PENNSYLVANIA STATE UNIVERSITY - LIGHTING DESIGN & COMMISSIONING MATRIX - JANUARY 2024 - REV 2.3

SPACE TYPE	LUMINAIRE AND CONTROLS REQUIREMENTS (Note 2)				REQUIREMENTS	COMMISSIONING (Note 7)		DESIGN AND COMMISSIONING CONSIDERATIONS AND COMMENTS. (Refer to IBC minimum illumination requirements) (Note 8)
	LUMINAIRE & LIGHTING DESIGN (Note 1, Note 5)	MANUAL CONTROLS	AUTOMATED CONTROLS	ADDITIONAL CONTROL REQUIREMENTS, INCLUDING DAYLIGHT HARVESTING	AVERAGE MAINTAINED HORIZONTAL ILLUMINANCE (FOOTCANDLES) (Note 1)	HIGH-END TRIM (FOOTCANDLES)	SENSOR: UNOCCUPIED TIMEOUT DELAY TO OFF (MINUTES)	
INTERIOR APPLICATIONS								
Vestibule	Refer to IES Day/Nighttime criteria	N/A	Occupancy Sensor	(Note 3)	IES Recommended	-	10	Daylight control per IECC.
Corridor	2x2 recessed volumetric.	N/A	Occupancy Sensor	(Note 3)	15 to 20	-	15	Auto ON to 80%. Dim to minimum light level of 10% when unoccupied. Raise upon detection of occupancy. N/E luminaires to be normally dimming controlled with normal lighting, and in loss of normal power automatically raise to 100% light
Stairwells	(Refer to PSU 26 52 00)	N/A	Occupancy Sensor	(Note 3)	10	-	2 minutes to unoccupied level	Luminaires shall remain illuminated at a reduced output when space is unoccupied; 10 second fade from 100% (occupied) to 10% (unoccupied).
Restrooms	2x2 volumetric. Consider recessed linear perimeter wallslot, and vanity lighting.	N/A	Occupancy Sensor	(Note 3)	15	-	15	(Provide N/E lighting with multi-occupant space.) Daylight control per IECC.
General Public Areas	-	Confirm with PSU Eng Svcs.	Occupancy Sensor	(Note 3)	IES Recommended	-	15	Auto ON to 80%. Dim to minimum light level of 10% when unoccupied. Raise upon detection of occupancy. N/E luminaires to be normally dimming controlled with normal lighting, and in loss of normal power automatically raise to 100% light output. In special applications, consider System Controller timeclock function with manual override. Daylight control per IECC.
Dorm Room / Housing / Food Service	Coordinate with PSU Housing & Food Service.	Wallbox devices for manual-ON, and/or dimming	Dual-Tech Occupancy Sensor in dorm rooms	(Note 3)	IES Recommended	-	15. Verify for Food Service.	IECC.
Storage Room	Recessed volumetric. Back-of-house: surface or suspended direct / indirect.	Raise/Lower dimming.	Occupancy Sensor	(Note 3)	10 to 20 FC. Higher for highly active storage.	-	5	Manual or Automatic ON to 50% power. For warehouse: provide aisle occupancy sensors per IECC. Daylight control per IECC.
Janitor Closet	-	Raise/Lower dimming.	Occupancy Sensor	(Note 3)	20	-	15	Automatic ON to 50% power.
Mechanical Space	Suspended linear industrial strip	Wallbox Timer Switch	N/A	(Note 3)	20	-	4 hours with 5 and 1 minute remain flash	
Elevator Pit	-	Line-voltage Toggle	N/A	N/A	Refer to code.	-	-	No control other than toggle switch.
Elevator Hoistway	-	Line-voltage Toggle	N/A	N/A		-	-	
Elevator Machine Room	Linear industrial strip	Line-voltage Toggle	N/A	N/A		-	-	
Elevator Cab Threshold (Corridor Side)	-	No Control - 24/7 Operation on Emergency circuit.			10 (min). Refer to code.	-	-	(Connect to unswitched N/E circuit.)
Electrical Room	Linear industrial strip	Line-voltage Toggle	N/A	(Note 3)	20	-	-	No control other than toggle switch. (Connect all luminaires to N/E circuit.)
Battery Room (UPS/Inverter)	-	Line-voltage Toggle	N/A	(Note 3)	20	-	-	No control other than toggle switch.
Telecom Closet	-	Wallbox Timer Switch	N/A	(Note 3)	50	30	4 hours with 5 and 1 minute remain flash	(Provide N/E lighting in the space.)
Private Office	Recessed volumetric or suspended linear indirect/direct.	One-zone control with ON/OFF and Raise/Lower dimming control per zone.	Vacancy Sensor	(Note 3)	40 at desk work areas.	30	15	Daylight control per IECC. Program so that the system remembers the previous User-defined dimmed setting and is Manual-ON to that level. Where this is not practical: Manual ON to 80% power.
Open Office	Suspended linear indirect/direct with minimum 18-inch suspension distance from ceiling. Recessed volumetric may also be acceptable. Coordinate with furniture layout.	One or Two-zone control with ON/OFF and Raise/Lower dimming control per zone.	Vacancy Sensor or Occupancy Sensor	(Note 3)	40 at desk work areas.	30	15	Luminaire layout to correspond with daylight zones. Daylight control per IECC
Conference Room: Small	Direct/Indirect linear suspended, linear recessed, or recessed volumetric.	One or Two-zone control with ON/OFF and Raise/Lower dimming control per zone.	Vacancy Sensor	(Note 3)	40 at desk work areas.	30	15	Manual ON to 80% power. Daylight control per IECC. Consider Scene control in addition to raise/lower.

