The National Research and Training Institute For the Blind

1800 Johnson St., Baltimore MD.

Allison Brown
Lighting/Electrical

Richard Mistrick
9/30/02

Lighting Existing Conditions and Design Criteria Report

Executive Summary:

I decided to focus my efforts on the fourth floor of the building which I believe will be the most challenging when considering disability discrepancies and is probably is the main "image maker" of the building from an aesthic standpoint. The visually impaired may require many different levels of light: For example an elderly person losing vision needs a large amount of illuminance and may be more sensitive to brightness where as another person of a differing sight disability may be extremely sensitive to light and require complete darkness in order to be comfortable. The owner also specified very glossy surfaces throughout the building which may create glare problems for visitors to the building who are not visually impaired.

From an analysis standpoint, I chose to carefully analyze the computer classroom for this submission of the project. I really wanted to determine how the complex geometry of the room and the glossy, dark materials affected the lighting levels, reflected light, and luminance ratios. I performed a brief analysis of the multi-purpose room to get a general idea of how the ambient system behaves. The two lighting systems are practically identical in nature, but the geometry and materials in the spaces vary. Since practically all the ambient light is provided by daylight in the skylight lobby, I chose to do a complex daylight analysis at a later date using radiance. I am still in the process of completing a full building model in order to perform the analysis for the exterior plaza and entrance. I made approximations on how I feel these systems will perform.

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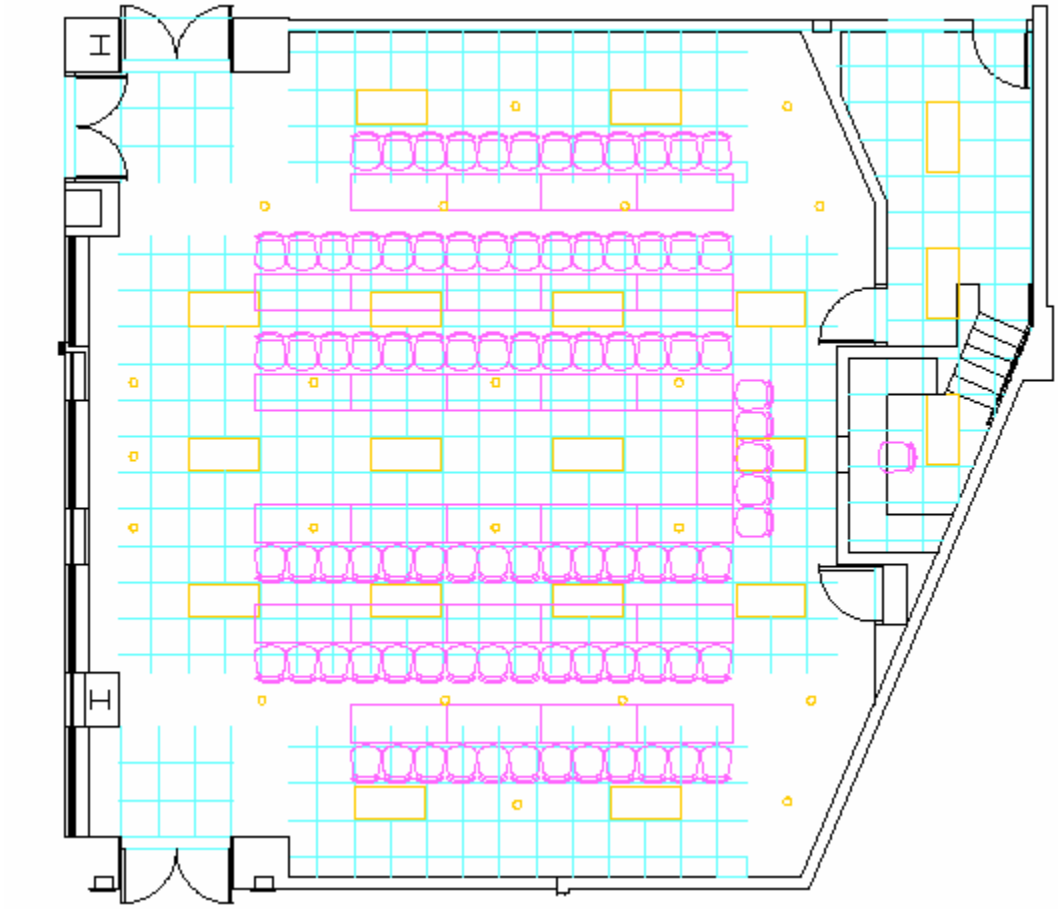
Computer Classroom (N401)



