LIGHTING DESIGN CONCEPT & PERFORMANCE

learning objectives and outcomes

OBJECTIVES

This assignment integrates concepts from the other modules as students create a lighting design for a defined space within a studio project. Lighting within the space is seen as integral to the basic design features of the space - its brand identity, spatial and material qualities and patterns of use. Success of the design is evaluated for both qualitative and quantitative aspects.

TASK ONE

- INTEGRATE - design thinking about lighting with overall design goals for the space and its use
- ESTABLISH - design criteria for lighting through observation and research

TASK TWO

- INTERACT - with spatial environments through hands-on experience
- RESPOND - to how daylight positively or negatively affects our experiences with space with design proposal

TASK THREE

- CREATE - conceptual design based on design criteria and daylight optimization
- EVALUATE - analyze lighting design performance relative to established goals

TASK FOUR

- COMMUNICATE - use lighting vocabulary and graphic representation to summarize design solution and beneficial properties

EDUCATORS NOTE- the above project is broken into four distinct task options to allow for different levels of engagement with the problem. An Addendum is provided showing additional ways to graphically present lighting quality and quantity.

ASSIGNMENT

Your assignment is to create a lighting design for a specific space within your studio project. Special attention should be placed on the role of lighting to reveal and define space and support desired uses. Additionally aim for your lighting design to conserve energy and enhance visual comfort for people by optimizing daylight and providing energy-efficient and well-controlled electric lighting.

TASK ONE: ESTABLISH LIGHTING DESIGN CRITERIA

Select a space in your studio project in which daylight plays an important role in illuminating the space. In selecting the space for your analysis. Similar to the Lighting Observation assignment, select a space that will provide a variety of lighting needs and opportunities for specific users of the space throughout the day and week. Establish criteria to support aesthetic as well as the functional objectives of the space.

1. Establish brand identity, typical users and analysis operations of the space.
2. Image collection to capture or explain ideas for spatial, material and lighting qualities.
3. Establish lighting design criteria for aesthetic and functional concerns; sketch a concept plan highlight use areas.

TASK TWO: OPTIMIZE DAYLIGHT

Experience and analyze the available daylight for the space. Assess existing illumination patterns and propose interventions to control and optimize the light.

1. Site visit or physical model analysis of daylight quantity and quality.
2. Design daylight control device and assess results.

TASK THREE: DEVELOP LIGHTING DESIGN CONCEPT

Conceptualize how electric lighting design can enhance visual comfort in the space with minimal energy use. Consider layouts and controls to provide a positive user experience as people interact with lighting in the space from day to evening. Evaluate the success of design proposals by comparing measured results to established lighting design criteria.

1. Lighting concept plan connecting electric lighting to use of the space.
2. Refine concept using layered lighting and adjusting the controllable aspects of light.
3. Test and play with light distribution strategies using digital simulation.

TASK FOUR: COMMUNICATE LIGHTING DESIGN

Communicate final lighting design in terms of experiential qualities and measured performance for specified lighting components.

1. Lighting layout and specification using reflected ceiling plan, details and schedules.
2. Lighting performance using renderings, control plan and energy intensity data.

ASSIGNMENT

The first task is to create a branded identity for your project. What are the important underlying needs of the building aesthetic. what are the drivers behind your architectural, interior and lighting schemes.

IDENTITY

- Om the mat is about inspiring the individual, about creating space and program for everyone.
- The lighting should be as adaptable to support a variety of moods for the different exercise classes.
- The ambience supports a theme of personal comfort within an open, industrial zone.
- The lighting will emphasize the exercise area as a singular 'open space' expression, with accent on the instructor.

TYPICAL USERS

- Pre work morning users.
- Lunchtime yoga users
- Private lessons
- Typical early evening classes

ASSIGNMENT

Chart the operational hours of your building type and provide a typical user function during each hour. This will help you identify what lighting needs your building will experience at the various times of day. Part of energy-efficient design is knowing when daylight may be harvested and what functions are performed at what time. Then your design may provide suitable lighting only for what is necessary.

OPERATIONAL ANALYSIS CHART

TIME OF DAY	TYPICAL USER	# USERS	ACTIVITIES AND FUNCTIONS
7:00 am	morning classes	10 - 20	pilates
8:00 am	morning classes	10 - 20	normal yoga
9:00 am	morning classes	10 - 20	extreme relax yoga
10:00 am	individual classes	10 - 20	high energy yoga
11:00 am	individual classes	10 - 20	pilates
12:00 pm	lunch crowd	20 - 30	normal yoga
1:00 pm	lunch crowd	20 - 30	extreme relax yoga
2:00 pm	lunch crowd	20 - 30	high energy yoga
3:00 pm	individual classes	2-3	one-on-one training
4:00 pm	individual classes	2-3	one-on-one training
5:00 pm	individual classes	2-3	one-on-one training
6:00 pm	post work crowd	20 - 40	normal yoga
7:00 pm	post work crowd	20 - 40	extreme relax yoga
8:00 pm	post work crowd	20 - 40	high energy yoga
9:00 pm	post work crowd	20 - 40	pilates

ASSIGNMENT

Collect images to capture or explain ideas you have for the brand identity and use of the space. What spatial, lighting and materials qualities will the space exhibit? These images can assist you later on as you make decisions on how light is distributed and the texture and reflectance of materials.



The studio space should appear open and fluid, receiving most of its light from the outside environment. The interior electric lighting scheme should interact with a soft materials palette to introduce diffuse luminous surfaces. Direct overhead-mounted lighting will provide accent light for instructor demonstration zones.

ASSIGNMENT

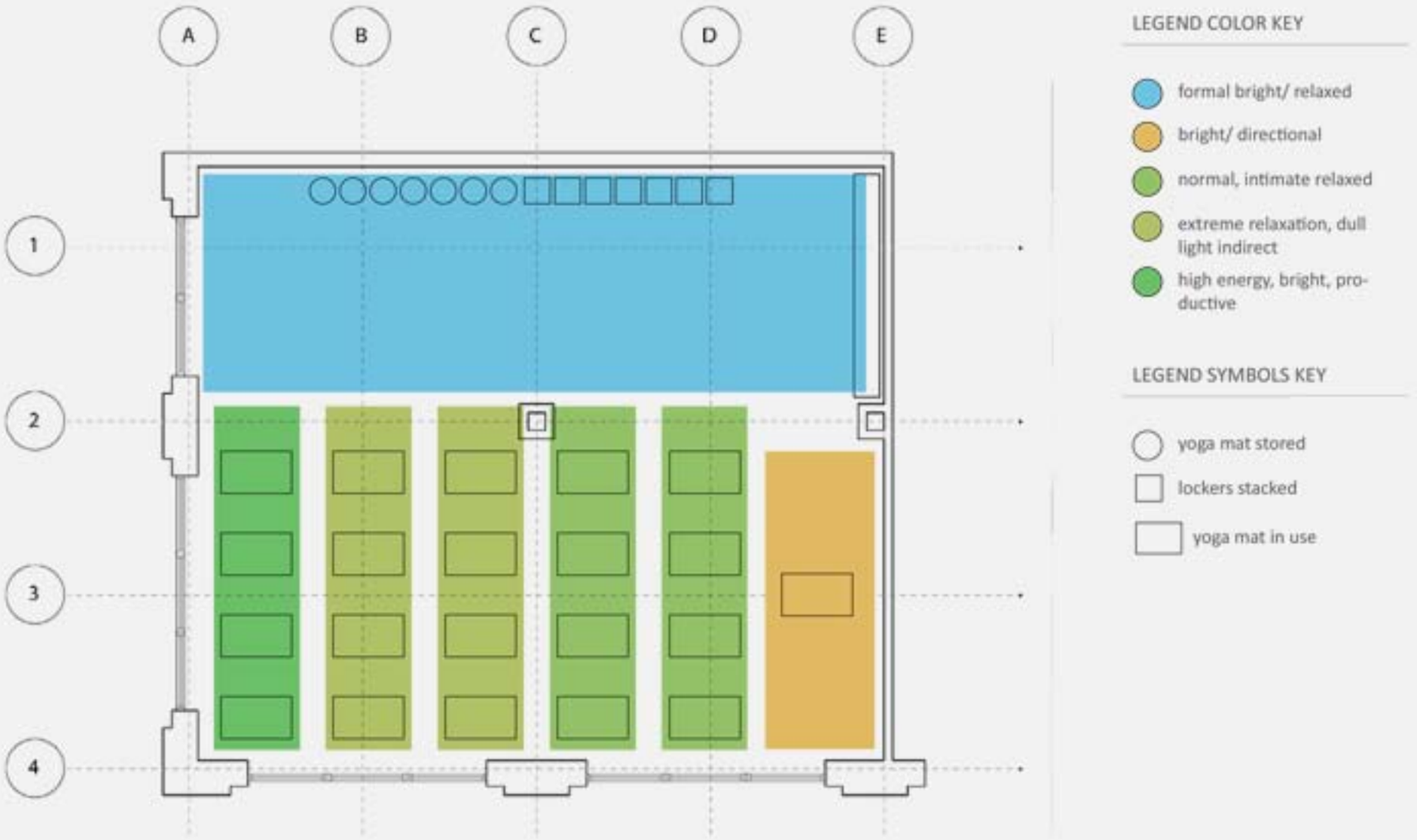
Create a chart that organizes the various spaces within your program and identifies your design goals, desired spatial qualities and activities that will take place within them. For specific tasks within the space, refer to IESNA guidelines to identify an appropriate illuminance target in footcandles or lux, associated to a particular workplane or surface. By breaking down a larger space into smaller individual spaces, it will provide a clearer and more organized way to identify lighting needs based not only on aesthetic value but functional necessity. You may also use this chart to consider how the lighting is distributed throughout the space, creating depth and focus to areas while balancing this with ambient lighting.

