



MEMORANDUM

TO:	Kelly Roberts	ACTION BY:	
FROM:	Colin MacKenzie	FOR INFO OF:	Bassam Hamwi Campbell Inwood
RESPOND BY:		PROJECT No.:	2150308.00
RE:	Moodie LRT Traffic Conditions	DATE:	December 14, 2017

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1.0 Background

The Stage 2 LRT project will see the implementation of light rail from Trim Station in the east to Bayshore Station in the west. As part of the Stage 2 project, this study was implemented to investigate the potential impacts on the local road network if the LRT was extended west of Bayshore Station to Moodie Drive.

Currently the West Transitway is under construction as a Bus Rapid Transit (BRT) facility between Bayshore Station and Moodie Drive. This extension of the existing Transitway will improve transit travel time to and from Kanata, since it removes buses from Highway 417 between Bayshore Station and Moodie Drive. This also removes the need for eastbound buses to use the Highway 416-417 off-ramps at Holly Acres Road, and the corresponding high volume signalized intersection.

In the future, the West Transitway will be converted from a BRT to an LRT. Once converted, the alignment will be completely grade separated from general traffic, so no direct impacts on roadways are anticipated. However, there are potential traffic impacts from the new LRT station at Moodie Drive, as well as changes to the bus routes in the area to accommodate the station. This memo will analyze these impacts.

1.1 Study Area

The study area for this project extends from Bayshore Station to Moodie Drive. The LRT alignment will be grade separated from any all roadways, so no direct impacts to roadways are expected. Therefore, the study area encompasses the major arterial and collector roadways within the vicinity of the Moodie LRT extension alignment, including Holly Acres Road, Moodie Drive and Corkstown Road. An overview of the study area is provided in **Figure 1** and descriptions of the three major roadways are provided below.

Figure 1 – Study Area



Holly Acres Road

Holly Acres Road is a 1.2 km arterial roadway, connecting Carling Avenue in the north to Richmond Road in the south. North of Carling Avenue, Holly Acres Road becomes the entrance to Andrew Haydon Park. South of Richmond Road, Holly Acres Road becomes Nanaimo Drive.

There are four signalized intersections along Holly Acres Road: Carling Avenue, Bayshore Station / Highway 417 westbound on-ramp, Highway 416 / Highway 417 off-ramp and Richmond Road / Nanaimo Drive. In addition, there is one signalized pedestrian/cycling crossing for the Watts Creek Pathway, just north of Aero Drive / Creeks End Lane.

Multi-use Pathways are provided on both sides of Holly Acres, south of Aero Drive/Creeks End Lane, with sidewalks on both sides provided north of Aero Drive/Creeks End Lane. The posted speed limit on Holly Acres Road varies from 60 km/h to 80 km/h.

Moodie Drive

Moodie Drive is an 18.5 km arterial roadway, extending from Carling Avenue in the north to Brophy Drive in the south. North of Carling Avenue, Moodie Drive becomes James Cummings Avenue, a local street. The limits of Moodie Drive for the purposes of this study will be from Carling Avenue to south of the Highway 417 eastbound ramps.

There are seven signalized intersections along Moodie Drive in the study area: Carling Avenue, North Ring Road, Network Access, South Ring Road¹, Abbott Point of Care Centre entrance, Corkstown Road, Highway 417 westbound ramps and Highway 417 eastbound ramps. The posted speed limit on Moodie Drive varies from 60 km/h to 80 km/h.

There is a sidewalk on the east side of Moodie Drive from Corkstown Road to Carling Avenue. A multi-use pathway is present on the west side of Moodie Drive from Carling Avenue to Network Access and from South Ring Road to Corkstown Road. Between Network Access and South Ring Road the pathway enters into the Department of National Defense Campus.

Corkstown Road

Corkstown Road extends from March Road in the west to Carling Avenue in the east. West of Moodie Drive it is designated as an arterial road; east of Moodie Drive it is designated as a collector roadway. The limits of Corkstown Road for the purposes of this study will be from Carling Avenue to the CNR rail corridor which forms the west boundary of Wesley Clover Park.

There is one signalized intersection along Corkstown Road in the study area, at Moodie Drive. There is a signalized pedestrian crossing on Carling Avenue, just west of the intersection with Corkstown Road. In addition, there are three all-way stop control intersections: Crystal Beach Drive, Horner Drive and Westdale Avenue. The speed limit on Corkstown Road varies from 40 km/h in the residential area to 60 km/h closer to Moodie Drive.

There is a sidewalk on the north side of Corkstown Road from Carling Avenue to Crystal Beach Drive. No dedicated cycling facilities are provided on Corkstown Road east of Moodie Drive. West of Moodie Drive, paved shoulders are provided for cyclists. These are to be extended from Moodie Drive to the planned Corkstown BRT Station as part of the West Transitway Extension.

¹ North Ring Road, Network Access and South Ring Road are all entrances to the Department of National Defense campus on the west side of Moodie Drive.

2.0 Existing Conditions

Turning movement counts, traffic signal timing plans and EMME traffic projections were received from the City of Ottawa to aid with the evaluation of existing traffic conditions. For the purpose of this study, it was assumed that the “existing condition” scenario is 2016, since that is the year the majority of the City’s most recent turning movement counts were taken. Any counts that are older were grown to 2016 in accordance with the growth rates derived from the EMME model. Intersection operations were modelled using Synchro Version 9 software.

The analysis of existing conditions was divided between the three corridors evaluated for the study: Holly Acres Road, Corkstown Road and Moodie Drive. The following section reviews the existing traffic volumes through the corridors, as well as the intersection operations within the study area.

2.1 Holly Acres Road

The peak direction of traffic on Holly Acres Road is generally southbound, in both the AM and PM peak hours. The traffic volumes on Holly Acres Road south of Highway 417 tend to be higher than those north of Highway 417 due to the presence of the Highway 416-417 eastbound off-ramps on Holly Acres. The majority of the traffic from this ramp is destined south to Richmond Road. North of Highway 417 the volumes are lower, with most traffic destined for Carling Avenue.

Figure 2 below indicates the existing traffic volumes on Holly Acres Road. Intersection performance along the corridor is shown in **Table 1**, which illustrates the performance of individual movements expressed in terms of v/c or volume to capacity ratio. The v/c ratio represents the volume of vehicles undertaking the movements compared to the available capacity for the movement. The v/c values are then used to derive a Level of Service (LOS) rating. LOS ratings range from LOS “A” which is indicative of an excellent operation (i.e. minimal delays) to LOS “F” which indicates a failing operation (i.e. very lengthy delays).

