REPORT

441 MAPLE AVENUE

BURLINGTON, ONTARIO

NOISE FEASIBILITY STUDY
RWDI # 1900412
November 28, 2018

SUBMITTED TO

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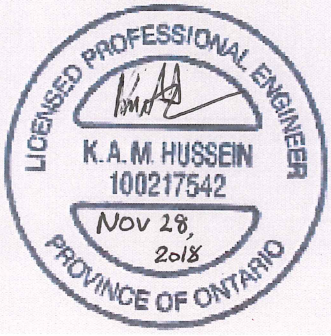
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EXECUTIVE SUMMARY

RWDI was retained to prepare a Noise Feasibility Study for a proposed residential development to be located at 441 Maple Avenue in Burlington, Ontario in support of Official Plan and Zoning By-Law Amendment applications. The proposed development consists of an 11-storey residential tower with a 10th floor rooftop amenity area. The location of the proposed development is near the intersection of Maple Avenue and Lakeshore Road.

Road traffic from nearby transportation corridors and existing stationary sources were identified as the only sources of sound with the potential to affect the proposed development. The development was found to be feasible with the following requirements:

- Standard window/door construction meeting the Ontario Building Code;
- Installation of central air conditioning;
- Acoustic barrier for the ground level outdoor patio area;
- Perimeter railings for the 10th floor amenity area; and
- Inclusion of warning clauses in all development agreements, offers of purchase and agreements of purchase and sale or lease.

This feasibility assessment was based on the current building configuration and design so the resulting recommendations are general. Prior to the construction of the building, a detailed design assessment is required to ensure that appropriate noise control measures have been incorporated into the design. The selection of building materials, such as windows and doors, should be reviewed by an acoustical engineer prior to construction to ensure the sound level limits are met. The mechanical equipment on the development should be designed in consultation with an acoustical engineer to meet the required sound level limits at the building itself and on the surrounding environment.

1 INTRODUCTION

Better Life Retirement retained RWDI Inc. to prepare a Noise Feasibility Study for the proposed development at 441 Maple Avenue in Burlington, Ontario. The location of the proposed development is near the intersection of Maple Avenue and Lakeshore Road (see Figure 1).

This assessment was completed to support Official Plan and Zoning By-Law Amendment applications as required by the City of Burlington. This assessment considered the potential impact from nearby transportation and stationary sources on the proposed development, and determined the appropriate noise control measures.

The proposed development consists of an 11-storey residential tower with a 10th floor rooftop amenity area. Based on the design drawings the façades of the proposed development are primarily constructed out of glass. Preliminary design drawings received on November 23, 2018 were used in this assessment and provided in



Figure 1: Site Location

The site is exposed to noise from road traffic on Lakeshore Road, North Shore Boulevard East and Maple Avenue. Nearby significant stationary sources of sound are Joseph Brant Hospital to the south across North Shore Boulevard East. A vibration assessment was not conducted as no significant sources of vibration were identified near the proposed development. Rail lines in the area are located more than 2 km away from the proposed development, and are therefore not considered to be potential significant noise or vibration sources on the proposed development.

The potential for impact of the proposed development on the surrounding environment, and on itself was not assessed quantitatively as part of this study due to the current preliminary design stage. General recommendations are provided in Sections 4 and 5. As the design progresses, on-site equipment will be selected and designed to meet the applicable Ontario Ministry of the Environment, Conservation and Parks (MECP[1]) guidelines.

[1] Formerly known as the Ministry of the Environment and Climate Change, or MOECC. Guidelines used in this report still references the MOECC.

The objective of this assessment was to determine the feasibility of the proposed residential development that is surrounded by existing sources of environmental noise.

2 INFLUENCE OF SOUND ON THE PROPOSED DEVELOPMENT

RWDI assessed the potential impact of the noise environment surrounding the development based on road traffic and stationary sources. This section describes the applicable criteria used for the noise feasibility assessment, the details of the data and calculations, the applicable points of reception, the prediction results, and recommendations.

2.1 Road Traffic Assessment

2.1.1 Road Traffic Assessment Criteria

There is no applicable guidance for the City of Burlington. Burlington falls within the Halton Region, which references the Ontario MECP guidelines. Guidance from the MECP publication NPC-300 Environmental Noise Guideline was used to assess environmental noise generated by transportation-related sources. There are three aspects to consider, which include the following:

1. Transportation source noise in indoor living areas, which determines façade sound isolation requirements.
2. Transportation source noise in Outdoor Living Areas (OLAs), which determines noise barrier requirements.
3. Transportation source noise at the plane of window, which determines HVAC system requirements.

For assessing sound originating from road traffic, NPC-300 defines sound level criteria as summarized in Table 1 for two types of locations: outdoor living areas (OLAs), and indoor areas of sensitive uses. Outdoor sound level limits are specified for OLAs, which include terraces and balconies with a minimum depth of 4 m and common amenity areas of a multi-unit dwelling. Indoor living areas include living rooms and sleeping quarters.

Table 1: NPC-300 Limits for Transportation Sources

Assessment Location	Time Period	NPC-300 Limit L_{EQ} (averaged over time period)	Requirement
		Road	
Indoor Living Quarters	16 hr Daytime 0700-2300h	45 dBA	Façade components should be specified to achieve the indicated indoor sound levels based on the assumption of a closed window.
Indoor Sleeping Quarters	8 hr Nighttime 2300-0700h	40 dBA	
Outdoor Living Areas	16 hr Daytime 0700-2300h	55 – 60 dBA	If technically and economically feasible, noise barriers should be used to achieve 55 dBA sound levels in OLAs. The 60 dBA limit is also acceptable, however a warning clause "Type A" must be included in this case.

The wording for any required warning clauses are included in Section 3.3. Any required warning clauses must be included in agreements of Offers of Purchase and Sale, lease/rental agreements and condominium declarations.

Ventilation and warning clauses requirements for residential buildings are determined based on predicted levels of transportation noise at the exterior plane of window as summarized in Table 2.

Table 1: NPC-300 Ventilation and Warning Clauses Requirements – Transportation Sources

Assessment Location	Transportation Noise Level		Requirement
	Daytime Leq,16-hr	Nighttime Leq,8-hr	
Plane of Window	Equal or greater than 65 dBA	Equal or greater than 60 dBA	Central air conditioning required to allow windows to remained closed. Warning clause "Type D" required.
	Between 55 dBA and 65 dBA	Between 50 dBA and 60 dBA	Provision for the installation of central air-conditioning. Warning clause "Type C" is required.
Outdoor Living Areas	Between 55 dBA and 60 dBA	Not Applicable	Warning Clause "Type A" or "Type B" required.
	Greater than 60 dBA	Not Applicable	Generally not acceptable.

2.1.2 Road Traffic Data

The main roadways that have the potential to influence the proposed development are North Shore Boulevard East, Lakeshore Road and Maple Avenue. Other roads in the area are minor, or distant, and are not expected to have a significant impact on the development.

Road traffic volumes were provided by the City of Burlington traffic department on and before October 23, 2018. The data were provided as 2018 Average Annual Daily Traffic (AADT) volumes at the North Shore Boulevard East and Maple Avenue intersection. As required by the NPC-300 guidelines, the volumes were adjusted to account for future growth for a ten-year horizon (2028). A growth rate of 1% per annum was provided by the City of Burlington. Day-night split was based on ORNAMENT typical of municipal roads. A summary of the traffic data used is included in Table 3. The raw data and traffic volume calculations are included in Appendix B.

Table 2: Road Traffic Data Summary

Roadway	Future Traffic (AADT)[1]	% Day[2]	% Night[2]	Post Speed Limit (km/hr)	% Medium Trucks[3]	% Heavy Trucks[3]
Maple Avenue North Leg	11785	90%	10%	50	1.9	3.0
Lakeshore Rd South Leg	13496	90%	10%	50	3.1	5.0
Lakeshore Rd East Leg	29269	90%	10%	50	2.5	4.0
North Shore Blvd West Leg	27772	90%	10%	60	2.4	3.8

Notes: 1 – Future traffic volumes were based on 1% growth rate per City of Burlington forecasted to 2028.
2 – Day-night split based on ORNAMENT for municipal roads.
3 – Commercial trucks ratio based on turning movement counts.

2.1.3 Representative Receptors for Transportation Sources

The selection of representative receptors affected by transportation sources was based on drawings provided in Appendix A, which show the intended use of areas for the development. Balconies are to be less than 4 m in depth and do not qualify as receptors per NPC-300. The NPC-300 guideline suggests that for elevated OLAs, the point of assessment is the middle of the OLA at 1.5 metres above floor level.

The development includes a rooftop outdoor living area located on the 10th floor (OLA in Figure 2), and an outdoor grade-level patio along the north side of the development (OLA2 in Figure 2). The locations of representative façade receptors (R1 and R2) are also shown in Figure 2.

