

# Niagara Region

# Sun/Shadow Study

## Terms of Reference

August 04, 2023

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## **1.0 INTRODUCTION**

### **1.1 PURPOSE**

The purpose of a Sun/Shadow terms of reference is to provide a starting point for the preparation of a sun/shadow study. These studies help plan developments by informing the design of buildings and the arrangement of buildings on sites. By understanding the nature of existing shadows and new shadows, new developments can ensure adequate access to sunlight thereby enhancing the livability and sustainability of public and private spaces.

Sun/shadow studies must demonstrate potential shadows and propose mitigation when excessive shadows result in negative impacts to their surroundings.

Contexts can vary, therefore the scope and requirements of a sun/shadow study can be adjusted by the municipality in consultation with the applicant to suit the nature of the subject proposal. The preparation of sun/shadow studies must consider local official plan policies and any relevant local design guidelines.

### **1.2 WHY ARE SUN/SHADOW STUDIES IMPORTANT?**

Sun/shadow studies are important for several reasons:

- Knowing how the position of the sun can affect the size of the shadow cast.
- Knowing where shadows fall within and outside a site.
- Knowing where to optimally locate buildings and site elements such as landscaped spaces, parking areas, trees, amenity spaces and more.
- Knowing how shadows from new developments impact, adjacent properties, streetscapes and public spaces.

### **1.3 WHEN IS A SHADOW STUDY REQUIRED?**

A Sun/Shadow study may be required in support of a complete application for development proposals within the urban settlement areas of the Niagara Region. A Sun/Shadow Study is prepared for buildings that are greater than 6 storeys in height. Buildings that is lower than 6 storeys may require a Sun/Shadow study where a site-specific basis is identified. Municipalities also may exempt developments above 6 storeys if the planned context or the prevailing building heights surrounding the development are more than 10 storeys. In all cases, the requirement for a sun/shadow study must conform to local official plan policies and relevant local guidelines.

### **1.4 WHO CAN PREPARE A SHADOW STUDY?**

A Shadow Study can be prepared by a design professional such as an architect, landscape architect, urban designer, engineer, or a qualified consultant with experience in this field.

### 1.5 HOW IS A SHADOW STUDY PREPARED?

Shadow studies should be generated through computer software that can simulate shadows. The software must be able to geo-reference the subject site, create massing models of proposed buildings and surrounding buildings and cast shadow accordingly.

## 2.0 TRIGGERS FOR A SHADOW STUDY

### 2.1 INTRODUCTION

Shadow Studies may be requested for development proposals with building heights of 6 storeys or more. Municipal staff may request a shadow study if one or more of the following is triggered:

Building height exceeds 5 storeys; building is in proximity to shadow-sensitive areas, including but not limited to adjacent sensitive uses, civic and cultural spaces, Heritage districts or buildings, private outdoor amenity spaces, parks and open spaces, places where children play, pedestrian predominant streetscapes and/or mixed use districts, and other identified site specific and when Official Plan policies require these.

## 3.0 METHODOLOGY

### 3.1 INTRODUCTION

The dates and times for preparing a Shadow Study may differ depending on the specific Shadow Impact Criteria that is being evaluated (**section 4.0**) and other relevant factors. The study should include the following:

<b>TABLE 1: SHADOW STUDY TIMES</b> (Hourly intervals from 10am to 6pm)		
<b>TEST DATES</b>	<b>APPROX: SUNRISE &amp; SUNSET</b>	<b>TIME ZONE</b>
• April 21	SR: 6:25AM SS: 8:05PM	• Time Zone: Eastern  • Standard Time: Universal Time minus 5 hours (Winter Solstice - December 21st)  • Daylight Saving Time: Universal Time minus 4 hours (Vernal Equinox - March 21st; Summer Solstice - June 21st; and Autumnal Equinox - September 21st)  Universal Time (UT) is Greenwich Mean Time
• June 21	SR: 5:35AM SS: 9:00PM	
• September 21 (March 21 has the exact amount of daylight)	SR: 7:00AM SS: 7:15PM	
• December 21	SR: 7:45AM SS: 4:45PM	

## **4.0 SHADOW IMPACT CRITERIA**

### **4.1 INTRODUCTION**

Sun/Shadow studies must consider the unique site-specific context and the surrounding features, built-form, and land uses. Each context requires a specific level of consideration and assessment. Below are typical conditions with corresponding criteria of exposure, coverage, times, dates, and standards.

### **4.2 PRIVATE REALM**

#### **4.2.1 – Outdoor Residential Amenity Spaces on Adjacent Properties**

To minimize the impact of shadow on existing adjacent properties from new development, adjacent residential amenity areas should receive at a minimum of 6 hours of sunlight between 10am to 6pm.

- April 21 to September 21

#### **4.2.2 - Outdoor Residential Amenity Spaces within the proposed development**

To maximize the functionality of private outdoor amenity spaces associated with new developments with rear yards, rooftop spaces, balconies, decks, and other shared common spaces, amenity areas should receive at least 4 hours of sun between 10am to 6pm.

- April 21 to September 21

### **4.3 PUBLIC REALM**

#### **4.3.1 – Public Outdoor Amenity Spaces**

Communal Outdoor Amenity Spaces include school yards, children’s play areas, public outdoor pools, community gardens, privately owned public spaces, Civic and Cultural Spaces, and other outdoor public areas.

