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Appendix A

Illumination Design Standards

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Approved Luminaires, Poles and Bases

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References
1.0 GENERAL

1.1 Purpose

This manual has been developed to bring together a comprehensive set of standards that will serve as a guide for the management of a safe, efficient, cost-effective street, walkway and outside area lighting system. This manual is to be considered a "living document" such that material will be issued periodically and added to the manual.

1.2 Scope

The scope of the manual is outlined in the Table of Contents and includes design standards, and energy consumption parameters. From time to time throughout the manual there are references to standards developed by outside resource groups. Generally, these groups include the Illuminating Engineering Society of North America (IESNA) and the Roads and Transportation Association of Canada (RTAC).

1.3 Objectives and Criteria for Street Walkway and Outside Area Lighting System

The provision of adequate night lighting for the University of Alberta Campus streets and walkways is intended to effect a reduction in the potential for night accidents and improve safety and security for pedestrian's traffic.

The Outside Lighting System is to be designed using proven technology with a limited number of products to facilitate easy maintenance.

The Outside Lighting System is to be installed in a cost-effective manner where there is a clear balance between first cost, energy consumption, and maintenance costs.

1.4 Safety Criteria

RTAC and IES Illumination Standards have been used as a guide to determine the amount of illumination required for areas along the roadway. The values to be used are summarized in Appendix A.

Basic structural engineering standards with a safety factor of 3.0 are used for the design of luminaire supporting elements. Wind loading is set at 160km/h maximum.

Tree trimming and landscape planning are an important part of developing and maintaining a lighting system that enhances the safety and security on the University of Alberta Campus. Generally, dark areas should be illuminated to aid viewing into the area and vegetation should be thinned out, to allow for the detection of security hazards and assist those in need of help.

The illumination requirements to security cameras must be coordinated for each luminaire location.
2.0 DEFINITIONS AND CLASSIFICATIONS

2.1 Definitions

A comprehensive list of definitions used in the field of roadway and street lighting is covered by Illuminating Engineering Society of North American Publication #RP16 – 86 included in Appendix A of this manual. Terms specific to the University of Alberta are listed as follows:

Decorative Lighting: lighting equipment including poles, luminaires, and banner arms, used for street lighting themes.

Utility Feed: connected to utility corridor power system with the use of panel based control relays or photo cells.

Building Feed: connected to power distribution system of a nearby building.

Shared use Pole: poles where security system components are attached.

Underground Distribution: buried wiring running from buildings, pad mounted distribution centers, utility tunnel distribution panels or power poles. This includes between lighting poles to supply power to the luminaires mounted on those poles.

2.2 Classifications

Included within this section of the manual is a copy of IES Technical Memorandum TM-3-95 "Discussion of Roadway Luminaire Classification Systems". The University of Alberta Outside Area Lighting system is broken down in to the following major classifications with the sub classifications listed. The sub classifications define the type of installation and in some cases both types of installation apply.
2.3 Lighting Task Classifications

For the purpose of establishing a basis of design and construction of outdoor lighting system, the lighting task requirements will be determined by the function of the area involved, defined by the following classifications:

- Parking Lots
- Public Traffic Streets
- University Vehicle Service Roads
- Exclusive Emergency Vehicle Routes
- Combined Emergency, Service Vehicle and Pedestrian Routes
- Exclusive Pedestrian Walkways
- Delivery Entrances
- Building Entrances
- Decorative Landscaping Lighting
- Special Areas
- City of Edmonton Streets
3.0 Lighting Task Classification Design Guidelines Details

3.1 Parking Lots

.1 Parking lots are to be lighted using square-pak fixtures with 150 W ceramic metal halide lamps with spacing and light shielding requirements to fit the application. Mounting height to be 26 feet above grade. Illumination is to meet the standards listed in Appendix A.

.2 All metal halide lamps shall be as in Section 5.3, Lamp Standards.

.3 Lighting of parking lots utilizing building mounted floodlight fixtures is to be avoided.

.4 Parking lot entrances and exits are to be illuminated to a higher light level, 1.5 X the average listed in Appendix A by carefully locating the standard 26 foot poles with standard 150 Watt luminaires.

