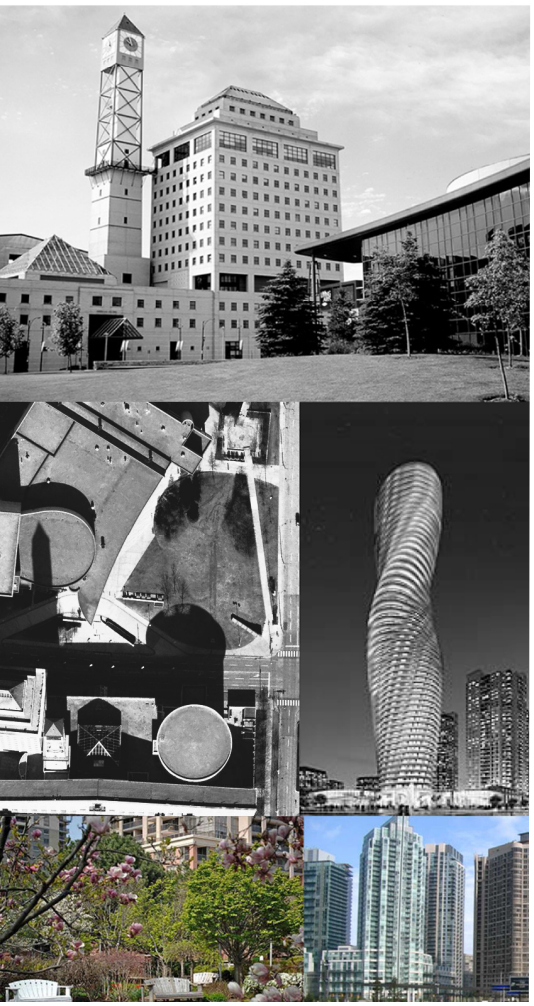
Urban Design Terms of Reference





Standards for

Shadow Studies

February 2023

MISSISSAUGA

Table of Contents

1 Introduction

2 Standard Requirements and Data

3 Criteria

- 3.1 Residential Private Outdoor Amenity Spaces
- 3.2 Communal Outdoor Amenity Areas
- 3.3 Public Realm
- 3.4 Turf and flower gardens in public parks
- 3.5 Building faces to allow for the possibility of using solar energy

4 Required Information

5 Mississauga Sun Angle Data

1

Introduction

1

Introduction

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.

Mississauga Official Plan, Section 19.4.5, identifies a Shadow Study as a study that staff may request as one of the requirements for a complete application.

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

Written Analysis and Mitigation Plan

Shadow drawings must be submitted with a written analysis which shall include the following information:

- Confirmation of site latitude and longitude used in shadow drawings
- A statement describing how astronomic north was determined
- Origin/source of base plan
- Description of all locations/uses of areas not meeting the shadow impact criteria (include a key plan for reference)
- Quantification and assessment of the impact in the areas that do not meet the shadow impact criteria
- **Summary outlining how the shadow impact criteria have been met and describing any mitigation features that have been incorporated into the site and building design**

The shadow drawings and reports shall be prepared by qualified Consultants with experience in this field.

All mitigation features shall be incorporated into the detailed concept plan, site plan, building elevations, landscape plans and all applicable drawings.

Please refer to Section 4 of this document entitled, Required Information for a list of the required information to be submitted with Shadow Studies in support of a Development Application.


2
Pkwy E
Standard Requirements and Data

2

Standard Requirements and Data

Dates

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

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

Times

Shadow Studies and Analyses will be conducted for 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 degrees 35' 20" N
- Longitude: 79 degrees 38' 40" W

Time Zone

Time Zone: Eastern
Standard Time: UT– 5 hours
Daylight Time: UT– 4 hours

Universal Time (UT) is Greenwich Mean Time

Shadow Length

- Shadow Length (SL) = Building Height (H) x Shadow Length Factor (SLF)
- Shadow Length Factor (SLF) = 1/tan (Alt)
- Alt refers to the Sun Altitude

See Figure 1 on this page, and Tables 2, 3, and 4: Mississauga Sun Angle Data on Pages 26, 27 and 28.



