DIVISION 16 - ELECTRICAL

Section 16510 - Lighting Design

Introduction

Lighting utilizes approximately 40% of the electrical energy consumed here at the university. In order to conserve the energy it is very important that the lighting design be energy efficient. Soffit lighting must be accessible.

Consideration for maintenance of the light fixtures needs to be taken into account also. If a lamp is known to have a short life or a fixture manufacturer is known for having problems with his equipment make sure to eliminate them from consideration as a manufacturer. Use linear type fixtures whenever possible. Recessed compacts are to be minimized. Long lead, specialty lighting shall be avoided and where the design team request a variance the final approval is by UA Electrical Engineer.

Light levels should be appropriate for the task and per the following guide in Part 1 - General.

Design Guidelines

- Lighting design shall comply with current IESNA guidelines and application notes, with selection of the median illuminance as the target optimum, not the minimum. In all areas designated higher than IESNA category C, specified illuminance shall be on task, with ambient illuminance generally task/3. In all areas, lighting targets shall be achieved by the most current energy efficient technology which meets the requirements of this Section 16510.
- Incorporation of natural daylight, and daylight-supplementing artificial light.
- Task lighting by LED lamps with laterally offset placement so as not to cause direct or veiling glare.
- Conference room dimming: provide continuous architectural-dimming (to 10%).
- Areas with visible daylight may use continuous-dimming photocell-controlled variable light output devices except those controlled by non-defeatable occupancy sensors. Daylighting contribution to be considered in calculation of IESNA target illuminance.
- Utilize high quality LED fixtures with proven industry records for endurance.

Prohibited technologies include:

- Rapid start systems (non-dimming applications)
- Tungsten filament incandescent except quartz-halogen
- Fluorescent lamps
- VHO and SHO lamps
- Mercury vapor lamps
- U-shaped lamps
- Small-cell paracube grates and large cell paracube fixtures where the lamp is not centered into the cell
- Magnetic fluorescent ballasts
- Series-circuit ballasts
- Indirect lighting in restrooms, corridors, and utility areas
- Neon systems of any type

Vacancy Sensors shall be specified and installed in accordance with EPA Green Lights guidelines, with control technology appropriate to the application. Areas with video display terminals shall be primarily illuminated by task lighting, use of overhead luminaries in each space to be evaluated for Visual Comfort Probability. Visual acuity factors are to be treated as minus weighting factors.

Discouraged Practices

- Indirect cone and soffit lighting

- Fixtures inaccessible from a landing or walkway.

Two level Lighting control should be provided in areas where multi use of the area would require various levels of light control.

Where remodeling is being done in an area it shall be considered to be part of the scope of work to bring the existing lighting in the area into compliance with this section.

In both new lighting and remodeling type lighting projects it shall be required to perform lighting calculations for the proposed systems and to submit point to point, area and lighting density calculations. Provide cut sheets for the fixtures proposed as a part of the schematic design of the project.

Part 1 – General

- Contractor to provide submittals of all light fixtures.

- **Lighting Levels**

  The following information shall be used by the designer in developing a lighting system for each specific project based on IES recommended practices, codes and ordinances, life safety requirements and good engineering practices. Major deviations due to engineering decisions shall be documented in writing and discussed with the UA Electrical Engineer during the design development stage or schematic design stage. When in doubt, call for a presentation by the University.

- **University Lighting Standards**

  Lighting levels at desk or tables tops shall be:

  Hallways: 25 foot-candles average maintained foot-candles
  Public areas: 30 foot-candles average maintained foot-candles.
  Offices: 50 foot-candles average maintained foot-candles.
  Reading rooms: 50 foot-candles average maintained foot-candles.
  Classrooms: 50 foot-candles average maintained foot-candles.
  Laboratories: 70 foot-candles average maintained foot-candles.
  Machine Shops/Workshop: 100 foot-candles average maintained foot-candles.

  Minimum lighting standards shall be defined as average maintained foot-candles (within the range of -10% to +25%) over the life of the lamps, unless otherwise pre-approved by the University.

