

Carleton University

New Residence Building - Transportation Brief

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Project Number:

60343120

Date:

April, 2015

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April 21, 2015

Mr. Darryl K. Boyce
Assistant Vice-President
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Carleton University
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Ottawa, Ontario
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Dear Mr. Boyce:

Project No: 60343120

Regarding: Carleton University - New Residence Building - Transportation Brief

Please find enclosed for your review the Transportation Brief for the new residence at Carleton University.

Sincerely,
AECOM Canada Ltd.



Vanessa Skelton, P. Eng.
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Distribution List

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	1	Carleton University

Revision Log

Revision #	Revised By	Date	Issue / Revision Description

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1. Introduction

1.1 Overview

AECOM prepared a Transportation Brief to support the proposed new student residence on the Carleton University Campus. This Transportation Brief follows the requirements set in the City of Ottawa's Transportation Impact Assessment (TIA) Guidelines (2006).

According to the TIA Guidelines, "a Transportation Brief focuses on determining the infrastructure and programs needed to mitigate the impact of the proposed development on the local transportation network and establishing the site design features needed to support system-wide transportation objectives. Transportation Briefs are generally undertaken for developments anticipated to have less significant impacts on the transportation network."

Carleton University is located at 1125 Colonel By Drive, south of Ottawa's city centre and is accessible by car, bus, and light rail. The Rideau Canal is to the north and west of the university and the Rideau River is to the south of the university. Brewer Park and the Old Ottawa South subdivision are located across Bronson Avenue to the east. Carleton University has more than 800 faculty members and 1,000 support staff and it serves almost 30,000 students¹.

The 2010 Campus Master Plan indicates that transportation priority at the University is, in decreasing order, pedestrians, bicycles, transit, cars, and trucks. This priority is objectified through the recommendations for dedication of space for pedestrians and cyclists and through use of incentives for multiple vehicle occupancy and increased parking charges. The University also continues to support the City of Ottawa's continual improvement of rail and bus initiatives.

This transportation brief assessed the traffic conditions within the study area to determine the effect of the new residence. Site visits were performed on December 18, 2014, January 25, 2015 and February 8, 2015 to observe traffic conditions on site. Future traffic conditions were evaluated and recommendations provided.

1.2 Proposed Development

The new residence will be built north of the Leeds House residence and west of the P-6 parking lot, as shown in **Figure 1**. The residence will have a capacity of 498 students. The proposed site layout is also shown in **Figure 1**. Access to the residence will be provided by the existing driveway to the P-6 parking lot and Leeds House.

