



STANDARDS FOR SHADOW STUDIES

August 2011

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Shadow Studies illustrate the impact of development in terms of sun and daylight access to the surrounding context including surrounding buildings, the public realm, public and private open space.

Shadow Studies may be required in support of development applications to demonstrate that the location and height of a proposed building if greater than 10.7m, will not cause undue shade on the subject lands, and on surrounding context including building facades, private and public outdoor amenity and open spaces, public parkland, sidewalks and other components of the public realm.

Shadow Studies and Analyses will be conducted for the following dates:

- **June 21**
- **September 21** (similar to March 21, and therefore, criteria for Sept. 21 are deemed to apply to March 21)
- **December 21**

At the following times:

- **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**

Hourly solar data are specified for each date

See Tables 2, 3 and 4: Mississauga Sun Angle Data

Sun Angles:

Sun Angles are based on the latitude and longitude of the Mississauga Civic Centre at 300 City Centre Drive, Mississauga ON L5B 3C1

- Latitude: 43 deg. 35' 20" N
- Longitude: 79 deg. 38' 40" W

Time Zone: Eastern

Standard Time: UT - 5 hours

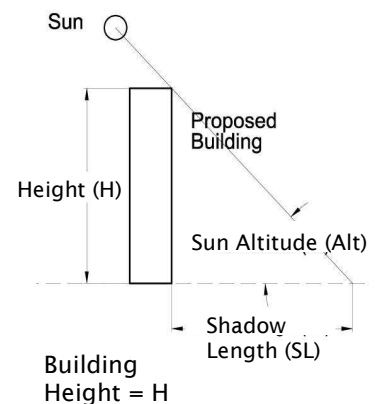
Daylight Time : UT - 4 hours

UT denotes Universal Time i.e. Greenwich Mean Time

Shadow Length (SL) = Building Height (H) x Shadow Length Factor (SLF). See Fig. 1



FIG. 1: DETERMINING SHADOW LENGTH



$$\text{Shadow Length Factor (SLF)} = 1/\tan(\text{Alt})$$

$$\text{Shadow Length (SL)} = H \times \text{SLF}$$

Ensure Adequate sunlight on the following:

1. Residential Private Outdoor Amenity Spaces

To maximise the use of private residential amenity spaces during spring, summer and fall, shadow impacts from proposed developments should not exceed one hour in duration on areas such as private rear yards, decks, patios and pools of surrounding residential dwellings on each of the following dates:

- **June 21**
- **September 21** (Mar. 21 shadow patterns are similar but occur 14 minutes later)

This criterion is met if there is shadow impact for no more than **two consecutive hourly test times** within the space between the exterior wall of the dwelling that abuts the amenity space and the line of impact assessment (“**No Impact Zone**”).

The line of impact assessment shall be, a line 7.5m minimum from the rear wall or other appropriate exterior building wall of the dwelling that abuts the private amenity space. See Fig. 2 and 3

New shadows shall not result in less than 2 hours of direct sunlight. Where less than 2 hours of sunlight already exists within the “**No Impact Zone**”, no new shade may be added.

Balconies are not considered “residential private outdoor amenity spaces” unless they are the only outdoor living area available to the dwelling unit, are unenclosed, and project 4m or more from the exterior wall of the building.

FIG. 2: SHADOW IMPACT ON PRIVATE RESIDENTIAL OUTDOOR AMENITY SPACES (PLAN VIEW)

