CASTLE HEIGHTS RESIDENCES
374 McARTHUR AVENUE
OTTAWA, ONTARIO

TRANSPORTATION IMPACT ASSESSMENT
REVISED

July 13, 2021

D. J. Halpenny & Associates Ltd.
Consulting Transportation Engineers
P. O. Box 774, Manotick, Ontario K4M 1A7

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Prepared for:

Castle Heights Development Inc.

722 TIA Analysis_R.doc

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STEP 1 - SCREENING

A Screening Form has been prepared which is included as Exhibit 1.1 in the Appendix. The Screening Form was submitted to the City of Ottawa which determined that the trip generation trigger was not met, but both the location and safety triggers were met and a Transportation Impact Assessment (TIA) study must continue onto the next stage. The following will address the requirements of the Scoping Document.

STEP 2 - SCOPING

MODULE 2.1 – Existing and Planned Conditions

Element 2.1.1 – Proposed Development

The Castle Heights Residence development would be located at 374 McArthur Avenue, approximately 40 m west of the intersection of McArthur Avenue and Brant Street (centre of property to centre of intersection). The property is 1,170.98 m^2 in size and has a "TM" zoning (Traditional Mainstreet) which will support the proposed apartment development. The building will be replacing an existing and currently vacant residential single-family home. Figure 2.1 provides a site location plan of the development.

The Site Plan proposes one 6 storey apartment building which will contain 64 rental apartment units and a gym for tenants and members (no parking provided for gym members). The building will provide 17 vehicle parking spaces and 44 bicycle storage spaces in an underground parking garage. It is expected that the apartment building would be completed and substantially occupied by the year 2022. Figure 2.2 shows a conceptual site plan of the development.

Element 2.1.2 – Existing Conditions

The site for the proposed apartment building is located along the south side of McArthur Avenue approximately 40 m west of Brant Street. McArthur Avenue is under the jurisdiction of the City of Ottawa and is designated as an arterial road in the City's *Transportation Master Plan* (TMP). The roadway originally had a four lane undivided cross-section, but was reconstructed in 2018 under the City of Ottawa project, *McArthur*

FIGURE 2.1
SITE LOCATION PLAN

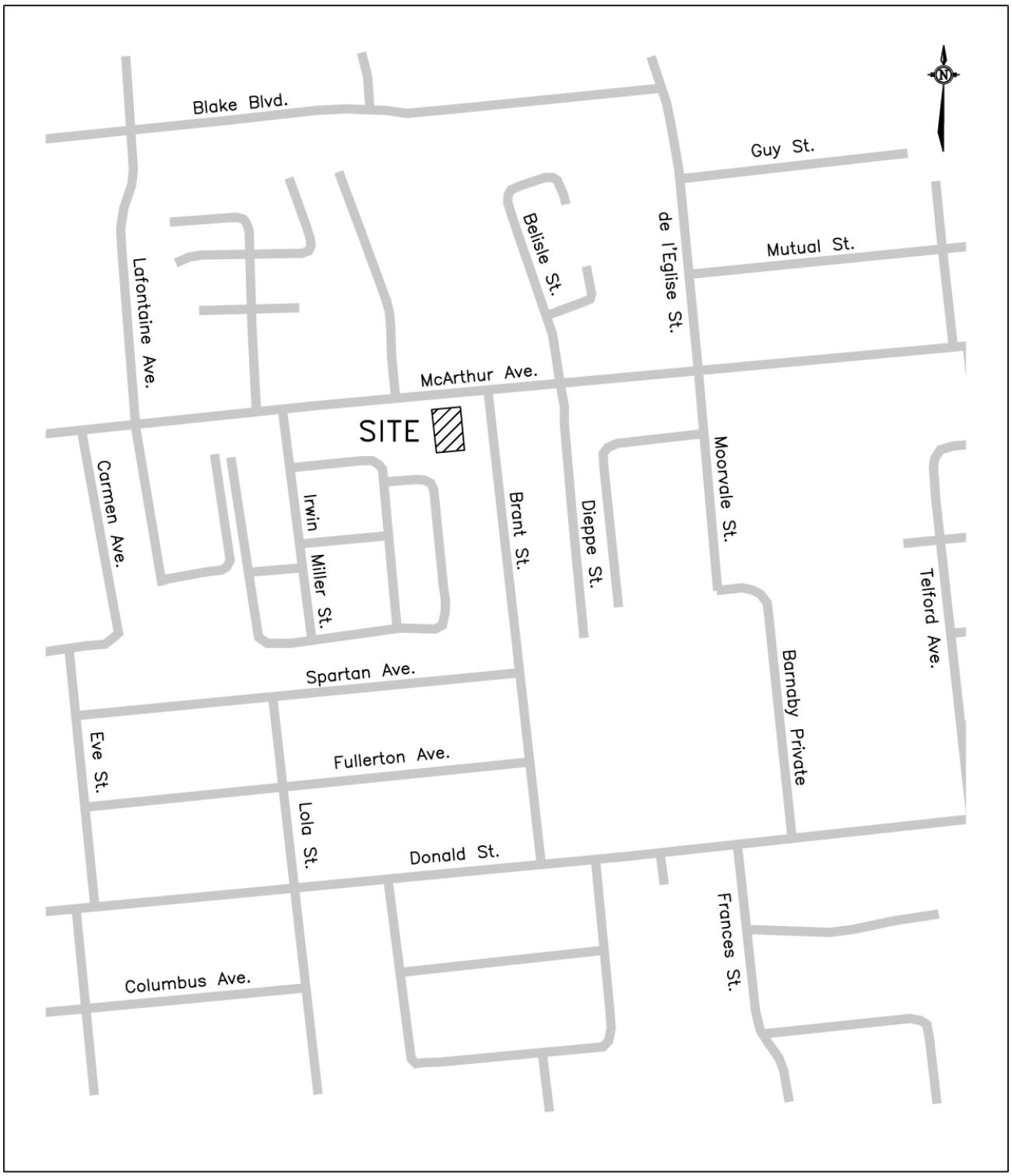

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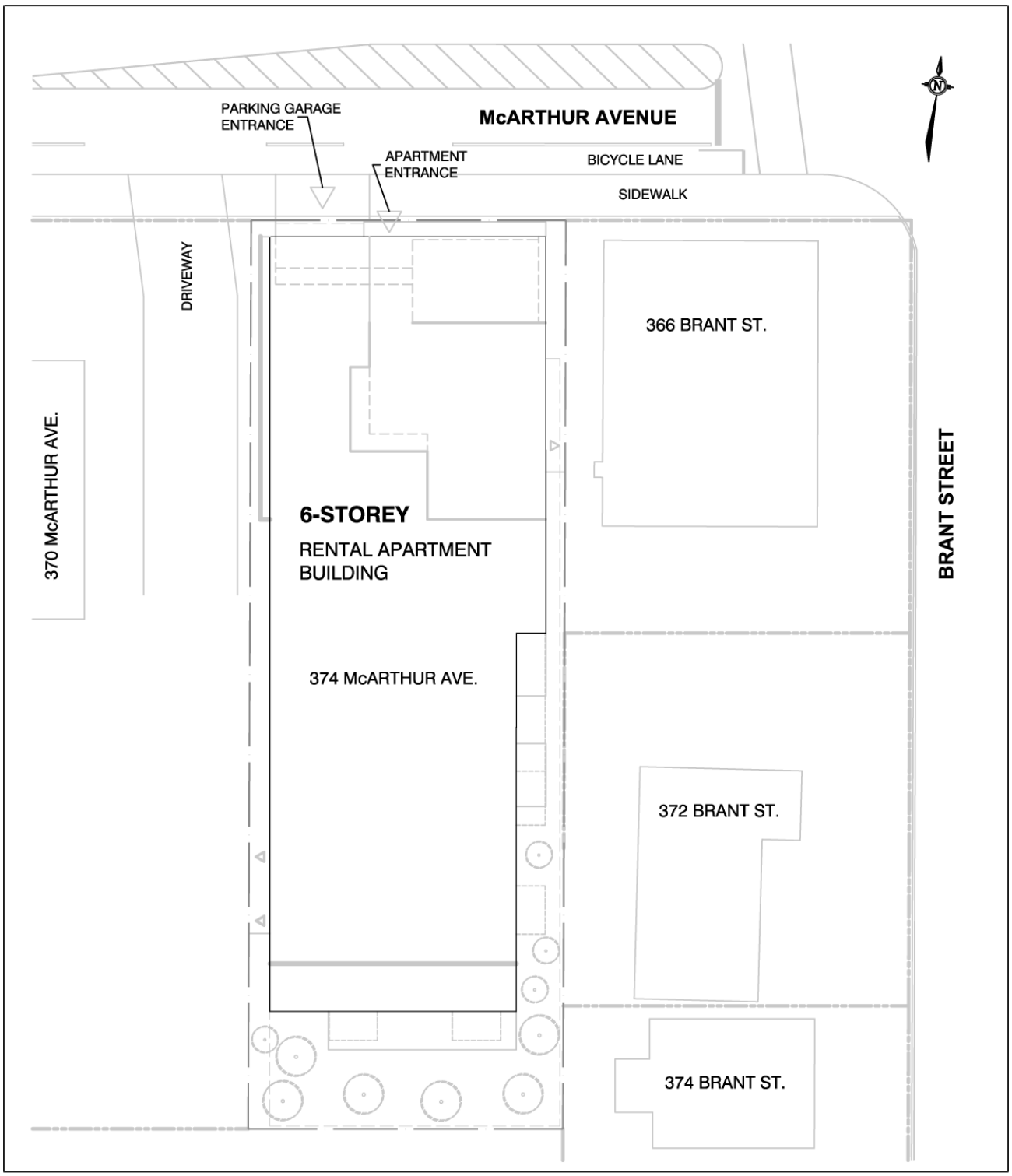
FIGURE 2.2
CONCEPTUAL SITE PLAN



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Bicycle Lanes, from North River Rd. to St. Laurent Blvd., which modified the road to a two lane road with cycling lanes. The geometry of the road incorporates traffic calming measures by the use of bulb-outs to reduce the width of the road. The speed is unposted at 50 km./h., with posted speeds of 40 km./h. during peak morning and afternoon hours on school days. Pedestrian sidewalks are provided along both the north and south sides of the road. The Robert E. Wilson Public School is located on the north side of McArthur Avenue across from the site. Along the north side of McArthur Avenue in front of the school there is a lane next to the curb which is designated as a school bus loading zone. Approximately 40 m west of the site, the bus loading area lane is terminated and on-street parking with a 3 hour restriction Monday to Friday from 7:00 AM to 7:00 PM is provided along a westbound lane adjacent to the travel lane with the cycling lane adjacent to the curb. The public parking extends for a distance of 30 m which also includes a break which provides access to the apartment building at 353 McArthur Avenue on the north side of the road.

The intersection of Brant Street and McArthur Avenue is located 40 m east of the site. The intersection is a “T” intersection with McArthur Avenue forming the eastbound and westbound approaches, and Brant Street the northbound approach. The intersection is controlled by traffic signals. The intersection has the following lane configuration:

Northbound Brant Approach	One exclusive left turn lane
	One exclusive right turn lane
Eastbound McArthur Approach	One left/through/right lane (left into the school)
Westbound McArthur Approach	One through lane
	One exclusive left turn lane

BRANT/McARTHUR INTERSECTION - Eastbound Approach

BRANT/McARTHUR INTERSECTION - Westbound Approach

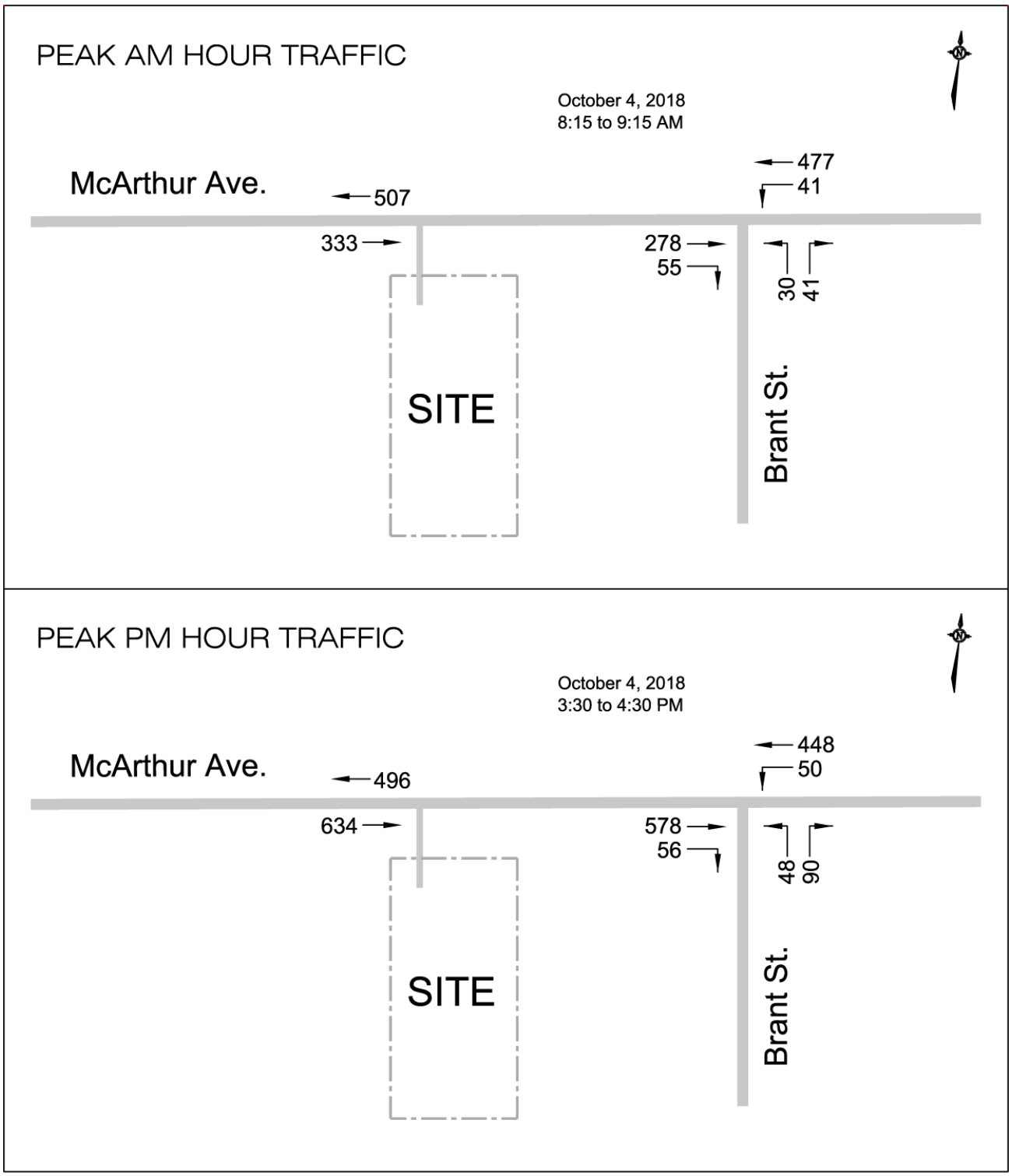
The intersection of Irwin Miller Street and McArthur Avenue is located 140 m west of the site. The intersection is a "T" intersection with Irwin Miller Street forming the northbound approach and McArthur Avenue the eastbound and westbound approaches. The intersection is a two-way stop controlled intersection with a stop sign at the northbound approach. Pedestrian traffic signals exist on the east side of the intersection which aids pedestrian crossing of McArthur Avenue. The intersection has the following lane configuration:

Northbound Irwin Miller Approach	One left/through/right lane (stop sign)
Eastbound McArthur Approach	One shared through/right lane
Westbound McArthur Approach	One through lane
	One exclusive left turn lane

Figure 2.3 shows the weekday peak AM and PM hour traffic counts obtained from the City of Ottawa at the Brant/McArthur intersection taken October 4, 2018. The traffic counts are presented in the Appendix as Exhibit 2.1.

The site is served by OC Transpo Frequent Route 14 which travels along McArthur Avenue past the site to the St. Laurent Transit Station to the east, and the downtown core and Tunney's Pasture Transit Station to the west. The closest eastbound bus stop is located at a 40 m walk at the far side of the Brant/McArthur intersection, and the westbound bus stop at a 75 m walk at the nearside of the Brant/McArthur intersection.

FIGURE 2.3
2018 PEAK AM AND PM HOUR TRAFFIC COUNTS



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Collision reports were obtained from the City of Ottawa through Open Data Ottawa for the five year time period between the years January 1, 2014 and December 31, 2018. The reports were for the Brant/McArthur intersection and the McArthur Avenue road segment across the frontage of the site between Brant Street and Irwin Miller Street. During the five year period there were 12 reported collisions at the Brant/McArthur intersection, of which 4 were rear end collisions, and 6 were sideswipe collisions. The sideswipe collisions would be reduced following the modifications of McArthur Avenue to a two lane road with bicycle lanes in 2018. The McArthur Avenue road segment between Brant Street and Irwin Miller Street had 7 reported collisions over the five year period with 3 of the collisions being rear end collisions. Table 2.1 summarizes the collisions by year and type.