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	LUMINAIRE & LIGHTING DESIGN (Note 1, Note 5)	MANUAL CONTROLS	AUTOMATED CONTROLS	ADDITIONAL CONTROL REQUIREMENTS, INCLUDING DAYLIGHT HARVESTING	AVERAGE MAINTAINED HORIZONTAL ILLUMINANCE (FOOTCANDLES) (Note 1)	HIGH-END TRIM (FOOTCANDLES)	SENSOR: UNOCCUPIED TIMEOUT DELAY TO OFF (MINUTES)	
INTERIOR APPLICATIONS								
Conference Room: Large	Direct/Indirect linear suspended in combination with linear recessed or front, side and rear recessed downlights. Recessed volumetric may also be acceptable.	Minimum of two-zone control with ON/OFF and Raise/Lower dimming control per zone. Consider scene control dimming.	Vacancy Sensor	Integrated lighting and audio/video manual control is typically not acceptable because of long-term maintenance	40 at desk work areas.	30	15	Manual ON to 80% power. Daylight control per IECC. Confirm scene control dimming such as: "ON", "Meeting", "Video", "OFF". Large rooms with video presentations on multiple walls shall have scenes configured for multiple scenarios of use.
General Laboratory Spaces	Extruded Aluminum Direct/Indirect linear suspended beam luminaire, placed and oriented to reduce shadowing on work area. Recessed linear and recessed volumetric may also be acceptable. Coordinate with specific laboratory purpose and environmental conditions.	Zoned control with ON/OFF and Raise/Lower dimming control per zone.	Occupancy Sensor. Consider luminaire-mounted occupancy sensors.	(Note 3)	IES Recommended. Capability to achieve 70 on benches depending on task. 40 at support spaces.	50 at bench. 30 in support spaces.	30	Raise upon detection of occupancy. (N/E luminaires remain on 24/7). Daylight control per IECC. Small labs with single zone may be vacancy sensor. However for safety and workflow concerns, large multi-zone labs shall be occupancy sensor controlled, with each zone dimmed separately. Coordinate special applications and ensure N/E lighting where warranted to promote safety.
Lecture Halls	-	Minimum of two-zone control with ON/OFF and Raise/Lower dimming control per zone.	Occupancy Sensor	An integrated lighting and audio/video manual control is typically not acceptable because of long-term maintenance concerns. (Note 3)	50 at seating areas.	40	15	Manual ON to 80% power. Daylight control per IECC. Confirm scene control dimming such as: "ON", "Lecture", "Video", "OFF". Large rooms with video presentations on multiple walls shall have scenes configured for multiple scenarios of use.
Auditorium Spaces	Discuss LED downlights, theatrical luminaires, CCT, 0.1% dimming, etc.	Discuss application with PSU Engineering Services.		(Note 3)	IES Recommended	-	-	Confirm DMX, fire alarm integration, manual override house lights ON wallstations, safety-by design luminaire mounting locations.
Classroom	(Note 4)	Minimum of two-zone control with ON/OFF and Raise/Lower dimming control per zone.	Occupancy Sensor	(Note 3)	50 at desk work areas.	40	15	Manual ON to 80% power. Daylight control per IECC.
Computer Lab	(Note 4)	Zoned control with ON/OFF and Raise/Lower dimming control per zone.	Occupancy Sensor	(Note 3)	40 at desk work areas.	30	15	Manual ON to 80% power. Daylight control per IECC.
Data Center White Space	-	Zoned control with ON/OFF control per zone.	Occupancy Sensor	(Note 3)	IES Recommended	-	15	Use occupancy sensing and not vacancy sensing for whitespace.
Loading Docks (Interior)	-	Zoned control with ON/OFF control per zone.	Occupancy Sensor	(Note 3)	IES Recommended	-	15	Daylight control per IECC.
Sports Lighting	IES RP-6-20 and NCAA	Coordinate with PSU Engineering Services.		(Note 3)	IES and NCAA Requirements, with margin for increasing over time.	IES/NCAA	-	-
Library	IES RP-4-20	Timeclock in 24/7 highly-occupied areas. Common areas in University libraries may be considered continuously operated and automatic shutoff has security concerns. Provide timeclock schedule dimming reduction with manual raise override, but not automatic OFF.		(Note 3)	IES Recommended	-	Discuss with PSU Eng Svcs.	Daylight control per IECC. In private collaboration areas, provide manual ON to 80% power with raise/lower dimming per zone. Occupancy and Vacancy sensor in various other areas per IECC.
Large Lobby / Atrium	-	Confirm with PSU Eng Svcs. Manual override with raise/lower dimming.	Occupancy Sensor or Timeclock	(Note 3)	IES Recommended	-	10	Daylight control per IECC.
Locker Rooms	Indirect linear suspended or recessed volumetric.	N/A. Confirm.	Occupancy Sensor	(Note 3)	15 to 20	-	15	-