Shadows cast by existing buildings and shadows from proposed buildings should allow for 5 hours of full sun between 10am-6pm on:

- April 21

School yards and children’s play areas should receive at least 3hours of sun on:

- December 21st (10am to 3pm)

#### **4.3.2 – Sidewalk areas and boulevards along the frontage of the development**

Streets with residential and mixed-uses, patio spaces, trees, and where significant numbers walk, cycle, or ride transit should continue to receive a minimum of 4 hours of sun 10am to 6pm.

- April 21<sup>st</sup> (*The south sides of streets with East and West orientations may receive less sunlight*)

### **4.3.3 – Parks, Open spaces, and natural heritage areas**

Shadows cast by existing buildings and proposed developments surrounding parks and other open spaces should not exceed 3 hours in duration between the hours of 10am to 6pm on:

- April 21<sup>st</sup>
- September 21<sup>st</sup>

*(Natural heritage areas subject to an Environmental Impact Study (EIS) that requires additional sunlight should be identified).*

## **5.0 MITIGATION MEASURE**

### **5.1 DESIGN STRATEGIES FOR SHADOW MITIGATION**

Sun/Shadow Studies should identify and describe mitigation measures taken by the proposal to limit and control impacts from shadows.

There are several design strategies that could be deployed to mitigate the impacts of shadows on neighbouring properties, public spaces, and natural features. The most effective ways to mitigate shadows involves the shaping and massing of buildings along with consideration for the placement, arrangement, and orientation of buildings on a site. A sun/shadow study can identify one or more ways and explain how these have been deployed to decrease impacts from shadow in the following ways:

#### **Building heights:**

Discuss and describe how the building is sculpted and massed to minimize the shadowing on the subject site, adjacent sites, and the public realm. Typically, building mass is reduced as building height increases. In this way the shadow coverage is reduced as a form of mitigation.

Describe setbacks and stepbacks considered through the design to reduce shadowing and optimize access to sunlight. Typically, stepback at different points of the height of buildings – for example between the podium and the tower – can reduce the coverage of shadow as a form of mitigation.

#### **Building orientation and layout:**

Discuss and describe how buildings have been placed and arranged on the subject site to minimize shadows within the subject site, adjacent sites, and the public realm. Describe how the site design optimizes exposure to sunlight.

## **6.0 SUBMISSION FORMAT**

A Sun/Shadow study should comprise the following parts:

### **Part A: Project Description:**

- Introduction: Description of the project
- Location: Address and site latitude and longitude.
- Surrounding uses and spaces.

### **Part B: Analysis**

Analysis of the shadows includes preparation of drawings and identification of mitigation strategies used to minimize the shadow coverage.

#### **B1: Drawings:**

Drawings should include the following:

- Use 11x17 sheets to illustrate the shadows: At least one sheet for each test date.
- Minimum distance (i.e. coverage area) of 10 times the building height to the north, east and west of the subject property
- Minimum distance of 2 times the building height to the south of the subject property
- Drawings may be based on 2D plans showing shadows from the proposal.
- 3D illustrations may be included to supplement the 2D drawings. This can be useful for sites that include significant differences in land elevation.

The drawings should include:

- A north arrow, scale and scale bar
- Reference bearing for at least one street adjacent to the subject property
- Scale suitable to depict the entire coverage area
- Name of individual who prepared the drawings
- Shadow information:
  - Existing shadow conditions in the coverage area (Shown in a distinct colour)
  - Proposed shadow conditions of the development (Shown in a distinct colour)
  - For proposals seeking increased building heights, indicate the incremental difference between as-of-right shadows compared to shadows of proposed building height
  - Approved but unbuilt buildings within the coverage area
  - Legend, describing colour/hatch pattern for each of the shadow conditions

#### **B2: Mitigation Strategies**

Describe the design strategies used to mitigate the extent and coverage of shadows falling on private and public areas.

#### **Part C: Conclusion**

Provide a conclusion of the scale of the impacts of shadow on relevant adjacent spaces. Include recommendations that can relevant to minimization of shadows.

# Template Checklist

1.General	
A. Name of the Project:	B. Date:
C. Address of Application:	D. Study Prepared by:

2.Project Description	
A. Short Description of the Project:	
B. Number of buildings for this Application:	
C. Number of Floors :	D. Height in Metres :
E. Did you submit the 3D Model for this project? (Yes or No) File Format Submitted:	
F. Coordinates Used: Longitude & Latitude	G. Solar North Matches True North? (Yes or No)

3.Massing Information	
A. Software Used	B. Terrain Corrected (Yes or No):

4.Shadow Diagrams Information	
A. Are you fully compliant with all of the technical specifications in the Terms of Reference? Yes..... No..... (If "No" explain which specifications have not been applied)	
B. Do the Shadow Diagrams use a standard metric scale?	Yes..... No.....
C. Are the Shadow Diagrams provided in Colour?	Yes..... No.....
D. Does the Shadow Diagrams use Shadow Study Drawing Standards – Colour Analysis?	Yes..... No.....
4 .Shadow Diagrams Information – Continued	
E. Date Used for Shadow Analysis: Year.....	Month.....
F. Daylight Savings Time considered?	Yes..... No.....