3.2 Public Traffic Streets

.1 University of Alberta public traffic streets are to utilize 150 Watt ceramic metal halide lamp installed in spare-pak fixtures housing with 26 feet mounting height. The luminaire is to be equipped with a flat lens and maintain illumination per Appendix A, Illumination Design Standards. Augmented lighting levels are to be provided at specific high use or pedestrian vehicle conflict areas, bus shelters, etc.

.2 Where pedestrian sidewalks occur adjacent to the streets, the luminaire location is to be established to maintain the same illumination level across the sidewalk as that provided in the street.

3.3 Service Roads

.1 Service roads to be lighted to the same standard and quality as public traffic streets, using the same fixture style but utilizing square-pak, fixture with 70 Watt ceramic metal halide lamps at a 17 feet mounting height. Because light distribution from bollards allows considerable light to fall into an auto driver’s “glare zone”, bollards shall not be used for this application. Where pedestrian use is shared with service roads, care shall be taken to ensure that fixture perspectives do not line up to cause vision obscuring glare to vehicle driver.

3.4 Exclusive Emergency Vehicle Roads

.1 Routes established solely for emergency vehicle use need not be provided with supplementary lighting.
3.5 Pedestrian Walkways

.1 Serve also as:

- Emergency vehicle roads
- Service vehicle roads

.2 Pedestrian walkways serving multiple use are to have a lighting system selected to meeting the most demanding of the shared function. Walkways should not be less than 5 LUX average over walkway paths with extended lighted coverage sufficiently beyond the immediate path to eliminate any potential “risk areas”. Fixture style shall be “square-pak” type using 70 Watt ceramic metal halide lamps and may be spaced to allow up to 4:1 average to minimum lighting ratio. Fixture mounting height shall be 17 feet and located so as to ensure clear passage of bulky and long vehicles such as fire trucks. Minimum clearance from edge of path to pole is to be as specified in Section 4.3.

.3 Pedestrian Walkways – when walkways for exclusive pedestrian use are involved, light fixtures are to be square-pak units with 70 Watt ceramic metal halide lamps. Bollard style fixture shall not be utilized.

.4 Fixture units be a square-pak units. Average lighting level 5 LUX with spacing to allow up to 4:1 average to minimum lighting ratio.

3.6 Delivery Entrances

.1 The general area of building delivery entrances shall be lighted to an average level of 10 LUX using square-pak fixture with 70 Watt ceramic metal halide lamps. Mounting height shall be compatible with those of the roadways leading to the delivery entrance. If 26 feet poles are required, the lamp wattage is to be 150 Watt.

.2 Supplementary light controlled by manual switches in the building dock area may be provided by under-canopy fixtures to supplement the general level so as to produce 20 LUX total for a space of 25 feet from the building along the entire length of the dock. It is intended that the supplementary lighting only be energized when loading dock is in use through use of manual re-set timers or similar devices.

3.7 Building Entrances

.1 Building entrances areas both for public and service shall be lighted using luminaire type and detail of same nature as those on the walkways or roads leading to the building. Level shall be 10 LUX minimum and may be supplemented by the building supplementary lighting to maintain 20 LUX at immediate entrance, the higher level to be used if outside entrance stairs are involved. Lighting shall be installed in all dark or obscure areas (i.e. behind heavy landscaping) in the building entrance area in the interests of security and public safety and as appropriate for each individual installation.
3.8 Decorative Landscape Lighting

.1 No decorative landscape lighting is to be provided except for special event applications of a temporary nature only (i.e. SUB Christmas tree).

3.9 Special Areas

.1 Special areas such as information centres, outdoor public assembly areas, bus stops, passenger drop-offs or hazardous areas shall be provided with the following higher lighting values:

- Information centre: .................................................................2 X average
- Outdoor assembly .................................................................1.25 X average
- Hazardous areas: .............................................3 X average (minimum 30 LUX)

.2 Fixture style, type and light source shall be of spare-pak style and match the other lighting installations of the area.

3.10 City of Edmonton Streets

.1 Street lighting design and layout on city streets adjoining the University shall be coordinated with the City of Edmonton utilizing standards set in these guidelines or City of Edmonton Standards.

.2 In particular, sidewalks are to be provided with supplemented lighting to the level described in 3.2 with the same light source and fixture style.
4.0 DESIGN REQUIREMENTS

4.1 General Standards

.1 Design calculation procedures shall be in accordance with those established by the Illuminating Engineering Society and RTAC.

