



2983 Navan Road

TIA Forecasting Report



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476713 - 01000



TIA Plan Reports

On 14 June 2017, the Council of the City of Ottawa adopted new Transportation Impact Assessment (TIA) Guidelines. In adopting the guidelines, Council established a requirement for those preparing and delivering transportation impact assessments and reports to sign a letter of certification.

Individuals submitting TIA reports will be responsible for all aspects of development-related transportation assessment and reporting, and undertaking such work, in accordance and compliance with the City of Ottawa's Official Plan, the Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines.

By submitting the attached TIA report (and any associated documents) and signing this document, the individual acknowledges that s/he meets the four criteria listed below.

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed¹ or registered² professional in good standing, whose field of expertise [check ☒ appropriate field(s)] is either transportation engineering ☒ or transportation planning ☐.

1,2 License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.

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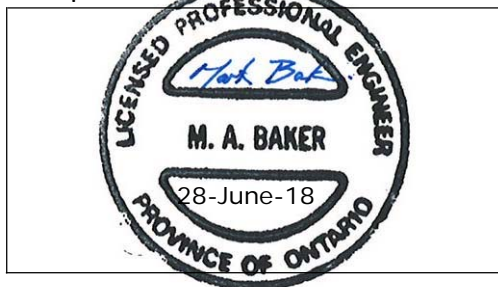


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TIA Forecasting Report

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

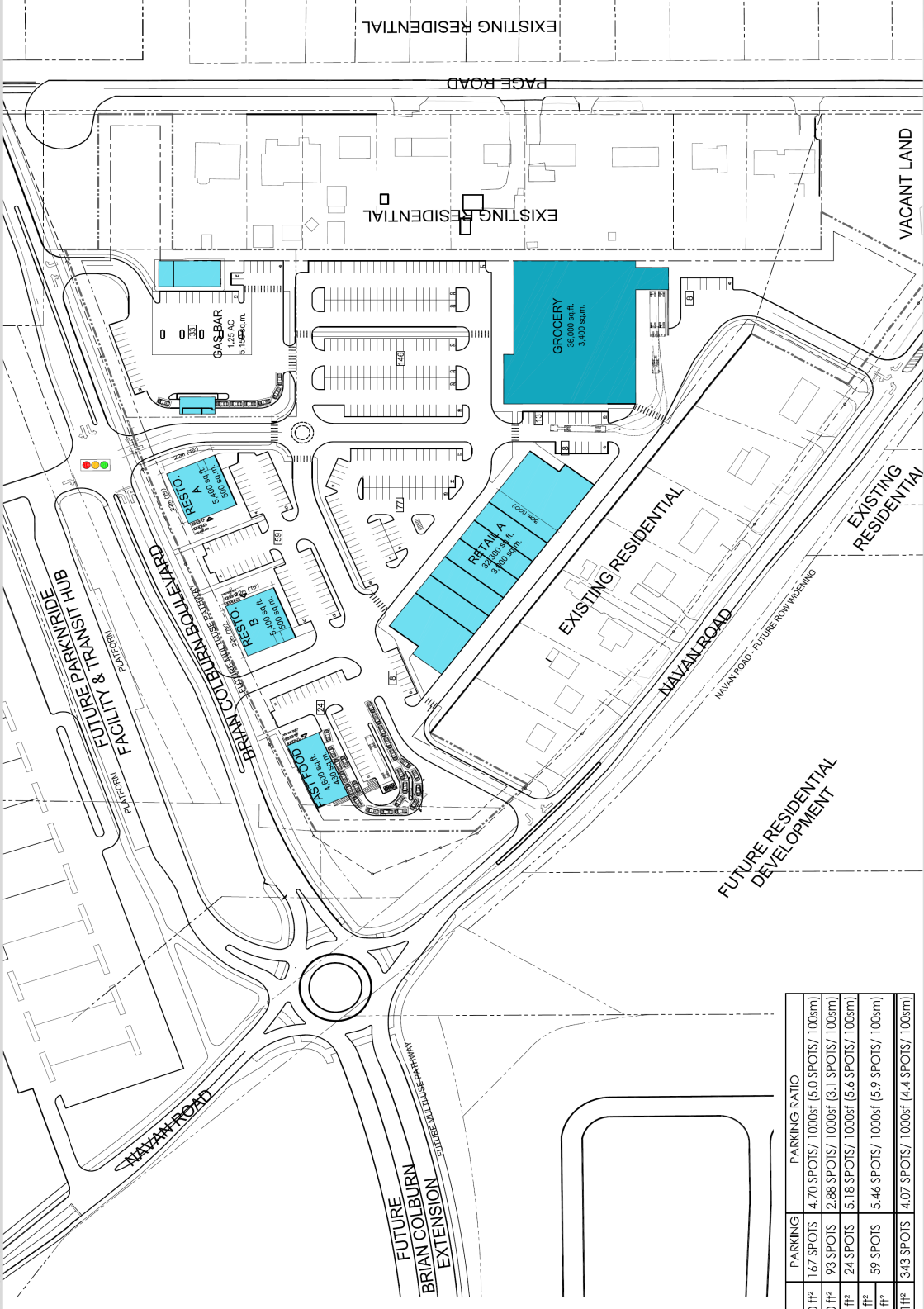
2.1. EXISTING AND PLANNED CONDITIONS

2.1.1. PROPOSED DEVELOPMENT

Based on the proposed Site 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 m²), general retail (3,000 m²), two sit-down restaurants (500 m² each), a fast-food restaurant (430 m²) and a gas bar with a car-wash (10 fueling positions). The proposed Site Plan shows five vehicle accesses to the site; two to Navan Road (one right-in/right-out access and one full-movement access) and three to Brian Coburn Boulevard (one full-movement signalized access and two right-in/right-out accesses). 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 Site Plan is provided as Figure 2.

Figure 1: Local Context





	LEASE AREA	PARKING	PARKING RATIO
GROCERY	3,400 m ²	167 SPOTS	4.70 SPOTS / 1000sf (5.0 SPOTS / 100sm)
RETAIL A	3,000 m ²	93 SPOTS	2.88 SPOTS / 1000sf (3.1 SPOTS / 100sm)
DRIVETHRU	430 m ²	24 SPOTS	5.18 SPOTS / 1000sf (5.6 SPOTS / 100sm)
RESTO. A	500 m ²	59 SPOTS	5.46 SPOTS / 1000sf (5.9 SPOTS / 100sm)
RESTO. B	500 m ²	343 SPOTS	4.07 SPOTS / 1000sf (4.4 SPOTS / 100sm)
TOTAL	7,830m ²		



TAGGART REALTY

NAVAN - BRIAN COBURN

Concept Plan

Scale 1:1500
MAY 28, 2018

There is a desire by the proponent to provide a right-in/right-out access and full-movement access to Brian Coburn Boulevard for the restaurant/retail component of the site, and an additional right-in/right-out access to Brian Coburn that would serve the gas-station. We have been advised by the City that there is a desire to minimize the number of accesses to Brian Coburn Boulevard. For the purposes of this study, all three driveways are shown to Brian Coburn Boulevard. At the Site Plan Approval stage of development, the number and locations of site driveways will be refined.

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.

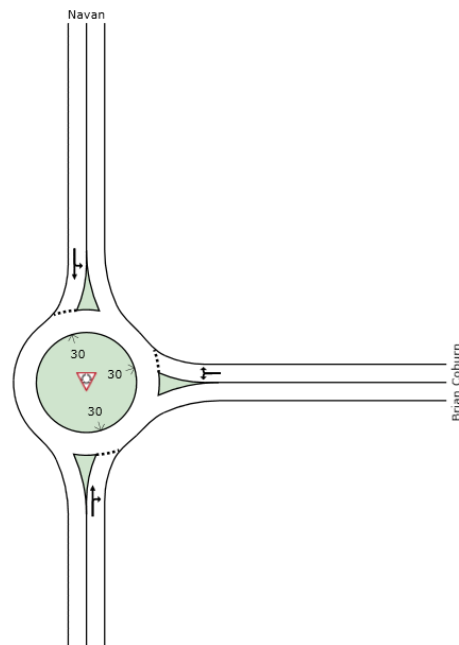
Renaud Road is an east-west, city owned, collector roadway that extends from Anderson Road in the west to Mer Bleue Road in the east. The roadway has a two-lane undivided cross-section with a posted speed limit of 50 km/h.