Figure 2 – Holly Acres Rd Existing Turning Movement Volumes and Lane Arrangement

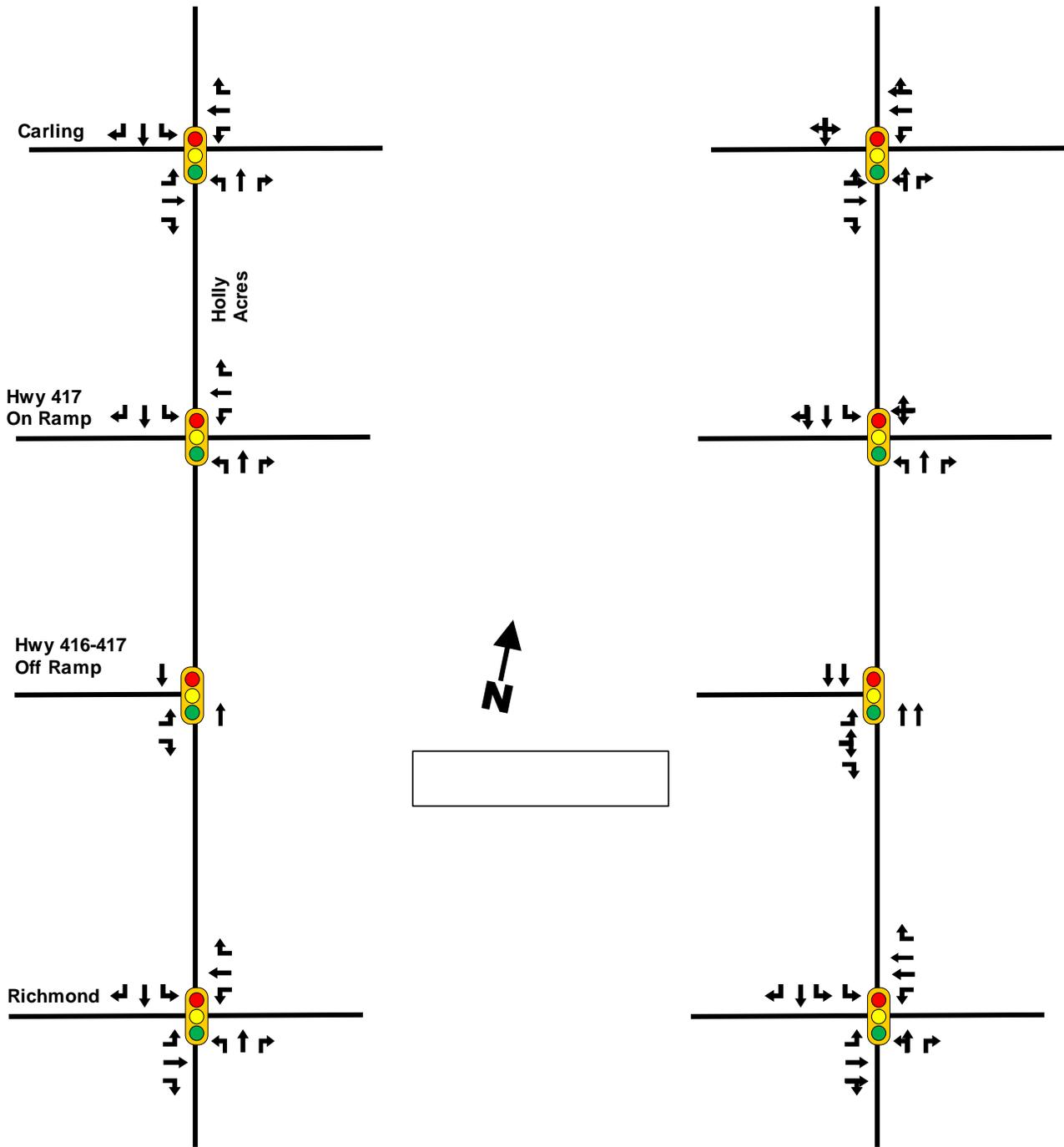


Table 1 – Holly Acres Road Existing Intersection Operations

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Carling Ave	Eastbound through	0.20 (0.29)	A (A)	14 (20)
	Eastbound right	0.03 (0.07)	A (A)	0 (0)
	Westbound left	0.06 (0.39)	A (A)	4 (20)
	Westbound through	0.24 (0.50)	A (A)	16 (41)
	Northbound left	0.07 (0.18)	A (A)	7 (18)
	Northbound right	0.08 (0.17)	A (A)	4 (9)
	Overall	0.22 (0.47)	A (A)	-
Hwy 417 On-Ramp / Bayshore Station	Westbound left/through/right	0.14 (0.34)	A (A)	8 (15)
	Northbound left	0.23 (0.20)	A (A)	13 (11)
	Northbound through/right	0.32 (0.29)	A (A)	34 (30)
	Southbound left	0.00 (0.00)	A (A)	0 (0)
	Southbound through/right	0.12 (0.22)	A (A)	15 (25)
	Overall	0.31 (0.30)	A (A)	-
Hwy 416-417 Off-Ramps	Eastbound left/right	0.73 (0.29)	C (A)	#100 (15)
	Eastbound right	0.83 (0.61)	D (B)	137 (30)
	Northbound through	0.10 (0.18)	A (A)	12 (14)
	Southbound through	0.38 (0.38)	A (A)	67 (38)
	Overall	0.76 (0.50)	C (A)	-
Richmond Rd / Nanaimo Ave	Eastbound left	0.43 (0.60)	A (A)	19 (33)
	Eastbound through/right	0.37 (0.39)	A (A)	66 (66)
	Westbound left	0.07 (0.11)	A (A)	8 (9)
	Westbound through	0.28 (0.60)	A (A)	51 (104)
	Westbound right	0.06 (0.10)	A (A)	0 (0)
	Northbound left/through	0.36 (0.51)	A (A)	24 (30)
	Northbound right	0.26 (0.11)	A (A)	0 (0)
	Southbound left	0.72 (0.68)	C (B)	54 (47)
	Southbound through	0.03 (0.14)	A (A)	5 (15)
	Southbound right	0.64 (0.59)	B (A)	23 (20)
Overall	0.46 (0.61)	A (B)	-	

All signalized intersections along Holly Acres Road operate acceptably in the AM and PM peak hours. No intersection has an overall LOS worse than LOS 'C' and no individual movement has a LOS worse than LOS 'D'. No excessive delays or vehicle queues are anticipated along this corridor.

2.2 Corkstown Road

The peak direction of traffic on Corkstown Road is generally eastbound in the AM peak hour and westbound in the PM peak hour. This corresponds with the general flow of traffic in the City of Ottawa, as commuters tend to be inbound to downtown in the morning and outbound during the afternoon. The volumes on Corkstown Road are in order with a collector roadway, and generally do not exceed 200 vehicles per direction per hour in any peak hour. Count data indicates there are approximately 15 cyclists per hour on Corkstown Road in the AM peak period, and 20 cyclists per hour in the PM peak period. Anecdotally, pedestrian and cyclist activity in the area is higher during the weekends, related to travel along the adjacent NCC Watt's Creek Pathway.

Figure 3 below indicates the existing traffic volumes on Corkstown Road. Intersection performance along the corridor is shown in **Table 2**, which illustrates the performance of individual movements expressed in terms of v/c ratio.

It should be noted that the Carling Avenue/Corkstown Road intersection is an Intersection Pedestrian Signal (IPS) with STOP control on Corkstown Road. When a pedestrian activates this signal, a red signal indication is displayed for Carling Avenue allowing pedestrians to cross and northbound left-turning vehicles to clear the intersection. The results shown in **Table 2** depict the traffic impacts associated with the IPS for the east-west movements along Carling Avenue.

Figure 3 – Corkstown Rd Existing Turning Movement Volumes and Lane Arrangement

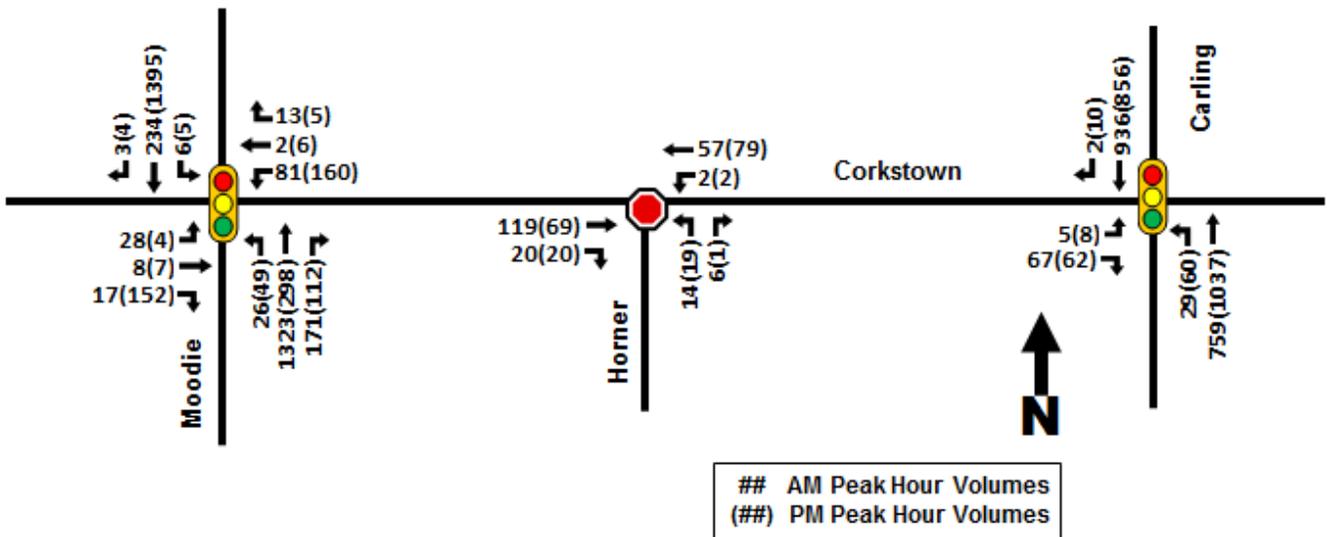


Table 2 – Corkstown Road Existing Intersection Operations

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Carling Ave	Eastbound through/right	0.73 (0.64)	C (B)	72 (67)
	Westbound through	0.61 (0.82)	B (D)	57 (92)
	Overall	0.73 (0.82)	C (D)	-
Horner Dr	Eastbound through/right	0.16 (0.10)	A (A)	-
	Westbound left/through	0.07 (0.10)	A (A)	-
	Northbound left/right	0.03 (0.03)	A (A)	-

All intersections in the Corkstown Road corridor operate well in both peak hours, with no intersection or individual movement operating with an overall LOS lower than LOS ‘D’. No delays or excessive queues are expected along Corkstown Road under existing conditions.

2.3 Moodie Drive

The peak direction of traffic on Moodie Drive is generally northbound in the AM peak hour and southbound in the PM peak hour. There were no cyclists counted on Moodie Drive south of Corkstown Road, likely due to the lack of a physically separated cycling facility, as well as the high traffic volumes on the Moodie Drive overpass over Highway 417. North of Corkstown Road the volumes range from 15 to 60 cyclists per day. The increase in cyclists is likely due to the presence of the east-west Trans Canada Trail, which crosses Moodie Drive at the intersection of Corkstown Road.

Figure 4 below indicates the existing traffic volumes on Moodie Drive. Intersection performance along the corridor is shown in **Table 3**.

