

Medical Education Building
Johns Hopkins University School of Medicine
Lighting Existing Conditions and Design Criteria Report
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Lighting/Electrical Option
10/05/07

The Anne and Michael Armstrong Medical Education Building



Johns Hopkins University School of Medicine
Technical Assignment 1

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Each space is analyzed for the following:

- 1) Existing Conditions
 - a. plans and elevations – lighting and furniture
 - b. lighting fixture schedule – fixtures, ballasts and lamps
 - c. daylight elements – materials and reflectances

- 2) Design Criteria
 - e. IESNA recommendations
 - f. AHSRAE/IESNA Standard 90.1
 - g. Light Loss Factors

- 3) Design Evaluation
 - h. general design critique
 - i. computer software calculations (2 spaces)

Executive Summary

The first technical report is to analyze the overall existing lighting conditions in the building and specifically how the design has met the design criteria pertinent to four specific spaces. The four spaces are the exterior façade, the central full height atrium, the first floor auditorium and the fourth floor anatomy lab.

The exterior façade and space is concerned especially with safety as it is a campus building. The design reaches this criteria in a creative way by uplighting trees and using the reflecting light to illuminate the area. White LED bollards are also used along the pavement to provide more interest to the exterior.

The auditorium has ten dimming zones controlled by a Lutron GRAFIK Eye to accommodate the various uses in the space. Recessed compact fluorescent and linear fluorescent downlights were designed in a fluid pattern to compliment the curved floating wood acoustical ceiling. The fixtures are zoned in bands horizontal to the front wall to accommodate the varying class or lecture attendance. Along the periphery are halogen wallwashers that are on their own zones to either create a sense of spaciousness especially during class time.

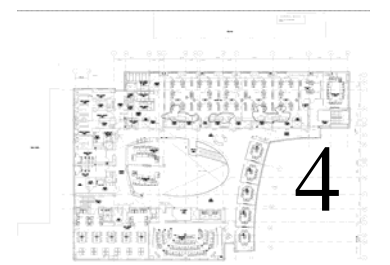
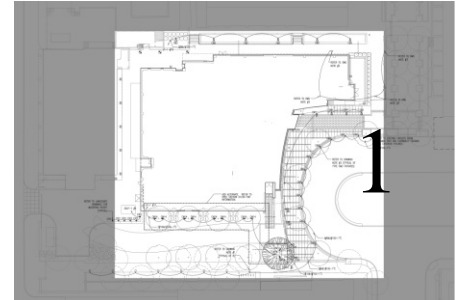
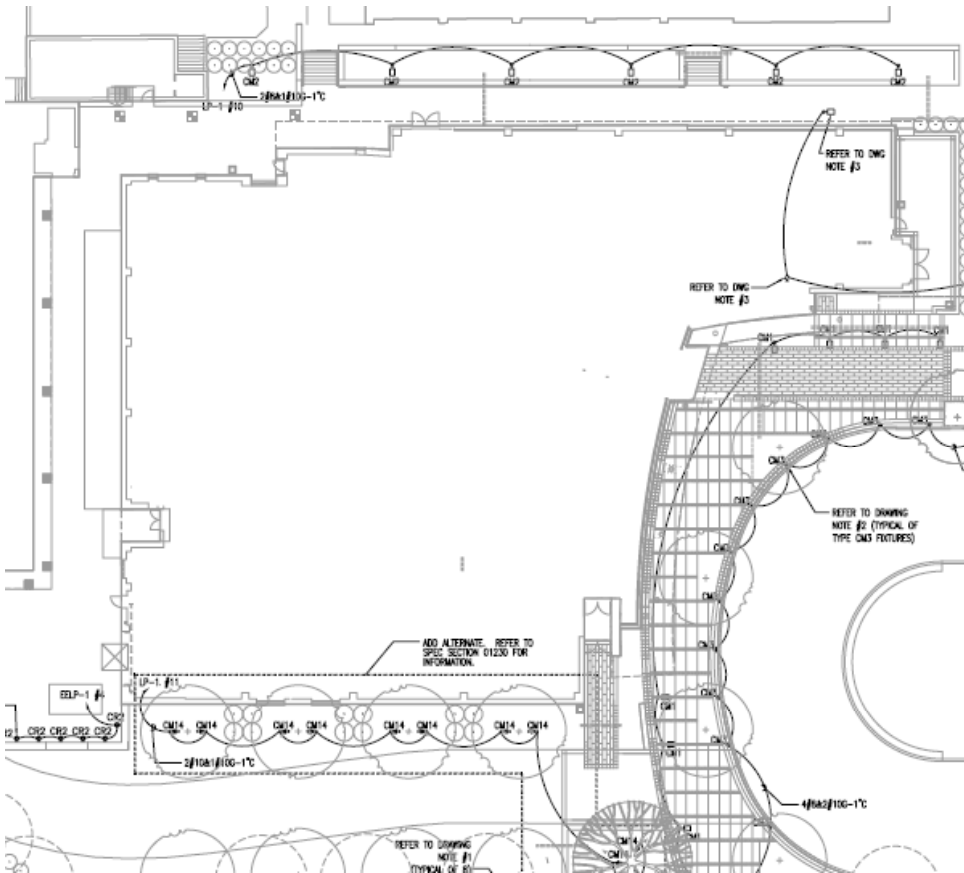
The atrium is a full height atrium in the center of the building. A large amount of natural daylight penetrates the space from the large skylight at the top of the atrium and an exterior curtain wall along the southwest façade. The daylight penetrates every floor, especially the meeting rooms along the northern glass curtain wall of the atrium. Compact fluorescent downlights surround the east south and

Executive Summary

West space edges of the atrium on the first and second floor. A combination of compact fluorescent and metal halide downlights are lined up along the perimeter of the third and fourth floor. Sensors are placed throughout the atrium to accurately measure the level of daylight. As one of the largest spaces in the building, there could have been more emphasis on the design and more integration of daylighting systems into the design.

The most important design criteria the lighting design should meet are daylight integration, direct glare, and illuminance levels.

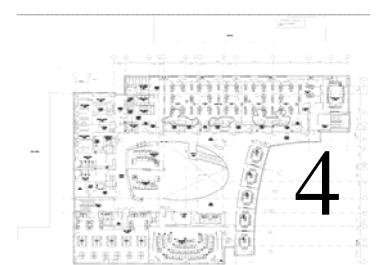
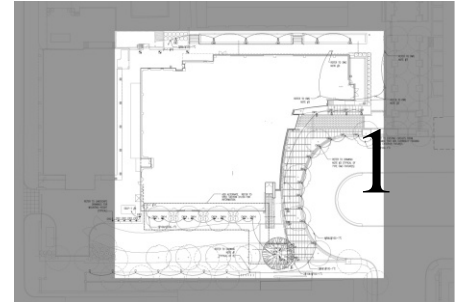
Exterior Façade



The lighting around the outside of the building is controlled by a photocell on the roof of the building. The main criteria the design is aiming for here is safety and facial rendering. To make up for the narrow landscape around the building the lighting uses trees to help disperse the lighting but does not bring out any of the architectural elements in the space.

Exterior Façade Lighting Fixture Schedule

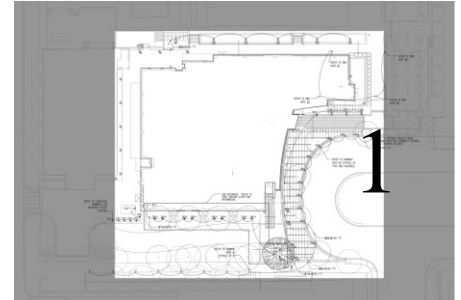
EXTERIOR LIGHTING FIXTURE SCHEDULE								
TYPE	DESCRIPTION	MANUFACTURER	DESCRIPTION	LAMPS		INPUT WATTAGE	VOLTAGE	MOUNTING
				QUANTITY	TYPE			
CA17	COMPACT FLUORESCENT DOWNLIGHT, VERTICAL LAMP, NOMINAL 6 INCH DIAMETER APERTURE X 11 INCH MAXIMUM RECESS DEPTH, SATIN CLEAR ALZAK LOW IRIDESCENT CONE AND FLANGE, INTEGRAL ELECTRONIC BALLAST WITH LAMP FAILURE PROTECTION.	GOTHAM	AFV-32TRT-6AR-LD-277-GEB10	1	CF32DT/E/IN/835	36	277	RECESSED
CA18	COMPACT FLUORESCENT WALLWASHER, NOMINAL 6 INCH DIAMETER APERTURE X 11-1/4 INCH MAXIMUM RECESS DEPTH, SATIN CLEAR ALZAK LOW IRIDESCENT CONE AND FLANGE, INTEGRAL ELECTRONIC BALLAST.	GOTHAM	AFVW-32TRT-6AR-LD-277-GEB10	1	CF32DT/E/IN/835	36	277	RECESSED
CK1	METAL HALIDE DOWNLIGHT, NOMINAL 6 INCH DIAMETER APERTURE X 10 INCH MAXIMUM RECESS DEPTH, SEMI-SPECULAR CLEAR ALZAK LOW IRIDESCENT REFLECTOR WITH FLAT FLANGE, HIGH POWER FACTOR, ELECTRONIC BALLAST.	GOTHAM	APRH-P3070MHC-6-AC-T30-LD-VOLT-HEB	1	CDM70/PAR30 L/M/FL	82	277	RECESSED
CL1	METAL HALIDE WALL MOUNTED LUMINAIRE, NOMINAL 5 INCH WIDE X 33-1/2 INCH TALL X 5 INCH PROJECTION, EXTRUDED ALUMINUM HOUSING WITH DIE CAST ALUMINUM END PIECE, HAND BLOWN, THREE-PLY TRIANGULAR SHAPED GLASS DIFFUSER, HIGH POWER FACTOR, ELECTRONIC BALLAST. UL WET LISTED. FINISH TO BE SELECTED BY DESIGN PROFESSIONAL.	BEGA	4482P	1	F39BX/SPX30/RS	44	277	WALL
CM1	DECORATIVE LINEAR POLE TOP LUMINAIRE, NOMINAL 6 INCH DIAMETER X 3 FOOT HIGH DIFFUSER X 12 FOOT OVERALL HEIGHT, STAINLESS STEEL TUBULAR HOUSING WITH UV STABILIZED WHITE POLYCARBONATE DIFFUSER, HIGH POWER FACTOR, INTEGRAL ELECTRONIC BALLAST. BRUSHED STAINLESS STEEL FINISH.	FORMS AND SURFACES	LIGHT COLUMN SERIES 600-MOD-3'-DIFFUSER-12' OVERALL HEIGHT	1	FO25/835/XP/ECO	28	277	POLE
CM2	SINGLE CUT-OFF TYPE LUMINAIRE, NOMINAL 13 INCH WIDE X 22 INCH LONG X 5 INCH DEEP CAST ALUMINUM ROUNDED HOUSING WITH HEAT SINK FINS, GASKETED CLEAR TEMPERED FLAT GLASS LENS AND GASKETED DOOR, UL WET LOCATION LABEL, MOUNT ON 5 INCH X 18 FOOT HIGH SQUARE ALUMINUM POLE, ABLE TO WITHSTAND 80 MPH WIND WITH 1.4 GUST FACTOR, DARK GRAY PAINT FINISH ON LUMINAIRE AND POLE.	LITHONIA	ASI150M-SR3-277-SPA-DSPD-POLE:SSA-18-5GDM19AS-DSPD	1	MCP150/U/ME D/830	185	277	POLE
CM3	LED BOLLARD, NOMINAL 8 INCH DIAMETER X 36 INCH TALL, EXTRUDED ALUMINUM BOLLARD COLUMN, DIE-CAST ALUMINUM LUMINAIRE HOUSING WITH INTEGRATED HEAT SINKS, ONE-PIECE, UV STABILIZED TRANSLUCENT POLYCARBONATE LENS, CONTINUOUS SILICONE GASKET, 12 HIGH OUTPUT WHITE LEDS WITH EXTRUDED ALUMINUM OPTIC, INTEGRAL DRIVER, PROVIDE ALL HARDWARE AND ACCESSORIES FOR COMPLETE INSTALLATION AND FULLY FUNCTIONING SYSTEM. SILVER FINISH.	SELUX	NT-3-L012-SV-277	1	HIGH OUTPUT WHITE LED BY MANUFACTURER	33	277	BOLLARD
CM14	METAL HALIDE ADJUSTABLE ACCENT LIGHT, NOMINAL 3 INCH DIAMETER X 9 INCH CYLINDRICAL MACHINED ALUMINUM HOUSING, CLEAR TEMPERED GLASS LENS, 90 DEGREE CAP, LOCKABLE, AIMING KNUCKLE RECESSED IN GRADE ELECTRONIC BALLAST HOUSING. WET LOCATION LISTED. OVERALL PAINT FINISH OF FIXTURE AND CANOPY TO BE SELECTED BY DESIGN PROFESSIONAL.	BK LIGHTING	EV-59-FINISH-9-B-HP2-H35E-277	1	MCP39PAR20/U830/FL	45	277	IN-GRADE



Exterior Façade

IESNA Handbook Light Loss Factors

Exterior Light Loss Factors					
Type	LLD	LDD	RSDD	BF*	TOTAL LLF
CA17	0.85	0.88	1	0.87	0.65076
CA18	0.85	0.88	1	0.87	0.65076
CB14A	0.95	0.86	1	0.87	0.71079
CK1	0.61	0.88	1	0.87	0.467016
CL1	0.85	0.82	1	0.87	0.60639
CM2	0.8	0.82	1	0.87	0.57072
CM3	1	0.82	1	0.87	0.7134
CM14	0.6	0.82	1	0.87	0.42804



ASHRAE 90.1 Power density requirements

Exterior Power Density Calculation			
W/SF Allowance	Area of space(SF)	Total Lamp Wattage	W/SF Existing
0.2	18400	3900	0.21

Exterior Façade Design Criteria

Appearance of Space and Luminaires. [IMPORTANT]

The luminaires should provide directional cues to the building entrances and distribute light downward and evenly on the walking paths.