FIGURE 1: SHADOW LENGTH

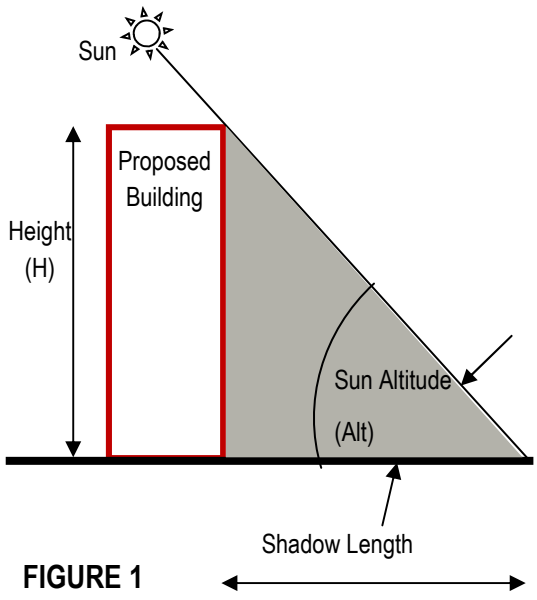


FIGURE 1



3

Criteria

3

Criteria

Ensure adequate sunlight on the following:

3.1 Residential Private Outdoor Amenity Spaces

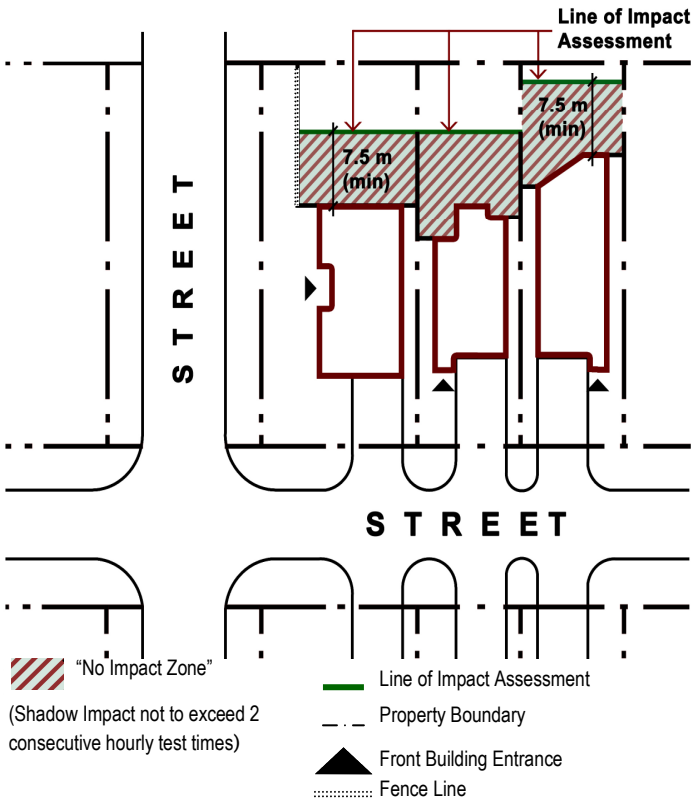
To maximize the use of private residential amenity spaces during spring, summer and fall, shadow impacts from proposed developments should not exceed one hour in duration on areas such as private rear yards, decks, patios and pools of surrounding residential dwellings on each of the following dates:

- June 21
- September 21 (March 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 **7.5 m** from the rear wall or other appropriate exterior building wall of the dwelling that abuts the private amenity space. **See Figures 2 and 3.**

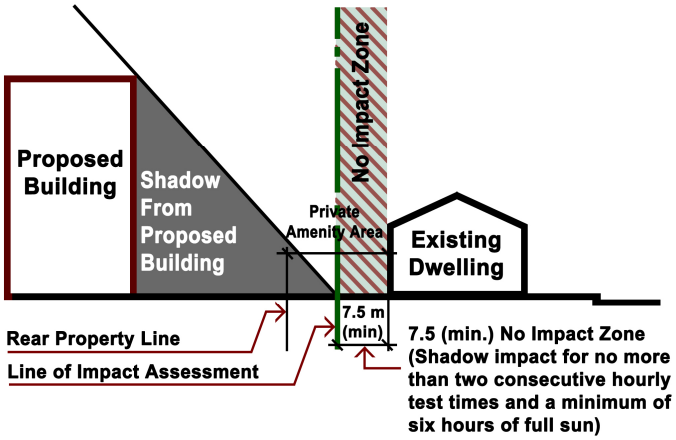
FIGURE 2: SHADOW IMPACT ON PRIVATE RESIDENTIAL OUTDOOR AMENITY SPACES (PLAN VIEW)



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 4 m or more from the exterior wall of the building.