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EXTERIOR APPLICATIONS (Note 6)								
Covered Parking Structure	IES RP-8-18 and IES RP-43-22. Discuss illumination criteria based on IES Lighting Zone recommendations. For the purposes of illumination criteria, parts of Penn State property may be identified as LZ-0, LZ-1, LZ-2 and LZ-3 - with LZ-2 assumed unless it is clear another zone applies. Example for LZ-2: Building Entrances: 1-2 FC; Walking surfaces (general and adjacent to landscape): 0.4 to 0.8 FC with 10:1 Avg:Min; Walking surfaces (adjacent to architecture / exits / hardscape): 1 to 2 FC with 10:1 Avg:Min; Stairs and Ramps: 2-3 FC.	Confirm with PSU Eng Svcs. Manual override.	IES & IECC	Dimming per ASHRAE 90.1	IES Recommended. Table 4.	-	-	Refer to IES Recommended Practices for vertical illumination and uniformity requirements and security lighting recommendations. Many areas of an outdoor campus environment have pedestrians throughout the night and it is typically important to maintain illumination levels (not dim) for safety and security.
Exterior Building Mounted		-	CCS. Integral photocell and motion sensor dimming may be acceptable.		IES Recommended	-	-	
Exterior Parking Areas and drive aisles		-	CCS On/Off. Typically motion sensor dimming is not acceptable for safety reasons.		IES Recommended. Table 2. 0.3 minimum with 0.5 average. 4:1 avg:min.	-	-	
Sidewalks		-	CCS	-	1 FC near streets. 0.5 far from streets. IES Recommended.	-	-	
Streets and intersections		-	CCS	-	Table 8. IES Recommended	-	-	
Bus Pull-off Areas		-	CCS	-	IES Recommended. Minimum of 2.5 average.	-	-	
Exterior Congregating Areas		Confirm with PSU Eng Svcs. Manual override. Consider raise/lower dimming.	CCS	-	IES Recommended. 0.8 to 1.5.	-	-	
Crosswalks and midblock crossings		-	CCS	-	IES Recommended	-	-	
Loading Docks (Exterior)		-	Occupancy Sensor-controlled lights dim when no occupancy	-	IES Recommended	-	-	
Sports Lighting	IES RP-6, NCAA, Broadcast requirements.	Confirm with PSU Eng Svcs.	CCS. Confirm	-	IES, NCAA, Broadcast	-	-	
Event / Game day Lighting	Events may warrant increased lighting levels, but only when needed for the event. Lighting should be provided to normally achieve non-event illumination levels (IES RP-43-22); Event lighting mode should be manually-activated and automatic timed-OFF to non-event illumination levels. Event lighting may be considered in IES RP-43 as "Spectator Areas for Outdoor Sporting Venues" (1 to 2 FC) or "Amenity Areas" (2 to 4 FC in LZ-2 and 4 to 8 FC in LZ-3).	Zone / Scene control	CCS On/Off with downstream automatic return to non-event light levels	-	IES Recommended	-	-	

NOTES

Note 1: Refer to the latest IES Recommended Practices and consult with Penn State Engineering Services. Refer to IES Recommended Practices for additional criteria, including vertical illuminance and uniformity ratios. Refer to IBC for minimum egress lighting levels.

Note 2: These requirements shall not be construed to supercede adopted building codes or direction from the Authority Having Jurisdiction. Refer to code and AHJ.

Note 3: Comply with IECC and ASHRAE 189.1 per Penn State Design and Construction Standards Division 01 80 00 and OPP exceptions. Note that this may be more stringent than currently adopted codes and requires daylighting control as applicable.

Note 4: Refer to the latest edition of Penn State Classroom and Technology Design & Construction Minimum Requirements.

Note 5: In addition to IES recommendations, coordinate the lighting design strategy with the architectural and interior design concepts, human visual perception and physiological response, and safety/security criteria. Provide lighting systems that can be readily maintained throughout the facility life cycle. Perform safety-by-design analysis of lighting systems to promote a safe-to-maintain built environment, including reducing mounting heights of lighting hardware in multi-story spaces. LED unless otherwise coordinated.

Note 6: For these and other exterior applications, refer to the latest edition of IES RP-8 and IES RP-43.

Note 7: Penn State buildings often may experience occupancy at any hour of the day. Where timeclock/scheduled control is deployed, provide accessible manual controls to raise lighting level after hours to aid special events and cleaning. 30 minute override.

Note 8: For UL924 bypass relay dimming control of emergency lighting, refer to 26 52 00 EMERGENCY LIGHTING specification section. For additional lighting and controls requirements, refer to 26 09 00 INSTRUMENTATION AND CONTROL FOR ELECTRICAL SYSTEMS and other Division 26 sections.