Color Appearance & Color Contrast. [IMPORTANT]

The color rendering is important to create the appropriate mood in the outdoor space.

Daylighting Integration and Control. [VERY IMPORTANT]

Daylighting controls are very important for fixtures outside to minimize energy use during the day.

Direct Glare. [VERY IMPORTANT]

Direct glare should be strictly avoided to maintain safety in the area at night. The contrast between the dark surroundings and a very bright source are very uncomfortable and can hinder visibility in the area.

Illuminance (Horizontal). [VERY IMPORTANT]

The illuminance on the ground is very important for people to be able to find their way around the building and to the building entrance.

Illuminance (Vertical). [IMPORTANT]

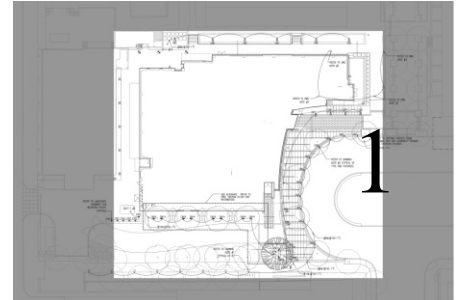
Vertical illuminance is important in this space for good facial modeling and safety around the perimeter of the building.

Intrinsic Material Characteristics. [SOMEWHAT IMPORTANT]

The exterior materials of the building façade as well as walkway materials can be used to highlight the building and create points of interest along the façade.

Light Distribution on Task Plan (Uniformly). [VERY IMPORTANT]

Uniform lighting along walkways and surroundings should be addressed to improve security in the vicinity of the building. Shadows should be avoided as much as possible around the walkways.



Exterior Façade Design Criteria

Light Pollution/Trespass. [VERY IMPORTANT]

Avoid luminaires with light directed above 90 degrees to keep direct light from entering into the atmosphere.

Modeling of Faces or Objects. [VERY IMPORTANT]

Lighting levels on faces and objects is very important for safety around the building.

Peripheral Detection. [IMPORTANT]

Lighting levels along the periphery of the walkways are important to safety.

Points of Interest. [IMPORTANT]

Architectural elements of the building such as the entrance and the glass façade are important for aesthetics and for directing pedestrians.

Reflected Glare. [IMPORTANT]

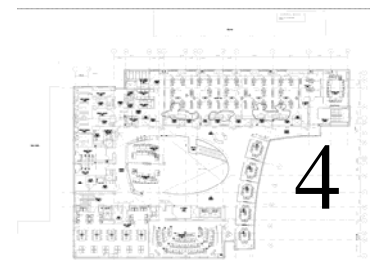
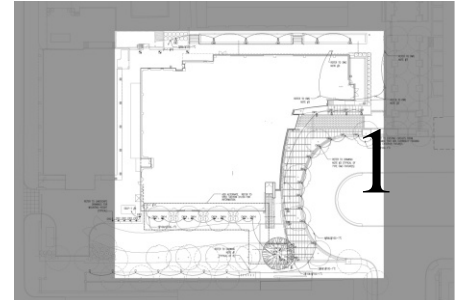
Reflections in the glass along the first floor should be avoided to prevent discomfort.

Shadows. [VERY IMPORTANT]

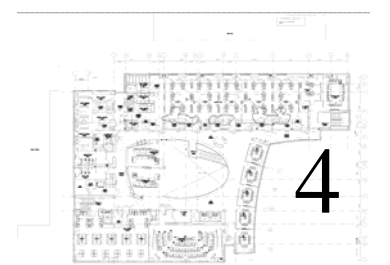
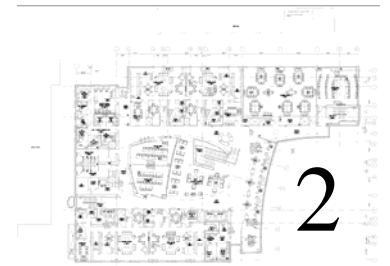
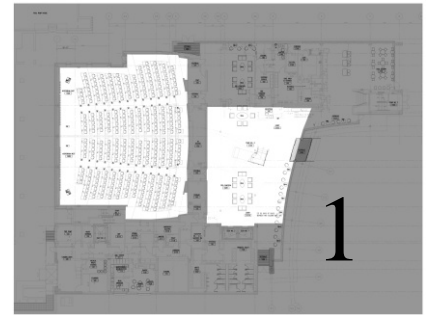
Shadows should be prevented to allow for pedestrian comfort and safety around the exterior of the building.

Sparkle/Desirable Reflected Highlights. [IMPORTANT]

Surrounding trees can be used to help distribute a diffuse indirect light to the surrounding area.



Auditorium



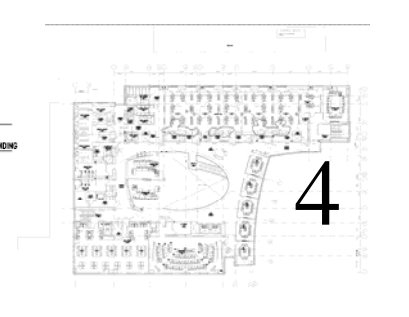
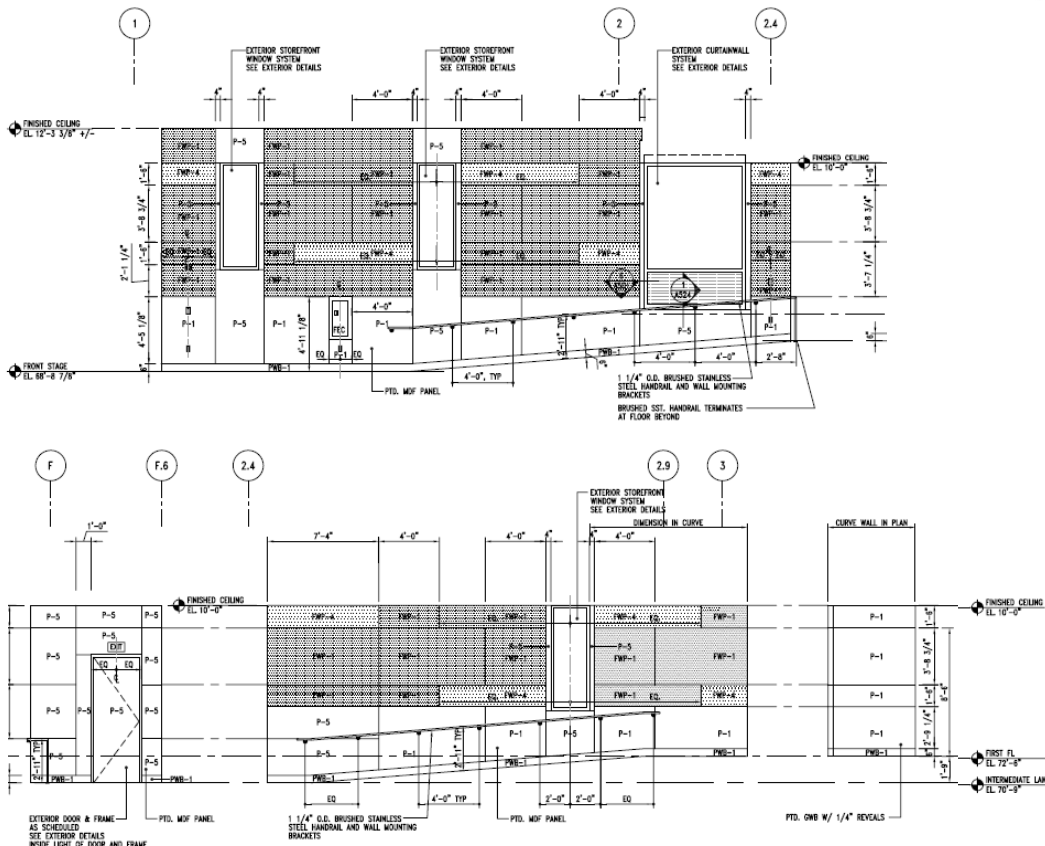
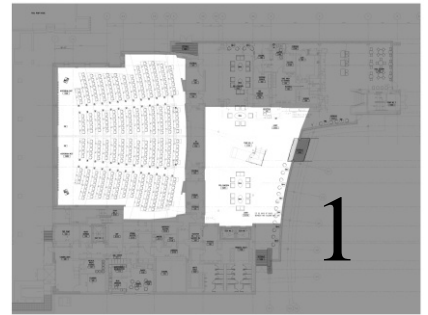
The Auditorium seats 350 people and has stadium seating lowering four feet below the first floor elevation. Although this space does not have any daylight, it has a Lutron GRX-4116 controls system to serve its multiple functions. Compact fluorescent and linear fluorescent downlighting is recessed in the floating wood ceiling above the seating areas. The side walls are washed with metal halide downlights to provide a more spacious feeling in the space. The lighting in both sides are controlled from the podium and entrance to the room.