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

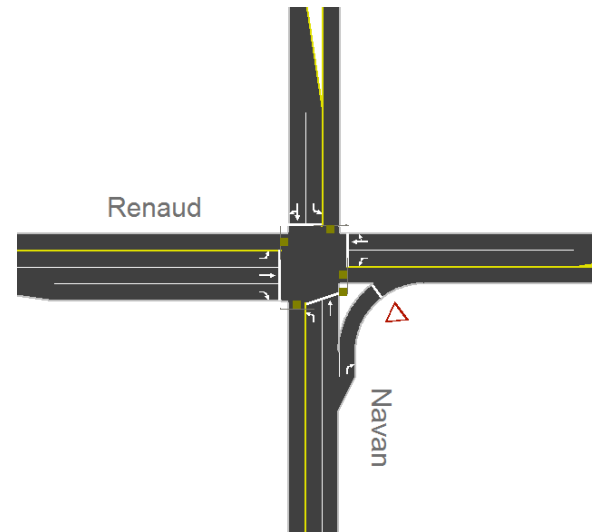
Navan/Brian Coburn

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.



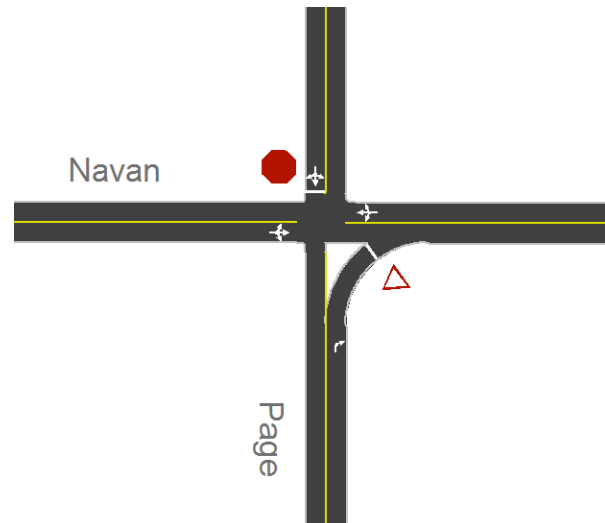
Navan/Renaud

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

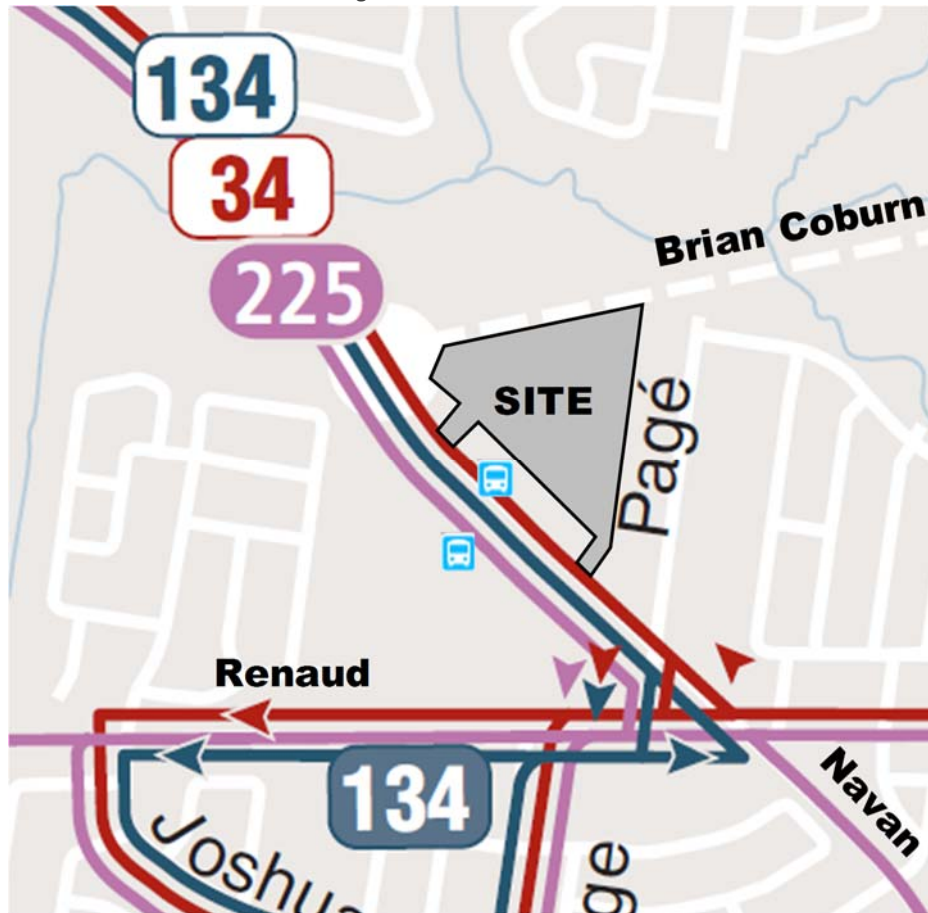
With respect to pedestrians, there are sidewalks provided on both sides of Renaud Road and a multi-use pathway (MUP) on the south side of Brian Coburn Boulevard. There are no sidewalk facilities along Navan Road or Pagé Road. Additionally, there is a pedestrian signal crossing Brian Coburn at Pagé Road.

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.