TABLE 2.1
COLLISION SUMMARY

YEAR	COLLISION TYPE					TOTAL
	REAR END	ANGULAR	TURNING	SIDESWIPE	OTHER-SMV	
Brant Street and McArthur Avenue Intersection						
2014	1	0	1	1	1	4
2015	1	0	0	3	0	4
2016	0	0	0	1	0	1
2017	1	0	0	0	0	1
2018	1	0	0	1	0	2
TOTAL	4	0	1	6	1	12
McArthur Avenue Between Brant Street and Irwin Miller Street						
2014	0	0	0	0	0	0
2015	1	0	0	1	0	2
2016	1	0	0	0	0	1
2017	0	0	1	0	0	1
2018	1	1	0	0	1	3
TOTAL	3	1	1	1	1	7

Element 2.1.3 – Planned Conditions

The City of Ottawa *Transportation Master Plan 2013* (TMP) has not identified any changes to the transportation network within the 2031 Affordable Network. The roadway modifications to McArthur Avenue for the Bicycle Lanes project are discussed in Element 2.1.2 and were completed in 2018. The project reduced the pavement cross-section to two travel lanes, and provided cycling lanes which would increase bicycle safety and provide traffic calming measures.

There have been no significant Site Plan Applications approved for large developments within the study area of the project.

MODULE 2.2 – Study Area and Time Periods

Element 2.2.1 – Study Area

The development will consist of a residential apartment building with one access onto McArthur Avenue. The entrance will provide access to an underground parking garage for the apartment tenants, and will be located approximately 40 m west of the intersection of McArthur Avenue and Brant Street (centre of property to centre of intersection).

The Study Area for the Transportation Impact Assessment report will include the McArthur Avenue road segment between Brant Street and Irwin Miller Street, and the Brant/McArthur intersection. The study will also assess the operation of the site access, and determine vehicular queuing which may have an impact on the operation of the site access and traffic at the Brant/McArthur intersection.

Element 2.2.2 – Time Periods

The time period for the analysis would be the weekday peak AM and PM time periods of traffic which would occur during the peak hours of the adjacent street traffic when drivers are travelling to and from work. The time period of traffic along McArthur Avenue would coincide with the peak hour trips generated from the residential apartment units.

Element 2.2.3 – Horizon Years

The TIA will address the impact of the trips from the proposed apartment units at the completion of the development in the year 2022. The analysis will further examine the impact at the year 2027 which represents five years beyond completion.

MODULE 2.3 – Exemptions Review

The exemptions, which provide possible reductions to the scope of work of the TIA Study, were examined using Table 4: Possible Exemptions which is provided in the City's *Transportation Impact Assessment Guidelines (2017).* Utilizing the table, the following lists the possible exemptions proposed for the TIA Study report:

MODULE	ELEMENT	EXEMPTION CONSIDERATIONS
Design Review Component		
4.1 Development Design	4.1.2 Circulation and Access	No – Will discuss moving trucks and garbage pickup.
	4.1.3 New Street Networks	Yes – The development does not propose any new municipal streets.
4.2 Parking	4.2.1 Parking Supply	No – Parking does not meet the City of Ottawa parking Bylaws.
	4.2.2 Spillover Parking	No – Spillover will be examined as parking does not meet bylaws.
Network Impact Component		
4.5 Transportation Demand Management	All Elements	No – TDM measures will be examined.
4.6 Neighbourhood Traffic Management	4.6.1 Adjacent Neighbourhoods	Yes – Access to the development will be from an arterial road.
4.8 Network Concept		Yes – The site would not generate more than 200 person-trips per peak hour in excess of the volume permitted by established zoning.

STEP 3 - FORECASTING

MODULE 3.1 - Development-generated Travel Demand

Element 3.1.1 – Trip Generation and Mode Shares

The development at 374 McArthur Avenue will consist of a 64 unit apartment building. The building will have one access onto McArthur Avenue from an underground parking garage. The site will provide 17 vehicle parking spaces including 5 visitor spaces.

Residential Land Use

The residential use would consist of 64 rental apartment units on all floors of a six storey apartment building. The number of expected site generated trips utilized the trip statistical data documented in the *2009 TRANS Trip Generation Study* report. The analysis used the Vehicle Trip Generation Rates from Table 6.3 of the TRANS document for ITE Land Use 223, “Mid-rise apartments (3-10 floors)” in an urban area inside the greenbelt. The number of site generated trips was proportioned inbound/outbound to the directional distribution shown in Table 3.17 of the document. The trips rates and distribution are shown in Table 3.1.

TABLE 3.1
VEHICLE TRIP GENERATION RATES - Residential Land Use

Trip Rate	Peak AM Hour		Peak PM Hour	
Vehicle Trip Rate	0.24 T/Dwelling Units		0.28 T/Dwelling Units	
Directional Distribution	24% Entering	77% Exiting	62% Entering	39% Exiting

The site generated trips were determined by the product of the number of apartment units (64 units) and the trip rates during the peak hour as shown in Table 3.1. The total number of auto-trips is shown in Table 3.2. The person-trips were determined by the number of auto-trips divided by the mode share for the number of vehicle trips. The mode share used was from Table 3.13 of the *2009 TRANS Trip Generation Study* report for an apartment development in an urban area (within the greenbelt). The mode share is 0.37 vehicle trips for the peak AM hour and 0.40 vehicle trips for the peak PM hour. Table 3.2 shows the future peak hour person-trips.

TABLE 3.2
TOTAL PEAK HOUR SITE GENERATED TRIPS - Residential Land Use

Apartment Units	AUTO-TRIP GENERATION		FUTURE PERSON-TRIPS	
	Peak AM Hour	Peak PM Hour	Peak AM Hour	Peak PM Hour
64 Apartments	15 veh.	18 veh.	41 per.	45 per.

The modal split of trips was determined from the City of Ottawa document, *2011 NCR Household Origin-Destination Survey*, January 2013. The primary travel modal share used the demographic characteristics for the Ottawa Inside Greenbelt area (Page 78) for trips. The residential modal share was calculated using the weighted average of from/within trips during the peak AM hour (leaving home), and to/within trips during the peak PM hour (returning home). Table 3.3 presents the modal share summary which will be used in the TIA study for the residential land use.

OC Transpo schedules Frequent Route 14 along McArthur Avenue past the site which provides service to the St. Laurent Transit Station to the east and the Ottawa downtown core to the west. Bus stops are located at the Brant/McArthur intersection. Cycling lanes have been provided in the McArthur Bicycle Lanes project which was completed in 2018. Pedestrian sidewalks are provided along both sides of McArthur Avenue.

The peak hour person-trips per mode were determined by the product of the peak hour future person-trips from Table 3.2 and the future mode share from Table 3.3. The result is shown in Table 3.4 for the residential portion of the development.

TABLE 3.3
MODE SHARE SUMMARY (Person-Trips) - Residential Land Use

Future Mode Share Targets for the Development			
Travel Mode	**AM**	**PM**	**Rationale**
Auto Driver	53%	54%	Consistent with modal share targets and proximity to residential and employment areas
Auto Passenger	10%	15%	
Transit	19%	17%	Consistent with the 2009 TRANS and 2011 TRANS-OD reports and the local retail and commercial area
Bicycle	3%	3%	
Walk/Other	15%	11%	

TABLE 3.4
FUTURE SITE GENERATED PERSON-TRIPS - Residential Land Use

TRAVEL MODE	DEVELOPMENT GENERATED PERSON-TRIPS	
	PEAK AM HR.	PEAK PM HR.
Auto Driver	22 per. trips	24 per. trips
Auto Passenger	4 per. trips	7 per. trips
Transit	8 per. trips	8 per. trips
Bicycle	1 per. trips	1 per. trips
Walk/Other	6 per. trips	5 per. trips
Total Trips	41 per. trips	45 per. trips

The TIA Guidelines allow for three Trip Reduction Factors that may be applied to the expected development trips. There were no trip reductions applied to the residential use as discussed below:

1) *Deduction of Existing Development Trips* - The existing vacant single-family house would not be generating any trips.

2) *Pass-by Vehicle Trips* - All residential trips are assumed as primary trips.

3) *Synergy or Internalization* - There would be no internalized trips with one land use.

Element 3.1.2 – Trip Distribution

The distribution of the peak hour site generated trips from the residential portion of the development was determined by examining the *2011 NCR Household Origin-Destination Survey* for the origin/destination of peak AM hour trips for the Ottawa East/Beacon Hill area, and the October 4, 2018 traffic counts during the peak AM and PM hours at the Brant/McArthur intersection. The trip distribution percentage for the residential trips during the weekday peak AM and PM hours are as follows:

	Peak AM	Peak PM
To/From the south along Brant Street	10%	10%
To/From the east along McArthur Ave.	35%	40%
To/From the west along McArthur Ave.	55%	50%

Element 3.1.3 – Trip Assignment

The distribution of trips entering and exiting the site was determined by applying the directional distribution of vehicle trips shown in Table 3.1 to the Auto Driver trips shown in Table 3.4 for the residential trips. Table 3.5 presents the distribution of vehicle trips entering and exiting the site during the peak AM and PM hours.

TABLE 3.5
PEAK HOUR DISTRIBUTION OF VEHICLE TRIPS

PEAK HOUR TRIPS / BUILDING USE	WEEKDAY PEAK AM HR.			WEEKDAY PEAK PM HR.		
	TOTAL	ENTER	EXIT	TOTAL	ENTER	EXIT
64 Apartment Units	22	5 (24%)	17 (77%)	24	15 (62%)	9 (39%)

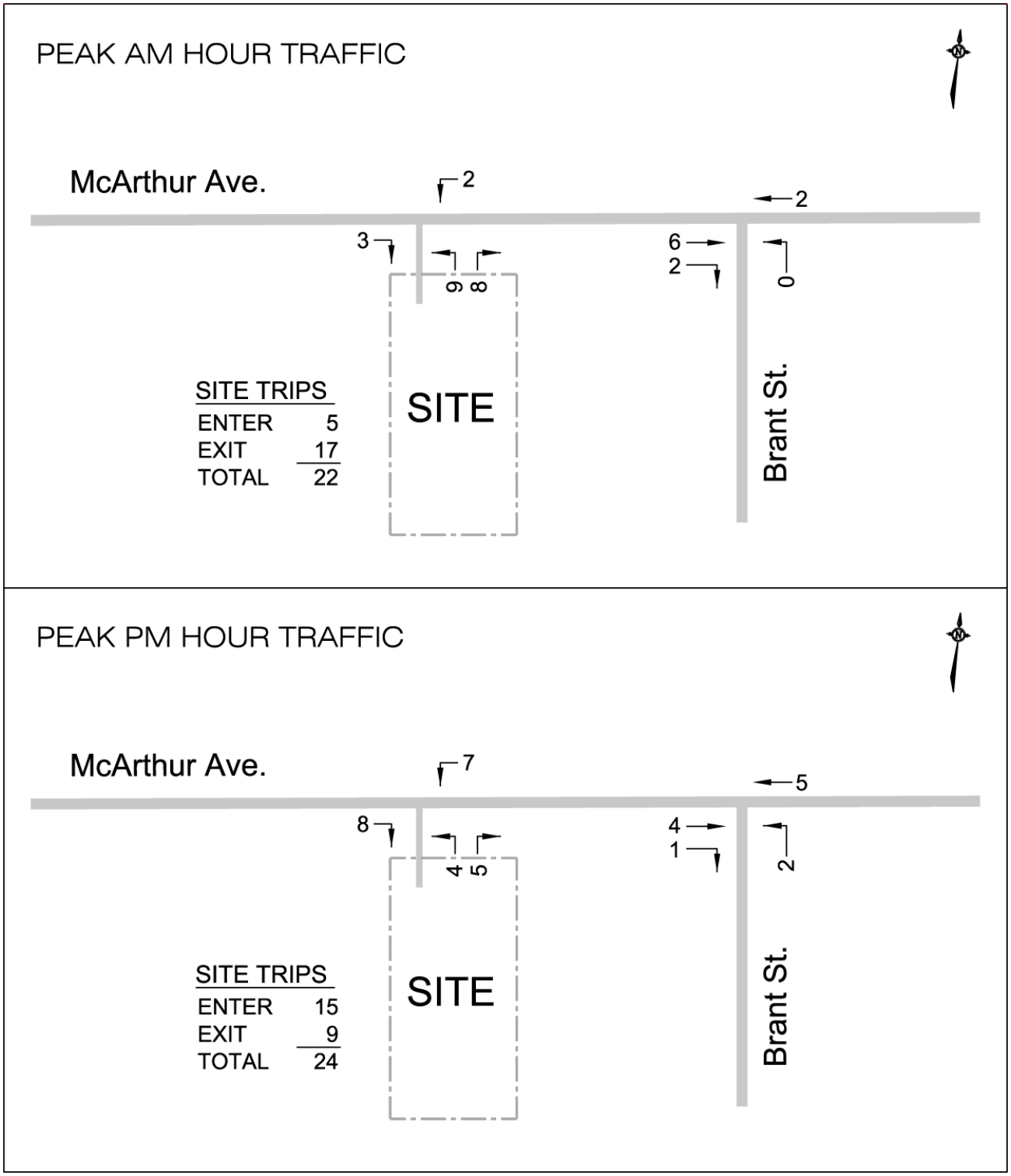
The peak AM and PM hour trips from Table 3.10 were distributed onto the adjacent roads using the distribution discussed in Element 3.1.2. Figure 3.1 shows the peak hour site generated trips for the residential land use.

MODULE 3.2 - Background Network Travel Demands

Element 3.2.1 – Transportation Network Plans

The City of Ottawa *Transportation Master Plan (TMP) 2013* was reviewed to identify transit and roadway projects in the vicinity of the development. The document did not identify any planned network changes which would have an impact on all modes of travel demand. The McArthur Bicycle Lane project, which was completed in 2018, would provide a safer facility for cyclists and increase traffic calming measures by

FIGURE 3.1
PEAK AM AND PM HOUR SITE GENERATED TRIPS



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reducing the number of vehicle travel lanes and providing bulb-outs. The bicycle lanes would also provide a buffer between the vehicles and sidewalks which would increase the feeling of safety for pedestrians along the sidewalks.

Element 3.2.2 – Background Growth

The background growth in traffic represents the increase or decrease in traffic due to development outside the study area. The trip trend of trips to/from the Ottawa Inner Area for auto driver trips was examined in the *National Capital Region Travel Trends* document prepared by the IBI Group. The document showed that trips from the Ottawa East area decreased at an average annual compounded rate of -1.12 percent, and trips to the Ottawa East area decreased at an average annual compounded rate of -1.04 percent between the years of 2005 and 2011.

The study has assumed that the background traffic would experience an annual compounded increase of 1.0 percent which translates to the following growth factors which were applied to the 2018 traffic counts at all approaches to the intersection of Brant Street and McArthur Avenue:

Growth Factor at the Brant/McArthur Intersection

2018 → 2022 = 1.041 Completion
2018 → 2027 = 1.094 Completion + 5 Years

Element 3.2.3 – Other Developments

A search for all significant development in the approval process with the City of Ottawa determined that there were no proposed developments within the study area of the proposed Castle Heights Residence project.

Figure 3.2 presents the 2022 peak AM and PM peak hour background vehicle traffic (does not include trips from the proposed Castle Heights Residence project). Figure 3.3 shows the expected 2027 peak hour background traffic which represents five years beyond completion of the development. All background traffic includes the 1.0 percent average annual compounded increase in traffic.

MODULE 3.3 - Demand Rationalization

There are no capacity limitations to the travel demands in the area. The approval of the reduction in travel lanes under the McArthur Bicycle Lanes project determined that future travel demand capacity would not be an issue.

The total vehicular traffic is the sum of the peak hour site generated trips and the peak hour background traffic. The site generated trips would be the addition of the site trips from Figure 3.1, and the background traffic (Figure 3.2 for the year 2022 and Figure 3.3 for the year 2027). Figure 3.4 presents the total 2022 peak hour vehicular traffic and Figure 3.5 the total 2027 peak hour vehicular traffic.