¹ www.carleton.ca/about/facts/, Accessed January 22, 2015

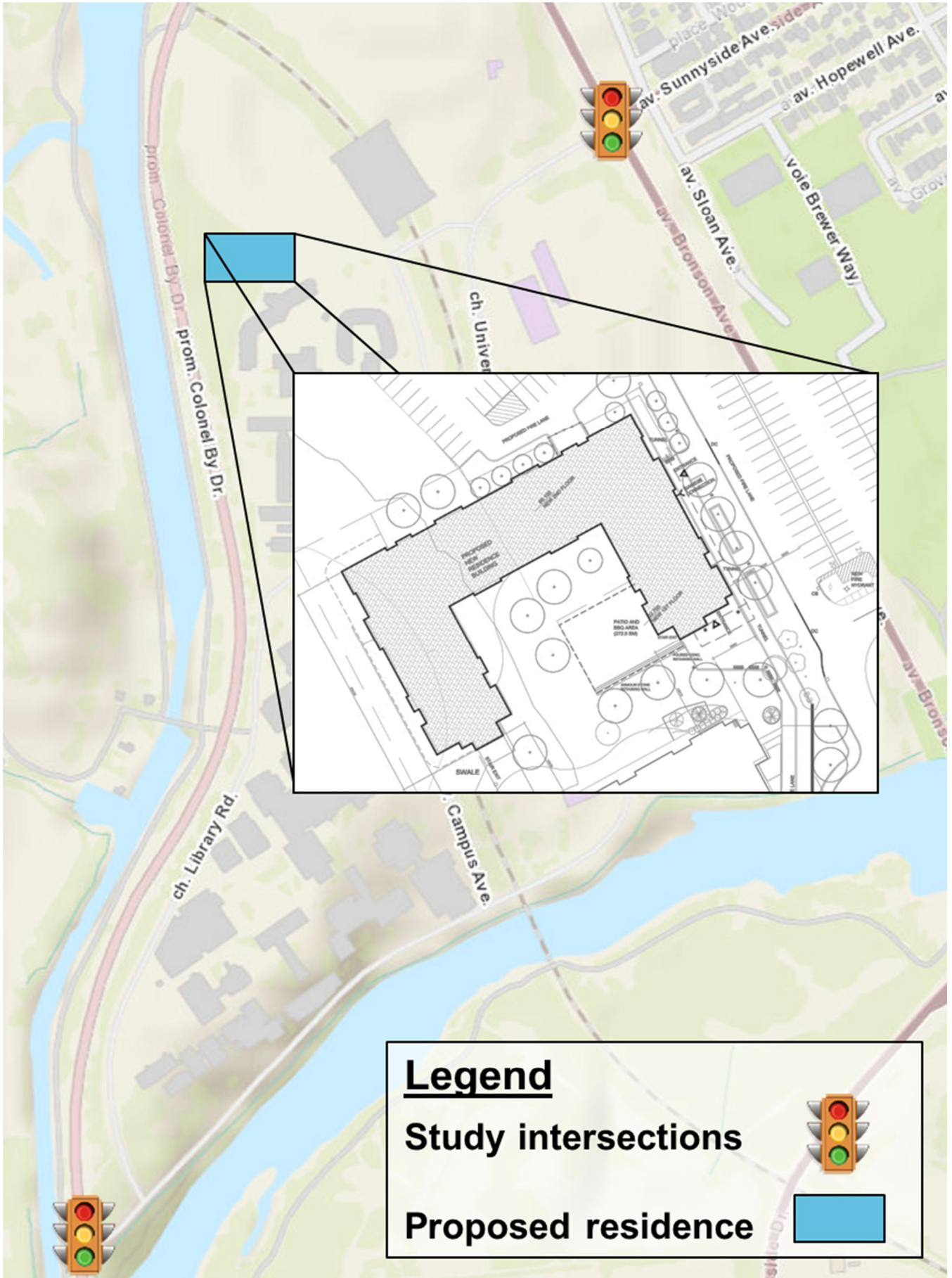


Figure 1. Key Area and Proposed Site Plan (Source: GeoOttawa)

2. Study Area Transportation Network

2.1 Road Network

Carleton University is accessed from either Colonel By Drive or Bronson Avenue.

Colonel By Drive is a north-south scenic parkway that is managed by the National Capital Commission (NCC). The NCC maintains the scenic natures of the parkway by limiting signage, prohibiting commercial vehicles, restricting access, and landscaping. At Carleton, Colonel By Drive is a two lane, undivided roadway with a posted speed limit of 60 km/h. The Colonel By Drive/ University Drive intersection is currently signalized with a southbound left turn lane and a northbound right turn lane entering Carleton University on Colonel By Drive and a westbound channelized right turn bay exiting Carleton University from University Drive.

Bronson Avenue is a north-south arterial road under the jurisdiction of the City of Ottawa. At Carleton University, Bronson Avenue is a six lane, divided roadway with a posted speed limit of 70 km/h. The Bronson Avenue/University Drive intersection is currently signalized with a southbound channelized right turn bay and northbound left turn lane entering Carleton University from Bronson Avenue and an eastbound channelized right turn bay exiting Carleton University from University Drive.

University Drive is a two lane road through most of the campus, except near Bronson Avenue where it widens to four lanes and near Colonel By Drive where it widens to three lanes.