Medical Education Building

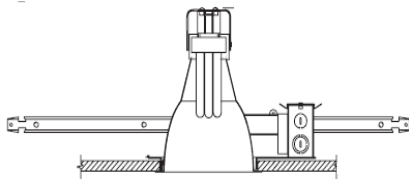
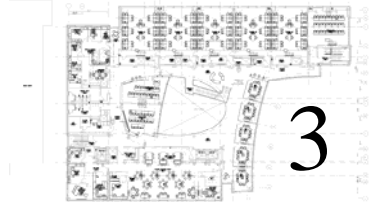
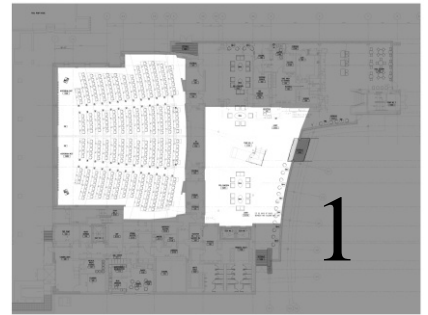
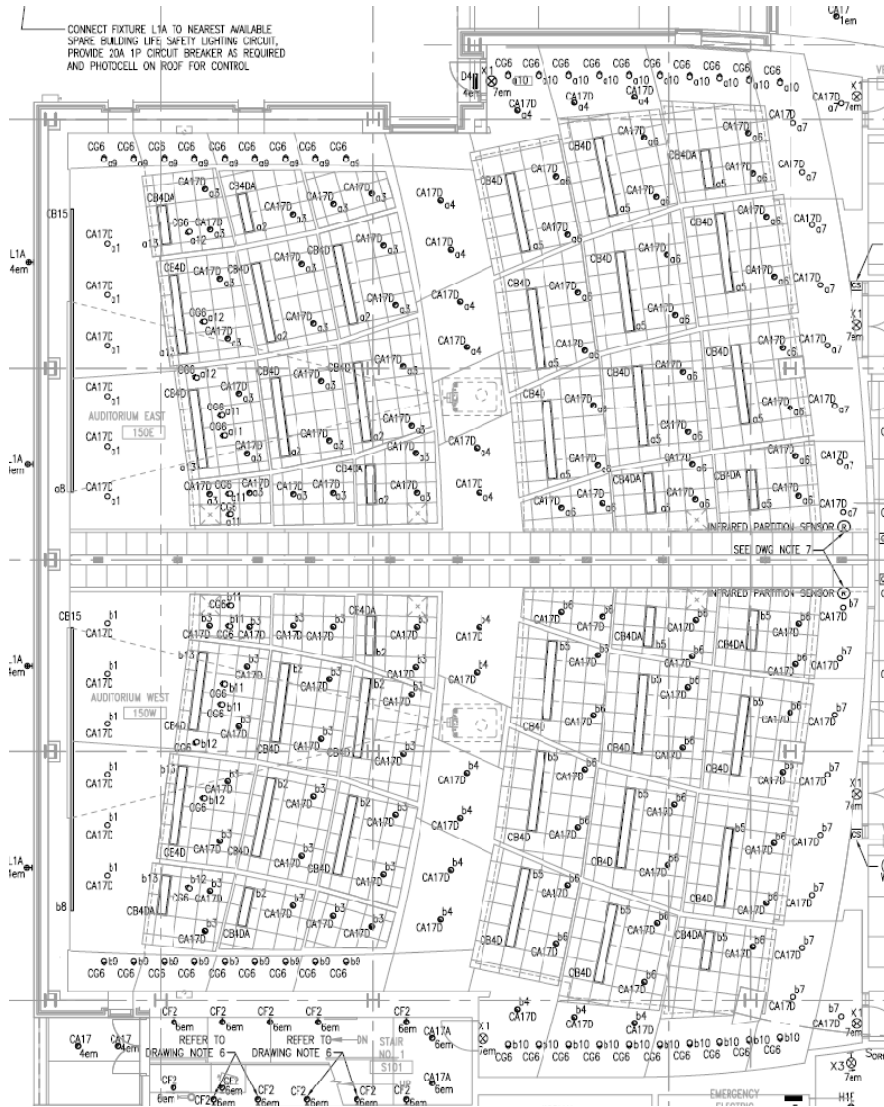
Johns Hopkins University School of Medicine

Lighting Existing Conditions and Design Criteria Report

Auditorium Sections



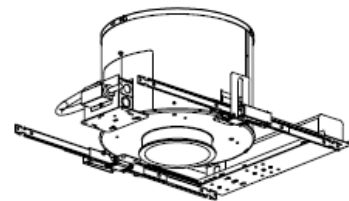
Auditorium Lighting Plan



CA17D



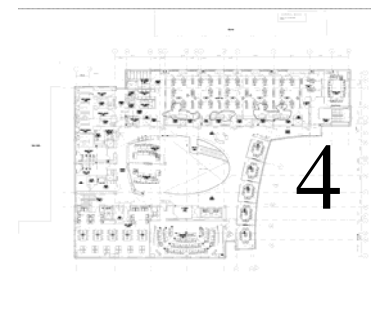
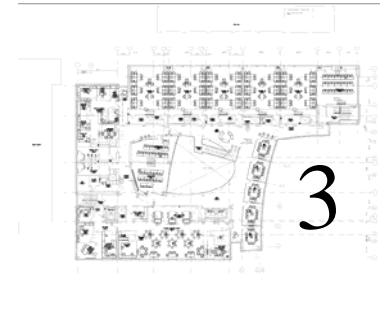
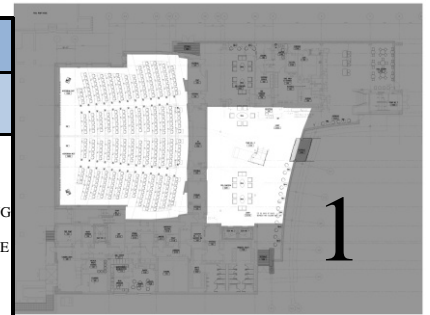
CB4D



CG6

Auditorium Lighting Fixture Schedule

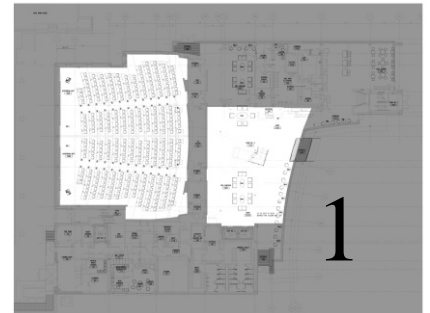
AUDITORIUM LIGHTING FIXTURE SCHEDULE									
TYPE	DESCRIPTION	MANUFACTURER	DESCRIPTION	LAMPS		INPUT WATTAGE	VOLTAGE	MOUNTING	REMARKS
				QUANTITY	TYPE				
CA17D	COMPACT FLUORESCENT DOWNLIGHT, NOMINAL 6 INCH DIAMETER APERTURE X 1-1/4 INCH MAXIMUM RECESS DEPTH, SATIN CLEAR ALZAK LOW BRIDGESCENT CONE AND FLANGE, WITH 5% ARCHITECTURAL DIMMING BALLAST AND TRIM FINISH PAINTED TO MATCH SAMPLE PROVIDED BY ARCHITECT	GOETHAM	AFV-32TRT-6AR-LD-277-DMHL TFCTBD MP7061	1	CF32DT/E/IN/835	38	277	RECESSED	PROVIDE LUTRON FDB SERIES DIMMING BALLAST. CUSTOM PAINT SAMPLE TO BE SUBMITTED WITH SHOP DRAWINGS
CB4D	RECESSED FLUORESCENT TROFFER, NOMINAL 12 INCH WIDE X 96 FOOT LONG BY 10 INCH DEEP, 1 LAMP PER CROSS SECTION, STEEL HOUSING, HIGH REFLECTANCE WHITE REFLECTOR, FLEXIBLE TRANSLUCENT WHITE PVC DIFFUSER WITH CLEAR OVERLAY, DIMMING BALLASTS. PROVIDE CUSTOM TRIM COLOR TO MATCH PAINT SAMPLE PROVIDED BY ARCHITECT.	MARK LIGHTING	VL-18-(MOD)-277-54WT5HO-EDB-(HILUME)-CUSTOM TRIM COLOR	2	FP54/835/H/O/ECO	126	277	RECESSED	PROVIDE LUTRON FOR DIMMING BALLAST
CB4DA	SAME AS TYPE CB4D EXCEPT 4 FOOT LONG	MARK LIGHTING	VL-14-(MOD)-277-54WT5HO-EDB-(HILUME)-CUSTOM TRIM COLOR	1	FP54/835/H/O/ECO	63	277	RECESSED	PROVIDE LUTRON FOR DIMMING BALLAST
CB15	LINEAR FLUORESCENT WALL MOUNTED DOWNLIGHT, NOMINAL 3 INCH WIDE X 4-1/2 INCH TALL X LENGTH AS SHOWN ON DRAWINGS, EXTRUDED ALUMINUM HOUSING, CORRUGATED REGRESSED TRIP WITH FLUSH SATIN LENS, STEEL REFLECTOR, CLEAR ACRYLIC DUST COVER, INTEGRAL HIGH POWER FACTOR, ELECTRONIC BALLASTS. REFER TO ARCHITECTURE DRAWINGS FOR MOUNTING HEIGHT.	FOCAL POINT	FAVDS-CR-1T5HO-1C-277-S-SM-TS-LENGTH	1/4FT	FP54/835/H/O/ECO	60	277	SURFACE	REFER TO ARCHITECTURAL SECTION FOR MOUNTING DETAIL
CG6	HALOGEN DOWNLIGHT, NOMINAL 4 INCH APERTURE X 9 INCH MAXIMUM RECESS DEPTH, SATIN CLEAR ALZAK REFLECTOR CONE AND RETURN FLANGE, 277/120V INTEGRAL AUTOTRANSFORMER.	GOETHAM	APR-PAR30-4AR-LD	1	75PAR30S/HAL/FL25	75	277	RECESSED	
CK3	METAL HALIDE ADJUSTABLE ACCENT, NOMINAL 4-1/2 INCH DIAMETER APERTURE X 6-1/2 INCH MAXIMUM RECESS DEPTH, DIE CAST CONSTRUCTION WITH INDUSTRIAL SILVER POWDER COAT FINISH, 30 DEGREE TILT, 359 DEGREE ROTATION, HIGH POWER FACTOR, ELECTRONIC BALLAST.	ORSA LIGHTING	CDMC-P3-S-70-277-NC	1	MCP70PAR30LN/U/830FL	82	277	RECESSED	



Auditorium

IESNA Handbook Light Loss Factors

Auditorium Light Loss Factors					
Type	LLD	LDD	RSDD	BF*	TOTAL LLF
CA17D	0.85	0.88	0.98	0.87	0.6377448
CB4D	0.95	0.86	0.98	0.87	0.6965742
CB4DA	0.95	0.86	0.98	0.87	0.6965742
CB15	0.95	0.88	0.98	0.87	0.7127736
CG6	0.95	0.88	0.98	0.87	0.7127736



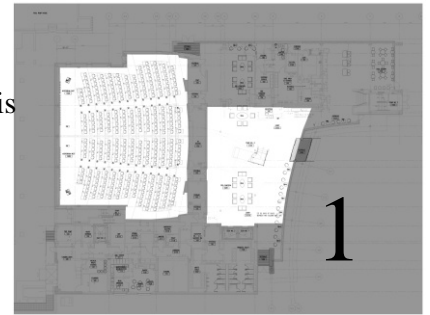
ASHRAE 90.1 Power density requirements

Auditorium Power Density Calculation			
W/SF Allowance	Area of space(SF)	Total Lamp Wattage	W/SF Existing
1.4	7680	19600	2.55

Auditorium Design Criteria

Appearance of Space and Luminaires. [IMPORTANT]

The arrangement and relationship of the luminaires to the layout of the auditorium is important in order to create a uniform level of light on the seating. It will also be important to give an overhead guide to flow throughout the space above the aisles.

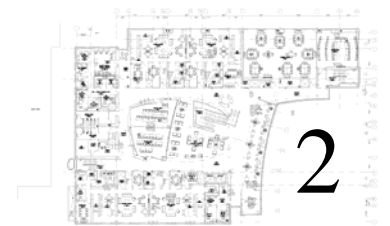


Color Appearance and Color Contrast. [IMPORTANT]

The importance of color along the ceiling and perimeter walls is important to enhance the wood finishes. It is also important for performing educational tasks.

Direct Glare. [VERY IMPORTANT]

This is very important in order for people to pay attention and see the front of the auditorium. Discomfort glare, overhead glare, reflected glare and disability glare are very important to address in the space to avoid visual issues in the space.



Illuminance (Horizontal). [VERY IMPORTANT]

The illuminance levels are very important on the horizontal task plane in the space to adequately supply the appropriate levels for tasks to be performed. The task plane in the space will be at 30 inches. A minimum of 10 footcandles is recommended by IESNA standards.



Illuminance (Vertical). [IMPORTANT]

The illuminance levels are very important on the vertical task plane in the space to adequately supply the appropriate levels along the front wall for chalkboard/whiteboards. It should also be uniform in order to avoid distractions. A minimum of 3 footcandles is recommended by The IESNA standards.



Light Distribution on Surfaces. [IMPORTANT]

The luminance ratios in the space should be uniform to avoid distractions and to open the space. Ceiling and wall luminance ratios should not exceed a 3:1 ratio but should be visibly different to avoid monotonousness in the space.

Light Distribution on Task Plane (Uniformly). [VERY IMPORTANT]

Non-uniform levels will be distracting and uncomfortable and will hinder the occupant from performing tasks well. Task illuminance levels should be 1.5 to 3 times higher than the immediate surroundings (aisles and walkways) to direct the attention of the occupant to the task plane.

Auditorium Design Criteria

Luminaire Noise. [IMPORTANT]

Noise from the luminaires (and HVAC equipment) is very distracting especially in a quiet space. It can be very distracting during presentations and lectures and in extreme cases.

Luminances of Room Surfaces. [VERY IMPORTANT]

The space should include direct and diffuse light to the occupants to increase comfort and satisfaction to avoid shadows and dark spots.