Figure 4 – Moodie Dr Existing Turning Movement Volumes and Lane Arrangement

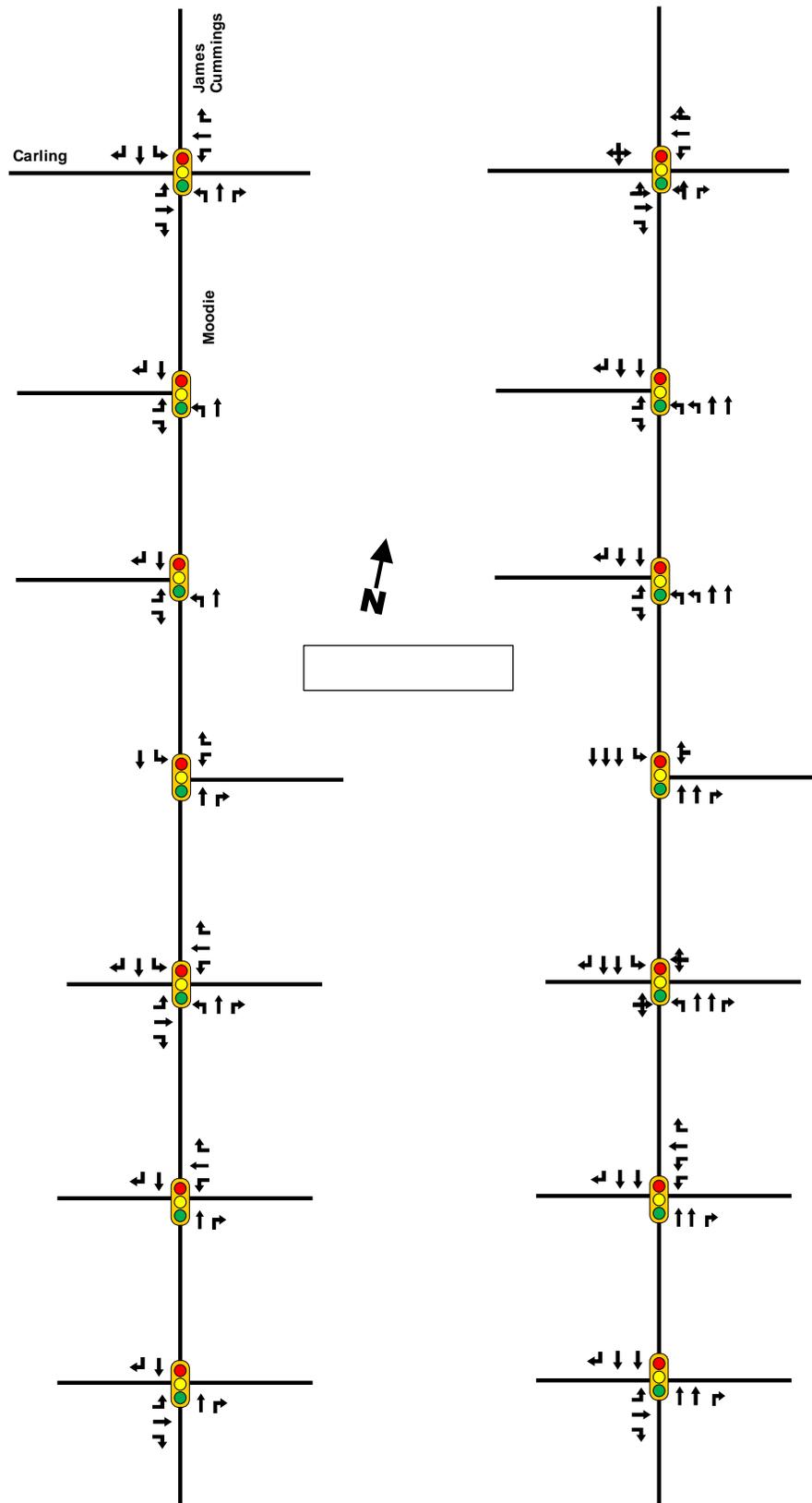


Table 3 – Moodie Drive Existing Intersection Operations

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Carling Ave / James Cummings Ave	Eastbound through	0.80 (0.36)	C (A)	101 (59)
	Eastbound right	0.29 (0.68)	A (B)	14 (28)
	Westbound left	0.55 (0.54)	A (A)	30 (37)
	Westbound through/right	0.60 (0.26)	A (A)	96 (34)
	Northbound left/through	1.13 (0.75)	F (C)	#287 (52)
	Northbound right	0.10 (0.24)	A (A)	9 (10)
	Southbound left/through/right	0.01 (0.02)	A (A)	3 (3)
	Overall	0.94 (0.69)	E (B)	-
Network Access (North)	Eastbound left	0.01 (0.10)	A (A)	2 (9)
	Eastbound right	0.06 (0.47)	A (A)	4 (14)
	Northbound left	0.62 (0.07)	B (A)	24 (4)
	Northbound through	0.17 (0.12)	A (A)	3 (3)
	Southbound through	0.08 (0.39)	A (A)	13 (56)
	Southbound right	0.02 (0.01)	A (A)	3 (1)
	Overall	0.41 (0.40)	A (A)	-
South Ring Rd ²	Northbound through	0.25 (0.09)	A (A)	0 (0)
	Southbound through/right	0.06 (0.24)	A (A)	0 (0)
	Overall	0.25 (0.24)	A (A)	-
Abbott Point of Care	Westbound left/right	0.10 (0.34)	A (A)	7 (20)
	Northbound through	0.26 (0.12)	A (A)	7 (9)
	Northbound right	0.05 (0.01)	A (A)	0 (1)
	Southbound left	0.03 (0.01)	A (A)	1 (m1)
	Southbound through	0.04 (0.30)	A (A)	1 (17)
	Overall	0.25 (0.30)	A (A)	-
Corkstown Rd	Eastbound left/through/right	0.26 (0.48)	A (A)	14 (34)
	Westbound left/through/right	0.55 (0.81)	A (D)	26 (43)
	Northbound left	0.03 (0.36)	A (A)	m3 (16)
	Northbound through	0.54 (0.14)	A (A)	62 (17)
	Northbound right	0.15 (0.12)	A (A)	4 (6)
	Southbound left	0.04 (0.01)	A (A)	1 (m1)
	Southbound through	0.10 (0.66)	A (B)	10 (70)
	Southbound right	0.00 (0.00)	A (A)	0 (m0)
Overall	0.53 (0.65)	A (B)	-	

² At the time of the count, South Ring Road was closed, but it will be opened when the new Department of National Defense campus is full open

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Hwy 417 westbound ramps	Westbound left	0.71 (0.71)	C (C)	43 (45)
	Westbound through (bus only)	0.00 (0.00)	A (A)	0 (0)
	Westbound right	0.48 (0.07)	A (A)	0 (0)
	Northbound through	0.20 (0.12)	A (A)	m22 (11)
	Southbound through	0.13 (0.58)	A (A)	11 (25)
	Southbound right	0.06 (0.15)	A (A)	0 (0)
	Overall	0.44 (0.61)	A (B)	-
Hwy 417 eastbound ramps	Eastbound left	1.09 (0.37)	F (A)	#143 (23)
	Eastbound through (bus only)	0.16 (0.01)	A (A)	12 (1)
	Eastbound right	0.41 (0.14)	A (A)	0 (0)
	Northbound through	0.29 (0.17)	A (A)	30 (14)
	Northbound right	0.10 (0.26)	A (A)	0 (0)
	Southbound through	0.28 (0.33)	A (A)	10 (25)
	Overall	0.66 (0.64)	B (B)	-

Most intersections in the Moodie Drive corridor operate well, with the exception of the intersection of Moodie Drive / Carling Avenue in the AM peak hour. The level of service at this intersection is LOS 'E' in the AM peak hour, mainly due to the high volume of northbound left turners (763 vehicles in the AM peak, LOS 'F'). All other movements at this intersection operate well in both peak hours.

Besides the northbound left turn at Carling Avenue, the only other turning movement along Moodie Drive that operates poorly is the eastbound left turn at the intersection with the Highway 417 eastbound ramps. This movement has 472 vehicles in the AM peak hour, resulting in a LOS 'F'.

3.0 Future Road Network and Transit Conditions

Future horizon years for this analysis are 2023 (the year Stage 2 LRT is expected to commence revenue service) and 2031 (the final year encompassed by the City of Ottawa Transportation Master Plan). The future scenarios to be evaluated are BRT to Moodie Drive, and LRT to Moodie Drive.

Information from the City's Regional Transportation Model was used to develop projected traffic volumes in the study area. **Table 4** below indicates the approximate growth/reduction in traffic volumes on all major roads in the study area from 2011 to 2031, according to the City's model.

Table 4 – 2011 to 2031 Background Growth

Corridor	Section	Northbound Growth (%)	Southbound Growth (%)
Holly Acres Road	North of Highway 417	55%	-4%
	South of Highway 417	14%	11%
Moodie Dr	North of Highway 417	29%	< -1%
	South of Highway 417	97%	< -1%
Corridor	Section	Eastbound Growth (%)	Westbound Growth (%)
Corkstown Road	East of Moodie Dr	-11%	-
	West of Moodie Dr	8%	-
Carling Ave	East of Moodie Dr	4%	6%
	West of Moodie Dr	5%	-7%

The largest growth is expected to be the northbound traffic on Moodie Drive, south of Highway 417. This is likely due to the new Department of National Defense (DND) campus, which is expected to generate significant traffic volumes due to employing more than 8,900 people on campus. Based on availability of more detailed information from traffic studies completed in support of the DND relocation (see **Section 3.1**), future traffic projections for the Moodie Drive were developed based on that information rather than the Regional Transportation Model.

A decrease in traffic is anticipated for southbound Holly Acres Road traffic north of Highway 417, eastbound Corkstown Road traffic east of Moodie Drive, and westbound Carling Avenue traffic west of Moodie Drive. The forecast reduction in traffic on Holly Acres Road and Corkstown Road is likely due to mode shift in the corridor, which sees vehicular traffic reduced in favour of transit, cycling and walking mode shares based on increased proximity to rapid transit. Additionally, the planned expansion of the westerly segment of Highway 417 will offer an alternative east/west route for Carling Avenue traffic. All growth rates will be applied to the existing turning movement volumes and used in the evaluation of 2023 and 2031 future traffic operations.

3.1 Department of National Defense Campus

One of the major changes in the study area from existing conditions to the horizon year will be the incorporation of the new Department of National Defense complex at the old Nortel campus on Moodie Drive. Employees have already started to move into the new location, and the campus is expected to be fully occupied by 2019 with over 8,900 employees on campus.

Three traffic studies have been completed related to the DND campus relocation, including an initial study completed by plania in 2014, a Transportation Demand Management Plan completed by Defense Construction Canada in 2015, and an update to the plania study, completed by Parsons Corporation in 2015. The Parsons

update was completed after the release of the TDM plan and is the most recent study, therefore the recommendations and turning movement volumes from that study will be used in this report.

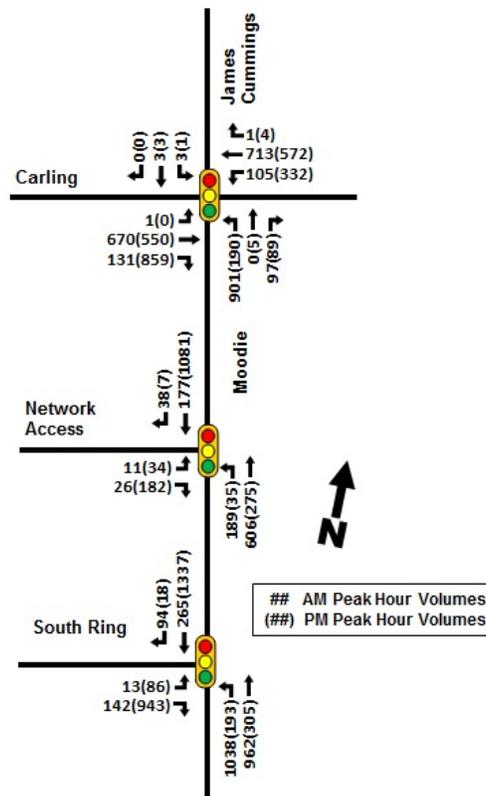
Four accesses to campus were analyzed for the study:

- Carling Avenue / North Access Road,
- Moodie Drive / North Ring Road,
- Moodie Drive / North Access Road, and,
- Moodie Drive / South Ring Road.

The intersection of Moodie Drive and South Ring Road is the only intersection that had recommended changes to accommodate the DND move. The Moodie Drive / North Access Road entrance will be less frequently used in the future due to a reconfiguration for higher security, therefore the majority of employee traffic will use the intersection of Moodie Drive / South Ring Road. The increased demand in the PM peak hour at this intersection means that a second eastbound right turn lane is recommended at this intersection, to accommodate the high traffic volumes bound for Highway 417. To accommodate this change, a no right-turn on red restriction is recommended for the eastbound approach, as well as the removal of the crosswalk on the south side of the intersection (the crosswalk on the north side of the intersection is to remain in place).