2.2 Transit

Carleton is served by the O-Train at the Carleton Station. The O-Train travels between Bayview Station and Greenboro Station from 6:30 AM to 10:00 PM seven days a week. Carleton is served by OC Transpo major routes #4 and #7, seven days a week. Route #4 travels between the Rideau Centre and the Hurdman Transitway station from 6:00 AM to 1:00 AM. Route #7 travels between Carleton University and the St. Laurent Transitway station from 6:00 AM to 1:00 AM. Some weekday trips on route #111 are extended from Billings Bridge to Carleton. The existing transit service at Carleton University is shown in **Figure 2**.

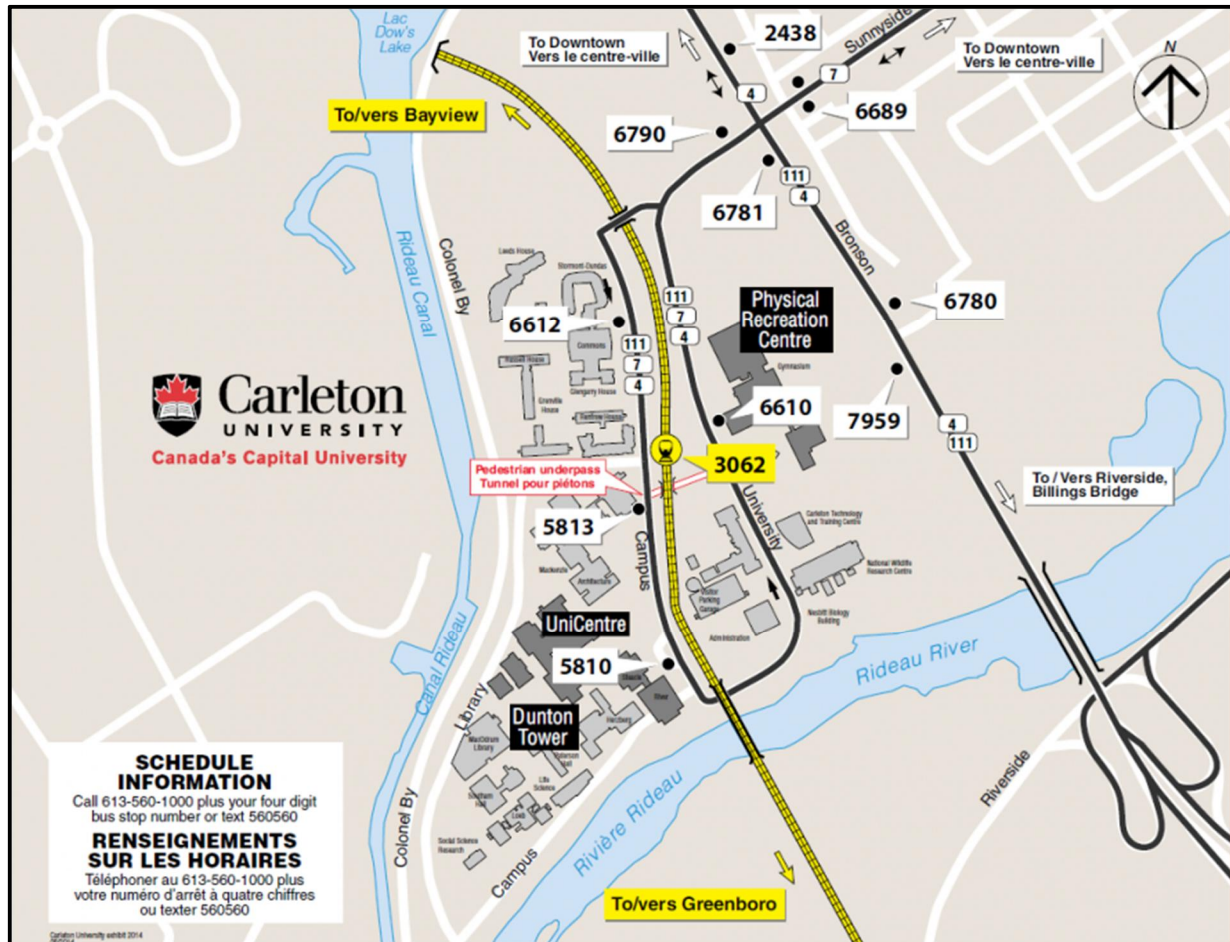


Figure 2. Existing Transit Service (Source: OC Transpo)