Modeling of Faces or Objects. [IMPORTANT]

The space is designed to focus the attention to the front of the room. Most uses of the space will involve a speaker at the front of the room where the attention will be on so shadows especially on the face should be avoided.

Points of Interest. [IMPORTANT]

The front of the room is the most important part of the room and the illuminance levels should be higher here. There should also be a focus on the sides where a podium would stand in case the luminaires are switched off and the speaker uses the projector.

Reflected Glare. [VERY IMPORTANT]

Glare in this space should be avoided to ensure optimal task performance and comfort and clarity for the occupants. It is important to provide illuminance from the sides of the tasks to avoid glare.

Source/Task/Eye Geometry. [VERY IMPORTANT]

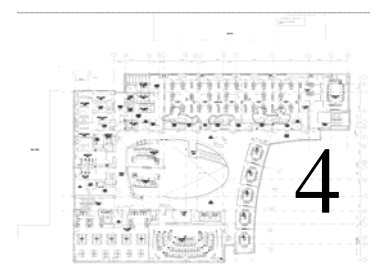
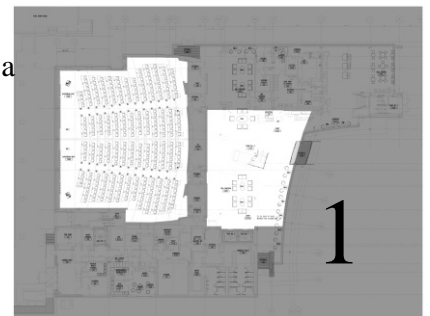
The angles between the light source, the task plane and the occupant are very important in this space. Improper placement of luminaires can cause discomfort and distractions to the occupant.

Surface Characteristics. [IMPORTANT]

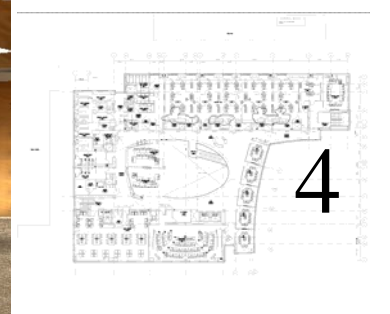
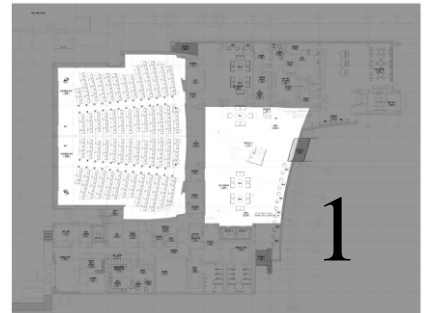
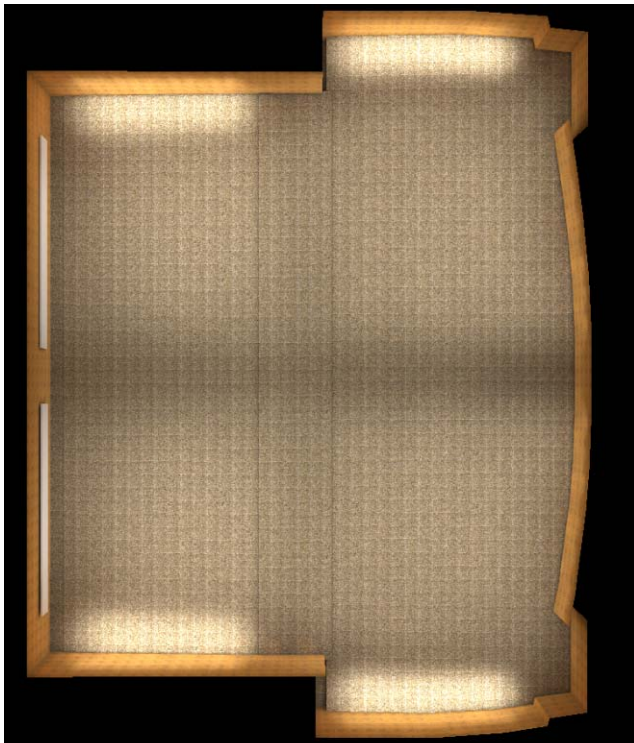
Surface materials and reflectances are important to increase ambient light in the room and decrease contrast from the fixtures and their backgrounds. The surfaces should be mainly a matte or satin finish to avoid glare. There is also wood finishes along the side walls to help decrease reverberations in the space.

System Control and Flexibility. [VERY IMPORTANT]

The multi-functionality of the space requires various light levels to accommodate the occupants. Lower light levels will be needed for projector-screen use and high levels will be needed for presentations and lectures using the front chalkboard/whiteboard. Dimming might also be used to lower the light levels in the space for projector-use or digital presentations.



Auditorium Calculations



Floor Material
Plaid weave Carpet
Reflectance = 0.21



Wall Material
Wood Acoustical Panels
Reflectance = 0.44



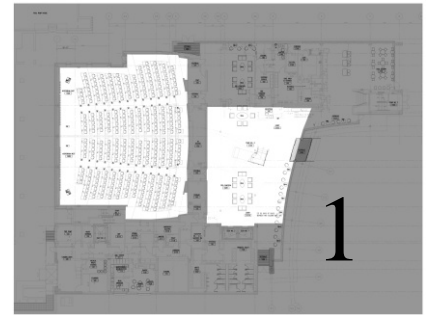
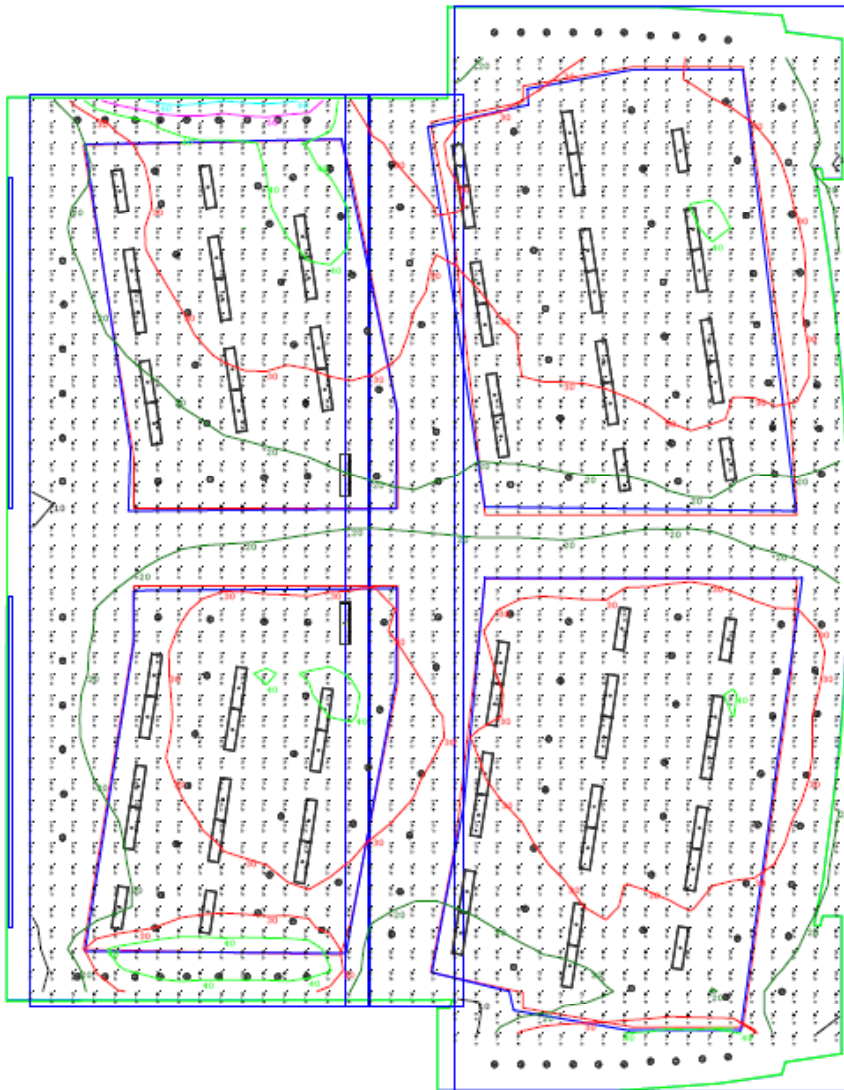
Ceiling Material
Wood Acoustical Panels
Reflectance = 0.31

Medical Education Building

Johns Hopkins University School of Medicine

Lighting Existing Conditions and Design Criteria Report

Auditorium Calculations



After analyzing the lighting conditions in the main auditorium space, the calculations met the design criteria for the space. An average of 30 footcandles was calculated on the task plane.

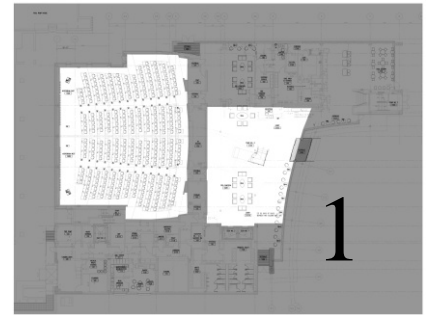
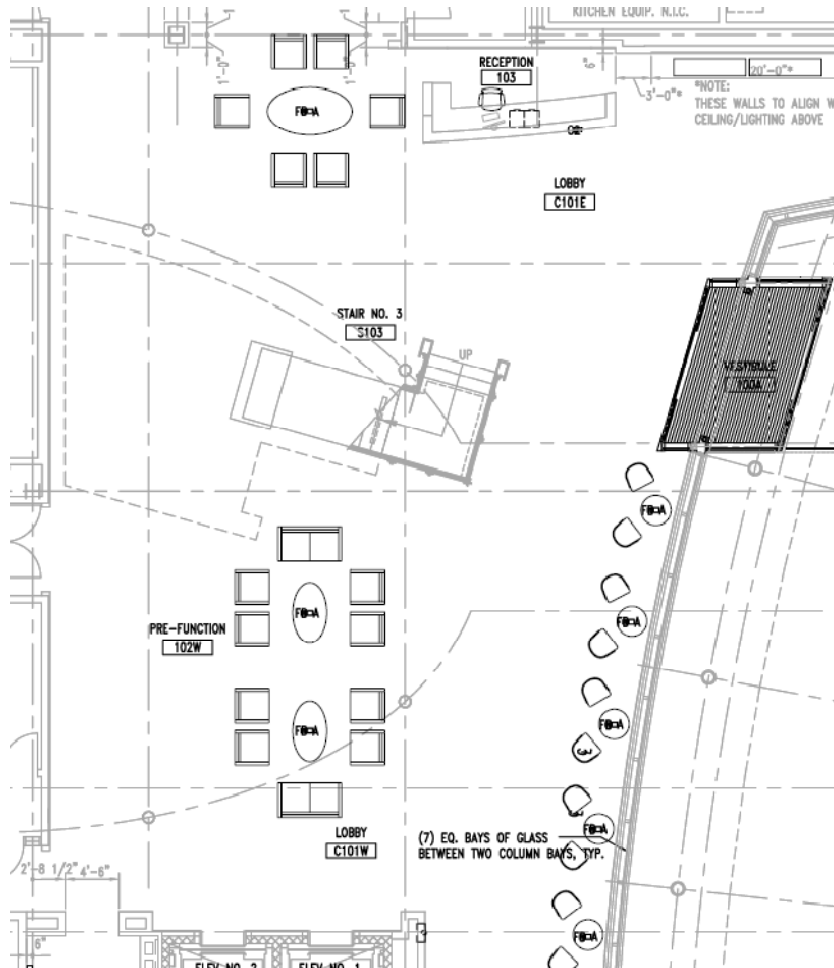
The lighting along the wall helps to present a more spacious feeling to the room and also helps to illuminate the walkways along the walls. The lighting compliments the wood acoustical ceilings that float above the four main seating areas in the space. Both systems work together to create a natural flow towards the center of the room, giving the space more interest and a more impressive look.