The traffic to and from the DND campus on Moodie Drive was added to the existing volumes along Moodie Drive, back to Highway 417. These new background volumes are indicated in **Figure 5** for the 2023 horizon. Since the DND campus is expected to be fully operational by 2019, it is not expected that there will be a large difference in Moodie Drive traffic volumes from 2023 to 2031.

Figure 5 – Future (2023) Turning Movement Volumes at DND Campus and Moodie Drive

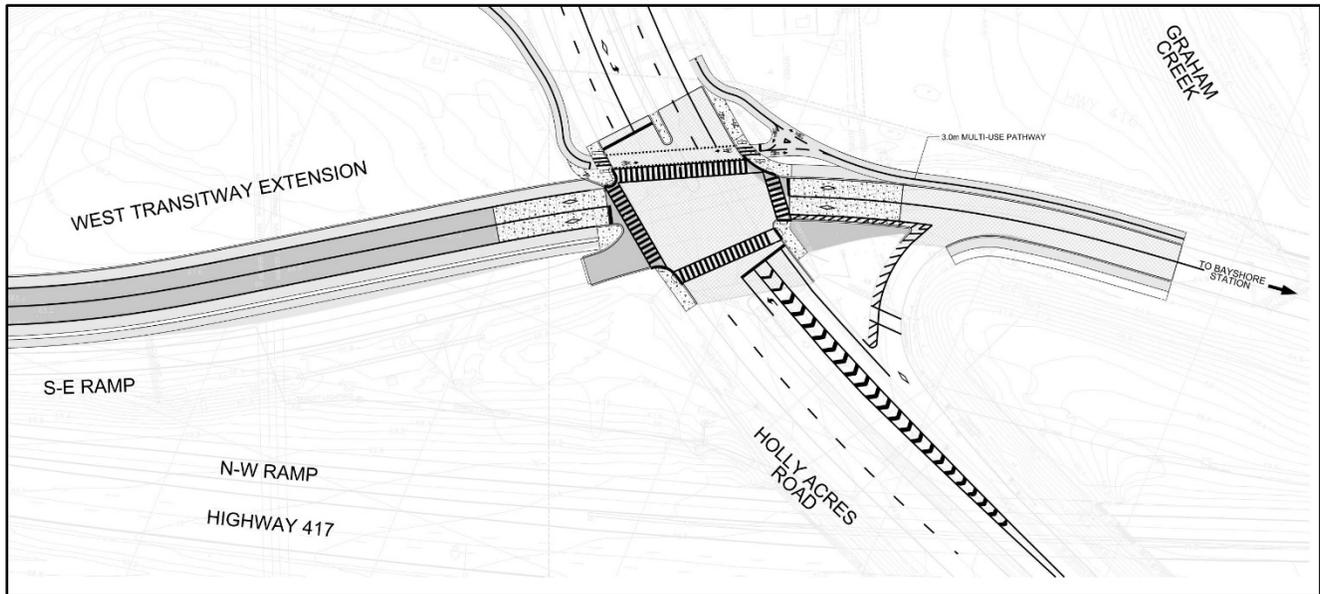


3.2 West Transitway Extension

The West Transitway Extension to Moodie Drive is expected to be operational in 2017. The extension will continue the BRT Transitway west of Bayshore Station, through the intersection of Holly Acres Road / Bayshore Station, and continue to Moodie Drive.

The future configuration of the Holly Acres Road / Bayshore Station – Highway 417 WB on-ramp intersection is indicated in **Figure 6** below. The west Transitway will cross Holly Acres Road at-grade, while the existing north/south to west ramp for Highway 417 will remain operational.

Figure 6 – Future Intersection of Holly Acres Road / Bayshore Station



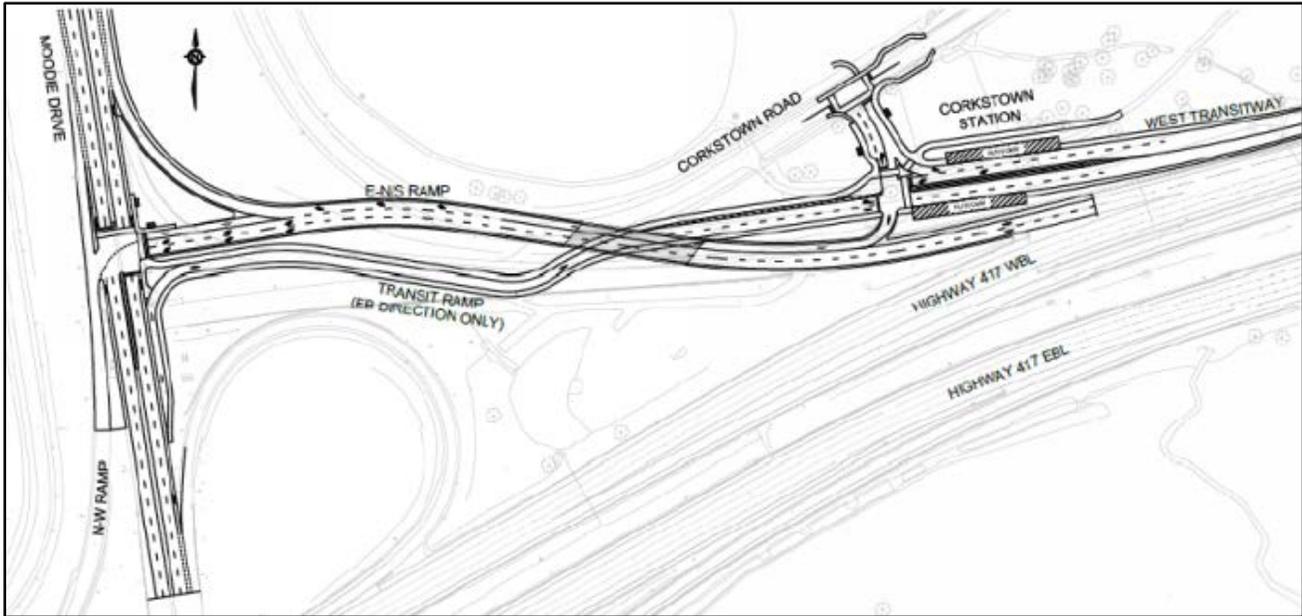
OC Transpo provided 2023 transit volume projections for the West Transitway extension. The volumes are shown in **Table 5**. Buses to/from the West Transitway Extension will travel eastbound-westbound through the intersection, while buses to/from Holly Acres Road will travel westbound left and northbound right through the intersection.

Table 5 – West Transitway Bus Volumes

Routes	Direction	AM Peak Hour	PM Peak Hour
Bayshore Station to West Transitway Extension	Eastbound	70	30
	Westbound	35	65
Bayshore Station to Holly Acres Road	Eastbound	30	15
	Westbound	25	35

The West Transitway alignment will continue on the north side of Highway 417, and therefore will not directly impact traffic on the highway. Closer to Moodie Drive a new Transitway station will be built south of Corkstown Road, known as Corkstown Station. This station will serve local residents in the Corkstown Road area, as well as provide an access point for buses to merge into general traffic on Moodie Drive / Highway 417 ramps, as indicated on **Figure 7**³.

Figure 7 – Moodie Drive and Corkstown Station



A kiss and ride facility will be provided at Corkstown Station to pick up and drop off passengers, however it is expected that this will only be used by residents of the local community, therefore no additional traffic volumes are anticipated on Moodie Drive as a result of Corkstown Station⁴.

From the 2023 OC Transpo Service Plan⁵, most buses that use Corkstown Station are Transitway buses that will continue to run from Kanata to Bayshore Station. These buses will use the bus-only accesses from Highway 417 into and out of Corkstown Station. However, there are two routes that will run on Moodie Drive that will be added to the turning movement volumes for this: Route 58 and Route 65, both of which serve the DND campus. These bus volumes will be added to the intersections north of Moodie Drive at Corkstown Road.

³ Source: Ottawa Stage 2 LRT Extension – Ridership Forecasts for Trim and Moodie Stations, AECOM, July 2016

⁴ Source: West Transitway Extension – Bayshore Station to Moodie Drive EPR, MRC, June 2012

