Power Outlets

Each communications equipment rack shall be fed from two independent tray mounted twist lock L-20R single receptacles. Each such receptacle shall be fed from a dedicated circuit. Refer the IT telecommunications and Systems document for detailed specifications.

See Presto subsection under Fare Handling Systems section for power requirements.

Provide a minimum of three (3) normal power 5-20R 120 V duplex receptacles, powered from three dedicated circuits, for maintenance and identified as such. These receptacles shall be wall mounted and not located on cable tray or cable ladders, as not to be confused with communication-dedicated receptacles.

Provide a power bar for the equipment mounted on the plywood backboard. Each connection on the power bar shall have nameplates to provide power tracing ease. The power bar shall be a multi-outlet raceway. All equipment connecting to the power bar shall have nameplates indicating model, capacity, and electrical data. Install equipment in accordance with manufacturer's recommendations.

Illumination

Lighting Design

This section addresses interior and exterior illumination and lighting design strategy for GO site and building facilities. The intent is to provide good uniform quality lighting design strategy that meets the locations application. The Lighting design strategy shall be applied as a sequential overlay of Guiding Principles; followed by lighting design considerations, lighting typology applications and selection criteria and individual lighting design requirements.

Lighting Design Guiding Principles → Design Considerations → Typologies → Design Requirements

Lighting Design Guiding Principles

- A cohesive and adaptable hierarchy of lighting
    - Provide a consistent and flexible lighting approach across all sites will promote intuitive wayfinding
    - Utilize built site elements with internal lighting as beacons to support wayfinding
    - Associate lighting types with the same conditions/activities at each element, to provide a recognizable visual language.
- The hierarchy of lighting is identified as:
    - Areas of transition and boarding of GO services that are highlighted to enhance the experience of movement
    - Illuminated built structures that serve as lanterns and aid wayfinding throughout the site
    - Pedestrian scaled illumination for areas of rest and waiting that promote comfort
    - Areas of vehicular movement and parking
- Durable and adaptable design with sustainable maintenance and operational efficiencies
    - Use LED technology for its low energy consumption and long lifecycle
    - Integrate control systems and sensors to assist energy management and contribute to sustainable practices.
- Shall guide customers through the sequence of unique customer journey touchpoints at a site
    - Use lighting to articulate each site element's sense of place
    - Highlight areas of transition to heighten the experience of movement
    - Reinforce site order and hierarchy by emphasizing important zones with light
- Deliver an engaging, comfortable, and safe experience for the customer
    - Use a variety of lighting types to create ambiance and provide comfort
    - Highlight significant edges of site elements–thresholds–to create a dynamic and engaging experience
    - Provide lighting levels that ensure visual and physical comfort of customers
    - Use light sources with good colour rendering and colour temperature to support comfort and well-being

- Highlight edges of train platforms and curbs to provide a high level of safety and legibility

Lighting Design Considerations

- The levels and quality of lighting for the various types of areas shall be as outlined in the latest edition of the Illuminating Engineering Society of North America (IES) Lighting Handbook, as modified here and as required to accommodate the Ontario Building Code and Ontario Electrical Safety Code. They shall take into consideration the aging population and the needs for accessibility of all groups (e.g. CNIB recommendations)
- Illumination systems shall require minimal maintenance, and shall be energy efficient and readily accessible, designed for passenger safety and security
  - Illumination shall be designed to provide visual comfort and mini- mum glare for GO staff and passengers.
  - The illumination systems shall be compatible with CCTV systems
- Building luminaries in public areas shall be integrated with the architecture
  - Luminaries shall be in locations designed by the architect, complementing daylight sources
  - All luminaries must be accessible for maintenance and lamp replacement without having to construct special means of approaching the fixture
- Urban light fixtures for each station site shall be selected from one fixture family and matched to the uses and lighting types called for at each site element
- Wayfinding through each station site shall be supported by using fixtures that are common to the scale of the user wherever possible
  - For example, for pedestrian areas, a common lamppost design and scale shall be used throughout the site to identify pedestrian areas
- Light fixture design shall be simple, elegant and contemporary
- Site lighting controls, including sensors and timers, shall be provided for all site element lighting where appropriate, and shall be integrated into the station building automation system
  - Lighting controls shall support daylight harvesting where applicable
- Photosensors are to be located so that there is a direct view of the sun and that no shadows or obstructions will interfere with readings
- Occupancy sensors are to be provided in the following areas: Parking garage lobbies
- Photosensors shall be provided for site lighting in the following areas
  - Bus platforms, including shelters
  - Surface parking lots
  - Station plaza
  - Rail platforms
  - Open bridges, including stairways
  - Closed bridges

