



SHADOW STUDY ANALYSIS

7211 & 7233 AIRPORT ROAD
CITY OF MISSISSAUGA

1.0 INTRODUCTION

This Shadow Study has been prepared by Weston Consulting at the request of the City of Mississauga via correspondence received on 2020/03/10, as required per Section 19.4.5 of the Mississauga Official Plan. The Study has been prepared by Holly Templeton under the direction of Shane Morgan. The Study is prepared according to the Urban Design Terms of Reference: Standards for Shadow Studies [2014] in support of a proposal that exceeds the requirement threshold for Shadow Studies of 10.7m height. The Study illustrates the impacts of the revised proposed development, assessing sun and daylight access on the surrounding context.

This Study supports the development application to approve the proposal for a Seniors Condominium Residence on the subject lands at 7211 and 7233 Airport Road, Parts #1, 2 & 3 in the City of Mississauga. The building is proposed to be 6 storeys in height [18.6m], containing a total of 128 units ranging from 1 - 2 bedrooms. The proposed outdoor amenity space constitutes an area of 1,235m² to the north of the proposed building. The immediate surrounding context is as follows:

North: Low-rise residential dwellings; Victory Park containing treed areas and a playground outside of the Study Area.

East: Low-rise residential dwellings; Malton Bible Chapel; Malton Victory Hall.

South: Commercial strip-plaza; low-rise residential dwellings further south; and Malton Village Park beyond containing a playground and tennis courts outside of the Study Area.

West: 6-storey residential apartment building; Sri Guru Singh Sabha Malton place of worship.

This purpose of this Study is to demonstrate that the proposed location, articulation and height of the building will not cause undue shadowing on the following areas:

- Subject lands;
- Surrounding building facades;
- Surrounding private and public outdoor amenity and open spaces;
- Public parkland; and
- Public sidewalks and other components of the public realm.

The following requirements have been observed in the preparation of this Study:

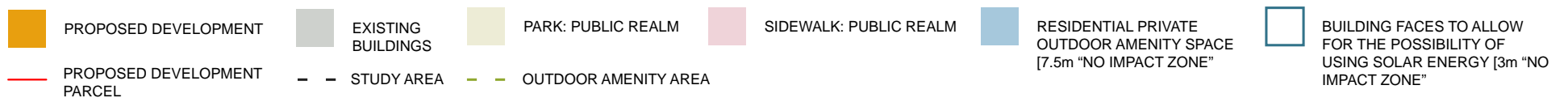
1. Preparation of shadow diagrams for the dates of:
 - June 21
 - September/March 21st
 - December 21
2. Preparation of shadow diagrams at the times of:
 - Solar Noon [SN]
 - Hourly intervals before and after Solar Noon [SN], up to and including 1.5 hours after sunrise and 1.5 hours before sunset.
3. Application of hourly solar data contained in Tables 2, 3 and 4 of the Standards for Shadow Studies: Mississauga Sun Angle Data, including Eastern Daylight Savings Time [EDST] and for the calendar year.
4. Assessment of Criteria 3.1 - 3.5 against the Terms of Reference to ensure adequate sunlight is preserved on the subject site and surrounding area following the addition of cumulative shadowing from the proposed development.

The base mapping was obtained from City of Mississauga Open Data resources 2018. The mapping has been modeled to an area 4 times the proposed building height [18.6 metres] to the north, east and west [74.4 metres], and 1.5 times the building height to the south [27.9 metres]. This area constitutes the 'Study Area', within which impacts have been primarily assessed to calculate required sun access factors on sensitive areas.

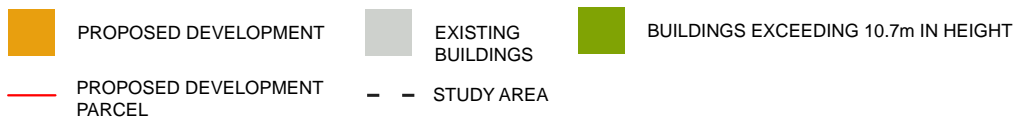
The reference bearing for this Study is 43°42'27.8"N, 79°38'50.8"W, taken from the nearest intersection to the subject site at Airport Road and Victory Crescent, Mississauga. The approximate site latitude is 43.707719. The approximate site longitude is -79.647445. Astronomic or True North has been determined using GPS Google Map Data 2021 supplemented by geo-referencing software powered by Trimble. There have been no turf or flower gardens identified within the Study Area in public parks. As such, no assessment for Criteria 3.4 has been prepared. The proposed amenity area within the subject lands have been included for assessment as requested by City Staff. Impacts are measured according to the assessment requirements for Criterion 3.2.

It should be noted that calculations for sunrise and sunset have not been prepared, as shadows are not visible during these hours.