Dimensions: *45'x 54'X14' with 2' bulkheads outlining room.*

Wall materials*: The walls are typically lined with sheets of 4'X10' acoustical panels. The perimeter is lined with a 4' high decorative wood panel topped with a 1"x6" wood railing. At the base of the walls is a 1"x8" wooden baseboard (stained). Outlining the door frames is a stained wood veneer panel (8'X10'). A retractable 10'x12' projection screen is located on the western wall in front of the windows.*

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Decorative wood panel (Georgia Pacific American Oak Beaded (WP-2))
ρ assumed = .44

Acoustical fabric (Guilford of Main Lucida 3553 Color 012= "illumination" (Fp-2))
ρ assumed = .52

Baseboard (Gossen Corp "deep dimension" 943 pine)
ρ assumed = .65

Windows: *The western wall contains four 6'x6'8" windows all consisting of two layers of ¼"tempered plate clear glass. The transmittance is about .95. The frames are a simulated wood trim to match baseboard.*

Floor: *The floor consists of two colors of carpet set in distinct patterns as shown in floor plans.*
(CPT-1 = Mannington Commercial, Style Sorata, Color= Brookside Tawny Bronze)
ρ assumed = .15

(CPT-2 = Mannington Commercial carpet, style = sorata, color= brookside moss)

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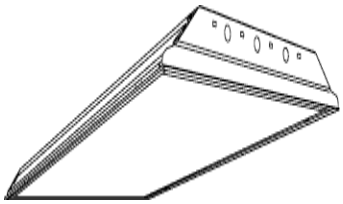
ρ assumed = .17

Ceiling: *The ceiling consists of a white 2'x2'x3/4" acoustical ceiling tile grid (Armstrong Cirrus tegular type 578) with a 3'x 2' painted "semi-gloss" Gypsum wallboard bulkhead.*
ρ = .83

Existing lighting Systems

- ***Ambient:*** *2'x4' lensed 3 lamp F32T8 fixtures on 277 volts. A second lighting system includes 6" 2 lamp F26DBX 4 pin 4100 K downlights on 277 Volts.*
- ** Note the lighting designer called out 3 different manufactures. Lithonia fixtures are pictured below.*



- ***Decorative:*** *A direct/indirect 4' wall bracket fluorescent fixture exists above the doorways. A decorative wall sconce (1 lamp F39Bx @ 120 V) accentuates the perimeter of the classroom.*
  ** Note: I don't yet have a picture of the uplight*

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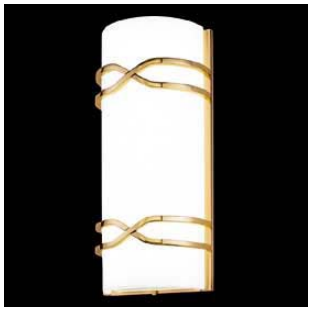

- ***Audiovisual:*** *Three 6" dimmable downlights serve for the audiovisual screen in the front of the classroom. The fixtures themselves are the same as the ambient downlights. Lutron Hi-lume dimming ballasts are specified.*

- ***Control:*** *The 2x4's and wall bracket fixtures are switched together on a switch by the northern entrance door. The downlight ambient system is on another switch by the northern door as well. The audiovisual downlights are on dimmable switches controlled at the same location as the other systems. Lastly, the wall sconces are on a 3-way switching scheme located at both main entrance doors.*