LIGHTING DESIGN CRITERIA CHART

SPACE	DESIGN	SPATIAL QUALITY	ACTIVITIES	ILLUMINATION
preparation	formal, bright relaxed	clarity and reference of orientation	greet visitors, administrative	15 -20 fc
teaching area	bright, directional	daylight, clarity for demonstrations	demonstrations, instruction, practice	15 - 20 fc
workout area: normal yoga	intimate, relaxed	daylight. focus on activity, opportunity for both relaxation and stimulation	stretching, movement, strength training, viewing, posing	10 - 15 fc
workout area: extreme relax	calm, dull lighting, indirect	daylight. focus on activity, opportunity for both relaxation and stimulation	pre natal. stretching, breathing exercises, laying down on floor	5 - 7.5 fc
workout area: high energy	bright proactive	daylight. focus on activity, opportunity for both relaxation and stimulation	pilates, power yoga, constant moving, vigorous	35 - 45 fc
restroom	intimate/ dim	avoid institutional light by overlighting	hygiene	10 - 20 fc
storage	well lit	artificial light very bright	storing items	30 - 50 fc

ASSIGNMENT

Create a conceptual floor plan to coordinate with your Lighting Design Criteria Chart. Identify the subspaces and the desired ambience for lighting. Identify where natural light is entering the space through windows or skylights. Show the flow of people and relationship of the various uses.



ASSIGNMENT

Visit your space if this is possible. Alternatively, build a daylight model to use in analyzing daylight in the space. Whether in the actual space or in the model, create an evenly spaced grid of points on a measurement plane. This plane is typically a horizontal "workplane" at around 30 or 36 inches above the floor. It can also be the floor plane, or a wall plane depending on the use of the space.

ASSIGNMENT

Record your measurements on a plan or elevation, and in a chart like the one below. The following example shows two sets of Illuminance readings for the floor plane (0" above floor) of the Om the Mat yoga studio. The analysis was done for two different sky conditions and time of afternoon.

DAYLIGHT MEASUREMENT WORKSHEET

Sky condition: Very Overcast
Time of day (start/stop): 3:30-5:00
Date: Jan. 31, 2011
Room or model name: In front of Alumni Hall, on the ground
Height of measurement plane (Ie. 30" or 36" AFF) 0"
Comments (Ie. room lights off if possible) Building to the south

METER READINGS (I = Illuminance measured in fc)

Meter location in Model or Room	Initial Meter Readings - Average of 3-5 readings per location: I ex External Meter Reading (average)	I int Internal Meter Reading (average)	Daylight Factor (Ratio of I int/ I ext)	Illuminance (fc) I int (adj) Adjusted for 2500 fc exterior daylight
Sample	*3076*	*152*	*0.049*	*124*
1	785	69	0.088	220
2	720	33	0.046	115
3	728	28	0.038	96
4	785	50	0.064	159
5	720	35	0.049	122
6	728	30	0.041	103
7	785	34	0.043	108
8	720	30	0.042	104
9	728	25	0.034	86

DAYLIGHT MEASUREMENT WORKSHEET

Sky condition: Overcast
Time of day (start/stop): 4-5pm
Date: Feb. 7, 2011
Room or model name: In front of Alumni Hall, on the ground
Height of measurement plane (Ie. 30" or 36" AFF) 0"
Comments (Ie. room lights off if possible) Building to the south

METER READINGS (I = Illuminance measured in fc)

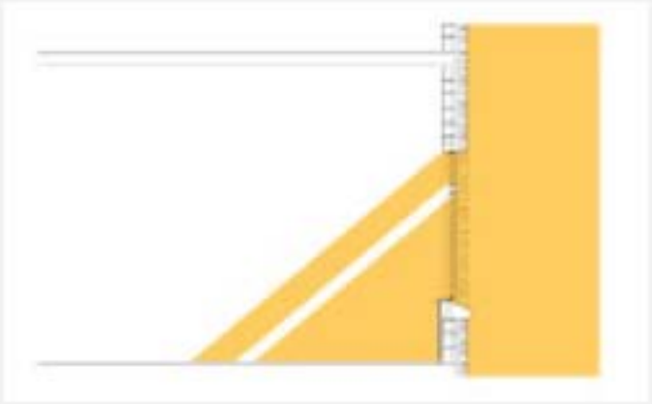
Meter location in Model or Room	Initial Meter Readings - Average of 3-5 readings per location: I ex External Meter Reading (average)	I int Internal Meter Reading (average)	Daylight Factor (Ratio of I int/ I ext)	Illuminance (fc) I int (adj) Adjusted for 2500 fc exterior daylight
Sample	*3076*	*152*	*0.049*	*124*
1	785	32	0.041	102
2	720	10	0.014	35
3	728	6	0.008	21
4	785	26	0.033	83
5	720	13	0.018	45
6	728	5	0.007	17
7	785	24	0.031	76
8	720	11	0.015	38
9	728	4	0.005	14

In addition to recording the Illuminance at a point, these tables express the daylight factor for the various grid locations. Daylight factor is calculated under overcast sky conditions only. It is the ratio of the interior Illuminance to the exterior Illuminance. As such it describes how much available daylight is present in the interior due to architectural constraints such as solar orientation and fenestration.

ASSIGNMENT

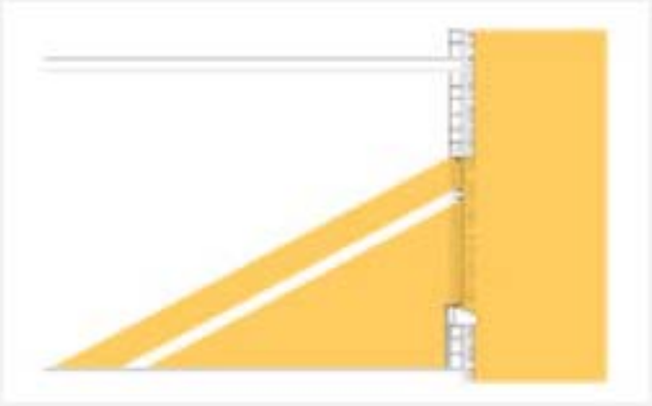
Use a sun angle chart to determine the solar altitude angle at key points during the year. Visually chart how sun would penetrate into the space in section view. You may also wish to create a similar study using the solar azimuth angle and a floor plan. Alternatively you may wish to study the sun penetration more comprehensively by placing a physical model on a Heliodon or other tilt table device that will mimic the changing solar conditions. A digital model with sun study capabilities is also an alternative at this juncture.

Existing condition of south-facing yoga studio wall, (40 degrees north latitude)

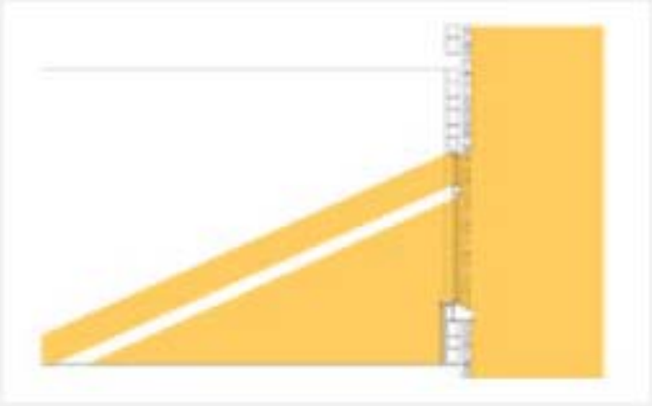


MARCH/ SEPTEMBER 21, NOON
SUN ANGLE 50 DEGREES

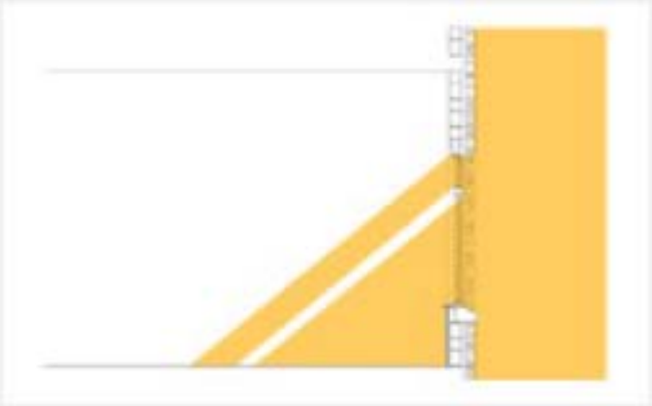
JUNE 21, NOON
SUN ANGLE 75 DEGREES



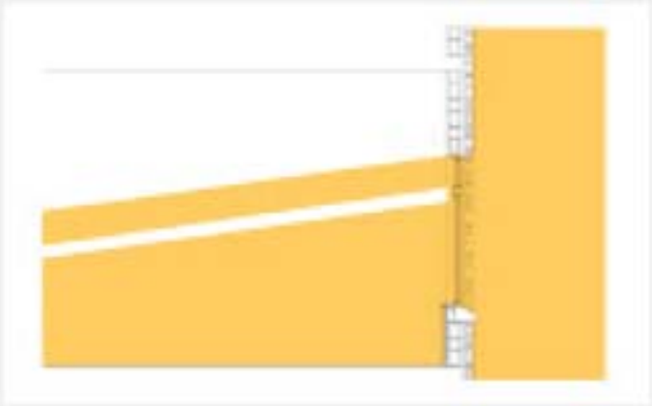
DECEMBER 21, NOON
SUN ANGLE 28 DEGREES



MARCH/ SEPTEMBER 8 AM
SUN ANGLE 24 DEGREES



JUNE 21, 8 AM
SUN ANGLE 39 DEGREES



DECEMBER 21, 8 AM
SUN ANGLE 8 DEGREES

ASSIGNMENT

The previous observations should give you an idea of how daylight is working well in the space, or how it is perhaps too intense or poorly distributed. Keeping in mind your desired lighting qualities for the space, explore a variety of options for controlling the available daylight to your advantage. Create a chart that organizes the various findings associated with some potential daylight control devices. Pay attention to how the space is conceptually laid out, and allow yourself to adapt the concept plan to be more in harmony with the existing light conditions. True, control may be possible through use of special glazing or window films. However, this exercise urges you to consider a more architectural solution involving exterior or interior devices. They may be permanent like overhangs or more ephemeral such as interior blinds or draperies.

OPTIONS FOR ARCHITECTURAL DAYLIGHT CONTROL

OPPORTUNITIES	SOLUTIONS	DAYLIGHT CONTROL	NOTES
unsuitable glare from the large windows, particularly during winter months.	sloped louvers will reflect direct sunlight out of the room	multiple light shelves sloped downwards	i question whether the addition of louvers will reduce the light too much. Will privacy be a problem for passersby?
the client wishes to harvest daylight from upper level tier windows and diffuse it into the space	reflect the light up so it can diffuse off of the concrete ceiling	sloped mirror light shelf will help to reflect the angle of the sun into the room.	will incoming light be too bright. will the ceiling be too bright for people looking up at the ceiling while doing yoga.
the client wants evenly distributed light throughout the entire space	diffuse light	see both options above	will this work for all times of day throughout the entire year.