⁵ Source: AECOM, June 7, 2016

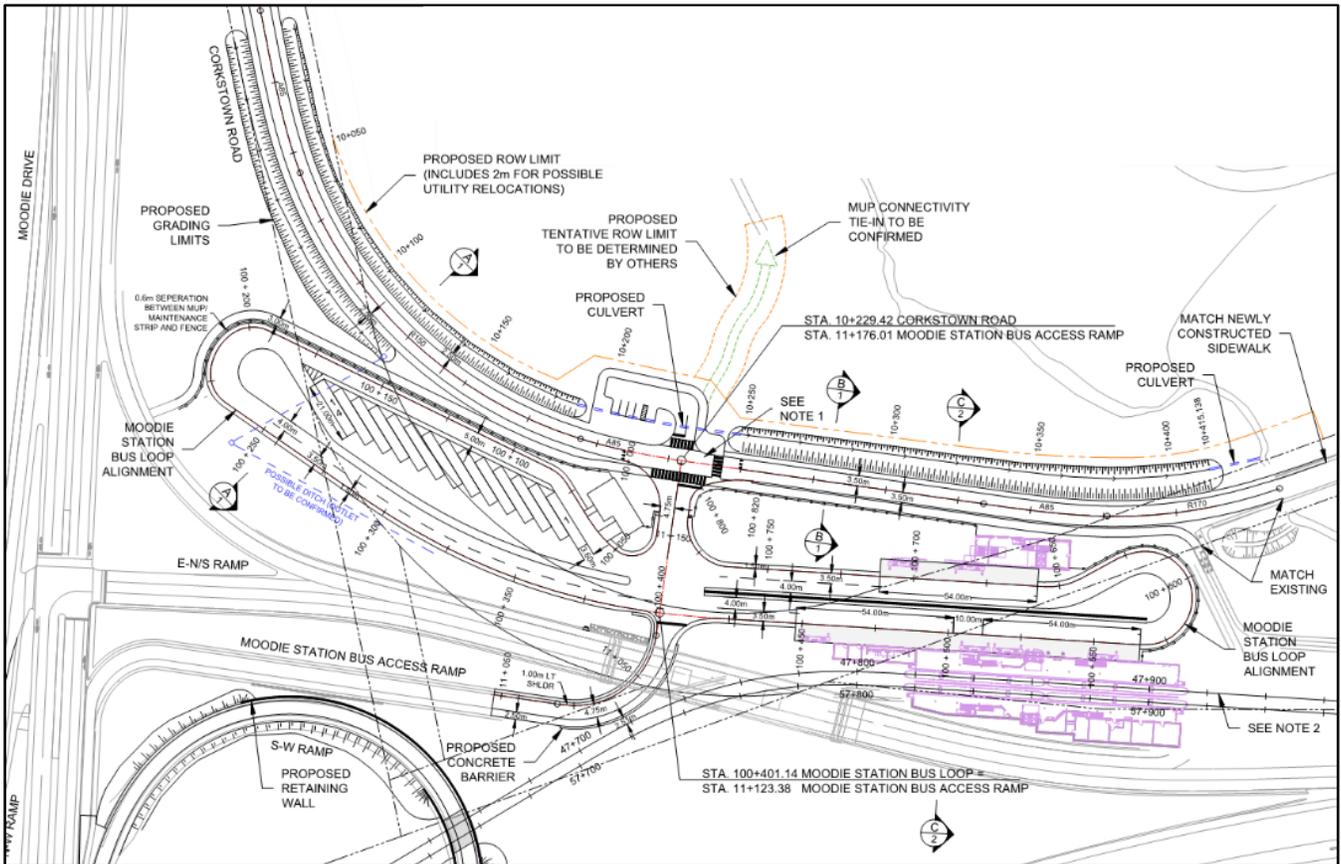
3.3 BRT to LRT Conversion

As part of the Stage 2 LRT project, the planned BRT alignment between Bayshore Station and Moodie Drive will be converted to a fully grade separated LRT facility. The LRT will follow the same general alignment as the BRT along the north side of Highway 417 between Holly Acres Road and Moodie Drive, and includes the conversion of Corkstown Station from a BRT station to a BRT / LRT station. This also includes changing the name of Corkstown Station to Moodie Station.

Due to the grade separation of the LRT track, east-west Transitway buses that would previously access Bayshore Station at the intersection of Holly Acres Road and Bayshore Station / Highway 417 WB on-ramp will be removed from the intersection. The only buses entering Bayshore Station will be buses that travel on Holly Acres Road.

At the future Moodie Station, the placement of the LRT station as well as the placement of the LRT tail track south of the bus loops will prevent westbound buses from using the direct exit from Moodie Station to the Highway 417 off-ramp that was constructed as part of the West Transitway extension. This will force westbound Kanata buses to use the intersection of Moodie Drive and Corkstown Road, instead of Moodie Drive and Highway 417 WB ramps. In addition, there is also potential for the LRT tail track to cause the realignment of the eastbound bus access to Moodie Station from Moodie Drive. It may prove more financially feasible to not rebuild this ramp, and instead allow eastbound buses to use the intersection of Moodie Drive and Corkstown Road to access Moodie Station. **Figure 8** indicates the proposed layout of the Moodie LRT Station.

Figure 8 – Moodie LRT Station

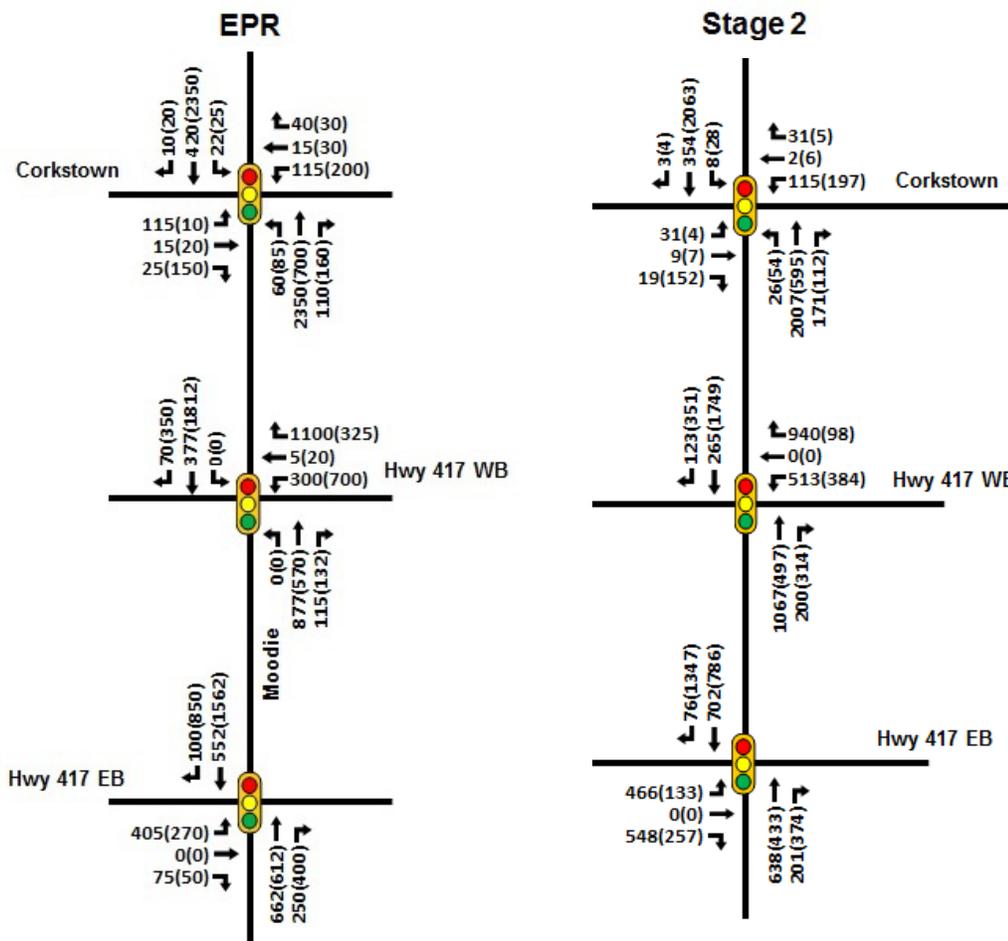


4.0 Future Traffic Operations

4.1 Volume Comparison to EPR Document

As previously indicated, new traffic volumes generated by the DND campus relocation to the area were taken from the most recent study for the campus, completed in 2015. Given that the EPR document was finalized in 2012, to ensure that the results of this study are in line with the results from the original Environmental Project Report (EPR), a comparison was made between the volumes used in this study and the volumes used in the ESR. **Figure 9** indicates the different turning movement volumes used for both studies.

Figure 9 – Volume Comparison



The volumes used in this study are generally in line with the volumes used in the original EPR document. There are slight differences in northbound and southbound volumes on Moodie Drive, likely due to a change in the travel modes assumed for the Carling DND campus. The Transportation Demand Management (TDM) Plan for the DND campus was completed in April of 2015, after the completion of the EPR.

4.2 Traffic Operations - 2023

Intersection operations were reviewed for the 2023 horizon year at all intersections in the study area. Two scenarios were analyzed for the 2023 horizon year: one with the LRT out to Bayshore Station and BRT to Moodie Drive, and one with the LRT all the way to Moodie Drive.

For both analyses it was assumed that the DND campus is fully built out to accommodate the projected 9,000 employees, as described in **Section 3.1**. All other background traffic growth in the study area was taken from the City of Ottawa's EMME model.

Future 2023 intersection performance for all signalized intersections in the study area is shown in **Table 6** and **Table 7**. As in existing conditions, the intersections were modelled using Synchro Version 9. Minor adjustments were made to the City's signal timing plans, where required, in order to maintain an acceptable intersection LOS.

Table 6 – Future Intersection Operations: 2023 BRT

Intersection	Intersection Performance			Critical Movements			
	Delay (s)	v/c ratio	LOS	Movement	v/c ratio	LOS	95 th % Queue
Holly Acres & Carling	6 (7)	0.23 (0.33)	A (A)	WBT (WBL)	0.25 (0.51)	A (A)	17 (29)
Holly Acres / Nanaimo & Richmond	34 (32)	0.69 (0.76)	B (C)	EBL (EBL)	0.80 (0.80)	C (C)	#132 (#78)
Holly Acres & Hwy 417 WB / Bayshore	17 (21)	0.62 (0.57)	B (A)	WBLTR (WBLTR)	0.62 (0.76)	B (C)	28 (42)
Holly Acres & Hwy 416/417 EB	26 (14)	0.82 (0.65)	D (B)	EBR (NBR)	0.84 (0.66)	D (B)	144 (20)
Moodie / James Cummings & Carling	37 (15)	0.74 (0.79)	C (C)	NBLT (EBR)	1.03 (0.80)	F (C)	#176 (#63)
Moodie & Network Access	9 (12)	0.28 (0.51)	A (A)	NBL (EBR)	0.51 (0.58)	A (A)	22 (20)
Moodie & South Ring	12 (27)	0.52 (0.65)	A (B)	NBL (EBR)	0.67 (0.82)	B (D)	115 (95)
Moodie & Abbott	5 (6)	0.66 (0.54)	B (A)	NBT (SBT)	0.66 (0.54)	B (A)	115 (96)
Moodie & Corkstown	14 (28)	0.79 (0.90)	C (D)	NBT (SBT)	0.81 (0.93)	D (E)	207 (#300)
Moodie & Hwy 417 WB	11 (14)	0.61 (0.81)	B (D)	WBL (SBT)	0.76 (0.82)	C (D)	49 (139)
Moodie & Hwy 417 EB	19 (6)	0.67 (0.75)	B (C)	EBL (SBR)	0.84 (0.77)	D (C)	98 (25)