Medical Education Building

Johns Hopkins University School of Medicine

Lighting Existing Conditions and Design Criteria Report

First Floor Atrium



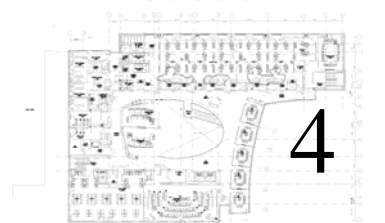
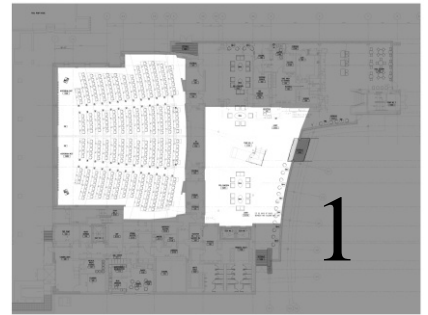
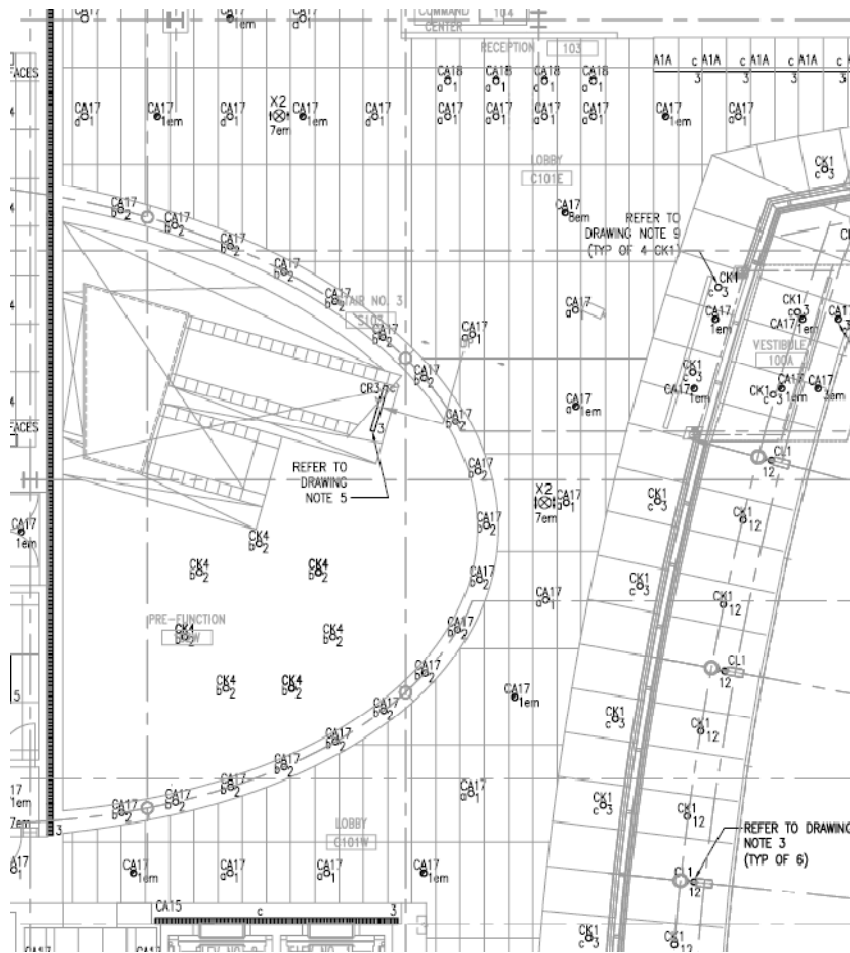
The first floor of the atrium is the main space people enter into when entering this building. Compact fluorescent downlights are recessed in the ceiling along with wallwashers along the walls. Metal halide downlights are located above the furniture in the center of the atrium and along the glass curtain wall. There is also a cove system along the north wall in the lobby .

Medical Education Building

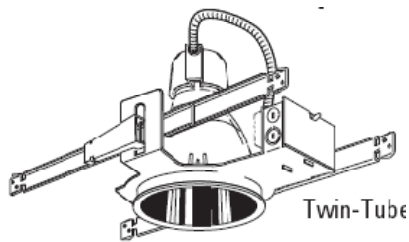
Johns Hopkins University School of Medicine

Lighting Existing Conditions and Design Criteria Report

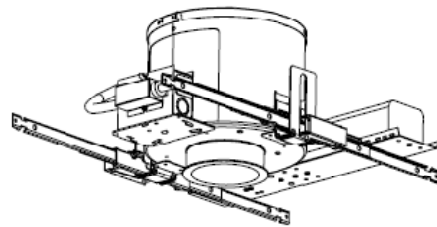
First Floor Atrium



CA15

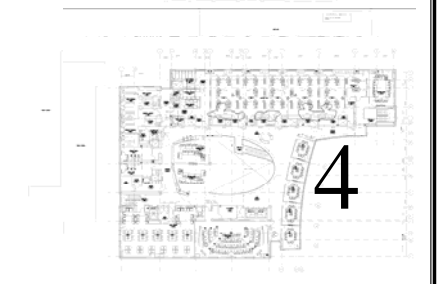
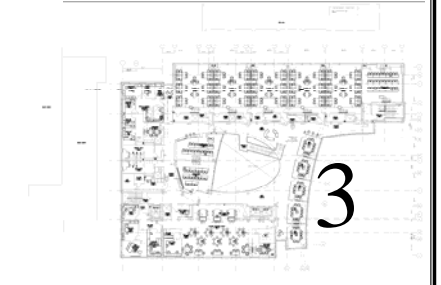
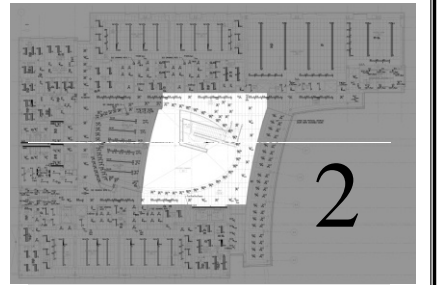
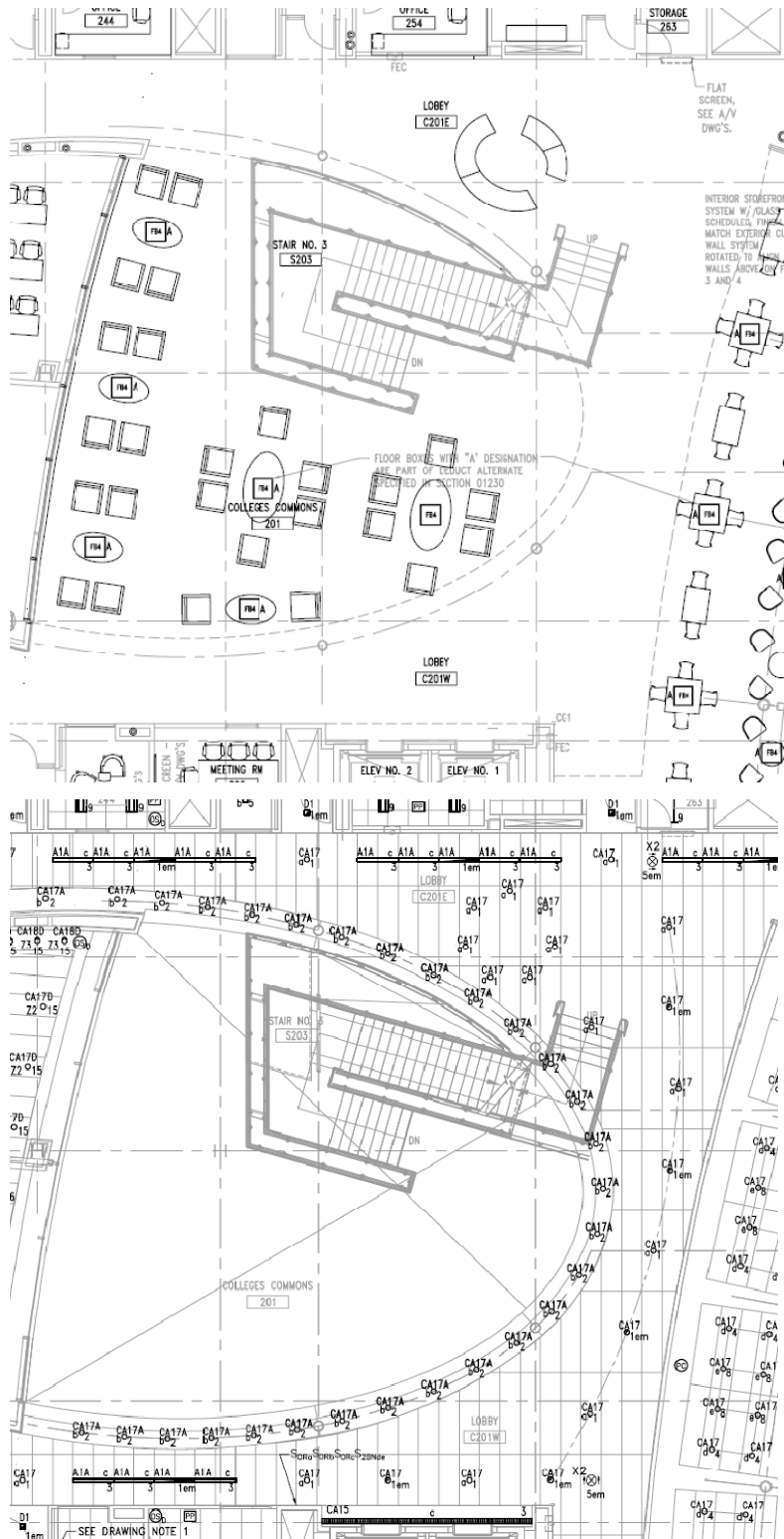


CA17

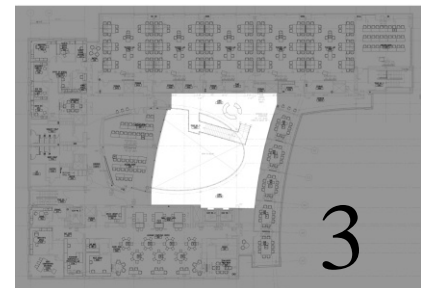
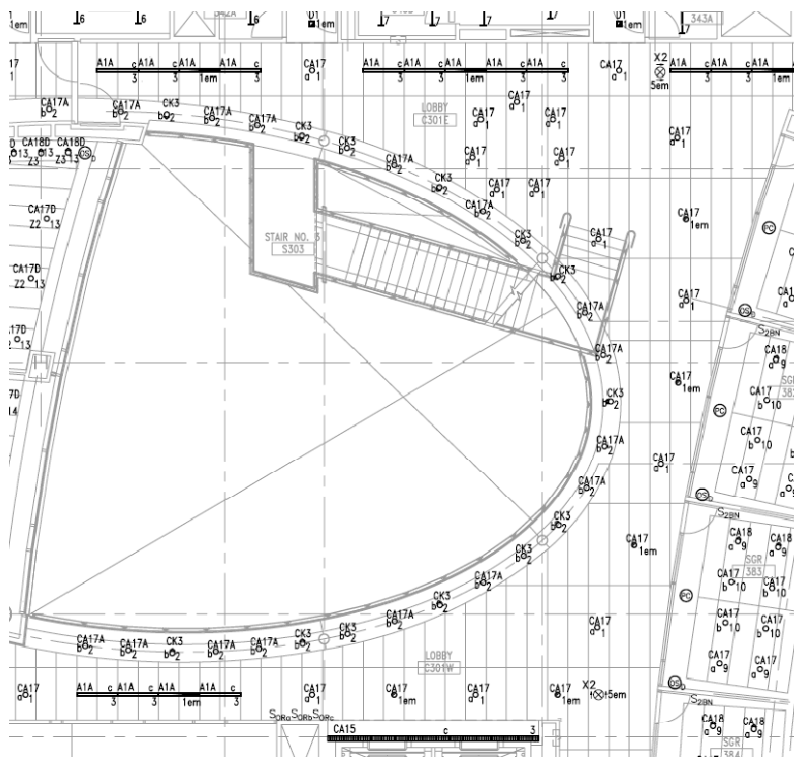
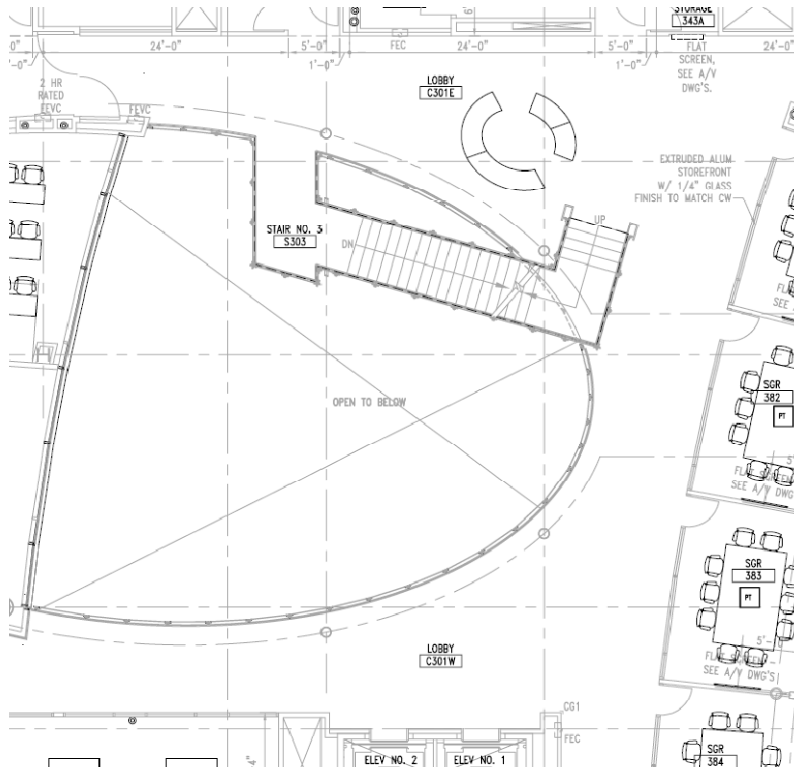