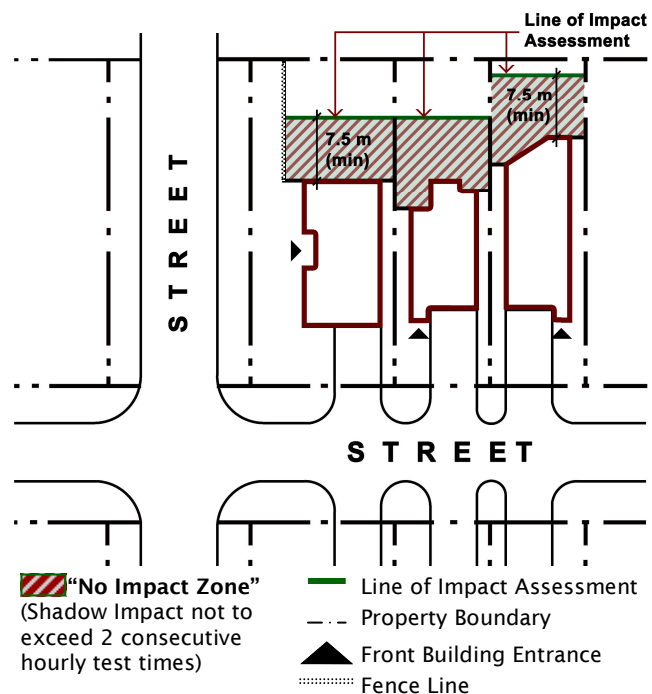
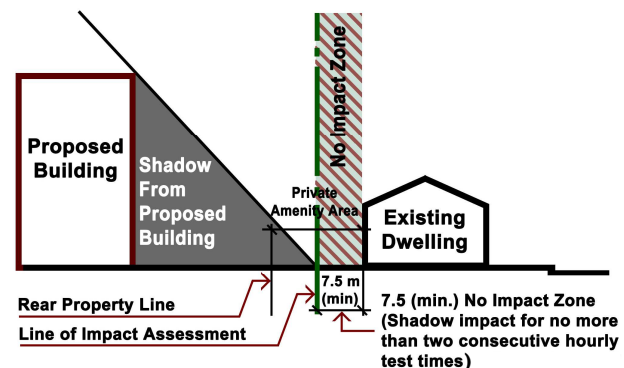


FIG. 3: SHADOW IMPACT ON PRIVATE RESIDENTIAL AMENITY SPACES (SECTION)



Ensure Adequate sunlight on the following:

- 2. Communal outdoor amenity areas including, children’s play areas, school yards, tot lots, and park features such as sandboxes, wading pools etc., and outdoor amenity areas used by seniors and those associated with commercial and employment areas during spring, summer, fall and winter.**

Shadows from proposed developments should allow for full sun on the above places at least half the time, or 50% sun coverage all the time, on each of the following dates:

- **June 21**
- **September 21**
- **December 21**

This criterion is met if the “sun access factor” is at least 50% or 0.5 on each of the test dates ($A_{s(ave)}/A_T = 0.5$ or more)

See 2a for Calculation of Sun Access Factor

This criterion applies to public amenity areas and common outdoor amenity areas that are part of a proposed or existing development.

2a) Calculating Sun Access Factor:

- Measure the total Area (A_T) of the space or feature
- Measure the area in sunshine (A_s) for each of the test times from 1.5 hours after sunrise to 1.5 hours before sunset both inclusive
- Find the average of the A_s values ($A_{s(ave)}$)
- Sun Access Factor = $A_{s(ave)}/A_T$



- 3. Public realm including sidewalks, open spaces, parks and plazas to maximize their use during the shoulder seasons (spring and fall)**

a) Low and Medium Density Residential streets

Developments should be designed to allow full sunlight on the opposite boulevard including the full width of the sidewalk on September 21 as follows:

For a total of at least **4 hours** between **9:12 a.m.** and **11:12 a.m.** and between **3:12 p.m.** and **5:12 p.m.**

This criterion is met if there is no incremental shade from the proposed development at **9:12 a.m., 10:12 a.m. and 11:12 a.m.**, and at **3:12 p.m., 4:12 p.m. and 5:12 p.m.**

See Fig. 4, 5, 6 and Table 1.

b) Mixed Use, Commercial, Employment and High Density Residential streets

Developments should be designed to allow full sunlight on the opposite boulevard including the full width of the sidewalk on September 21 as follows:

For a total of at least 5 hours that must include the 2 hour period between 12:12 p.m. and 2:12 p.m., and an additional 2 hour period from either 9:12 a.m. to 11:12 a.m. or from 3:12 p.m. to 5:12 p.m.