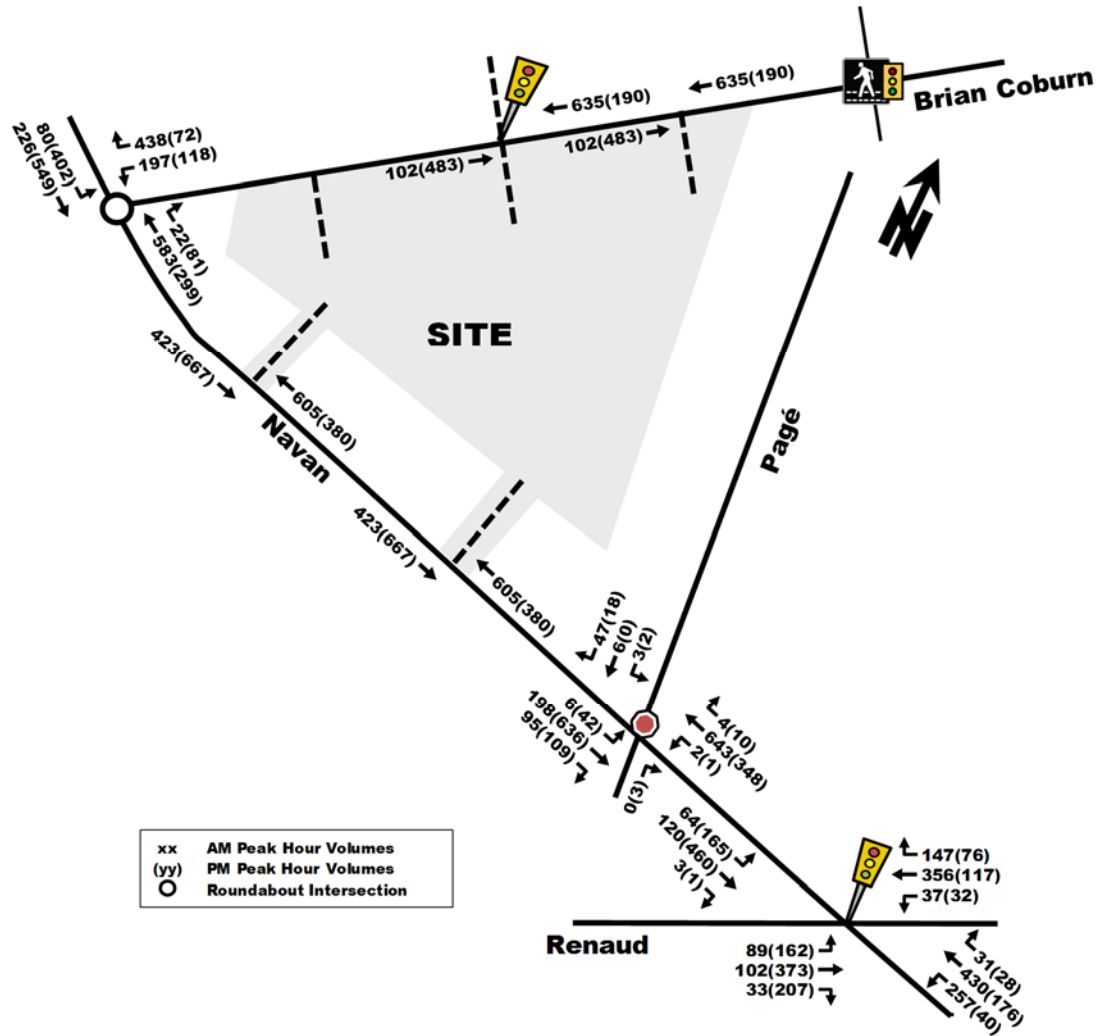
Figure 3: Area Transit Network



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

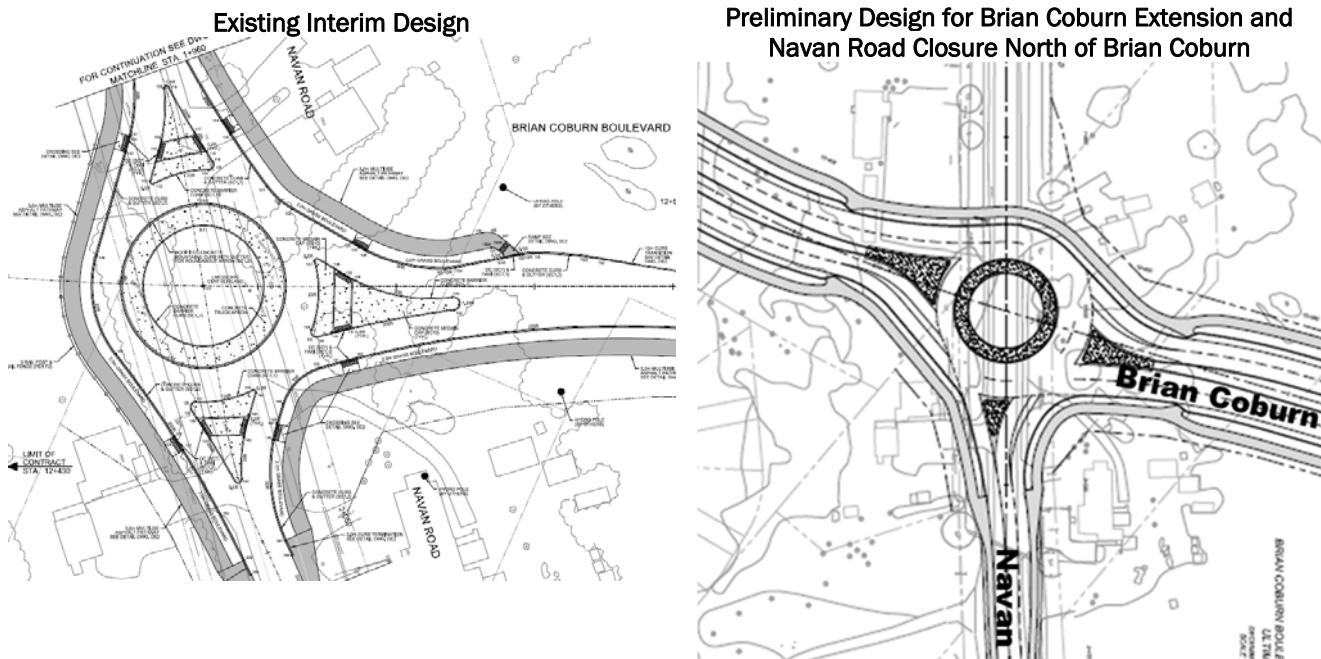
A transit priority corridor (isolated measures) along Brian Coburn Boulevard between Navan Road and Tenth Line Road is identified in the 2031 Affordable Network. A Park and Ride is planned along the north side of Brian Coburn Boulevard, adjacent to the subject site. Along the Blackburn Bypass and the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



- 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.

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 only of Steps 1, 2 and 3 of the TIA process. As such, for the purposes of this application, Step 4 is assumed to be exempt. At the time of Site Plan, a TIA Strategy Report will be prepared.

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	$T = 3.82(X)$	$T = 9.24(X);$ $\ln(X) = 0.75\ln(X) + 3.21$	$T = 10.34(X);$ $\ln(T) = 0.69\ln(X) + 3.61$
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 ft ² 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 ft ²	107	72	179	240	232	472	289	278	567
Shopping Centre	43,000 ft ²	24	15	39	75	82	157	96	89	185
Quality Restaurant	10,800 ft ²	3	7	10	71	36	107	86	61	147
Fast-Food Restaurant	4,600 ft ²	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	576	531	1,107	758	711	1,469

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/h)			PM Peak (Person Trips/h)			SAT Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	55%	73	49	122	174	174	348	212	202	414
Auto Passenger	15%	21	13	34	47	47	94	59	56	115
Transit	20%	25	17	42	63	62	125	77	74	151
Non-motorized	10%	12	8	20	31	31	62	37	35	72
Total Person Trips	100%	131	87	218	315	314	629	385	367	752
Less Pass-by (30%)		-18	-18	-36	-52	-52	-104	-62	-62	-124
Total 'New' Auto Trips		55	31	86	122	122	244	150	140	290

Table 4: Quality Restaurant Modal Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)			SAT Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	55%	2	4	6	40	20	60	48	34	82
Auto Passenger	15%	1	2	3	10	6	16	13	9	22
Transit	20%	0	1	1	14	7	21	17	12	29
Non-motorized	10%	0	0	0	7	3	10	8	6	14
Total Person Trips	100%	3	7	10	71	36	107	86	61	147
Total 'New' Auto Trips		2	4	6	40	20	60	48	34	82

Table 5: Fast-Food Restaurant Modal Site Trip Generation

Travel Mode	Mode Share	AM Peak (Person Trips/h)			PM Peak (Person Trips/h)			SAT Peak (Person Trips/h)		
		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	5%	24	23	47	20	18	38	32	32	64
Non-motorized	5%	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' 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/h)			PM Peak (Person Trips/h)			SAT Peak (Person Trips/h)		
		In	Out	Total	In	Out	Total	In	Out	Total
Auto Driver	75%	46	45	91	69	66	135	93	93	186
Auto Passenger	15%	9	9	18	14	14	28	18	19	37
Transit	5%	3	3	6	4	4	8	6	6	12
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%)		-27	-27	-54	-41	-41	-82	-56	-56	-112
Total 'New' Auto Trips		19	18	37	28	25	53	37	37	74

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	59	40	99	132	128	260	159	153	312
Shopping Centre	14	9	23	42	46	88	53	49	102
Quality Restaurant	2	4	6	40	20	60	48	34	82
Fast-Food Restaurant	66	65	131	55	52	107	91	88	179
Gasoline Station	46	45	91	69	66	135	93	93	186
Supermarket Pass-by (30%)	-15	-15	-30	-39	-39	-78	-47	-47	-94
Shopping Centre Pass-by (30%)	-3	-3	-6	-13	-13	-26	-15	-15	-30
Fast-Food Pass-by (50%)	-33	-33	-66	-27	-27	-54	-45	-45	-90
Gasoline Station Pass-by (60%)	-27	-27	-54	-41	-41	-82	-56	-56	-112
Multi-purpose Trips (10%)	-10	-9	-19	-22	-19	-41	-29	-25	-54
Total 'New' Auto Trips	99	76	175	196	173	369	252	229	481

As shown in Table 7, the resulting number of potential 'new' two-way vehicle trips for the proposed development is approximately 175, 370, and 480 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