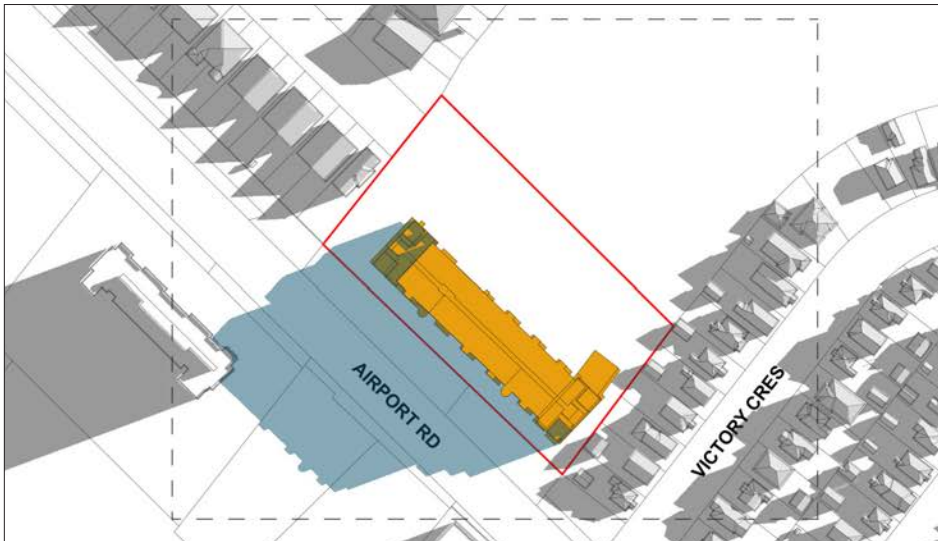
MAP A : KEY MAP



MAP B : BUILDING HEIGHTS MAP



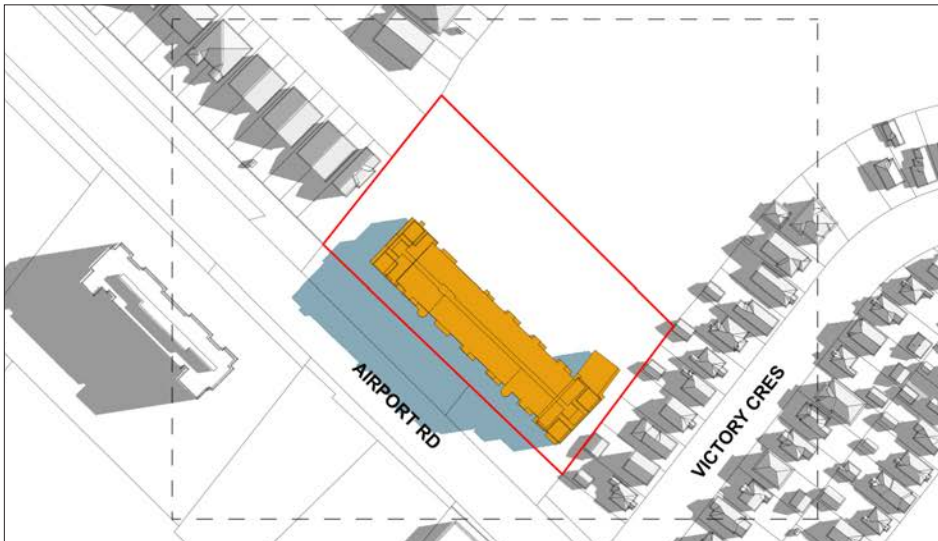
2.0 SHADOW DIAGRAMS - JUNE 21st



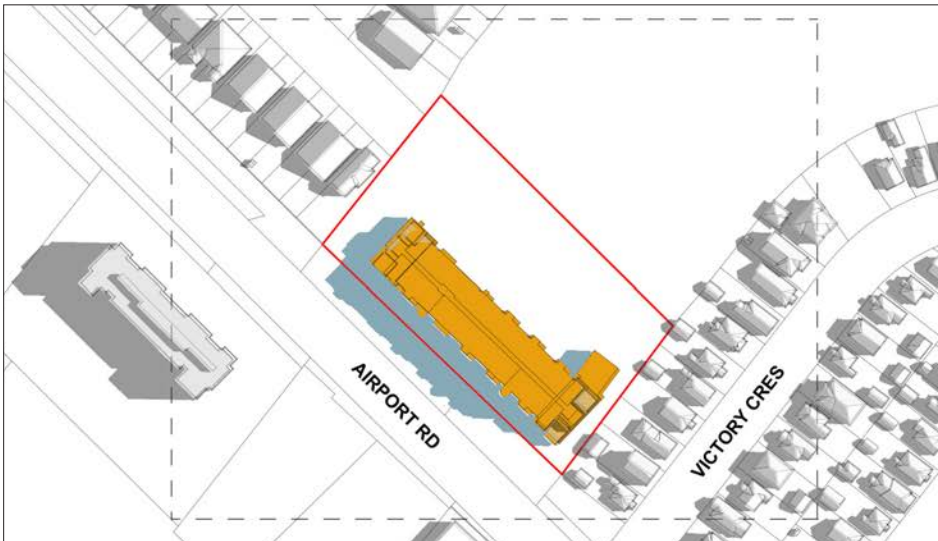
June 7:07am



June 7:20am



June 8:20am



June 9:20am

PROPOSAL

SUBJECT SITE

CUMULATIVE SHADOW CAST BY PROPOSAL

EXISTING SHADOW

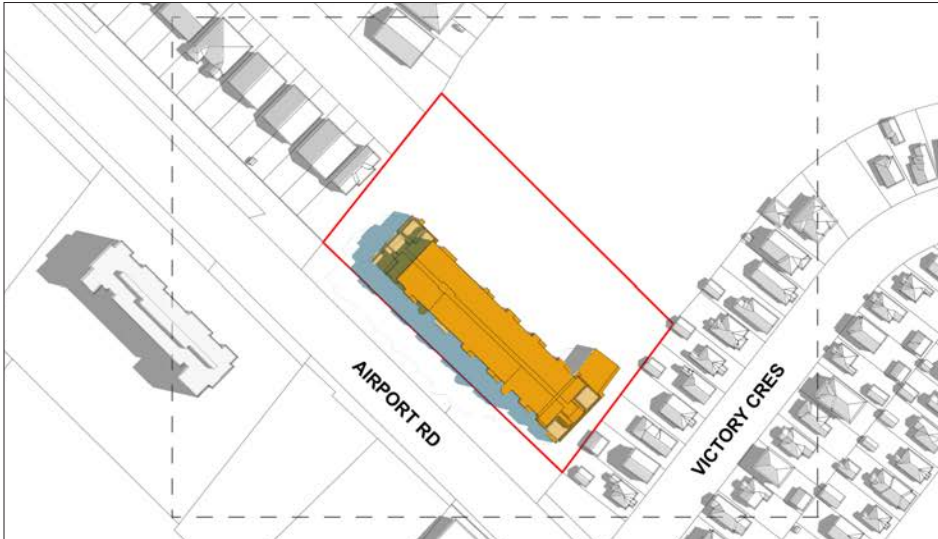
0m

25

50

100

JUNE 21st



June 10:20am



June 11:20am



June 12:20pm



June 1:20pm

PROPOSAL

SUBJECT SITE

CUMULATIVE SHADOW CAST BY PROPOSAL

EXISTING SHADOW

0m 25 50 100

JUNE 21st



June 2:20pm



June 3:20pm



June 4:20pm



June 5:20pm

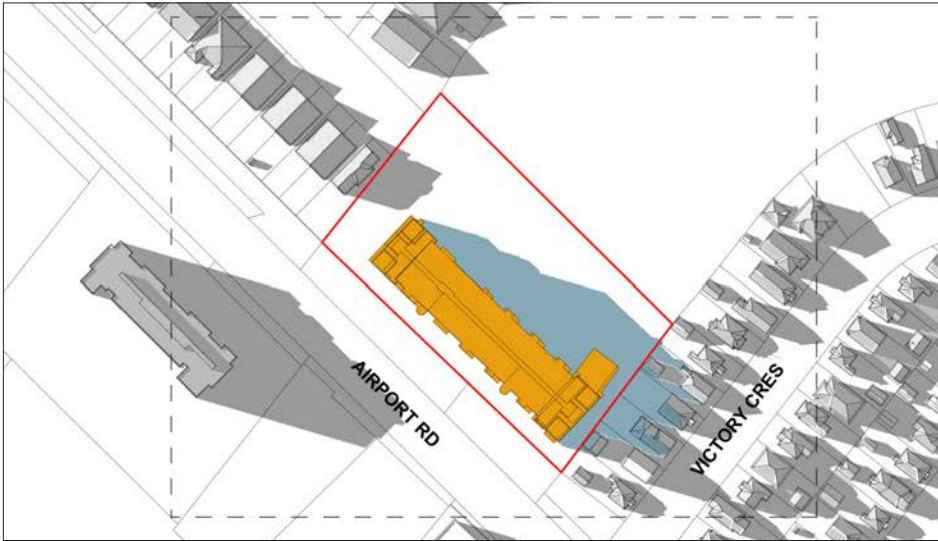
PROPOSAL SUBJECT SITE CUMULATIVE SHADOW CAST BY PROPOSAL EXISTING SHADOW



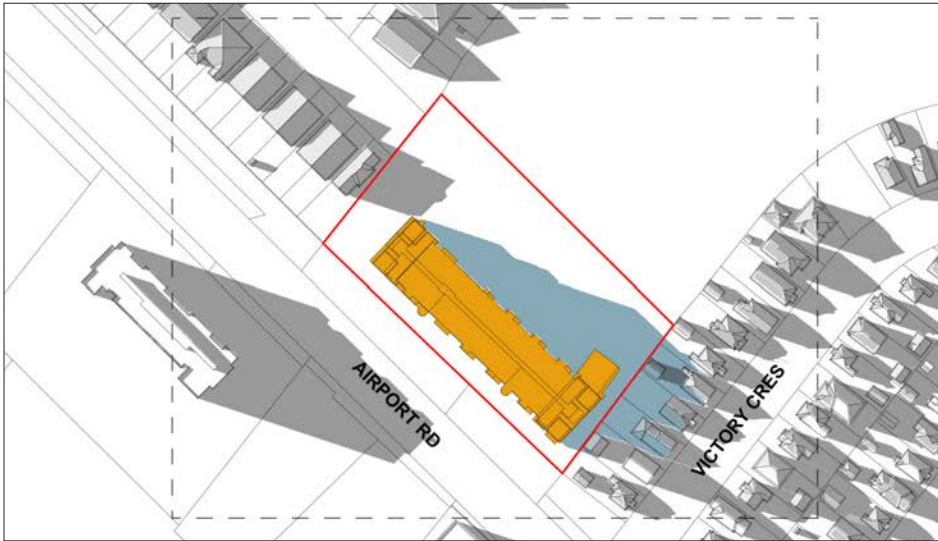
JUNE 21st



June 6:20pm



June 7:20pm

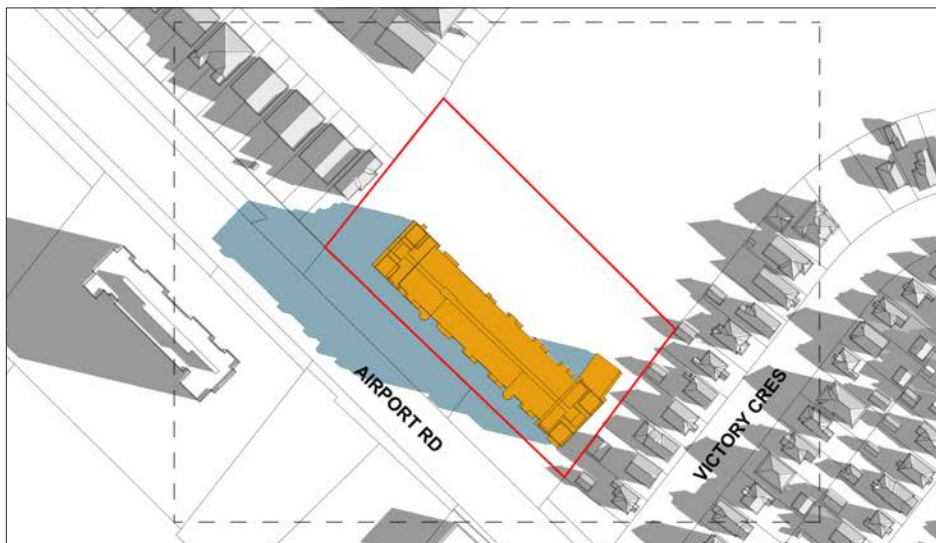


June 7:33pm