FIGURE 3: SHADOW IMPACT ON PRIVATE RESIDENTIAL OUTDOOR AMENITY SPACES (SECTION)



3.2. Communal Outdoor Amenity Areas

Communal Outdoor Amenity Areas include children's play areas, school yards, tot lots, features such as sandboxes, wading pools etc., and other outdoor amenity areas that are part of an existing or proposed development, outdoor amenity areas used by seniors and outdoor amenity areas 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 (As(ave) /AT = 0.5 or more) .

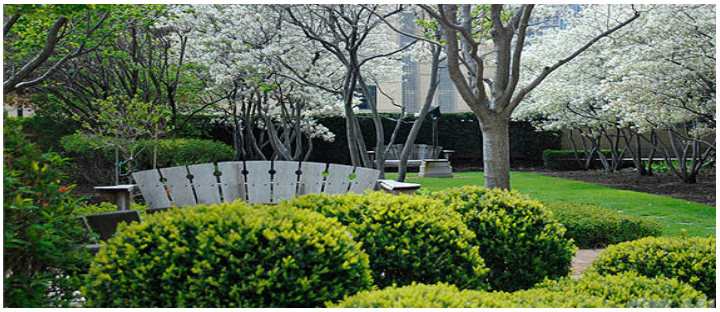
See 3.2a for Calculating Sun Access Factor.

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

3.2a) 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





3.3. Public Realm

The Public Realm includes sidewalks, open spaces, parks and plazas. The objective is to maximize the use of these spaces during the shoulder seasons (spring and fall).

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 Figures 4, 5, 6 and Table 1.

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.

3 Criteria

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 3.2a on Page 14 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.

NOTES:

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

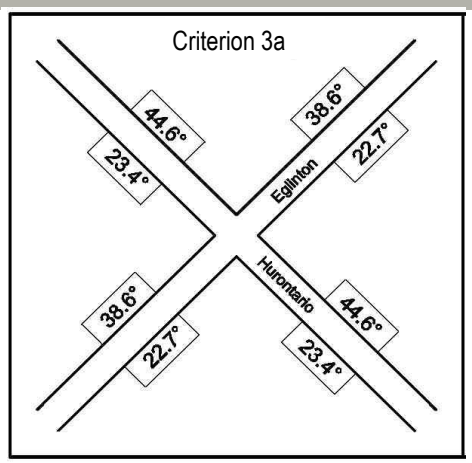
See Figures 4, 5, 6 and Table 1 for angular planes that will achieve this criterion for Hurontario Street, Eglinton Avenue and streets with a similar alignment.

Table 1

	Criterion 3a Low and Medium Density Residential Streets	**Criterion 3b Mixed Use, Commercial, Employment and High Density**
Eglinton Avenue	**Maximum Angular Plane**	**Maximum Angular Plane**
Proposed building on north side of Eglinton Avenue	38.6 degrees	_
Proposed building on south side of Eglinton Avenue	22.7 degrees	48.9 degrees

Hurontario Street	**Maximum Angular Plane**	**Maximum Angular Plane**
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	_

FIGURE 4: MAX. ANGULAR PLANES TO PROTECT OPPOSITE BOULEVARDS & SIDEWALKS



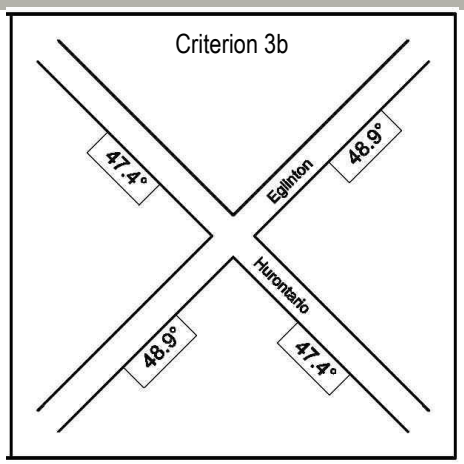
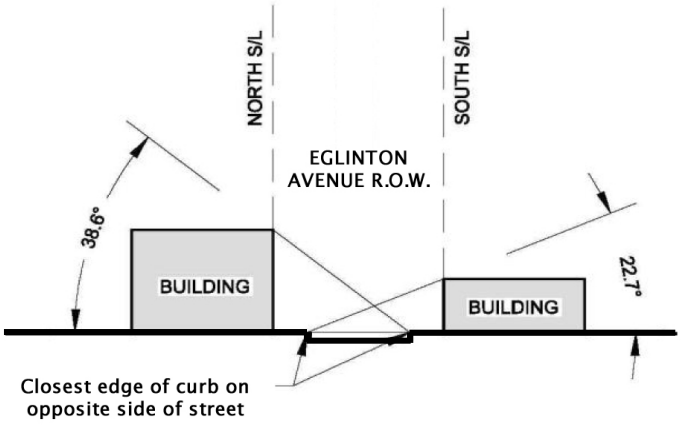