CONCLUSIONS FOR DAYLIGHT CONTROL

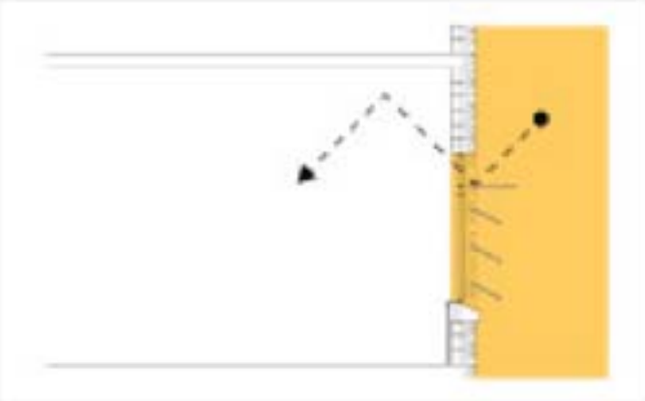
The shade device we designed for this situation is composed of two portions. The first was created for the larger lower windows and is designed to greatly reduce the amount of light entering the space. This would eliminate and control any glare that might disrupt the yoga students as they attempt to relax and practice their art. It was determined that the best solution for this was to have three wide horizontal louvers sloped downward on each window. This would minimize glare but allow for exterior vision.

The second portion of the shade device was an exterior light shelf/overhang applied to the upper windows. Here the intent is to distribute daylight deeply and indirectly into the space, especially since we have blocked it at the lower window zone. The top surface will have a white matte reflective finish on the top surface to reflect the light upward to the ceiling. The white painted ceiling will further diffuse the light into the space.

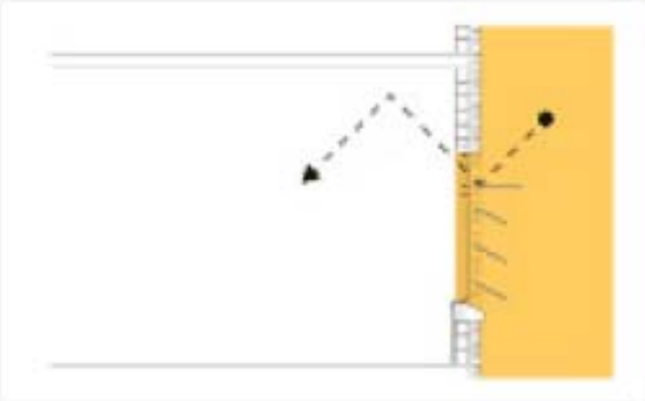
ASSIGNMENT

Adjust your visual study of sun penetration to account for the addition of daylight control. Adjust the design of the intervention until you are satisfied with the results. The daylight control device is now an integral part of your lighting design, just as daylight is a critical layer of light that is to be supplemented with electric lighting.

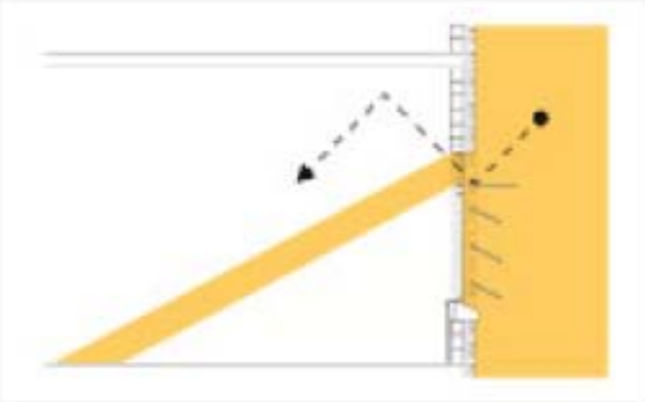
Proposed Condition Of South-Facing Yoga Studio Wall, (40 Degrees North Latitude)—With Added Daylight Control Devices



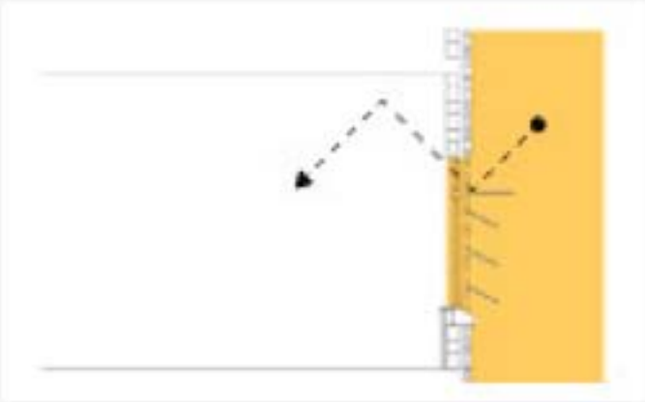
MARCH/ SEPTEMBER 21, NOON
SUN ANGLE 50 DEGREES



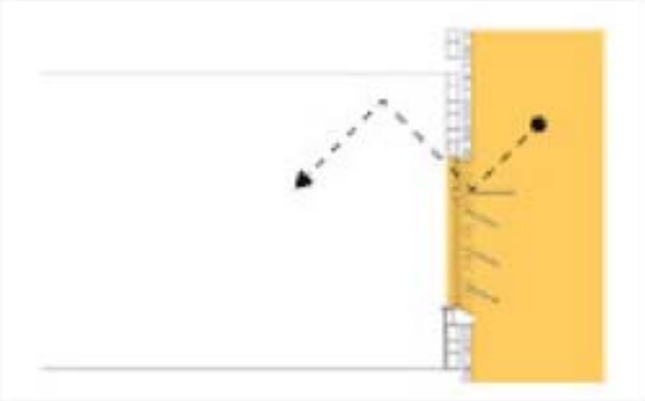
JUNE 21, NOON
SUN ANGLE 75 DEGREES



DECEMBER 21, NOON
SUN ANGLE 28 DEGREES



MARCH/ SEPTEMBER 8 AM
SUN ANGLE 24 DEGREES



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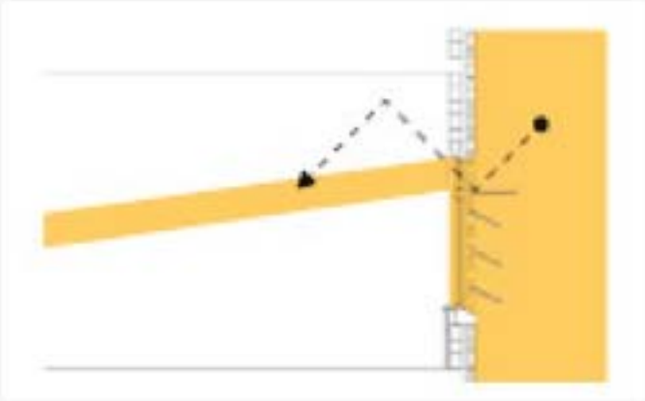
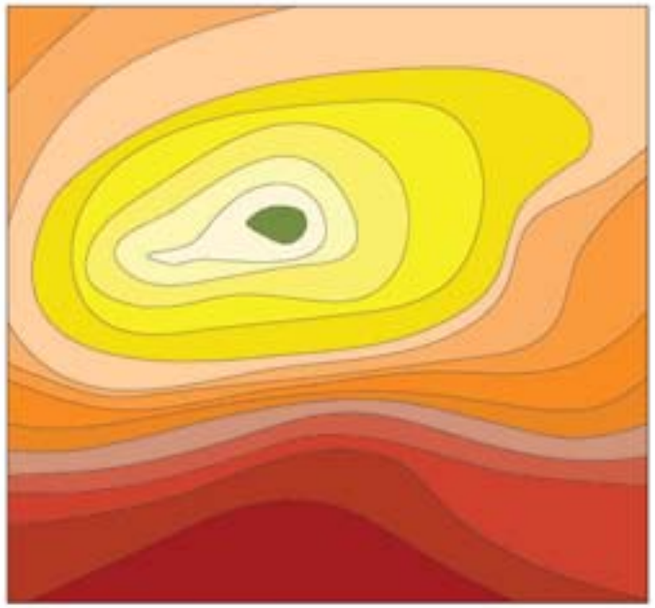


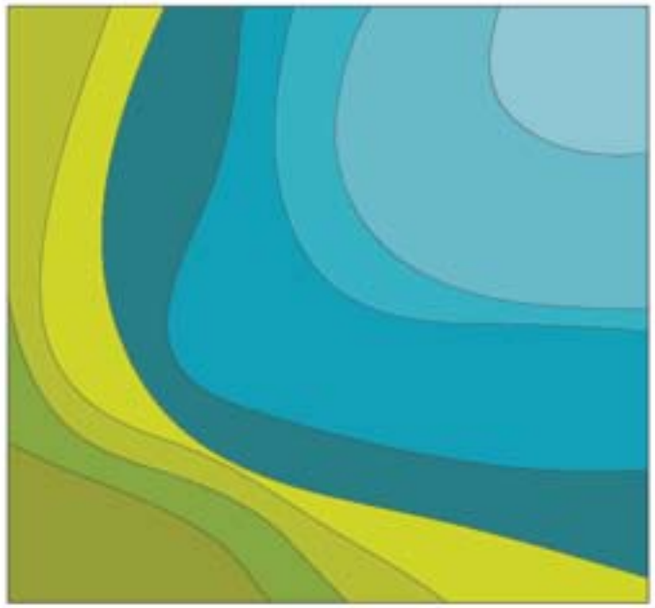
DECEMBER 21, 8 AM
SUN ANGLE 8 DEGREES

ASSIGNMENT

Study the impact of the daylight control device on the distribution of daylight in the space. Mock up your devices full-scale if in an existing space, or at model space using a physical scale model. Alternatively, model the device using a digital model. Once this has been done, repeat the process of measuring illuminance in a grid on the desired workplanes. Keep the date and time of the "AFTER DAYLIGHT CONTROL" experiment as close as possible to your original "BEFORE" experiment. Interpolate the illuminance points or the daylight factor points to create Isocontour lines. This process is automated in some digital softwares. Ideally, include the data points and numbers on your drawings, or use a legend like the one shown below.