This criterion is met if there is no incremental shade from the proposed development at 12:12 p.m., 1:12 p.m. and 2:12 p.m., and three consecutive times either 9:12 a.m., 10:12 a.m. and 11:12 a.m. or 3:12 p.m., 4:12 p.m. and 5:12 p.m.

See Fig. 4, 5, 6 and Table 1 for angular planes that will achieve this criterion for Hurontario Street, Eglinton Avenue and streets with a similar alignment.

c) Public Open Spaces, parks and Plazas

Developments should be designed to provide a sun access factor of at least 50% on public open spaces, parks and plazas on September 21.

See 2a for calculating Sun Access Factor

Please note the following:

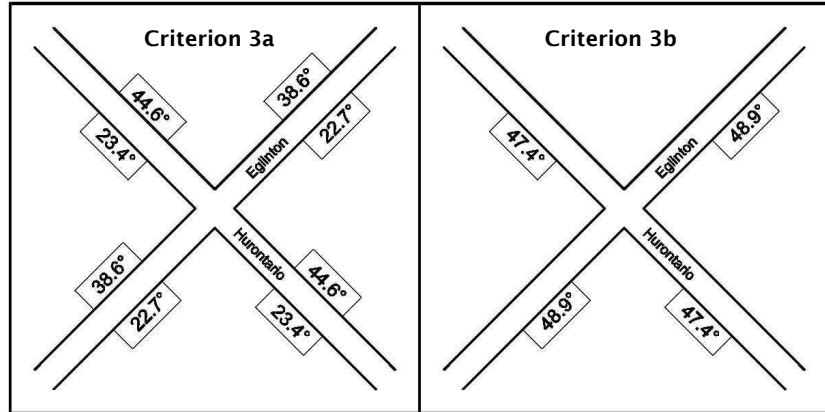
- **Solar Noon in Mississauga on September 21 is 1:12 p.m.**
- **Shadow Patterns for September 21 and March 21 are similar**
- **Criteria for September 21 are deemed to apply to March 21**

TABLE 1	Criterion 3a Low and Medium Density Residential Streets	Criterion 3b Mixed use, Commercial, Employment and High Density Residential Streets
	Maximum Angular Plane	Maximum Angular Plane
Eglinton Avenue		
Proposed building on north side of Eglinton Ave.	38.6 degrees	–
Proposed building on south side of Eglinton Ave.	22.7 degrees	48.9 degrees
Hurontario Street		
Proposed building on west side of Hurontario Street	23.4 degrees	47.4 degrees
Proposed building on east side of Hurontario Street	44.6 degrees	–

NOTES:

1. Angular planes given above apply to the alignment of Eglinton Avenue and Hurontario Street and streets with equivalent orientation.
2. Angular planes are measured from the closest edge of the opposite curb (see Fig.5).
3. Angular planes are measured beginning at grade.
4. Angular planes are measured perpendicular to the street.
5. See Figures 4, 5, 6 for graphical representations of the angular plane limits.

**FIG. 4:
MAX. ALLOWABLE ANG.
PLANES TO PROTECT
OPPOSITE BOULEVARDS
AND SIDEWALKS**



ANGULAR PLANE SECTION VIEWS

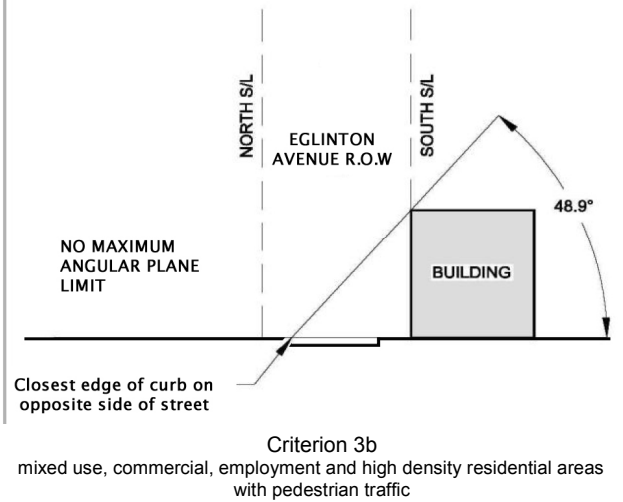
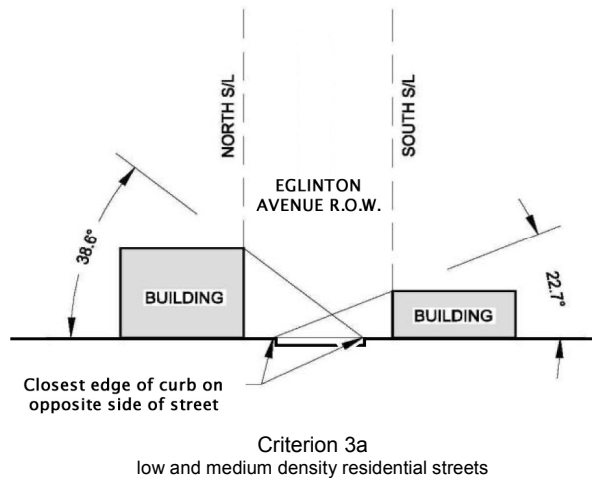