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COMPUTER CLASSROOM SUMMARY

Area = 2430 Sqft								
Average Reflectance								
Walls	Floor	Ceiling						
0.5	0.18	0.75						
Power Density Allowable @ 1.6 w/sqft acc. To IES								
3888 watts								
			Power Density					
Fixture	# of fix	Lamp	Voltage	# of lamps	Lamp watts	Ballast (typical for lamp type)	B watts	Total watts
A1 (2x4)	16	F32T8/4100K	277	3	32	Centrium electron instant start	2	1632
B2 (DL)	20	F26DBX(4P)4100K	277	2	26	Advance CFL program start	2	1120
B3 (DL)	3	F26DBX(4P)4100K	277	2	26	Hi-Lume Lutron Dimming	4	180
B1(sconce)	8	F39BX	120	1	39	Advance CFL program start	3	336
D1 (uplight)	2	F32T8/4100K	277	2	32	Centrium electron instant start	2	136
Total								**3404**

*The classroom meets the power density requirements: 3404w< 3888w

Light Loss Factors (with clean environment every 6 months)						
Fixture	Maint.Cat	LDD	LLD	RSDD	Ballast Facto	Total LLF
2x4	V	0.95	0.95	0.92	1	0.83
DL	IV	0.85	0.85	0.92	1	0.66
DL (dim)	IV	0.85	0.8	0.92	0.95	0.59
Sconce	II	0.98	0.95	0.92	0.97	0.83
uplight	VI	0.92	0.95	0.92	1	0.80

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Design Criteria

The occupancy and function of this room is very diverse. This room is meant for training and lecturing with the intent of using computer work stations. I am still in the process of learning exactly what type of design criteria is required when considering VDT glare issues, daylight integration, and audiovisual requirements based on requirements of blind vs.sighted occupants. For design criterion, I used data in the Educational Portion of IES. Because the room is contains various tasks, multiple lighting systems should be used: Task, Ambient, and Presentation. A dimming system and daylight control system should be utilized.

Reading and Writing Tasks (could be increased due to disabilities)
Horizontal Illuminance: (category E) = 500 lux
Vertical illuminance (category D) = 300 lux

VDT tasks:
Horizontal Illuminance (category C) = 300 lux
Vertical illuminance (category B) = 5 fc

**There could be a larger illuminace required because of the visual impairment of the occupants.*

Appearance of Spaces and Luminaires (some-what important)

Because of the disabilities of the occupants, circulation patterns for the room should be clearly defined for those who are partially sighted. Attention should be brought to the doorways and the presentation screen by utilizing areas of high wall luminance and illuminance and there should be a good contrast with surrounding areas.

Color Appearance (some-what important)

There is a large amount of daylight that will be entering the space; therefore the CCT of the lamps should be on the bluer end of the spectrum to avoid color clashing. The lamps should be designed to have a CRI of 70+ for good color appearance of surfaces in the space.

Daylight Integration (very important)

Daylight integration should be considered when considering veiling reflections on VDT screens, (high luminance levels causing distracting glare) The desks are logically arranged so the windows will provide light from the side of the occupant, which was done correctly and should not produce glare. The windows face westward, so evening sunlight may be an issue. Blinds or drapery should be utilized due to the multi-task environment (audio-visual presentations, etc) and to keep the occupants comfortable. Since the room is rather large, it may be wise to increase vertical illuminance on the opposite facing wall to decrease contrasting luminance and to open up the space.

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Direct Glare (very important)

Direct Glare is a very important issue especially when considering the partially sighted and the elderly. The occupants of the space may be extremely sensitive to bright objects, so it is very critical to eliminate direct glare. The luminaries should be of a lower brightness and the lamps should be out of the direct field of view of the occupants. The luminaire luminances should not be more than 100 times those of surrounding surfaces. This can be achieved with luminaries that illuminate the ceiling as well as the task and by increasing ceiling reflectance. Optical control devices should be used.

Flicker and Strobe (important)

Electronic ballasts were specified for all lighting fixtures in the building which should eliminate this issue. Careful consideration should be applied for noise control due to the extreme sensitivity of the sight-impaired.

Light Distribution on Surfaces (important)

The wood paneling on the perimeter walls is fairly glossy which my cause some reflected glare. The bulkheads may cause some shadowing as well. The light patterns on the walls should not be too distracting; however large luminance ratios may be desired for the visually impaired. Ceiling and wall luminance should be within a 3:1 ratio.