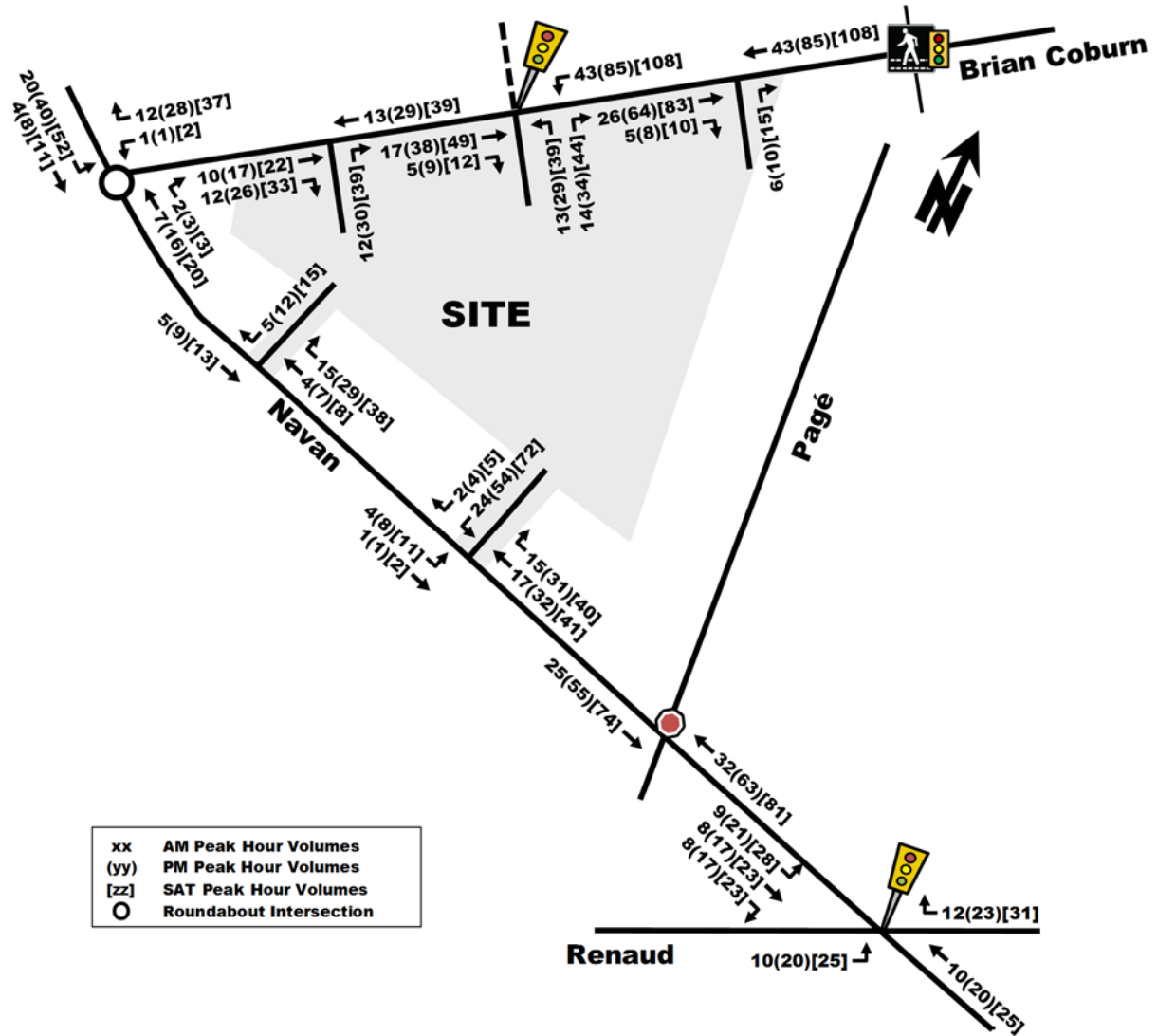
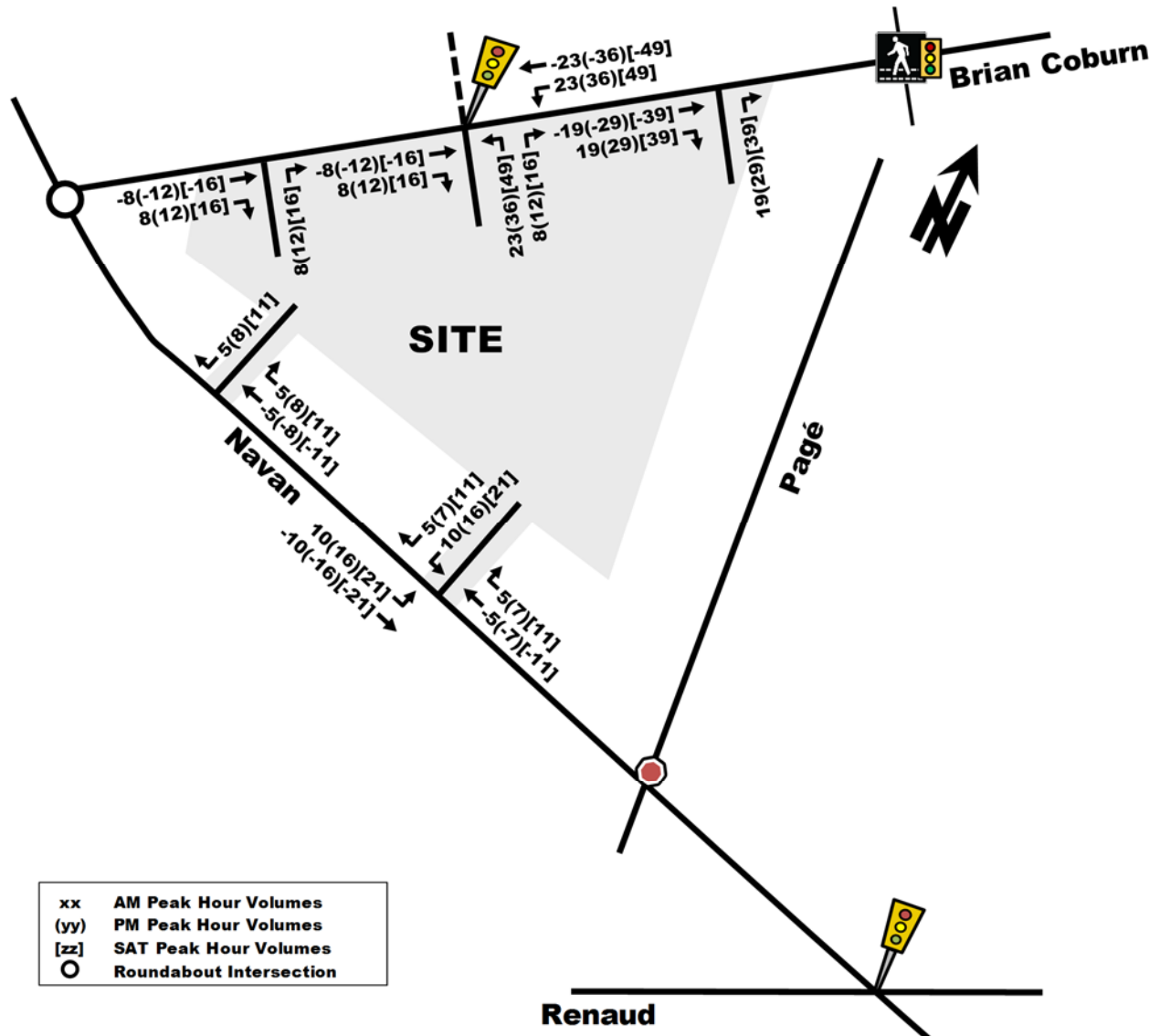
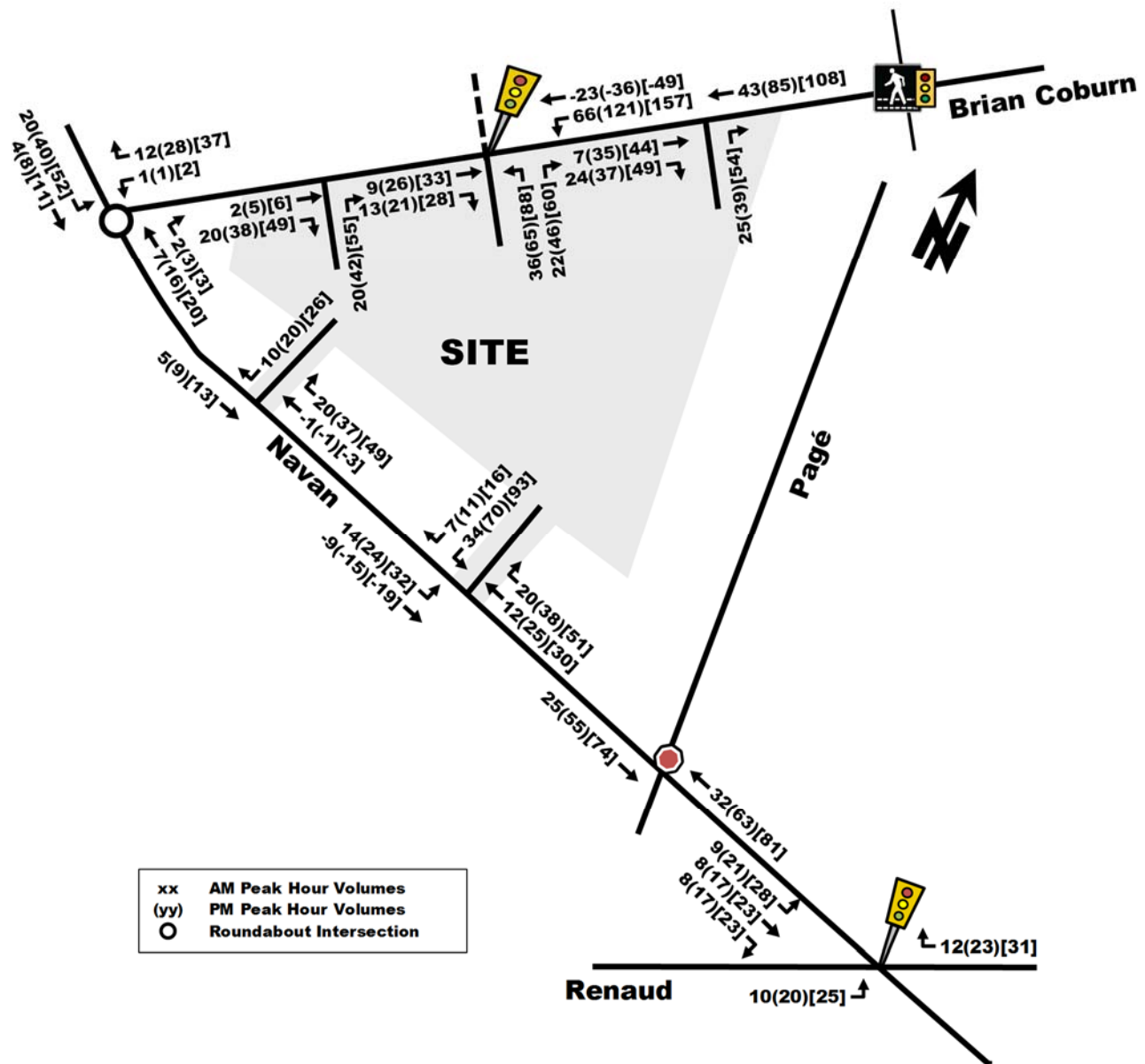