PROPOSAL SUBJECT SITE CUMULATIVE SHADOW CAST BY PROPOSAL EXISTING SHADOW



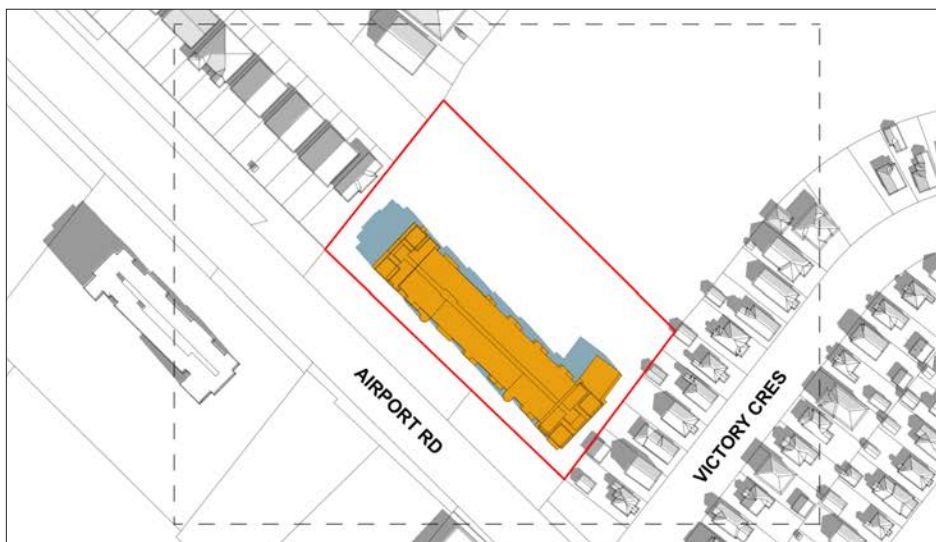
SEPTEMBER 21st



September 8:35am



September 9:12am



September 10:12am



September 11:12am

■ PROPOSAL ■ SUBJECT SITE ■ CUMULATIVE SHADOW CAST BY PROPOSAL ■ EXISTING SHADOW

0m 25 50 100



SEPTEMBER 21st



September 12:12pm



September 1:12pm



September 2:12pm



September 3:12pm

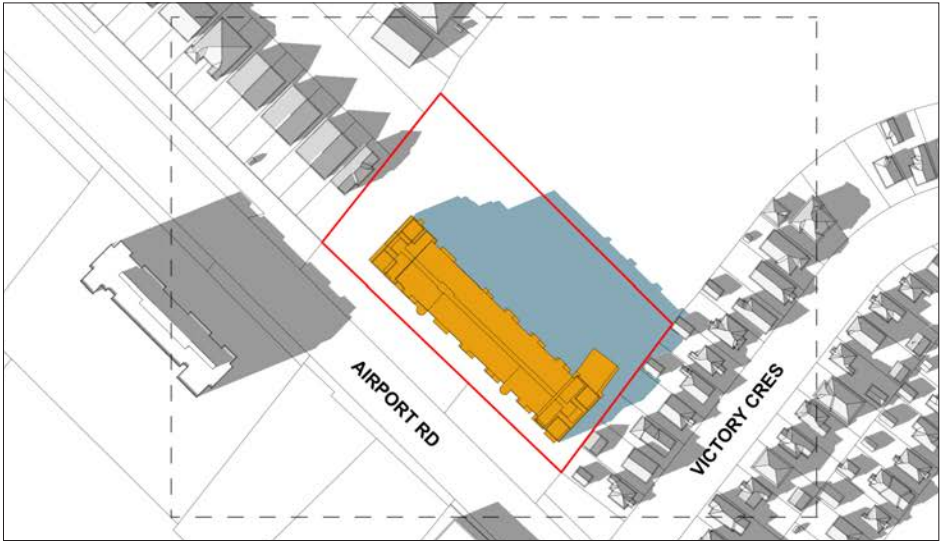
PROPOSAL SUBJECT SITE CUMULATIVE SHADOW CAST BY PROPOSAL EXISTING SHADOW



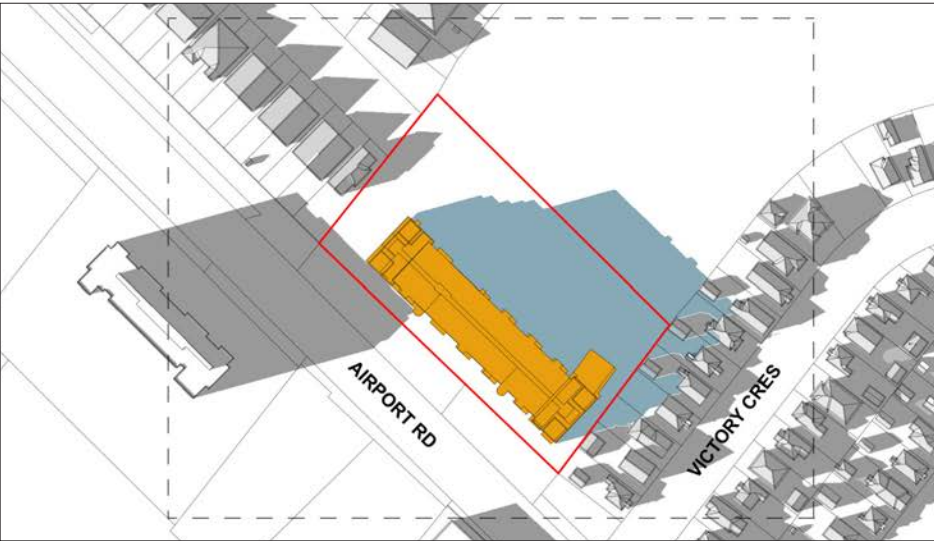
SEPTEMBER 21st



September 4:12pm



September 5:12pm

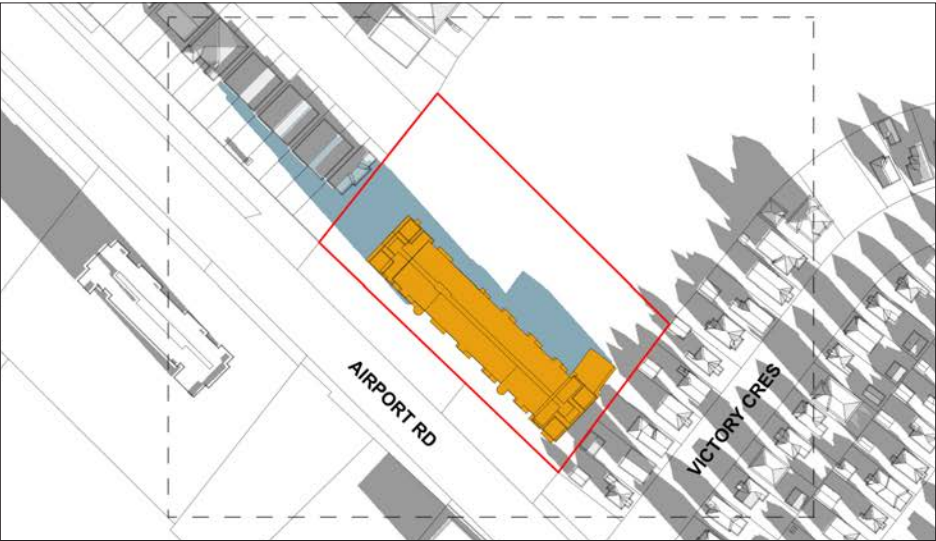


September 5:48pm

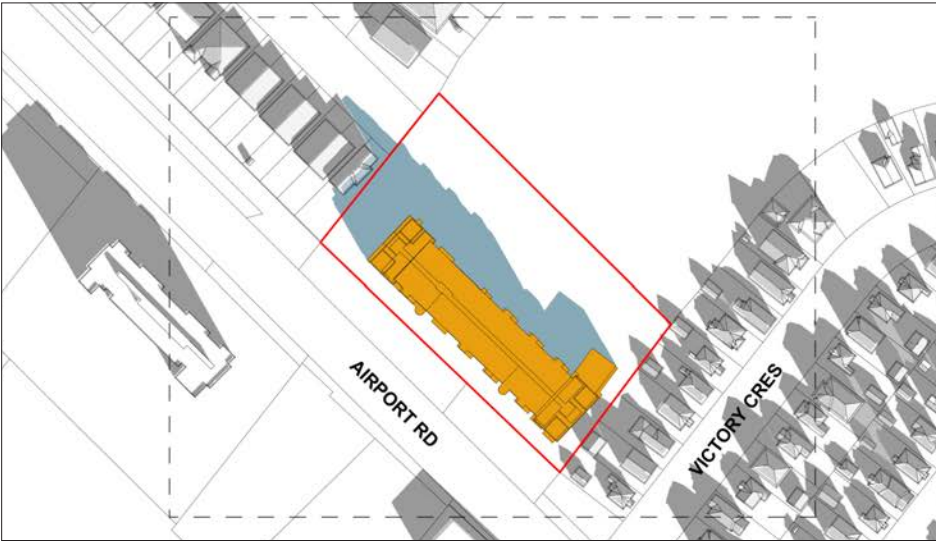
PROPOSAL SUBJECT SITE CUMULATIVE SHADOW CAST BY PROPOSAL EXISTING SHADOW



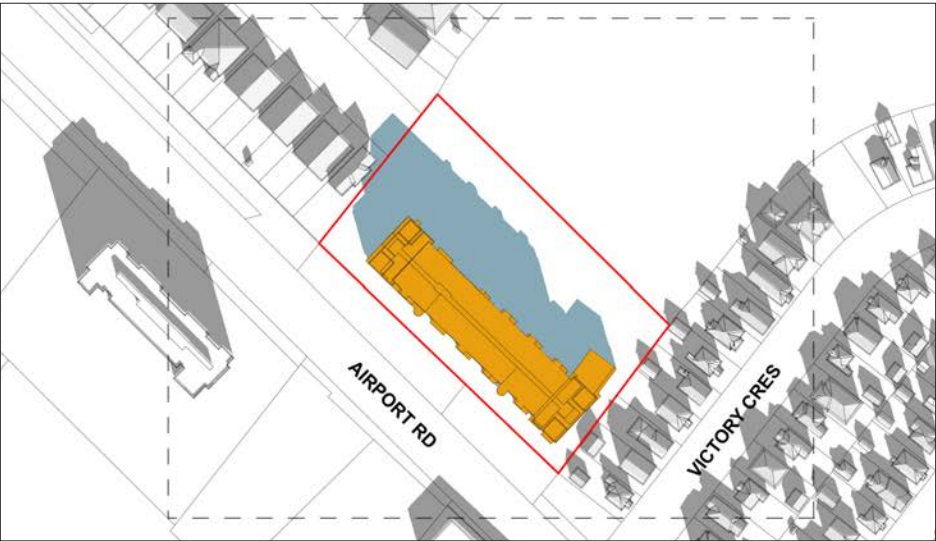
DECEMBER 21st



December 9:19am



December 10:17am



December 11:17am