Light Distribution on task plane (very important)

A fairly even light distribution on the work plane is desirable, however higher levels of light may be required for the disabilities for the occupants. For the VDT screens, however, a lower level of ambient light is usually desirable, thus two separate task vs. ambient systems should be utilized. Work surface illuminances should be 1.5 to 3 times higher than those in surrounding areas to assist in directing occupants' attention to the task. Greater luminance ratios should be avoided to minimize visual fatigue.

Modeling of Faces and Objects (important)

Since the space is used for lecture purposes, modeling of faces is important when considering the instructor and students. Diffuse and reflected light should be used to soften facial shadows and higher wall reflectances should be used. Separate lighting systems can be used to achieve this affect.

Luminances of Room surfaces (important)

Luminance levels should not exceed 850 cd/m^2 on ceiling to avoid glare. Average wall luminances of 30 to 100 cd/sq meter are preferred. In the classroom, however it should be taken into account the occupant's potential sensitivity to brightness.

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Luminance ratios
- *Paper vs VDT = 3:1*
- *Paper vs Desk = 3:1*
- *Task vs Remote = 10 :1*

Points of Interest (some-what important)

The major point of interest in the room is the audiovisual screen at the front. For presentation purposes (speaker and audiovisual) this space should be separately lit from the rest of room and stand-alone to focus attention. The doorways should also be accentuated visually somehow for safety egress purposes due to the occupant disabilities)

Reflected Glare (very important)

This will be probably the major design issue to consider in this space. The surfaces in the room are extremely glossy, the large amount of VDT screens, the sensitivity of the occupants, and the large amount of daylight will all be major glare factors. The ratio of illuminance on the task from the mirror angle to the total illuminance on the task should be less than 0.3 and not to exceed 0.7. Ideally, the computer stations should be lit from the side to avoid all reflections and to select diffuse reflecting screens with bright background and dark text. Glare should be limited at common viewing angles (i.e. behind computer) and secular louvers should be avoided.. Luminance levels should not exceed 850 cd/m^2 on ceiling to avoid glare. The source distribution should be out of reflected field of view and the intensity distribution above 55 deg altitude should be kept under 850 cd/m^2.

Shadows (important)

Shadowing should definitely be controlled to keep distraction low, but may be utilized to accentuate objects in room. Sharp shadows should be avoided in the ambient atmosphere by using diffuse and reflected light. The bulkheads may also cause shadowing and lighting should be localized beneath them.

Surface Characteristics (important)

The surfaces in the space are somewhat dark and glossy which could have a huge impact on the overall lighting levels and reflected glare. The walls themselves should be illuminated with a source to increase vertical illuminance and to decrease luminance ratios. The carpet is also quite dark, but it has distinct patterns used to guide the occupants. Thus an over-all high lighting level is required for this space.

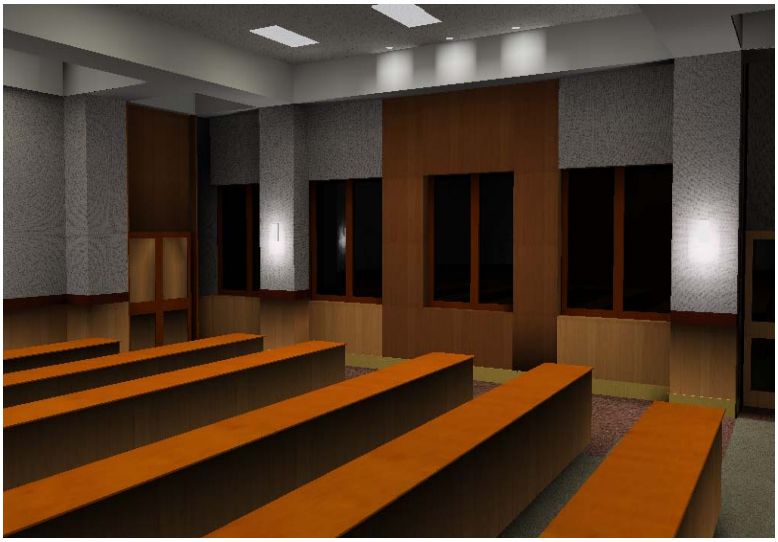
System Control and Flexibility (very important)