Table 7 – Future Intersection Operations: 2023 LRT

Intersection	Intersection Performance			Critical Movements			
	Delay (s)	v/c ratio	LOS	Movement	v/c ratio	LOS	95 th % Queue
Holly Acres & Carling	6 (7)	0.23 (0.33)	A (A)	WBT (WBL)	0.25 (0.51)	A (A)	17 (29)
Holly Acres / Nanaimo & Richmond	33 (32)	0.66 (0.74)	B (C)	SBR (EBL)	0.76 (0.78)	C (C)	26 (#66)
Holly Acres & Hwy 417 WB / Bayshore	9 (13)	0.50 (0.38)	A (A)	NBTR (WBLTR)	0.51 (0.50)	A (A)	69 (19)
Holly Acres & Hwy 416/417 EB	26 (13)	0.82 (0.65)	D (B)	EBR (NBR)	0.84 (0.66)	D (B)	144 (20)
Moodie / James Cummings & Carling	37 (15)	0.74 (0.79)	C (C)	NBLT (EBR)	1.03 (0.80)	F (C)	#176 (#63)
Moodie & Network Access	9 (13)	0.28 (0.52)	A (A)	NBL (EBR)	0.51 (0.62)	A (B)	22 (23)
Moodie & South Ring	12 (27)	0.52 (0.65)	A (B)	NBL (EBR)	0.67 (0.82)	B (D)	115 (95)
Moodie & Abbott	5 (6)	0.66 (0.54)	B (A)	NBT (SBT)	0.67 (0.55)	B (A)	116 (97)
Moodie & Corkstown	20 (39)	0.84 (0.96)	D (E)	NBT (SBT)	0.87 (1.00)	D (E)	#287 (#300)
Moodie & Hwy 417 WB	11 (14)	0.61 (0.80)	B (C)	WBL (SBT)	0.76 (0.81)	C (D)	49 (139)
Moodie & Hwy 417 EB	18 (6)	0.63 (0.75)	B (C)	EBL (SBR)	0.81 (0.77)	D (C)	87 (25)

In both future 2023 scenarios, all intersections in the Holly Acres Road corridor continue to operate well in both peak hours, with no intersection or individual turning movement operating with an overall LOS lower than LOS 'D'. The addition of east-west Transitway buses to the intersection of Holly Acres Road and Bayshore Station in the BRT scenario lowered the intersection from LOS 'A' to LOS 'B' in the AM peak hour. Some queueing issues are noted at the Holly Acres Road / Highway 416-417 Off-Ramps and Holly Acres Road / Richmond Road intersections, however the reported queues are not considered to be severe and critical issues are not expected in the future condition.

Similar to existing conditions, most intersections on Moodie Drive near the DND campus operate well. As discussed in **Section 3.1**, the road network in this area can accommodate the additional traffic generated by the new DND campus. The only change made to the road network here was the addition of a second eastbound right turn lane to the intersection of Moodie Drive and South Ring Road, as recommended in the Parsons study. The intersection of Moodie Drive / Carling Avenue improved in LOS since some of the northbound left turn volumes now use the South Ring Road to access the DND campus, although the northbound left turn continues to operate poorly, with a LOS 'F' in the AM peak hour. All other movements at this intersection operate well in both peak hours.

The intersection of Moodie Drive at Corkstown Road sees a large change in its LOS, due to the increase of north-south traffic from the DND campus, as well as the increase in buses using Corkstown Road to access Moodie LRT Station. **Section 4.4** includes a more detailed analysis of this intersection.

4.3 Traffic Operations - 2031

Intersection operations were reviewed for the 2031 horizon year at all intersections in the study area. Two scenarios were analyzed for the 2031 horizon year: one with the LRT out to Bayshore Station and BRT to Moodie Drive, and one with the LRT all the way to Moodie Drive.

For both analyses it was assumed that the DND campus is fully built out to accommodate the projected 9,000 employees, as described in **Section 3.1**. All other background traffic growth in the study area was taken from the City of Ottawa's Regional Transportation Model.

Future 2031 intersection performance for all signalized intersections in the study area is shown in **Table 8** and **Table 9**. As in previous scenarios, the intersections were modelled using Synchro Version 9. Minor adjustments were made to the City's signal timing plans, where required, in order to maintain an acceptable intersection LOS.

Table 8 – Future Intersection Operations: 2031 BRT

Intersection	Intersection Performance			Critical Movements			
	Delay (s)	v/c ratio	LOS	Movement	v/c ratio	LOS	95 th % Queue
Holly Acres & Carling	8 (7)	0.30 (0.39)	A (A)	WBT (WBL)	0.33 (0.65)	A (B)	17 (#74)
Holly Acres / Nanaimo & Richmond	34 (32)	0.69 (0.77)	B (C)	EBL (EBL)	0.80 (0.80)	C (C)	#133 (#78)
Holly Acres & Hwy 417 WB / Bayshore	20 (23)	0.76 (0.59)	C (A)	NBTR (WBLTR)	0.78 (0.76)	C (C)	#209 (42)
Holly Acres & Hwy 416/417 EB	27 (14)	0.82 (0.65)	D (B)	EBR (NBR)	0.85 (0.66)	D (B)	151 (20)
Moodie / James Cummings & Carling	42 (22)	0.87 (0.93)	D (E)	NBLT (EBR)	1.08 (0.97)	F (E)	#189 (#167)
Moodie & Network Access	9 (13)	0.28 (0.52)	A (A)	NBL (EBR)	0.51 (0.61)	A (A)	22 (22)
Moodie & South Ring	12 (27)	0.52 (0.65)	A (B)	NBL (EBR)	0.67 (0.82)	B (D)	115 (95)
Moodie & Abbott	5 (6)	0.66 (0.54)	B (A)	NBT (SBT)	0.67 (0.55)	B (A)	117 (96)
Moodie & Corkstown	14 (29)	0.79 (0.90)	C (D)	NBT (NBL)	0.81 (0.95)	D (E)	207 (#27)
Moodie & Hwy 417 WB	12 (14)	0.61 (0.76)	B (C)	WBL (WBL)	0.84 (0.78)	D (C)	#64 (50)
Moodie & Hwy 417 EB	19 (10)	0.64 (0.90)	B (D)	EBL (SBR)	0.83 (0.94)	D (E)	92 (#42)

Table 9 – Future Intersection Operations: 2031 LRT

Intersection	Intersection Performance			Critical Movements			
	Delay (s)	v/c ratio	LOS	Movement	v/c ratio	LOS	95 th % Queue
Holly Acres & Carling	8 (7)	0.30 (0.39)	A (A)	WBT (WBL)	0.33 (0.65)	A (B)	17 (#74)
Holly Acres / Nanaimo & Richmond	34 (32)	0.67 (0.76)	B (C)	EBL (EBL)	0.77 (0.78)	C (C)	#125 (#66)
Holly Acres & Hwy 417 WB / Bayshore	11 (13)	0.63 (0.39)	B (A)	NBTR (WBLTR)	0.65 (0.47)	B (A)	126 (19)
Holly Acres & Hwy 416/417 EB	27 (14)	0.82 (0.65)	D (B)	EBR (NBR)	0.85 (0.66)	D (B)	151 (20)
Moodie / James Cummings & Carling	42 (22)	0.87 (0.93)	D (E)	NBLT (EBR)	1.08 (0.97)	F (E)	#189 (#167)
Moodie & Network Access	9 (13)	0.28 (0.52)	A (A)	NBL (EBR)	0.51 (0.62)	A (B)	22 (23)
Moodie & South Ring	12 (27)	0.52 (0.65)	A (B)	NBL (EBR)	0.67 (0.82)	B (D)	115 (95)
Moodie & Abbott	5 (6)	0.66 (0.54)	B (A)	NBT (SBT)	0.67 (0.55)	B (A)	115 (97)
Moodie & Corkstown	22 (43)	0.86 (0.98)	D (E)	NBT (SBT)	0.89 (1.02)	D (F)	#291 (#302)
Moodie & Hwy 417 WB	12 (13)	0.61 (0.76)	B (C)	WBL (WBL)	0.84 (0.78)	D (C)	#64 (50)
Moodie & Hwy 417 EB	18 (10)	0.61 (0.90)	B (D)	EBL (SBR)	0.81 (0.94)	D (E)	85 (#42)

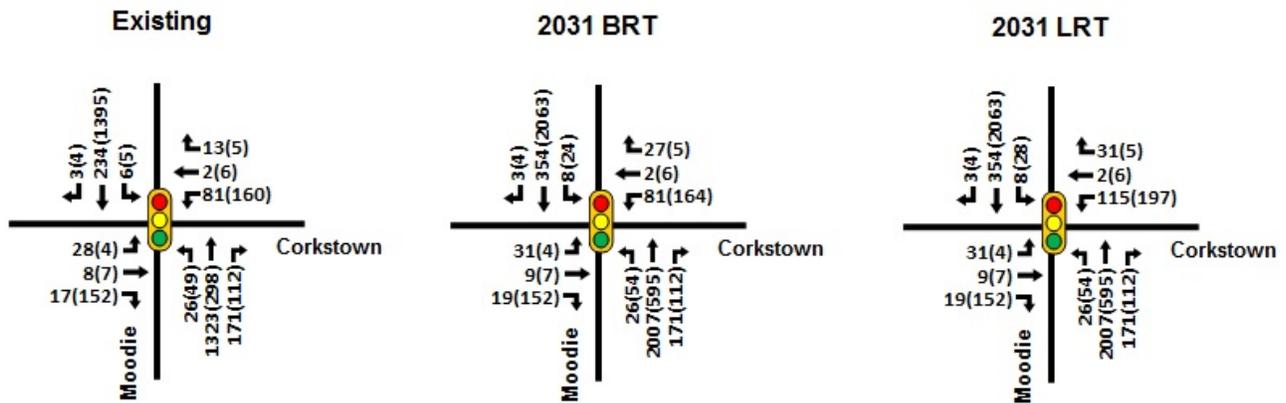
There are no major changes in intersection operations from 2023 to 2031 for both the Moodie BRT and Moodie LRT scenarios. Intersections that operated well in the 2023 scenario continue to operate well in the 2031 scenario, and intersections that operated poorly in the 2023 scenario continue to operate poorly in the 2031 scenario. Due to the potential operational issues at the signalized intersection of Moodie Drive at Corkstown Road, as well as its proximity to Moodie LRT Station, it is analyzed in more detail in **Section 4.4** below.

4.4 Moodie Drive at Corkstown Road Intersection Operations

The intersection that is most impacted by the Moodie LRT Station is the intersection of Moodie Drive at Corkstown Road. The increased transit volumes at this intersection, combined with the increased general traffic to and from the DND campus causes a significant deterioration in the LOS.

The existing intersection consists of two through lanes in the northbound and southbound directions, left and right turning lanes in the northbound and southbound directions, and a single lane on the eastbound and westbound approaches. The existing intersection turning movements and 2031 turning movements for both LRT and BRT scenarios are shown in **Figure 10** below. The intersection operations for existing and 2031 scenarios are shown in **Table 10**.