FIGURE 3.2
2022 PEAK AM AND PM HOUR BACKGROUND TRAFFIC

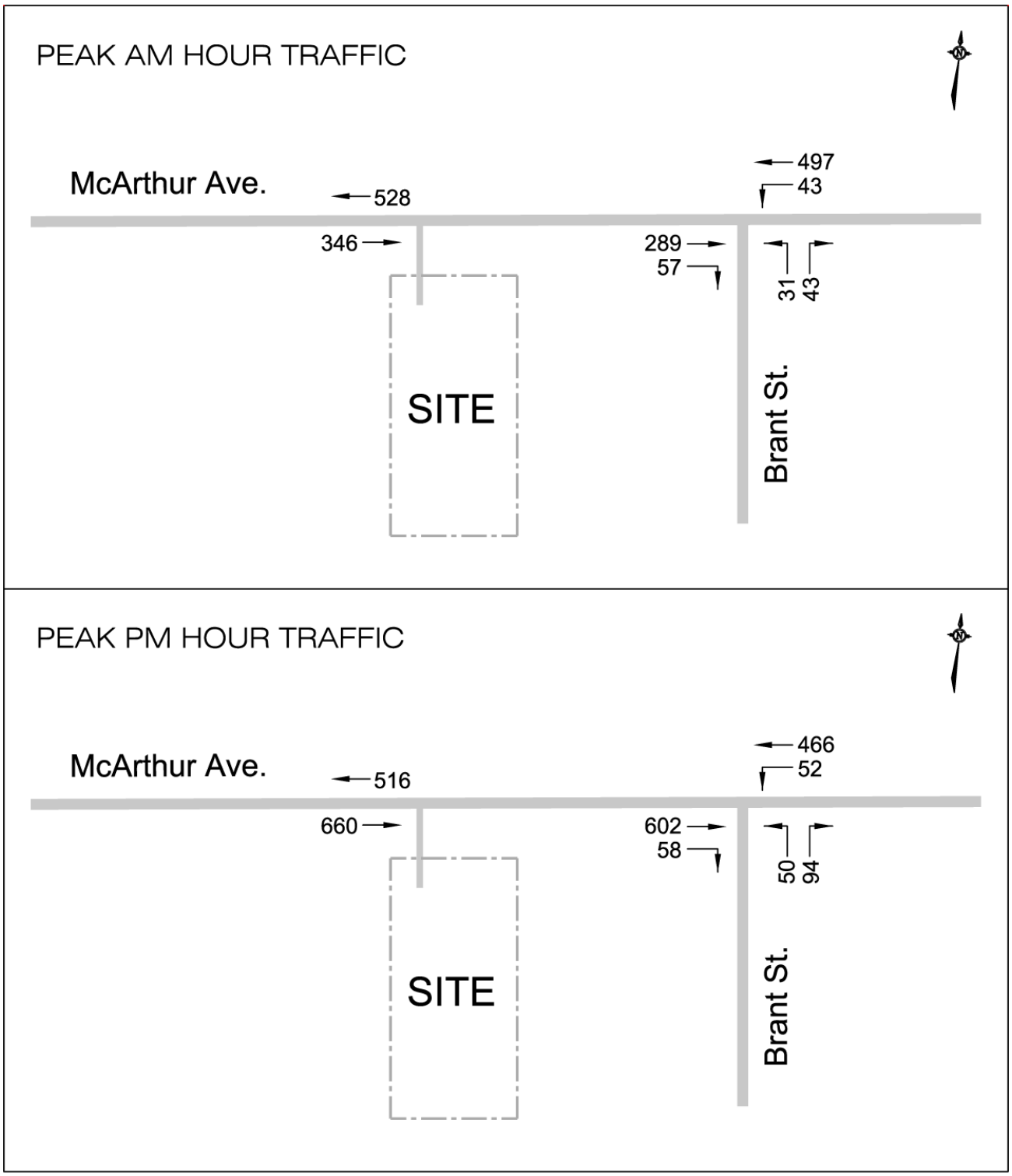

FIGURE 3.3
2027 PEAK AM AND PM HOUR BACKGROUND TRAFFIC

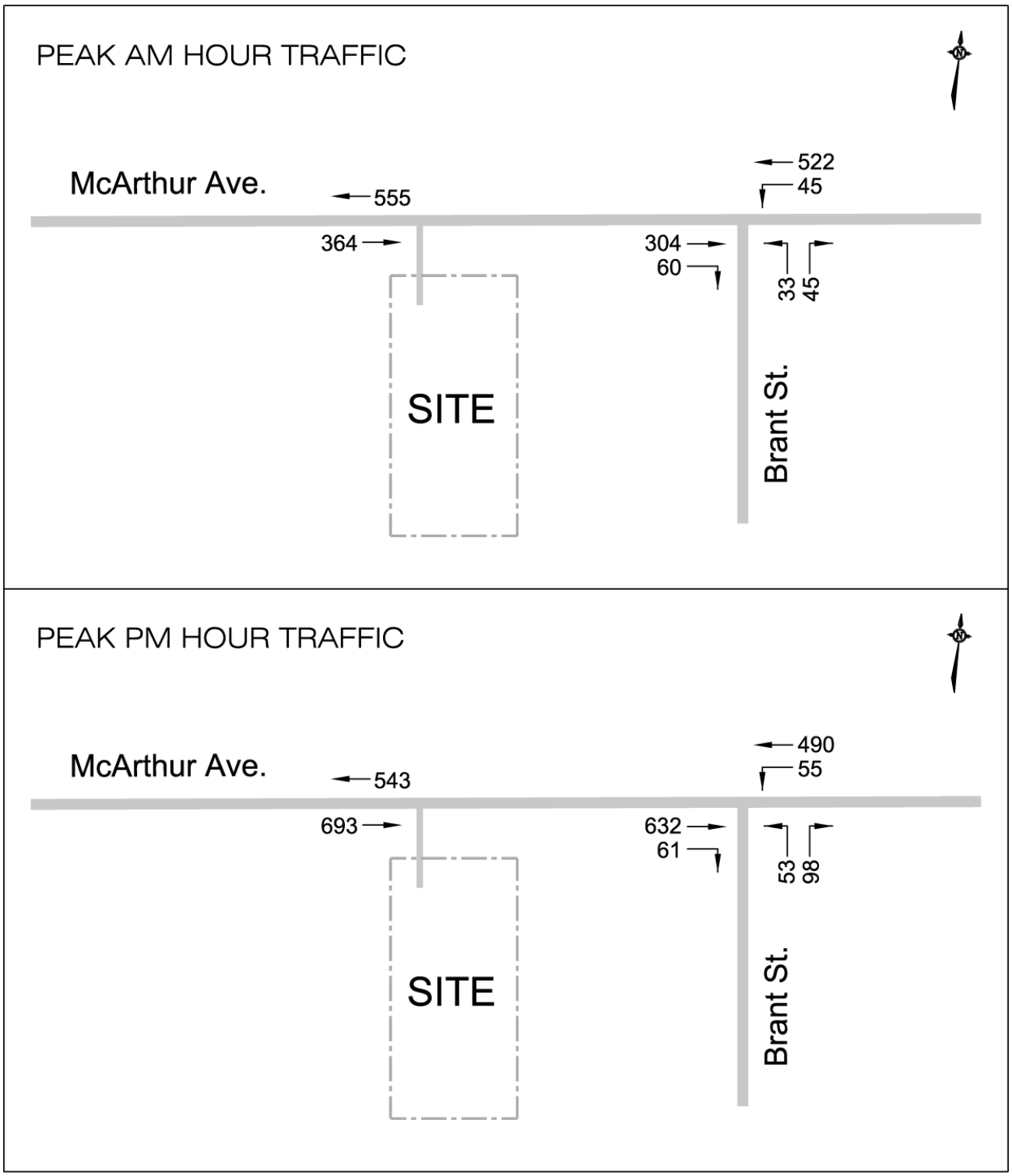

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FIGURE 3.4
2022 PEAK AM AND PM HOUR TOTAL TRAFFIC

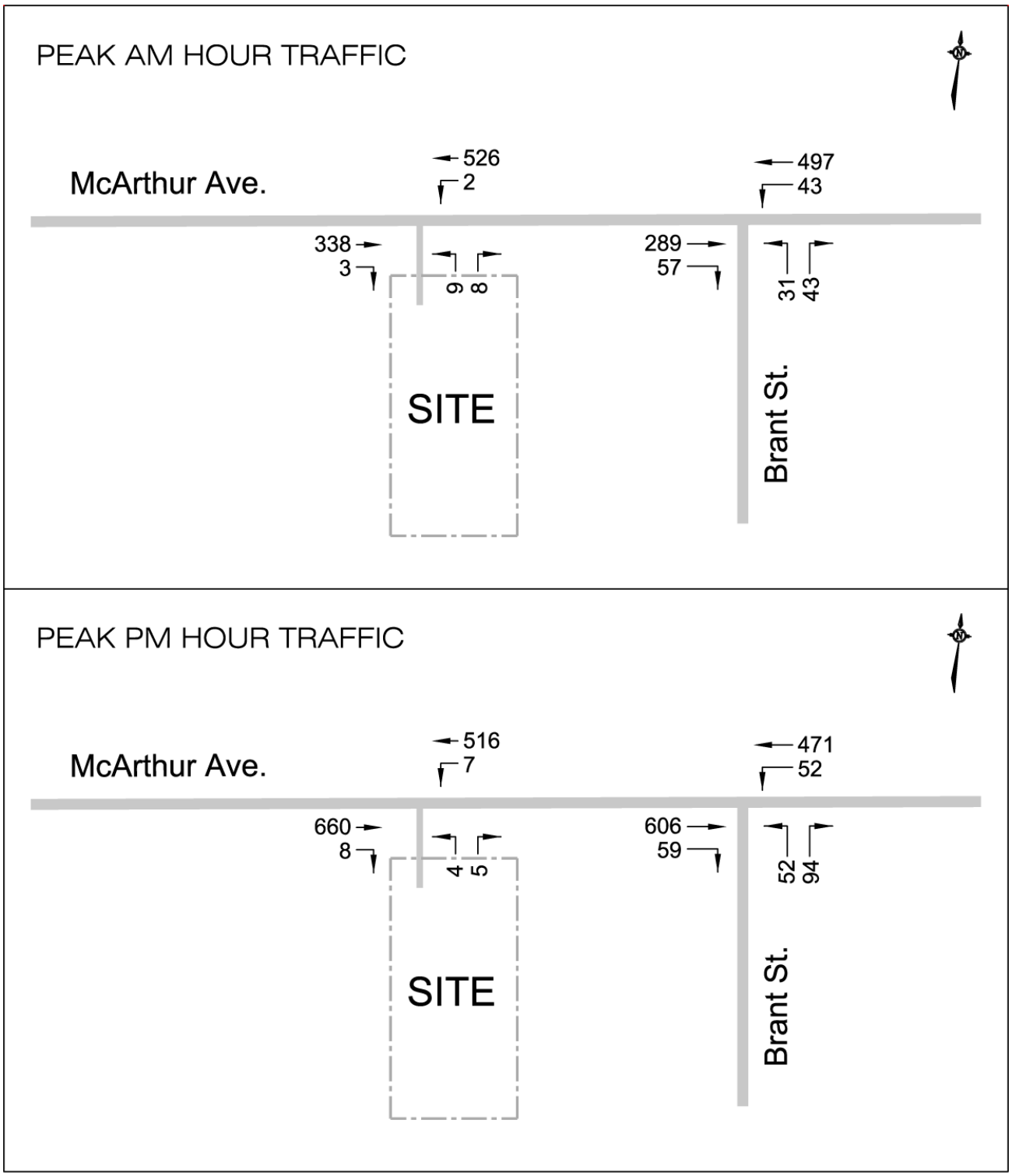
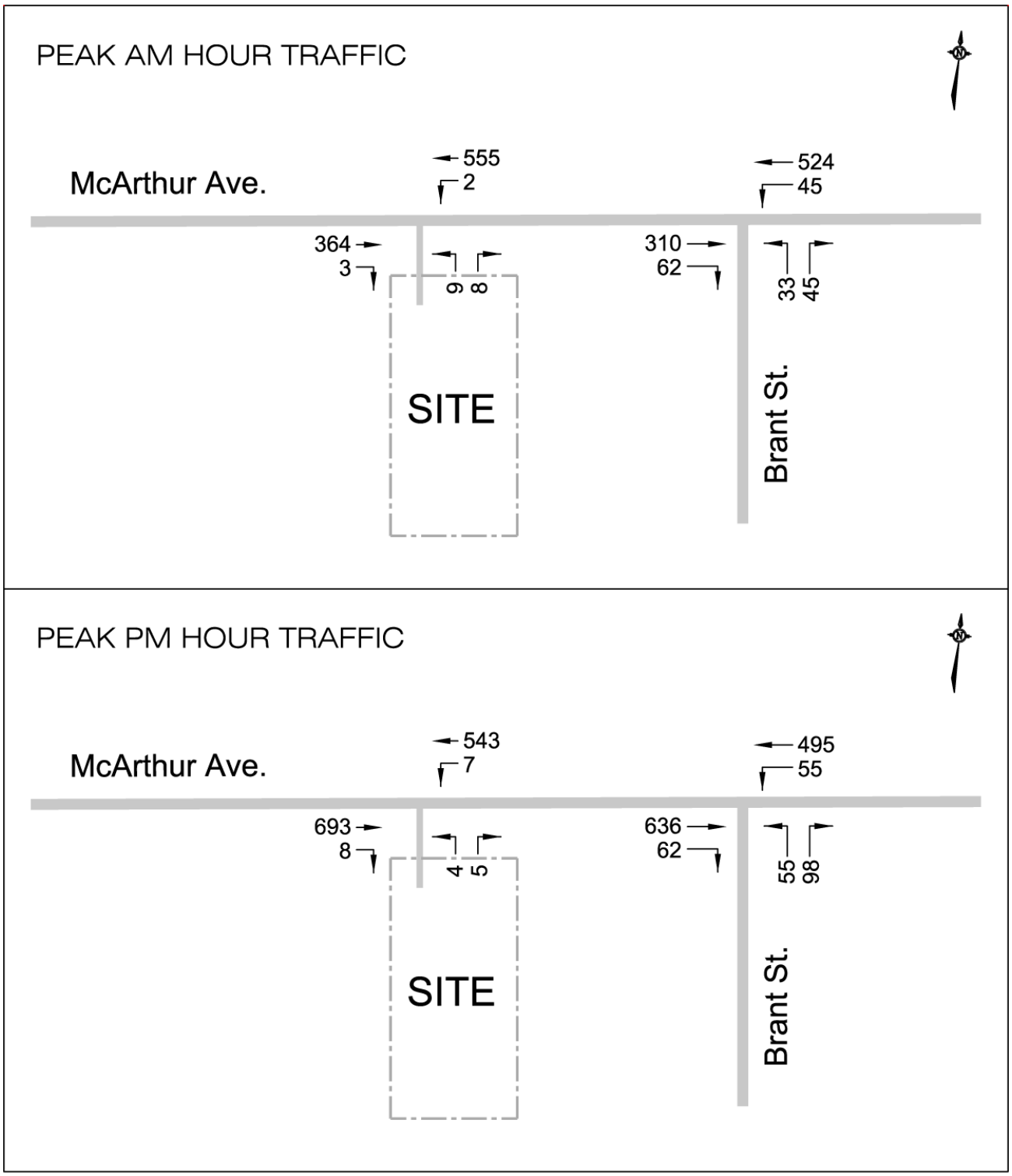


FIGURE 3.5
2027 PEAK AM AND PM HOUR TOTAL TRAFFIC



STEP 4 – ANALYSIS

MODULE 4.1 – Development Design

Element 4.1.1 – Design for Sustainable Modes

The proposed development will have 64 rental apartment units and 17 parking spaces including 1 barrier free space provided in an underground parking garage.

A bicycle storage room will be located on the ground floor of the building which would provide storage for 44 bicycles. McArthur Avenue provides cycling lanes along both sides of the roadway which were constructed under the McArthur Bicycle Lanes project in 2018.

Pedestrian sidewalks exist along both sides of McArthur Avenue which form part of the pedestrian sidewalk network.

The site is served by OC Transpo Frequent Route 14 which travels along McArthur Avenue past the site and provides service to the St. Laurent Transit Station to the east, and the downtown area and Tunney's Pasture Transit Station to the west. The eastbound and westbound Route 14 bus stops are located at the Brant/McArthur intersection with a maximum walk of 75 m.

The study has utilized the *TDM - Supportive Development Design and Infrastructure Checklist provided below* for a Residential Development for the rental apartment units. The checklist examines the opportunity to implement facilities which are supportive of sustainable modes.