The lighting systems need to perform for a variety of tasks in the space, and need to easily be controlled. The switching system should be easily accessible for the occupants and non-complex. The switches should be accentuated somehow (i.e. with a bright light or color change) The ambient system

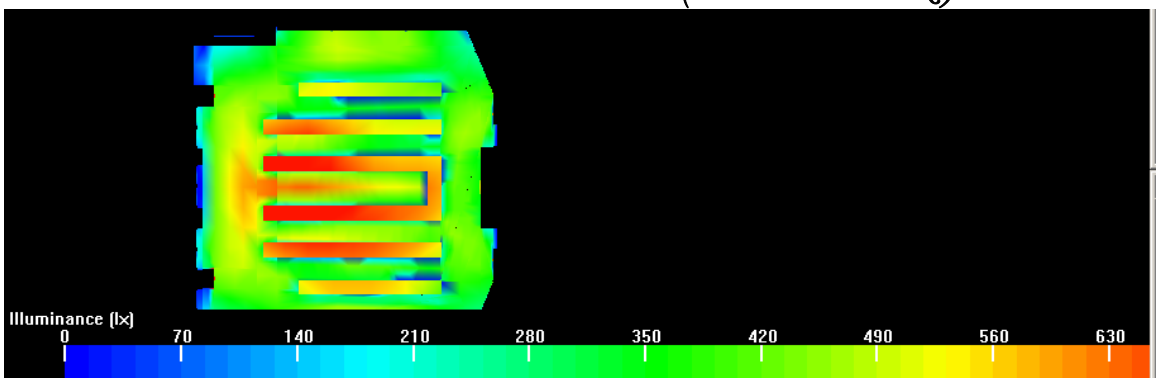
could utilize a daylight sensor to automatically adjust lighting levels to save energy. Dimming will be required for audiovisual and presentation purposes and should be easily switched from the Audiovisual room and near the screen if possible.

System Performance

**Note: I approximated the distribution for the wall sconce and I could not find a fixture to approximate the wall bracket. It will be added at a later date.*



Horizontal Illuminance Levels (based on 700lux)



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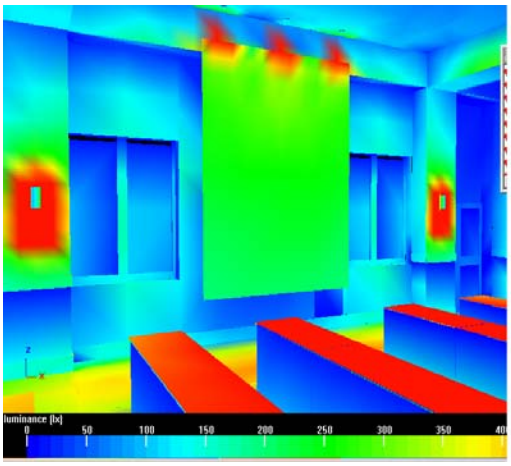
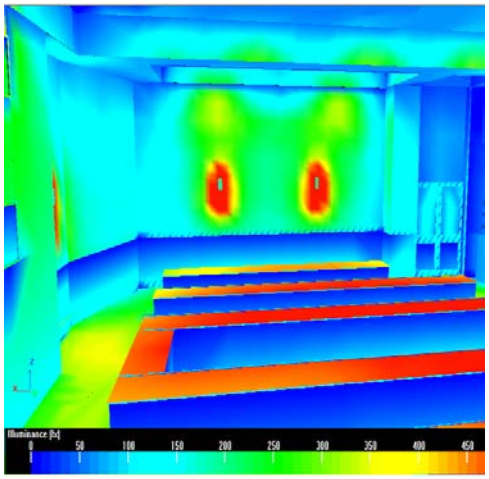
As you can see from above around 600 to 700 lux was achieved on the computer desks when all systems are functioning. The desks close to the perimeter are a little bit darker than the center, but over-all uniformity was achieved.

