

SECTION 26 50 00
LIGHTING
Design Standard

PART 1 GENERAL

1.1 PURPOSE

Lighting systems are critical to safety and human productivity in the classroom, lab, office and field. This design standard has the purpose of creating safe, low maintenance, appealing, consistent and efficient lighting system throughout the San Mateo County Community College District.

1.2 GENERAL REQUIREMENTS:

- A. All lighting shall be designed to comply with or exceed Title 24 and follow the recommendations of the Illuminating Engineering Society (IES).
- B. Comply with applicable ANSI standards pertaining to lamp materials, lamp ballasts and transformers, and luminaires.
- C. Comply with applicable NEMA standards pertaining to lighting equipment.
- D. Lighting fixtures shall be on the Design Lights Consortium Qualified Products List and/or Energy star rated depending on the fixture type.
- E. Provide luminaires and lamp holders which comply with UL standards and have been UL listed and labeled for location and use indicated.
- F. Provide attic stock as noted:
 - 1) Furnish 1 percent extra lenses or louvers for each Luminaire size and type
 - 2) Furnish 1 percent extra lamps for each size and type installed.
 - 3) Furnish 1 percent extra drivers for each size and type.
- G. Comply with CEC as applicable to installation and construction of luminaires.
- H. Comply with fallout and retention requirements of CBC for diffusers, baffles, louvers, and the like.
- I. Provide recessed LED fixture supports as required by DSA.
- J. Lighting design to conform with latest Title 24 requirements for energy efficiency and control.
- K. Provide lighting levels for both interior and exterior spaces that conform to IES recommendations for the task and type space to be illuminated.
- L. Lighting in office and study spaces to be designed for minimum levels of ambient light. Task lights to be provided at each workstation to provide required lighting level at the work plane. Generally, task lights to be incorporated into the system furniture, coordinate with design team and provide LED task lights where not otherwise furnished.
- M. Submit documentation to the District for any and all rebate/incentive applications that may apply to the project.

PART 2 PRODUCTS AND PERFORMANCE

2.1 LIGHTING AS A SYSTEM

SMCCCD views Modern Lighting products as a system typically consisting of LED fixtures with hardwired or wireless tunable/dimmable controls with BACnet integration capabilities. All designs shall include and consist of a comprehensive system single line electrical diagram, and controls architecture in addition to specifications for lighting fixtures, switches, controls and any associated hardware. Software products and dashboards must be compatible with existing systems. The lighting system is complete upon full commissioning of light levels, control sequences and confirmed acceptable operation of luminaires by Campus and District Maintenance and Operations Staff.

2.2 LUMINAIRES

Luminaires shall meet code requirements and industry standard of design and care. All Luminaires must be listed as Design Lights Consortium approved products.

- A. Where recessed luminaires are installed in cavities intended to be insulated, provide IC rated luminaires or other code approved installation.
- B. UL label luminaires installed under canopies, roof or open porches, and similar damp or wet locations, as suitable for damp or wet locations.
- C. Recessed Luminaires: Frame compatible with ceiling material installed at particular luminaire location. Provide proper factory trim and frame for luminaire to fit location and ceiling material.
- D. Finishes:
 - 1) Manufacturer's standard finish (unless otherwise indicated) over a corrosion resistant primer. Interior Light Reflecting Finishes: White or specular finish with not less than 85 percent reflectances.
 - 2) Interior fixtures shall be standard manufacturer models with standard colors and finishes or match existing. All custom colors and finishes shall be approved in writing by SMCCCD's Representative.
 - 3) Exterior Finishes: In most cases, to match existing. Confirm with the Executive Director of Construction Planning or the Vice Chancellor of Facilities.
- E. Light Transmitting Components:
 - 1) Plastic diffusers, molded or extruded of 100 percent virgin acrylic.
 - 2) Prismatic acrylic, extruded, flat diffusers, 0.125 inch overall thickness.

2.3 DRIVERS

Drivers shall meet code requirements and industry standard of design and care.