TDM-Supportive Development Design and Infrastructure Checklist:
Residential Developments (multi-family or condominium)

Legend

REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	1.	**WALKING & CYCLING: ROUTES**	
	1.1	**Building location & access points**	
BASIC	1.1.1	Locate building close to the street, and do not locate parking areas between the street and building entrances	☒ The building has an underground parking garage
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☒ The building and entrances are adjacent to the street
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☒
	1.2	**Facilities for walking & cycling**	
REQUIRED	1.2.1	Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations *(see Official Plan policy 4.3.3)*	☒ OC Transpo bus stops are located at the Brant/McArthur intersection, within a 75 m walk from the building entrance
REQUIRED	1.2.2	Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible *(see Official Plan policy 4.3.12)*	☒ The building entrances are located at the north limit of the property next to the municipal sidewalk

TDM-supportive design & infrastructure measures: *Residential developments*			Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3	Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks *(see Official Plan policy 4.3.10)*	☒
REQUIRED	1.2.4	Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps *(see Official Plan policy 4.3.10)*	☒
REQUIRED	1.2.5	Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians *(see Official Plan policy 4.3.11)*	☒ The McArthur Bicycle Lanes provide the safe and efficient movement of bikes throughout the roadway network
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☒ The building entrances are within 75 m of bus stops
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☒ All walking routes are along an arterial road with street lighting
BASIC	1.2.8	Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
	1.3	**Amenities for walking & cycling**	
BASIC	1.3.1	Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☐
BASIC	1.3.2	Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☐

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	2.	**WALKING & CYCLING: END-OF-TRIP FACILITIES**	
	2.1	**Bicycle parking**	
REQUIRED	2.1.1	Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible *(see Official Plan policy 4.3.6)*	☒ There will be a bicycle room in the underground parking garage for 44 bikes
REQUIRED	2.1.2	Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas *(see Zoning By-law Section 111)*	☐
REQUIRED	2.1.3	Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored *(see Zoning By-law Section 111)*	☒
BASIC	2.1.4	Provide bicycle parking spaces equivalent to the expected number of resident-owned bicycles, plus the expected peak number of visitor cyclists	☒ The number of bike storage spaces meets City By-laws.
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single residential building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers *(see Zoning By-law Section 111)*	☐ N/A
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to at least the number of units at condominiums or multi-family residential developments	☐ Secure bike parking spaces will meet City By-laws
	2.3	**Bicycle repair station**	
BETTER	2.3.1	Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☐
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐ N/A
BASIC	3.1.2	Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐ N/A
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐ N/A

		TDM-supportive design & infrastructure measures: *Residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	4.	**RIDESHARING**	
	4.1	**Pick-up & drop-off facilities**	
BASIC	4.1.1	Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☐
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide up to three carshare parking spaces in an R3, R4 or R5 Zone for specified residential uses *(see Zoning By-law Section 94)*	☐ N/A
	5.2	**Bikeshare station location**	
BETTER	5.2.1	Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐
	6.	**PARKING**	
	6.1	**Number of parking spaces**	
REQUIRED	6.1.1	Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☒ The Site Plan provides 17 spaces which does not meets City By-law requirements
BASIC	6.1.2	Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☐
BASIC	6.1.3	Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly *(see Zoning By-law Section 104)*	☐
BETTER	6.1.4	Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking *(see Zoning By-law Section 111)*	☐
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Provide separate areas for short-term and long-term parking (using signage or physical barriers) to permit access controls and simplify enforcement (i.e. to discourage residents from parking in visitor spaces, and vice versa)	☐

Element 4.1.2 – Circulation and Access

With only a parking garage access to McArthur Avenue, the building garbage containers will be kept in the garage with pickup coordinated with building management who would move the containers to the street for pickup. Small moving trucks can be accommodated within the parking garage with larger trucks parked on the street.

Element 4.1.3 – New Street Networks

Exempt as determined in the Scoping Document.

MODULE 4.2 – Parking

Element 4.2.1 – Parking Supply

The development will provide 17 parking spaces which includes 1 barrier free space. The parking will all be contained in the underground garage and would consist of 12 spaces for the tenants of the building and 5 spaces for visitors. The vehicular parking provided will not meet the City of Ottawa parking By-laws requiring 31 parking spaces.

The site will provide spaces for the parking of 44 bicycles in a secured area on the ground floor of the building. City By-laws require only 32 bicycle storage spaces.

Element 4.2.2 – Spillover Parking

The site is well served by transit with OC Transpo Frequent Route 14 travelling past the site and bus stops located at the Brant/McArthur intersection. Transit, which provides service to the downtown core and Tunney's Pasture Transit Station to the west, and the St. Laurent Transit Station to the east, would be well used by residents thereby reducing the need for vehicles and spillover parking.

Residents leasing apartment units in the building would be aware of the limited parking available in the parking garage and would likely not depend on on-street parking in the area.

The apartment development would provide on-site visitor parking. On-street parking is allowed along both sides of Brant Street, approximately a minimum 90 m walk from the building entrance.

Spillover parking in the area resulting from the development of the site would likely not be a problem.

MODULE 4.3 – Boundary Street Design

The City of Ottawa Complete Streets concept allows for the safe movement of everyone whether they choose to walk, bike, drive, or take public transit. The boundary road to the Castle Heights Residences would be McArthur Avenue. McArthur Avenue is a two

lane arterial road which is not designated as a Spine Route in the City of Ottawa TMP, Cycling Network - Primary Urban.

Dedicated bicycle lanes are provided along both sides of the road adjacent to the curb. Sidewalks are provided along both sides of the road adjacent to the curb and bicycle lanes. Transit service travels along McArthur Avenue past the site with Frequent Route 14 providing all day 7 days a week service.

The multi-modal level of service for the McArthur Avenue road segment between Irwin Miller Street and Brant Street was determined utilizing the City of Ottawa publication, *Multi-Modal Level of Service (MMLOS) Guidelines*. The following examined the MMLOS for the various modes of travel along the McArthur Avenue road segment.

PEDESTRIAN LEVEL OF SERVICE (PLOS)

There are sidewalks along both sides of McArthur Avenue. The sidewalks are approximately 2.0 m in width with a paved boulevard and are adjacent to the curb and bike lanes. The sidewalk across the frontage of the site is a 2.5 m concrete sidewalk adjacent to the curb. Table 4.1 presents the level of service for the street segment adjacent to the site, with the analysis sheets provided in the Appendix.

TABLE 4.1
PEDESTRIAN LEVEL OF SERVICE (PLOS) – Street Segment

Street	Segment	Level of Service	Analysis
McArthur Ave.	Between Irwin Miller St and Brant St.	D	Exhibit 4.1

BICYCLE LEVEL OF SERVICE (BLOS)

McArthur Avenue between Irwin Miller Street and Brant Street is identified in the *Ottawa Cycling Plan* as a local cycling route. McArthur Avenue has a dedicated bike lane on both sides of the road which were constructed in 2018 under the McArthur Bicycle Lanes project. Table 4.2 presents the level of service for the McArthur Avenue road segment with the analysis sheets provided in the Appendix.

TABLE 4.2
BICYCLE LEVEL OF SERVICE (BLOS) – Street Segment

Street	Segment	Level of Service	Analysis
McArthur Ave.	Between Irwin Miller St and Brant St.	B	Exhibit 4.2

TRANSIT LEVEL OF SERVICE (TLOS)

OC Transpo provides transit service along McArthur Avenue past the site with Frequent Route 14 which provides all day service 7 days a week. Route 14 travels to the Tunney's Pasture Transit Station to the west and St. Laurent Transit Station to the east with stops in the downtown core. Table 4.3 presents the level of service along the McArthur Avenue road segment between Irwin Miller Street and Brant Street. The analysis sheets are provided in the Appendix.

TABLE 4.3
TRANSIT LEVEL OF SERVICE (TLOS) – Street Segment

Street	Segment	Level of Service	Analysis
McArthur Ave.	Between Irwin Miller St and Brant St.	D	Exhibit 4.3

TRUCK LEVEL OF SERVICE (TkLOS)

The truck LOS was determined for the McArthur Avenue road segment adjacent to the site. McArthur Avenue is designated as an urban truck route, with truck travel prohibited along Brant Street. Table 4.4 presents the truck level of service with the analysis sheets provided in the Appendix.

TABLE 4.4
TRUCK LEVEL OF SERVICE (TkLOS) – Street Segment

Street	Segment	Level of Service	Analysis
McArthur Ave.	Between Irwin Miller St and Brant St.	A	Exhibit 4.4

Traffic collisions along the McArthur Avenue road segment between Irwin Miller Street and Brant Street are shown in Table 2.1 in Element 2.1.2. Over the five year period between January 1, 2014 and December 31, 2018, 7 collisions were recorded along the McArthur Avenue road segment across the frontage of the site. The majority of collisions were rear end collisions. The traffic calming measures of the 2018 construction of the bike lanes with precast curbs defining the bike lanes would reduce the number of collisions.

The McArthur Avenue road segment was analyzed to determine the level of service which was compared to the MMLOS targets for pedestrians, bicycles, transit and trucks. The calculated Level of Service (LOS) as shown in Tables 4.1 to 4.4 is compared to the LOS targets for all modes of travel for a development within 300 m of a school. The

Robert E. Wilson Public School is located on the north side of McArthur Avenue across from the site. The LOS targets were obtained from Exhibit 22 of the *Multi-Modal Level of Service (MMLOS) Guidelines*. Table 4.5 summarizes the MMLOS results for the road segments and targets.

TABLE 4.5
MULTI-MODAL (MMLOS) SEGMENT SUMMARY TABLE - Street Segment

SEGMENTS	Level of Service (LOS) – 2029				
	Pedestrian	Bicycle	Transit	Auto	Truck
SEGMENT					
Calculated McArthur Ave.	D	B	D	-	A
Target	A	B	D	-	D

The pedestrian level of service (PLOS) target was based on the close proximity to a school and a reduced speed limit during school hours. The PLOS did not meet the target due to the volume of traffic along McArthur Avenue. Having the designated bike lane between the sidewalk and road would increase the level of comfort of pedestrians.

MODULE 4.4 – Access Intersection Design

Element 4.4.1 – Location and Design of Access

The apartment development will have one access to an underground garage. The access will be 6.0 m in width and would provide one lane entering and one lane exiting. The access would be located at the west side of the property approximately 43 m from the Brant/McArthur intersection (center to center). There is a residential driveway adjacent to the west limit of the site, and an access to the Robert E. Wilson public school across from the site on the north side of McArthur Avenue.

The Access to the development's parking garage would provide full turning movements to/from McArthur Avenue. As part of the McArthur Bicycle Lanes project, precast curbs were installed within the 0.5 m buffer between the bike lane and travel lane. Across the frontage of the site, a precast curb was installed at the west portion of the site providing an opening at the east portion in front of the existing driveway. With the proposed access being relocated to the west portion of the site, the 4.9 m long precast curb would be relocated 7.0 m further east next to the existing precast curb (end to end). This would provide an unobstructed access to/from the proposed parking garage.

The precast curb which requires relocation is shown in the following photograph. A discussion with City of Ottawa staff has determined that the relocation of the precast curb would not trigger the requirement of a Road Modification Approval (RMA) report.

McARTHUR AVENUE - Eastbound View of The Precast Curb At The Site Access

Element 4.4.2 – Intersection Control

The access to the underground parking garage would be controlled by a stop sign at the northbound garage exit, and the one exit lane to have shared left/right turning movements. The volume of site generated trips and the proximity to the Brant/McArthur intersection would not trigger any further traffic control measures.

Element 4.4.3 – Intersection Design

The analysis of the intersection of the site access and the Brant/McArthur intersection were completed for all modes using the *Multi-Modal Level of Service (MMLOS) Guidelines* and the *Highway Capacity Manual (HCM) 2010*. Each mode will be addressed in the following sections:

VEHICLE LEVEL OF SERVICE (LOS) – Intersection Capacity Analysis

The analysis of the site access and the Brant/McArthur intersection will use the *Highway Capacity Software, Version 7.8.5,* which uses the capacity analysis procedure as documented in the *Highway Capacity Manual (HCM) 2010 and HCM 6th Edition*.

For unsignalized intersections, the level of service of each lane movement and approach is determined as a function of the average control delay of vehicles at the approach. The following relates the level of service of each lane movement with the expected control delay at the approach.

LEVEL OF SERVICE	AVERAGE CONTROL DELAY	
Level of Service A	0-10 sec./vehicle	Little or No Delay
Level of Service B	>10-15 sec./vehicle	Short Traffic Delays
Level of Service C	>15-25 sec./vehicle	Average Traffic Delays
Level of Service D	>25-35 sec./vehicle	Long Traffic Delays
Level of Service E	>35-50 sec./vehicle	Very Long Traffic Delays
Level of Service F	>50 sec./vehicle	Extreme Delays – Demand Exceeds Capacity

The expected length of queue at the critical lane movements for an unsignalized two-way stop controlled intersection was determined by the calculation of the 95th percentile queue at the lane approach. The 95th percentile queue length is the calculated 95th greatest queue length out of 100 occurrences at a movement during a 15-minute peak period. The 95th percentile queue length is a function of the capacity of a movement and the total expected traffic, with the calculated value determining the magnitude of the queue by representing the queue length as fractions of vehicles.

For a signalized intersection, the operation or level of service of an intersection is determined from the volume to capacity ratio (v/c) for each lane movement as documented by the City of Ottawa in the *Transportation Impact Assessment Guidelines (2017)*. The following relates the level of service with the volume to capacity ratio at each lane movement.

LEVEL OF SERVICE	VOLUME TO CAPACITY RATIO
Level of Service A	0 to 0.60
Level of Service B	0.61 to 0.70
Level of Service C	0.71 to 0.80
Level of Service D	0.81 to 0.90
Level of Service E	0.91 to 1.00
Level of Service F	> 1.00

Access and McArthur Avenue Intersection

The site access onto McArthur Avenue will be a new access to the underground parking garage. The access intersection will be a “T” intersection with the site access forming the northbound approach which will be controlled by a stop sign. The following is the lane configuration of the Access intersection:

Northbound Access Approach	One left/right turn lane (Stop Sign)
Eastbound McArthur Ave. Approach	One shared through/right lane
Westbound McArthur Ave. Approach	One shared left/through lane

The operational analysis was conducted for the expected traffic at the year 2022 when the development is expected to be completed. The time period would be for the peak AM and PM hours of the adjacent road which would coincide with the expected site generated trips of residents travelling to/from work.

The operational analysis at the Access/McArthur intersection determined that the intersection would function at a Level of Service (LOS) "C" during the 2022 peak AM and PM hours. Table 4.6 summarizes the operation of the intersection with the analysis sheets provided in the Appendix as Exhibit 4.5 for the peak AM hour and Exhibit 4.6 for the peak PM hour.

TABLE 4.6
ACCESS/McARTHUR INTERSECTION – LOS & Control Delay

INTERSECTION APPROACH	**WEEKDAY PEAK AM HOUR** *2022 Total* (2027 Total)		**WEEKDAY PEAK PM HOUR** *2022 Total* (2027 Total)	
	LOS	**Delay (sec.)**	**LOS**	**Delay (sec.)**
WB Left/Through - McArthur	*A* (A)	*8.0* (8.1)	*A* (C)	*9.1* (9.2)
NB Left/Right - Access	*C* (C)	*14.8* (15.6)	*C* (C)	*19.6* (20.9)
Total Intersection	*C* (C)	*14.8* (15.6)	*C* (C)	*19.6* (20.9)

At the year 2027 which represents five years beyond completion, the Access/McArthur intersection would continue to operate at a LOS "C" during both the peak AM and PM hours. Table 4.6 summarizes the operation of the intersection with the analysis sheets provided as Exhibit 4.7 and Exhibit 4.8.

The 95th percentile queue was calculated using the expected 2027 traffic. The analysis determined that the westbound left/through McArthur Avenue movement would experience a 0.0 vehicle queue and the northbound left/right turn movement a 0.2 vehicle queue during both the 2027 peak AM and PM hours. The westbound McArthur Avenue queuing of vehicles entering the site's garage entrance would not impact the operation of the Brant/McArthur intersection.

Brant Street and McArthur Avenue Intersection

The intersection of Brant Street and McArthur Avenue is a "T" intersection with McArthur Avenue forming the eastbound and westbound approaches, and Brant Street the northbound approach. The intersection is controlled by traffic signals and has the following intersection geometry:

Northbound Brant Approach	One exclusive left turn lane One exclusive right turn lane
Eastbound McArthur Approach	One left/through/right lane (left into the plaza)
Westbound McArthur Approach	One through lane One exclusive left turn lane

An operational analysis was completed for the peak AM and PM hours using the existing 2018 traffic counts obtained from the City of Ottawa (Figure 2.3). The analysis used the existing lane geometry following the reconstruction of McArthur Avenue with designated bike lanes in 2018. The analysis determined that all lane movements functioned at a Level of Service (LOS) "A" during the peak AM hour. During the peak PM hour all lane movements functioned at a LOS "A" with the exception of the eastbound McArthur through/right lane movement which functioned at a LOS "C". The operation of the intersection is summarized in Table 4.7, with the analysis sheets provided in the Appendix as Exhibit 4.9 for the peak AM hour and Exhibit 4.10 for the peak PM hour.

TABLE 4.7
BRANT/McARTHUR INTERSECTION – LOS & v/c Ratio

INTERSECTION APPROACH	**WEEKDAY PEAK AM HOUR** 2018 Existing **2027 Background** *2022 Total* (2027 Total)		**WEEKDAY PEAK PM HOUR** 2018 Existing **2027 Background** *2022 Total* (2027 Total)	
	LOS	**v/c Ratio**	**LOS**	**v/c Ratio**
EB Through/Right	A **A** *A* (A)	0.398 **0.435** *0.413* (0.445)	C **D** *D* (D)	0.785 **0.858** *0.824* (0.865)
WB Left	A **A** *A* (A)	0.083 **0.097** *0.089* (0.098)	A **A** *A* (A)	0.231 **0.317** *0.268* (0.324)
WB Through	A **A** *A* (A)	0.549 **0.601** *0.572* (0.603)	A **A** *A* (A)	0.540 **0.590** *0.567* (0.596)
NB Left	A **A** *A* (A)	0.065 **0.071** *0.067* (0.071)	A **A** *A* (A)	0.089 **0.099** *0.097* (0.102)
NB Right	A **A** *A* (A)	0.100 **0.109** *0.105* (0.109)	A **A** *A* (A)	0.203 **0.221** *0.212* (0.221)
Total Intersection	*A* (A)	*0.314* (0.474)	*A* (A)	*0.335* (0.503)

The analysis for the expected 2027 background traffic which does not include the site generated site trips, determined that all lane movements functioned at a LOS "A" during the peak AM hour, and during the peak PM hour all movements functioned at a LOS "A" with the exception of the eastbound through/right movement which functioned at a LOS "D". Table 4.7 summarizes the operation of the intersection with the analysis sheets provided as Exhibits 4.11 and 4.12.