CK1

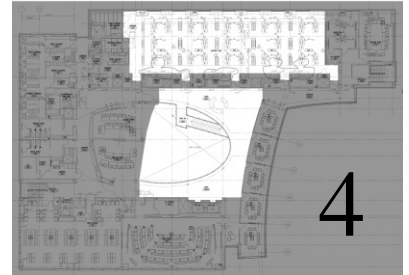
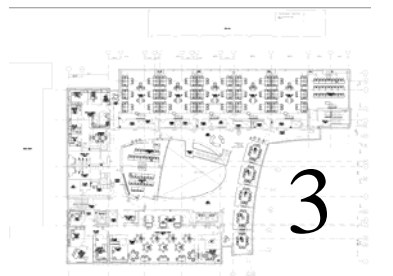
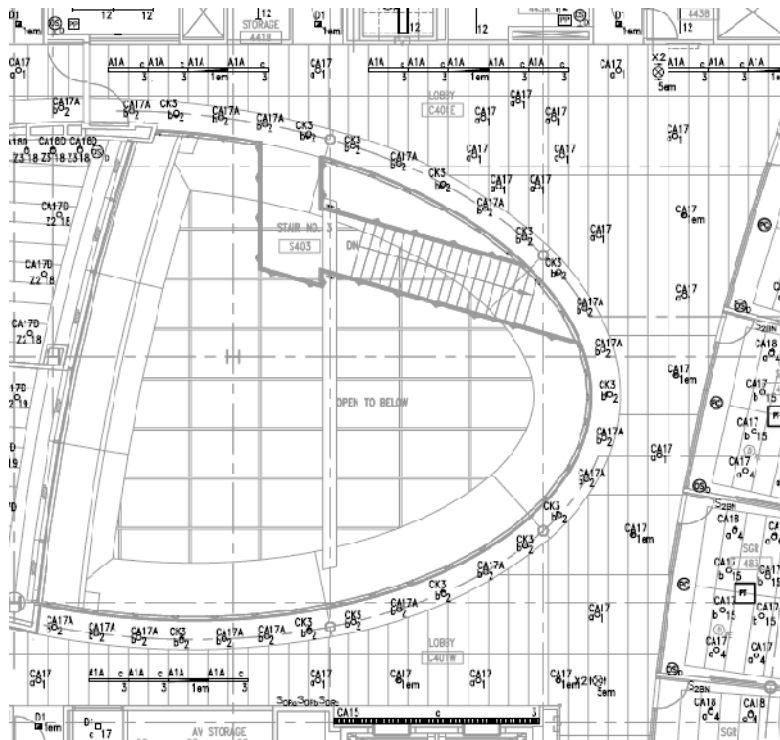
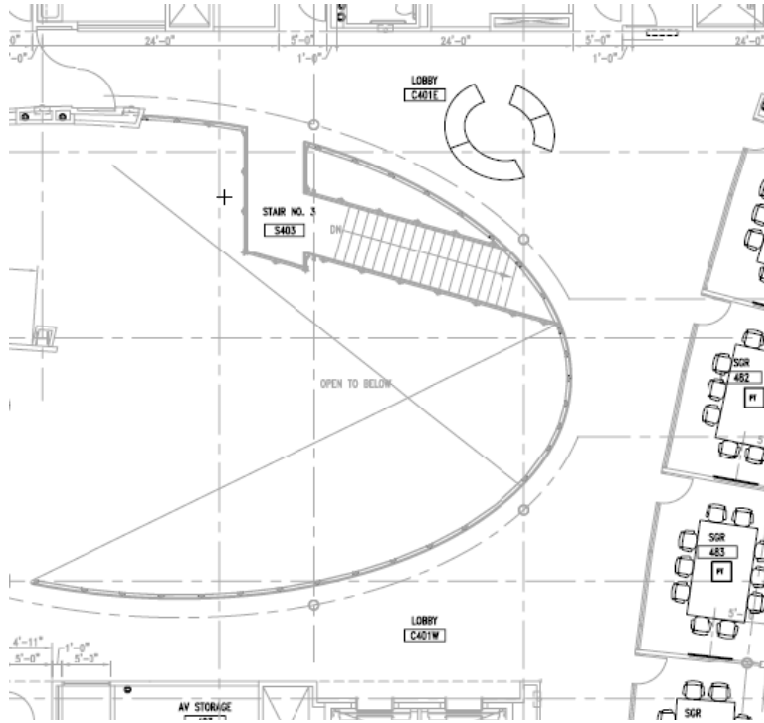
Second Floor Atrium



Third Floor Atrium

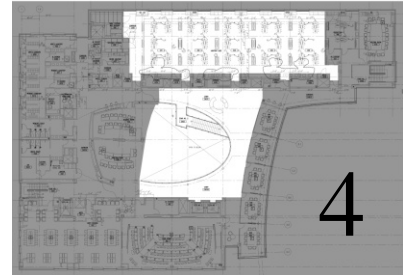


Fourth Floor Atrium



Atrium Lighting Fixture Schedule

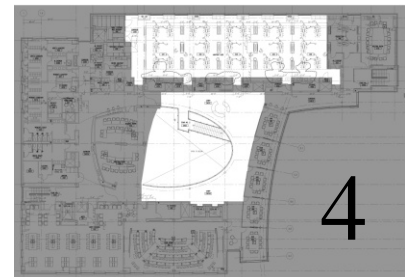
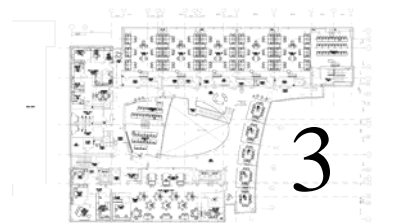
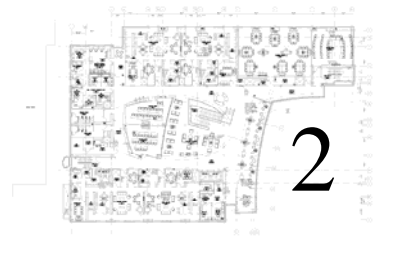
ATRIUM LIGHTING FIXTURE SCHEDULE								
TYPE	DESCRIPTION	MANUFACTURER	DESCRIPTION	LAMPS		INPUT WATTAGE	VOLTAGE	MOUNTING
				QUANTITY	TYPE			
AI1A	RECESSED 4 FOOT LONG WALL WASHER WITH NOMINAL 2 INCH WIDE APERTURE, EXTRUDED ALUMINUM REFLECTOR WITH BLACK MATTE PERFORATED DIFFUSER.	PEERLESS	LWAR9-G-1-54T5HO-HOL-U4-GEB10	1	FP54/835/HO/ECO	60	277	RECESSED
CA15	LINEAR FLUORESCENT RECESSED LUMINAIRE, NOMINAL 11 INCH WIDE X MAXIMUM 8-3/8 INCH RECESS DEPTH X LENGTH AS SHOWN ON DRAWINGS, STEEL HOUSING, CONTINUOUS WHITE REFLECTOR UP TO 40 FEET LONG, HIGH POWER FACTOR, ELECTRONIC BALLASTS. PROVIDE SLIDING SLEEVE AS REQUIRED. REFER TO ARCHITECTURAL DRAWINGS FOR LENGTH.	MARK LIGHTING	PPL-WH-LENGTH-277-2T5HO-EB	2/4 FT	FP54/835/HO/ECO AND FP39/835/HO/ECO	120/4 FT	277	RECESSED
CA17	COMPACT FLUORESCENT DOWNLIGHT, VERTICAL LAMP, NOMINAL 6 INCH DIAMETER APERTURE X 11 INCH MAXIMUM RECESS DEPTH, SATIN CLEAR ALZAK LOW IRIDESCENT CONE AND FLANGE, INTEGRAL ELECTRONIC BALLAST WITH LAMP FAILURE PROTECTION.	GOTHAM	AFV-32TRT-6AR-LD-277-GEB10	1	CF32DT/E/IN/835	36	277	RECESSED
CK1	METAL HALIDE DOWNLIGHT, NOMINAL 6 INCH DIAMETER APERTURE X 10 INCH MAXIMUM RECESS DEPTH, SEMI-SPECULAR CLEAR ALZAK LOW IRIDESCENT REFLECTOR WITH FLAT FLANGE, HIGH POWER FACTOR, ELECTRONIC BALLAST.	GOTHAM	APRH-P3070MHC-6-AC-T30-LD-VOLT-HEB	1	CDM70/PAR30L/M/FL	82	277	RECESSED
CK3	METAL HALIDE ADJUSTABLE ACCENT, NOMINAL 4-1/2 INCH DIAMETER APERTURE X 6-1/2 INCH MAXIMUM RECESS DEPTH, DIE CAST CONSTRUCTION WITH INDUSTRIAL SILVER POWDER COAT FINISH, 30 DEGREE TILT, 359 DEGREE ROTATION, HIGH POWER FACTOR, ELECTRONIC BALLAST.	RSA LIGHTING	CDMC-P3-S-70-277-NC	1	MCP70/PAR30LN/U/830FL	82	277	RECESSED
CK4	METAL HALIDE ADJUSTABLE ACCENT, NOMINAL 4 INCH DIAMETER APERTURE X 9-1/2 INCH MAXIMUM RECESS DEPTH, SEMI-SPECULAR CLEAR ALZAK LOW IRIDESCENT REFLECTOR WITH FLAT FLANGE, 40 DEGREE TILT, 360 DEGREE ROTATION, HIGH POWER FACTOR, ELECTRONIC BALLAST.	GOTHAM	DPH-P2039MHC-4-AC-T20-LD-277-HEB	1	CDM35/PAR20/M/FL	45	277	RECESSED
CR3	FLUORESCENT RECESSED IN-FLOOR UPLIGHT, NOMINAL 4-1/2 INCH WIDE X 48-1/2 INCH LONG X 5 INCH MAXIMUM RECESSED DEPTH, DIE CAST ALUMINUM ALLOY HOUSING WITH EXTRUDED ALUMINUM INNER HOUSING, STAINLESS STEEL FACEPLATE, TEMPERED GLASS LENS, ANODIZED ALUMINUM ASYMMETRICAL REFLECTOR WITH LOUVER, HIGH POWER FACTOR, ELECTRONIC BALLAST. UL WET LISTED.	BEGA	8643P	1	FP54/835/HO/ECO	60	277	RECESSED IN MILLWORK



Atrium

IESNA Handbook Light Loss Factors

Atrium Light Loss Factors					
Type	LLD	LDD	RSDD	BF	TOTAL LLF
A1A	0.95	0.86	0.98	0.87	0.6965742
CA15	0.95	0.86	0.98	0.87	0.6965742
CA17	0.85	0.88	0.98	0.87	0.6377448
CA18	0.85	0.88	0.98	0.87	0.6377448
CK1	0.61	0.88	0.98	1	0.526064
CK3	0.61	0.88	0.98	1	0.526064
CK4	0.61	0.88	0.98	1	0.526064
CR3	0.95	0.88	0.98	0.87	0.7127736



ASHRAE 90.1 Power density requirements

Atrium Power Density Calculation			
W/SF Allowance	Area of space(SF)	Total Lamp Wattage	W/SF Existing
1.1	6430	4851	0.76

Atrium Design Criteria

Daylighting Integration and Control. [VERY IMPORTANT]

Daylight directly penetrates the space from the roof glass ceiling and through the glass curtain wall on the first and second floor. It also can come through the student group rooms lining the glass curtain wall on the third and fourth floor. With the amount of daylight penetrating the space, it will be important to have daylight control in order to keep a comfortable level constant throughout the day.