Refer GO Standard specifications for detailed requirements

- Lighting in enclosed stairways and parking garages shall remain on at all times, unless otherwise noted
- Lighting fixtures and ballasts shall be selected and installed to ensure ease of access for servicing and ease of maintenance
- All light fixtures shall be LED with the following criteria:
  - CRI (Colour Rendering Index) to be a minimum of 80 unless otherwise noted
  - Colour temperature to be 4000K unless otherwise noted
  - Exterior luminaires to have CSA or CUL Wet Location labels
- Use light fixtures equipped with industry standard LED light engines that are equal or better in performance and build quality to Bridgelux or Xecato or equivalent

- Specify light fixtures that limit glare and uplight, and support dark sky policy
- Specify light fixtures that are locally distributed and serviced
- Lighting fixtures to have a minimum 5-year warranty
- Negotiate longer warranties where option is offered by the manufacturer
- Where accessible by the public, light fixtures are to have vandal resistant features
- The underside of ceiling mounted fixtures is to be a minimum of 2750mm above the finished floor
- Glare: Adjacent properties shall be shielded from glare or light trespass. There shall be no interference with railroad signal or operations systems due to glare. The discomfort Glare Rating shall have a Visual Comfort Probability (VCP) of 65% or greater for interior lighting. Station attendants and passengers at service counters shall be able to see each other 100% when the sliding glass panel is in the closed position. Luminaries in this location shall have parabolic egg crate lenses, with all illumination directed vertically down to the task. Passengers and station attendants shall be capable of seeing out to the exterior at night. All glass shall be clear and not tinted, for maximum visibility of the interior. Luminaries' placement shall take into account viewing angles and fields of view of close circuit television cameras. Luminaries shall not present a source of glare to surveillance cameras.
- Exit lights shall be of the fully self-contained and low energy LED type
- Emergency lighting shall be in accordance with the OBC, the Ontario Electrical Safety Code, and the latest CSA standards
- Daylight–Particular attention shall be directed to parking structure, rail station and bus terminal entrance/ exit areas, especially on large projects. Illumination shall provide for a visually comfortable transition from outdoors to facility entry areas during all hours of system operation. Illumination levels will likely have to be graduated during the daylight hours to minimize otherwise abrupt changes from outdoors to indoors, and vice versa. Photoelectric cells for the automatic operation of additional lighting fixtures may be utilized
- Sundry: All rail platform poles shall be hinged to avoid flagman services. Hinged poles shall be installed in such a manner to avoid obstructions when lowered. Hinging shall be always parallel to the track. CCTV camera(s) shall have dedicated split pole(s). PA speakers can be installed on existing lighting poles only if they are split. High-mast lighting poles shall have no objects attached onto (e.g. parking identification, PA speakers, etc.) to avoid obstruction of the lowering device
- Standard Light Pole Drawings: Digital drawing files (AutoCAD 2012) are available for 3 and 6 metre hinged pole, 6 metre, 12 metre and 30 meter (high mast) pole under PMPS GO Standard Drawings
- Uniformity Ratio:
  - Maximum to minimum: 4:1 or better
  - Average to minimum: 3:1 or better
- Where lighting is of a complex or unique nature or if required by GO, the Consultant shall engage the services of a qualified Illumination Designer
- Design photometric digital file in PDF or DWG format, complete with printouts using recognized computer lighting design software, shall be provided for GO review of design illumination levels. These photometric files shall be included in the As-built drawings

Lighting Design Typology

- The following Design Typology shall be adapted to applicable site configurations to provide a consistent approach for the illumination of site elements

