

## 5 Illumination

### 5.1 General

*The perception of space is affected by the nature of the light through which it is seen and the nature of the surfaces off of which the light is reflected. The primary purpose of an artificial lighting system is to provide sufficient illumination for the performance of visual tasks. The greater the degree of difficulty of the task, the higher the required illumination levels. Adequate lighting should be provided in all public rooms, walkways, parking areas, reception areas, signs, exhibits, service areas and paths (particularly if night use is anticipated).*

*Persons with visual impairments benefit from increased levels of illumination in general and from individualized lighting systems which can be focused and adjusted in a controlled setting. Due to changes in the aging lens, the elderly population as a whole requires higher levels of illumination. An 80-year old needs at least three times as much light on a task to see it with the same clarity as a 20-year old. While illumination should be adequate to enable persons with visual impairments to utilize their vision effectively, it should also be directed and controlled so that it does not create glare.*



#### 5.1.1 Lighting and Colour / Brightness Contrast

*Lighting and colour schemes cannot be treated separately. Even optimum illumination may not assist a visually impaired person to travel safely through an environment if objects and their surrounding areas present very little colour / brightness contrast. Conversely, the eye is sensitive to colour experiences only if the strength of light is sufficient to stimulate the eye. The level of light, however, should not be overpowering or misdirected as it may cause glare which tends to veil and minimize colour contrast.*

*Under optimal illumination conditions, all persons having useful vision are able to perceive at least some differences in brightness, while many have difficulty discriminating different hues. Therefore, the primary guiding principle in colour selection should be choice of colour combinations with excellent contrast in brightness. The experience of colour is at its maximum with orange, yellow, and light green colours, but decreases with red and violet colours.*

Adequate lighting for both indoor and outdoor public areas is essential to facilitate lip-reading and manual communication. The level of illumination should be consistent and constant throughout a setting as many people with visual impairments experience problems with light adaptation.



#### 5.1.2 Glare

Lights should be directed and controlled so that they do not create glare. Glare on signage should be avoided. Matte finishes should be used instead of glossy, glare-promoting surfaces. Low level fixtures (i.e. below 1500 mm in height) should also be designed to avoid creating glare.



5.1.3 Hazardous areas (e.g. changes in elevation, building entrances, construction zones) should be well-lit and signposted. Supplementary lighting may be required if the background lighting does not provide adequate illumination, particularly in hazardous locations.

5.1.4 Lighting fixtures and posts should be situated so they are not hazardous to people with visual impairments.

## 5.2 Interior Illumination



The minimum level of illumination for a barrier-free path including every exit, public corridor, corridor providing access to exit for the public, corridor serving classrooms, and corridor serving employees, and students, shall be not less than 100 lux at floor or tread level and at all points such as angles and intersections at changes of level where there are stairs or ramps. (Note: OBC 3.2.7.1(1) only requires 50 lux)



5.2.1 The minimum illumination level shall be 100 lux on all controls and mechanisms including public telephones, and elevators. 200 lux is required wherever the viewer is required to read text. It may be impossible to reach these levels of illumination for all areas. **It is therefore recommended that particular care be taken to ensure that pedestrian routes are well illuminated and that areas where it is required to read text meet the requirements (200 lux).**

## 5.3 Stairways and Ramps

Stairways and ramps shall be illuminated to a minimum level of 100 lux. Where possible, lighting should come from overhead in order to shadow the risers and illuminate the treads. Locating lights directly overhead of intended targets will be less likely to cause direct glare. If a flight of stairs is long, **it is recommended that the light fixtures be indirect or shielded.**

## 5.4 Exterior Illumination



*The following guidelines supplement the Queen's master plan for outdoor lighting relating to accessibility for people with disabilities.*

*The human eye utilizes colour as an aid in sensing movement and in depth perception. This is of particular importance for the elderly and people who have visual impairments. The light provided by low and high pressure sodium lamps is not recommended due to poor colour rendition (deficient in the blue wavelengths).*

5.4.1 **Exterior lighting is required to provided safe, illuminated passage to and from facilities which are intended for night use. This may include but is not limited to the exterior of buildings, recreation facilities, as well as parking lots and pedestrian routes throughout the campus.**

**5.4.2 The source of illumination shall provide colour rendering which is not deficient in the blue spectrum. Incandescent, fluorescent, mercury vapour, and metal halide lamps currently meet this criteria.**

**Fixtures should be placed so that light patterns intersect at 2100 mm above ground.**

**5.4.3 Lighting for Exterior Stairways and Ramps**

Exterior stairways and ramps shall be illuminated to the same standard as required for the interior. (Refer to Clause 5.3)



5.4.4 Pathways and public open spaces shall be illuminated where designed and when intended for night use to the standard of pedestrian walkways.