- A. Provide drivers UL rated for specified lamps:
 - 1) Drivers shall have a minimum efficiency of 85%
 - 2) Starting Temperature of -40F
 - 3) Input voltage 120V to 480V nominal (+/- 10%)
 - 4) Power Factor to exceed 0.90.

- 5) Provide poles and pole bases rated for area's minimum wind EPA loading for quantity and type of luminaire it supports with a 1.3 gust factor.
- 6) Provide poles with gasketed hand holes, stainless steel tamper resistant hardware and ground lugs.

2.4 LAMPS

Lamps shall meet code requirements and industry standard of design and care.

- A. Specify the provision of similar lamps by a common manufacturer. The predominant interior fixture lamp should be LED Troffer Retrofit kits, though some fixtures may be fully replaced with new LED troffers and others will be lamp replacements, as determined appropriate by the contractor with approval and acceptance by SMCCCD. Fixtures other than retrofit-kits may be used to achieve the safety, lower maintenance, and energy efficiency goals of this project. For instance, TLED lamps may be used in certain places, if they support the design objective, while maintaining or improving the quality of the interior visual environment and minimizing design changes and future maintenance to the existing buildings. SMCCCD requires the electrical contractor to take appropriate measures to meet Title 24 requirements for the different space types in the building in terms of lighting power density (LPD) and Lighting controls. Refer to Title 24, Part 6 for a full summary of the requirements.
- B. LED: Lighting Technology other than LED: Not allowed unless approved by SMCCCD
 - 1) Color temperature to be match existing fixtures or 3500K unless otherwise specified
 - 2) Operating temperature for exterior fixtures: -40F to 120F
 - 3) Lamp CRI is to equal or exceed 80.
 - 4) Minimum 60 Lumens/Watt
 - 5) Utilize high performance Class 1 LED System.
 - 6) Dimming required to 5%, except specialty location such as auditoriums, theater, and similar spaces where dimming shall be to 0%
 - 7) Fixtures should be able to be made individually addressable given the lighting control system in the building.
 - 8) Retrofit kits should be considered over entirely new fixtures wherever aesthetic appeal, ease of installation and maintenance and functionality is maintained.

2.5 Emergency Lighting

The design professional shall design emergency lighting to meet code requirements and industry standard of design and care

- A. Most areas of each campus do not have emergency generators.
- B. Individual battery units should be avoided because they constitute a greater operational cost for maintenance staff.
- C. If individual battery powered emergency lights are more appropriate to any particular new construction or retrofit project, the design professional must first seek approval from the SMCCCD Project Manager
 1. If battery powered emergency downlights smaller than 6" in diameter are approved, also provide access hatches for emergency battery backup ballasts, adjacent to downlights installed in inaccessible ceilings.

2.6 Exit Lights

Exit lighting shall be designed to meet code requirements and industry standard of design and care.

- A. Exit fixtures shall be AC, LED with battery backup, self-diagnostic, thin profile for high abuse areas. Color of lettering shall be Red or Green, as determined by the Executive Director of Construction Planning and/or the Vice Chancellor of Facilities.
- B. For illustrative purposes, this Energy Star rated Lithonia EDG/R or Evenlite Telesis exit light (with LED lamp, hardwired to building emergency power inverter and/or Nickel-Cadmium Battery backup) are the preferred type of exit lights.



- C. Non-electric supplied exit signs shall be non-radioactive photo luminescent signs. Tritium powered (radioactive) exit signs are prohibited for installation on campus.

2.7 Exterior Lighting Poles

All lighting poles to meet the following requirements based on Code requirements and industry standard of design and care.

- A. Provide exterior light poles with minimum 30" concrete bases when installed in vehicle traffic area or direct buried in pedestrian or landscaped areas and which are structurally supportive of pole under design loading.
- B. Provide exterior poles clean and scratch free with base bolt covers to match pole and luminaire finish.
- C. Provide poles and pole bases rated for area's minimum wind effective projected area (EPA) loading for quantity and type of luminaire it supports with a 1.3 gust factor.
- D. Provide poles with gasketed hand holes, stainless steel tamper resistant hardware and ground lugs.
- E. Provide concrete footings for pole-mounted lighting units and bollard lights.
- F. Ensure installation of luminaire poles plumb and straight.
- G. Exterior fixtures to be capable of multilevel control as required by Title 24.
- H. Lighting fixture shall be capable of providing IES type II, III, IV and V distributions.
- I. Provide labeling, asset tags and associated schedule of assets for all new or retrofit lighting poles (including any changes made to the luminaire) as designated by the SMCCCD Project Manager.

