delays on Brian Coburn –

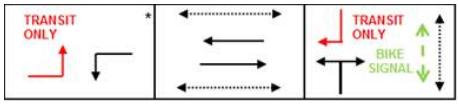
Intersection	Weekday AM Peak (PM Peak)			
	Average Vehicle Delay (s)		Average Transit Delay (s)	
	EBT	WBT	EBLT	SB
2026 Horizon				
Brian Coburn/P&R (with south leg)	7.6(19.6)	12.9(9.8)	34.8(40.3)	0.4(0.1)
Brian Coburn/P&R (without south leg)	2.2(3.2)	8.7(4.8)	39.9(40.3)	0.6(0.1)
2031 Horizon				
Brian Coburn/P&R (with south leg) *FP N/S Left-Turns*	16.7(22.4)	14.4(13.2)	46.0(46.3)	41.8(46.3)
Brian Coburn/P&R (with south leg) *Split Phase*	16.9(27.4)	14.6(16.7)	46.0(46.0)	37.7(37.7)
Brian Coburn/P&R (without south leg)	2.4(2.5)	7.1(7.1)	46.0(46.0)	37.7(37.7)

Queueing –

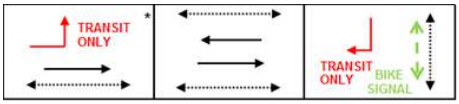
Intersection	Weekday AM Peak (PM Peak)			
	50th Percentile Queue (m)		95th Percentile Queue (m)	
	EBT	WBT	EBT	WBT
2026 Horizon				
Brian Coburn/P&R (with south leg)	8.7(67.9)	35.9(7.0)	18.5(115.4)	127.9(34.2)
Brian Coburn/P&R (without south leg)	0.0(0.0)	0.0(0.0)	8.8(45.8)	#164.9(19.8)
2031 Horizon				
Brian Coburn/P&R (with south leg) *FP N/S Left-Turns*	56.4(75.6)	30.9(33.1)	#120.6(#143.9)	#136.2(119.7)
Brian Coburn/P&R (with south leg) *Split Phase*	56.4(76.6)	30.9(33.1)	#119.1(#170.9)	#135.5(#154.6)
Brian Coburn/P&R (without south leg)	0.0(0.0)	0.0(0.0)	36.8(41.4)	86.3(89.3)
Approximately 215 m of storage between Brian Coburn/Park & Ride and Brian Coburn/Navan				

Phasing –

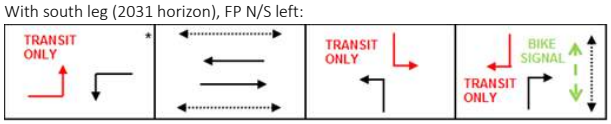
With south leg (2026 horizon):



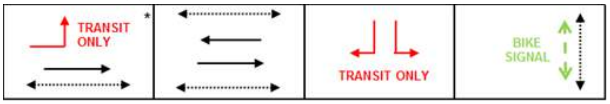
Without south leg (2026 horizon):



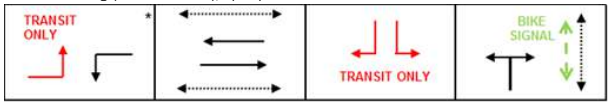
With south leg (2031 horizon), FP N/S left:



Without south leg (2031 horizon):

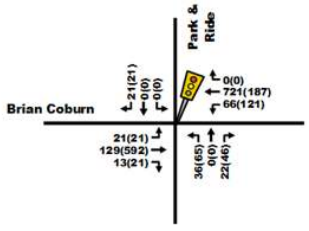


With south leg (2031 horizon), split phase:

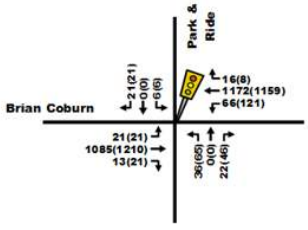


Volumes –

2026 Horizon:



2031 Horizon:



From: Pach, Jon <Jon.Pach@ottawa.ca>
Sent: Thursday, October 18, 2018 10:43 AM
To: Nahas, Rani <Rani.Nahas@parsons.com>
Cc: Baker, Mark <Mark.Baker@parsons.com>; Ha, Leng <Leng.Ha@ottawa.ca>
Subject: RE: Navan TIA - Brian Coburn/Park & Ride Signal Analysis

Hi Rani,

Thanks for providing the analysis. We've reviewed and have a few modifications we'd like you to make to the models.