Graphic

- Visually distinct from its context
- Linear, geometric or curvilinear
- Animates and provides a visual cue, supporting wayfinding
- Defines edges or thresholds and suggests movement and direction
- Can be created by a line of luminaires viewed from a distance

Integrated

- Recessed (integrated) or concealed within an architectural element or object
- Can provide direct or indirect illumination
- Accentuates form and volume
- Creates ambiance

Object of Light

- Emanates from a surface of a defined form or area
- Light becomes a form in itself
- Can be the result of lighting that comes from a built structure, creating a lantern effect

Lighting Typology–Selection Matrix

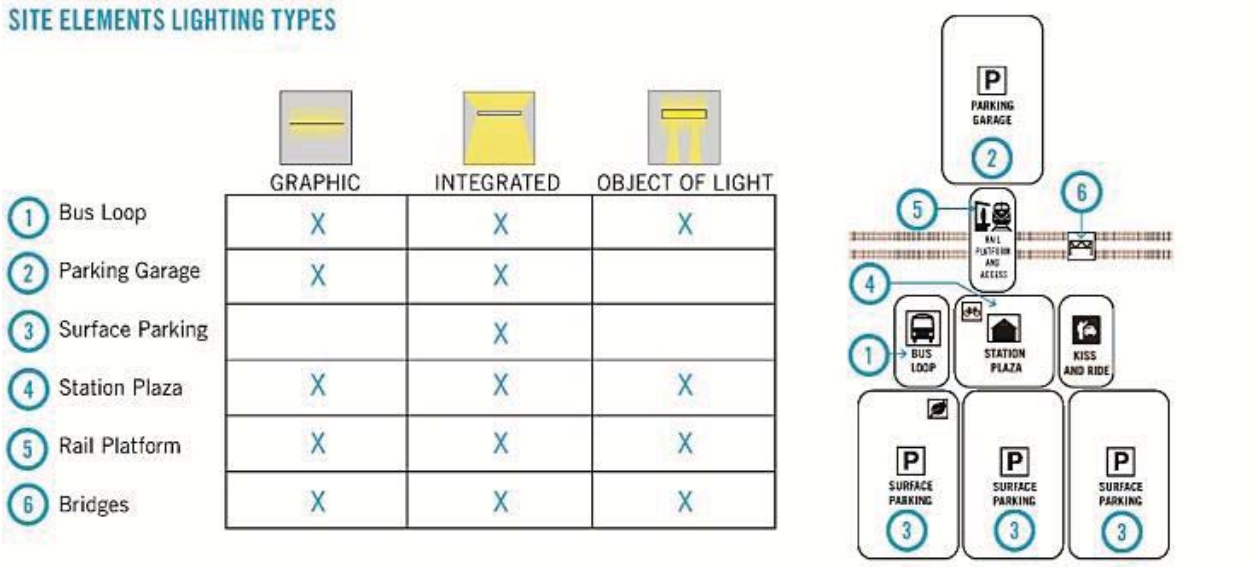

Figure F-3: Site Elements Lighting Types

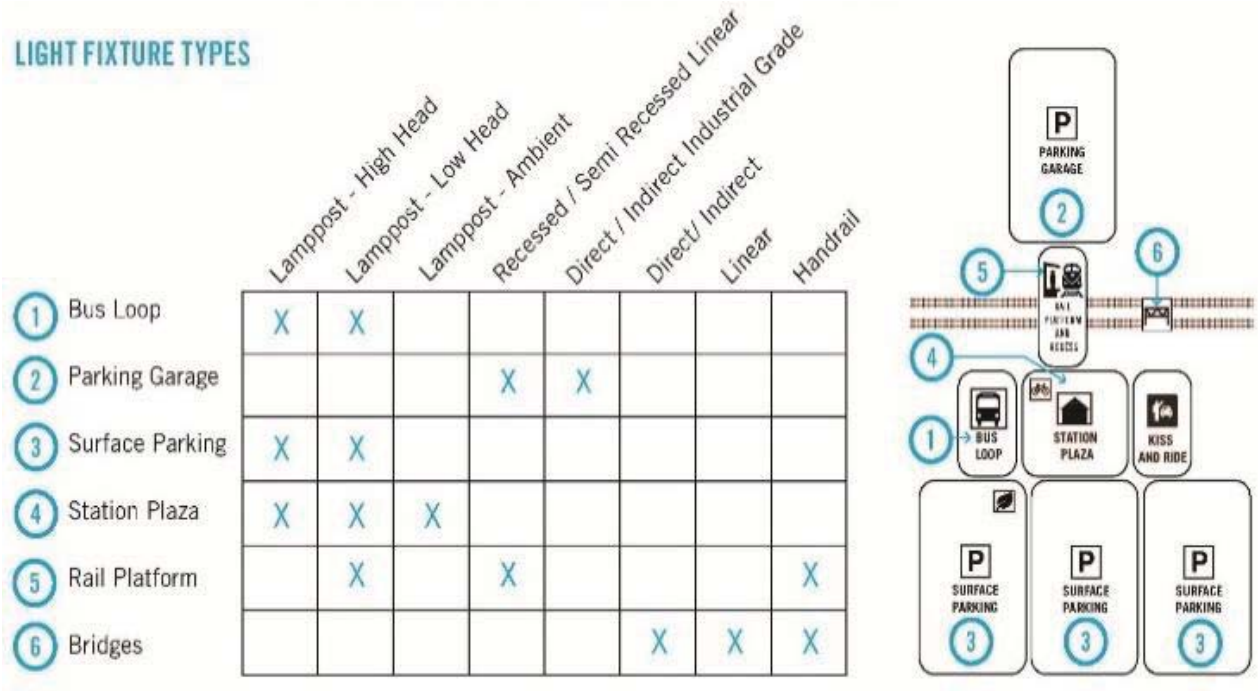

Figure F-4: Light Fixtures Types

Lighting Design Requirements

Bus Loops:

- General illumination for bus platform shall be provided by a line of full cut-off single-headed downlights on lampposts aligned with the back of bus shelters
- Lamppost height shall be kept to a minimum, based on site layout and context