December 12:17pm



DECEMBER 21st



December 1:17pm



December 2:17pm



December 3:15pm

PROPOSAL SUBJECT SITE CUMULATIVE SHADOW CAST BY PROPOSAL EXISTING SHADOW



3.0 CRITERIA: 3.1 RESIDENTIAL PRIVATE OUTDOOR AMENITY

Table 1 - 3.1 Residential Private Outdoor Amenity: June 21st

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 5:37	235.73	18.6	2,251	n/a	n/a	n/a
RISE + 1.5 hr: 7:07	250.48	18.6	2,251	0	2,251	1.0
SN - 6 hr: 7:20	252.58	18.6	2,251	0	2,251	1.0
SN - 5 hr: 8:20	262.02	18.6	2,251	0	2,251	1.0
SN - 4 hr: 9:20	272.04	18.6	2,251	0	2,251	1.0
SN - 3 hr: 10:20	283.79	18.6	2,251	0	2,251	1.0
SN - 2 hr: 11:20	299.52	18.6	2,251	0	2,251	1.0
SN - 1 hr: 12:20	323.67	18.6	2,251	0	2,251	1.0
SOLAR NOON (SN): 13:20	0	18.6	2,251	0	2,251	1.0
SN + 1 hr: 14:20	36.32	18.6	2,251	0	2,251	1.0
SN + 2 hr: 15:20	60.47	18.6	2,251	0	2,251	1.0
SN + 3 hr: 16:20	76.21	18.6	2,251	0	2,251	1.0