Figure 8: 'Pass-by' Projected 2021 Site-Generated Traffic Volumes



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 D.

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

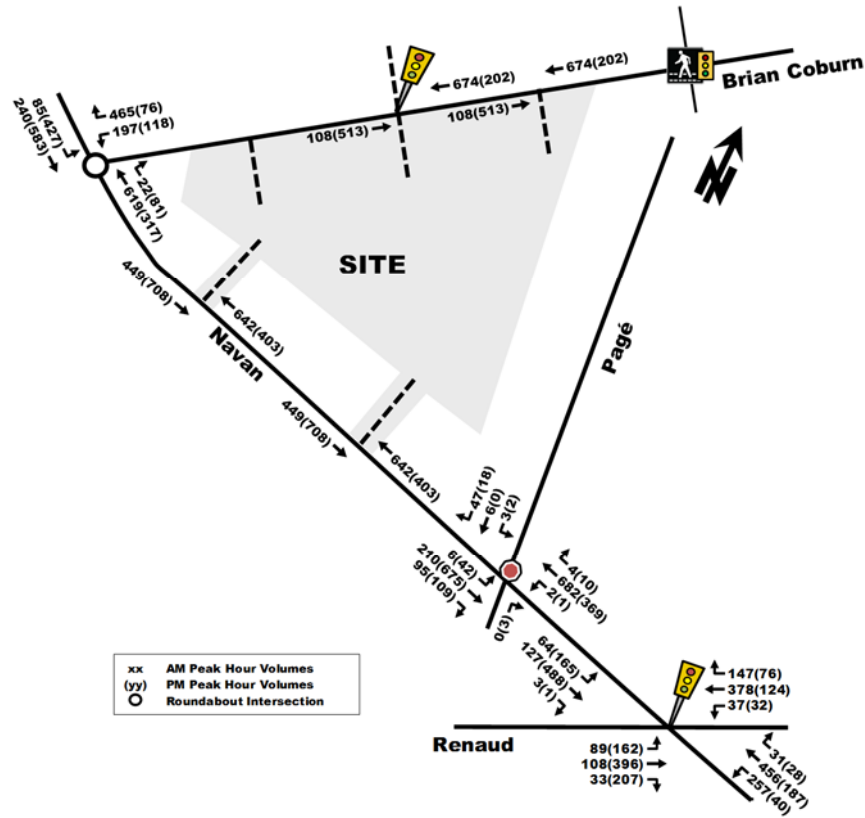
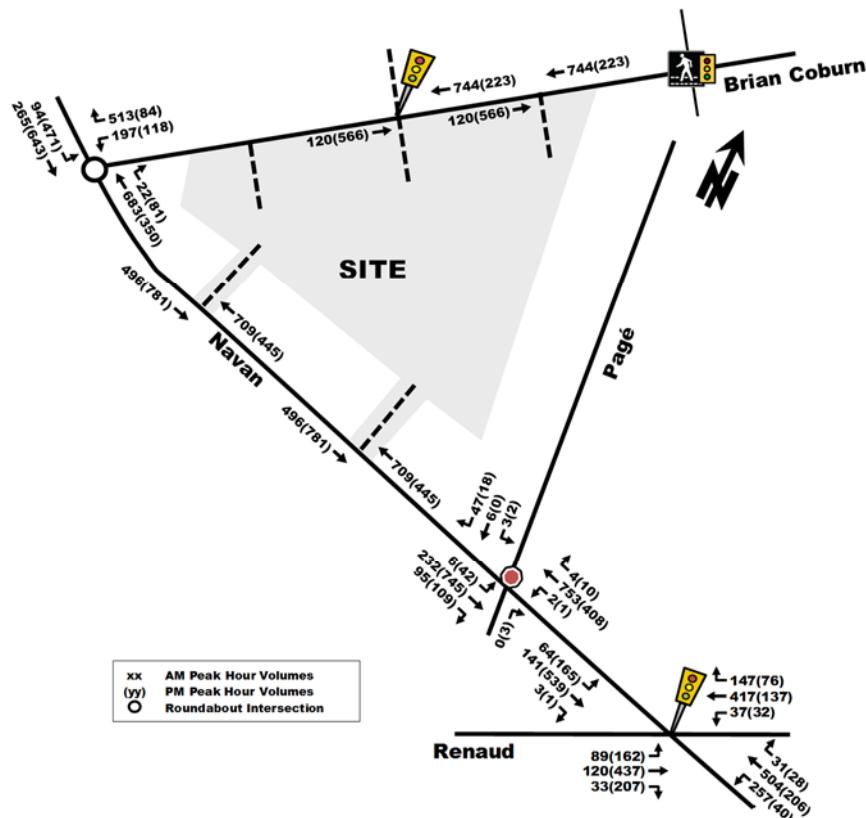


Figure 11: 2026 Background Traffic Volumes



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 E.

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 F.

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.						

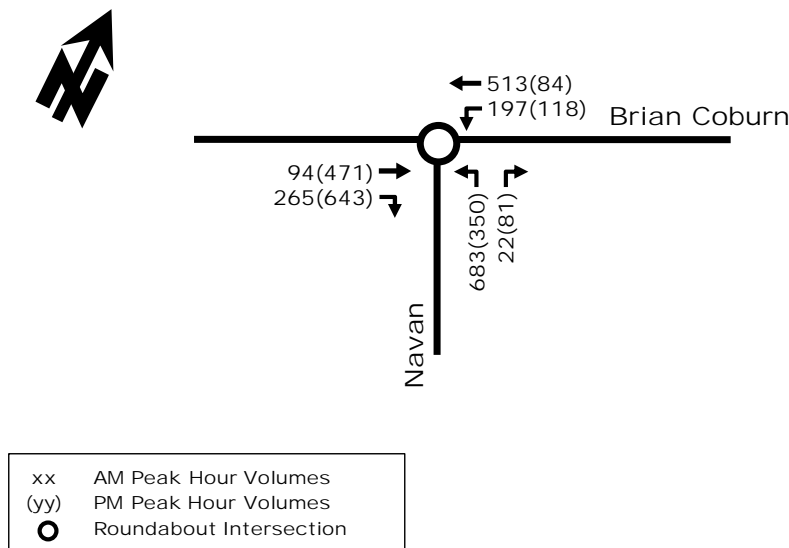
As shown in Table 11, all study area intersections are projected to operate 'as a whole' at an acceptable LoS 'D' or better during both peak hours. With regard to critical movements, all are projected to operate at LoS 'D' or better during peak hours with the exception of the westbound movement at the 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 F.