DAYLIGHT FACTOR ISOCONTOUR DRAWING
PLAN: WITHOUT SHADING DEVICE



DAYLIGHT FACTOR ISOCONTOUR DRAWING
PLAN: WITH SHADING DEVICE

DAYLIGHT FACTOR KEY

25%	12%
24%	11%
23%	10%
22%	09%
21%	08%
20%	07%
19%	06%
18%	05%
17%	04%
16%	03%
15%	02%
14%	01%
13%	

DAYLIGHT FACTOR ISOCONTOUR DRAWING
REAR WALL ELEVATION: WITHOUT SHADING

DAYLIGHT FACTOR ISOCONTOUR DRAWING
REAR WALL ELEVATION: WITH SHADING DEVICE

NOTE: DAYLIGHT FACTOR (%) INDICATES DAYLIGHT DISTRIBUTION BEFORE AND AFTER SHADING DEVICES, USING DATA FROM JAN 31, 2011 PHYSICAL DAYLIGHT MODEL STUDY

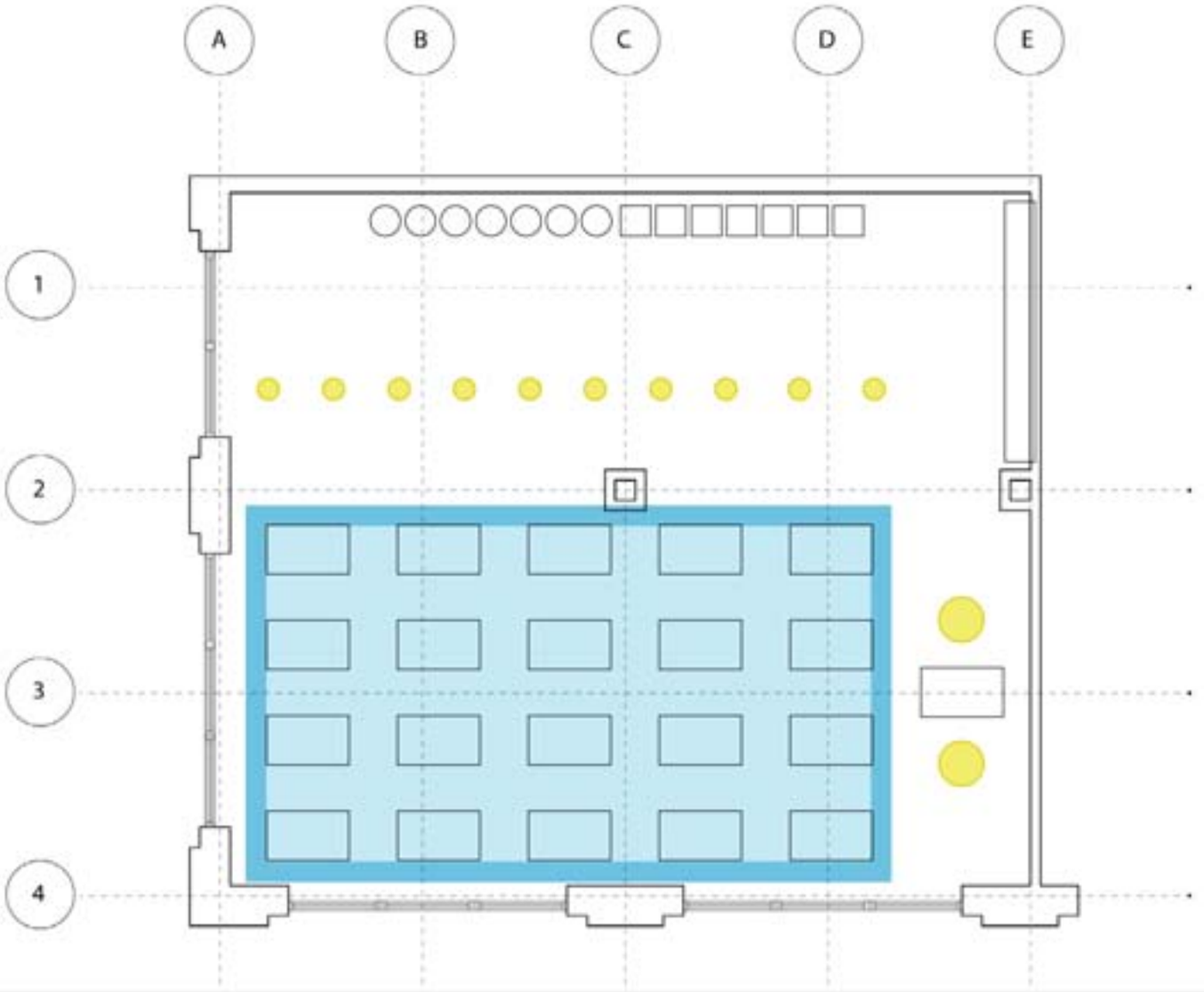
DISCUSSION:
the daylight control device has made a dramatic change to the light distribution, especially in plan

the overlay bright daylight factor in the 25% range is reduce to 10% - a more appropriate target for this use

the westerly direction of the afternoon light is still evident when viewing the rear wall elevation

ASSIGNMENT

Conceptualize how electric lighting design can enhance visual comfort in the space with minimal energy use. Consider layouts and controls to provide a positive user experience as people interact with lighting in the space from day to evening. Use a variety of techniques to explore design solutions. For example, lighting may be conceptualized as individual layers that achieve unique objectives. Keep in mind that a single lighting strategy, such as the cove in this design, may serve multiple layers at once.



LEGEND: LIGHTING ZONES

- instructor demonstration lighting
- entrance directional lighting
- yoga studio diffused cove lighting

LIGHTING LAYERS

L1 - choreography: draw people into the areas above the yoga mats

L2 - ambience: dimmer is used to create varied lighting experiences

L3 - visual interest: recessed ceiling and point lights will identify teaching areas as well as identify important nodes such as storage

L4 - architecture: activity lights display all features

L5 - specific task: track lighting for storage and entrance and recessed lighting for yoga practice

LIGHTING CONTROLS

Intensity - dimmers for easy adjustment

Color - warm lighting

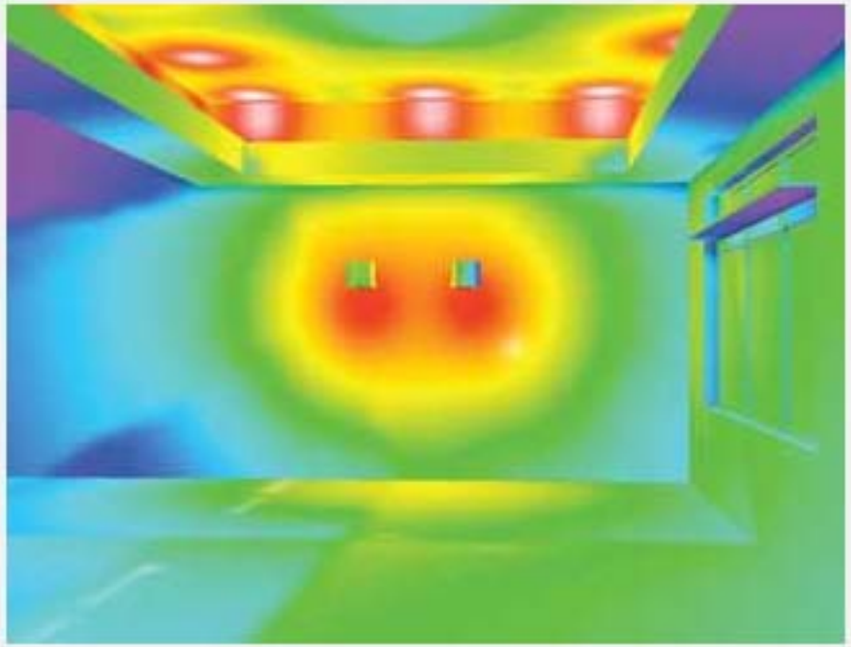
Texture - minimal texture throughout

Ambience - relaxed, comfortable

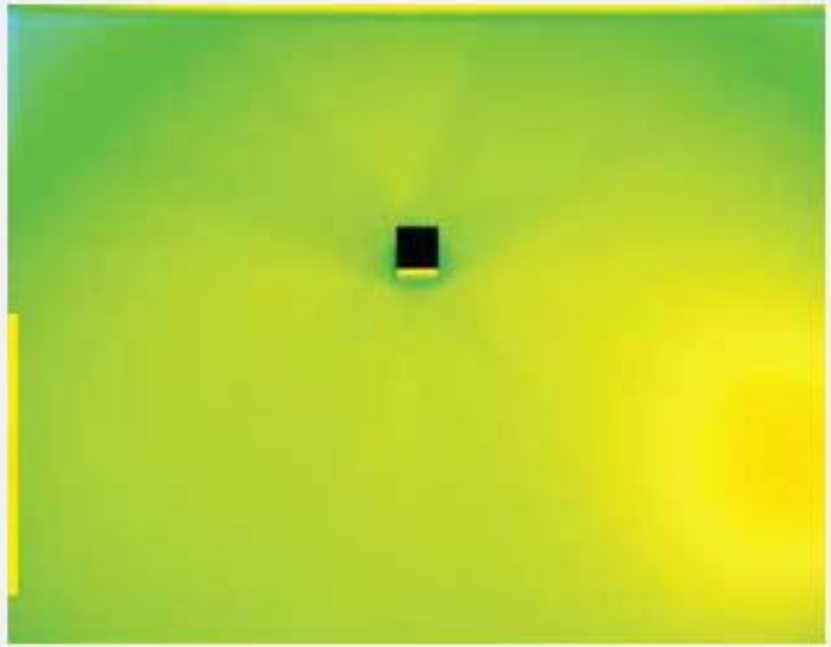
ASSIGNMENT

Create a digital model of the space to so that you may evaluate the success of design proposals. Use the model to play with different light distribution strategies and different layouts. Utilize the computation power of the model to assess the quantity of light. Periodically compare the measured results to your established lighting design criteria. How well does the design meet your original goals?

DIGITAL SIMULATION USING LIGHT-UP FOR SKETCHUP



Pseudo-Color rendering of illuminance



Pseudo-color rendering of illuminance

INTERIOR ELEVATION/PERSPECTIVE FACING EAST

The light is clearly more intense near the windows, yet the overall contrast between window wall and the edge of the yoga workout area is acceptable.