- Peak Hour Factor for future conditions is 1.0

- Minimum green times for through movements should be 10 seconds
- For the 2026 with south leg scenario, we would operate the northbound and southbound vehicles at the same time as the east ped and bike phase. Essentially north and south would display green balls and southbound would have a left turn prohibition sign
- For the 2031 with south leg, can you also include a scenario with north-south protected lefts instead of split phasing – you can keep the split phasing for comparison

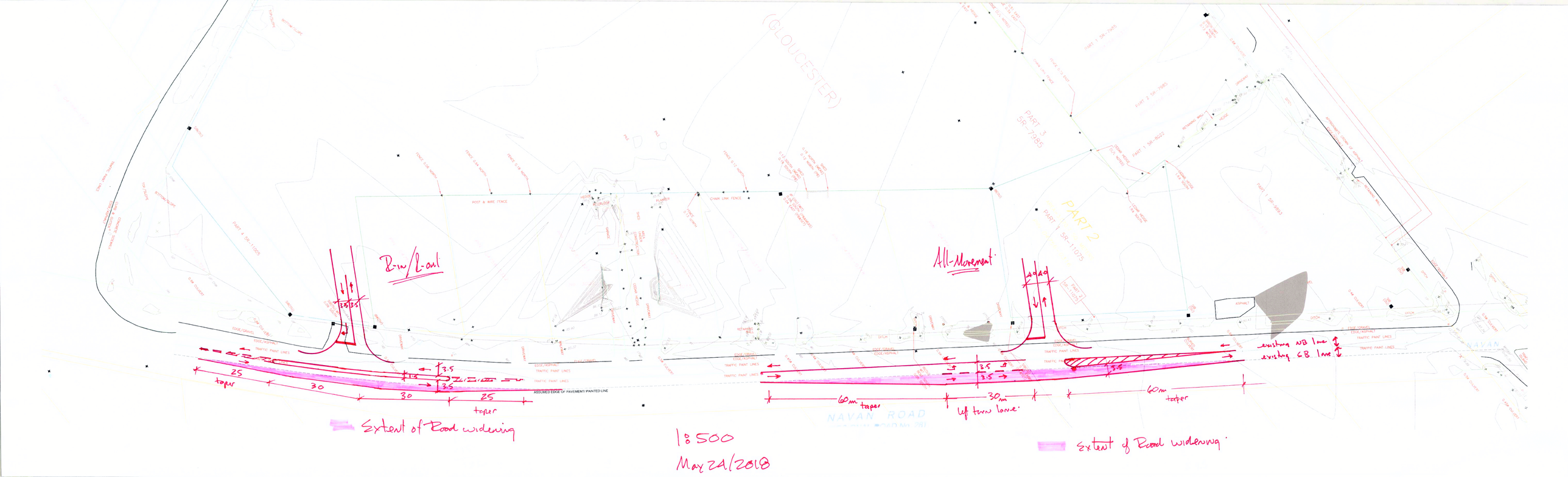
If the eastbound queues are going to impact roundabout operations at Navan Road, then we have concerns from a safety perspective. We also have to be mindful of delays to transit exiting the park and ride. Can you please modify the models as requested and provide an updated analysis, and we'll review again and provide our comments regarding the south leg access on Brian Coburn. If you could also provide a table summarizing the southbound delays to transit for all scenarios that would be helpful as well.

Let me know if you have any questions regarding the above.

Thanks,
Jon

Appendix I

Preliminary Sketches of Anticipated Design of Candidate Site Driveways


B-w/L-out
All-Movement
3.5
3.5
3.5
3.5
3.5
3.5
3.5
3.5
25
taper
30
30
25
taper
ASSUMED EDGE OF PAVEMENT/ PAINTED LINE
Extent of Road widening
60m taper
30m
left turn lane
60m
taper
existing NB lane
existing SB lane
Extent of Road widening
1:500
May 24/2018

Scale 1:500
(May 23, 2018)
BRIAN COBURN BOULEVARD
NEW ROAD CONSTRUCTION
GEOMETRY & GENERAL LAYOUT
STA. 12+425 TO STA. 12+875
Ottawa
ISD14-5104
G1
Robinson Consultants
NAVAN ROAD
PAGE ROAD
BRIAN COBURN BOULEVARD
LIMIT OF CONTRACT STA. 12+430
MATCHLINE STA. 2+060 FOR CONTINUATION SEE DWG. G11
FOR CONTINUATION SEE DWG. G12
FOR PAGE ROAD TURNING BASIN SEE DRAWING G12
12+550
12+600
12+650
12+700
12+750
12+800
12+850
median extension beyond Ped Xing to deter left turns.
required widening.
median extension.
5.5m (traffic lane + cycle lane)
traffic control signal ultimately required.
median reconstruction to accommodate westbound left-turn lane into site.
required widening
30m
55m
4m
1.5m
10m R
7m
15m
40m
throat lengths.
3.5
4m
Existing Multi-Use Pathway 3.0
further analysis required to determine if eastbound right-turn lane required