Following the completion of the residential development in 2022, the intersection would function at an acceptable level of service with all approaches functioning at a LOS "A" during the peak AM hour, and a LOS "A" during the peak PM hour with the exception of the eastbound through/right lane movement which functioned at a LOS "D". Table 4.7 summarizes the 2022 total traffic operation of the intersection, with the analysis sheets provided as Exhibit 4.13 for the peak AM hour and 4.14 for the peak PM hour.

For the expected total traffic at the year 2027, the intersection would continue to operate at the same level of service as the 2027 background and 2022 total traffic. All lane

movements would function at a LOS “A” during the peak AM as shown in Table 4.7, and all lane movements at a LOS “A” with the exception of the eastbound McArthur Avenue through/right movement which functioned at a LOS “D” during the peak PM hour.

The 95th percentiles queue length was examined for the eastbound McArthur Avenue approach to the Brant/McArthur intersection. The queue length was determined to be 45 m during the peak AM hour and 130 m during the peak PM hour. The clear length between the eastbound stop bar of the Brant/McArthur intersection and the east limit of the garage access is 28 m. During the peak hours the eastbound queue to the Brant/McArthur intersection may extend past the garage access interfering with the exiting of vehicles. The queue would clear every signal cycle allowing vehicles to enter or exit the site.

The operational analysis determined that the Brant/McArthur intersection operated at the same 2027 level of service following the development of the site as compared to the 2027 background traffic. There would not be any requirements for modifications to the intersection of Brant Street and McArthur Avenue due to the development of the apartment development.

PEDESTRIAN LEVEL OF SERVICE (PLOS)

The pedestrian level of service was determined utilizing the City of Ottawa publication, *Multi-Modal Level of Service (MMLOS) Guidelines*. There are sidewalks along both sides of McArthur Avenue adjacent to the curb. The sidewalk on the south side across the frontage of the site is 2.5 m in width. Table 4.8 presents the level of service for the Brant/McArthur intersection adjacent to the site, with the analysis sheet provided in the Appendix.

TABLE 4.8
PEDESTRIAN LEVEL OF SERVICE (PLOS) – Intersection

Intersection	Level of Service	Analysis
Brant Street and McArthur Avenue	D	Exhibit 4.17

BICYCLE LEVEL OF SERVICE (BLOS)

The bicycle level of service (BLOS) was determined for the intersection of Brant Street and McArthur Avenue. There are dedicated cycling lanes which were constructed in 2018 under the City of Ottawa *McArthur Bicycle Lanes, from North River Rd. to St. Laurent Blvd.* project. Table 4.9 presents the level of service for the Brant/McArthur intersection with the analysis sheet provided in the Appendix.

TABLE 4.9
BICYCLE LEVEL OF SERVICE (BLOS) – Intersection

Intersection	Level of Service	Analysis
Brant Street and McArthur Avenue	B	Exhibit 4.18

TRANSIT LEVEL OF SERVICE (TLOS)

OC Transpo provides transit service along McArthur Avenue past the site with Frequent Route 14 which travels to the St. Laurent Transit Station to the east, and the downtown core and the Tunney's Pasture Transit Station to the west. Table 4.10 presents the level of service at the Brant/McArthur intersection which was determined from the evaluation tables provided in the City of Ottawa publication, *Multi-Modal Level of Service (MMLOS) Guidelines*. The LOS was based on the worst transit movement delay as determined in the 2027 intersection analysis sheets (Exhibit 4.15 and 4.16). The analysis sheets are provided in the Appendix.

TABLE 4.10
TRANSIT LEVEL OF SERVICE (TLOS) – Intersection

Intersection	Level of Service	Analysis
Brant Street and McArthur Avenue	D	Exhibit 4.19

TRUCK LEVEL OF SERVICE (TkLOS)

The Brant/McArthur level of service for a truck mode was not determined in the analysis as Brant Street prohibits truck travel.

MODULE 4.5 – Transportation Demand Management

Element 4.5.1 – Context for TDM

The site is located along the south side of McArthur Avenue which is designated as an arterial road. The site is well served by the sidewalk network and dedicated cycling lanes along McArthur Avenue. OC Transpo provides transit service to two major transit stations as well as the downtown area. The number of residential trips would be low due to the number of units and available multimodal travel options, and any site generated trips which would be greater than determined would have a minor impact on the adjacent land uses and services.

Element 4.5.2 – Need and Opportunity

The residential component of the development would not require a program to promote various mode shares as the adjacent sidewalk network, dedicated bicycle lanes, and transit routes to the downtown core and transit stations, would promote the use of alternative modes of travel.

Element 4.5.3 – TDM Program

TDM measures could be implemented to encourage travel by sustainable modes which would be applied to the residential component of the development. The TDM measures which would reduce the number of vehicle trips would mainly be the encouragement of transit and bicycle use. The programs would mainly be that of providing information in the form of transit schedules/routes, and maps showing designated bike routes.

The study has utilized the TDM Measures Checklist for a Residential Development which examines the implementation of facilities that are supportive of sustainable modes. The following provides the checklist which examines the Site Plan and transportation components for the proposed residential development at 374 McArthur Avenue.

TDM Measures Checklist:

Residential Developments (multi-family, condominium or subdivision)

Legend

BASIC — The measure is generally feasible and effective, and in most cases would benefit the development and its users

BETTER — The measure could maximize support for users of sustainable modes, and optimize development performance

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

		TDM measures: *Residential developments*	Check if proposed & add descriptions
	1.	**TDM PROGRAM MANAGEMENT**	
	1.1	**Program coordinator**	
BASIC ★	1.1.1	Designate an internal coordinator, or contract with an external coordinator	☐
	1.2	**Travel surveys**	
BETTER	1.2.1	Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
	2.	**WALKING AND CYCLING**	
	2.1	**Information on walking/cycling routes & destinations**	
BASIC	2.1.1	Display local area maps with walking/cycling access routes and key destinations at major entrances *(multi-family, condominium)*	☒ Area maps for walking/cycling can be displayed on an information board in the lobby
	2.2	**Bicycle skills training**	
BETTER	2.2.1	Offer on-site cycling courses for residents, or subsidize off-site courses	☐

			TDM measures: *Residential developments*	Check if proposed & add descriptions
		3.	**TRANSIT**	
		3.1	**Transit information**	
BASIC		3.1.1	Display relevant transit schedules and route maps at entrances *(multi-family, condominium)*	☒ Transit schedules can be displayed on an information board in the lobby
BETTER		3.1.2	Provide real-time arrival information display at entrances *(multi-family, condominium)*	☐
		3.2	**Transit fare incentives**	
BASIC	★	3.2.1	Offer PRESTO cards preloaded with one monthly transit pass on residence purchase/move-in, to encourage residents to use transit	☐
BETTER		3.2.2	Offer at least one year of free monthly transit passes on residence purchase/move-in	☐
		3.3	**Enhanced public transit service**	
BETTER	★	3.3.1	Contract with OC Transpo to provide early transit services until regular services are warranted by occupancy levels *(subdivision)*	☐
		3.4	**Private transit service**	
BETTER		3.4.1	Provide shuttle service for seniors homes or lifestyle communities (e.g. scheduled mall or supermarket runs)	☐
		4.	**CARSHARING & BIKESHARING**	
		4.1	**Bikeshare stations & memberships**	
BETTER		4.1.1	Contract with provider to install on-site bikeshare station (*multi-family)*	☐
BETTER		4.1.2	Provide residents with bikeshare memberships, either free or subsidized *(multi-family)*	☐
		4.2	**Carshare vehicles & memberships**	
BETTER		4.2.1	Contract with provider to install on-site carshare vehicles and promote their use by residents	☐
BETTER		4.2.2	Provide residents with carshare memberships, either free or subsidized	☐
		5.	**PARKING**	
		5.1	**Priced parking**	
BASIC	★	5.1.1	Unbundle parking cost from purchase price *(condominium)*	☐ N/A
BASIC	★	5.1.2	Unbundle parking cost from monthly rent *(multi-family)*	☒ Unbundling parking from apartment rent will be considered

TDM measures: *Residential developments*				Check if proposed & add descriptions
		6.	**TDM MARKETING & COMMUNICATIONS**	
		6.1	**Multimodal travel information**	
BASIC	★	6.1.1	Provide a multimodal travel option information package to new residents	☒ A multimodal travel information package can be included with the rental agreement
		6.2	**Personalized trip planning**	
BETTER	★	6.2.1	Offer personalized trip planning to new residents	☐

MODULE 4.6 – Neighbourhood Traffic Management

Element 4.6.1 – Adjacent Neighbourhoods

Exempt as determined in the Scoping Document.

MODULE 4.7 - Transit

Element 4.7.1 – Route Capacity

OC Transpo provides Frequent Route as Route 14 which operates in all time periods 7 days a week. The route provides 15 minute bus service during peak hours. Frequent Route 14 travels from the St. Laurent Transit Station to the east to Tunney's Pasture Transit Station to the west. The route also travels through the downtown core.

The low number of transit person trips would produce a minor impact on the capacity of transit in the area and would not trigger the need for additional transit capacity.

Element 4.7.2 – Transit Priority

Transit Priority Measures do not exist along McArthur Avenue past the site, but may be implemented along other arterial roads along the route if transit delay becomes an issue.

MODULE 4.8 – Review of Network Concept

Exempt as determined in the Scoping Document.

MODULE 4.9 – Intersection Design

Element 4.9.1 – Intersection Control

The intersection of Brant Street and MacArthur Avenue is located 40 m east of the site. The intersection is controlled by traffic signals. No further traffic control measures are required.

Element 4.9.2 – Intersection Design

Intersection of the Site Access and McArthur Avenue

The site access onto McArthur Avenue will be located at the west portion of the site. The access will be a full movement access which will operate at an acceptable level of service as shown in Table 4.6. The existing precast concrete curb between the bicycle lane and roadway travel lane will be relocated in order to provide full turning movements at the access. The 4.9 m precast curb would be placed end to end with the existing curb to the east. Figure 4.1 shows the proposed relocation of the curb.

Intersection of Brant Street and McArthur Avenue

The Brant/McArthur signalized intersection was analyzed to determine the level of service which was compared to the MMLOS targets for pedestrians, bicycles, transit, and autos. The calculated Level of Service (LOS) as shown in Tables 4.7 to 4.10 is compared to the LOS targets for all modes of travel. The LOS targets were obtained from Exhibit 22 of the *Multi-Modal Level of Service (MMLOS) Guidelines*. Table 4.11 summarizes the MMLOS results for the Brant/McArthur intersection and targets.

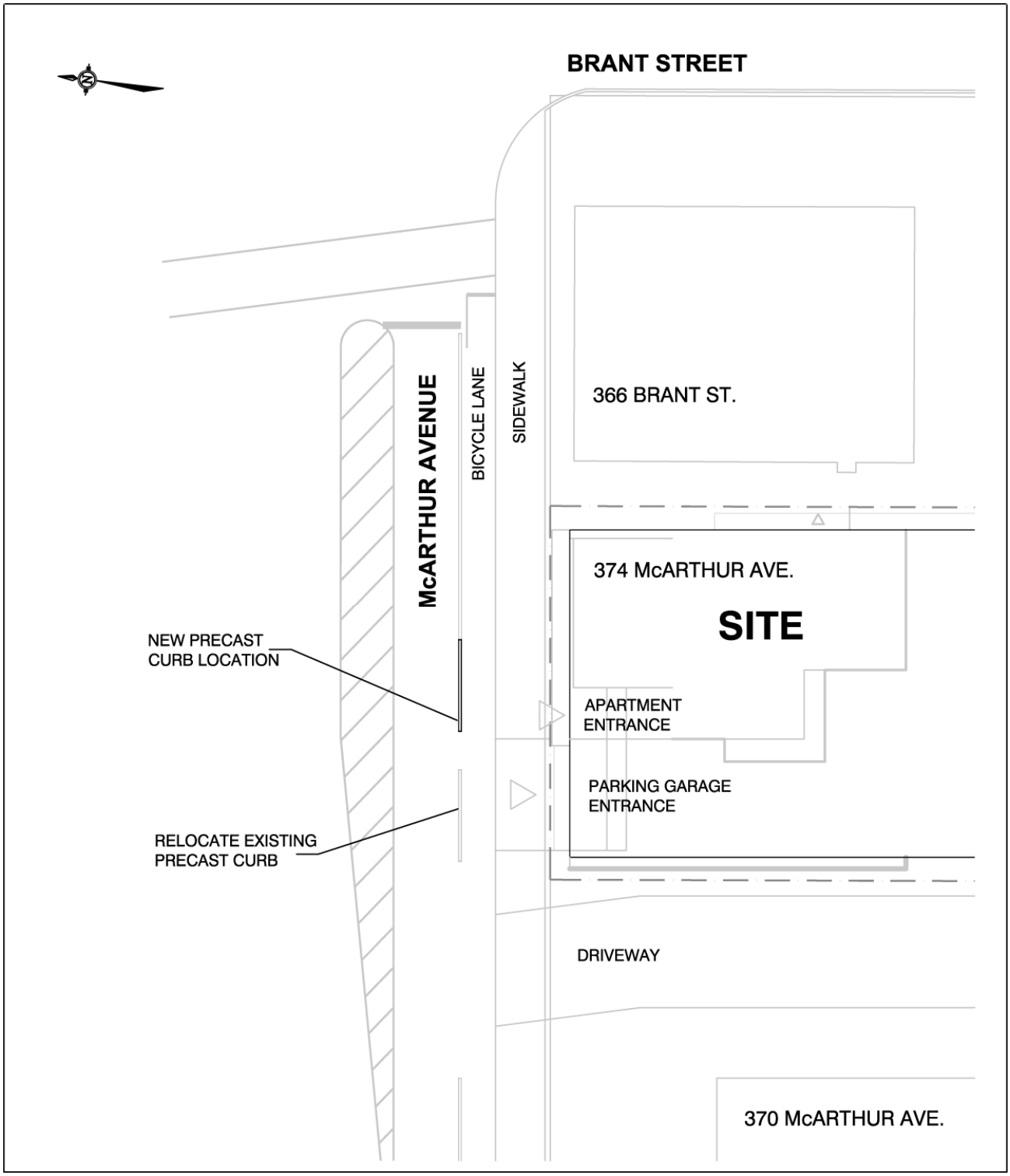
TABLE 4.11
MULTI-MODAL (MMLOS) INTERSECTION SUMMARY TABLE - Intersection

BRANT/McARTHUR INTERSECTION	Level of Service (LOS) – 2027				
	Pedestrian	Bicycle	Transit	Auto	Truck
INTERSECTION					
Calculated LOS	D	B	D	A	-
Target LOS	A	B	D	E	-

The pedestrian LOS at the Brant/McArthur intersection did not meet the target due to the number of lanes crossed and the right turn conflicts of lanes.

The LOS for the bicycle mode of transportation met the target due to the construction of the designated bike lanes along McArthur Avenue.

FIGURE 4.1
PRECAST CURB RELOCATION - Site Access/McArthur Intersection



NOT TO SCALE

The Transit LOS (TLOS) and the auto LOS both met the MMLOS target.

The operation of the Brant/McArthur intersection was analyzed for the 2018 counts, and expected 2022 and 2027 future traffic as discussed in Element 4.4.3 using the procedure documented in the *Highway Capacity Manual (HCM) 2010.* The existing geometry and expected traffic volumes determined that the Brant/McArthur interaction operated at an acceptable level of service using the 2027 traffic volumes, with all lane movements functioning at a LOS "A" during the peak AM hour and all lane movements functioning at a LOS "A" during the peak PM hour with the exception of the eastbound through/right movement which functioned at a LOS "D". The overall intersection LOS was a LOS "A" during both the peak AM and PM hours.

The Truck LOS was not calculated as Brant Street prohibits truck travel.

There would be no requirement for intersection modifications to the Brant/McArthur intersection due to the proposed Castle Heights Residences.

SUMMARY

A Site Plan has been prepared for the redevelopment of a 1,171 m^2 parcel of land at 374 McArthur Avenue which is currently occupied by one vacant residential house. The property fronts on the south side of McArthur Avenue approximately 40 m west of the Brant/McArthur intersection.