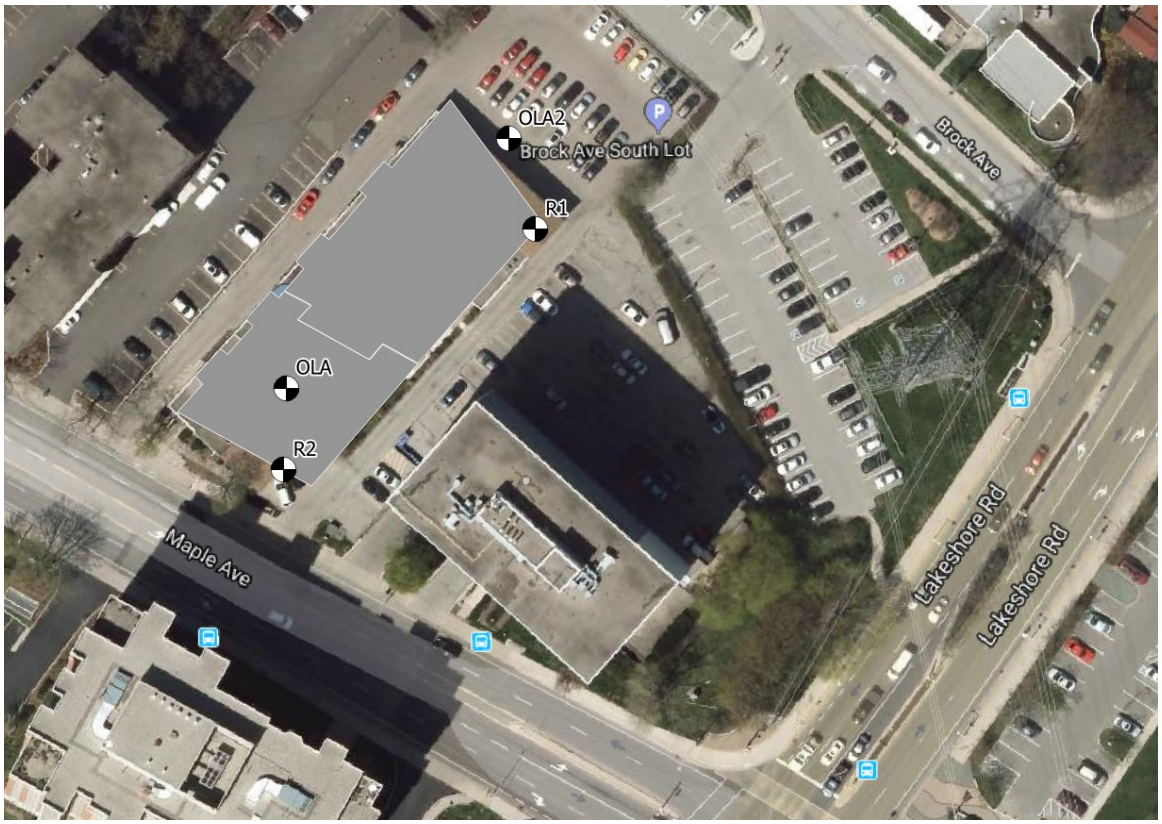


Figure 2: Representative Receptor Locations

2.1.4 Road Traffic Modelled Results

Road traffic modelling was carried out using a spreadsheet implementation of the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT) (MECP, 1989) algorithms. The sound level calculations are provided in Appendix B with results summarized in Table 4. The predicted façade sound levels represent the sound levels at the exterior plane of the windows. Indoor sound levels were estimated from the predicted plane of window levels by accounting for a 20 dB loss through a glass pane, consistent with industry standard practice. This reduction assumes windows will be closed with the use of central air conditioning.

For the 10th floor outdoor amenity area, 1.2m tall perimeter railings were shown in some of the provided drawings and were included in the analysis. Without the perimeter railings, sound levels would exceed 60 dBA in the OLA. The outdoor patio OLA2 will require a 1.5 m tall acoustic barrier to achieve sound levels that comply with the NPC-300 sound level limits. The OLA nighttime calculations were not necessary as NPC-300 does not specify a nighttime limit.

Table 3: Results of ORNAMENT Modelling

Receptor	Predicted Outdoor Sound Exposures (dBA)		Predicted Indoor Sound Exposures (dBA) [1]		Sound Level Limit (dBA) [2]		Complies with Criteria? (Yes/No)
	Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr	Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr	Daytime L_{EQ}, 16hr	Nighttime L_{EQ}, 8hr	
R1	62	56	42	36	45	40	Yes
R2	65	58	45	38	45	40	Yes
OLA – Rooftop Terrace	52 [3]	-	-	-	55	-	Yes
OLA2 – Outdoor Patio	53[4]	-	-	-	55	-	Yes

1. Predicted indoor sound levels include a 20 dB reduction in sound level due to losses through glass panes.
2. Sound level limits are indoors for façade locations and outdoors for OLA locations.
3. Inclusion of 1.2 m perimeter railing.
4. Inclusion of 1.5 m acoustic barrier.

Sound levels from road traffic were found to be below MECP sound level limits at all representative receptors. Specialized noise control measures are not required but general recommendations are provided in Section 3.

2.2 Stationary Source Assessment

2.2.1 Stationary Source Assessment Criteria

Stationary sources are treated differently from transportation sources and require sound levels be assessed for the predictable worst-case 1-hour L_{EQ} for each period of the day. For assessing sound originating from stationary sources, MECP NPC-300 defines sound level criteria for two types of Points of Reception (PORs): outdoor and façade.

The assessment criteria for all PORs is the higher of either the exclusion limit per NPC-300 or the minimum background sound level that occurs or is likely to occur at a POR. The applicable exclusion limit is determined based on the level of urbanization or "Class" of the area. The proposed development is to be located in a Class 1 area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the

activities of people, usually road traffic, often referred to as "urban hum". The background sound levels were not determined in this feasibility assessment through measurement or modelling. As such, the NPC-300 Class 1 exclusion limits apply to PORs in this study.

The NPC-300 exclusion limits for continuously operating stationary sources are summarized in Table 5. For the façade, the exclusion limits apply at the exterior plane of window; there are no indoor criteria for stationary sources.

Planned emergency equipment testing are considered separate and allow for 5 dB on top of levels shown in Table 5.

Table 5: NPC-300 Exclusion Limit for Stationary Sources – Continuous

Time Period	Exclusion Limit for Class 1 Outdoor / Façade L_{EQ-1hr}
Daytime-Evening 0700-2300h	50 / 50 dBA
Nighttime 2300-0700h	-- / 45 dBA

2.2.2 Stationary Sources

Existing stationary sources with the potential to influence the proposed development were identified from aerial imagery (see Figure 3). Notable existing stationary sources include Joseph Brant Hospital to the south and Spencer's at the Waterfront restaurant to the northeast.

Some facilities require a MECP permit to operate such as the Joseph Brant Hospital. However, no recent MECP permit was found. If the Hospital obtains a permit, the Hospital would need to meet the MECP NPC-300 limits at existing receptors. Existing receptors are closer to the Hospital than the proposed development. Therefore, the Joseph Brant Hospital would also comply at the development and therefore was not assessed further.

The Spencer's at the Waterfront restaurant typically does not require to obtain a MECP permit. However, sources on its rooftop may affect sound levels at the development. Sources include: a 10-fan chiller and a 6-fan chiller located approximately 175 m northeast of the proposed development. Screening-level modelling was completed for sources associated with the restaurant using data on file at RWDI for similar sized equipment. A summary of the sound levels used are provided in Table 6. The restaurant operates only during the daytime and evening hours based on current hours of operation and were considered as such in this assessment.

Table 4: Significant Sources at Spencer's at the Waterfront

Stationary Source	Sound Power Level (dBA)	Data Source
6-fan Chiller	93	Data on file at RWDI
10-fan Chiller	100	Data on file at RWDI

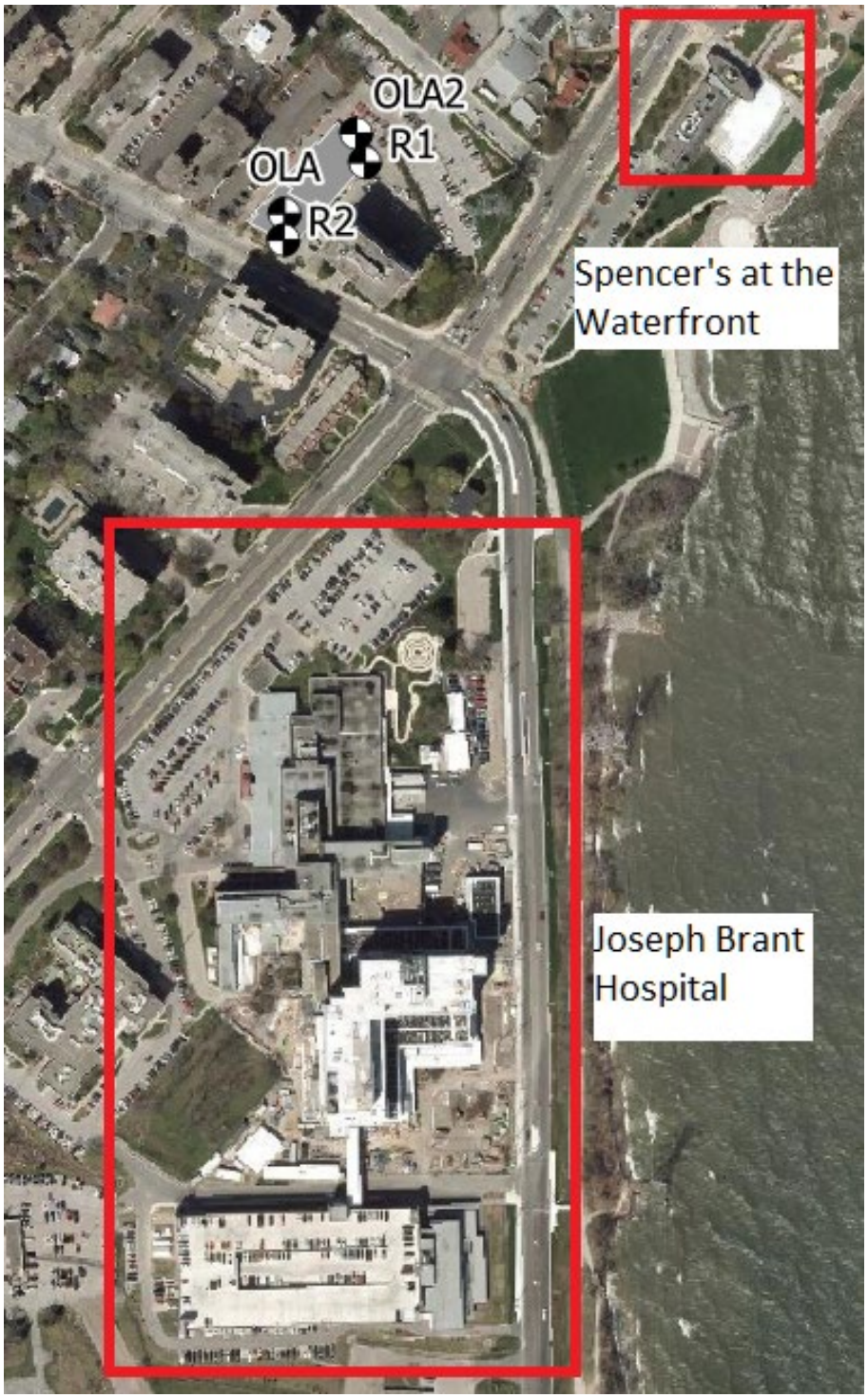


Figure 2: Existing Stationary Sources of Sound

2.2.3 Representative Receptors

The selection of points of reception (PORs) affected by stationary sources is conducted differently than the selection for transportation sources. The outdoor PORs for stationary source assessment can include front yards, backyards, balconies, terraces or patios. The façade PORs are the centre of any window or door on the most exposed wall. Due to a large number of POR locations, only the worst-case PORs have been presented herein.

2.2.4 Stationary Source Modelling Results

Screening-level modelling of the Spencer's at the Waterfront restaurant was carried out using the Cadna/A software package, a commercially available implementation of the ISO 9613 (ISO, 1994 and ISO, 1996) algorithms. The worst-case receptor for stationary sources was identified to be the northeastern façade of the building. The predicted sound level at this facade during the worst-case 1-hour was assessed against the Class 1 Area limits and presented in Table 7.

