Manitoba Energy Code for Buildings 2011
Part 4: Lighting

Ian Naften, MIES, EIT
Electrical Systems Engineer, Manitoba Hydro
Education Chair, Illuminating Engineering Society of Manitoba
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Lighting – A Significant Load Component

- Lighting: 33%
- Heating: 21%
- Cooling & Ventilation: 20%
- Computing: 15%
- Other: 11%
Outline

• Scope of Part 4 – Lighting
• Methods of compliance
• Exterior lighting – prescriptive path
• Interior lighting – prescriptive path
• Interior lighting trade-off path
• Performance compliance path
• Traditional vs New Technology: A Brief Case Study Brandon
Outline

• Scope of Part 4 – Lighting
  • Methods of compliance
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  • Traditional vs New Technology: A Brief Case Study Brandon
Scope of Part 4 – Lighting

- Applies to lighting components and systems connected to building's electrical service
- Exemptions:
  - emergency lighting automatically off during normal building operation
  - lighting in dwelling units
  - where impractical due to nature of occupancy
- Similar to ASHRAE 90.1 2010 in content
Outline

• Scope of Part 4 – Lighting

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  • Exterior lighting – prescriptive path
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  • Traditional vs New Technology: A Brief Case Study Brandon
3 Methods of compliance

1. Prescriptive path

2. Tradeoff path (interior lighting)

3. Performance path
Outline

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Exterior lighting – options

- Compliance:
  - Prescriptive or
  - Performance
  - **No option** for tradeoff path

- For exterior lighting systems that are connected to the building’s electrical service
Exterior lighting – options

4 Exterior Lighting

4.1. General

Select compliance path

Building

Prescriptive Path

Performance Path

Apply requirements of 4.2.3.

Apply requirements of 4.2.4.

Compliance with Part 4 achieved

Apply requirements of Part 8, as referenced in 4.4.

Compliance with NECB achieved
Exterior lighting power – Prescriptive Path

3 Parts of Exterior Lighting Power Allowance:

1. Base site allowance
2. Specific building power allowance
3. General building power allowance
Exterior lighting power – Prescriptive Path

Step 1: Base site allowance

– Determine “Lighting zone”

– Lighting zone classification will determine base power allowance
# Exterior lighting power – Prescriptive Path

## Table 4.2.3.1.A.
Lighting Zones Used to Determine Exterior Lighting Allowances
Forming Part of Sentence 4.2.3.1.(1)

<table>
<thead>
<tr>
<th>Lighting Zone</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Undeveloped areas within national, provincial or territorial parks, forest land, and rural areas, and other undeveloped areas</td>
</tr>
<tr>
<td>1</td>
<td>Developed areas within national, provincial or territorial parks, and rural areas</td>
</tr>
<tr>
<td>2</td>
<td>Areas predominantly consisting of residential zoning, neighbourhood business districts, light industrial areas with limited nighttime use, and residential mixed-use areas</td>
</tr>
<tr>
<td>3</td>
<td>All other areas</td>
</tr>
<tr>
<td>4</td>
<td>High-activity commercial districts</td>
</tr>
</tbody>
</table>
Exterior lighting power – Prescriptive Path

Step 2: Specific building power allowance

Lighting power for each specific exterior application

≤

Specific exterior application allowance
## Exterior lighting power – Prescriptive Path

<table>
<thead>
<tr>
<th>Exterior Application</th>
<th>Lighting Power Allowances According to Lighting Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone 0</td>
</tr>
<tr>
<td><strong>Building facades (facade lighting)</strong></td>
<td>No allowance</td>
</tr>
<tr>
<td>Automated teller machines (ATM) and night depositories</td>
<td></td>
</tr>
<tr>
<td>Entrances and gatehouse inspection stations at guarded facilities</td>
<td></td>
</tr>
<tr>
<td>Loading areas for law enforcement, fire, ambulance and other emergency service vehicles</td>
<td></td>
</tr>
<tr>
<td>Drive-up windows and doors</td>
<td></td>
</tr>
<tr>
<td>Parking near 24-hour retail entrances</td>
<td></td>
</tr>
</tbody>
</table>

**Table 4.2.3.1.C**
Exterior lighting power – Prescriptive Path

Step 2 (cont):

– The base site allowance can be drawn down to compensate for applications that are greater than the specific allowance.