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.

4. 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 480 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 three new connections to Brian Coburn Boulevard (two right-in/right-out and one signalized full-movement);
 - There is a desire by the proponent to provide three accesses to Brian Coburn Boulevard, however we have been advised by the City that there is a desire to minimize the number of accesses to Brian Coburn Boulevard. For the purposes of this study, the three driveways are shown to Brian Coburn Boulevard. At the Site Plan Approval stage of development, the number and location of site driveways will be refined;
 - 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;

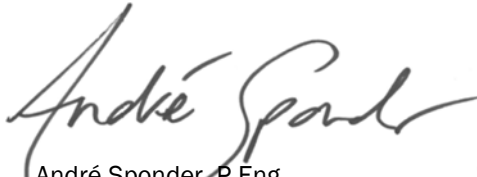
Intersection Operations – Background Traffic

- 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;
- 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.

PARSONS

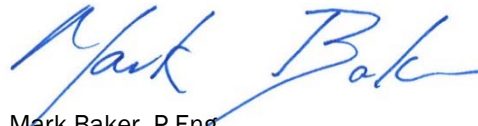
Based on the foregoing conclusions, the Zoning By-Law Amendment for the proposed development is recommended from a transportation perspective. Additional transportation analyses, consistent with Step 4 of the TIA process, will be completed to support the subsequent Site Plan Approval application.

Prepared By:



André Sponder, P.Eng.
Transportation Engineer

Reviewed By:



Mark Baker, P.Eng.
Senior Transportation Engineer/Project Manager



Appendix A

Screening Form

City of Ottawa 2017 TIA Guidelines

Date

4/26/2018

TIA Screening Form

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	<u>Two (2) on Navan:</u> One (1) right-in/right-out access approx. 100m south of Brian Coburn and one (1) full-movement access approx. 150m northwest of Pagé. <u>Three (3) on Brian Coburn:</u> 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 - Full Study Peak Hour Diagram