SN + 4 hr: 17:20	87.96	18.6	2,251	18	2,233	0.9
SN + 5 hr: 18:20	97.98	18.6	2,251	261	1,990	0.8
SN + 6 hr: 19:20	107.42	18.6	2,251	344	1,907	0.8
SET - 1.5 hr: 19:33	109.41	18.6	2,251	367	1,884	0.8
SET: 21:03	124.27	18.6	2,251	n/a	n/a	n/a
TOTAL AVERAGE:						0.9

3.1 RESIDENTIAL PRIVATE OUTDOOR AMENITY

Table 2 - 3.1 Residential Private Outdoor Amenity: March/September 21st

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 7:05	268.27	18.6	2,251	n/a	n/a	n/a
RISE + 1.5 hr: 8:35	284.22	18.6	2,251	46	2,205	1.0
SN - 4 hr: 9:12	291.23	18.6	2,251	32	2,219	1.0
SN - 3 hr: 10:12	304.14	18.6	2,251	0	2,251	1.0
SN - 2 hr: 11:12	319.68	18.6	2,251	0	2,251	1.0
SN - 1 hr: 12:12	338.54	18.6	2,251	0	2,251	1.0
SOLAR NOON (SN): 13:12	0	18.6	2,251	0	2,251	1.0
SN + 1 hr: 14:12	21.45	18.6	2,251	0	2,251	1.0
SN + 2 hr: 15:12	40.28	18.6	2,251	0	2,251	1.0
SN + 3 hr: 16:12	55.79	18.6	2,251	0	2,251	1.0
SN + 4 hr: 17:12	68.68	18.6	2,251	25	2,226	1.0
SET - 1.5 hr: 17:48	75.63	18.6	2,251	376	1,875	0.8
SET: 19:18	91.46	18.6	2,251	n/a	n/a	n/a
TOTAL AVERAGE:						1.0

The private residential amenity within the Study Area measures 2,251m². This constitutes a 7.5m “no impact zone” within the rear yard of private, low-rise residential dwellings.

No more than two consecutive hours of sunlight should be impacted during the test dates. The test dates required for this criterion include June and March/September 21st.

There is cast shadow from the proposed development at more than two consecutive hourly test times for the test date of June 21st. The criterion is not met for June, however, the average Sun Access Factor achieved remains sufficient at 0.9.

There is no shadow impact for more that two consecutive hourly test times for the months of March/September. Therefore, this criterion is met for the test month of March/September.