FIGURE 5: ANGULAR PLANE SECTION VIEWS FOR EGLINTON AVENUE

Criterion 3a: Low and Medium Density Residential Streets



Criterion 3b: Mixed Use, Commercial, Employment and High Density Residential Streets with pedestrian traffic

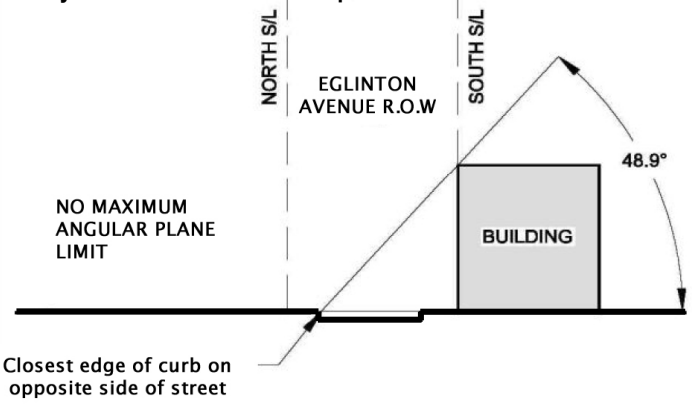
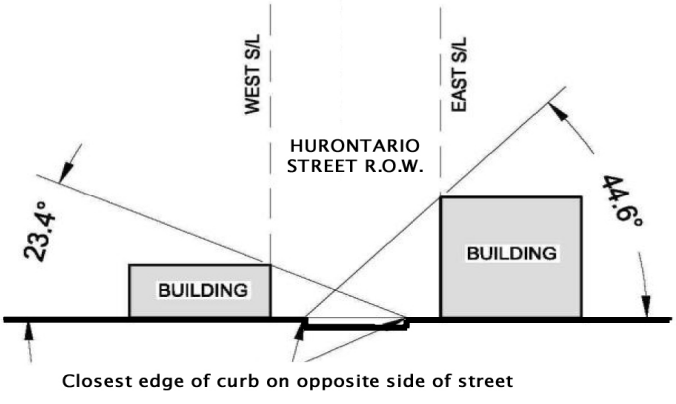
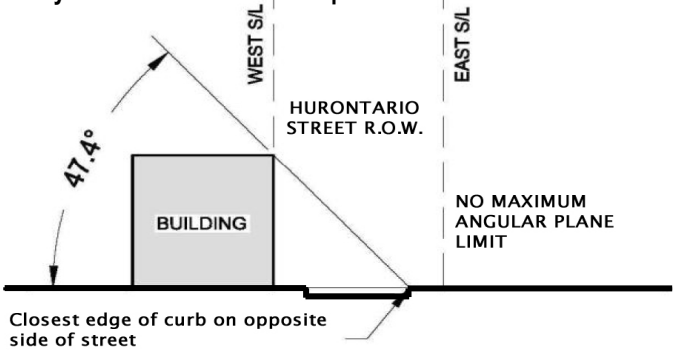


FIGURE 6: ANGULAR PLANE SECTION VIEWS FOR HURONTARIO STREET

Criterion 3a: Low and Medium Density Residential Streets



Criterion 3b: Mixed Use, Commercial, Employment and High Density Residential Streets with pedestrian traffic



3.4. Turf and flower gardens in Public Parks

Proposed developments should allow for adequate sunlight during the growing season from March to October by allowing for a minimum of 6 hours of direct sunlight on September 21.



This criterion is met if full sun is provided on any 7 test times on September 21, from 1.5 hours after sunrise to 1.5 hours before sunset.