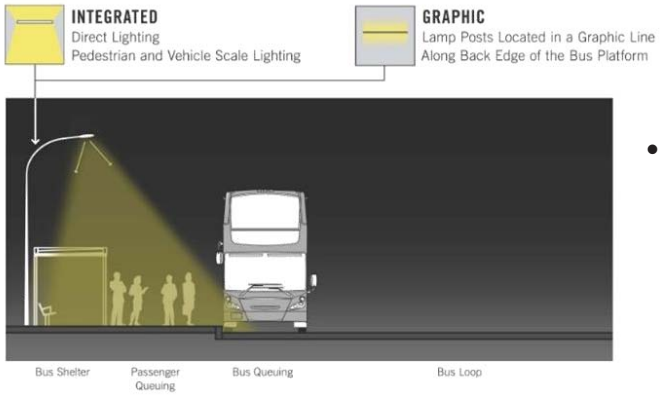

Figure F-5: Lighting Design Requirements- Bus Loops

- Lamppost height shall be kept to a minimum, based on site layout and context
- Pedestrian scale fixture head shall be between 3.5 and 4.5 metres above the plaza surface
- Lighting of the bus shelter, while not within the scope of site lighting, shall be taken into Consideration in calculations and overall balance of lighting design
- Minimum average maintained illumination levels shall be:
- General illumination for bus platforms with pedestrian walkways behind shelters shall be provided by a line of full cut-off double-headed downlights on lampposts aligned with the back of bus shelters
- One head will provide platform lighting; the other head will provide pedestrian scale lighting on the pedestrian walkway behind the shelter
    - Bus Platform Boarding Area: 100 lux horizontal and 50 lux vertical
    - Bus Platform: 50 lux horizontal, 25 lux vertical
- Colour temperature shall be 3500K and shall be confirmed through testing with site materials.