2.3 Pedestrian and Cycling Facilities

There is a network of pedestrian and cycling routes on campus that connect with City of Ottawa pedestrian and cycling facilities at Bronson Avenue / Sunnyside Avenue and at Bronson Avenue / Brewer Park. There are sidewalks and bicycle lanes on both sides of Bronson Avenue. The Rideau Canal Pathway follows the Rideau Canal near campus, and campus pedestrian and cycling facilities connect with pathways at University Drive / Colonel By Drive and Colonel By Drive / Hartwell Locks.

3. Existing Traffic Conditions

3.1 Traffic Volumes

Turning movement counts for the intersection of Bronson Avenue and Sunnyside Drive / University Drive were received from the City of Ottawa. The counts were collected on January 28, 2015 and indicate a morning peak hour of traffic flow at 7:45 – 8:45 AM and an evening peak hour of traffic flow at 4:00 – 5:00 PM. Traffic volume data was collected at the intersection of Colonel By Drive / University Drive on April 6, 2015 during the peak hours. The morning peak hour at this intersection is 7:30 – 8:30 AM and the evening peak hour is 4:30 – 5:30 PM.

The existing turning movements are shown in **Figure 3**.

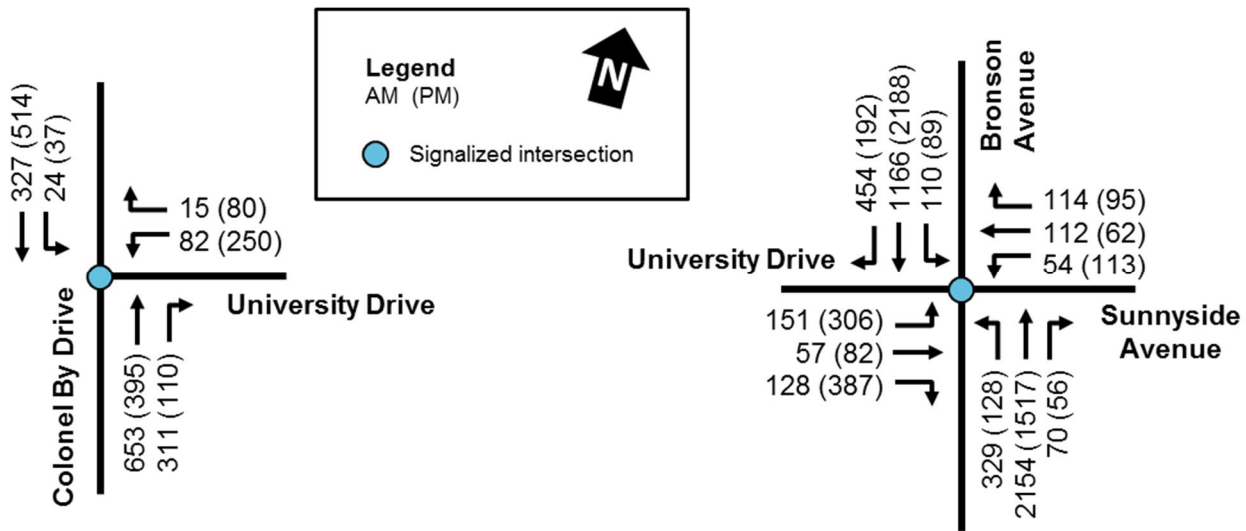


Figure 3. Existing Turning Movement Volumes

3.2 Traffic Operations

Level of Service (LOS) is used by the Highway Capacity Manual (HCM) 2010 to describe the quality of service of a transportation facility. There are six levels defined, ranging from LOS 'A' to LOS 'F'. LOS 'A' represents the best operating conditions from the traveller's perspective and LOS 'F' represents the worst. As provided in the City's Transportation Brief guidelines, LOS is related to the volume to capacity ratio as shown in **Table 1**:

Table 1. City of Ottawa Level of Service Criteria

Level of Service	Volume to Capacity Ratio
A	0 – 0.60
B	0.61 – 0.70
C	0.71 – 0.80
D	0.81 – 0.90
E	0.91 – 1.00
F	> 1.00

The volume to capacity ratio represents the capability of a transportation facility to accommodate the traffic demand. As the v/c ratio approaches 1.00 there is an increased possibility of delays and queuing. Once the v/c ratio exceeds

1.00, excessive delays and queues are expected. The City of Ottawa’s Traffic Impact Assessment Guidelines (2006) indicates that mitigation measures will be required for intersections with a v/c ratio greater than 0.90, except in the urban core where 1.0 is acceptable.

Using the capacity analysis software Synchro version 9 (HCM 2010 methodology) and signal timing plans received from the City of Ottawa, we analyzed the existing traffic operations at the intersections of Bronson Avenue at Sunnyside Drive/University Drive and Colonel By Drive at University Drive. The results of the operations analysis are shown in **Error! Reference source not found.** The HCM 2010 methodology only calculates v/c ratios for individual movements and does not calculate an overall v/c ratio for the intersection. We have defined critical movements as movements where the v/c ratio is greater than 0.90.

Table 2. Existing Traffic Operations

Intersection	AM Peak			PM Peak		
	LOS	Delay	Critical Movements	LOS	Delay	Critical Movements
Bronson Ave. / University Dr.	D	41.0 s	-	D	47.5 s	EBL v/c = 1.00 SBT v/c = 1.00
Colonel By Dr. / University Dr.	A	5.7 s	-	B	12.7 s	-

The intersection of Colonel By Drive / University Drive operates with acceptable level of service and no critical movements in the existing conditions scenario for the AM and PM peak hours. The intersection of Bronson Avenue / University Drive operates with an acceptable level of service in the AM and PM peak hours. The v/c ratio exceeds 0.90 in the southbound direction and eastbound direction in the PM peak hour. The high v/c ratios correspond with the general flow of traffic, since the majority of traffic flows southbound from the downtown core in the evening. The eastbound left turning movement in the PM peak hour is typically characterised by long queues from the intersection to the University Drive / Campus Avenue intersection.

4. Future Conditions

4.1 Future Background Traffic

The development is expected to be completed in the year 2015. We estimated future background traffic conditions for the year 2020, which is five years after the expected completion date. Based on the *Rideau Canal Multi-Use Crossing EA* and the *Lansdowne Revitalization TIS and TDM Plan*, we have used a 5% background growth rate over 5 years to project future traffic. This is approximately 1% growth per year which was applied to the existing turning movement volumes on Bronson Avenue and Colonel By Drive.

Carleton University's student population is expected to grow by 1% annually from 2017 to 2025. The new trips generated from the increase in students were allocated to specific mode types according to the existing modal split. Fifty percent (50%) of the trips are by auto and 50% of the trips use non-auto modes such as transit, cycling and walking. No growth in traffic was expected to occur on Sunnyside Avenue since the area is built-out. The background traffic volumes in the horizon year of 2020 are shown in **Figure 4**.