3.5. Building Faces to allow for the possibility of using solar energy

Shadow impacts from proposed developments should not exceed **one hour** in duration on the **roofs, front, rear and exterior side walls** of adjacent **low rise** (one to four storeys) residential buildings including townhouses, detached and semi-detached dwellings on **September 21,** in order to allow for the possibility of harvesting solar energy.

The line of impact assessment shall be a line at grade, 3 m from the front, rear and exterior side wall of the adjacent low rise residential building.

This criterion is met if there is shadow impact for no more than two consecutive hourly test times in the "No Impact Zone" i.e. the space between the front, rear and exterior side walls of the adjacent low rise residential buildings and the respective lines of impact assessment.
See Figures 7 and 8

Note:
Incremental shadows do not necessarily represent adverse or undue impacts, and each proposal will be assessed on its own merits.

FIGURE 7: PLAN

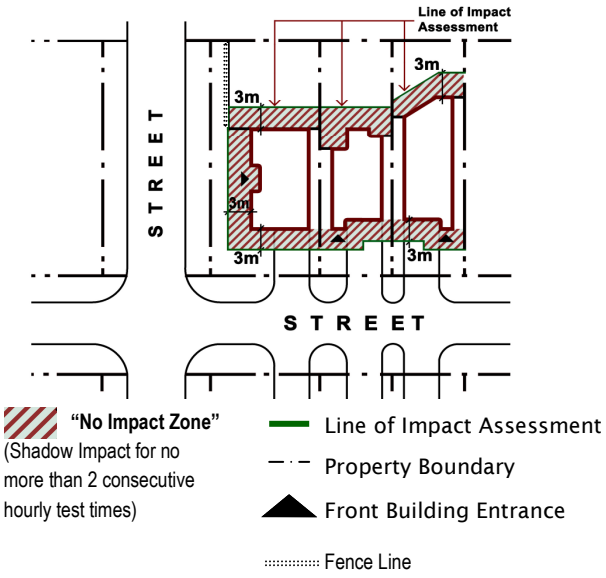
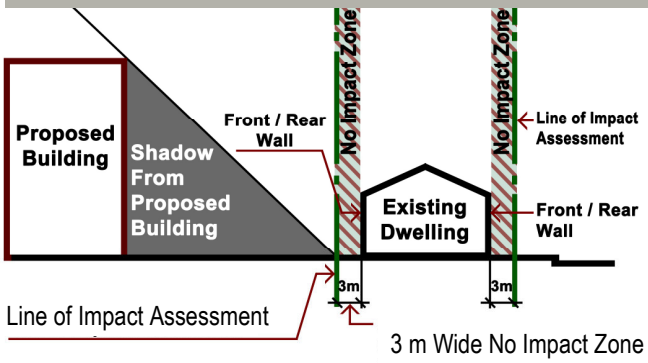
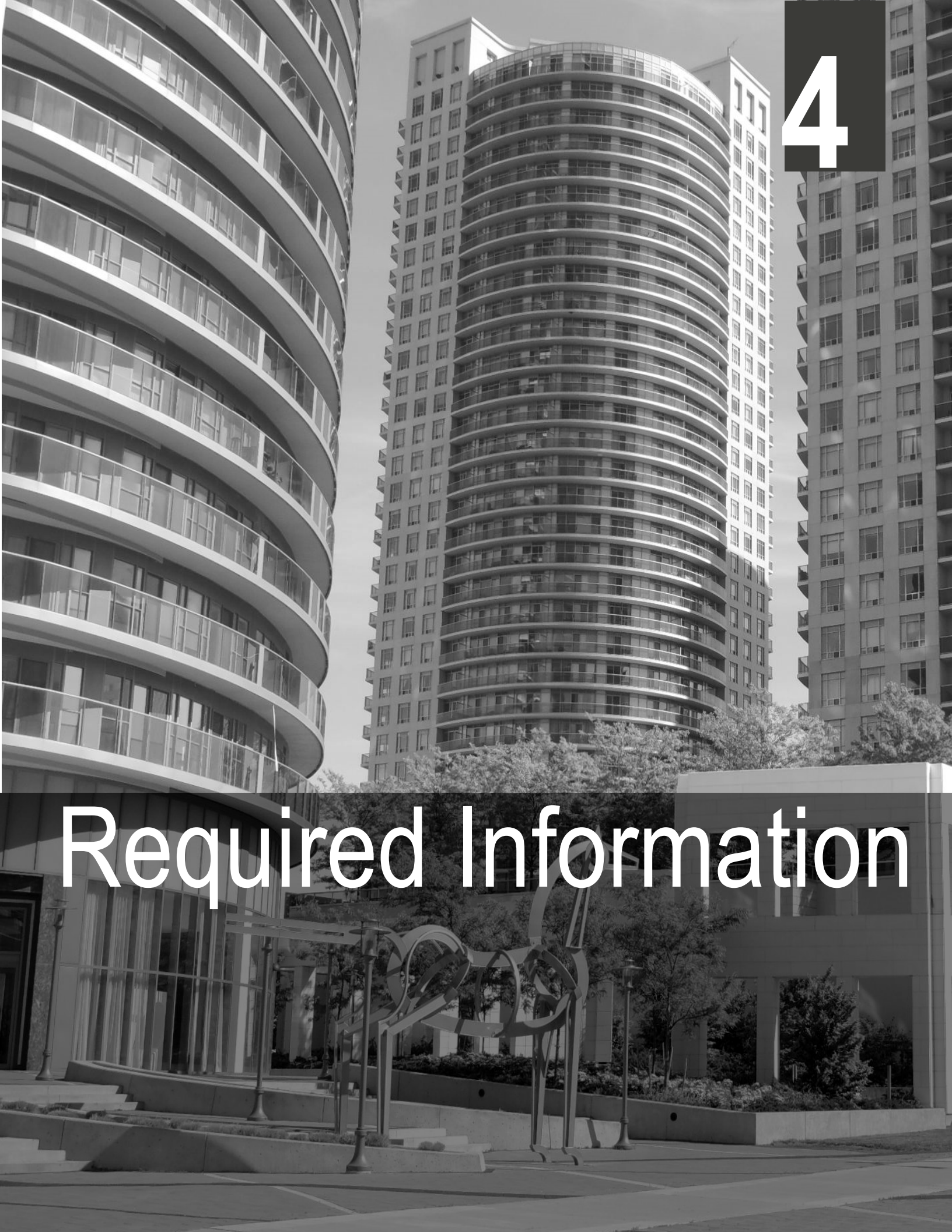