The proposed development will comprise of one 6 storey residential apartment building which will provide 64 rental units. The building will have an underground parking garage providing 17 vehicle parking spaces, of which 12 will be for the residents of the apartment building and 5 spaces for visitors. The development is expected to be completed and occupied by the year 2022.

The TIA analysis has examined the modes of transportation along the McArthur Avenue road segment between Irwin Mills Street and Brant Street, and the Brant/McArthur intersection for the weekday peak AM and PM hour of operation following development of the site. The transportation analysis has determined the following:

1. The proposed Castle Heights Residences would be a residential building consisting of 64 rental units. The development is expected to generate 7 vehicle trips arriving and 17 vehicle trips departing during the weekday peak AM hour for a total of 22 trips, and 15 vehicle trips arriving and 9 vehicle trips departing during the weekday peak PM hour for a total of 24 trips.

2. The parking garage will provide 17 parking spaces for tenants and visitors of the apartment building including 1 barrier-free space. The parking does not meet the Zoning By-law for vehicular parking.

3. The Site Plan provides bicycle racks in a secured area on the ground floor for 44 bicycles which meets the City of Ottawa Zoning By-law.

4. The underground parking garage access would be located approximately 43 m west of the Brant/McArthur intersection. A 95th percentile queuing analysis using the 2027 traffic determined that the westbound McArthur Avenue left turn movement into the site would be minor and would not have an impact on the operation of the Brant/McArthur intersection.

   The 2027 peak hour queuing analysis at the Brant/McArthur intersection determined that the 95th percentile queue at the eastbound approach would periodically extend past the parking garage access impacting access to the garage. The queue would clear every signal cycle.

5. The MMLOS analysis of the McArthur Avenue road segment determined that the pedestrian (PLOS) level of service did not meet the MMLOS target due to the volume of traffic along McArthur Avenue. The designated bike lanes and bulb-outs along McArthur Avenue would provide traffic calming measures which would improve the pedestrian level of comfort.

   The pedestrian (PLOS) target was not met for the Brant/McArthur intersection due to number of lanes crossed and the right turn conflicts.

6. The operation analysis determined that the Access/McArthur and Brant/McArthur intersections would both function at an acceptable level of service. There would be no requirement for modifications to the road or intersections due to the development with the exception of a private approach permit for the 6.0 m garage access onto McArthur Avenue and the relocation of the precast curb for the cycling lane (Figure 4.1). The operational analysis determined that all movements at the Brant/McArthur intersection would operate at the same level of service for the 2027 total traffic (including site generated trips) when compared to the 2027 background traffic.

Prepared by:

David J. Halpenny

David J. Halpenny, M. Eng., P. Eng.

APPENDIX

SCREENING FORM

TRAFFIC COUNTS

ITE TRIP GENERATION GRAPHS

MMLOS ROAD SEGMENT AND INTERSECTION ANALYSIS

EXHIBIT 1.1
SCREENING FORM

City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	3817-3843 Innes Road, Ottawa
Description of Location	Residential Development
Land Use Classification	"TM" Zoning – Traditional Mainstreet
Development Size (units)	64 Units
Development Size (m^2)	3,663 m^2 - 6 storey apartment building
Number of Accesses and Locations	1 access to/from underground parking garage onto McArthur Ave.
Phase of Development	One Phase of development
Buildout Year	2022

If available, please attach a sketch of the development or site plan to this form.

2. Trip Generation Trigger

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size
Apartments	64 units

	Yes	No
64 Apartment units < 90 Minimum Development Size		X

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, the Trip Generation Trigger is satisfied.

3. Location Triggers

	Yes	No
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?		X
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?*	X	

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).*

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street are 80 km/hr or greater?		X
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?		X
Is the proposed driveway 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)?	X	
Is the proposed driveway within auxiliary lanes of an intersection?		X
Does the proposed driveway make use of an existing median break that serves an existing site?		X
Is there a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		X
Does the development include a drive-thru facility?		X

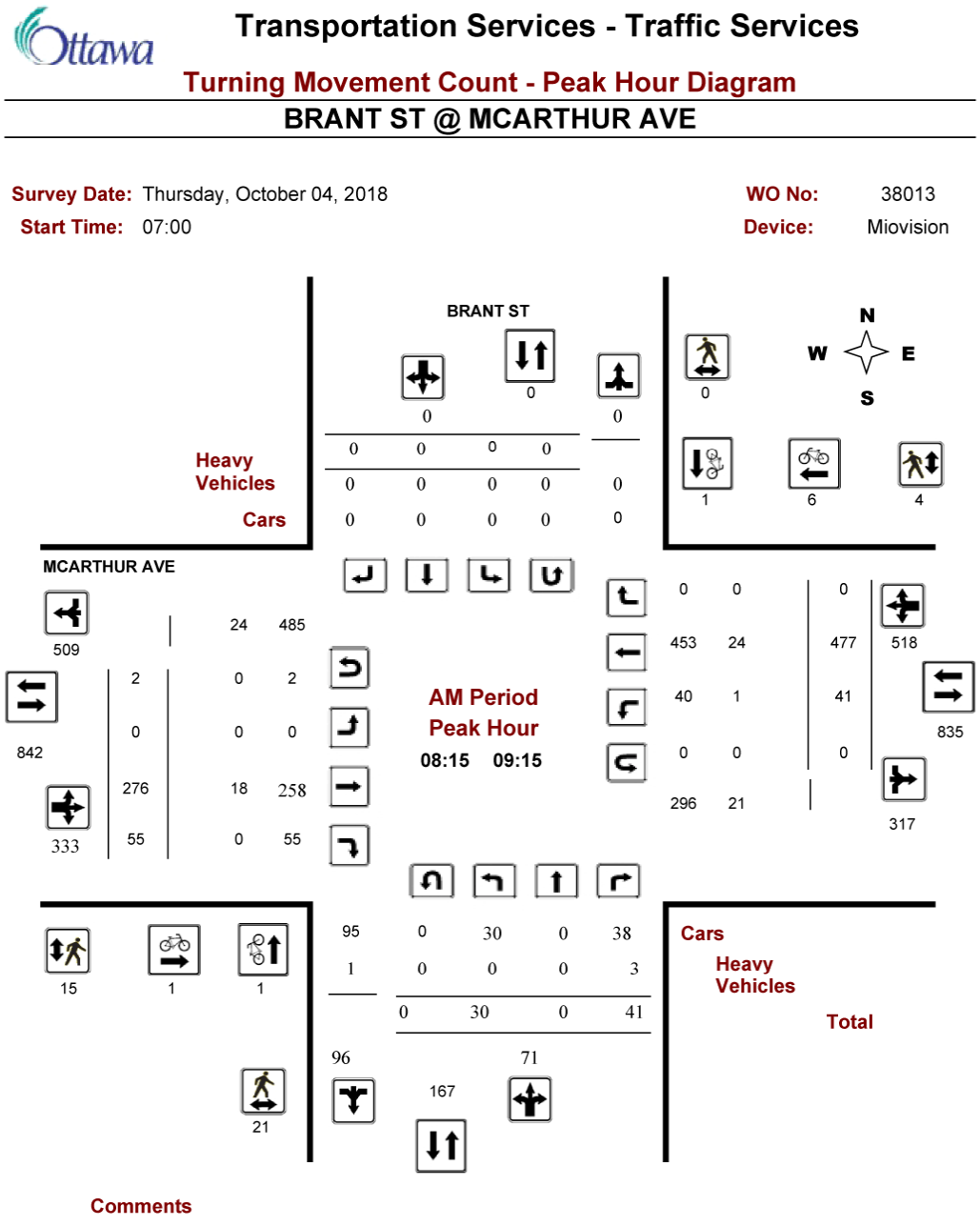
If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?		X
Does the development satisfy the Location Trigger?	X	
Does the development satisfy the Safety Trigger?	X	

If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

EXHIBIT 2.1
2018 PEAK AM HOUR TRAFFIC COUNTS - BRANT/McARTHUR INTERSECTION



2018 PEAK PM HOUR TRAFFIC COUNTS - BRANT/McARTHUR INTERSECTION

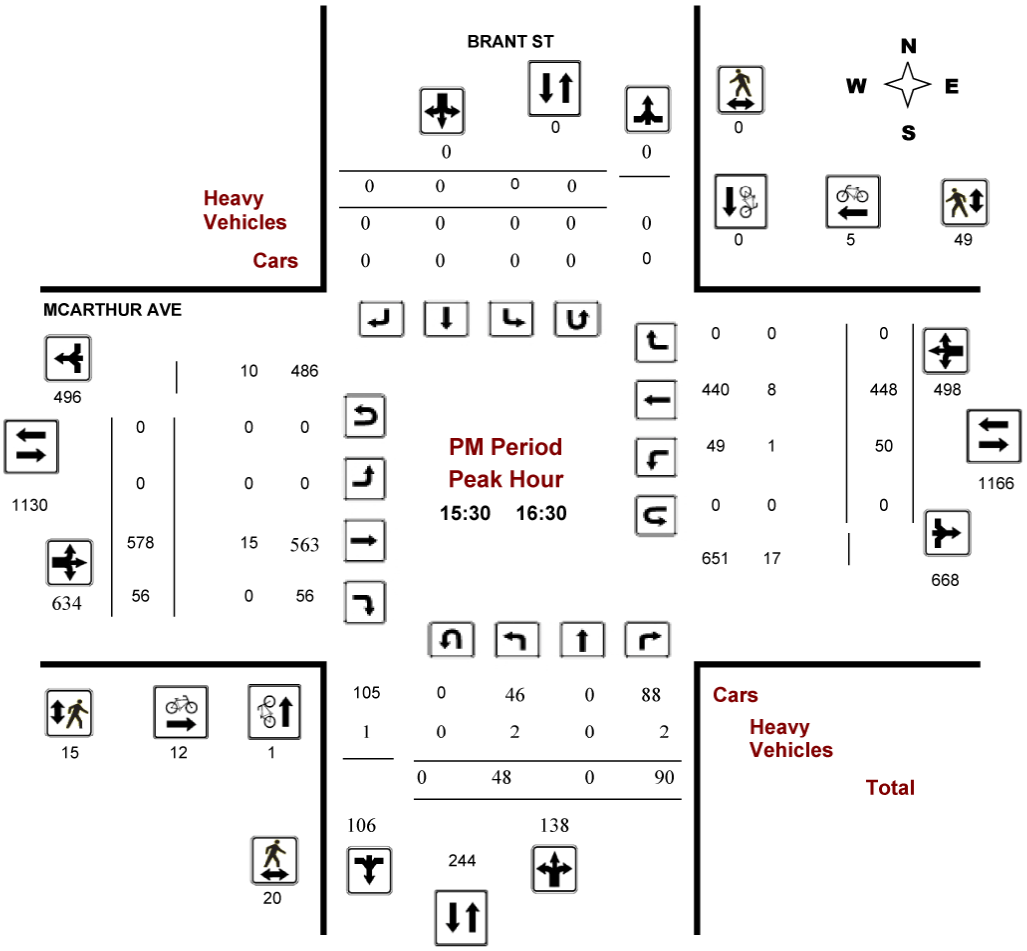
Transportation Services - Traffic Services

Turning Movement Count - Peak Hour Diagram

BRANT ST @ MCARTHUR AVE

Survey Date: Thursday, October 04, 2018 **WO No:** 38013

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



Comments

EXHIBIT 4.1
McARTHUR AVENUE - PLOS SEGMENT EVALUATION

STREET	McArthur Avenue
FROM	Irwin Miller Street
TO	Brant Street
YEAR	2027
DIRECTION	Eastbound–Westbound
MMLOS MODE	PLOS

SEGMENT SCORE **C**

Sidewalk Width (m)	Boulevard Width (m)	Motor Vehicle Traffic Volume (AADT)	Presence of On-street Parking	Segment PLOS			
				Operating Speed (km/h)			
				≤30	>30 or 50	>50 or 60	>60 [1]
2.0 or more	> 2	≤ 3000	N/A	A	A	A	B
		> 3000	Yes	A	B	B	N/A
			No	A	B	C	D
	0.5 to 2	≤ 3000	N/A	A	A	A	B
		> 3000	Yes	A	B	C	N/A
			No	A	C	D	E
	0	≤ 3000	NA	A	B	C	D
		> 3000	Yes	B	B	D	N/A
			No	B	C	E	F
1.8	> 2	≤ 3000	N/A	A	A	A	B
		> 3000	Yes	A	B	C	N/A
			No	A	C	D	E
	0.5 to 2	≤ 3000	N/A	A	B	B	D
		> 3000	Yes	A	C	C	N/A
			No	B	C	E	E
	0	≤ 3000	N/A	A	B	C	D
		> 3000	Yes	B	C	D	N/A
			No	C	D	F	F
1.5	> 2	≤ 3000	N/A	C	C	C	C
		> 3000	Yes	C	C	D	N/A
			No	C	D	E	E
	0.5 to 2	≤ 3000	N/A	C	C	C	D
		> 3000	Yes	C	C	D	N/A
			No	D	E	E	E
	0	N/A		D	E	F [2]	F [2]
<1.5	N/A			F [3]	F [3]	F [3]	F [3]
No sidewalk	N/A			C [4]	F [3]	F [3]	F [3]

EXHIBIT 4.2
McARTHUR AVENUE - BLOS SEGMENT EVALUATION

STREET	McArthur Avenue
FROM	Irwin Miller Street
TO	Brant Street
YEAR	2027
DIRECTION	Eastbound–Westbound
MMLOS MODE	BLOS

SEGMENT SCORE **B**

Type of Bikeway		LOS
Physically Separated Bikeway (cycle tracks, protected bike lanes and multi-use paths). Physical separation refers to, but is not limited to, curbs, raised medians, bollards and parking lanes (adjacent to the bike lane along the travelled way i.e. not curbside).		A
Bike Lanes Not Adjacent Parking Lane - Select Worst Scoring Criteria		
No. of Travel Lanes	1 travel lane in each direction	A
	2 travel lanes in each direction separated by a raised median	B
	2 travel lanes in each direction without a separating median	C
	More than 2 travel lanes in each direction	D
Bike Lane Width	≥ 1.8 m wide bike lane (includes marked buffer and paved gutter width)	A
	≥1.5 m to <1.8 m wide bike lane (includes marked buffer and paved gutter width)	B
	≥1.2 m to <1.5 m wide bike lane (includes marked buffer and paved gutter width)	C
Operating Speed	≤ 50 km/h operating speed	A
	60 km/h operating speed	C
	≥ 70 km/h operating speed	E
Bike lane blockage (commercial areas)	Rare	A
	Frequent	C
Bike Lanes Adjacent to curbside Parking Lane - Select Worst Scoring Criteria		
No. of Travel Lanes	1 travel lane in each direction	A
	2 or more travel lanes in each direction	C
Bike Lane and Parking Lane Width	4.5 m wide bike lane plus parking lane (includes marked buffer and paved gutter width)	A
	4.25 m wide bike lane plus parking lane (includes marked buffer and paved gutter width)	B
	≤ 4.0 m wide bike lane plus parking lane (includes marked buffer and paved gutter width)	C
Operating Speed	< 40 km/h operating speed	A
	50 km/h operating speed	B
	60 km/h operating speed	D
	≥ 70 km/h operating speed	F
Bike lane blockage (commercial areas)	Rare	A
	Frequent	C
Mixed Traffic		
No. of Travel Lanes and Operating Speed	2 travel lanes; ≤ 40 km/h; no marked centerline or classified as residential	A
	2 to 3 travel lanes; ≤ 40 km/h	B
	2 travel lanes; 50 km/h; no marked centerline or classified as residential	B
	2 to 3 travel lanes; 50 km/h	D
	4 to 5 travel lanes; ≤ 40 km/h	D
	4 to 5 travel lanes; ≥ 50 km/h	E
	6 or more travel lanes; ≤ 40 km/h	E
	≥ 60 km/h	F
Unsignalized Crossing along Route: no median refuge		
No. of Travel Lanes on Side Street and Operating Speed	3 or less lanes being crossed; ≤ 40 km/h	A
	4 to 5 lanes being crossed; ≤ 40 km/h	B
	3 or less lanes being crossed; 50 km/h	B
	4 to 5 lanes being crossed; 50 km/h	C
	3 or less lanes being crossed; 60 km/h	C
	4 to 5 lanes being crossed; 60 km/h	D
	6 or more lanes being crossed; ≤ 40 km/h	E
	3 or less lanes being crossed; ≥ 65 km/h	E
	6 or more lanes being crossed; ≥ 50 km/h	F
	4 to 5 lanes being crossed; ≥ 65 km/h	F
Unsignalized Crossing along Route: with median refuge (≥ 1.8 m wide)		
No. of Travel Lanes on Side Street and Operating Speed	5 or less lanes being crossed; ≤ 40 km/h	A
	3 or less lanes being crossed; 50 km/h	A
	6 or more lanes being crossed; ≤ 40 km/h	B
	4 to 5 lanes being crossed; 50 km/h	B
	3 or less lanes being crossed; 60 km/h	B
	6 or more lanes being crossed; 50 km/h	C
	4 to 5 lanes being crossed; 60 km/h	C
	3 or less lanes being crossed; ≥ 65 km/h	D
	6 or more lanes being crossed; 60 km/h	E
	4 to 5 lanes being crossed; ≥ 65 km/h	E
	6 or more lanes being crossed; ≥ 65 km/h	F