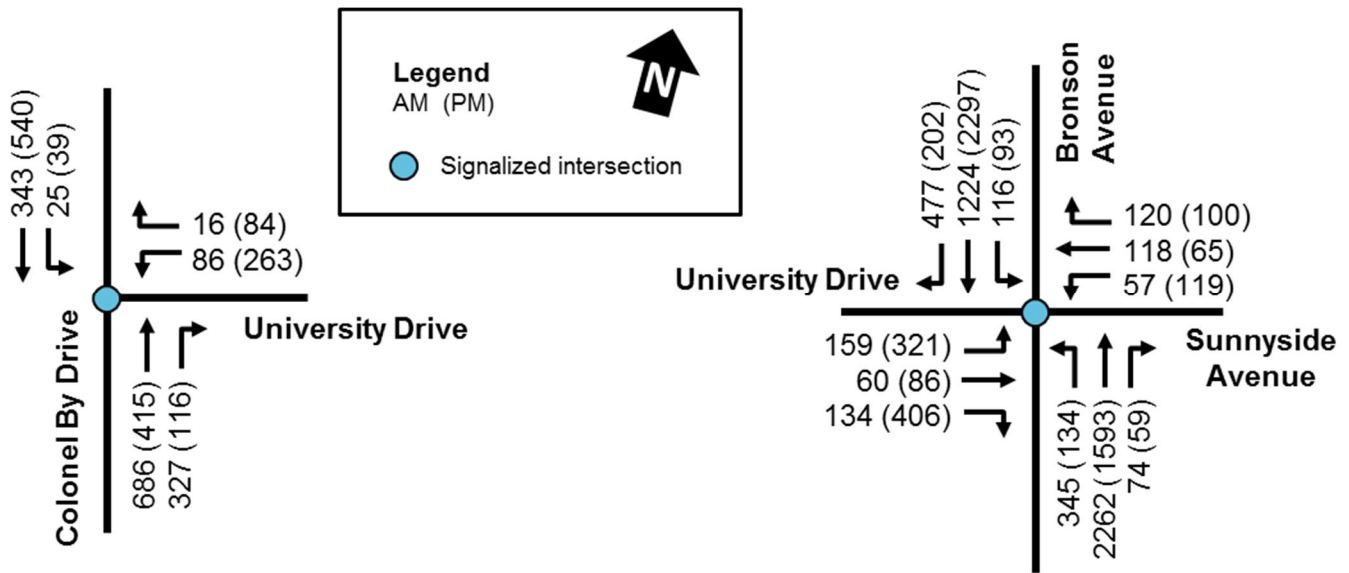


Figure 4. Future Background Traffic Volumes

Using the capacity analysis software, Synchro version 9 (HCM 2010 methodology), we analyzed the future background traffic operations at the intersections of Bronson Avenue / University Drive and Colonel By Drive / University Drive. The results of this analysis are shown in **Table 3**.

Table 3. Future Background Traffic Operations

Intersection	AM Peak			PM Peak		
	LOS	Delay	Critical Movements	LOS	Delay	Critical Movements
Bronson Ave. / University Dr.	D	47.2 s	-	E	58.9 s	EBL v/c = 1.05 SBT v/c = 1.06
Colonel By Dr. / University Dr.	A	5.9 s	-	B	13.1 s	-

The intersection of Colonel By Drive / University Drive operates with an acceptable level of service and no critical movements with the future background traffic for the AM and PM peak hours. The intersection of Bronson Avenue / University Drive operates with acceptable level of service in the AM peak hour and a poor level of service in the PM peak hour. The additional vehicles at the intersection that are due to general growth in the City increase the v/c ratios to greater than 1.0 in the southbound and eastbound directions in the PM peak hour. The movements with the high v/c ratios are the same movements as the existing situation, indicating that the operations at the intersection get incrementally worse as traffic volumes increase. It is assumed that the city will adjust the signal timing at this intersection in the future to accommodate the expected increase in traffic on Bronson Avenue.

4.2 Trip Generation

The new residence will generate vehicle trips from students who live in the residence and own personal vehicles. There is no land use code in the ITE Trip Generation Manual for university residences; therefore a calculation using residence parking permits was used to determine the number of vehicle trips.

Carleton University provided the maximum number of parking permits that are sold annually to residence students, as well as the number of students who live in residence. Using this information, we calculated the number of parking permits for the students living at the new residence, which is assumed to be equal to the number of trips generated by the new residence. The information is shown in **Table 4**.