2.8 INTERIOR LIGHTING REQUIREMENTS

Interior lighting shall be designed to meet code requirements and industry standard of design and care.

- A. Philips EvoKit LED retrofit Kit, or equivalent, shall be specified for classrooms, offices and other spaces with similar lighting requirements.

- B. An equivalent pendant-type fixture, such as Finelight, is acceptable in applications without suspended ceilings.
1. Specify the provision of similar lamps by a common manufacturer. The predominant interior fixture lamp should be LED Troffer Retrofit kits, though some fixtures may be fully replaced with new LED troffers and others will be lamp replacements, as determined appropriate by the contractor with approval and acceptance by SMCCCD. Fixtures other than retrofit-kits may be used to achieve the safety, lower maintenance, and energy efficiency goals of this project. For instance, TLED lamps may be used in certain places, if they support the design objective, while maintaining or improving the quality of the interior visual environment and minimizing design changes and future maintenance to the existing buildings. SMCCCD requires the electrical contractor to take appropriate measures to meet Title 24 requirements for the different space types in the building in terms of lighting power density (LPD) and Lighting controls. Refer to Title 24, Part 6 for a full summary of the requirements.
 2. A lifecycle cost analysis (LCCA) shall be completed to evaluate any proposed equivalencies. A lifecycle cost analysis can show the financial value of the new lighting solution over time and includes factors other than first cost. The following factors should be included in the LCCA:
 - a. Electricity cost rate: \$0.14/kWh
 - b. Electricity escalation rate: 3%
 - c. Discount rate: 4%
 - d. Time period: 15 years
 - e. Annual lighting hours of operation: 3,500 hr/yr
 - f. Annual maintenance cost (\$): provided by contractor
 - g. Total first cost (\$): provided by contractor
 - h. The LCCA should report Return on Investment (ROI), Net Present Value (NPV), and total cost of ownership (TCO).
- C. All lighting fixtures shall be selected and their placement designed with operational and maintenance requirements in mind.
1. Specify fixtures that can be serviced by a single maintenance staff person (i.e., that do not require more than one person to service the fixture due to lens attachment configurations, ballast access configurations, etc.)
 2. Specify fixture locations in areas that allow maintenance personnel to access the fixture for re-lamping or other service with a standard 6', 8' or 10' ladder. High bay ceilings are an exception to this requirement; high bay ceiling fixtures can be accessed with a lift, provided the floor is flat.
 3. Restroom lighting shall be specified with acrylic lenses for ease of cleaning. Per Restroom Design Standard, avoid installation of lighting over stalls (hard to relamp).
 4. In stairways, do not design fixtures that cannot be safely serviced from a flat landing area of the stairway.
 5. Predominantly, LED luminaires shall be 2x4 (not 2x2). This preference is stated in an effort to minimize the number of types of luminaires needed for replacement stock.
 - a. Where luminaire form factors may differ, driver manufacturer and type shall be uniform wherever possible as to eliminate the need for separate replacement stock.
 6. Lighting levels to meet IES Recommendations