.2 Light contributed to an outside area by “building-light-shine” shall not be considered as useful light source. This light source is unreliable as a source for outdoor lighting requirements, particularly in view of the growing interest of reduction of building energy use by shutdown when not in use.

.3 fixture pole location shall be determined by taking into account:

.1 Distance spacing to maintain minimum lighting levels as defined in task lighting requirements.

.2 Location of trees, existing buildings, roadways, etc., shall be taken into consideration to provide as close as possible satisfactory spacing of all elements.

.3 Pole locations shall be:

- Located back of street curbs approximately 3 feet and set to be a minimum hazard to vehicle traffic,
- Fixture tops shall not overhang street, side walks, or pathways,
- Located to be clear of machine snow clearing operations of streets, sidewalks, or pathways and take into account grass mowing and cultivation needs,
- Located clear of pedestrian traffic,
- Compatible with landscape design layout.

.4 Luminaire style for all new and replacement installations shall be uniform throughout and shall be ceramic metal halide, “spare-pak” style, pole mounted utilizing square steel pole and extension arms as appropriate. Lamp reflector, lens, and other light control components shall be selected as appropriate. Lamp reflector, lens, and other light control components shall be selected as appropriate for the specific application involved.

.5 All fixture poles, exposed metal bases, housings, etc., shall be painted with University of Alberta brown.

.6 Fixture pole heights shall be:

- 26 feet for public traffic and parking areas.
- 17 feet for pedestrian / service roads.
The use of light standards for mounting traffic signs is to be encouraged in preference to installing separate sign poles.

Identification number decals will be applied on all light units and poles readable from ground level, these decals to be applied by University of Alberta personnel in accordance with outdoor lighting record drawings maintained by the University of Alberta.

Pole base and foundation details shall be as shown on the Drawings in Appendix C.

### 4.2 Luminaire Standards

#### .1 General

Luminaires have been selected on the basis of overall efficiency and effectiveness. Only approved luminaires are to be used and the specific beam distribution pattern of each luminaire is to be evaluated to provide an even distribution of light along streets and walkways. Appendix A establishes the average to minimum illumination ratios accepted. Luminaires are full cut off design with a clear flat bottom lens to minimize light trespass and light pollution. Approved luminaire manufacturers and model numbers are found in Appendix C.

#### .2 Housings

Housings are to be either cast or welded aluminum complete with silicone gasketed lens frame to prevent the entrance of dirt, moisture and insects.

The housing shape is to be rectangular, generally a “shoe box shape”.

The housing is to be designed for easy maintenance access to the ballast components. All screws are to be captive type stainless steel.

The bottom or back edge of the housing is to be fitted with a cast aluminum to coordinate with the square pole top.

The housing paint finish is to be 2 coats of enamel over a prime finish or polyester dark bronze coat finish. The colour is to be University of Alberta brown to match the poles.

#### .3 Reflectors

Reflectors shall be manufactured of polished specular anodized aluminum, minimum thickness of .020”. The minimum total reflectance rating is to be 95% (equivalent to Anomet MIRO 4). Reflectors are to be held securely in place with springs or locking type stainless steel screws.
4.3 Lamp Standards

The following are the only acceptable light sources: (Incandescent lamp types are NOT to be used)

**High Intensity Discharge:** Metal Halide lamps should be ceramic arc tube metal halide 70 Watt, 100 Watt, or 150 Watt only with high colour rendering (80 CRI) rating, these lamps have a longer life rating and are more efficient. High Pressure Sodium should only be used for street lighting that is serviced by EPCOR.

4.4 Ballast Standards

.1 Ballasts – Metal Halide

- *Electronic specifications to be inserted here.*

Acceptable Manufacturers: ........................................................................................................ADVANCE
4.5 Pole Standards

.1 Square shaft 5” A/F grade 50W pole, uniform dimension throughout length and shall be 17ft or 26ft long factory prime coated to prevent rust and factory finish painted with two coats of high grade weather proof enamel, or polyester powder coat finish, dark bronze in colour to match the standard University of Alberta dark bronze colour. Bolting holes to be located on an 11” bolt circle, slotted 1 ¼” wide, ±7°.