Parking Garage:

- The lighting in the parking area of the garage shall be provided by direct/indirect fixtures positioned above the bottom edge of structural beams
- The lighting in the elevator lobby shall be provided by graphic direct LED fixtures positioned parallel to the elevator doors
- In cases where the design and layout of the garage permit, use graphic direct LED fixtures to highlight key pedestrian areas and promote wayfinding within the garage
- Minimum average maintained illumination levels shall be:
    - General Parking and Pedestrian Areas: 55 lux horizontal
    - Ramps and Corners: 110 lux horizontal
    - Elevator Lobbies: 200 lux horizontal
    - Parking Garage Entrance Areas– Nighttime: 110 lux horizontal, 55 lux vertical
    - Parking Garage Entrance Areas– Daytime: 550 lux horizontal, 275 lux vertical
- Colour temperature–4000K preferred, 3500K minimum
- CRI–80 preferred, 70 minimum

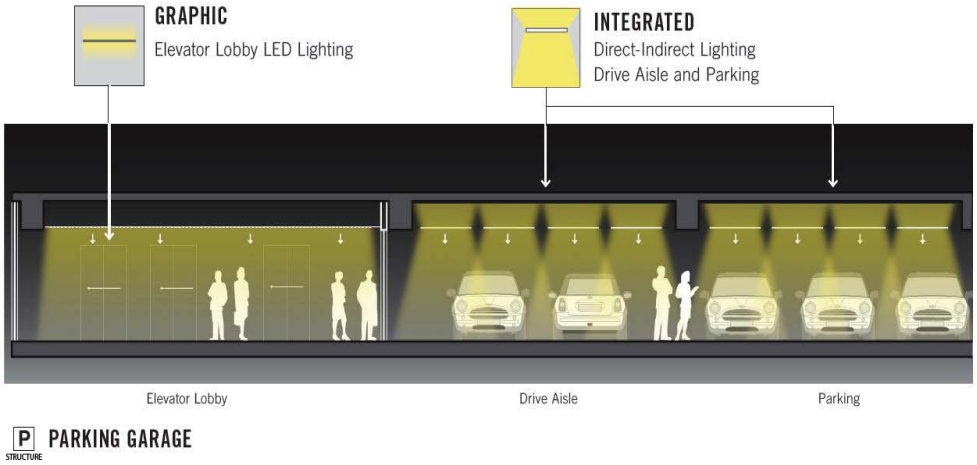

Figure F-6: Lighting Design Requirements-Parking Garage

Surface Parking:

- The lighting in the parking and drive aisle areas shall be provided by full cut-off single and double-headed downlights on lampposts
    - Lamppost height shall be kept to a minimum, based on site layout and context
- The lighting in the pedestrian walkways shall be provided by full cut-off single-headed lighting fixtures on lampposts
    - Fixture head shall be between 3.5 and 4.5 metres above the walkway surface
- Minimum average maintained illumination levels shall be:
    - Parking Lot: 20 lux horizontal, 10 lux vertical
    - Pedestrian Walkways: 20 lux horizontal
- Colour temperature–4000K preferred, 3500K minimum
- CRI–80 preferred, 70 minimum