FIGURE 8: SECTION



3 m Wide No Impact Zone
(Shadow impact for no more than 2 consecutive hourly test times)



4

Required Information

4

Required Information

Information 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:

   - 4.0 times the building height to the north, east and west
   - 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:

   - North Arrow and scale bar
   - Reference bearing for at least one street adjacent to the subject site
   - A scale suitable to show the entire shadow coverage area
   - Existing and incremental shadows differentiated by hatching or colour
   - Approved but not yet constructed buildings identified in contrasting colour
   - 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:

- Confirmation of site latitude and longitude used in shadow drawings
- A statement describing how astronomic north was determined
- Origin/source of base plan
- Description of all locations/uses of areas not meeting the shadow impact criteria (include a key plan for reference)
- Quantification and assessment of the impact in the areas that do not meet the shadow impact criteria
- Summary outlining how the shadow impact criteria have been met and describing any mitigation features that have been incorporated into the site and building design

6. The shadow drawings and reports shall be prepared by qualified Consultants with experience 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.



5

Mississauga Sun Angle Data

5

Mississauga Sun Angle Data

Table 2: Mississauga Sun Angle Data (June 21)

DATE: JUNE 21	**Azimuth** (deg)	**SLF** (ratio length/height)	**COMMENTS**
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 nr.
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

Source: R. BOUWMEESTER & ASSOCIATES, Sun & Shadow Position Specialists
www.sunposition.com

Table 3: Mississauga Sun Angle Data (September 21)

Date: September 21	**Azimuth** (deg)	**SLF** (ratio length/height)	**Comments**
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

Source: R. BOUWMEESTER & ASSOCIATES, Sun & Shadow Position Specialists
www.sunposition.com

5 Mississauga Sun Angle Data

Table 4: Mississauga Sun Angle Data (December 21)

Date: December 21	**Azimuth** (degrees)	**SLF** (ratio length/height)	**Comments**
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

Source: R. BOUWMEESTER & ASSOCIATES, Sun & Shadow Position Specialists
www.sunposition.com

City of Mississauga

Planning and Building Department, Development and Design Division

300 City Centre Drive, 6th Floor, Mississauga, ON L5B 3C1– Tel: 905-896-5511 Fax: 905-896-5553

www.mississauga.ca