.2 Handholes reinforced type minimum 4” wide by 7” high, on side of pole, complete with removable gasketted cover installed with a tamper-proof fastener and located approximately 15” from the pole base. A corrosion resistant grounding stud is to be located inside the handhole opposite the handhole opening.

.3 Base plate 11” square A36 or equivalent continuous weld to pole. All welding shall conform to C.S.A. Standard W59 and shall be performed by welders and welding operators qualified in accordance with C.S.A. Standard W47.1.

.4 Design each pole to withstand a wind load equivalent to 160 kmph peak wind pressure at a yield strength of the material with a safety factory of at least 1.5 on a luminaire whose drag factor is 1 or less and whose maximum vertical cross-sectional area of 0.5 square meter.

.5 Pole pre-drilled for mounting luminaire University of Alberta pole name tag.

4.6 Pole Base Standards

.1 General

Wherever possible pre-cast concrete bases are to be used with a standard 11” bolting circle for pole mounting. Refer to Appendix C for University of Alberta standard pole base design.

.2 Cast in Place Concrete

Constructed of 3500 psi (in 28 days, steel reinforced) concrete with minimum dimensions of 450 mm round by 1800 mm depth in accordance with the electrical drawings.

Acceptable Manufacturers: CONFORCE
.3 Anchor Bolts

.1 Provide four anchor bolts per each pole base minimum diameter 19 mm N.C. and 900 mm long with 75 mm right angle bands on lower end and 150 mm of thread on the upper end.

.2 Material: to be constructed of minimum Grade 5 Cadmium plated carbon steel.

.3 Provide four (4) Cadmium plated lock washers, flat washers, and eight (8) hexagonal nuts.

.4 Provide nut covers the same colour as the poles.

.4 Installation

.1 Install concrete bases for pole with the top of the base at 4” minimum above finished grade.

.2 Once Base is in place and orientated correctly, backfill with fill-crete or equivalent thin concrete sand mixture and support base until set provide gray backfill compacted to 98% proctor around remained of base up to top of subgrade.

.3 Mount the standards on bases plumb and true utilizing shims as required and then torque nuts on bolts and install nut covers.

.4 Touch up all chips and scratches on the poles upon completion.

.5 Install identification (tag riveted or screw fastened) number on all poles, readable from ground level. The designating to be in accordance with University of Alberta Outdoor Lighting record drawings.
5.0 POWER FEEDS AND CONTROLS

5.1 General

.1 All electrical power for outside lighting systems to be fed from service corridor sources.

.2 All wiring shall be run underground, utilizing copper teckcable. Wire size to be selected to maintain voltage drop to a maximum of 3% at end luminaire.

.3 Lighting distribution voltage shall be 120/208 Volt, 3 phase, 4 wire, 60 cycle only.

.4 Distribution and control panels shall be located in the service corridors.

.5 Service corridor distribution supply is 347/600 Volt, 3 phase, 4 wire. Appropriate sized transformers may be installed in service corridor system, spare 120/208 Volt, 3 phase, 4 wire, 60 cycle capacity is available from existing tunnel system for outdoor lighting use. All power for exterior lighting shall be metered separately.

.6 All installation work and equipment shall conform to the requirements of all applicable codes.

.7 Exterior lighting shall be controlled by suitable photocells. Future connections to central control system shall be provided within the service corridor.

Photo cells where used are to control as many luminaires as possible aimed north and connected to relays at the panels controlling the luminaire grouping. Photo cells located at luminaires is only by special University of Alberta approval. located external to the luminaire for easy maintenance.

All photo cells are to be identified on the University of Alberta record drawings with an assigned number decal located on the photocell for easy confirmation.

Photocell control is to be centralized; confirm locations with the University of Alberta before completing design.

.8 Provide circuitry so as to have adjacent fixtures on alternate circuit breakers to permit lighting level control by turning off selected circuits. No area or section of fixtures shall be fed by a single circuit.

.9 Outdoor lighting panels shall be independent and separate from parking lot car plug loads or other distribution requirements so as to permit cycling of these other loads without distribution lighting system operations. Loads may be combined to be serviced by common transformers, secondary distribution to be arranged to achieve separate system load control.

.10 Where conduit is required, provide PVC type underground and galvanized EMT in service corridors. Provide each conduit with pull string.