Table 5: Predicted Sound Levels at Worst-case Locations – Continuous

Time Period	Exposure	Exclusion Limit	Meets Criteria?
	Worst-Case Outdoor / Façade $L_{EQ,1hr}$	Class 1 Outdoor / Façade L_{EQ-1hr}	Class 1 Outdoor / Façade
Daytime-Evening 0700-2300h	33 / 46 dBA	50 / 50 dBA	Yes / Yes

Based on sound level used in this assessment (see Table 7), the sound levels from existing stationary sources are predicted to comply with the Class 1 limits at the proposed development.

3 RECOMMENDATIONS AND REQUIREMENTS

Based on an analysis of the predicted noise levels, the following recommendations and requirements were determined for the project.

3.1 Building Façade Components

The indoor sound levels are predicted to meet the indoor sound level limit. Specialized noise control design is not anticipated to be required for the proposed development unless window-to-wall ratio is much higher than 60%. Current information in the preliminary design drawings does not have enough information to determine window-to-wall ratio. This needs to be reviewed during the detailed design. General acoustic measures are required and are outlined below.

- Standard window/door construction meeting the Ontario Building Code is acceptable.
- Ensure exterior window frames/doors and insulation are air tight. Use acoustic seals for operable windows/doors for noise insulation.
- Warning clause Type C is required. Sample wording is provided in Section 3.3.
- Installation of central air conditioning be provided.

3.2 Outdoor Amenity Area

The sound levels at the OLAs are predicted to meet the MECP limit with the inclusion of the following mitigation measures:

- A minimum 1.2 m high solid railing must surround the entire perimeter of the 10th floor rooftop amenity area (LOA in Figure 2).
- A minimum 1.5 m high acoustic barrier surrounding the outdoor patio area (OLA2 in Figure 2.
- The railing and barrier must be free of gaps or cracks, and have a minimum face density of 20 kg/m^2.
- Warning clause Type B is required. Sample wording are provided in Section 3.3.

3.3 Warning Clauses

Warning clauses must be included on all development agreements, offers of purchase and agreements of purchase and sale or lease. Warning clauses may be used individually or in combination.

The following warning clauses are required by the MECP:

Type B: *"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."*

Type C: *"This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."*

4 IMPACT OF PROPOSED DEVELOPMENT ON ITS SURROUNDINGS

4.1 Applicable Criteria

Traffic noise for surrounding developments would be assessed based on the requirements described in Sections 2.1.1. The noise produced by stationary noise sources associated with the development itself would be evaluated based on the MECP NPC-300 Environmental Noise Guideline.

4.2 Recommendations

The potential impact of noise due to increased transportation source noise from the development on its surroundings is expected to be low. Traffic noise related to the proposed relation to the traffic noise on the major

roads immediately adjacent to the development. Traffic noise development will be insignificant in related to the development is therefore not of concern.

On-site stationary sources for the development are expected to consist of HVAC related equipment on the roof-top. As the design is currently in progress, a detailed assessment of the noise impact by the development on the surrounding environment is not possible. Provided that best practices for the acoustical design of the building are followed, noise associated with the proposed development is expected to meet the NPC-300 limits due to the nature of the proposed development.

5 IMPACT OF THE PROPOSED DEVELOPMENT ON ITSELF

5.1 Applicable Criteria

The noise produced by stationary noise sources associated with the development itself and on surrounding areas would be evaluated based on the MECP NPC-300 Environmental Noise Guideline.

5.2 Recommendations

Consideration should be given to control air-borne and structure-borne noise generated within the proposed development. Within the development itself, the main sources of noise that are likely to affect the uses of the building are the mechanical systems. Provided that best practices for the acoustical design of the building are followed, noise from the development itself is expected to meet the requirements of NPC-300 due to the nature of the proposed development.

6 CONCLUSIONS

RWDI has completed a Noise Feasibility Study to assess the feasibility of the 441 Maple Avenue residential development. The sound levels due to road-traffic sources are predicted to comply with MECP guideline NPC-300 sound levels limits. As such, specialized noise mitigation design of the façade and glazing are not required. Acoustic barriers and perimeter railings are required for the outdoor living areas.

The inclusion of warning clauses related to transportation sources are required to be included on all development agreements, offers of purchase and agreements of purchase and sale or lease. The required warning clauses are included with Section 3.3.

This feasibility assessment was based on assumptions regarding basic building construction so the resulting recommendations are broad. The selection of building materials, such as windows and doors should be reviewed by an acoustical engineer prior to construction to ensure the sound level limits are met. The mechanical equipment on the development will be designed in consultation with an acoustical engineer to meet the required sound-level limits at the building itself and on the surrounding environment.

7 REFERENCES

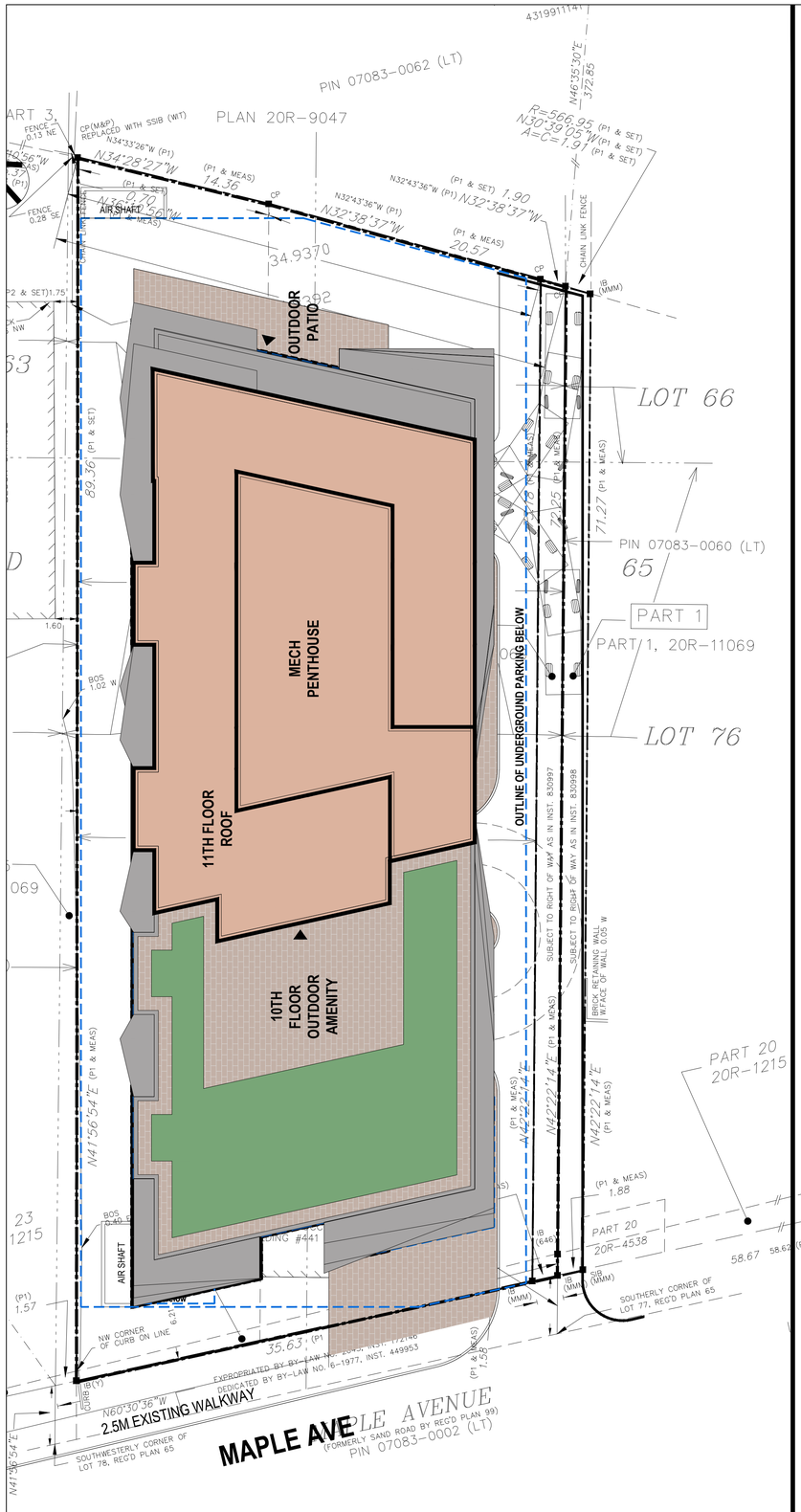
1. Ontario Ministry of the Environment and Climate Change (MOECC), August 2013, Publication NPC-300, Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning

2. Ontario Ministry of the Environment and Climate Change (MOECC), 1989, ORNAMENT Ontario Road Noise Analysis Method for Environment and Transportation, Technical Publication

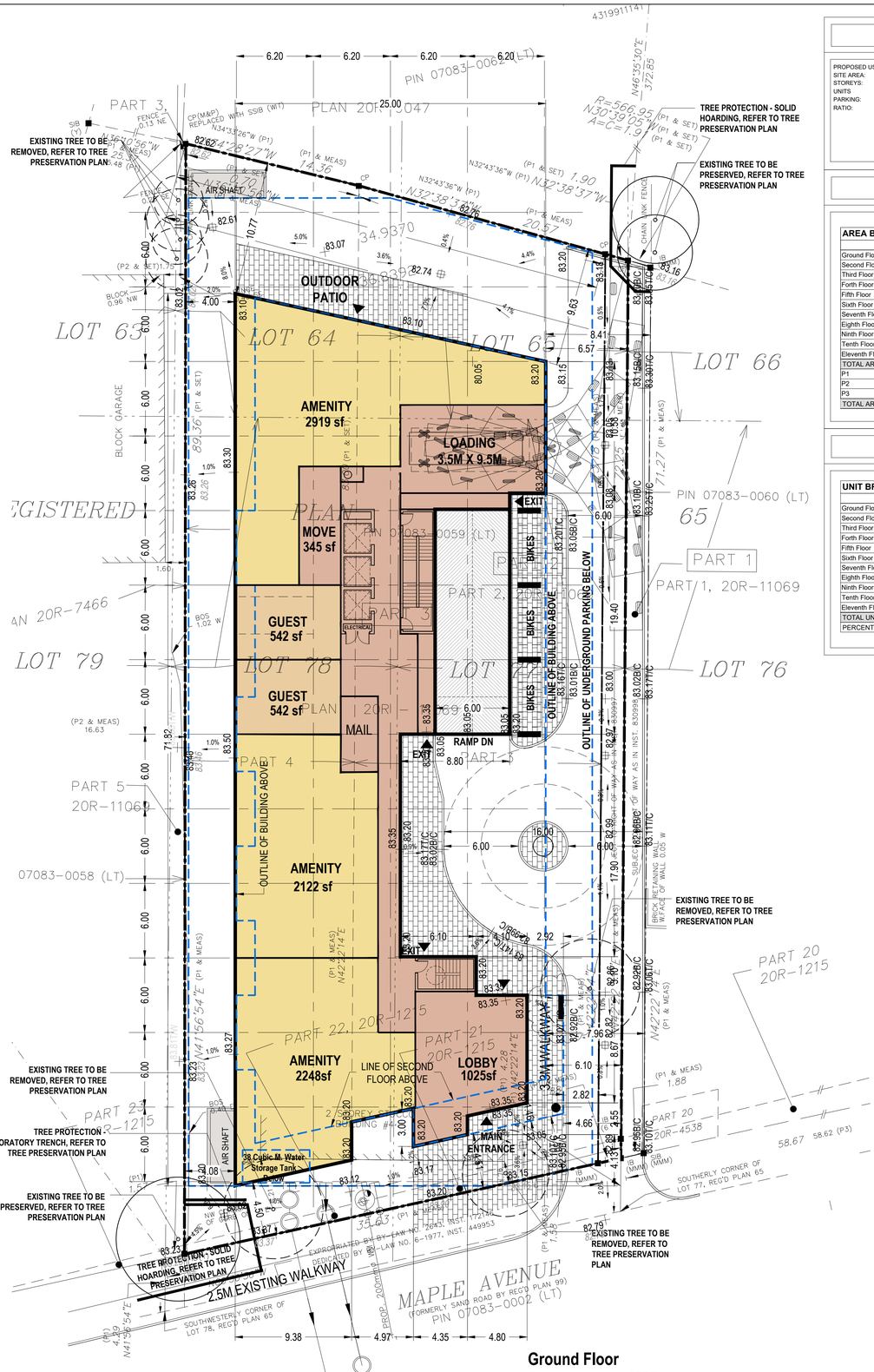
3. International Organization for Standardization (ISO), 1994b, International Standard ISO 9613-1:1994, Acoustics – Attenuation of Sound during propagation outdoors. Part 1: Calculation of the absorption of sound by the atmosphere.