Figure 10 – Moodie Drive at Corkstown Road Turning Movement Volumes



Significant changes in traffic volumes at this intersection are noted below:

- There is a large increase in north-south general traffic in the corridor due to the full buildout of the DND campus;
- Due to the presence of a shuttle bus that will be between the DND campus and Moodie Station, volumes were added to the westbound right turn and southbound left turn movements;
- The westbound through movement at Highway 417 westbound ramps in the existing and 2031 BRT scenarios is shifted to the westbound left turn movement at Corkstown Road for the 2031 LRT scenario. This is due to the Moodie LRT Station blocking the westbound bus-only ramp that is present in the 2031 BRT scenario, shifting westbound transit to the intersection of Corkstown Road.

Table 10 – Moodie Drive at Corkstown Road Intersection Operations

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Existing Conditions	Eastbound left/through/right	0.26 (0.48)	A (A)	14 (34)
	Westbound left/through/right	0.55 (0.81)	A (D)	26 (43)
	Northbound left	0.03 (0.36)	A (A)	m3 (16)
	Northbound through	0.54 (0.14)	A (A)	62 (17)
	Northbound right	0.15 (0.12)	A (A)	4 (6)
	Southbound left	0.04 (0.01)	A (A)	1 (m1)
	Southbound through	0.10 (0.66)	A (B)	10 (70)
	Southbound right	0.00 (0.00)	A (A)	0 (m0)
	Overall	0.53 (0.65)	A (B)	-
2031 BRT Conditions	Eastbound left/through/right	0.32 (0.48)	A (A)	19 (47)
	Westbound left/through/right	0.64 (0.91)	B (E)	37 (#67)
	Northbound left	0.04 (0.95)	A (E)	4 (#27)
	Northbound through	0.81 (0.27)	D (A)	207 (40)
	Northbound right	0.15 (0.11)	A (A)	8 (6)
	Southbound left	0.20 (0.10)	A (A)	4 (6)
	Southbound through	0.14 (0.93)	A (E)	18 (#300)

	Southbound right	0.00 (0.00)	A (A)	0 (0)
	Overall	0.79 (0.90)	C (D)	-
2031 LRT Conditions	Eastbound left/through/right	0.22 (0.41)	A (A)	17 (48)
	Westbound left/through/right	0.77 (0.98)	C (E)	48 (#92)
	Northbound left	0.04 (0.97)	A (E)	6 (#25)
	Northbound through	0.89 (0.30)	D (A)	#291 (40)
	Northbound right	0.17 (0.13)	A (A)	11 (6)
	Southbound left	0.18 (0.10)	A (A)	4 (6)
	Southbound through	0.16 (1.02)	A (F)	23 (#302)
	Southbound right	0.00 (0.00)	A (A)	0 (0)
	Overall	0.86 (0.98)	D (E)	-

The intersection operates well under the existing turning movements, as the lowest LOS for any individual movement is a LOS 'C' in the PM peak hour for the westbound approach.

In the 2031 BRT scenario the intersection continues to operate well, however the southbound through movement in the PM peak hour is approaching capacity, with a LOS 'E' and a v/c ratio of 0.93.

The overall intersection LOS for the 2031 LRT scenario decreases to a LOS 'E' in the PM peak hour with a v/c ratio of 0.98 that indicates that the intersection is approaching capacity. However, according to the City of Ottawa's Transportation Improvement Plan Guidelines, a LOS 'E' is acceptable at locations within 600 metres of a rapid transit station. This would indicate that the LOS 'E' at this intersection is acceptable, however there are still potential modifications to explore particularly to address potential transit priority for westbound buses at this location.

Another complication at this intersection is that a bi-directional crossside will be provided on the north leg of this intersection in the future. A bi-directional crossside requires its own protected signal phasing, so that vehicles are not conflicting with cyclists on the crossside. The only acceptable vehicular movement that can conflict with the crossside is a right turn, in this case the westbound right turn. In light of the provision of a bi-directional crossside on the north side of the intersection, no crosswalk will be provided on the south side of the intersection. In addition to a lack of other pedestrian / cycling facilities on the south side of the intersection, this will also allow for more green time to be provided for general traffic in the rest of the intersection.

4.4.1. Potential Modifications for Moodie Drive at Corkstown Road Intersection

Option 1 – Widen Moodie Drive

The first option is to widen the intersection to accommodate a third N-S through lane in each direction. Given the relatively low volume of right turning vehicles in both directions during the AM and PM peak hours, this would involve the conversion of the right turn lanes into shared through/right turn lanes, and widening the roadway on the side of the receiving lanes to accommodate three general purpose traffic lanes.

Widening Moodie Drive would accommodate more traffic in the northbound-southbound direction, allowing for more green time to be assigned to the eastbound and westbound direction. The results of this option are shown in **Table 11**.

Table 11 – Moodie Drive at Corkstown Road Option 1 Operations

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Option 1 – Widen Moodie Drive	Eastbound left/through/right	0.25 (0.55)	A (A)	15 (19)
	Westbound left/through/right	0.70 (0.37)	B (A)	40 (12)
	Northbound left	0.04 (0.68)	A (B)	6 (#31)
	Northbound through/right	0.71 (0.21)	C (A)	151 (22)
	Southbound left	0.19 (0.11)	A (A)	5 (6)
	Southbound through/right	0.12 (0.59)	A (A)	17 (96)
	Overall	0.70 (0.59)	B (A)	-

This option improves operations for the entire intersection, with the overall intersection operating at a LOS ‘B’ in the AM peak hour and a LOS ‘a’ in the PM peak hour, compared to a LOS ‘D’ and LOS ‘E’ in the previous scenario.

This option is not recommended due to the additional cost to widen Moodie Drive, as well as the fact that the intersection is operating acceptably in the base 2031 LRT scenario. The goal of the City’s Transportation Improvement Plan Guidelines is to prevent overbuilding of roadways and intersections, and given the low volume of traffic in the off-peak direction, three northbound and southbound lanes at this intersection would only be required for the peak hours of the day.

Option 2 – Westbound Left Turn Lanes

The second option is to implement westbound left turn lanes at the intersection. Given that the majority of the westbound traffic is turning left (78% in AM peak, 95% in PM peak), this would provide the most benefit to the westbound through and right turning vehicles that would no longer be stuck behind the queue of left turning vehicles. Table 11 evaluates a variety of options for westbound left turn lanes, with one or two turn lanes, as well as different signal timing options, listed below:

- Option 2a – New westbound left turn lane, standard signal timing, crossside phase prior to east-west phase;
- Option 2b – New westbound left turn lane, existing westbound left/through/right lane remains, split phasing, crossside phase during westbound phase;
- Option 2c – New double westbound left turn lane, new eastbound left turn lane, fully protected left turns, crossside during east-west through/right phase.

Table 11 – Moodie Drive at Corkstown Road Option 2 Operations

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Option 2a – Westbound Left Turn	Eastbound left/through/right	0.30 (0.33)	A (A)	19 (24)
	Westbound left	0.63 (0.87)	B (D)	41 (#82)
	Westbound through/right	0.16 (0.02)	A (A)	8 (5)
	Northbound left	0.04 (0.93)	A (E)	6 (#27)
	Northbound through	0.86 (0.30)	D (A)	#292 (50)
	Northbound right	0.16 (0.12)	A (A)	14 (8)
	Southbound left	0.23 (0.13)	A (A)	#6 (8)
	Southbound through	0.15 (1.03)	A (F)	24 (#334)
	Southbound right	0.00 (0.00)	A (A)	0 (0)
Overall	0.83 (0.97)	D (E)	-	

Option 2b – Westbound Left Turn, Split Phasing	Eastbound left/through/right	0.42 (0.70)	A (B)	24 (#38)
	Westbound left/through/right	0.72 (0.80)	C (C)	55 (74)
	Northbound left	0.04 (1.04)	A (F)	7 (#30)
	Northbound through	0.94 (0.31)	E (A)	#337 (56)
	Northbound right	0.17 (0.13)	A (A)	18 (8)
	Southbound left	0.25 (0.14)	A (A)	#7 (9)
	Southbound through	0.17 (1.08)	A (F)	30 (#364)
	Southbound right	0.00 (0.00)	A (A)	0 (0)
	Overall	0.91 (1.03)	E (F)	-
Option 2c – Double Westbound Left Turn	Eastbound left	0.26 (0.03)	A (A)	17 (4)
	Eastbound through/right	0.21 (0.73)	A (C)	11 (54)
	Westbound double left	0.49 (0.78)	A (C)	24 (#41)
	Westbound through/right	0.27 (0.03)	A (A)	10 (6)
	Northbound left	0.04 (0.97)	A (E)	5 (#28)
	Northbound through	0.82 (0.29)	D (A)	224 (51)
	Northbound right	0.15 (0.12)	A (A)	12 (8)
	Southbound left	0.24 (0.13)	A (A)	5 (8)
	Southbound through	0.15 (1.01)	A (F)	19 (#347)
	Southbound right	0.00 (0.00)	A (A)	0 (0)
	Overall	0.79 (0.97)	C (E)	-

The single westbound left turn lane has a minimal impact on the intersection operations, as it reduces the overall v/c ratio in the PM peak hour from 0.98 to 0.97. The westbound left turn has a v/c ratio of 0.87, versus the v/c ratio of 0.98 when there was no left turn lane. As expected, the westbound through/right lane operates well, although there are fewer than 40 vehicles per hour in peak hours.

The single westbound left turn lane with split phasing lowers the overall LOS for the intersection, to a LOS 'E' in the AM peak hour and a LOS 'F' in the PM peak hour. The split phasing increases the overall east-west green time, negatively impacting the heavier volume northbound through and southbound through movements.

The double westbound left turn lane improves the westbound left turn in the PM peak hour from a LOS 'E' to a LOS 'C'. In addition, the impact to the overall intersection is very minor: the v/c ratio in the AM peak hour decreases from 0.86 to 0.79, however the PM peak hour increases from 0.98 to 1.01. The peak direction flows (northbound in the AM and southbound in the PM) remain at a similar level of service as in the base 2031 LRT scenario.

Option 3 – Bus-Only Westbound Left Turn Lane

The third option is to implement a westbound bus-only left turn lane at the intersection. The main concern on the westbound approach is the delay to westbound buses to Kanata, therefore it may be preferable to implement a bus-only left turn lane that provide westbound buses with signal priority over westbound general traffic. Table 12 evaluates the option for a westbound bus-only left turn lane, with a transit priority phase that runs at the same time as the bi-directional crossside.