The instructor spotlights create a fine effect in plan but the viewer may find these have too much contrast; likewise I find the cove lighting should have more distribution to provide a unified look for the ceiling.

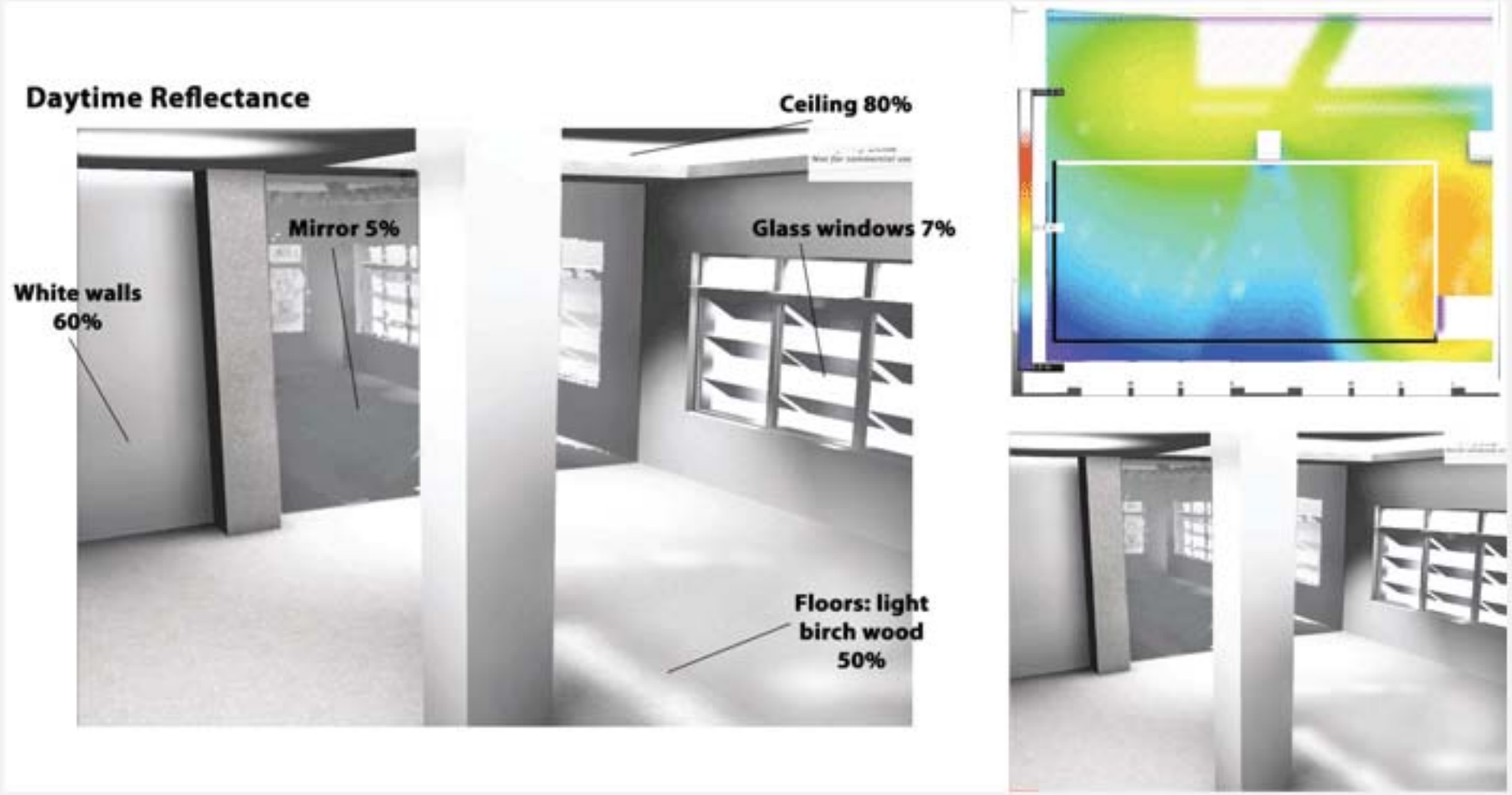
PLAN VIEW

The lighting design is most successful when assessing light distribution on the workplane, in this case the floor level of the yoga studio

The lighting produces a fine distribution; the vertical scale indicates the green area to be around 30 footcandles appropriate for the high-energy uses. the lighting can be dimmed to lower levels for the calmer activities

ASSIGNMENT

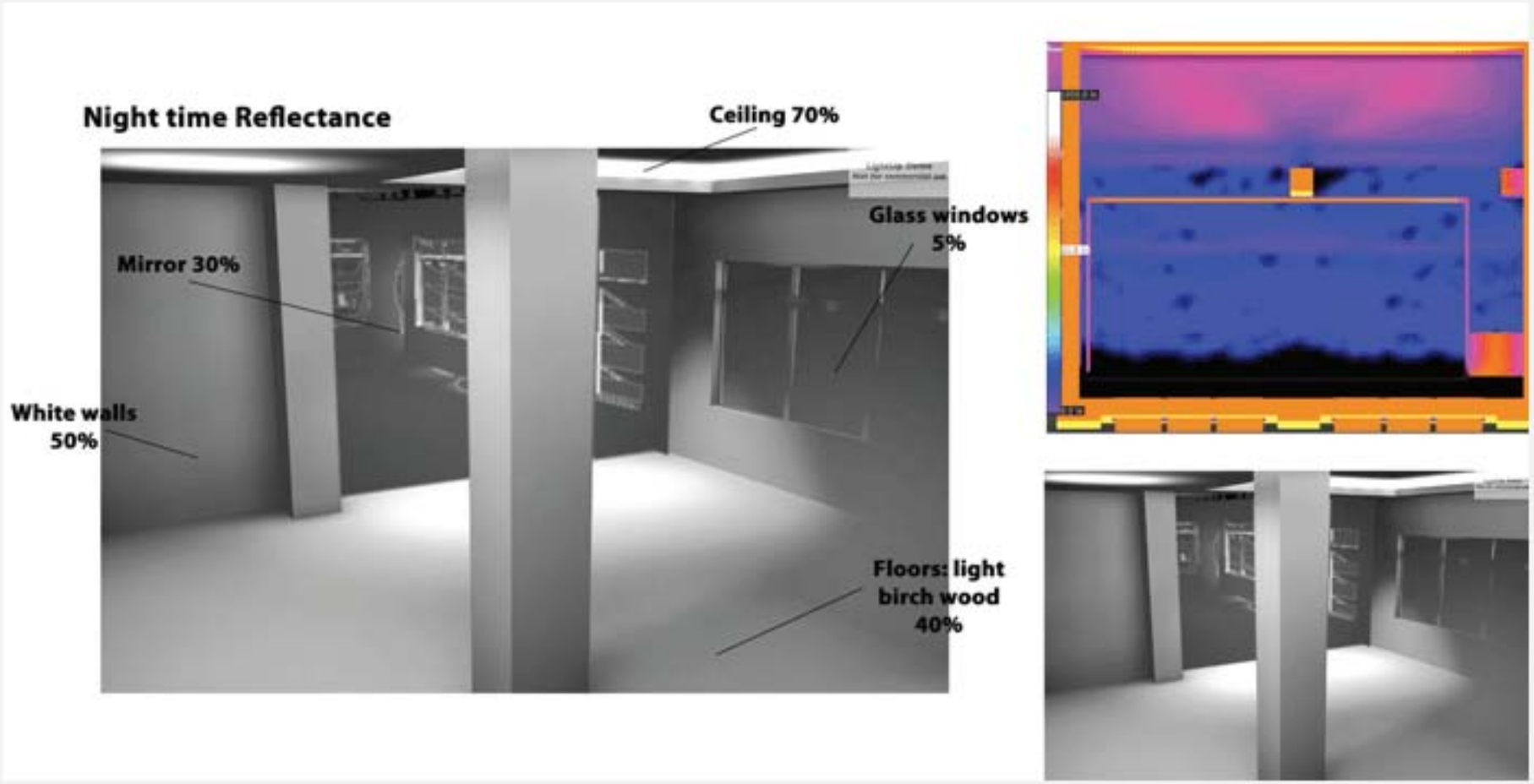
Further use the digital model to explore the effect of material finishes on the lighting quality and quality. Understand the connection between material reflection and the resulting light distribution. View the model in Day and Night situations. For the day scene, turn luminaires off that are unnecessary due to the daylight entering the space. For the night scene, turn on all of the luminaires that would be needed for a particular use of the space. Ask again, how well does the design meet original goals and lighting criteria?



Digital Simulation Using Light-up For Sketchup—Day Scene
Material Reflectances | Pseudo-Color Illuminance Plan | Grayscale Render