NOT APPLICABLE

NOT APPLICABLE

NOT APPLICABLE

EXHIBIT 4.3
McARTHUR AVENUE - TLOS SEGMENT EVALUATION

STREET	McArthur Avenue
FROM	Irwin Miller Street
TO	Brant Street
YEAR	2027
DIRECTION	Eastbound–Westbound
MMLOS MODE	TLOS

SEGMENT SCORE **D**

Facility Type		Level/exposure to congestion delay, friction and incidents			Quantitative Measurement	LOS
		Congestion	Friction	Incident Potential		
Segregated ROW		No	No	No	N/A	A
Bus lane	No/limited parking/driveway friction	No	Low	Low	$C_f \leq 60$	B
	Frequent parking/driveway friction	No	Medium	Medium	$C_f > 60$	C
Mixed Traffic	Limited parking/driveway friction	Yes	Low	Medium	$Vt/Vp \geq 0.8$	D
	Moderate parking/driveway friction	Yes	Medium	Medium	$Vt/Vp \leq 0.6$	E
	Frequent parking/driveway friction	Yes	High	High	$Vt/Vp < 0.4$	F

Notes:

Cf, Conflict Factor = = (Number of driveways x crossing volume) / 1 km

Vt/Vp is the ratio of average transit travel speed to posted speed limit

EXHIBIT 4.4
McARTHUR AVENUE - TkLOS SEGMENT EVALUATION

STREET	McArthur Avenue
FROM	Irwin Miller Street
TO	Brant Street
YEAR	2027
DIRECTION	Eastbound–Westbound
MMLOS MODE	TkLOS

SEGMENT SCORE **A**

Exhibit 20 – TkLOS Segment Evaluation Table

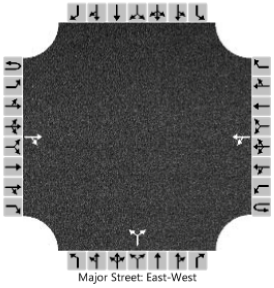
Curb Lane Width (m)	Only two travel lanes (one in each direction)	More than two travel lanes
>3.7	B	A
≤3.5	C	A
≤3.3	D	C
≤3.2	E	D
≤3	F	E

EXHIBIT 4.5
2022 PEAK AM HOUR ANALYSIS (Total Traffic) - Access/McArthur

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Access/McArthur
Agency/Co.		Jurisdiction	City of Ottawa
Date Performed	12/18/2020	East/West Street	McArthur Avenue
Analysis Year	2022	North/South Street	Site Access
Time Analyzed	Peak AM Hour	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Castle Heights Residences		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			338	3		2	526			9		8				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						2					18					
Capacity, c (veh/h)						1199					386					
v/c Ratio						0.00					0.05					
95% Queue Length, Q_{95} (veh)						0.0					0.2					
Control Delay (s/veh)						8.0					14.8					
Level of Service (LOS)						A					B					
Approach Delay (s/veh)					0.1				14.8							
Approach LOS									B							

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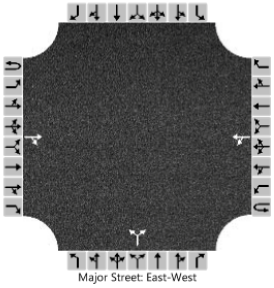
EXHIBIT 4.6
2022 PEAK PM HOUR ANALYSIS (Total Traffic) - Access/McArthur

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Access/McArthur
Agency/Co.		Jurisdiction	City of Ottawa
Date Performed	12/18/2020	East/West Street	McArthur Avenue
Analysis Year	2022	North/South Street	Site Access
Time Analyzed	Peak PM Hour	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Castle Heights Residences		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			660	8		7	516			4		5				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						8					10					
Capacity, c (veh/h)						886					256					
v/c Ratio						0.01					0.04					
95% Queue Length, Q_{95} (veh)						0.0					0.1					
Control Delay (s/veh)						9.1					19.6					
Level of Service (LOS)						A					C					
Approach Delay (s/veh)					0.2				19.6							
Approach LOS									C							

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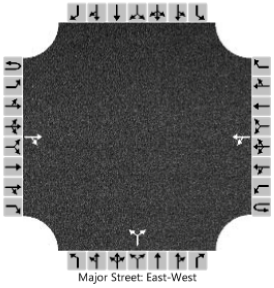
EXHIBIT 4.7
2027 PEAK AM HOUR ANALYSIS (Total Traffic) - Access/McArthur

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Access/McArthur
Agency/Co.		Jurisdiction	City of Ottawa
Date Performed	12/18/2020	East/West Street	McArthur Avenue
Analysis Year	2027	North/South Street	Site Access
Time Analyzed	Peak AM Hour	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Castle Heights Residences		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			364	3		2	555			9		8				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						2					18					
Capacity, c (veh/h)						1171					360					
v/c Ratio						0.00					0.05					
95% Queue Length, Q_{95} (veh)						0.0					0.2					
Control Delay (s/veh)						8.1					15.6					
Level of Service (LOS)						A					C					
Approach Delay (s/veh)					0.1				15.6							
Approach LOS									C							

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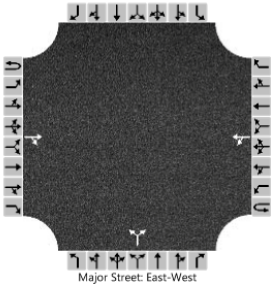
EXHIBIT 4.8
2027 PEAK PM HOUR ANALYSIS (Total Traffic) - Access/McArthur

HCS7 Two-Way Stop-Control Report

General Information		Site Information	
Analyst		Intersection	Access/McArthur
Agency/Co.		Jurisdiction	City of Ottawa
Date Performed	12/18/2020	East/West Street	McArthur Avenue
Analysis Year	2027	North/South Street	Site Access
Time Analyzed	Peak PM Hour	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Castle Heights Residences		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			693	8		7	543			4		5				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)										0						
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						8					10					
Capacity, c (veh/h)						859					237					
v/c Ratio						0.01					0.04					
95% Queue Length, Q_{95} (veh)						0.0					0.1					
Control Delay (s/veh)						9.2					20.9					
Level of Service (LOS)						A					C					
Approach Delay (s/veh)					0.2				20.9							
Approach LOS									C							

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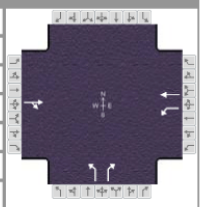
EXHIBIT 4.9
2018 PEAK AM HOUR ANALYSIS (Existing Traffic) - Brant/McArthur

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak AM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2018_ex_am.xus		
Project Description	Castle Heights Residences				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		278	55	41	477		30		41			

Signal Information					EB		WB		NB		SB	
Cycle, s	70.0	Reference Phase	2		L	T	L	T	L	T	L	T
Offset, s	0	Reference Point	End	Green	37.2	20.1	0.0	0.0	0.0	0.0		
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.3	3.3	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.5	2.6	0.0	0.0	0.0	0.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		26.0		
Change Period, (*Y+R c*), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.4		
Queue Clearance Time (*g s*), s						3.5		
Green Extension Time (*g e*), s		0.0		0.0		0.1		
Phase Call Probability						1.00		
Max Out Probability						0.00		

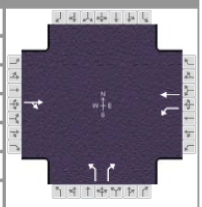
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		362		45	518		33		45			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1667		1029	1730		1672		1483			
Queue Service Time (*g s*), s		8.8		1.8	13.6		1.0		1.5			
Cycle Queue Clearance Time (*g c*), s		8.8		10.7	13.6		1.0		1.5			
Green Ratio (*g/C*)		0.55		0.55	0.55		0.30		0.30			
Capacity (*c*), veh/h		910		535	944		504		447			
Volume-to-Capacity Ratio (*X*)		0.398		0.083	0.549		0.065		0.100			
Back of Queue (Q), ft/ln (50 th percentile)		80.2		10.9	130.6		8.9		12.4			
Back of Queue (Q), veh/ln (50 th percentile)		3.1		0.4	5.0		0.4		0.5			
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.15	0.00		0.14		0.00			
Uniform Delay (*d 1*), s/veh		9.2		12.3	10.3		17.4		17.6			
Incremental Delay (*d 2*), s/veh		1.3		0.3	2.3		0.0		0.0			
Initial Queue Delay (*d 3*), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		10.5		12.6	12.6		17.4		17.6			
Level of Service (LOS)		B		B	B		B		B			
Approach Delay, s/veh / LOS	10.5	B		12.6	B		17.6	B		0.0		
Intersection Delay, s/veh / LOS	12.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.68	A	1.92	B	1.70	B
Bicycle LOS Score / LOS	1.53	B	1.86	B		F		

EXHIBIT 4.10
2018 PEAK PM HOUR ANALYSIS (Existing Traffic) - Brant/McArthur

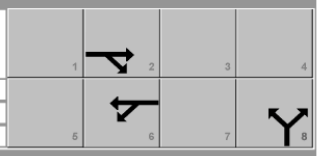
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak PM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2018	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2018_ex_pm.xus		
Project Description	Castle Heights Residences				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		578	56	50	448		48		90			

Signal Information					Green	37.2	25.1	0.0	0.0	0.0	0.0
Cycle, s	75.0	Reference Phase	2		Yellow	3.3	3.3	0.0	0.0	0.0	0.0
Offset, s	0	Reference Point	End		Red	3.5	2.6	0.0	0.0	0.0	0.0
Uncoordinated	No	Simult. Gap E/W	On								
Force Mode	Fixed	Simult. Gap N/S	On								



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		31.0		
Change Period, (*Y+R c*), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.5		
Queue Clearance Time (*g s*), s						5.7		
Green Extension Time (*g e*), s		0.0		0.0		0.3		
Phase Call Probability						1.00		
Max Out Probability						0.00		

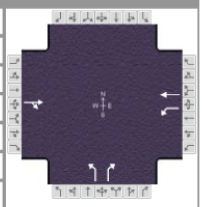
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		689		54	487		52		98			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1723		766	1772		1677		1388			
Queue Service Time (*g s*), s		24.5		4.7	13.9		1.6		3.7			
Cycle Queue Clearance Time (*g c*), s		24.5		29.2	13.9		1.6		3.7			
Green Ratio (*g/C*)		0.51		0.51	0.51		0.35		0.35			
Capacity (*c*), veh/h		878		236	902		584		483			
Volume-to-Capacity Ratio (*X*)		0.785		0.231	0.540		0.089		0.203			
Back of Queue (Q), ft/ln (50 th percentile)		259.8		24.4	140.1		14.5		28.4			
Back of Queue (Q), veh/ln (50 th percentile)		10.1		1.0	5.5		0.6		1.1			
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.33	0.00		0.22		0.00			
Uniform Delay (*d 1*), s/veh		15.0		27.0	12.4		16.5		17.1			
Incremental Delay (*d 2*), s/veh		7.0		2.3	2.3		0.0		0.1			
Initial Queue Delay (*d 3*), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		22.0		29.3	14.8		16.5		17.2			
Level of Service (LOS)		C		C	B		B		B			
Approach Delay, s/veh / LOS	22.0	C		16.2	B		17.0	B		0.0		
Intersection Delay, s/veh / LOS	19.2						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.69	A	1.93	B	1.70	B
Bicycle LOS Score / LOS	2.07	B	1.82	B		F		

EXHIBIT 4.11
2027 PEAK AM HOUR ANALYSIS (Background Traffic) - Brant/McArthur

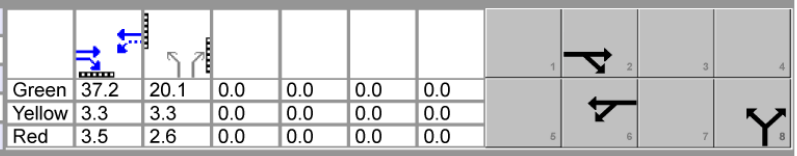
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak AM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2027_bak_am.xus		
Project Description	Castle Heights Residences (Background)				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		304	60	45	522		33		45			

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On



Green	37.2	20.1	0.0	0.0	0.0	0.0	
Yellow	3.3	3.3	0.0	0.0	0.0	0.0	
Red	3.5	2.6	0.0	0.0	0.0	0.0	

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		26.0		
Change Period, (*Y+R c*), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.4		
Queue Clearance Time (*g s*), s						3.7		
Green Extension Time (*g e*), s		0.0		0.0		0.1		
Phase Call Probability						1.00		
Max Out Probability						0.00		

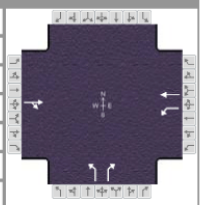
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		396		49	567		36		49			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1667		999	1730		1672		1483			
Queue Service Time (*g s*), s		9.9		2.1	15.5		1.1		1.7			
Cycle Queue Clearance Time (*g c*), s		9.9		12.0	15.5		1.1		1.7			
Green Ratio (*g/C*)		0.55		0.55	0.55		0.30		0.30			
Capacity (*c*), veh/h		910		507	944		504		447			
Volume-to-Capacity Ratio (*X*)		0.435		0.097	0.601		0.071		0.109			
Back of Queue (Q), ft/ln (50 th percentile)		90.2		12.5	150		9.9		13.6			
Back of Queue (Q), veh/ln (50 th percentile)		3.5		0.5	5.8		0.4		0.5			
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.17	0.00		0.15		0.00			
Uniform Delay (*d 1*), s/veh		9.5		13.1	10.7		17.5		17.7			
Incremental Delay (*d 2*), s/veh		1.5		0.4	2.8		0.0		0.0			
Initial Queue Delay (*d 3*), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		11.0		13.4	13.6		17.5		17.7			
Level of Service (LOS)		B		B	B		B		B			
Approach Delay, s/veh / LOS	11.0	B		13.6	B		17.6	B		0.0		
Intersection Delay, s/veh / LOS	12.9						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.68	A	1.92	B	1.70	B
Bicycle LOS Score / LOS	1.58	B	1.95	B		F		

EXHIBIT 4.12
2027 PEAK PM HOUR ANALYSIS (Background Traffic) - Brant/McArthur

HCS7 Signalized Intersection Results Summary

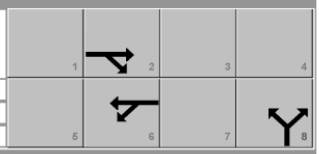
General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak PM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2027_bak_pm.xus		
Project Description	Castle Heights Residences (Background)				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		632	61	55	490		53		98			

Signal Information			
Cycle, s	75.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	37.2	25.1	0.0	0.0	0.0	0.0	
Yellow	3.3	3.3	0.0	0.0	0.0	0.0	
Red	3.5	2.6	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		31.0		
Change Period, (*Y+R c*), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.5		
Queue Clearance Time (*g s*), s						6.1		
Green Extension Time (*g e*), s		0.0		0.0		0.3		
Phase Call Probability						1.00		
Max Out Probability						0.00		

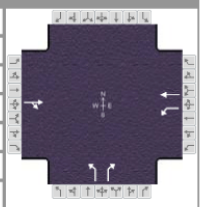
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		753		60	533		58		107			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1723		721	1772		1677		1388			
Queue Service Time (*g s*), s		28.6		5.9	15.8		1.7		4.1			
Cycle Queue Clearance Time (*g c*), s		28.6		34.5	15.8		1.7		4.1			
Green Ratio (*g/C*)		0.51		0.51	0.51		0.35		0.35			
Capacity (*c*), veh/h		878		189	902		584		483			
Volume-to-Capacity Ratio (*X*)		0.858		0.317	0.590		0.099		0.221			
Back of Queue (Q), ft/ln (50 th percentile)		318.2		30.6	160.1		16		31.1			
Back of Queue (Q), veh/ln (50 th percentile)		12.4		1.2	6.3		0.6		1.2			
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.41	0.00		0.25		0.00			
Uniform Delay (*d 1*), s/veh		16.0		31.1	12.9		16.5		17.3			
Incremental Delay (*d 2*), s/veh		10.6		4.4	2.8		0.0		0.1			
Initial Queue Delay (*d 3*), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		26.7		35.4	15.7		16.5		17.4			
Level of Service (LOS)		C		D	B		B		B			
Approach Delay, s/veh / LOS	26.7	C		17.7	B		17.1	B		0.0		
Intersection Delay, s/veh / LOS	22.1						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.69	A	1.93	B	1.70	B
Bicycle LOS Score / LOS	2.17	B	1.91	B		F		

EXHIBIT 4.13
2022 PEAK AM HOUR ANALYSIS (Total Traffic) - Brant/McArthur

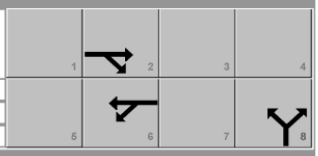
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak AM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2022	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2022_tot_am.xus		
Project Description	Castle Heights Residences				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		289	57	43	497		31		43			