4. International Organization for Standardization (ISO), 1996, International Standard ISO 9613-2:1996, Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation

APPENDIX A



ROOF PLAN - 1:200



Ground Floor
Area: 1230 sm

SITE PLAN SHOWING GROUND FLOOR - 1:200

SITE STATISTICS

PROPOSED USE:	Multi - Residential
SITE AREA:	0.28 HA (2,863.19 sm)
STOREYS:	11 Storeys
UNITS	153 Units
PARKING:	164 Cars
RATIO:	1.17

AREA CALCULATION

AREA BREAK DOWN PER FLOOR

	AREA (SQ.M)	AREA (SQ.FT)
Ground Floor	1,230	13,240
Second Floor	1,507	16,220
Third Floor	1,507	16,220
Forth Floor	1,507	16,220
Fifth Floor	1,507	16,220
Sixth Floor	1,507	16,220
Seventh Floor	1,507	16,220
Eighth Floor	1,507	16,220
Ninth Floor	1,507	16,220
Tenth Floor	866	9,322
Eleventh Floor	866	9,322
TOTAL AREA ABOVE GRADE:	15,018	161,644
P1	2,540	27,287
P2	2,540	27,287
P3	2,540	27,287
TOTAL AREA BELOW GRADE:	7,620	81,861

UNIT COUNT

UNIT BREAK DOWN PER FLOOR

	1 BED	1 BED + D	2 BED	3 BED	TOTAL
Ground Floor	-	-	-	-	-
Second Floor	3	7	4	3	17
Third Floor	3	7	4	3	17
Forth Floor	3	7	4	3	17
Fifth Floor	3	7	4	3	17
Sixth Floor	3	7	4	3	17
Seventh Floor	3	7	4	3	17
Eighth Floor	3	7	4	3	17
Ninth Floor	3	7	4	3	17
Tenth Floor	3	-	4	1	8
Eleventh Floor	3	-	4	2	9
TOTAL UNITS:	30	56	40	27	153
PERCENTAGE:	20%	37%	26%	17%	100%

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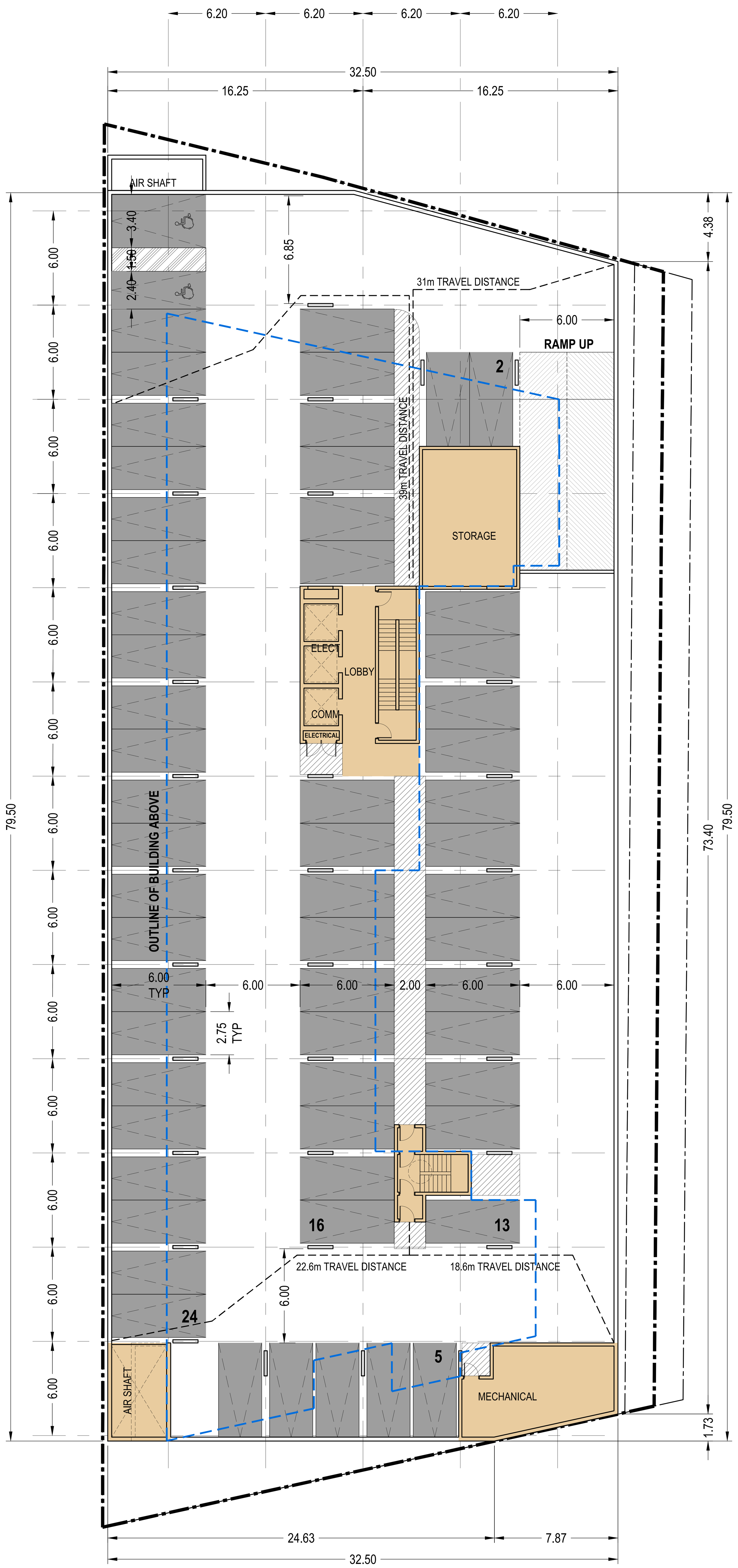
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Burlington, ON