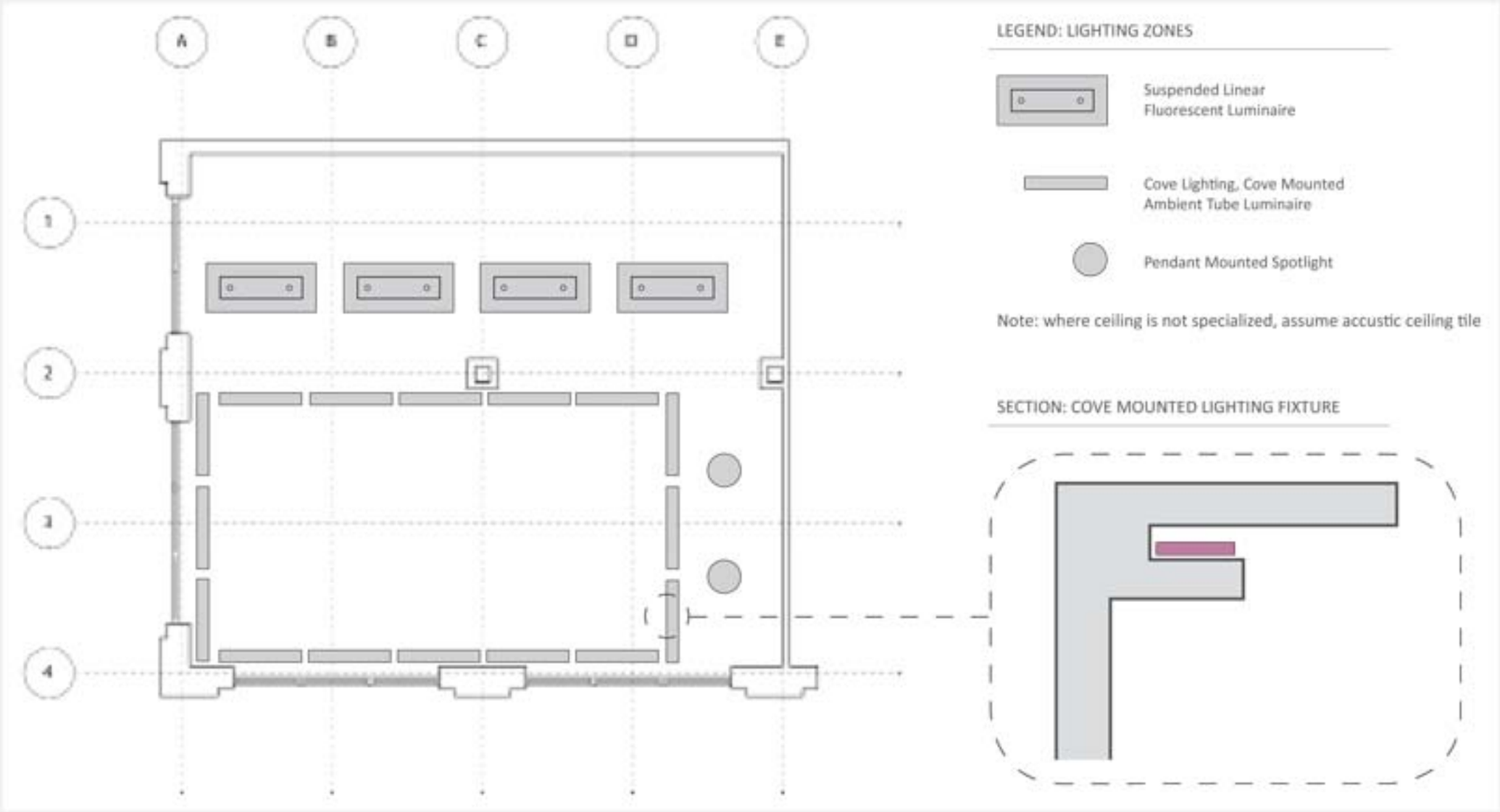
The daylight is successfully diffused by the daylight control devices on the south-facing windows; some views out would still be possible through the large louvers.

The cove lighting is on in this scene, however we observe from the illuminance study that these lights should be turned off to better balance the different lighting conditions in the room.



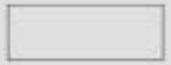
Digital Simulation Using Light-up For Sketchup—Night Scene
Material Reflectances | Pseudo-Color Illuminance Plan | Grayscale Render

The instructor spotlight in this view is creating a dramatic focalizing effect that would be appropriate for the relaxing yoga sessions; the design should be adjusted, however, to better illuminate the mat area for the active sessions that would be held in the evening.



ASSIGNMENT

Communicate final lighting design in terms of specific luminaires, layouts, and energy performance for specified lighting components.

SYMBOL	TAG	QTY	DESCRIPTION	MANUFACTURER	VOLT	TYPE	WATT	LAMP	MODEL	LOCATION	MOUNTING	NOTES
	L1	18	COVE MOUNTED FLUORESCENT 4 FT.	PHILIPS CL - 1	120	FLUOR	32	1	T8	COVE	COVE MOUNTED	DIMMER
	L2	4	ONE LAMP T8 SEGMENTED MICROPRISMATIC LENS 4 FT	PHILIPS ARGUS - 14	120	FLUOR	30	1	T8	HANGING CUBBIES	PENDANT	DIMMER
	L3	2	LYTESPAN ALCYON LED MEDIUM CYLINDER	PHILIPS LLA11	MULTI	LED	23	1	LED	TRACK HANGING CYLINDER	TRACK ATTACHMENT FITTING	DIMMER

ASSIGNMENT

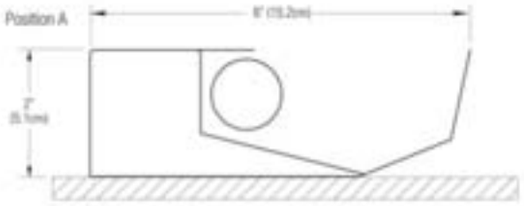
Create a table to consolidate information about the specific light fixtures, or luminaires, chosen for your design. Be sure to tag each luminaire (for example L1, L2, etc) in the same way on this schedule, on the lighting plans and on the product information cutsheets.

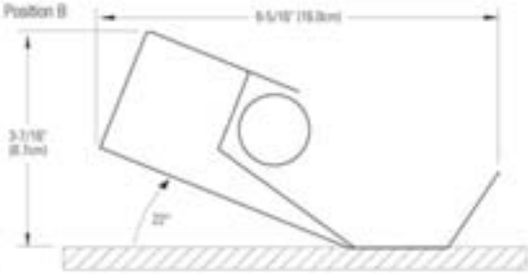
Lighting Systems **CL-1**

Page 1 of 2

Covelite 1-Lamp T8

L1





Half Scale

Ordering Information

Style	Lamps	Lower Optics	Upper Optics	Length	Wiring	Voltage	Ballast	Color & Finish
CL08	T01	E	N				E	W
	T01 = 1 Lamp T8	E = Solid Housing	N = None	02 = 2 ft. 03 = 3 ft. 04 = 4 ft. 06 = 6 ft. 08 = 8 ft.	1 = 1 circuit 3 = 1 circuit w/ Emergency circuit 5 = 1 circuit w/ Bottom Pack 7 = 1 circuit Dimming	D = Dual 120v/277v 3 = 347v	E = Standard Ballast	W = High Reflective White

Features

Housing: Die-formed 20 gauge cold-rolled steel painted white.

Weight: 3.0 lb/ft.

Optical System: Constructed of highly specular Miro IV ® aluminum and highly reflective white 20 gauge steel to produce an asymmetric distribution.

Lamping: One T8 fluorescent lamp in cross section. 18 watt 2 foot, 32 watt 4 and 8 foot, 25 watt 2 and 6 foot lengths.

Mounting: Fixtures can be screwed down in multiple positions and orientations to enable precise coordination of optical distributions.

Additional Information

Modules Lengths

Module	Nominal Length
2ft	2'0"
3ft	3'0"
4ft	4'0"
6ft	6'0"
8ft	8'0"

Peak Candel Angles

Mounting	Peak
Position A	113°
Position B	91°

Electrical

Factory pre-wired to section ends with quick-wire connectors.
Maximum ballast size is 1.3" (3.3cm) by 1.7" (4.3cm).
Standard dimming ballast is Advance Mark VI.

Labels

Certified to UL & CSA standards.

Job Information **Type:**

Job Name:

Cat. No.:

Lamp(s):

Notes:

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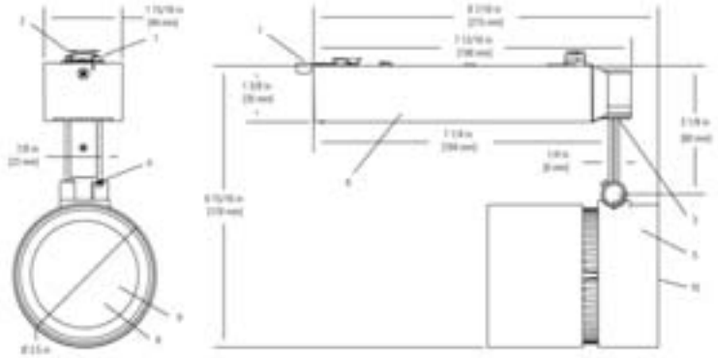
L3

LLA11

Lytespan Alcyon LED Medium Cylinder

Page 1 of 3



Features

1. **Track attachment fitting:** For mechanical/electrical connection.
2. **Brass contact:** Extends for connection to second circuit (Advent track only).
3. **Horizontal pivot:** Wireless stem profile with 365° horizontal rotation.
4. **Vertical pivot:** 0-90° vertical adjustment with aiming indicator.
5. **Heat sink:** Die-cast aluminum maintains LED junction temperature for minimum 50,000 hr lifetime at 70% lumen maintenance
6. **Driver housing:** Molded Polycarbonate
7. **Safety locking lever:** Locks driver housing to track
8. **Interchangeable optics:** Sold Seperately. Refer to Spec Sheet LLA11R Series.
9. **Led board:** Metal core board. 9 tightly packed high brightness White LED's.
10. **Synjet:** Integrated active cooling solution used to aid in the thermal management of the heatsink.

Ordering Information

Cat. No.	Finish	Description	CCT	CRI
LLA11NDWH LLA11NDBK LLA11NDAL	White Black Aluminum	Dimmable	3000K	83
LLA11ND30WH LLA11ND30BK LLA11ND30AL	White Black Aluminum	Non-Dimmable		

Cat. No.	Finish	Description	CCT	CRI
LLA11ND27WH LLA11ND27BK LLA11ND27AL	White Black Aluminum	Dimmable	2700K	83
LLA11ND27WH LLA11ND27BK LLA11ND27AL	White Black Aluminum	Non-Dimmable		

Job Information **Type:**

Job Name:

Cat. No.:

Notes:

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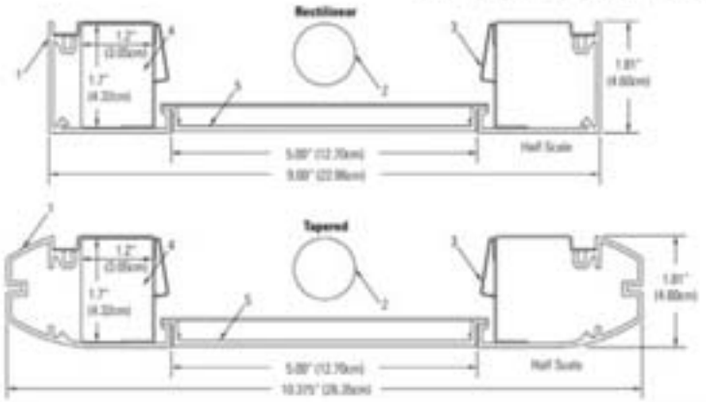
Lighting Systems **Argus-14**

One-Light T8 Segmented Micro Prismatic Lens



Electrical

Factory installed ballast disconnect allows the ballast to be disconnected from and reconnected to incoming power under load without turning the entire circuit off.