FIG. 5: EGLINTON AVENUE

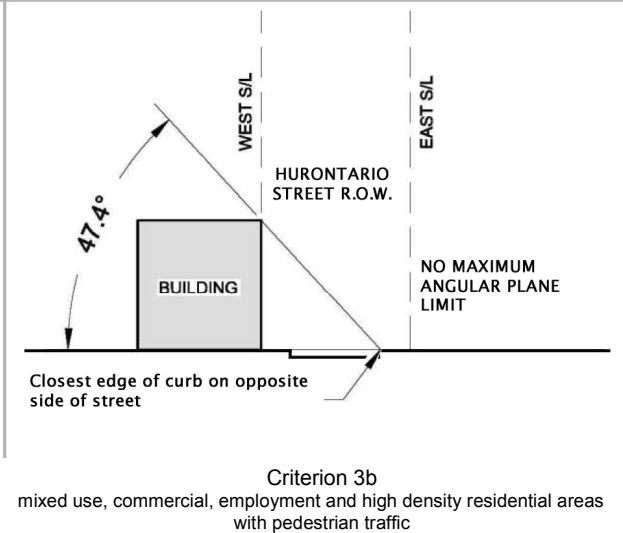
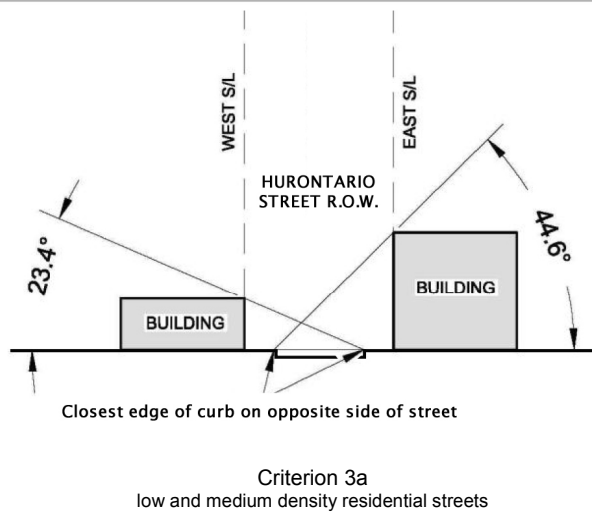


FIG. 6: HURONTARIO STREET

Material to be submitted with Development Application:

1. Complete set of shadow drawings for the dates and times shown in **Tables 2, 3, and 4: Mississauga Sun Angle data, from 1.5 hours after sunrise to 1.5 hours before sunset**
2. Base mapping must include a minimum coverage area as follows:
 - a) 4.0 times the building height to the north, east and west
 - b) 1.5 times the building height to the south
3. Shadow drawings may be based on 2D mapping or air photos showing shadows from only the proposal, or they may be based on 3D mapping and include shadows from the proposed building and all buildings within the coverage area.
4. Shadow drawings shall include the following:
 - a) North Arrow and scale bar
 - b) Reference bearing for at least one street adjacent to the subject site
 - c) A scale suitable to show the entire shadow coverage area
 - d) Existing and incremental shadows differentiated by hatching or colour
 - e) Approved but not yet constructed buildings identified in contrasting colour.
 - f) The name of the individual who has prepared the shadow drawings
5. Shadow drawings must be submitted with a written analysis which shall include the following information:
 - a) Confirmation of site latitude and longitude used in shadow drawings
 - b) A statement describing how astronomic north was determined
 - c) Origin/source of base plan
 - d) Description of all locations/uses of areas not meeting the shadow impact criteria (include a key plan for reference)
 - e) Quantification and assessment of the impact in the areas listed in 5(d)
 - f) Summary outlining how the shadow impact criteria have been met and describing any mitigating features that have been incorporated into the site and building design
- 6) The shadow drawings and reports shall be prepared by individuals qualified and/or experienced in this field.

Additional study times and analyses may be required to properly determine the degree of impact.

The intent and objectives of the Standards For Shadow Studies are as interpreted by the Development and Design Division of the Planning and Building Department.

TABLE 2: MISSISSAUGA SUN ANGLE DATA (JUNE 21)

DATE: JUNE 21	SHADOW DIRECTION AND LENGTH		COMMENTS
	Az (deg)	SLF (ratio length/height)	
LOCAL TIME EDT			
5:37	235.73		Rise
7:07	250.48	4.1230	Rise + 1.5 hr.
7:20	252.58	3.5045	SN - 6 hr.
8:20	262.02	2.0048	SN - 5 hr.
9:20	272.04	1.3106	SN - 4 hr.
10:20	283.79	0.8976	SN - 3 hr.
11:20	299.52	0.6203	SN - 2 hr.
12:20	323.67	0.4375	SN - 1 hr.
13:20	0.00	0.3670	Solar Noon (SN)
14:20	36.32	0.4375	SN + 1 hr.
15:20	60.47	0.6203	SN + 2 hr.
16:20	76.21	0.8975	SN + 3 hr.
17:20	87.96	1.3105	SN + 4 hr.
18:20	97.98	2.0047	SN + 5 hr.
19:20	107.42	3.5042	SN + 6 hr.
19:33	109.41	4.0852	Set - 1.5 hr.
21:03	124.27		Set

TABLE 3: MISSISSAUGA SUN ANGLE DATA (SEPT. 21)

DATE: SEPTEMBER 21	SHADOW DIRECTION AND LENGTH		COMMENTS
	Az (deg)	SLF (ratio length/height)	
LOCAL TIME EDT			
7:05	268.27		Rise
8:35	284.22	3.6329	Rise + 1.5 hr.
9:12	291.23	2.5132	SN - 4 hr.
10:12	304.14	1.6445	SN -3 hr.
11:12	319.68	1.2181	SN -2 hr.
12:12	338.54	1.0011	SN -1 hr.
13:12	0.00	0.9329	Solar Noon (SN)
14:12	21.45	1.0022	SN + 1 hr.
15:12	40.28	1.2205	SN + 2 hr.
16:12	55.79	1.6495	SN + 3 hr.
17:12	68.68	2.5255	SN + 4 hr.
17:48	75.63	3.6493	Set - 1.5 hr.
19:18	91.46		Set

TABLE 4: MISSISSAUGA SUN ANGLE DATA (DEC. 21)

DATE: DECEMBER 21	SHADOW DIRECTION AND LENGTH		COMMENTS
	Az (deg)	SLF (ratio length/height)	
LOCAL TIME EST			
7:49	302.37		Rise
9:19	319.05	4.8874	Rise + 1.5 hr.
10:17	331.25	3.1643	SN -2 hr.
11:17	345.21	2.5293	SN -1 hr.
12:17	0.00	2.3589	Solar Noon (SN)
13:17	14.79	2.5293	SN + 1 hr.
14:17	28.75	3.1644	SN + 2 hr.
15:15	41.06	4.9172	Set - 1.5 hr.
16:45	57.63		Set

Standards for Shadow Studies August 2011

Adopted by Council on November 23, 2011

Resolution No. 0266-2011

City of Mississauga

Planning and Building Department, Development and Design Division

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