– ‘Unused’ or ‘underbudget’ allowances CANNOT be transferred to other specific areas
Exterior lighting power – Prescriptive Path

Step 3: General building power allowance

Lighting power for each general exterior application ≤

General exterior application allowance
# Exterior lighting power – Prescriptive Path

<table>
<thead>
<tr>
<th>Exterior Application</th>
<th>Lighting Power Allowances According to Lighting Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone 0</td>
</tr>
<tr>
<td>Uncovered Parking Areas</td>
<td>No allowances</td>
</tr>
<tr>
<td>Parking areas and drives</td>
<td></td>
</tr>
<tr>
<td><strong>Building Grounds</strong></td>
<td></td>
</tr>
<tr>
<td>Walkways less than 3 m wide</td>
<td>2.3 W/m²</td>
</tr>
<tr>
<td>Walkways 3 m wide or greater, plaza areas, special feature areas</td>
<td>1.5 W/m²</td>
</tr>
<tr>
<td>Stairways</td>
<td>8.1 W/m²</td>
</tr>
<tr>
<td>Pedestrian tunnels</td>
<td>1.6 W/m²</td>
</tr>
<tr>
<td>Landscape lighting</td>
<td>0.4 W/m²</td>
</tr>
<tr>
<td><strong>Exterior Entrances and Exterior Exits</strong></td>
<td></td>
</tr>
<tr>
<td>Main entries</td>
<td>66 W/m² of door width</td>
</tr>
<tr>
<td>Other doors</td>
<td>66 W/m² of door width</td>
</tr>
<tr>
<td>Entry canopies</td>
<td>2.7 W/m²</td>
</tr>
<tr>
<td><strong>Sales Canopies</strong></td>
<td>No allowances</td>
</tr>
<tr>
<td>Free-standing and attached</td>
<td></td>
</tr>
<tr>
<td><strong>Outdoor Sales</strong></td>
<td>No allowances</td>
</tr>
<tr>
<td>Open areas (including vehicle sales lots)</td>
<td></td>
</tr>
<tr>
<td>Street frontage for vehicle sales lots in addition to “open area” allowance</td>
<td>No allowance</td>
</tr>
</tbody>
</table>

**Table 4.2.3.1.C**
Exterior lighting power – Prescriptive Path

Step 3 (cont):

– The base site allowance can be drawn down to compensate for applications that are greater than the general allowance.

– ‘Unused’ or ‘underbudget’ allowances can be transferred to other general areas
  – Cannot be transferred to specific areas
### Exterior lighting power – Prescriptive Path – exemptions

<table>
<thead>
<tr>
<th>Specialized signal, directional, and marker lighting associated with transportation</th>
<th>Lighting for production, material handling, transportation sites, and associated storage areas for industrial sites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising signage or directional signage</td>
<td>Temporary lighting</td>
</tr>
<tr>
<td>Lighting integral to equipment or instrumentation and installed by its manufacturer</td>
<td>Theme elements in theme/amusement parks</td>
</tr>
<tr>
<td>Lighting for theatrical purposes, including performance, stage, film production, and video production</td>
<td>Lighting used to highlight features of recognized art objects, public monuments and designated national or provincial historic sites</td>
</tr>
<tr>
<td>Lighting for athletic playing areas</td>
<td>---</td>
</tr>
</tbody>
</table>
Exterior lighting controls – Prescriptive Path

Requirements - Exterior Lighting Controls

1. Astronomical time controls
2. Photosensors
3. Photosensors and timer shutoff switch
4. An equivalent control system equivalent in operation to those above
5. Controllers must retain programming and time setting for a 10 hour power outage
Exterior lighting controls – Prescriptive Path

Exemptions

1. Covered vehicle exterior entrances;
2. Exterior exits from buildings;
3. Parking structures

“Where needed for safety, security or eye adaptation”
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Interior Lighting
3 Methods of compliance

1. Prescriptive path

2. Tradeoff path

3. Performance path
Interior lighting – compliance options
1. Prescriptive path
Installed interior lighting power

- Installed interior lighting power cannot exceed interior lighting power allowance as determined by either:
  I. Building area method
  II. Space-by-space method

- **Cannot** be mixed
1. Prescriptive path
Installed interior lighting power

• Includes
  – All power used by luminaires, both permanent and supplemental or task-related provided by movable or plug-in luminaires
    • ‘Maximum’ rated power consumption
    • Doesn’t include EE lamp usage
  – Higher wattage when more than one system provides lighting but not simultaneously
1. Prescriptive path
Installed interior lighting power

- Exemptions

<table>
<thead>
<tr>
<th>Lighting description</th>
<th>Exemption</th>
</tr>
</thead>
<tbody>
<tr>
<td>lighting for TV broadcasting in sporting activities</td>
<td>lighting for retail or educational demonstration</td>
</tr>
<tr>
<td>lighting integral to equipment</td>
<td>casinos</td>
</tr>
<tr>
<td>lighting used during medical or dental procedures</td>
<td>lighting in retail displays in fully enclosed spaces</td>
</tr>
<tr>
<td>lighting integral to refrigerator and freezer cases</td>
<td>special lighting for visually impaired and other conditions</td>
</tr>
<tr>
<td>lighting integral to food warming and food preparation</td>
<td>lighting integral to advertising or directional signs</td>
</tr>
<tr>
<td>lighting for plants</td>
<td>exit signs</td>
</tr>
<tr>
<td>lighting in historic landmarks</td>
<td>lighting for theatrical purposes</td>
</tr>
<tr>
<td>mirror lighting in dressing rooms</td>
<td>accent lighting in religious areas</td>
</tr>
<tr>
<td>display or accent lighting essential for galleries, museums, monuments</td>
<td>where it can be shown that the inclusion will adversely affect the intended function or use</td>
</tr>
</tbody>
</table>
1. Prescriptive path
Installed interior lighting power