SHEET TITLE:
Proposed Site Plan

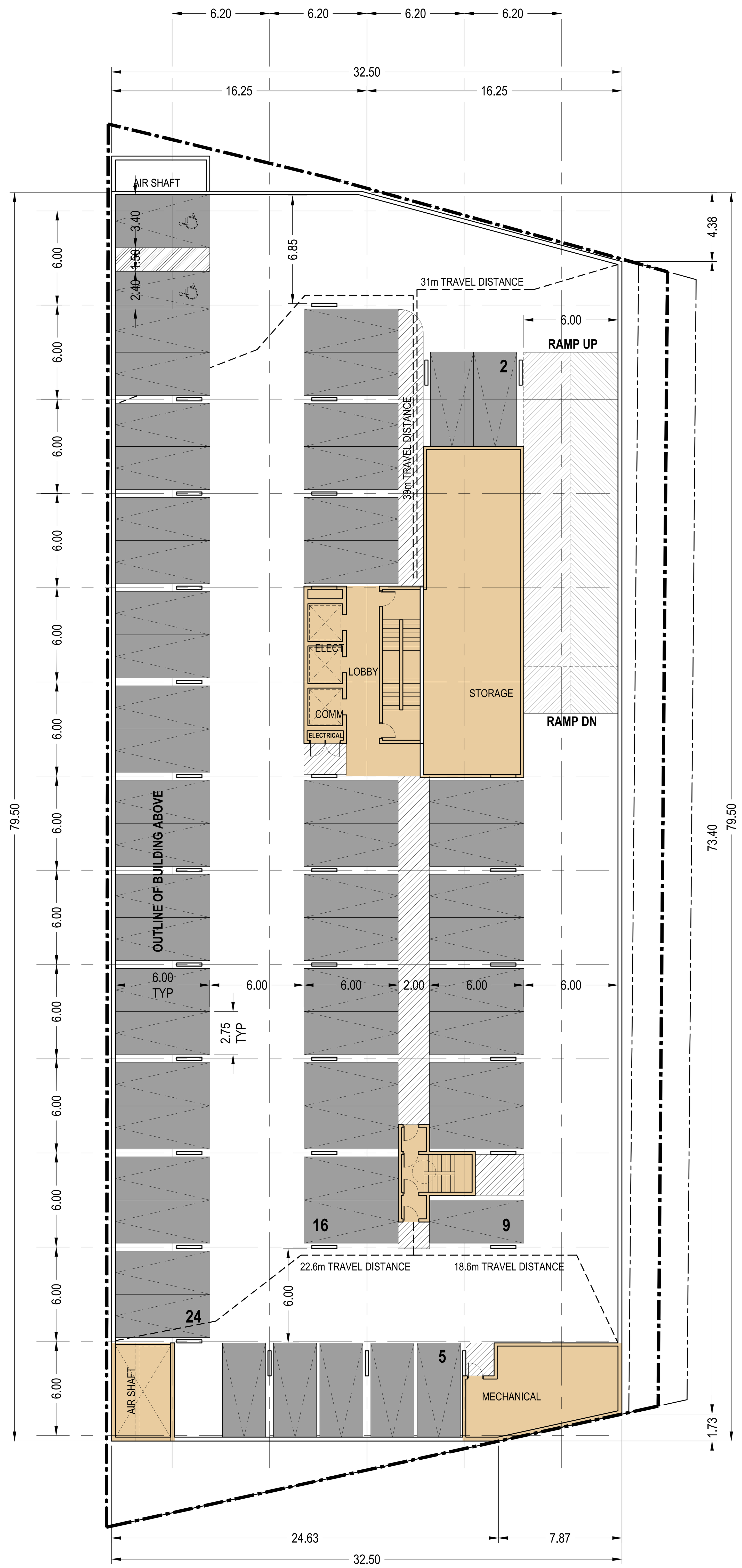
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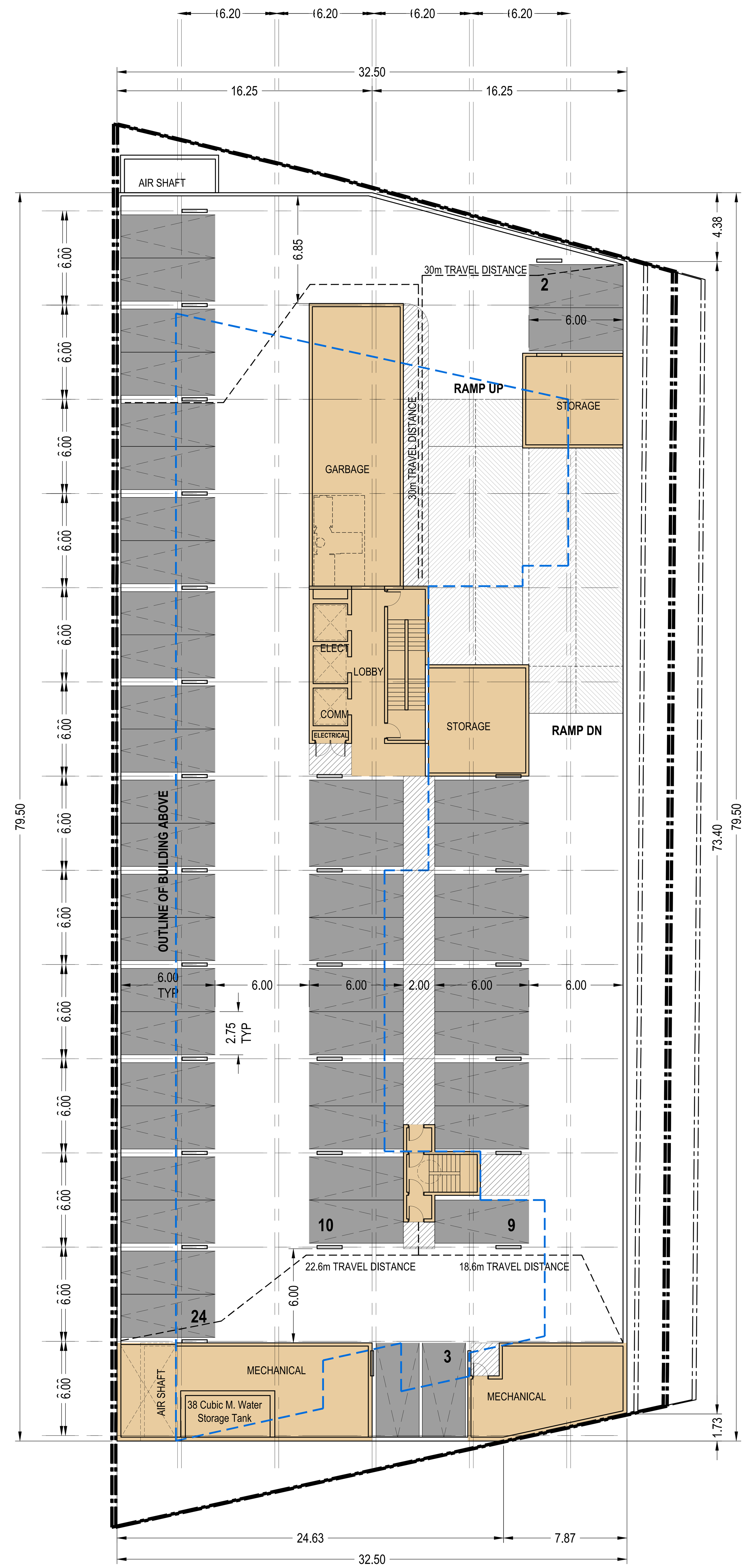
P3 (Lower) - Underground Parking

Area: 2540 sm
Parking: 60 Cars



P2 (Lower) - Underground Parking

Area: 2540 sm
Parking: 56 Cars



P1 (Typical) - Underground Parking

Area: 2540 sm
Parking: 48 Cars

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CLIENT:
Better Life Retirement Residence Inc.

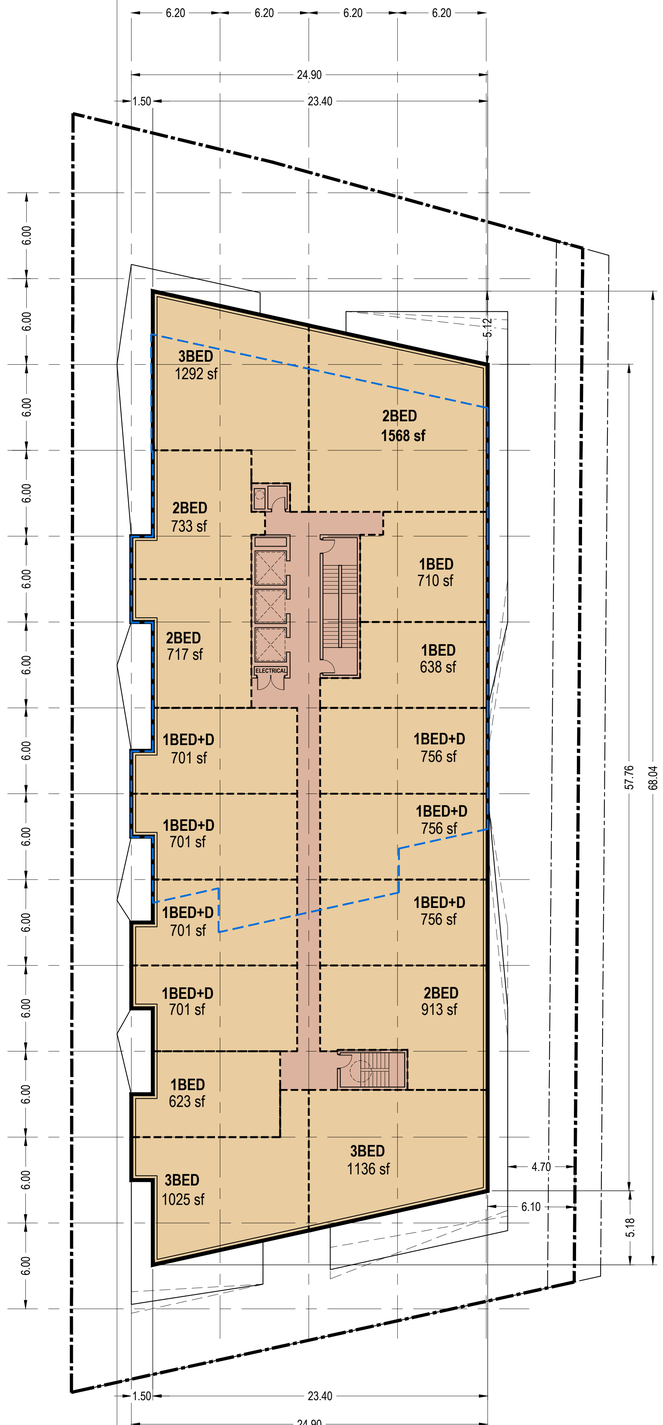
PROJECT:
441 Maple Street

Burlington, ON

SHEET TITLE:
Proposed Floor Plans

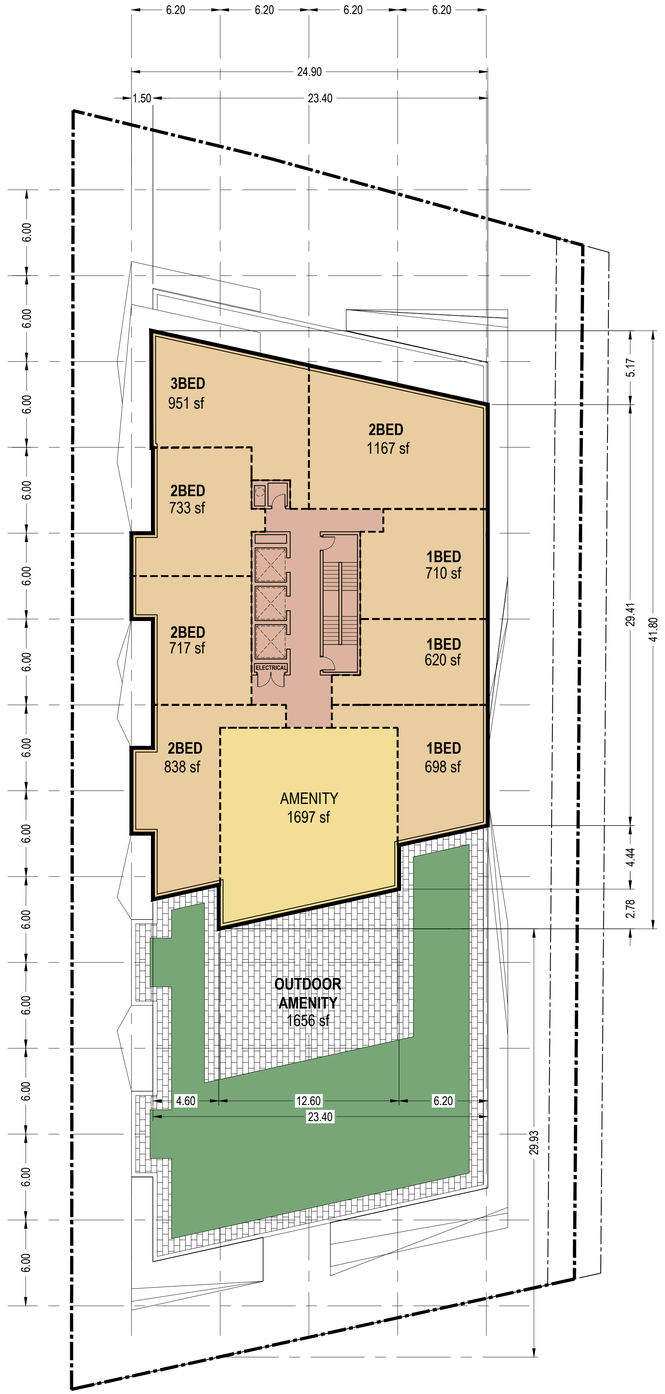
PROJECT NO.
C6075

SCALE: 1:200
DATE: Nov, '18
DRAWN: msai
SHEET NO: A01
CHECKED: ms
FILE NO.