3.2 COMMUNAL OUTDOOR AMENITY AREAS

Table 3 - 3.2 Communal Outdoor Amenity Areas: June 21st

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 5:37	235.73	18.6	1,235	n/a	n/a	n/a
RISE + 1.5 hr: 7:07	250.48	18.6	1,235	0	1,235	1.0
SN - 6 hr: 7:20	252.58	18.6	1,235	0	1,235	1.0
SN - 5 hr: 8:20	262.02	18.6	1,235	0	1,235	1.0
SN - 4 hr: 9:20	272.04	18.6	1,235	0	1,235	1.0
SN - 3 hr: 10:20	283.79	18.6	1,235	0	1,235	1.0
SN - 2 hr: 11:20	299.52	18.6	1,235	0	1,235	1.0
SN - 1 hr: 12:20	323.67	18.6	1,235	0	1,235	1.0
SOLAR NOON (SN): 13:20	0	18.6	1,235	0	1,235	1.0
SN + 1 hr: 14:20	36.32	18.6	1,235	82	1,153	0.9
SN + 2 hr: 15:20	60.47	18.6	1,235	108	1,127	0.9
SN + 3 hr: 16:20	76.21	18.6	1,235	211	1,024	0.8
SN + 4 hr: 17:20	87.96	18.6	1,235	310	925	0.7
SN + 5 hr: 18:20	97.98	18.6	1,235	461	774	0.6
SN + 6 hr: 19:20	107.42	18.6	1,235	705	530	0.4
SET - 1.5 hr: 19:33	109.41	18.6	1,235	759	476	0.4
SET: 21:03	124.27	18.6		n/a	n/a	n/a
TOTAL AVERAGE:						0.8

3.2 COMMUNAL OUTDOOR AMENITY AREAS

Table 4 - 3.2 Communal Outdoor Amenity Areas: March/September 21st

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 7:05	268.27	18.6	1,235	n/a	n/a	n/a
RISE + 1.5 hr: 8:35	284.22	18.6	1,235	43	1,192	1.0
SN - 4 hr: 9:12	291.23	18.6	1,235	47	1,188	1.0
SN - 3 hr: 10:12	304.14	18.6	1,235	82	1,153	0.9
SN - 2 hr: 11:12	319.68	18.6	1,235	85	1,150	0.9
SN - 1 hr: 12:12	338.54	18.6	1,235	82	1,153	0.9
SOLAR NOON (SN): 13:12	0	18.6	1,235	136	1,099	0.9
SN + 1 hr: 14:12	21.45	18.6	1,235	205	1,030	0.8
SN + 2 hr: 15:12	40.28	18.6	1,235	334	901	0.7
SN + 3 hr: 16:12	55.79	18.6	1,235	655	580	0.5
SN + 4 hr: 17:12	68.68	18.6	1,235	1,235	0	0.0
SET - 1.5 hr: 17:48	75.63	18.6	1,235	1,235	0	0.0
SET: 19:18	91.46	18.6	1,235	n/a	n/a	n/a
TOTAL AVERAGE:						0.7

3.2 COMMUNAL OUTDOOR AMENITY AREAS

Table 5 - 3.2 Communal Outdoor Amenity Areas: December 21st

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 7:49	302.37	18.6	1,235	n/a	n/a	n/a
RISE + 1.5 hr: 9:19	319.05	18.6	1,235	134	1,101	0.9
SN - 2 hr: 10:17	331.25	18.6	1,235	187	1,048	0.8
SN - 1 hr: 11:17	345.21	18.6	1,235	266	969	0.8
SOLAR NOON (SN): 12:17	0	18.6	1,235	602	633	0.5
SN + 1 hr: 13:17	14.79	18.6	1,235	606	629	0.5
SN + 2 hr: 14:17	28.75	18.6	1,235	827	408	0.3
SET - 1.5 hr: 15:15	41.06	18.6	1,235	1,035	200	0.2
SET: 16:45	57.63	18.6	1,235	n/a	n/a	n/a
TOTAL AVERAGE:						0.6

The communal outdoor amenity area within the Study Area is 1,235 m².

Shadows from the proposed development should allow for full sunlight on this area at 50% of the test times required, translating to a sun access factor of 0.5. The test dates required for this criterion include June, March/September, and December.

While the outdoor amenity area is moderately impacted between 14.20 and sundown on June 21st, and partially throughout all times required for the test dates of March/September and December, shadow testing reveals a sun access factor for this area of no less than 0.6. The criterion has therefore been met.

3.3 PUBLIC REALM

Table 6 - 3.3 Public Realm: March/September 21st

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 7:05	268.27	18.6	11,182	n/a	n/a	n/a
RISE + 1.5 hr: 8:35	284.22	18.6	11,182	189	10,993	1.0
SN - 4 hr: 9:12	291.23	18.6	11,182	0	11,182	1.0
SN - 3 hr: 10:12	304.14	18.6	11,182	0	11,182	1.0
SN - 2 hr: 11:12	319.68	18.6	11,182	0	11,182	1.0
SN - 1 hr: 12:12	338.54	18.6	11,182	0	11,182	1.0
SOLAR NOON (SN): 13:12	0	18.6	11,182	0	11,182	1.0
SN + 1 hr: 14:12	21.45	18.6	11,182	0	11,182	1.0
SN + 2 hr: 15:12	40.28	18.6	11,182	0	11,182	1.0
SN + 3 hr: 16:12	55.79	18.6	11,182	0	11,182	1.0
SN + 4 hr: 17:12	68.68	18.6	11,182	363	10,819	1.0
SET - 1.5 hr: 17:48	75.63	18.6	11,182	1,247	9,935	0.9
SET: 19:18	91.46	18.6	11,182	n/a	n/a	n/a
TOTAL AVERAGE:						1.0

The public realm within the Study Area includes a portion of the public sidewalk along Airport Road and Victory Park to the north. These areas amount to 11,182m². Sunlight should be maximized on these areas during spring and fall. As such, the test date required for this criterion includes March/September only.