Connections: Wiring is via 18 gauge wire. All electrical connections for standard configurations are plug and play via 6-wire coreen plug connections. Connections are seated in end castings of fixtures, allowing for simultaneous mechanical/electrical coupling. Connectors are male/female therefore modules must be installed male to female, starting from the power feed and set.

All static ballasts have the following features:

- Electronic
- Class A sound rating
- High Power Factor
- Metal can

Emergency Battery Pack: 90 minute operation, 520 lumens for 32W 1IM pack fixtures ship with a 4th wire as standard. Use 4-wire power feed end set and order a 4th through wire in all non-EM pack fixtures in that run.

Dimming (Standard Control Option): Advance Mark 10 standard (no additional wires required) for T8. T8 lamps can be dimmed down to 5%.

Power Tray: Code gauge, die-formed steel, pre-paint white enamel finish. Accepts ballasts up to 1.70" (4.32cm) wide by 1.20" (3.05cm) high.

Power Feeds: Standard 18/3 power feed is rated for 10 amps. #4 power feed is 18/4 and is rated for 7 amps. Observe amperage limitations and provide additional Intermediate Power Cables, as required. When providing an additional power feed, the through wiring from the previous module must be disconnected from the cannon plug and capped.

Tandem Switching: Tandem switched fixtures ship with a 4th wire as standard.

Features

1. **Housing:** High purity extruded aluminum, a portion from recycled material. Mitered end caps (3" (7.62cm) rectilinear end cap and 3.88" (6.31cm) tapered end cap). No exposed fasteners or hardware.
2. **Lamping:** One T8 fluorescent lamp per 4-foot section. Lamps by Lightolier as an option, see ordering information.
3. **Reflector:** Precision die-formed premium anti-iridescent, highly reflective aluminum.
4. **Ballast:** Electronic. Meets ANSI starting, end-of-life protection and sound rating specifications. Low THD. Use ballasts with maximum height of 1.7" (4.32cm) and maximum depth of 1.2" (3.05cm).
5. **Shielding:** Extruded acrylic lens.

Mountings

Cable suspension is on 48" (121.92cm) and 96" (243.84cm) centers and consists of a 4-1/2" (11.43cm) diameter canopy finished white enamel. A 1/16" (0.19cm) diameter stainless steel aircraft cable accomplishes suspension and is adjustable from 12" (30.48cm) to 36" (91.44cm). Power feed is 18-gauge SJT white jacket. For special mounting consult factory. For mounting locations on a wall-mounted fixture type, see specification sheet Argus-26 to Argus-33.

Finish

Powder coated, baked enamel, white, black or aluminum, as specified. Custom colors available, consult factory.

Labels UL, cUL and I.B.E.W.

Job Information	Type:
Job Name:	
Cat. No.:	
Lamp(s):	
Notes:	

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Lighting Systems **Argus-14**

One-Light T8 Segmented Micro Prismatic Lens

Module Ordering Information

Family	Mounting	Series	Lamping & Distribution	Shielding	Ballast	Lamp	Length	Voltage	Finish	On-Board Control[1]	Options (Blank)
A	P	R = Rectilinear T = Tapered	1 = 1 Lamp Open Top	L = Micro Prismatic Lens	See Chart Below	See Chart Below	4 = 4 Feet 8 = 8 Feet	1 = 120V 2 = 277V M = 347V (120V-277V)	A = Aluminum B = Black W = White	ST = Standard (none)	4 = 4 through wires C = Cord Cover E = EM Pack T = Tandem Switch[3]
A = Argus	P = Pendant										

[1] *Standard fixtures ship with no On-Board Control systems. For explanation of On-Board Control features, see specification sheet: Argus-Control*
[2] *For step dimming, use ballast E and option S. Step dimming is not available in 4' fixtures with an odd number of lamps. Order 4 wire power feed.*
[3] *Tandem Switch available in 8 foot fixtures only. Tandem switch available in standard control only.*
NOTE: Voltage 1 or 2 must be selected when using Dimming or EM Packs.

Ordering Instructions

1. Determine run length.
2. Order the appropriate number of MODULES for the complete run.
3. Order one POWER FEED END SET for each run.
4. Order one CABLE ASSEMBLY per MODULE minus one per run.
5. For runs that exceed conductor ampacity ratings order the appropriate number of CABLE/CORD ASSEMBLIES (Pg. 3)

Ballast Ordering Information

Design	Lamp Type	Ballast Factor	Start Type	THD %
A	T8	0.77	Instant	<10
B	T8	0.88	Instant	<10
C	T8	1.20	Instant	<20
D	T8	0.71	Program	<10
E	T8	0.88	Program	<10
E*	T8 Step Dim	.87	Program	<10
H	Dim T8	1.00/.05	Program	<10
J	T8	0.88	Instant	<20

** For step dimming, use ballast E and option S.*

Lamp Ordering Information

Design	Lamp Type	Wattage	Rated Output** (Lumens)	Color (K)
A	T8	28	2725	3000
B	T8	28	2725	3500
C	T8	28	2725	4100
D	T8	30	2950	3000
E	T8	30	2950	3500
F	T8	30	2950	4100
G	T8	32	3000	3000
H	T8	32	3000	3500
I	T8	32	3000	4100
J	T8	32	3100	3000
K	T8	32	3100	3500
L	T8	32	3150	4100
S	T8	25	2500	3000
T	T8	25	2500	3500
U	T8	25	2500	4100
Z	No lamps provided by Lightolier			

**25's Rating

Feature Options

T = Tandem Switching

Tandem Switch fixtures ship with a 4th wire. Be sure to order the appropriate quantity of wires in the power feed.

E = Emergency Battery Pack

Standard Emergency wiring is to have Battery Pack operating a single lamp. All EM fixtures are wired as "switched" and include 4th through wire for the wall switch (see diagrams). All non-EM pack fixtures and power feeds in that run should be ordered to include a dedicated 4th through wire to carry the hot power all the way through the run to the EM pack. (Option 4)

Job Information	Type:

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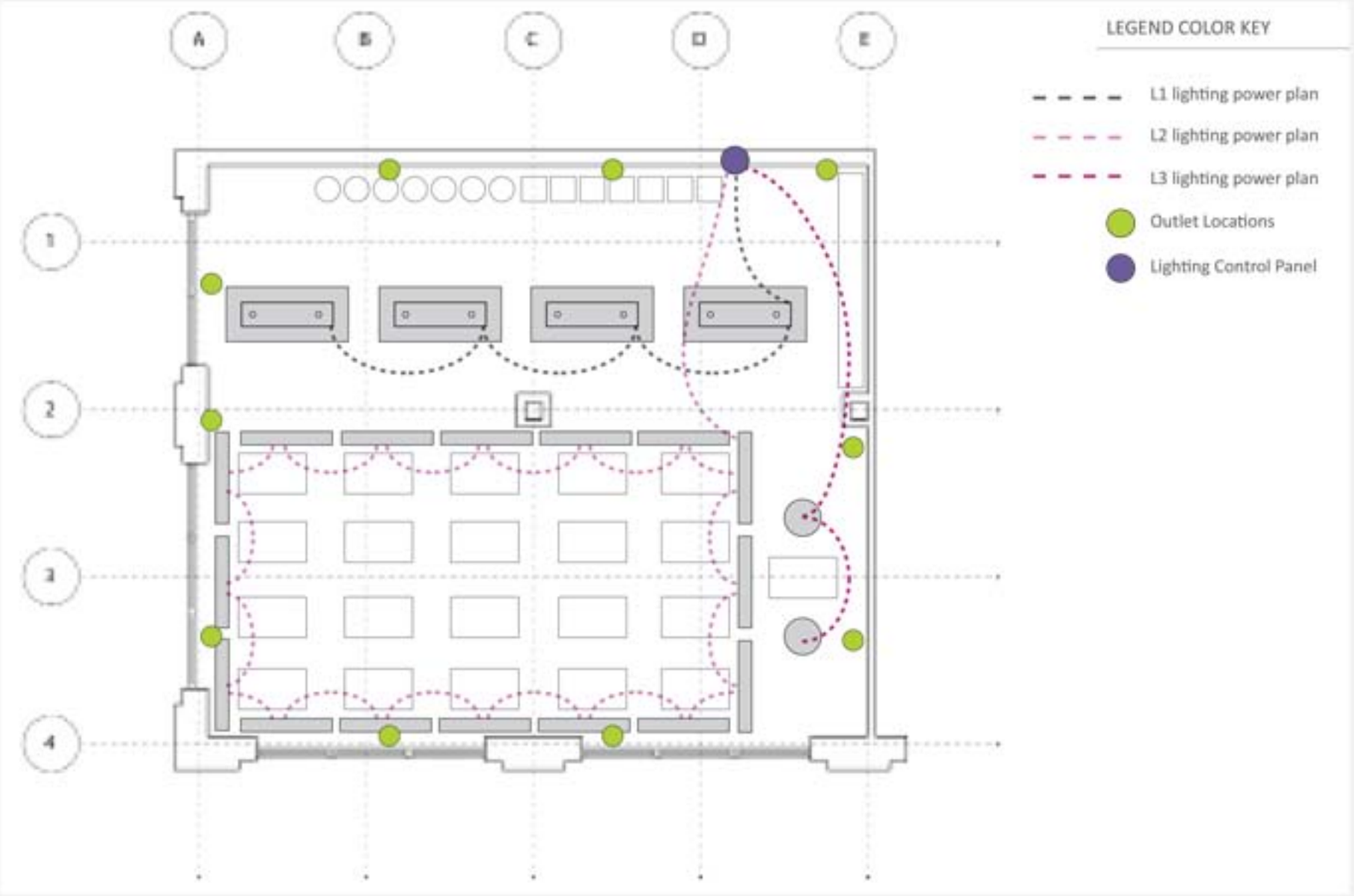
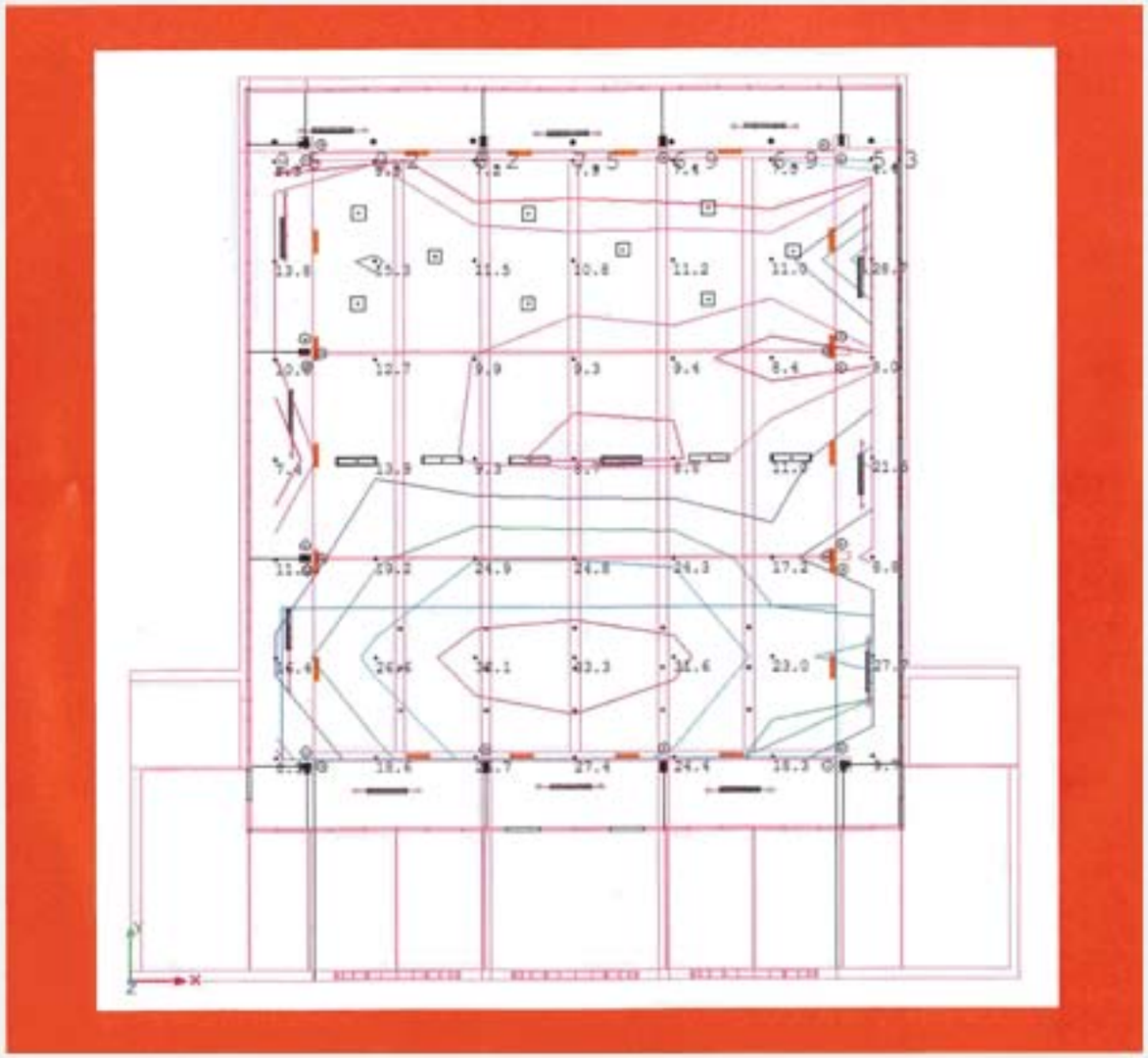