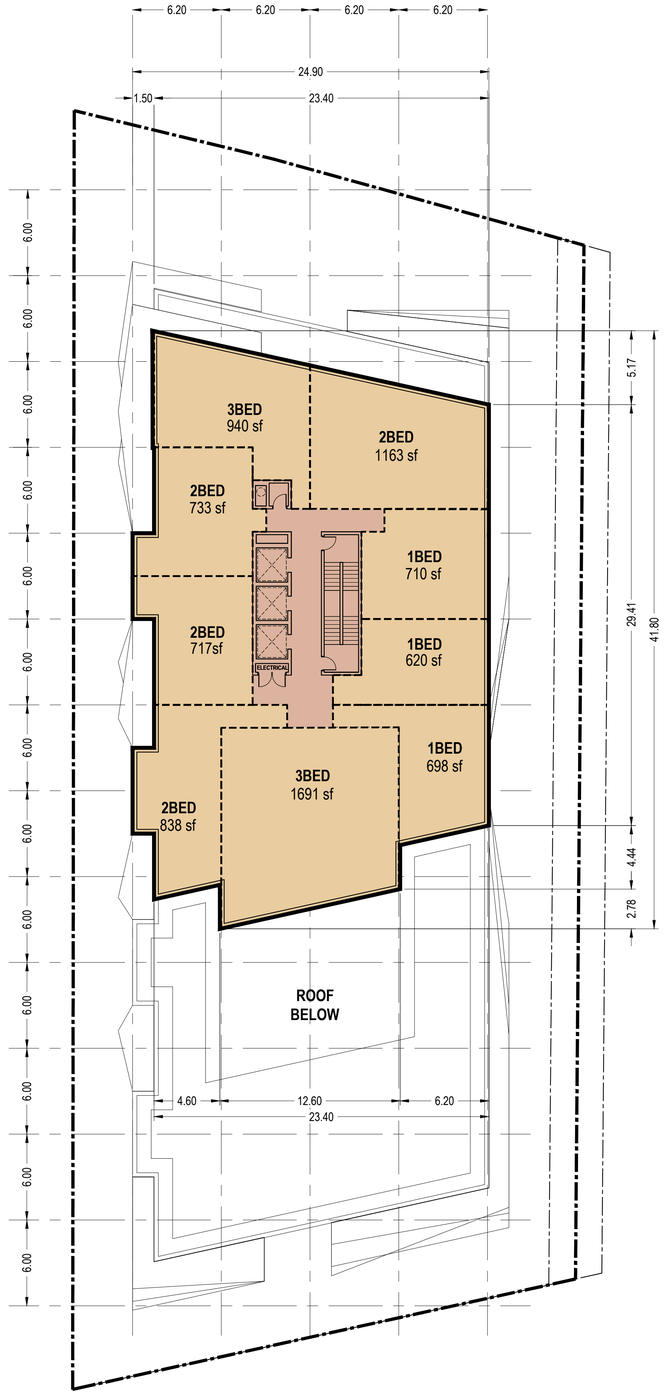
Typical Floor - 2nd-9th Floor

Area:	1507 sm	x 8 = 129,760 sm
Units:	17 Units	x 8 = 136 Units



10th Floor

Area:	866 sm	
Units:	8 Units	



11th Floor

Area:	866 sm	
Units:	9 Units	

MSAi

MICHAEL SPAZIANI ARCHITECT INC
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Planning | Development | Urban Design | Architecture

ONTARIO ASSOCIATION OF ARCHITECTS
MICHAEL SPAZIANI
LICENCE
3631

NO:	REVISIONS:	ISSUED:
6		
5		
4		
3		
2		
1	Issued for OPA / ZBA	Dec 07, '18

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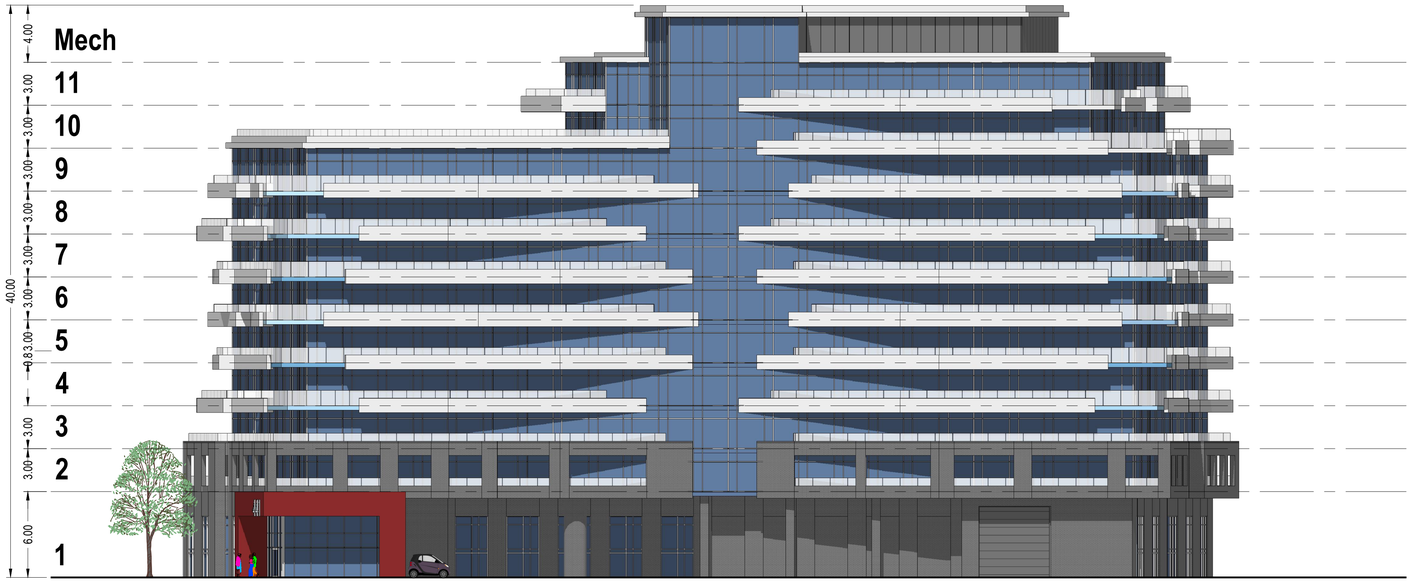
PROJECT:
441 Maple Street

Burlington, ON

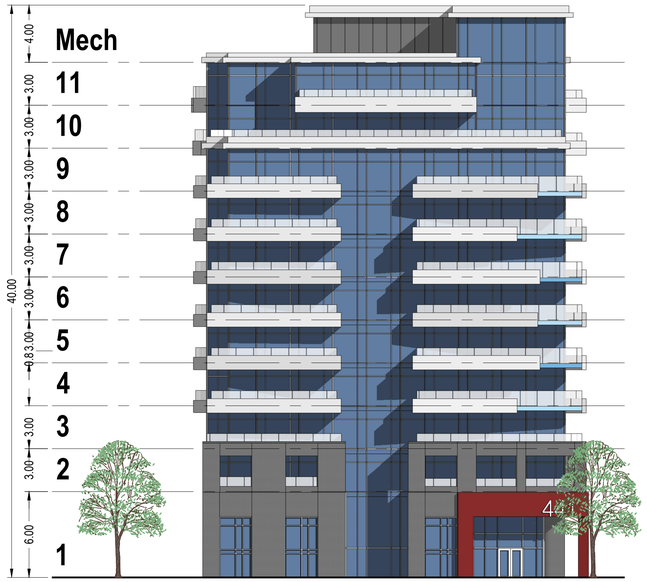
SHEET TITLE:
Proposed Floor Plans

PROJECT NO.
C6075

SCALE: 1:200	DATE: Nov, '18
DRAWN: msai	SHEET NO: A02
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FILE NO.	



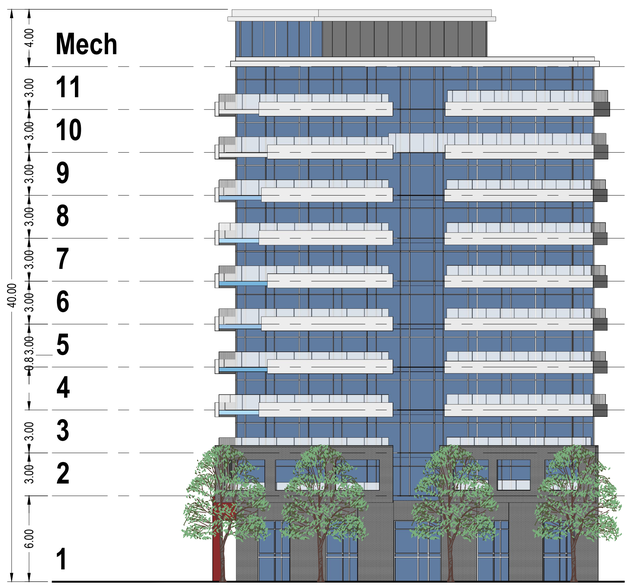
South Elevation



West Elevation



North Elevation



East Elevation

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NO:	REVISIONS:	ISSUED:
6		
5		
4		
3		
2		
1	Issued for OPA / ZBA	Dec 07, '18

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CLIENT:
Better Life Retirement Residence Inc.

PROJECT:
441 Maple Street

Burlington, ON

SHEET TITLE:
Proposed Elevations

PROJECT NO.
C6075

SCALE:	DATE:
1:200	Nov, '18
DRAWN: msai	SHEET NO: A03
CHECKED: ms	
FILE NO.	