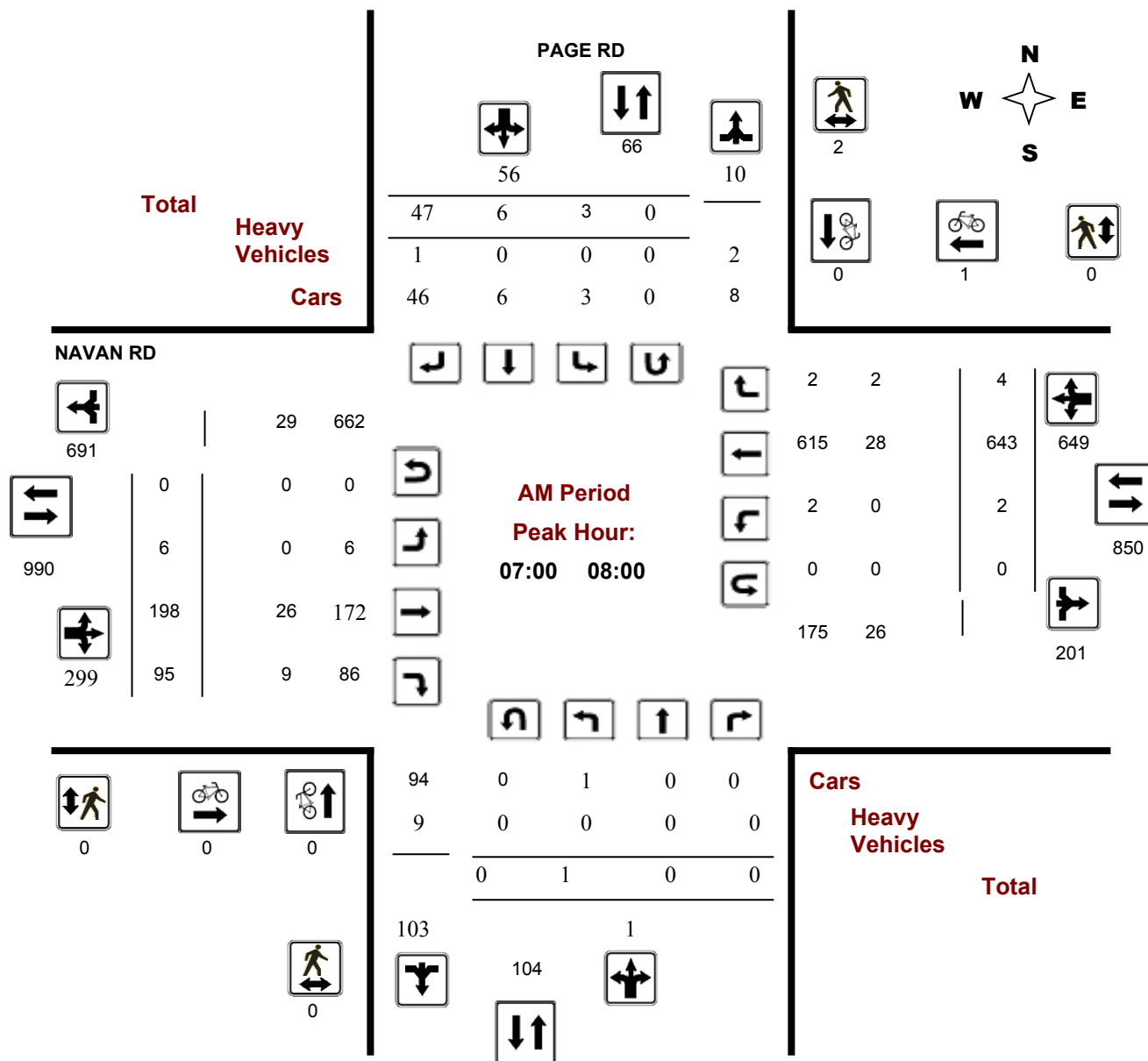
NAVAN RD @ PAGE RD

Survey Date: Thursday, May 25, 2017

Start Time: 07:00

WO No: 37064

Device: Miovision



Comments

Turning Movement Count - Full Study Peak Hour Diagram

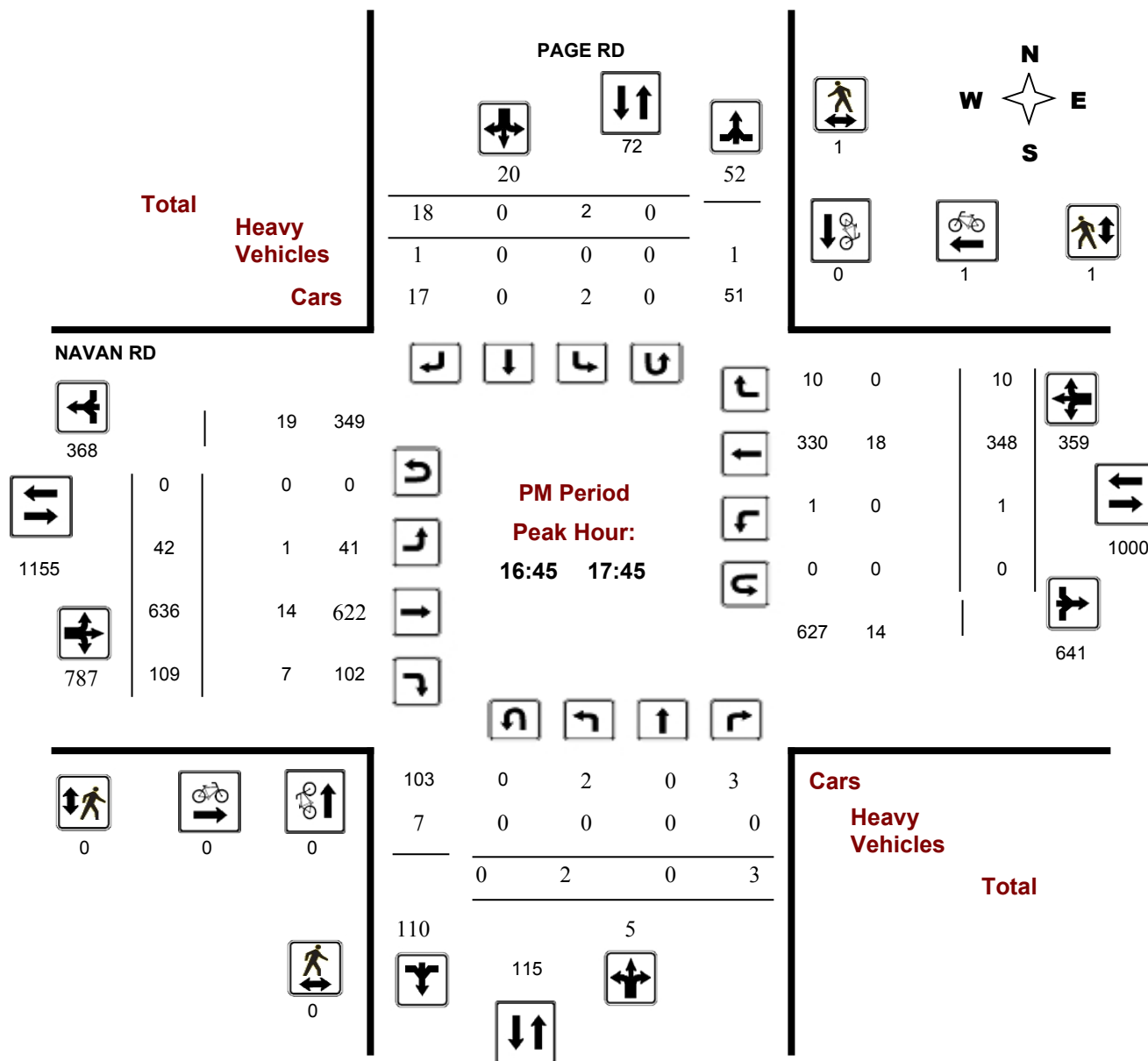
NAVAN RD @ PAGE RD

Survey Date: Thursday, May 25, 2017

Start Time: 07:00

WO No: 37064

Device: Miovision



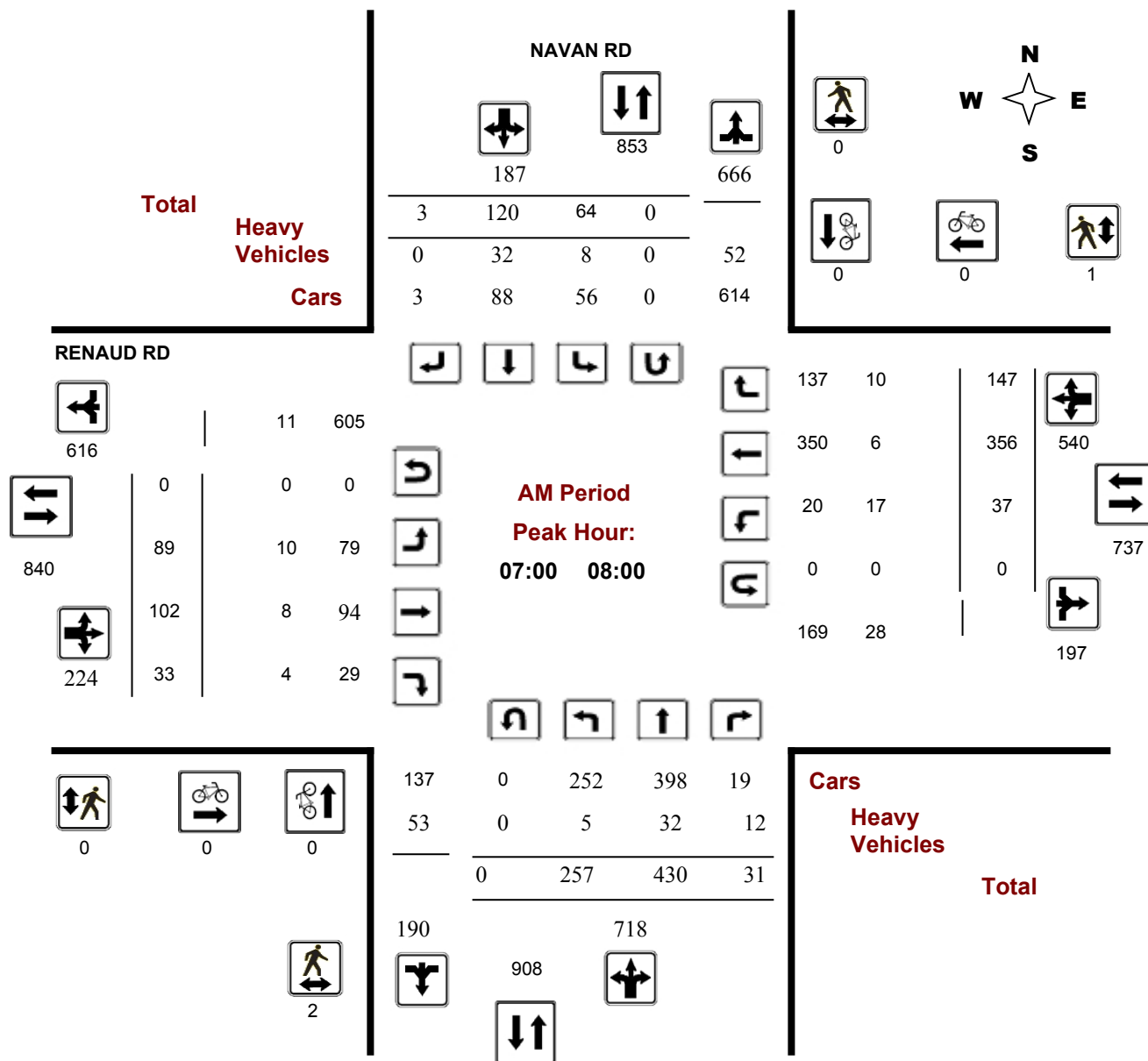
Comments

Survey Date: Wednesday, June 08, 2016

Start Time: 07:00

WO No: 35962

Device: Miovision

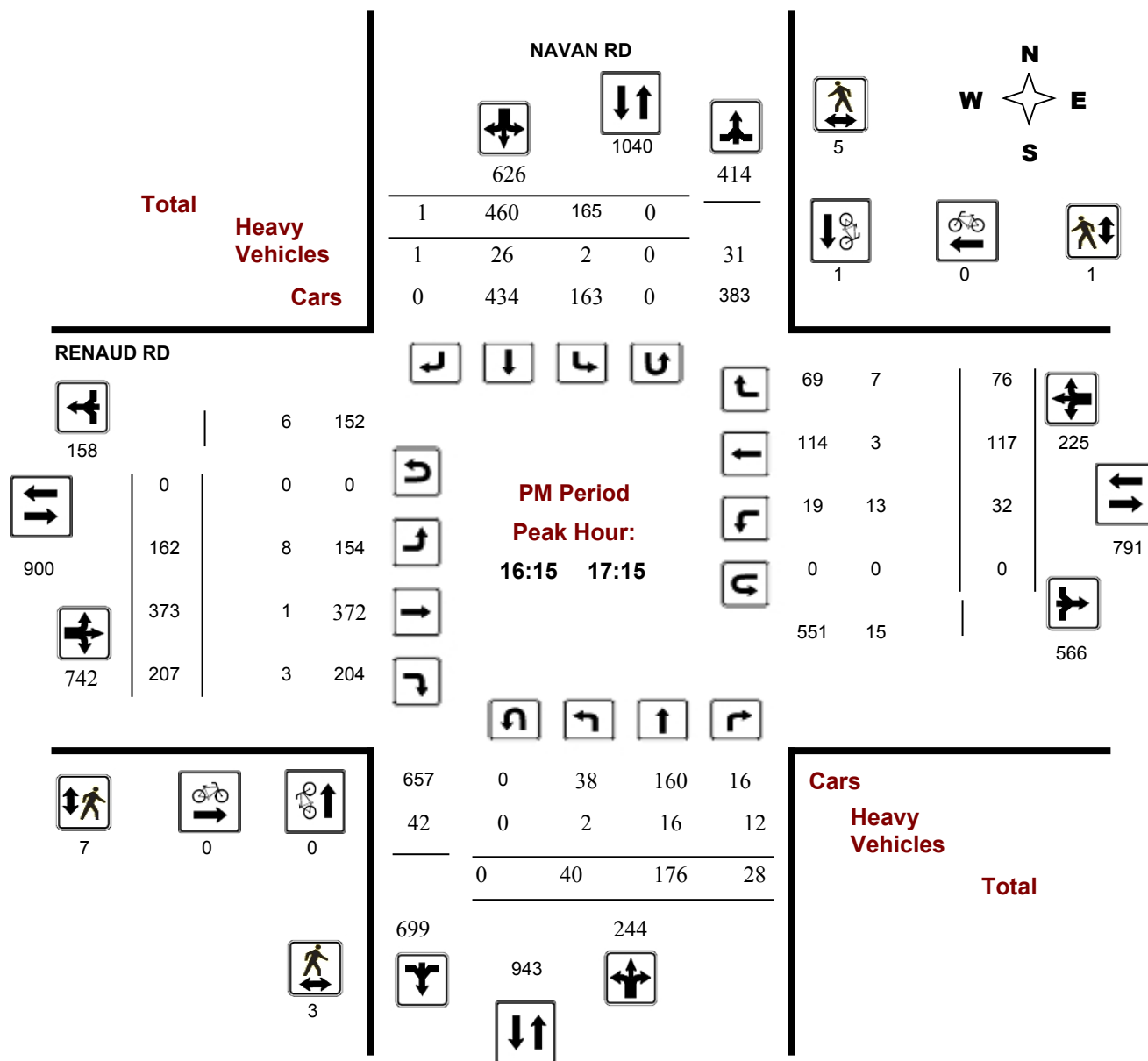


Survey Date: Wednesday, June 08, 2016

Start Time: 07:00

WO No: 35962

Device: Miovision



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
Non-fatal injury	2	2	0	8	1	0	0	0	13
Non reportable	0	0	0	0	0	0	0	0	0
Total	10	2	1	39	1	3	0	0	56
	#2 or 18%	#4 or 4%	#5 or 2%	#1 or 70%	#5 or 2%	#3 or 5%	#7 or 0%	#7 or 0%	

77%
23%
0%
100%

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
Non-fatal injury	2	1	0	1	0	0	0	0	4
Non reportable	0	0	0	0	0	0	0	0	0
Total	7	1	0	6	0	2	0	0	16
	44%	6%	0%	38%	0%	13%	0%	0%	

75%
25%
0%
100%

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
Non-fatal injury	0	1	0	7	1	0	0	0	9
Non reportable	0	0	0	0	0	0	0	0	0
Total	1	1	0	33	1	1	0	0	37
	3%	3%	0%	89%	3%	3%	0%	0%	

76%
24%
0%
100%

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)

Wednesday, May 02, 2018

Page 1 of 2

Collision Main Detail Summary

OnTRAC Reporting System

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

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)

Wednesday, May 02, 2018

Page 2 of 2



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 Manoeuvre	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 Manoeuvre	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 Manoeuvre	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 Manoeuvre	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 V2 E	Dry Dry	Slowing or Slowing or	Pick-up truck Delivery van	Other motor vehicle Other motor vehicle	0
2	2012-04-11	We	14:25	Clear	Daylight	Other	P.D. only	V1 N V2 S	Dry Dry	Going ahead Going ahead	Truck - dump Automobile, station	Other Events Debris falling off	0
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 V2 E	Dry Dry	Going ahead Slowing or	Automobile, station Automobile, station	Other motor vehicle Other motor vehicle	0
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 V2 E	Ice Ice	Going ahead Going ahead	Pick-up truck Automobile, station	Steel guide wall Ran off road	0

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 V2 N	Dry Dry	Turning left Going ahead	Automobile, station Automobile, station	Other motor vehicle Other motor vehicle	0
8	2012-08-11	Sat	18:37	Clear	Daylight	Angle	Non-fatal	V1 W V2 N V3 S	Dry Dry Dry	Going ahead Going ahead Turning right	Passenger van Automobile, station Pick-up truck	Other motor vehicle Other motor vehicle Other motor vehicle	0