Table 4. New Residence Trip Generation

Maximum number of parking permits sold to students in residence	120
Number of students who currently live in residence	3617
Ratio of parking permits to students in residence	0.033
Number of students expected to live in the new residence	498
Parking permits required for the new residence	17
Trips generated by the new residence	17

The new residence will house 498 students, which will generate 17 trips. For a conservative analysis, it was assumed that an equal number of trips will occur in the AM peak hour and the PM peak hour. The enter/exit split for trips generated by the residence was taken from the ITE Trip Generation Manual Land Use Code for University/College. These trips were applied to the intersections of Bronson Avenue / University Drive and Colonel By Drive / University Drive according to the existing turning movement patterns. The trip distribution is shown in **Figure 5**.

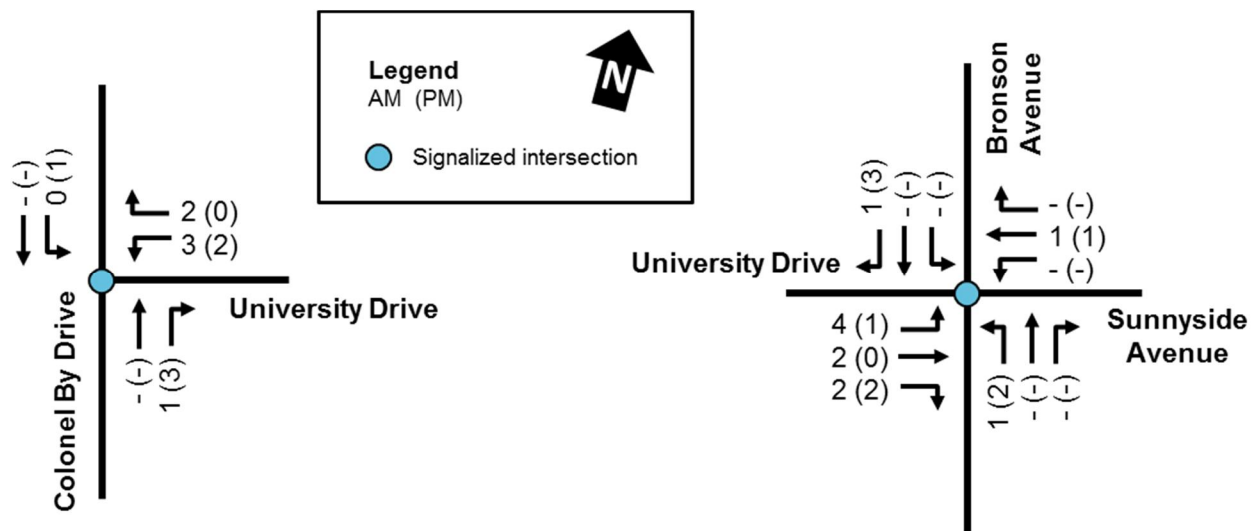


Figure 5. Trips Generated by New Residence

4.3 Future Total Traffic

The 2020 total traffic was calculated by adding the expected trips generated by the new residence to the future background traffic. The total traffic volumes are shown in **Figure 6**.