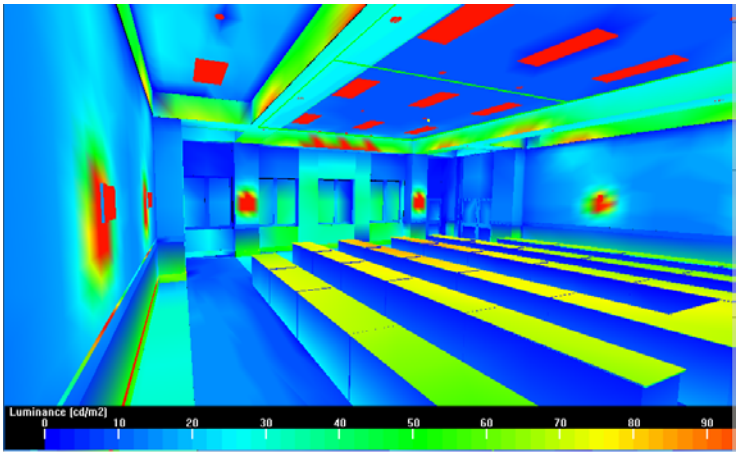
Vertical Illuminance Levels (based on 500 lux)





The average wall illuminance achieved is around 5 to 50 fc or so with hotter spots near the sconces and darker spots in the corners. The doorways will be brighter when the uplights are added. The sconces serve as a "guide" to the sight impaired occupants, . The screen in fairly uniformly lit to about 30 fc which should be very adequate for visual presentations, though hotter spots exist near the top.

Luminance Levels (based on 100 cd/sq m)



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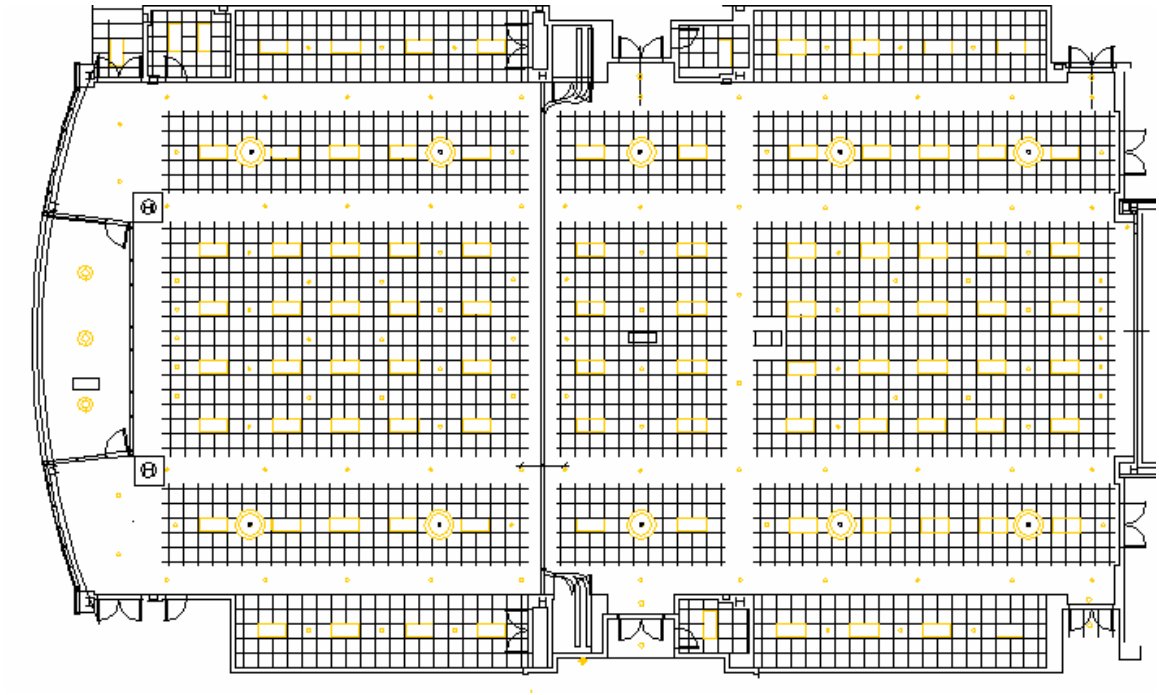
The lensed fixtures are extremely bright in comparison to the ceiling which is an extreme glare issue for VDT veiling reflections and direct glare. The wall sconces are also very bright in comparison to the surrounding walls, but this may be beneficial to guide the occupants yet be distracting to others. The task, surrounding ratio is not too bad: about 3:1 in most cases which is good. The three downlights do create some hot spots on the surrounding bulkhead.