9	2013-01-06	Sun	14:00	Snow	Daylight	Angle	P.D. only	V1 E V2 S	Ice Ice	Slowing or Going ahead	Automobile, station Pick-up truck	Other motor vehicle Other motor vehicle	0
10	2013-04-02	Tue	08:48	Clear	Daylight	Angle	P.D. only	V1 E V2 N	Dry Dry	Turning left Turning left	Municipal transit bus Pick-up truck	Other motor vehicle Other motor vehicle	0

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

Thursday, February 08, 2018

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Collision Main Detail Summary

OnTRAC Reporting System

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

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)

Thursday, February 08, 2018

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Appendix D

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 E

Existing Synchro and SIDRA Analysis

Existing AM
3: Navan & Renaud

06/28/2018

									
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%

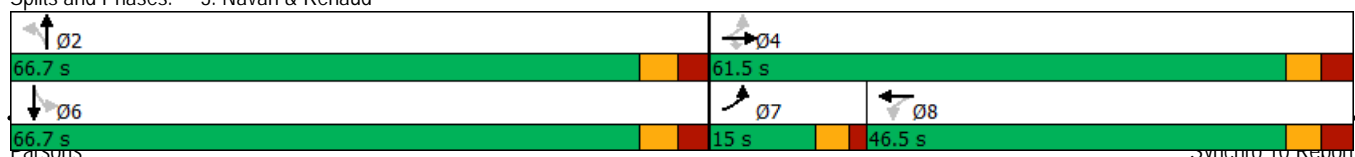
ICU Level of Service G

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



Synchron to Report

												
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

 Ø2	 Ø4
66.7 s	61.5 s
 Ø6	 Ø7
66.7 s	15 s
	 Ø8
	46.5 s

												
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 Total veh/h	Flows 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 Total veh/h	Flows 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 F

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%

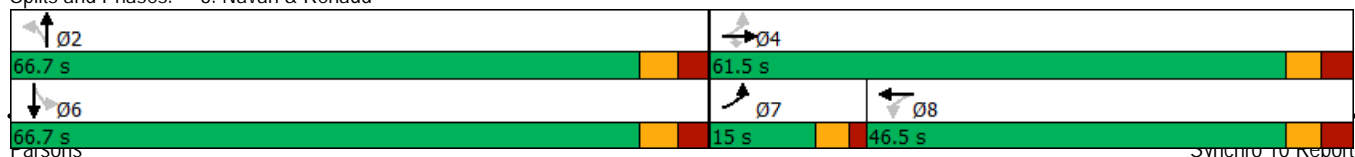
ICU Level of Service G

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



Synchron to Report

												
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

 Ø2	 Ø4
66.7 s	61.5 s
 Ø6	 Ø7
66.7 s	15 s
	 Ø8
	46.5 s

												
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 Total veh/h	Flows 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.

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MOVEMENT SUMMARY

 Site: [Navan/Brian Coburn]

2021 PM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows 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.

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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%

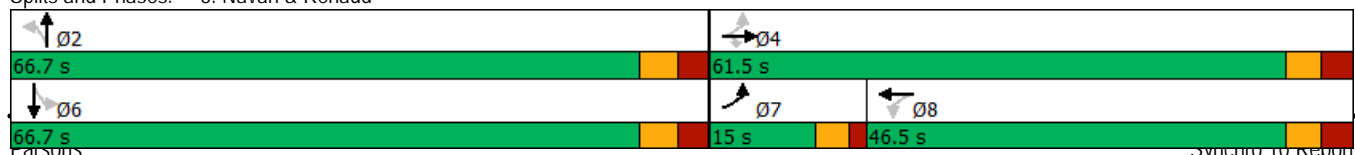
ICU Level of Service H

















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

 Ø2	 Ø4
66.7 s	61.5 s
 Ø6	 Ø7
66.7 s	15 s
	 Ø8
	46.5 s

												
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 Total veh/h	Flows 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.

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MOVEMENT SUMMARY

 Site: [Navan/Brian Coburn]

2026 PM
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows 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.

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