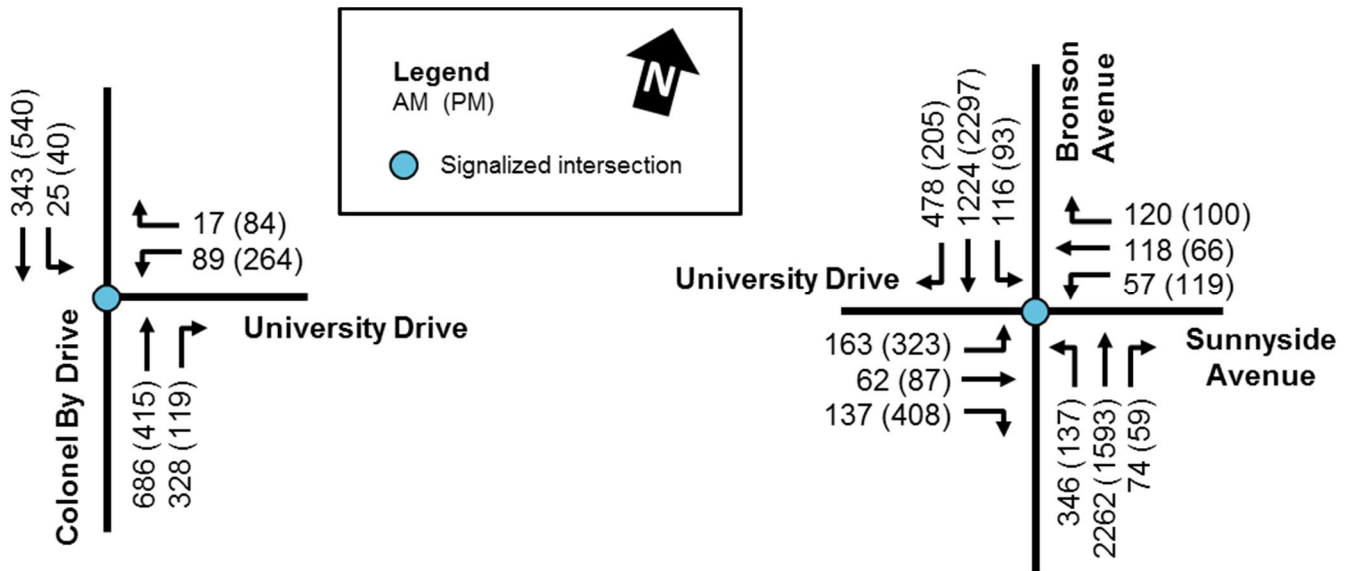


Figure 6. Future Total Traffic Volumes

Using the capacity analysis software, Synchro version 9 (HCM 2010 methodology), we analyzed the future total traffic operations at the intersections of Bronson Avenue / University Drive and Colonel By Drive / University Drive. The results of this analysis are shown in **Table 5**.

Table 5. Future Total Traffic Operations

Intersection	AM Peak			PM Peak		
	LOS	Delay	Critical Movements	LOS	Delay	Critical Movements
Bronson Ave. / University Dr.	D	47.4 s	-	E	59.8 s	EBL v/c = 1.06 SBT v/c = 1.07
Colonel By Dr. / University Dr.	A	6.0 s	-	B	13.1 s	-

The intersection of Colonel By Drive / University Drive operates with acceptable level of service under future total traffic conditions for the AM and PM peak hours. The intersection of Bronson Avenue / University Drive operates with acceptable level of service in the AM peak hour. The v/c ratio exceeds 0.90 in the southbound and eastbound directions in the PM peak hour. The movements with the high v/c ratios are the same movements as the future background situation.

The vehicle trips added to the network from the new residence have little impact on the traffic operations at Colonel By Drive / University Drive. The intersection of Colonel By Drive / University Drive has a LOS 'A' in the AM peak hour and LOS 'B' in the PM peak hour for the scenarios reviewed in this study. The delay for the AM peak hour increases by less than a second when the residence trips are added to the network. The overall delay at the intersection during

the PM peak hour doesn't change with the additional vehicles generated by the new student residence. No mitigation measures are required at this intersection.

The intersection of Bronson Avenue / University Drive operates with a LOS 'D' in the AM peak hour and there are no turning movements with a v/c ratio that exceeds 0.90 in the future scenarios. The overall delay for AM and PM peak hours at this intersection increases by less than a second with the additional vehicles generated by the new student residence. There are two turning movements with v/c ratios that exceed 0.90 in the PM peak hour for the 2020 total traffic scenario. These movements also have v/c ratios that exceed 0.90 with the 2020 background traffic. The small increases in overall delay and v/c ratio have a negligible impact on the flow of traffic at the intersection; therefore, mitigation measures are not required at this intersection.

5. Conclusion

The development of a new student residence at Carleton University will have little impact on future traffic conditions in the area. It was estimated that the residence will generate 17 vehicle trips in the AM peak hour and 17 vehicle trips in the PM peak hour. The new vehicle trips will access the university at the intersections of Bronson Avenue / University Drive and Colonel By Drive / University Drive.

The new vehicle trips from the student residence will not impact the level of service at these intersections; therefore, no mitigation measures are required at the intersections in this study.