- D. The following classroom lighting conceptual planning aspects shall be reviewed in the schematic design phase for classroom lighting and switching.
1. For classrooms supporting AV presentations, provide at a minimum bi-level switching. The first row of lights in these rooms is to be switched separately and controlled from the front of the class for control by the instructor. The switch shall be identified by a distinct color (preferably, blue). This is intended to support AV presentations while still allowing some light for emergency egress, general circulation and note taking.
 2. Half or greater than half of each fixture lamps are to be tied to the front zone and manually controlled on/off by switches at the podium or nearest exit door to instructor, whichever is closest.
 3. Switch control labeling and relative position: Label all light control switch device plates only at instructional podium position in rooms where there are more than two switches in a single gang. Possible labels for the lights operated – FRONT, MIDDLE, BACK, SCREEN DIM, TABLE, CHALKBOARD, AISLES, etc. Lettering to be minimum 1/8" high, in nonitalicized, sanserif font, either all upper case or upper and lower case. Orient all switching positions and labeling to the room orientation.
- E. In small rooms or offices with more than one light fixture, do not tandem wire the fixtures such that they rely on a single ballast. The intent of this requirement is that a single ballast failure will not result in total darkness within an enclosed space.
- F. Network lighting control system shall have the ability to interface with the existing campus building management system via BACnet IP. The campus Facility Management System shall have the capability to turn individual fixtures, zones, and the entire array of fixtures on and off with less than 30 second delay between command and response
- G. Daylight, occupancy, vacancy and other sensors shall be designed and installed to meet or exceed code. Consult design standard 26 09 26 "Lighting Controls for further information
- H. Laboratories should incorporate best practices as applicable from the "Labs for the 21st Century: Best Practice Guide – Efficient Electric Lighting in Laboratories" (http://www.i2sl.org/documents/toolkit/bp_lighting_508.pdf) including, as appropriate:
1. Use indirect/direct lighting fixtures with at least 70 percent up light and at least 5 percent down light.
 2. Make all light measurements 12 inch in from edge of work surfaces at 24 inch increments along the length of the work surface.
 3. Evenly distribute the illumination over the full length of the bench.
 4. Pay attention to reflective surfaces and glare.
 5. Where a large amount of daylighting is available, the use of a higher CCT may be appropriate.
 6. Provide a locally controlled task light level not to exceed 100 fc at 12 inch in from edge of work surface at all locations where critical task work may be performed. Tailor the light level to the specific task, closer to 100 fc for critical work, closer to 50 fc for non-critical work.
 7. Match task lamp color temperature to general illumination color temperature.

2.9 Exterior Lighting Requirements

Exterior Lighting shall be designed to meet code requirements and industry standard of design and care. In addition, take into account the following considerations:

- A. The District's current exterior lighting system is Enlighted. Integration into this system is encouraged.
- B. Communications between fixtures and the network shall default for failed communication to "on"
- C. Network lighting control system will control all lights in zones (parking lot, roadway, etc.) and sub-zones (intersection areas, high traffic, secure areas, etc.) that will be defined by the user during the project. The network lighting control system will execute the sequence of operations that is defined by the District during the project.
- D. Networked lighting controls must have an astronomical clock function.
- E. Each fixture shall have an integrated photocell/occupancy sensor control device with additional capability to control a high and low light level based on a signal from the network lighting control system. High and low levels shall be adjustable.
- F. The network lighting control system will be capable of allowing each fixture to be controlled by its own occupancy sensor and photocell, with programmable time delays, sensitivity, and light levels
- G. The network lighting control system will also allow fixtures to be in multiple control groups so that their on-off and dimming operation is remotely controlled according to programmable logic. This will allow a large group, such as a section of parking lot, to be controlled together. It will also allow the programming of smaller groups, such as every fixture adjacent to any other fixture, so that a finer level of control can be achieved. Each fixture can be in multiple control groups.
- H. The network lighting control system shall have the capability to monitor, track, report, and store operating and energy use data for the controlled fixtures.
- I. The network lighting control shall retain basic sequence of operations and functionality in the event of loss of communication with the BMS.
- J. The network lighting control system shall be provided with functionality to override the basic control sequences, e.g. when override control is required.
- K. When the system operates improperly, such as fixtures not following required commands, the network lighting control system software shall initiate factory-programmed diagnosis of failure and display messages/provide alerts identifying the problem and possible cause(s).
- L. The network lighting control system functionality should be accessible through a web-based service with multi-level password and access control.
- M. The network lighting control system shall have the ability to interface with the existing campus building management system via BACnet IP. The campus Facility Management System shall have the capability to turn individual fixtures, zones, and the entire array of fixtures on and off with less than 30 second delay between command and response.
- N. Provide a data drop (CAT 6 where appropriate) and route to the nearest IDF cabinet or data connection (in Coordination with District Information Technology Services and Systems Manager).
- O. System manufacturer shall meet the following qualifications and at a minimum shall make the following site visits to ensure proper system installation and operation:
- P. Qualifications for factory certified field service engineer:
 - 1. Minimum experience of 2 years training in the electrical/electronic field.
 - 2. Certified by the equipment manufacturer on the system installed.
- Q. Prior to installation of wiring, system manufacturer shall review with the District the following items:
 - 1. The desired sequence of operations, grouping and sub grouping of fixtures associated with the advanced control system. (Street Lighting, Parking Lots, Secure Areas etc.)
 - 2. Network wiring requirements for the advanced control system.
 - 3. Connections to other equipment (BMS).
 - 4. Advance control system locations and location of associated devices.