**5.4.5 Exterior Illumination Levels**

*The following table developed by the Transportation Association of Canada shows the minimum acceptable exterior lighting levels:*

Table 5.1

	commercial	industrial	residential
<b>1. PEDESTRIAN AREAS</b>			
a. Sidewalks	6	1.5	1.5
b. Pedestrian Ways	2	1	1
<b>2. ROADWAYS</b>			
a. Freeways	9	7	7
b. Major Expressways	15	13	11
c. Collectors	13	6	10
d. Local	10	6	6
e. Alleys	6	6	4
<b>3. PARKING AREAS</b>			
a. Self Parking	11	-	-
b. Attendant Parking	22	-	-
<b>4. BUILDINGS</b>			
a. Entrance, Doorways	54	-	-
b. General Grounds	11	-	-

Note: Values are given in lux (10.76 lux = 1 footcandle).

The following table developed by the Illuminating Engineers Society shows the preferred exterior lighting levels:

**Table 5.2**



	commercial	industrial	residential
<b>1. PEDESTRIAN AREAS</b>			
a. Sidewalks	10	6.5	2
b. Pedestrian Ways	22	11	6
<b>2. ROADWAYS</b>			
a. Freeways	6.5	6.5	6.5
b. Major Expressways	22	15	11
c. Collectors	13	10	6.5
d. Local	10	6.5	4.3
e. Alleys	10	4.3	2
<b>3. PARKING AREAS</b>			
a. Self Parking	11	-	-
b. Attendant Parking	22	-	-
<b>4. BUILDINGS</b>			
a. Entrance, Doorways	54	-	-
b. General Grounds	11	-	-

Note: Values are given in lux (10.76 lux = 1 footcandle).

Unrestricted public areas of the campus shall be considered a "Commercial" setting for the purpose of establishing illumination levels. Restricted utility areas may be considered as "Industrial" settings.

Lamp type	Wattage Range	Efficiency (lumens/watt)	Life (hours)	Colours Strengthened	Colours Diminished	Remarks
Incandescent	15-100	low	750-2000	yellow, red, orange	blue	good colour rendition
Deluxe Cool-white fluorescent	90-1000	medium	10,000-24,000	blue, red, yellow	green	good colour rendition
Metal Halide	175-1000	high	7,500-10,500	yellow, blue, green	red	good colour rendition
High-pressure sodium	150-1000	high	10,000-15,000	yellow, green, orange	red, blue	poor colour rendition

**Table 5.3 Lamp Types and Characteristics**

**1. Low Level**

- \*heights below eye level
- \*very finite patterns with low wattage capabilities
- \*incandescent, fluorescent
- \*lowest maintenance requirements but highly susceptible to vandals
- \*outside public buildings

**2. Mall & Walkway**

- \*3-9 meter height average
- \*multi-use because of extreme variety of fixtures and light patterns
- \*incandescent, metal halide
- \*susceptible to vandalism
- \*walkways

**3. Special Purpose**

- \*6-10 meter heights average
- \*recreational, commercial, residential, industrial
- \*metal halide
- \*fixtures maintained by gantry
- \*parking lots

**4. Parking & Roadway**

- \*9-15 meter heights average
- \*large recreational, commercial, industrial areas; highways
- \*metal halide
- \*fixtures maintained by gantry
- \*sports fields
- \*not recommended, too high for maintenance vehicle

**5. High Mast**

- \*18-30 meter heights average
- \*large area lighting - parking recreational, highway interchanges
- \*metal halide
- \*fixtures must be lower for maintenance