- **Preferred Lighting Densities**

  The maximum lighting power density (LPD) for any building may be calculated by either the Complete Building Method (Table 2.1) or the Area Category Method (Table 2.2)

Table 2.1
Complete Building Method

Building Type	Max. Lighting Power Density (W/sf)	
	Goals	Max *
General Commercial or Industrial Work Buildings	0.8	
Grocery Stores	1.2	
Industrial or Commercial Storage Buildings	0.5	.8

Medical Buildings and Clinics	1.0	A.R.
Office Buildings	1.0	1.8
Religious Worship, Auditorium/Convention Centers	1.3	A.R.
Restaurants	1.0	
Retail and Wholesale Stores	1.3	A.R.
Schools	1.2	
Theaters	1.0	
All Others	0.5	

*AR means “as required”

Table 2.2
Area Category Method

Area Type	Max. Lighting Power Density (W/sf)	
	Goals	Max *
Auditorium	1.3	A.R.
Bank and ATM’s	1.2	1.8
Classrooms	1.3	1.8
Convention/Conference/Meeting Centers	1.0	2.0
Corridors, Restrooms, Support Areas	0.5	
Dining	0.8	1.4
Exhibit	1.5	2.0
General Commercial and Industrial Work	0.8	A.R.
Grocery	1.3	A.R.
Hotel Function	1.5	
Industrial and Commercial Storage	0.4	1.8
Kitchen	1.5	
Lobbies: Hotel Lobby	1.5	
Main Entry Lobby	1.0	
Malls, Arcades, and Atria	0.8	
Medical and Clinical Care	1.2	A.R.
Office	1.0	1.8
Precision Commercial and/or Industrial Work	1.3	A.R.
Religious Worship	1.4	
Retail Sales, Wholesale Showrooms	1.4	
Theaters: Motion Picture	0.7	
Performance	1.0	A.R.

* AR means “as required”

Part 2 – Products

- Light fixtures are to be the product of a manufacturer of high quality light fixtures generally used in an industrial or commercial type setting. Fixtures shall be UL or CSA listed and certified.
- LED Drivers shall be capable of being removed below ceiling with ground wire attached.
- Fixtures shall be 3500°K with a CRI of 85 minimum.
- Driver shall be installed such that they are contained within the fixture. Where this is not possible the driver shall be installed clear of any combustible material and in an accessible location. Drivers for recessed non-linear type fixtures shall be located between the fixture housing and the junction box.
- No fixtures smaller than 4” shall be installed in hard lid ceilings.

Part 3 – Execution

- Light fixtures shall be installed so that they are accessible for maintenance.
- Reference 16190 for supports.
- Fixtures mounted in a plaster or drywall type ceiling shall be rigidly supported in an approved manner using channels connected to the ceiling support system
- Provide plaster frames for all fixtures requiring them.
- Light fixtures mounted flush in fire rated walls or ceilings shall be rated to the wall/ceiling rating.
- 3/8" light fixture whips may be utilized when fixture whip comes from the factory attached to the fixture via a steel box connection. Wire size shall not be less than #18 THHN. Box connectors must have a locknut, i.e., pop in type connectors will not be permitted. Lengths shall not exceed 6'0". (Tandem whips may be longer with University approval.) Whip will be secured within 18" of J-box.
- Removable snap in entrance fittings shall be secured to the fixture body using a #8 (minimum) self tapping screw.
- 2x2; 2x4; 1x4; 1x6 and 1x8 types of light fixtures including recessed can type fixtures installed in grid ceilings shall be supported using not less than #12 gauge steel galvanized support wire and earthquake clips shall be installed. Each rectangular or square type fixture shall have a minimum of two support wires attached at opposite corners. Each recessed can type fixture shall have a minimum of one support wire. Support wires shall be secured attached directly and independently to the building structure with minimum size ¼" galvanized steel anchors (use expansion type anchors when in concrete). Wires shall have a minimum of three twists (turns) at each attachment point. Deflection on the support wires shall not exceed 10-degrees from plumb. Refer to Section 16190 – Supports – LIGHT FIXTURE SUPPORTS.

End of Section 16510