APPENDIX B

Intersection	AADT Year	Year	Source	AADT Prediction	Volume	Major Volume	Minor Volume	North Approach AADT	South Approach AADT	East Approach AADT	West Approach AADT
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2000	2000	Count		33692	25425	8267	0	0	0	0
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2001	2001	Count		33388	25142	8246	9188	7082	25991	24515
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2002	2002	Count		33819	25637	8182	0	0	0	0
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2003	2003	Count		33883	25743	8140	0	0	0	0
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2004	2004	Count		34597	25928	8669	9428	7076	26587	26101
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2005	2005	Count		34010	25956	8054	0	0	0	0
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2006	2006	Count		32443	22711	9732	10673	6870	22734	24609
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2007	2007	Count	2009 Intersection Prediction	32384	22929	9455	10205	7220	22899	24446
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2008	2008	Count		32326	23148	9178	9736	7570	23064	24282
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2009	2009	Count	2009 Intersection Prediction	32649	23379	9270	9833	7646	23295	24525
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2010	2010	Count		38574	27105	11469	12047	8138	27807	29154
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2011	2011	Time linear average	2012 Intersection Predicitions	36812	26190	10622	11125	7806	26479	28212
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2012	2012	Count		35049	25275	9774	10203	7474	25151	27270
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2013	2013	Count	2013 Intersection Predictions	35400	25528	9872	10305	7549	25403	27543
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2014	2014	Count		39186	28562	10624	11265	8676	28434	29998
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2015	2015	Growth from count	2015 Intersections	39578	28848	10730	11378	8763	28718	30298
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2016	2016	Count		42718	30997	11721	11547	9555	30674	33659
MAPLE AVE @ NORTH SHORE BLVD E (201174)	**2018**	**2018**	**Count**		**37263**	**24734**	**12529**	**12218**	**10669**	**25142**	**26497**

Lakeshore Road @ Maple Ave

Morning Peak Diagram

Specified Period
From: 7:00:00
To: 9:00:00

One Hour Peak
From: 7:45:00
To: 8:45:00

Municipality: Burlington
Site #: 0000201174
Intersection: Lakeshore Road & Maple Ave
TFR File #: 1
Count date: 2-May-2018

Weather conditions:
Sunny

Person(s) who counted:
Nik
Mira

**** Signalized Intersection ****

Major Road: Lakeshore Road runs W/E

North Leg Total:	1005
North Entering:	436
North Peds:	35
Peds Cross:	⋈

Cyclists	0	7	1	8
Trucks	8	3	6	17
Cars	276	92	43	411
Totals	284	102	50	

Cyclists	1
Trucks	46
Cars	522
Totals	569

East Leg Total:	2026
East Entering:	817
East Peds:	61
Peds Cross:	⧖

Maple Ave

Cyclists	Trucks	Cars	Totals
6	29	909	944

Cars	Trucks	Cyclists	Totals
52	7	1	60
608	15	6	629
119	8	1	128
779	30	8	

Lakeshore Road

N
W E
S

Cyclists	Trucks	Cars	Totals
0	23	306	329
5	95	743	843
2	11	92	105
7	129	1141	

Lakeshore Road

Cars	Trucks	Cyclists	Totals
1067	134	8	1209

Maple Ave

Peds Cross:	⧖
West Peds:	15
West Entering:	1277
West Leg Total:	2221

Cars	303
Trucks	22
Cyclists	10
Totals	335

Cars	25	164	281	470
Trucks	6	16	33	55
Cyclists	0	0	2	2
Totals	31	180	316	

Peds Cross:	⋈
South Peds:	35
South Entering:	527
South Leg Total:	862

Comments

Lakeshore Road @ Maple Ave

Mid-day Peak Diagram

Specified Period
From: 11:00:00
To: 14:00:00

One Hour Peak
From: 11:15:00
To: 12:15:00

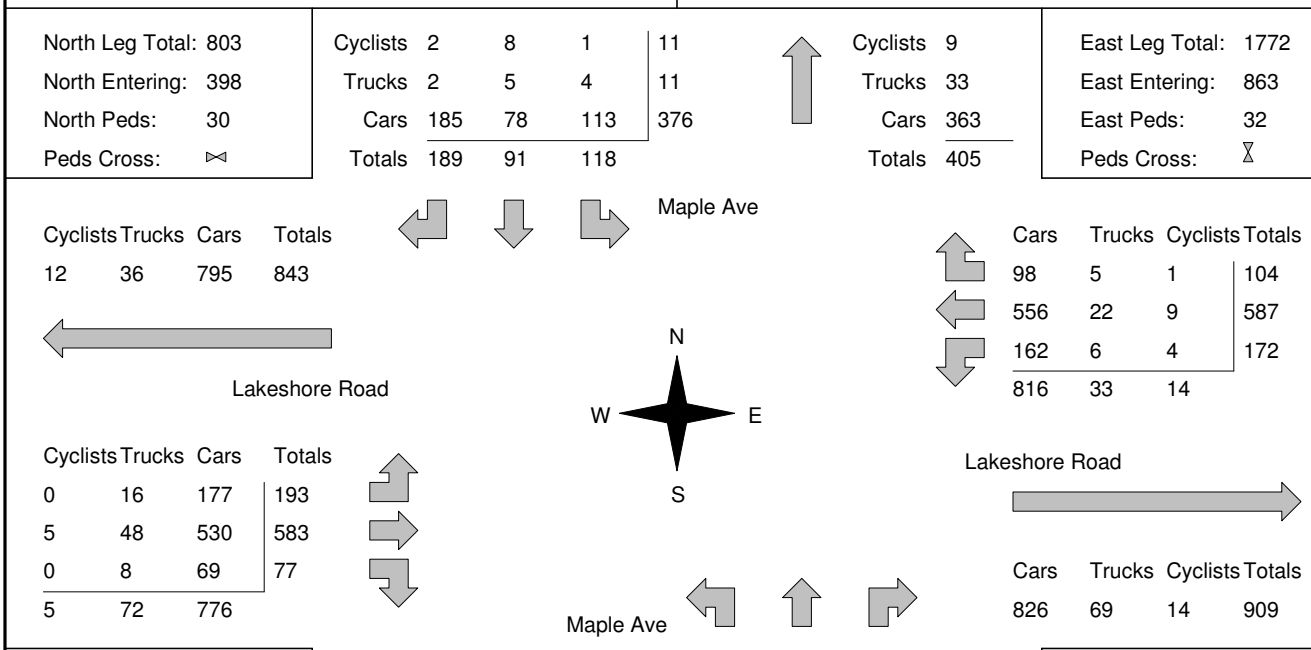
Municipality: Burlington
Site #: 0000201174
Intersection: Lakeshore Road & Maple Ave
TFR File #: 1
Count date: 2-May-2018

Weather conditions:
Sunny

Person(s) who counted:
Nik
Mira

**** Signalized Intersection ****

Major Road: Lakeshore Road runs W/E



Comments

Lakeshore Road @ Maple Ave

Afternoon Peak Diagram

Specified Period
From: 15:00:00
To: 18:00:00

One Hour Peak
From: 16:30:00
To: 17:30:00

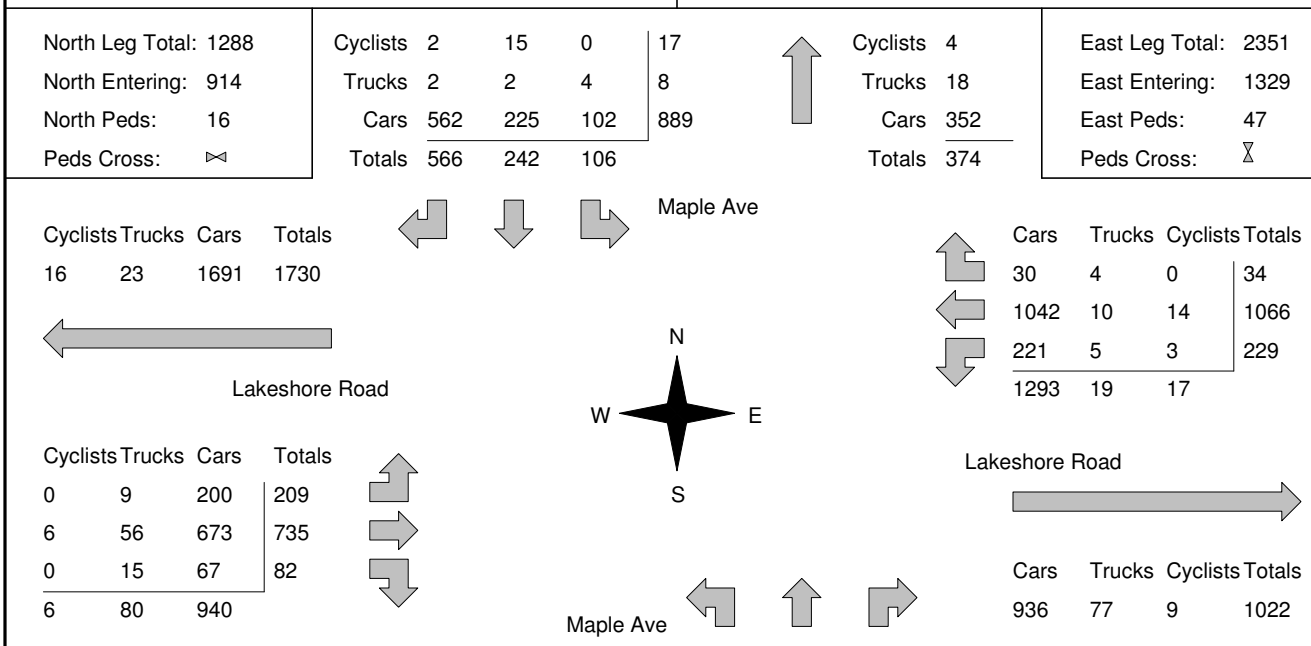
Municipality: Burlington
Site #: 0000201174
Intersection: Lakeshore Road & Maple Ave
TFR File #: 1
Count date: 2-May-2018

Weather conditions:
Sunny

Person(s) who counted:
Nik
Mira

**** Signalized Intersection ****

Major Road: Lakeshore Road runs W/E



Comments

Lakeshore Road @ Maple Ave

Total Count Diagram

Municipality: Burlington
Site #: 0000201174
Intersection: Lakeshore Road & Maple Ave
TFR File #: 1
Count date: 2-May-2018

Weather conditions:
Sunny

Person(s) who counted:
Nik
Mira

**** Signalized Intersection ****

Major Road: Lakeshore Road runs W/E

North Leg Total:	7555			
North Entering:	4246			
North Peds:	208			
Peds Cross:	⋈			
Cyclists	12	73	6	91
Trucks	60	27	38	125
Cars	2392	945	693	4030
Totals	2464	1045	737	
Cyclists	33			
Trucks	241			
Cars	3035			
Totals	3309			
East Leg Total:	15546			
East Entering:	7759			
East Peds:	353			
Peds Cross:	⧖			

Maple Ave

Cyclists	Trucks	Cars	Totals
110	288	8451	8849

Lakeshore Road

Cars	Trucks	Cyclists	Totals
522	39	3	564
5535	147	91	5773
1328	58	36	1422
7385	244	130	

N
W E
S

Cyclists	Trucks	Cars	Totals
0	126	1577	1703
42	504	4657	5203
5	81	543	629
47	711	6777	

Lakeshore Road

Cars	Trucks	Cyclists	Totals
6959	743	85	7787

Maple Ave

Peds Cross:	⧖			
West Peds:	227			
West Entering:	7535			
West Leg Total:	16384			
Cars	2816			
Trucks	166			
Cyclists	114			
Totals	3096			
Cars	524	936	1609	3069
Trucks	81	76	201	358
Cyclists	7	30	37	74
Totals	612	1042	1847	
Peds Cross:	⋈			
South Peds:	276			
South Entering:	3501			
South Leg Total:	6597			