The north side of the Airport Road public sidewalk is impacted at 8.35 only on March/September 21st. Therefore, this criterion is met for a minimum of 5 hours of direct sunlight on *Mixed Use, Commercial, Employment and High Density Residential Streets*.

Victoria Park is impacted by shadowing from the proposed development between 17.12 and sundown. The sun access factor achieved is 1.0. This criterion has therefore been met.

3.4 TURF & FLOWER GARDENS IN PUBLIC PARKS

Table 7 - 3.4 Turf and Flower Gardens in Public Parks: March/September

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 7:05	268.27	18.6	0	n/a	n/a	n/a
RISE + 1.5 hr: 8:35	284.22	18.6	0	n/a	n/a	n/a
SN - 4 hr: 9:12	291.23	18.6	0	n/a	n/a	n/a
SN - 3 hr: 10:12	304.14	18.6	0	n/a	n/a	n/a
SN - 2 hr: 11:12	319.68	18.6	0	n/a	n/a	n/a
SN - 1 hr: 12:12	338.54	18.6	0	n/a	n/a	n/a
SOLAR NOON (SN): 13:12	0	18.6	0	n/a	n/a	n/a
SN + 1 hr: 14:12	21.45	18.6	0	n/a	n/a	n/a
SN + 2 hr: 15:12	40.28	18.6	0	n/a	n/a	n/a
SN + 3 hr: 16:12	55.79	18.6	0	n/a	n/a	n/a
SN + 4 hr: 17:12	68.68	18.6	0	n/a	n/a	n/a
SET - 1.5 hr: 17:48	75.63	18.6	0	n/a	n/a	n/a
SET: 19:18	91.46	18.6	0	n/a	n/a	n/a
TOTAL AVERAGE:						n/a

There are no turf or flower gardens identified within public parks in the Study Area.

3.5 BUILDING FACES: SOLAR ENERGY ZONE

Table 8 - 3.5 Building Faces to Allow for the Possibility of Using Solar Energy: March/September 21st

LOCAL TIME	AZIMUTH (DEG)	BUILDING HEIGHT (m)	TOTAL AREA (m2)	PROPOSED BUILDING SHADOW AREA (m2)	AREA IN SUNSHINE (m2)	SUN ACCESS FACTOR [AVE %]
RISE: 7:05	268.27	18.6	1,781	n/a	n/a	n/a
RISE + 1.5 hr: 8:35	284.22	18.6	1,781	0	1,781	1.0
SN - 4 hr: 9:12	291.23	18.6	1,781	0	1,781	1.0
SN - 3 hr: 10:12	304.14	18.6	1,781	0	1,781	1.0
SN - 2 hr: 11:12	319.68	18.6	1,781	0	1,781	1.0
SN - 1 hr: 12:12	338.54	18.6	1,781	0	1,781	1.0
SOLAR NOON (SN): 13:12	0	18.6	1,781	0	1,781	1.0
SN + 1 hr: 14:12	21.45	18.6	1,781		1,781	1.0
SN + 2 hr: 15:12	40.28	18.6	1,781	0	1,781	1.0
SN + 3 hr: 16:12	55.79	18.6	1,781	0	1,781	1.0
SN + 4 hr: 17:12	68.68	18.6	1,781	0	1,781	1.0
SET - 1.5 hr: 17:48	75.63	18.6	1,781	154	1,627	0.9
SET: 19:18	91.46	18.6	1,781	n/a	n/a	n/a
TOTAL AVERAGE:						1.0

Shadow impacts from the proposed development should not exceed one hour in duration on the roofs, front, rear and exterior side walls of adjacent low-rise dwellings, up to four storeys in height. This zone is referred to as the “no impact zone”, constituting a 3m buffer around residential dwellings, in order to allow for the possibility of harvesting solar gain. This zone within the Study Area is 1,781 m². The test date required for this criterion includes March/September only.

The cumulative “no impact zone” received shadow impacts from the proposed development at 17.48 only on the test date required. This illustrates no more than two consecutive hourly test times impacted. The criterion has therefore been met.

4.0 CONCLUSION

The proposed building is designed and sited to minimize shadow impacts on the surrounding area. The proposal successfully maximizes sunlight access for the surrounding low-rise residential dwellings during the majority of the daytime hours included in the Study test times.

Generally, the proposal produces moderate cumulative shadowing in the early morning and towards sundown, at which hours the use of public/private outdoor areas, amenity spaces and the possibility for using building faces for solar gain are limited.

All criterion set out within the Standards for Shadow Studies have been met. While cast shadow from the proposed development is present at more than two consecutive hourly test times for the test date of June 21st on private outdoor amenity spaces, the average Sun Access Factor of 0.9 allows for a healthy degree of sunlight access. Impacts on these areas occur from 17.20 towards sundown, when usage of outdoor spaces in the later evening will be limited.

While the proposed communal outdoor amenity area is impacted across all three test dates required in Criterion 3.2, these impacts are moderate during the morning and early afternoon hours of the day. The largest impacts are seen in December, when the outdoor area will be in limited use. The outdoor amenity area will receive eight consecutive hours of sunlight in the summer.

A number of urban design and architectural components, including specific elements of the buildings design and layout have been revised to minimize massing impacts on the surrounding area. Rooftop articulations have been rationalized to reduce shadowing. The overall siting of the building towards the Airport Road frontage, including the application of sufficient side-yard setbacks, suitably minimizes impacts on the adjacent low-rise residential dwellings and the park to the rear of the property. In summary, it has been demonstrated that the proposal meets the minimum Criteria set out in the Mississauga Standards for Shadow Studies.



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