I. Building area method:
- Select building type or equivalent from table based on primary use
- Multiply lighting power density by gross lighted area to obtain interior lighting power allowance
- If 10% or more of gross lighted area can be classified as another type or if no equivalent building, must use space-by-space method
1. Prescriptive path
Installed interior lighting power

II. Interior Lighting Power Allowance – space-by-space method:
- For each enclosed space:
  • Find lighting power density from table based on intended use of space
  • Multiply lighting power density by gross interior floor area
- Sum results for all spaces
- Ensure total interior lighting power is less than total allowance
1. Prescriptive path Controls

• Automatic shut off
  – Time-of-day operation
  – Occupant sensor
  – Control system

• Exemptions
  – 24-hour operation
  – Patient care is rendered
  – Safety or security issues
1. Prescriptive path
Controls for spaces

• At least one control for general lighting in enclosed spaces
• Space types listed below must use automatic controls based on space occupancy:
  – Offices up to 25 m²
  – Classrooms and lecture halls, excl. shop and laboratory classrooms
  – Conference, meeting and training rooms
  – Employee lunch and break rooms
  – Storage and supply rooms up to 100 m²
  – Copying and printing rooms
  – Dressing, locker and fitting rooms
  – Washrooms
1. Prescriptive path
Controls for spaces - Toplighting

- Daylight area > 400 m² → photocontrol to reduce general lighting
- Exemptions
  - light blocked
  - insufficient skylight aperture
  - small enclosed space above 55°N latitude
- Provisions on how to calculate daylighted area
1. Prescriptive path
Controls for spaces - Sidelighting

• Sidelighted area > 100 m² →
  photocontrol to reduce general lighting
• Exemptions
  – light blocked by adjacent building
  – insufficient sidelight aperture
  – retail spaces
• Provisions on how to calculate
  sidelighted area
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2. Trade-off path

• Applies to interior lighting only

• More detailed calculations required

• Used when prescriptive path (building area and/or space-by-space method) power limits are exceeded

• Building owner requires higher light levels, yet doesn’t qualify for exemptions
2. Trade-off path

• Compliance is based primarily on energy (kWh) as opposed to demand (W)

• Compliance achieved when:

\[
\text{Installed Interior Lighting Energy (IILE)} \leq \text{Interior Lighting Energy Allowance (ILEA)}
\]
2. Trade-off path

Installed Interior Lighting Energy (IILE)

- Sum of the annual energy consumption of the proposed interior lighting designs
- Includes:
  - Daylighting Controls  -- Personal controls
  - Time of operation  -- Dimming
  - Occupancy Sensor
2. Trade-off path

Interior Lighting Energy Allowance (ILEA)

- Sum of the annual energy consumption allowances for interior lighting in the spaces under consideration using the space by space prescriptive path
2. Trade-off path

• Compliance:

\[
\text{Installed Interior Lighting Energy (IILE)} \leq \text{Interior Lighting Energy Allowance (ILEA)}
\]
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3. Performance compliance path

- Whole building energy modeling
- NECB Part 4 Lighting → no limitations
- Criteria found in Part 8 “Building Energy Performance Compliance Path”
- Somewhat complicated
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Traditional vs New Technology: A Brief Case Study Brandon

HPS shoebox → LED

• Motivation
  – Energy savings
  – Maintenance savings
  – Improve light ‘quality’

• IES RP-20 for parking facilities
  – (They make an RP for nearly everything…)
Traditional vs New Technology: A Brief Case Study Brandon

HPS Design (circa 1971)

- HPS overall fixture efficiency approx 70%
- Amber light
- Prone to hot spots directly under lamps
- 2x 290W per point, roughly 600W
Traditional vs New Technology: A Brief Case Study Brandon

LED Proposed Design

- High fixtures efficiency, “delivered lumens”
- White light high CRI
- Extremely uniform, less than 2:1 contrast ratio
- Approximately 130W per point (one head)
- Used only 25% of the power of the original design, yet superior
Questions?

http://www.firecomm.gov.mb.ca/codes_energy.html
Thanks!

Ian Naften, MIES, EIT
Electrical Systems Engineer, Manitoba Hydro
Education Chair, Illuminating Engineering Society of Manitoba