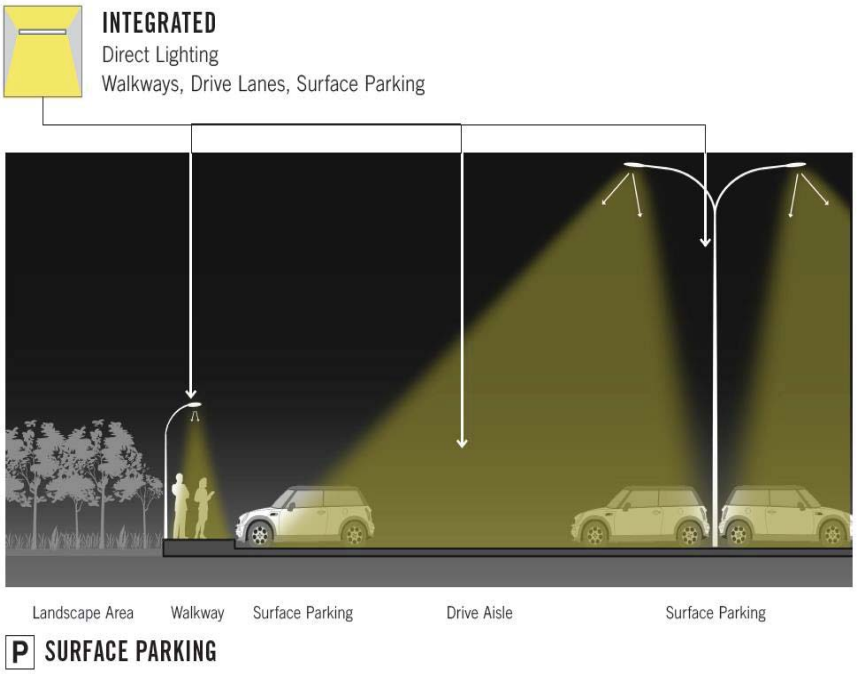

Figure F-7: Lighting Design Requirements-Surface Parking

Station Plaza:

- Lighting along the Plaza Edge/Drop Off and Pick-up Area shall be provided by full cut-off double-headed downlights on lampposts aligned parallel to edge of plaza
    - One head will provide roadway lighting, the other head will provide pedestrian scale lighting on the plaza
    - Lamppost height shall be kept to a minimum, based on site layout and context
- Lighting of the station building shall be taken into consideration in calculations and overall balance of lighting design
- Minimum average maintained illumination levels shall be:
    - Plaza Edge/Drop Off and Pick-up Area: 50 lux horizontal, 25 lux vertical
    - Pedestrian scale fixture head shall be between 3.5 and 4.5 metres above the plaza surface
- Lighting within the plaza shall be provided by indirect light lampposts aligned parallel to the station building and integrated with the planting zone if one exists
    - Pedestrian scale fixture head shall be between 3.5 and 5 metres above the plaza surface
    - Plaza: 50 lux horizontal
- Colour temperature shall be:
    - Plaza Edge/Drop Off and Pick-up Area: 4000K preferred, 3500K minimum
      Plaza: 3500K

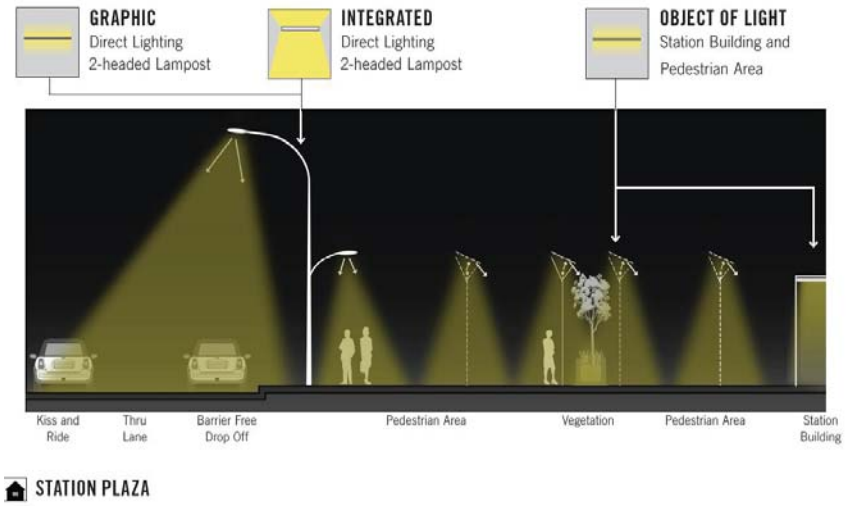

Figure F-8: LightingDesignRequirements-StationPlaza

Rail Platforms:

- The lighting of the platform area and its stair and elevator access points shall be provided by direct/indirect lighting fixtures that produce a graphic effect, aligned parallel to the platform edge
- At platforms without roof soffits, lighting is to be provided by direct full cut-off lighting on 2 headed lampposts
    - Each head will illuminate one side of the platform
    - Lamp post height shall be kept to a minimum, based on site layout and context
- Stairwells and their handrails shall have integrated lighting
    - Avoid placing lights in the ceiling above stairs
- Minimum average maintained illumination levels shall be:
    - Platform Boarding Area: 100 lux horizontal, 50 lux vertical
    - Platform: 50 lux horizontal, 25 lux vertical
    - Stairwells: 200 lux horizontal
- Colour temperature shall be 3500K