Signal Information					EB		WB		NB		SB	
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	No	Simult. Gap E/W	On	Green	37.2	20.1	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.3	3.3	0.0	0.0	0.0	0.0		
				Red	3.5	2.6	0.0	0.0	0.0	0.0		



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		26.0		
Change Period, (*Y+R c*), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.4		
Queue Clearance Time (*g s*), s						3.6		
Green Extension Time (*g e*), s		0.0		0.0		0.1		
Phase Call Probability						1.00		
Max Out Probability						0.00		

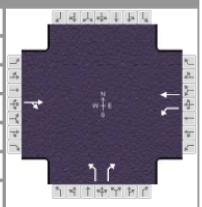
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		376		47	540		34		47			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1667		1017	1730		1672		1483			
Queue Service Time (*g s*), s		9.3		2.0	14.4		1.0		1.6			
Cycle Queue Clearance Time (*g c*), s		9.3		11.2	14.4		1.0		1.6			
Green Ratio (*g/C*)		0.55		0.55	0.55		0.30		0.30			
Capacity (*c*), veh/h		910		523	944		504		447			
Volume-to-Capacity Ratio (*X*)		0.413		0.089	0.572		0.067		0.105			
Back of Queue (Q), ft/ln (50 th percentile)		84.4		11.6	138.9		9.2		13			
Back of Queue (Q), veh/ln (50 th percentile)		3.2		0.5	5.3		0.4		0.5			
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.16	0.00		0.14		0.00			
Uniform Delay (*d 1*), s/veh		9.3		12.6	10.5		17.4		17.6			
Incremental Delay (*d 2*), s/veh		1.4		0.3	2.5		0.0		0.0			
Initial Queue Delay (*d 3*), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		10.7		13.0	13.0		17.5		17.7			
Level of Service (LOS)		B		B	B		B		B			
Approach Delay, s/veh / LOS	10.7	B		13.0	B		17.6	B		0.0		
Intersection Delay, s/veh / LOS	12.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.68	A	1.92	B	1.70	B
Bicycle LOS Score / LOS	1.55	B	1.90	B		F		

EXHIBIT 4.14
2022 PEAK PM HOUR ANALYSIS (Total Traffic) - Brant/McArthur

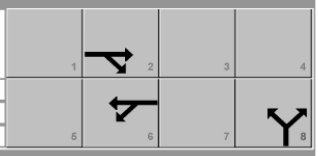
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak PM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2022	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2022_tot_pm.xus		
Project Description	Castle Heights Residences				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		606	59	52	471		52		94			

Signal Information					EB		WB				NB			SB		
Cycle, s	75.0	Reference Phase	2		L	T	L	T	R		L	T	R	L	T	R
Offset, s	0	Reference Point	End	Green	37.2	25.1	0.0	0.0	0.0	0.0						
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.3	3.3	0.0	0.0	0.0	0.0						
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.5	2.6	0.0	0.0	0.0	0.0						



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		31.0		
Change Period, (*Y+R c*), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.5		
Queue Clearance Time (*g s*), s						5.9		
Green Extension Time (*g e*), s		0.0		0.0		0.3		
Phase Call Probability						1.00		
Max Out Probability						0.00		

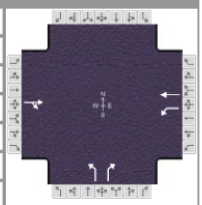
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		723		57	512		57		102			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1723		742	1772		1677		1388			
Queue Service Time (*g s*), s		26.6		5.2	15.0		1.7		3.9			
Cycle Queue Clearance Time (*g c*), s		26.6		31.8	15.0		1.7		3.9			
Green Ratio (*g/C*)		0.51		0.51	0.51		0.35		0.35			
Capacity (*c*), veh/h		878		211	902		584		483			
Volume-to-Capacity Ratio (*X*)		0.824		0.268	0.567		0.097		0.212			
Back of Queue (Q), ft/ln (50 th percentile)		288.3		27	150.8		15.7		29.7			
Back of Queue (Q), veh/ln (50 th percentile)		11.3		1.1	5.9		0.6		1.2			
Queue Storage Ratio (*RQ*) (50 th percentile)		0.00		0.36	0.00		0.24		0.00			
Uniform Delay (*d 1*), s/veh		15.6		29.0	12.7		16.5		17.2			
Incremental Delay (*d 2*), s/veh		8.6		3.1	2.6		0.0		0.1			
Initial Queue Delay (*d 3*), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		24.2		32.1	15.3		16.5		17.3			
Level of Service (LOS)		C		C	B		B		B			
Approach Delay, s/veh / LOS	24.2	C		17.0	B		17.0	B		0.0		
Intersection Delay, s/veh / LOS	20.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.69	A	1.93	B	1.70	B
Bicycle LOS Score / LOS	2.12	B	1.87	B		F		

EXHIBIT 4.15
2027 PEAK AM HOUR ANALYSIS (Total Traffic) - Brant/McArthur

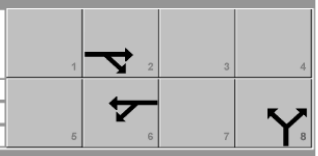
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak AM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2027_tot_am.xus		
Project Description	Castle Heights Residences				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		310	62	45	524		33		45			

Signal Information					EB		WB		NB		SB	
Cycle, s	70.0	Reference Phase	2									
Offset, s	0	Reference Point	End	Green	37.2	20.1	0.0	0.0	0.0	0.0		
Uncoordinated	No	Simult. Gap E/W	On	Yellow	3.3	3.3	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Red	3.5	2.6	0.0	0.0	0.0	0.0		



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		26.0		
Change Period, ($Y+R_c$), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.4		
Queue Clearance Time (g_s), s						3.7		
Green Extension Time (g_e), s		0.0		0.0		0.1		
Phase Call Probability						1.00		
Max Out Probability						0.00		

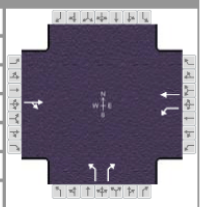
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		404		49	570		36		49			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1666		991	1730		1672		1483			
Queue Service Time (g_s), s		10.2		2.2	15.6		1.1		1.7			
Cycle Queue Clearance Time (g_c), s		10.2		12.4	15.6		1.1		1.7			
Green Ratio (*g/C*)		0.55		0.55	0.55		0.30		0.30			
Capacity (*c*), veh/h		909		500	944		504		447			
Volume-to-Capacity Ratio (*X*)		0.445		0.098	0.603		0.071		0.109			
Back of Queue (Q), ft/ln (95 th percentile)		167.4		22.7	253.9		17.8		24.6			
Back of Queue (Q), veh/ln (95 th percentile)		6.4		0.9	9.8		0.7		1.0			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00		0.30	0.00		0.27		0.00			
Uniform Delay (d_1), s/veh		9.5		13.2	10.8		17.5		17.7			
Incremental Delay (d_2), s/veh		1.6		0.4	2.9		0.0		0.0			
Initial Queue Delay (d_3), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		11.1		13.6	13.6		17.5		17.7			
Level of Service (LOS)		B		B	B		B		B			
Approach Delay, s/veh / LOS	11.1	B		13.6	B		17.6	B		0.0		
Intersection Delay, s/veh / LOS	13.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.68	A	1.92	B	1.70	B
Bicycle LOS Score / LOS	1.60	B	1.95	B		F		

EXHIBIT 4.16
2027 PEAK PM HOUR ANALYSIS (Total Traffic) - Brant/McArthur

HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency				Duration, h	0.250
Analyst		Analysis Date	Dec 19, 2020	Area Type	Other
Jurisdiction	City of Ottawa	Time Period	Peak PM Hour	PHF	0.92
Urban Street	McArthur Avenue	Analysis Year	2027	Analysis Period	1> 7:00
Intersection	Brant/McArthur	File Name	722_2027_tot_pm.xus		
Project Description	Castle Heights Residences				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h		636	62	55	495		55		98			

Signal Information					EB		WB				NB			
Cycle, s	75.0	Reference Phase	2											
Offset, s	0	Reference Point	End											
Uncoordinated	No	Simult. Gap E/W	On	Green	37.2	25.1	0.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	3.3	3.3	0.0	0.0	0.0	0.0				
				Red	3.5	2.6	0.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		
Case Number		8.0		6.0		9.0		
Phase Duration, s		44.0		44.0		31.0		
Change Period, (*Y+R c*), s		6.8		6.8		5.9		
Max Allow Headway (*MAH*), s		0.0		0.0		3.5		
Queue Clearance Time (*g s*), s						6.1		
Green Extension Time (*g e*), s		0.0		0.0		0.3		
Phase Call Probability						1.00		
Max Out Probability						0.00		

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		2	12	1	6		3		18			
Adjusted Flow Rate (*v*), veh/h		759		60	538		60		107			
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1723		718	1772		1677		1388			
Queue Service Time (*g s*), s		29.0		6.0	16.0		1.8		4.1			
Cycle Queue Clearance Time (*g c*), s		29.0		34.9	16.0		1.8		4.1			
Green Ratio (*g/C*)		0.51		0.51	0.51		0.35		0.35			
Capacity (*c*), veh/h		878		184	902		584		483			
Volume-to-Capacity Ratio (*X*)		0.865		0.324	0.596		0.102		0.221			
Back of Queue (Q), ft/ln (95 th percentile)		473.8		55.8	268.1		30		56			
Back of Queue (Q), veh/ln (95 th percentile)		18.5		2.2	10.6		1.2		2.2			
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00		0.74	0.00		0.46		0.00			
Uniform Delay (*d 1*), s/veh		16.1		31.4	13.0		16.5		17.3			
Incremental Delay (*d 2*), s/veh		11.1		4.6	2.9		0.0		0.1			
Initial Queue Delay (*d 3*), s/veh		0.0		0.0	0.0		0.0		0.0			
Control Delay (*d*), s/veh		27.2		36.1	15.9		16.6		17.4			
Level of Service (LOS)		C		D	B		B		B			
Approach Delay, s/veh / LOS	27.2	C		17.9	B		17.1	B		0.0		
Intersection Delay, s/veh / LOS	22.4						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.93	B	0.69	A	1.93	B	1.70	B
Bicycle LOS Score / LOS	2.18	B	1.92	B		F		

EXHIBIT 4.17
McARTHUR AVENUE - PLOS INTERSECTION EVALUATION

MAIN STREET	McArthur Avenue
MINOR STREET	Brant Street
APPROACHES	All
YEAR	2027
DIRECTION	All
MMLOS MODE	PLOS

	North Approach		South Approach		East Approach		West Approach	
	Comment	Points	Comment	Points	Comment	Points	Comment	Points
5.1 Crossing Distance & Conditions								
Median?			No		No		No	
Total Travel Lanes Crossed			4	88	4	88	4	88
5.2 Signal Phasing & Timing Features								
Left Turn Conflict			Permissive	−8	Permissive	−8	Permissive	−8
Right Turn Conflict			Permissive or Yield Control	−5	No Right Turn	0	Permissive or Yield Control	−5
Right Turns on Red			RTOR Allowed	−3	No Right Turn	0	RTOR Allowed	−3
Leading Ped Interval			No	−2	No	−2	No	−2
5.3a Corner Radius			> 5m to 10m	−5	No Right Turn	0	> 5m to 10m	−5
5.3b Right Turn Channel			No Right Turn Channel	−4	No Right Turn	0	No Right Turn Channel	−4
5.4 Crosswalk Treatment			Standard Transverse Markings	−7	Standard Transverse Markings	−7	Standard Transverse Markings	−7
TOTAL PETSI SCORE				54 pts		71 pts		54 pts
DELAY SCORE				30.8 s		28.2 s		30.8 s
Cycle length			75		75		75	
From Signal Timing Plan			7		10		10	
PETSI SCORE				**D**		**C**		**D**
DELAY SCORE				**D**		**C**		**D**
OVERALL APPROACH SCORE				**D**		**C**		**D**

OVERALL INTERSECTION SCORE **D**

EXHIBIT 4.18
McARTHUR AVENUE - BLOS INTERSECTION EVALUATION

STREET	McArthur Avenue
FROM	Irwin Miller Street
TO	Brant Street
YEAR	2027
DIRECTION	Eastbound–Westbound
MMLOS MODE	BLOS

SEGMENT SCORE **B**

Type of Bikeway		LOS
Physically Separated Bikeway (cycle tracks, protected bike lanes and multi-use paths). Physical separation refers to, but is not limited to, curbs, raised medians, bollards and parking lanes (adjacent to the bike lane along the travelled way i.e. not curbside).		A
Bike Lanes Not Adjacent Parking Lane - Select Worst Scoring Criteria		
No. of Travel Lanes	1 travel lane in each direction	A
	2 travel lanes in each direction separated by a raised median	B
	2 travel lanes in each direction without a separating median	C
	More than 2 travel lanes in each direction	D
Bike Lane Width	≥ 1.8 m wide bike lane (includes marked buffer and paved gutter width)	A
	≥1.5 m to <1.8 m wide bike lane (includes marked buffer and paved gutter width)	B
	≥1.2 m to <1.5 m wide bike lane (includes marked buffer and paved gutter width)	C
Operating Speed	≤ 50 km/h operating speed	A
	60 km/h operating speed	C
	≥ 70 km/h operating speed	E
Bike lane blockage (commercial areas)	Rare	A
	Frequent	C
Bike Lanes Adjacent to curbside Parking Lane - Select Worst Scoring Criteria		
No. of Travel Lanes	1 travel lane in each direction	A
	2 or more travel lanes in each direction	C
Bike Lane and Parking Lane Width	4.5 m wide bike lane plus parking lane (includes marked buffer and paved gutter width)	A
	4.25 m wide bike lane plus parking lane (includes marked buffer and paved gutter width)	B
	≤ 4.0 m wide bike lane plus parking lane (includes marked buffer and paved gutter width)	C
Operating Speed	≤ 40 km/h operating speed	A
	50 km/h operating speed	B
	60 km/h operating speed	D
	≥ 70 km/h operating speed	F
Bike lane blockage (commercial areas)	Rare	A
	Frequent	C
Mixed Traffic		
No. of Travel Lanes and Operating Speed	2 travel lanes; ≤ 40 km/h; no marked centerline or classified as residential	A
	2 to 3 travel lanes; ≤ 40 km/h	B
	2 travel lanes; 50 km/h; no marked centerline or classified as residential	B
	2 to 3 travel lanes; 50 km/h	D
	4 to 5 travel lanes; ≤ 40 km/h	D
	4 to 5 travel lanes; ≥ 50 km/h	E
	6 or more travel lanes; ≤ 40 km/h	E
	≥ 60 km/h	F
Unsignalized Crossing along Route: no median refuge		
No. of Travel Lanes on Side Street and Operating Speed	3 or less lanes being crossed; ≤ 40 km/h	A
	4 to 5 lanes being crossed; ≤ 40 km/h	B
	3 or less lanes being crossed; 50 km/h	B
	4 to 5 lanes being crossed; 50 km/h	C
	3 or less lanes being crossed; 60 km/h	C
	4 to 5 lanes being crossed; 60 km/h	D
	6 or more lanes being crossed; ≤ 40 km/h	E
	3 or less lanes being crossed; ≥ 65 km/h	E
	6 or more lanes being crossed; ≥ 50 km/h	F
	4 to 5 lanes being crossed; ≥ 65 km/h	F
Unsignalized Crossing along Route: with median refuge (≥ 1.8 m wide)		
No. of Travel Lanes on Side Street and Operating Speed	5 or less lanes being crossed; ≤ 40 km/h	A
	3 or less lanes being crossed; 50 km/h	A
	6 or more lanes being crossed; ≤ 40 km/h	B
	4 to 5 lanes being crossed; 50 km/h	B
	3 or less lanes being crossed; 60 km/h	B
	6 or more lanes being crossed; 50 km/h	C
	4 to 5 lanes being crossed; 60 km/h	C
	3 or less lanes being crossed; ≥ 65 km/h	D
	6 or more lanes being crossed; 60 km/h	E
	4 to 5 lanes being crossed; ≥ 65 km/h	E
	6 or more lanes being crossed; ≥ 65 km/h	F

NOT APPLICABLE

NOT APPLICABLE

NOT APPLICABLE

EXHIBIT 4.19
McARTHUR AVENUE - TLOS INTERSECTION EVALUATION

MAIN STREET	McArthur Avenue
MINOR STREET	Brant Street
APPROACHES	All
YEAR	2027
MMLOS MODE	TLOS

INTERSECTION SCORE **D**

Delay	Typical Location	LOS
0	Grade Separation	A
≤10 sec	High Level TSP	B
≤20 sec	TSP & short (e.g. <60 sec) to medium (e.g.	C
≤30 sec	60-90 sec) cycle length	D
≤40 sec	TSP & long cycle length (e.g. >90 sec)	E
>40 sec	No TSP & long cycle length (e.g. >90 sec)	F

Note: Delay includes travel time from end of queue to entering the intersection