Multi-Purpose Room

This space was mainly for convention use. Seating can either be banquet or auditorium style.



Room Characteristics

Dimensions: *The large room is divided into two sections by a folding partition. The space also contains a 4'8" deep bulkhead with a fiberglass cove. I will probably concentrate on the space to the left of the partition. This space is approximately 95' x 60' x 20' (at highest point beneath cove), and 15'4" high at beneath bulkhead.*

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Materials: *The western wall is lined with floor to ceiling windows on-looking a small balcony. The remaining walls are lined with acoustical fabric and wood paneling and painted gypsum wall board (same materials as computer classroom). The floor is carpeted with similar patterns as computer classroom (same materials). Two decorative 19" architectural fiberglass columns outline with windows. The base consists of the same decorative wood paneling as the surrounding walls.*

Windows: *The western wall contains lined with windows overlooking a small balcony. The glass is the same as the classroom described above.*

Ceiling: *The ceiling consists of a white 2'x2'x3/4" acoustical ceiling tile grid (Armstrong Cirrus tegular type 578) with a 3'x 2' painted "semi-gloss" Gypsum wallboard bulkhead.*

Existing lighting Systems

- ***Ambient:*** *Same 2'x4' lensed 3 lamp F32T8 fixtures on 277 volts. (5 of these fixtures are on emergency egress power) A second lighting system includes 6" 2 lamp F26DBX 4 pin 4100 k on 277 Volts.*

- ***Decorative:*** *The same 4' wall bracket fluorescent fixture exists above the doorways. And the same decorative wall sconces accentuate the perimeter of the room. Four 48" Davis Muller Pendant fixtures (6 lamp CPF Q26/4100 K @277 V with dimmable Lutron Hi-Lume ballasts) lie in outlining coves.*

- ***Audiovisual:*** *Five 6" dimmable downlights serve for the audiovisual screen in the front of the room. The fixtures themselves are the same as the ambient downlights. Lutron Hi-lume dimming ballasts are specified.*
- ***Control:*** *The left side of the room is switched separately from the right side of the retractable partition. The 2x4's and wall bracket fixtures are switched together at the south entrance door. The ambient downlights are on a separate switch by the southern entrance door. The*

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audiovisual downlights are switched with the decorative pendants on a dimmable switch at the same location as the others. The wall sconces are on a 3-way switching system located at both entrances on the western side.

Multi-purpose room (left side of partition only)

Area = 5700 Sqft

Average Reflectance

Walls	Floor	Ceiling
0.51	0.16	0.8

Power Density Allowable @ 1.5 w/sqft acc. To ASHRAE

8550 watts

Power Density

Fixture	# of fixtures	Lamp	Voltage	# of lamps	Lamp watts	Ballast (typical for lamp type)	B watts	Total watts
A1 (2x4)	38	F32T8/4100K	277	3	32	Centrium electron instant start	-3	3306
B2 (DL)	55	F26DBX(4P)4100K	277	2	26	Advance CFL program start	2	3080
B3 (DL)	5	F26DBX(4P)4100K	277	2	26	Hi-Lume Lutron Dimming	4	300
B1(sconce)	2	F39BX	120	1	39	Advance CFL program start	3	84
C1(pendan	4	CPF Q26/4100 K	277	6	39	Advance CFL program start	9	1152
D1 (upligh	2	F32T8/4100K	277	2	32	Centrium electron instant start	-3	116
Total								8038