Comments

Lakeshore Road @ Maple Ave
Traffic Count Summary

Intersection: Lakeshore Road & Maple Ave | **Count Date:** 2-May-2018 | **Municipality:** Burlington

North Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds	North/South Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	47	86	214	347	21	963
9:00:00	55	102	279	436	41	945
11:00:00	0	0	0	0	0	0
12:00:00	117	87	186	390	28	769
13:00:00	91	110	188	389	22	773
14:00:00	92	102	175	369	22	705
15:00:00	0	0	0	0	0	0
16:00:00	114	130	357	601	31	1026
17:00:00	117	211	519	847	15	1294
18:00:00	104	217	546	867	28	1272
Totals:	737	1045	2464	4246	208	7747

South Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	25	179	412	616	17
9:00:00	34	175	300	509	44
11:00:00	0	0	0	0	0
12:00:00	66	104	209	379	34
13:00:00	71	107	206	384	34
14:00:00	66	97	173	336	32
15:00:00	0	0	0	0	0
16:00:00	117	139	169	425	50
17:00:00	124	116	207	447	42
18:00:00	109	125	171	405	23
Totals:	612	1042	1847	3501	276

East Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds	East/West Total Approaches
7:00:00	0	0	0	0	0	0
8:00:00	98	465	38	601	31	1821
9:00:00	128	635	64	827	68	2074
11:00:00	0	0	0	0	0	0
12:00:00	181	558	93	832	32	1687
13:00:00	165	568	96	829	41	1611
14:00:00	176	599	114	889	53	1615
15:00:00	0	0	0	0	0	0
16:00:00	205	920	86	1211	42	2016
17:00:00	226	980	39	1245	37	2174
18:00:00	243	1048	34	1325	49	2296
Totals:	1422	5773	564	7759	353	15294

West Approach Totals

Hour Ending	Includes Cars, Trucks, & Cyclists: Left	Thru	Right	Grand Total	Total Peds
7:00:00	0	0	0	0	0
8:00:00	334	800	86	1220	26
9:00:00	329	825	93	1247	18
11:00:00	0	0	0	0	0
12:00:00	184	584	87	855	27
13:00:00	153	549	80	782	31
14:00:00	155	493	78	726	33
15:00:00	0	0	0	0	0
16:00:00	162	590	53	805	38
17:00:00	188	667	74	929	40
18:00:00	198	695	78	971	14
Totals:	1703	5203	629	7535	227

Calculated Values for Traffic Crossing Major Street

Hours Ending:	8:00	9:00	12:00	13:00	14:00	16:00	17:00	18:00
Crossing Values:	308	350	346	344	346	450	529	493

Turning Movement Count Convertor

Intersection: Maple Avenue (north-south)

and Lakeshore Rd (east-west)

1. Turning Movement Count Summary Information

		Northbound (n/b)					Eastbound (e/b)					Soutbound (s/b)					Westbound (w/b)				
		Exits	Left	Thru	Right	Total	Exits	Left	Thru	Right	Total	Exits	Left	Thru	Right	Total	Exits	Left	Thru	Right	Total
8-hr Count	Car	3035	524	936	1609	3069	6959	1577	4657	543	6777	2816	693	945	2392	4030	8451	1328	5535	522	7385
	Truck	241	81	76	201	358	743	126	504	81	711	166	38	27	60	125	288	58	147	39	244
	Bus	0				0	0				0	0				0	0				0
	TOTAL		605	1012	1810	3427		1703	5161	624	7488		731	972	2452	4155		1386	5682	561	7629

Notes:

Exits - traffic which will head in a particular direction after it clears the intersection. For example, westbound exists are w/b thru + n/b left + s/b right

Link volume - sum of the turning movements, or simply the sum of the exists plus opposite bound (e.g., north link is n/b exits + s/b total)

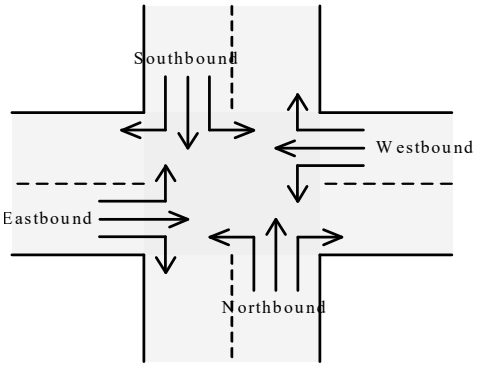
2. Resulting Traffic Volumes Per Link

West Link Volume

	AM	PM	8-hr
Car	0	0	15228
Truck	0	0	999
Bus	0	0	0
Total	0	0	16227
%Comm	#DIV/0!	#DIV/0!	6.2%
%Bus	#DIV/0!	#DIV/0!	0.0%
% Trucks	#DIV/0!	#DIV/0!	6.2%

South Link Volume

	AM	PM	8-hr
Car	0	0	5885
Truck	0	0	524
Bus	0	0	0
Total	0	0	6409
%Comm	#DIV/0!	#DIV/0!	8.2%
%Bus	#DIV/0!	#DIV/0!	0.0%
% Trucks	#DIV/0!	#DIV/0!	8.2%



General Turning Movement Diagram

North Link Volume

	AM	PM	8-hr
Car	0	0	7065
Truck	0	0	366
Bus	0	0	0
Total	0	0	7431
%Comm	#####	#####	4.9%
%Bus	#####	#####	0.0%
% Trucks	#####	#####	4.9%

East Link Volume

	AM	PM	8-hr
Car	0	0	14344
Truck	0	0	987
Bus	0	0	0
Total	0	0	15331
%Comm	#####	#####	6.4%
%Bus	#####	#####	0.0%
% Trucks	#####	#####	6.4%

Notes:

%Comm - Percent Commercial - the percentage of traffic composed of commercial trucks (medium and heavy)

%Bus - Percentage of the total as bus traffic (buses count as medium trucks)

%Trucks - Percentage of fleet made up by commerical vehicles and buses

Vehicle Breakdown

Conversion Factors

Roadway	AADT Conversion Factor[1]				%Comm Breakdown[3]		%Comm Ratio	
	DHV[2]	AM Peak	PM Peak	8-hr	%MT	%HT	%MT	%HT
Maple Avenue	10%	8%	10%	60%	5%	8%	38%	62%
Lakeshore Rd	10%	9%	10%	60%	5%	8%	38%	62%

%Truck Estimates

%Comm Trucks		%Bus	Total Trucks	
%MT	%HT	%MT	%MT	%HT
1.9%	3.0%	0.0%	1.9%	3.0%
3.1%	5.0%	0.0%	3.1%	5.0%
2.5%	4.0%	0.0%	2.5%	4.0%
2.4%	3.8%	0.0%	2.4%	3.8%

Notes:

[1] Percentage of traffic typically occuring in that hour or period (default is based on arterial roadway (ITE) distribution)

[2] Design hourly volume. If you know the actual DHV and it's different from this number, then put that value in to AM and PM slots

[3] Percentage of traffic typically made up by medium and heavy trucks (MTO defaults)

[4] Total volume on link / conversion factor (in percent)

[5] Average of (maximum of AADT from AM and PM counts) and AADT from 8-hr count

[6] %Diff - difference in volume between maximum predicted and average of the predictions

[6] dB Diff - the approximate dB difference in noise prediction which would result from using the maximum versus the average

%MT Percent Medium Trucks

%HT Percent Heavy Trucks

ORNAMENT

Ontario Road Noise Analysis Method for ENvironment and Transportation

version 2.09

Job No. 1900412
Job Name 441 Maple Ave, Burlington

Scenario

ROAD CHARACTERISTICS | **SOURCE-RECEIVER-BARRIER-TOPOGRAPHY CHARACTERISTICS**

ID	Description	Time Period	Number of Vehicles			Speed (km/h)	Road Gradient (%)	Two Way? (y/n)	Pavement Type	Road Viewable Angle		Source-Receiver Distance (m)	Ground Type (Hard/Soft)	Topography Type	Source Height (m)	Road Elevation (m asl)	Receptor Height (m)	Receptor Elevation (m asl)	Ground Elevation Change (m)			Barrier Height (m)	Barrier Elevation (m asl)	Barrier-Reciever Distance (m)	Barrier Viewable Angle		Total Segment L_{eq} (dBA)
			Autos	Medium	Heavy					Q_1	Q_2								Elevation Change e (m)	Hor. Dist a (m)	Hor. Dist b (m)				Q_1	Q_2	
R1	Lakeshore Ave	16	24646	652	1044	50	0	y	1	-90	90	93.0	Hard	A	1.4	0.0	15.0	0.0									62
		8	2738	72	116	50	0	y	1	-90	90	93.0	Hard	A	1.4	0.0	15.0	0.0									56
R2	Maple Ave	16	10084	201	321	50	0	y	1	-90	90	19.3	Hard	A	1.3	0.0	4.5	0.0									64
		8	1120	22	36	50	0	y	1	-90	90	19.3	Hard	A	1.3	0.0	4.5	0.0									58
	North Shore Blvd	16	23456	592	947	60	0	y	1	0	40	103.5	Hard	A	1.4	0.0	4.5	0.0									57
		8	2606	66	105	60	0	y	1	0	40	103.5	Hard	A	1.4	0.0	4.5	0.0									50
																									R2 Day Sum		65
																									R2 Night		58
OLA - Rooftop Terrace	Lakeshore Ave	16	24646	652	1044	50	0	y	1	-90	90	115.2	Hard	A	1.4	0.0	31.5	0.0				1.2	30.0	12.0	-90	90	51
	Maple Ave	16	10084	201	321	50	0	y	1	-90	90	44.1	Hard	A	1.3	0.0	31.5	0.0				1.2	30.0	12.0	-90	90	45
																									OLA - Rooftop Terrace		52
OLA - Outdoor Patio	Lakeshore Ave	16	24646	652	1044	50	0	y	1	-35	35	102.0	Hard	A	1.4	0.0	1.5	0.0				1.5	0.0	7.0	-35	35	53
																									OLA - Outdoor Patio		53

Traffic Data	2028 AADT	Autos	Medium	Heavy	Day	Night
Maple Avenue North Leg	11785	95.1%	1.9%	3.0%	90%	10%
Lakeshore Rd South Leg	13496	91.8%	3.1%	5.0%		
Lakeshore Rd East Leg	29269	93.6%	2.5%	4.0%		
North Shore Blvd West Leg	27772	93.8%	2.4%	3.8%		

Intersection	AADT Year	Year	Source	AADT Prediction	Volume	Major Volume	Minor Volume	North Approach AADT	South Approach AADT	East Approach AADT	West Approach AADT
MAPLE AVE @ NORTH SHORE BLVD E (201174)	2018	2018	Count		37263	24734	12529	12218	10669	25142	26497