ASSIGNMENT

Communicate how luminaires are grouped into controllable zones. Specify type and location of controls.

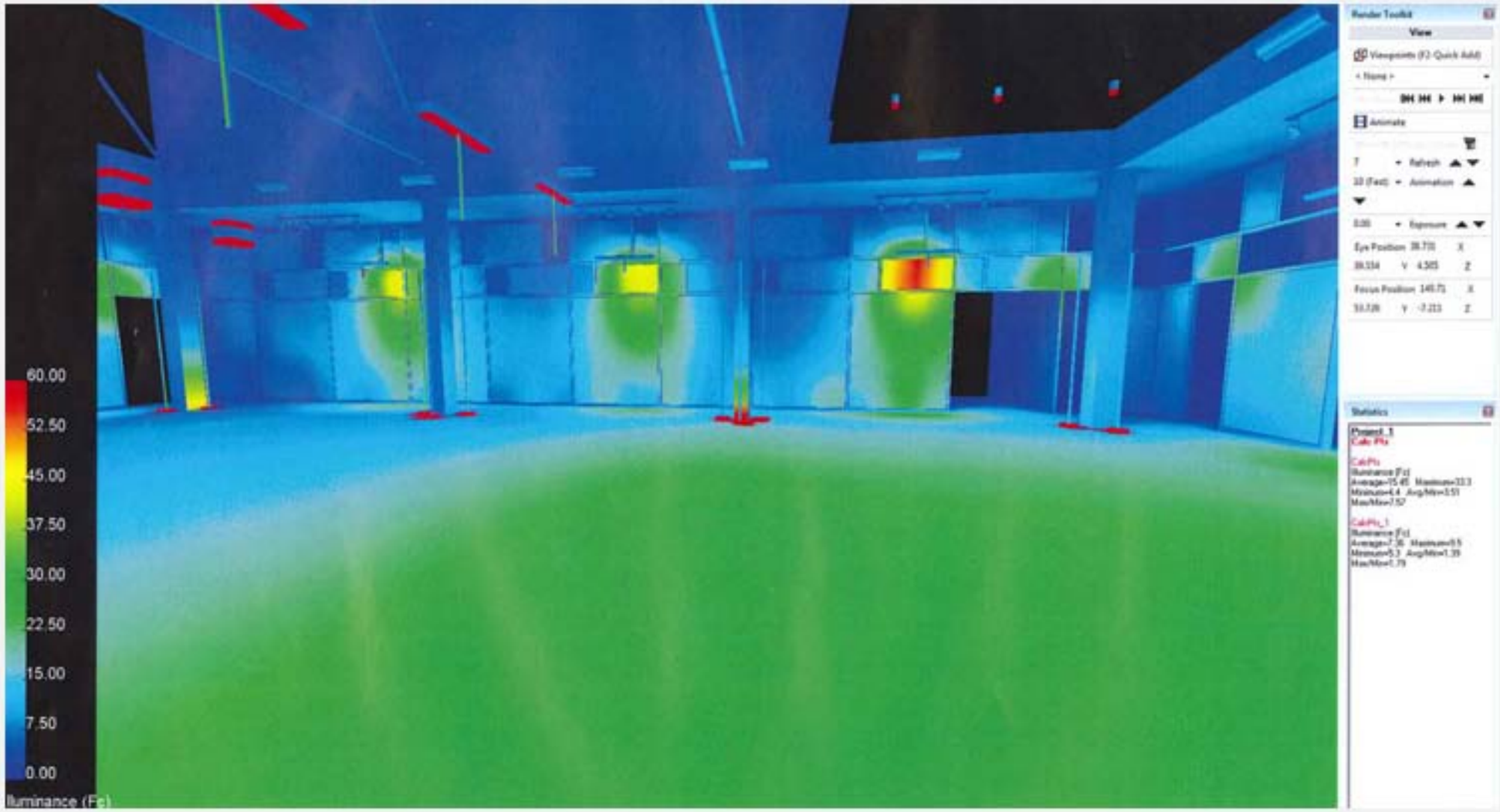


Illumination Iso-Contour Plan View Using Agi32

These **ADDENDUM** pages show additional ways to study and communicate lighting design performance. The examples are excerpts from a studio project to convert an existing space to a new library reading room use. This is an Illuminance Iso-Contour plan made in AGi32. It shows the placement of each fixture as well as the distribution of the lighting/illuminance. We have an even distribution of light over the reading area and a more concentrated distribution over the group study area for a better work environment. One can also see the concentration of light on the outer walls that highlights the white boards during the evening hours for group work.

Illumination Iso-Contour Plan View Using Agi32

GRAYSCALE RENDERING: Here is the grayscale rendering of our space with just the lighting so one can get an idea of the distribution of light throughout the space at night.



Illumination Iso-Contour Plan View Using Agi32

PSEUDO-COLOR RENDERING: This is the pseudo-color rendering of our space that shows the distribution of light within the space accurately.

LIGHTING POWER DENSITY (LPD) is a measure of electrical power used to provide lighting to a space. The measure is expressed in watts per square foot (or watts per square meter). During the design process, you should periodically check the total watts that would be required for the luminaires and layouts you are considering, to ensure you will meet your lighting design criteria for energy-efficiency. Establish goals to meet code requirements and more ambitious goals that would contribute to LEED or other green building rating system requirements. In the example below, the design resulted in a LPD of 0.97 - about 25% less than the code allowed maximum of 1.3 watts/ft2. This calculation was also produced through the AGI32 based on the luminaire data placed in the model.

Generated by COM*check-Web* Software

Interior Lighting Compliance Certificate

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)
Library	4868	1.3	6328
		Total Allowed Watts =	6328

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
ACTIVITY_COMMON_LIBRARY (4868 sq.ft.)				
Linear Fluorescent: Wall Washer / 36" T12 30W / Magnetic	2	12	60	720
Linear Fluorescent: Magazine Lights / 48" T8 32W (Super T8) / Electronic	2	6	54	324
LED: Above Shade Device / Other / Standard	1	15	56	840
LED: Column Uplights / Other / Standard	1	24	18	432
Incandescent: Pendant Lights / Incandescent 150W	1	9	200	1800
HID: Column Downlights / Ceramic Metal Halide 50W / Standard	1	15	40	600
			Total Proposed Watts =	4716

Our space is 4868 SF and COMcheck tells us that the 2009 IECC code allows 1.3 W/SF for Library" use.

4868 sf x 1.3 W= 6328 allowable watts for our lighting design

COMcheck tells us that we have proposed 4716 total watts

We comply: (4716 W/4868 W=0.97 W/sf)

Section 4: Requirements Checklist

Lighting Wattage:

☐ 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
6328	4716	YES

LPD Area Summary			
Label	Area	Total Watts	LPD
LPD Area	4868	4728.5	0.971

LPD Area Summary from AGi32:

CREDITS

All images in tasks 1-4 excerpted from student project by B. Boyne, C. Howerton, M. Sessa, and E. Sharp (edited by J.B. Hamill)

All images in the addendum excerpted from student project by B. Longenbaker, E. Nahrup, and E. Thomas.