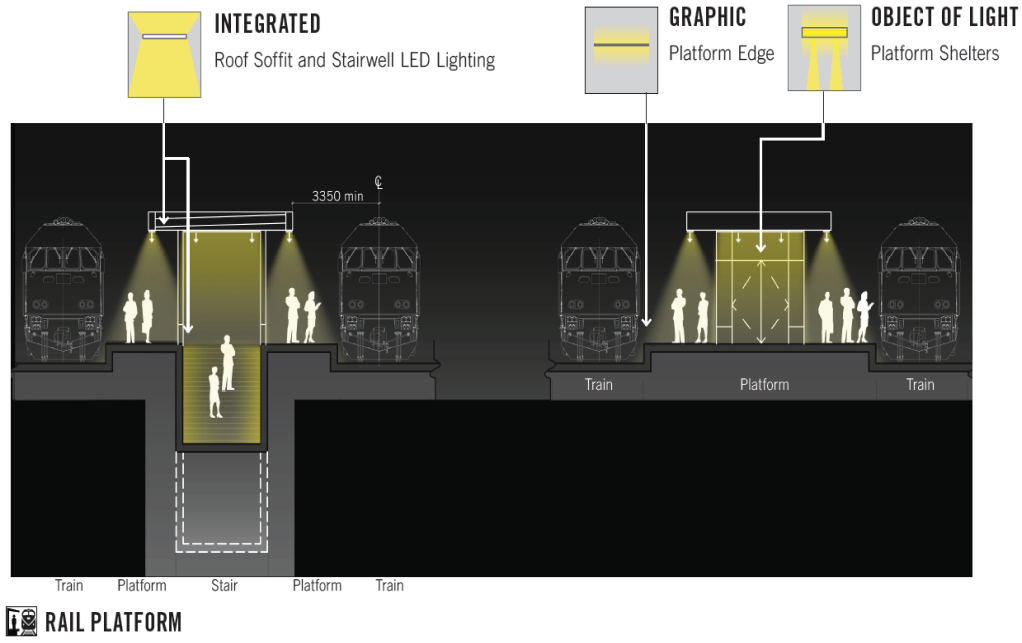

Figure F-9: Lighting Design Requirements-Rail Platform

Bridges:

- Enclosed bridges shall have ceiling integrated direct/indirect lighting that produces a graphic effect
- Open bridges shall have lighting integrated on the interior, into side elements such as structure, handrails and guards
- Light sources shall not to be visible from the point of view of train conductors
- Enclosed stairs to bridges shall have lighting integrated into side walls above head height, and lighting integrated into handrails
- Open stairs to bridges shall have lighting integrated into handrails
- Minimum average maintained illumination levels shall be:
    - Enclosed and Open Bridges: 150 lux horizontal, 75 lux horizontal
    - Enclosed and Open Stairs: 200 lux horizontal
- Colour temperature shall be 3500K

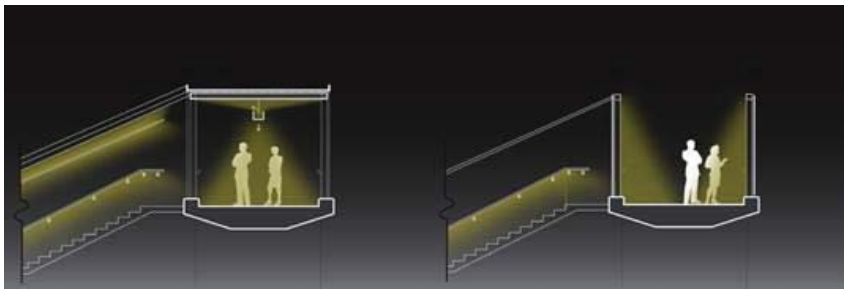

Figure F-10: Lighting Design Requirements-Bridges