- R. Upon completion of the installation, all systems of the networked lighting control system including all other components controlling the associated lights, such as photocell, individual lighting controllers and the networked lighting control systems shall be tested by the manufacturer's certified field service engineer(s) in collaboration with the SMCCCD designated staff person and/or commissioning agent.
 - 1. Commission communication devices, program schedules and all interfaces to ensure a trouble-free wireless outdoor monitoring and control system.
 - 2. System manufacturer shall provide operation, administration and maintenance training of the advance control system to the District at the project site. It shall be comprehensive and cover all aspects of the wireless communication monitoring and advance control system operation, configuration and troubleshooting.
 - 3. Submit a synopsis of the training content with detailed content for approval to the owner at least 4 weeks prior to the initial training.
- S. Design accent lighting for buildings, particularly near entries. Entrance lighting is important as there are as many evening students as daytime students, and accent lighting enhances building wayfinding. Ground mounted uplights should be minimized, but where used should have sealed or remote drivers and sealed conduit to minimize chance of water entering fixture.
- T. All exterior lighting must address dark sky concerns, and to the extent practical specify lights, in advance of code requirements, with cut offs to cover only intended area.
- U. Special controls may be needed to minimize light pollution around astronomical observatories (ground or structure). Work closely with the Executive Director of Construction Planning and/or the Vice Chancellor of Facilities to ascertain the exact areas and controls to be designed near the following locations:
 - 1. College of San Mateo, Building 36 rooftop Observatory
- V. Roadway Lighting on the three campuses shall be high pressure sodium, full cut off, cobra head type.
- W. Luminaires for exterior lighting shall be LED.
- X. Illumination level shall be as follows:

PART 3 EXECUTION

Parking Lot Illumination Requirements			
Level	Horizontal Illuminance Footcandles (avg)	Vertical Illuminance Footcandle (avg)	Uniformity Ratio (max/min)
Basic Maintained Illuminance	0.2	0.1	20/1
Enhanced Security Illuminance	0.5	0.25	15/1

Street Lighting Illumination Requirements			
Street Lighting Classification	Illuminance Footcandle (avg)	Illuminance Uniformity	
		(avg/min)	
Road Way Lighting	0.5	6/1	

3.1 SUBSTITUTES ALLOWED?

Yes, if performance and quality equivalency can be evidenced. Any proposed changes to these standards must be submitted in writing to the Project manager and approved by appropriate personnel at SMCCCD. These standards may contain omissions in specifications or performance requirements. Where omissions may occur, a substitution or proposed solution may be made by the project team.

3.2 ASSOCIATED DESIGN STANDARDS AND CONSTRUCTION SPECIFICATIONS

- A. Space Standards – Administrative Spaces
- B. Space Standards – Circulation Spaces
- C. Space Standards – Instructional Spaces
- D. Restroom Design Standard
- E. 25 55 00 Integrated Automation Facility Controls (Building Management System) Design Standard
- F. 26 27 26 Wiring Devices Design Standard
- G. Division 26 Design Standards

END OF SECTION