Table 12 – Moodie Drive at Corkstown Road Option 3 Operations

Intersection	Movement	v/c ratio (AM/PM)	LOS (AM/PM)	95 th % Queue (m) (AM/PM)
Option 3 – Westbound Bus Only Left Turn	Eastbound left/through/right	0.32 (0.36)	A (A)	18 (20)
	Westbound bus-only left	0.60 (0.65)	A (B)	#22 (#24)
	Westbound left/through/right	0.63 (0.91)	B (E)	36 (#66)
	Northbound left	0.04 (0.90)	A (D)	6 (#36)
	Northbound through	0.95 (0.33)	E (A)	#290 (52)
	Northbound right	0.17 (0.13)	A (A)	15 (8)
	Southbound left	0.22 (0.14)	A (A)	6 (9)
	Southbound through	0.17 (1.14)	A (F)	25 (#336)
	Southbound right	0.00 (0.00)	A (A)	0 (0)
	Overall	0.91 (1.07)	E (F)	-

The option with a westbound bus-only left turn lane that runs at the same time as a bi-directional crossside provides the worst overall intersection operation of all options that were evaluated. However, this is due to the trade-off made between general traffic and transit, as this option provides the best operations for the westbound bus movement. This impacts the peak directional movements in both peak hours: the northbound through in the AM peak hour increases from a 0.89 v/c to 0.95, and the southbound through movement in the PM peak hour increases from a 1.02 v/c to 1.14.

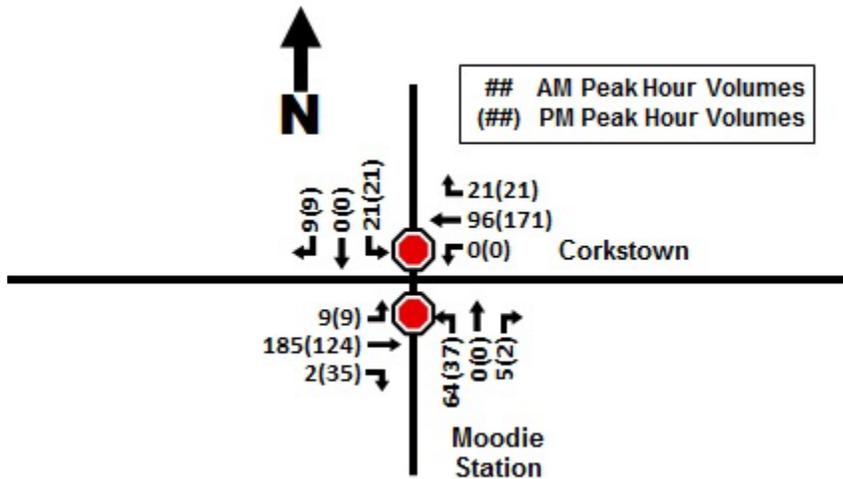
In this scenario with a bus-only lane, it would be important that the bus-only lane be designed long enough so that buses can always access the lane, and that it is not blocked by the queue from the general traffic westbound lane. To verify the queue lengths presented in Table 12 above, a SimTraffic analysis was undertaken for this scenario to confirm the 95th% queue lengths. The analysis indicated that the 95th% queue length for the westbound general traffic lane is 51m in the AM peak hour and 65m in the PM peak hour. Any bus-only lane implemented at this location would have to bypass these queues.

4.5 Corkstown Road at Moodie Station Intersection Operations

In the post LRT Stage 2 scenario, the intersection of Corkstown Road at Moodie Station will have a bus-only access into Moodie Station on the south side of the intersection and an access to the pedestrian pick-up and drop-off area (PPUDO) on the north side of the intersection. The analysis for the intersection of Corkstown Road and Moodie Station access was undertaken for the horizon year of 2031.

Traffic volumes at the intersection of Corkstown Road and Moodie Station were developed using the traffic count at the intersection of Moodie Drive / Corkstown Road, and grown to 2031 volumes by using EMME model growth rates. Transit volumes and routings were determined using the most recent version of the 2023 Transit Service Plan. There are 5 PPUDO stalls provided on the north side of the intersection. Due to a general lack of reliable studies on PPUDO rates, a conservative assumption of 30 vehicles per hour entering and exiting the PPUDO area was used. These vehicles were split 70% to the east and 30% to the west, due to the proximity of the large residential neighbourhood to the east. Traffic volumes for 2031 are shown in Figure 11 below for AM and PM peak hours.

Figure 11 – 2031 Volumes at Corkstown Road / Moodie Station



For the base case scenario, it was assumed that free-flow movement would be maintained on Corkstown Road, with stop controls for both the bus access and PPUDO access. Intersection operations for this scenario are shown in Table 13 below.

Table 13 – Two-way Stop Control Intersection Operations at Corkstown Road / Moodie Station

Movement	Synchro				SimTraffic		
	Delay (s)	LOS	v/c Ratio	95 th % queue	Delay (s)	LOS	95 th % queue
Eastbound	0 (0)	A (A)	0.01 (0.01)	0m (0m)	1 (1)	A (A)	3m (3m)
Westbound	0 (0)	A (A)	0.00 (0.00)	0m (0m)	2 (2)	A (A)	0m (0m)
Northbound	14 (14)	B (B)	0.15 (0.09)	4m (2m)	6 (5)	A (A)	30m (28m)
Southbound	11 (11)	B (B)	0.05 (0.05)	1m (0m)	4 (4)	A (A)	12m (14m)

The intersection will operate well under stop control in the 2031 horizon, due to the relatively low east-west vehicular volumes, which result in minimal delays from the stop controlled approaches.

A traffic signal warrant from OTM Book 12 was undertaken at this location using the projected 2031 traffic volumes shown. The intersection did not come close to meeting the signal warrant, fulfilling 25% of the Warrant 1 criteria and 23% of the Warrant 2 criteria. Despite not meeting the signal warrants, an operational analysis was undertaken for the intersection assuming traffic signals are installed. The results of this analysis are shown in Table 14.

Table 14 – Traffic Signal Operations at Corkstown Road / Moodie Station

Movement	Synchro				SimTraffic		
	Delay (s)	LOS	v/c Ratio	95 th % queue	Delay (s)	LOS	95 th % queue
Eastbound	16 (14)	B (B)	0.45 (0.44)	23m (18m)	11 (9)	B (A)	36m (34m)
Westbound	12 (14)	B (B)	0.26 (0.42)	13m (20m)	11 (12)	B (B)	24m (34m)
Northbound	5 (3)	A (A)	0.16 (0.09)	6m (3m)	5 (6)	A (A)	25m (28m)
Southbound	2 (2)	A (A)	0.03 (0.03)	2m (2m)	3 (6)	A (A)	9m (11m)

The intersection will operate well with a signal, however there is an increased delay to the east-west movement, which is the movement with the highest volume of traffic. The delay for buses exiting from Moodie Station is reduced, however the difference relative to the stop controlled intersection is about 10 seconds according to Synchro analysis and negligible according to SimTraffic analysis.

Using OTM Book 15, a pedestrian crossing warrant was undertaken for the east side of this intersection, where the Watts Creek Pathway will cross Corkstown Road. The location does not meet the requirements for a pedestrian traffic signal, however it does meet the warrants for a pedestrian crossover, due to the 8-hour pedestrian volume being greater than 100, and the 8-hour vehicular volume being greater than 750.

According to the pedestrian crossover matrix in OTM Book 15, a PXO 'D' is recommended at this location, due to the 2 lane cross-section, vehicular volume of approximately 1600 vehicles in an 8 hour period, and speed limit ≤ 50 km/h. However, the West Transitway Extension project will implement a PXO 'C' at a similar location for where the Watts Creek Pathway crosses Corkstown Road. Since a PXO 'C' provides better crossing facility for pedestrians, it is recommended that a PXO 'C' be used at the new crossing as well, so that users do not see a lower quality of crossing moving forward.

4.6 Light Maintenance and Storage Facility

Part of the Moodie Drive LRT Extension includes provision of a Light Maintenance and Storage Facility (LMSF) on the west side of Moodie Drive, which will support rail operations. Activities occurring at the LMSF include vehicle cleaning, minor repairs and operator hand-over/hand-off. A small complement of staff will be based at the LMSF, including maintenance workers, supervisory staff and train operators. Traffic generated by the LSMF is anticipated to be very low, and will occur mainly in off-peak hours, as this is when trains are brought in for maintenance. Therefore, a traffic impact study will not be provided as part of this study, however it is recommended that the builder of the LMSF be required to undertake a preliminary traffic analysis on the impact of the LMSF.

5.0 Conclusions and Recommendations

In general, the above analysis indicated that the additional background traffic growth, growth from the DND Carling Campus and transit volume increase due to Corkstown BRT Station / Moodie LRT Station can be accommodated by the majority of study area intersections without severely diminishing network performance in terms of capacity and queue lengths.

However, the intersection of Moodie Drive and Corkstown Road will operate with a LOS 'E' in PM peak hour of the 2031 LRT scenario. In addition, the westbound left turn is a LOS 'E' in the PM peak hour, which is when the largest number of buses will be westbound on Corkstown Road, therefore incurring additional delay. To accommodate this, it is recommended that measures be taken at this intersection to improve the operations for the westbound buses, while maintaining a comparable LOS for the peak direction movements.

Of the options evaluated in Section 4.4 above, it is recommended that one of option 2b (westbound left turn with split phasing), or option 3 (westbound bus-only lane) be implemented. These improvements both provide an acceptable trade-off between general traffic LOS and westbound transit LOS, as well as protected movements for pedestrians and cyclists. Option 2b provides a simpler, more standard traffic signal phasing, as well as a better LOS for general traffic, while option 3 provides a better LOS for westbound transit operations.

There is one new intersection within the study area: Corkstown Road at Moodie Station. Due to the generally low volume of east-west vehicles, the delay for buses exiting Moodie Station and for vehicles exiting the PPUDO is very low. The intersection does not meet the warrants for a traffic signal, therefore the recommended control at this new intersection is two-way stop control for the north and south approaches. The Watts Creek Pathway will cross Corkstown Road on the east side of this intersection. Due to the pedestrian volumes, as well as previous commitments made as part of the West Transitway Extension project, a pedestrian crossover type 'C' is recommended at this location.