Direct Glare. [IMPORTANT]

It is important to minimize glare because of the importance of circulation and heavy meeting use of the space.

Illuminance (Horizontal). [VERY IMPORTANT]

Horizontal Illuminance levels are important for safety along the stairwell and atrium edge as well as clearly light the circulation areas of the occupants. The recommended illuminance level should be 10 footcandles.

Light Distribution on Surfaces. [IMPORTANT]

It is important to differentiate the illuminance levels of the different surfaces in the space to keep a visual interest. The recommended ratio between the ceiling and floor is a 3:1 ratio.

Light Distribution on Task Plan (Uniformly). [IMPORTANT]

It is important to have a uniform level of light along the staircase and floor throughout the space to keep it safe.

Light Pollution/Trespass. [VERY IMPORTANT]

It is important not to waste energy by directing light outside of the building through the large glass ceiling or full height glass façade. Reflected lighting should also be minimized to reduce light escaping from the glass.

Modeling of Faces or Objects. [IMPORTANT]

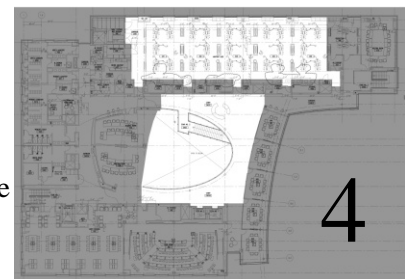
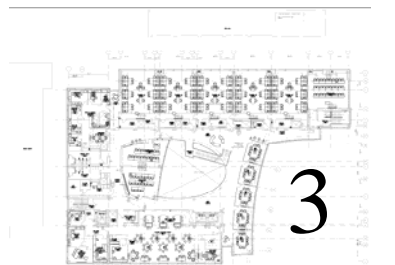
The atrium and lobby spaces will be the main circulation spaces in the building where people will meet and relax. It will be important to use multi-directional lighting to improve facial modeling and reflected lighting from the walls helps to fill in facial shadows.

Points of Interest. [IMPORTANT]

The grandiose atrium architecture and surrounding lobby spaces will be main points of interest because they are located in the middle of the building and span the whole height of the building.

Reflected Glare. [IMPORTANT]

It is important to avoid reflections from the glass ceiling and glass wall along the north wall of the atrium.

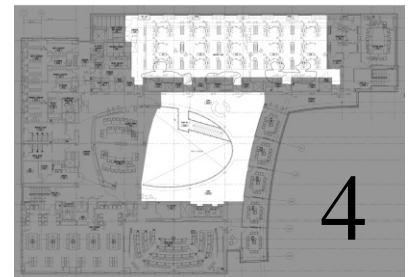


Atrium Design Evaluation

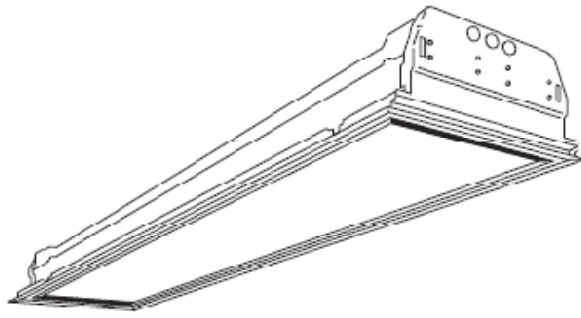
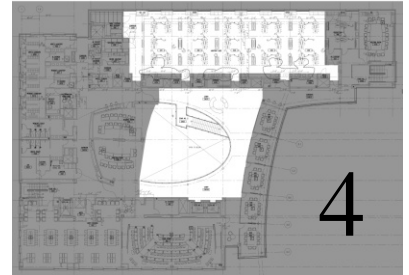
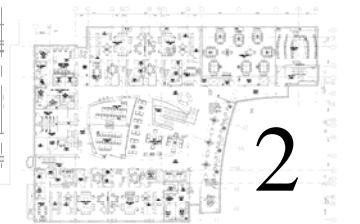
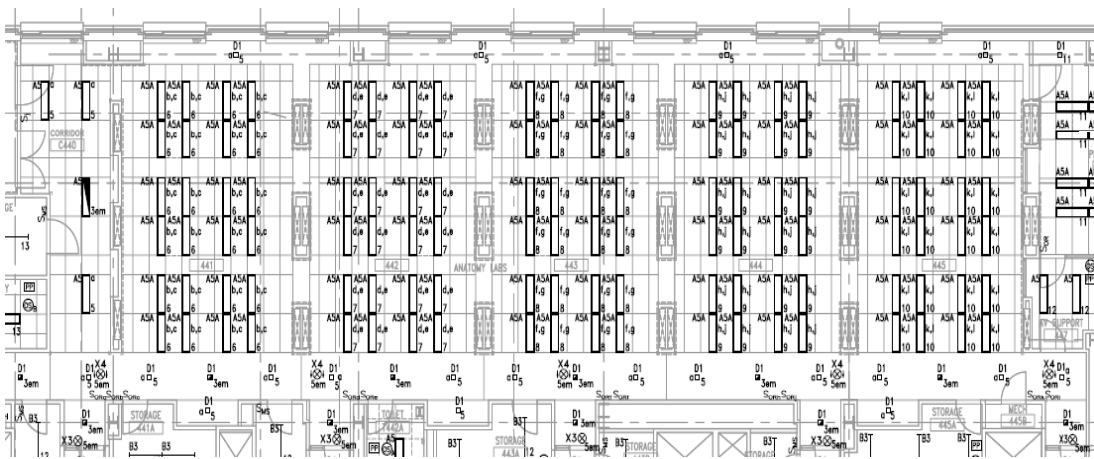
The lighting design of the atrium creates a very open space by the compact fluorescent and metal halide downlights along the perimeter of each floor. However, as the central and largest space in the building, the atrium is naturally the most commonly visited space in the building. The lighting should emphasize the powerful architectural statement it creates in the building.

Most of the first floor is separated from the atrium and creates more of a basement feeling to the first floor. The lighting design should emphasize the full height atrium and open up the first floor to open up the space. The stairwell also could be emphasized with its central location within the atrium. Giving this a vertical element could also connect the full height of the atrium.

The glass curtain wall also creates an illusion of a larger atrium space. The meeting rooms next to the atrium add to the lighting into the space from the skylight and southwest exterior glass curtain wall.



Anatomy Lab



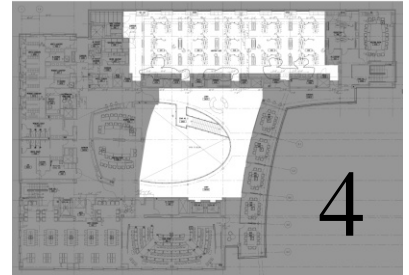
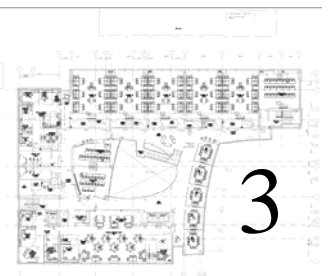
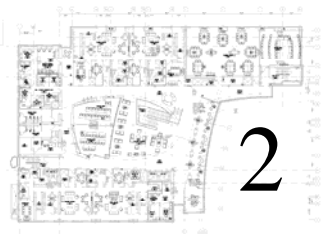
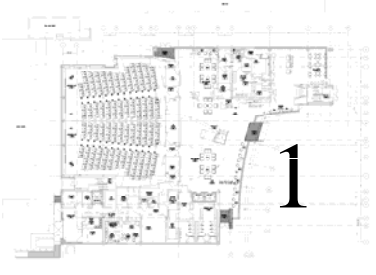
A5A



D1

Anatomy Lab Lighting Fixture Schedule

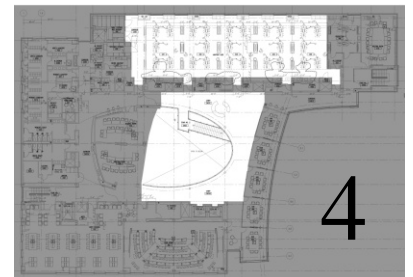
ANATOMY LABORATORY LIGHTING FIXTURE SCHEDULE								
TYPE	DESCRIPTION	MANUFACTURER	DESCRIPTION	LAMPS		INPUT WATTAGE	VOLTAGE	MOUNTING
				QUANTITY	TYPE			
A5	RECESSED 1 FOOT X 4 FOOT FLUORESCENT FIXTURE WITH 0.125" #12 PRISMATIC ACRYLIC LENS AND FLUSH WHITE STEEL DOOR. RAPID START BALLAST.	LITHONIA	SP-G-232-A12125-277-GEB10RS	2	F032/835/ECO	54	277	RECESSED
A5A	SAME AS TYPE "A5" EXCEPT WITH 3 LAMPS	LITHONIA	SP-G-332-A12125-277-GEB10RS(2)	3	F032/835/ECO	85	277	RECESSED
D1	RECESSED COMPACT FLUORESCENT DOWNLIGHT WITH 6 INCH SQUARE APERTURE, HORIZONTAL LAMP, AND MATTE-DIFFUSED CLEAR ALZAK REFLECTOR WITH WRAPAROUND ONE-PIECE TRIM.	GOTHAM	SQF-1/32TRT-6AR-LD-MVOLT	1	CF32DT/EIN/835	36	277	RECESSED



Anatomy Lab

IESNA Handbook Light Loss Factors

ANATOMY LAB LIGHT LOSS FACTORS					
Type	LLD	LDD	RSDD	BF*	TOTAL LLF
A5	0.95	0.88	0.98	0.87	0.7127736
A5A	0.95	0.88	0.98	0.87	0.7127736
D1	0.85	0.88	0.98	0.87	0.6377448



ASHRAE 90.1 Power density requirements

Anatomy Lab Power Density Calculation			
W/SF Allowance	Area of space(SF)	Total Lamp Wattage	W/SF Existing
1.4	4480	11532	2.57

Anatomy Lab Design Criteria

Appearance of Space and Luminaires. [IMPORTANT]

The layout of the space with the different examination tables and flat screen TVs need higher light levels than the walkways between the different stations.

Color Appearance and Color Contrast. [VERY IMPORTANT]

Luminaires with higher CRI values should be used to see color better and distinguish between color while occupants are using anatomy stations.

Daylighting Integration and Control. [IMPORTANT]

The space is located on the eastside of the building so there will be a large amount of light entering in the morning hours. Daylighting controls should be used to compliment the daylight with electric lighting to ensure optimal light levels throughout the day and to minimize energy use.

Direct Glare. [VERY IMPORTANT]

It is very important not to have direct glare during anatomy labs. Visual clarity is very important in this space and direct glare will be very uncomfortable and distracting.

Illuminance (Horizontal). [VERY IMPORTANT]

It is very important to have appropriate light levels along the task plane. A minimum of 50 footcandles is recommended in this space.

Illuminance (Vertical). [VERY IMPORTANT]

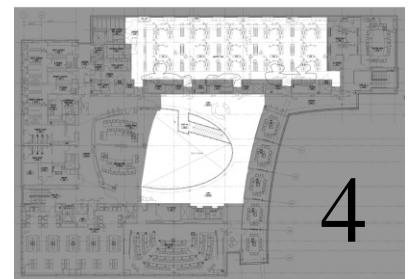
It is very important to have appropriate vertical light levels for facial recognition. A minimum of 30 footcandles is recommended in this space.

Light Distribution on Surfaces. [IMPORTANT]

Light levels at stations should be higher than the light levels along the periphery and in the walkways between stations to direct attention to the stations.

Light Distribution on Task Plan (Uniformly). [VERY IMPORTANT]

Uniform lighting along task plane is essential for performing critical tasks along stations that require visual detail. There should not be any shadow around work station.



Anatomy Lab Design Criteria

Luminances of Room Surfaces. [IMPORTANT]

An average of 30-100 candela per square meter are recommended for wall luminance levels in a workspace to increase brightness along the periphery of the room.

Modeling of Faces or Objects. [VERY IMPORTANT]

The depth and shape of objects are important in this space to see and be able to perform necessary tasks at stations throughout the space in order to see the small details.

Points of Interest. [VERY IMPORTANT]

The stations and TVs are the points of interest in the space and should have higher illuminance levels than the walkways between the stations.

Reflected Glare. [VERY IMPORTANT]

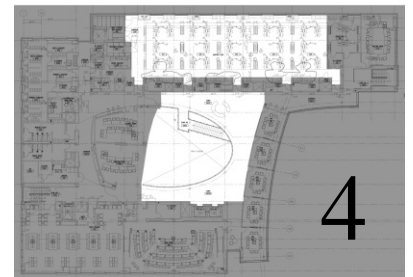
Glare should be avoided to minimize distraction and discomfort in the space. The daylight and electric lighting both could hinder the tasks being performed. Reflected glare from the TV screens also needs to be avoided in order that the students can easily see the screen.

Shadows. [IMPORTANT]

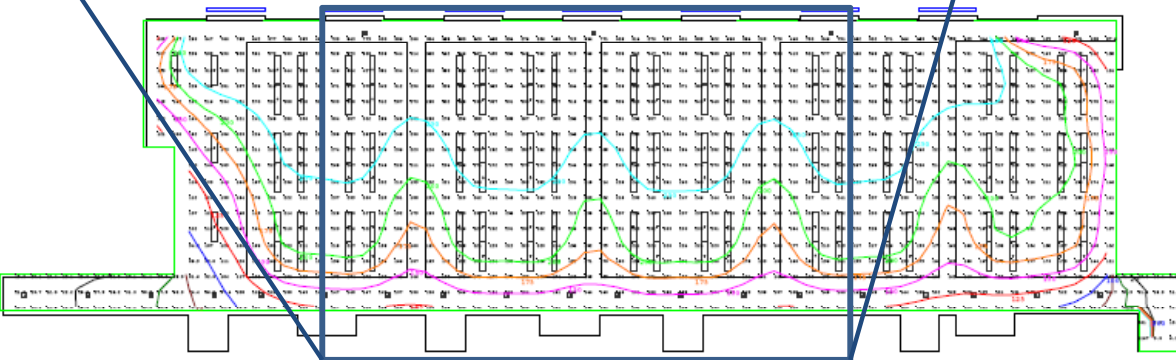
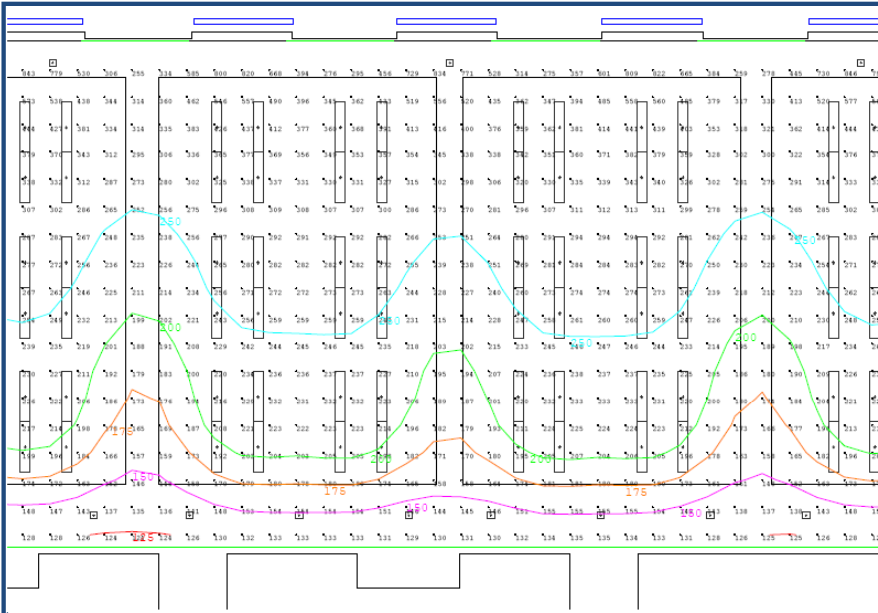
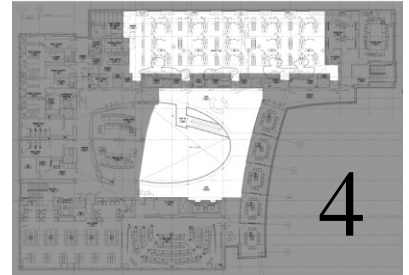
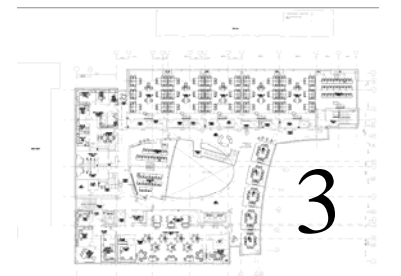
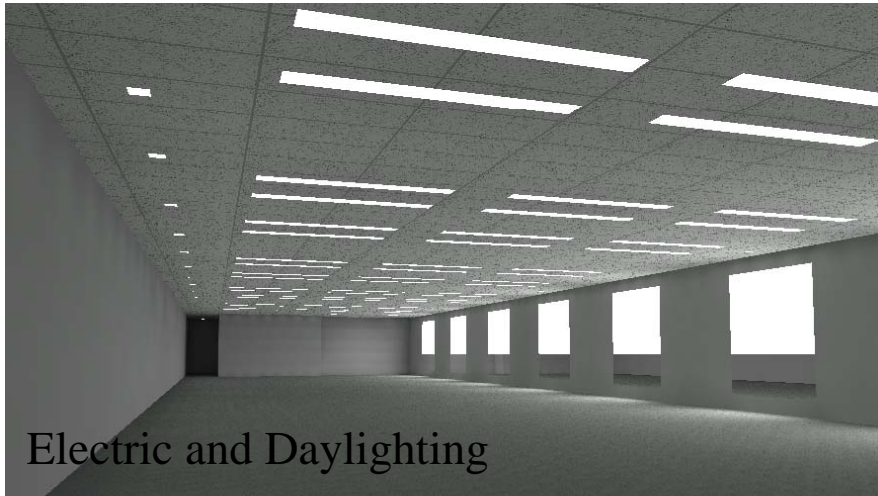
Shadows should be avoided in this space due to the important visual tasks being performed at the stations throughout the room.

Source/Task/Eye Geometry. [VERY IMPORTANT]

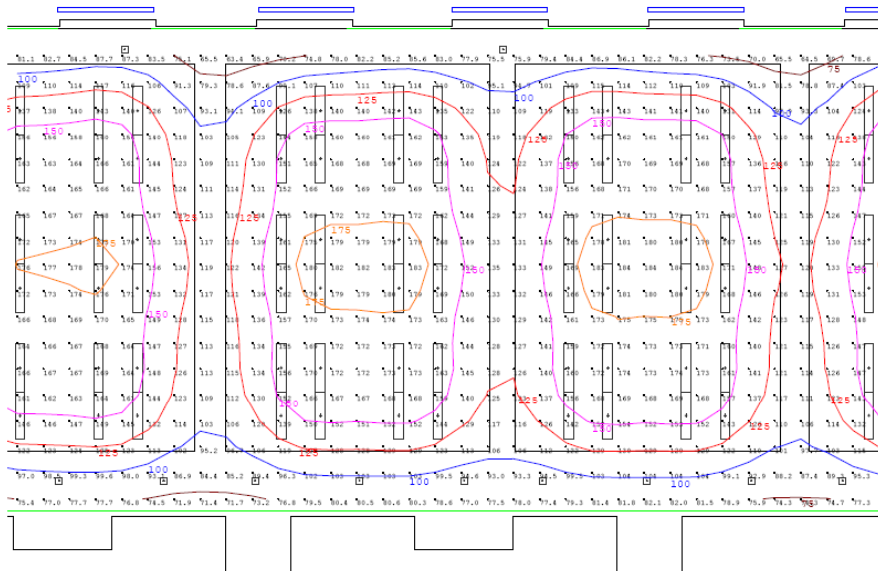
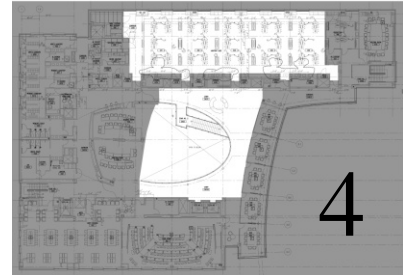
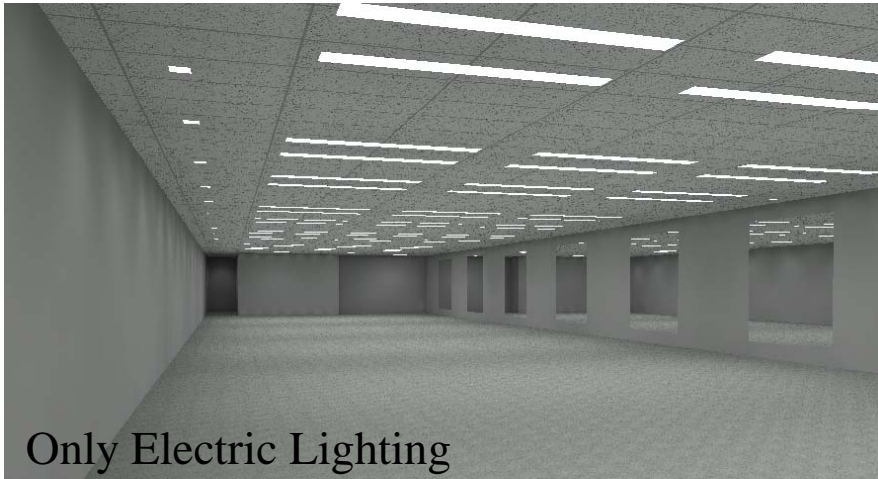
Due to the importance of the visibility of the tasks being performed, the sources should not interfere with the vision of the occupants.



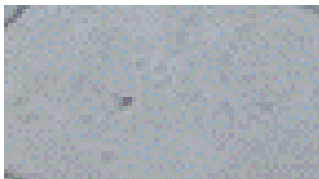
Anatomy Lab Calculations



Anatomy Lab Calculations



The average lighting levels on the task plane in the anatomy lab are around 238 Footcandles with daylighting and electric lighting. With only electric lighting the average illuminance levels on the task plane is 124 Footcandles. The high levels are needed on the task plane in order for occupants to see minute details while they perform the common tasks of the space.



Floor Material
 Epoxy Painted Concrete
 Reflectance = 0.35

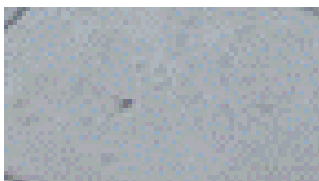
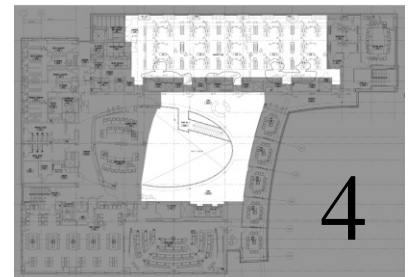


Ceiling Material
 Acoustical ceiling tile
 Reflectance = 0.85

Anatomy Lab Calculations

After calculating the lighting levels on the task plane in the anatomy lab, the results showed high values. The average lighting levels on the task plane in the anatomy lab are around 238 Footcandles with daylighting and electric lighting. With only electric lighting the average illuminance levels on the task plane is 124 Footcandles. However, most of the tasks performed will require high levels in the space in order for occupants to see minute details while conducting anatomy labs.

The space is very open and long. The lab is 112 feet long and 40 feet wide. Each work station is sits next to a flat screen TV for occupants to receive instructions for lab assignments. The openness of the space allows occupants to move around easily especially when various equipment will be needed for the assigned tasks.



Floor Material
Epoxy Painted Concrete
Reflectance = 0.35



Ceiling Material
Acoustical ceiling tile
Reflectance = 0.85

Appendix

All relevant computer files can be found on the Penn State Architectural Engineering computer server.

- IES Files for existing fixtures
- AGI 32 Files – Auditorium.a32; Anatomy Lab.a32
- Excel Files – LLF.xls; Power Density Calcs.xls;
Existing LFS.xls
- Word documents – lighting design criteria for each space