Light Loss Factors (with clean environment every 6 months)

Fixture	Maint Cat	LDD	LLD	RSDD	B Factor	Total LLF
Pendant	V1	0.92	0.95	0.92	0.97	0.78
DL	IV	0.85	0.85	0.92	1	0.66
sky uplight	VI	0.75	0.85	0.8	1	0.51
decorative	II	0.95	0.85	0.92	1	0.74
sconce	II	0.98	0.95	0.92	0.97	0.83

Design Criteria

The occupancy and function of this room is very diverse. This space was mainly for convention use. Seating can either be banquet or auditorium style. The lighting should be flexible enough to utilize the space as a banquet hall or for purely presentation purposes, For design criterion, I a combination of data for a ballroom/social events and auditorium (social activity). Because the space contains a plethora of tasks, multiple lighting systems should be used: Multiple levels of ambient, and Presentation. A dimming system and daylight control system should be utilized.

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Social Mode
Horizontal Illuminance: (category B) = 50 lux (this value should probably be increased)
Vertical illuminance (category A) = 30 lux

Presentation Mode:
Horizontal Illuminance (category C down to A) = 300 lux to 30 lux
Vertical illuminance (category A) = 3 lux (this value should probably be higher to open the space).

Appearance of Spaces and Luminaires (some-what important)

This space is contains very interesting architectural elements that should be accentuated. The large columns at the head of the room, the bulkheads, and the stage area all add unique design elements The luminaries should make a unique statement and be pleasing to look at. Because of the disabilities of the occupants, circulation patterns for the room should be clearly defined for those who are partially sighted.

Color Appearance (important)

There is a large amount of daylight that will be entering the space, therefore the CCT of the lamps should be on the bluer end of the spectrum to avoid color clashing. The lamps should be designed to have a CRI of 80+ for good color appearance of surfaces in the space.

Daylight Integration (important)

Daylight integration should be considered when considering veiling reflections on material surfaces, (high luminance levels causing distracting glare) The windows face westward, so evening sunlight may be an issue. Blinds or drapery should be utilized due to the multi-task environment (audio-visual presentations, etc) and to keep the occupants comfortable. Since the room is rather large, it may be wise to increase vertical illuminance on the opposite facing wall to decrease contrasting luminance and to open up the space.

Direct Glare (some-what important)

(same design criteria as classroom)

Modeling of Faces and Objects (important)

Since the space is used for social activities, modeling of faces is important for occupant comfort. Diffuse and reflected light should be used to soften facial shadows and higher wall reflectances should be used. Separate lighting systems can be used to achieve this affect.

Luminances of Room surfaces (some-what important)

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Luminance levels should not exceed 850 cd/m^2 on ceiling to avoid glare. Average wall luminances of 30 to 100 cd/sq meter are preferred.

Points of Interest (important)

The doorways should also be accentuated visually somehow for safety egress purposes due to the occupant disabilities)

Reflected Glare (some-what important)

The sensitivity of the occupants, and the large amount of daylight will all be major factors. The ratio of illuminance on the task from the mirror angle to the total illuminance on the task should be less than 0.3 and not to exceed 0.7.

System Control and Flexibility (very important)

The lighting systems need to perform for a variety of tasks in the space, and need to easily be controlled. The switching system should be easily accessible for the occupants and non-complex. The switches should be accentuated somehow (i.e. with a bright light or color change) The two "modes" should be lit independently from each other. The ambient system could utilize a daylight sensor to automatically adjust lighting levels to save energy. Dimming will be required for presentation purposes and should be easily switched from an ideal location.

System Performance

For the multi-purpose room, I did a short luxicon analysis for the "social mode" to see exactly how much light would be provided by the ambient system. The overall lighting scheme is very close to the one in the classroom, which would give me a good idea how the space will look. I intend to perform a more detailed analysis further down to road to incorporate daylight, the wall sconces, and pendant fixtures. The room is an approximated rectangular box of 95'X 60'. The ceiling is set at the base of the bulkhead (15'4") which will cause some inaccuracy.

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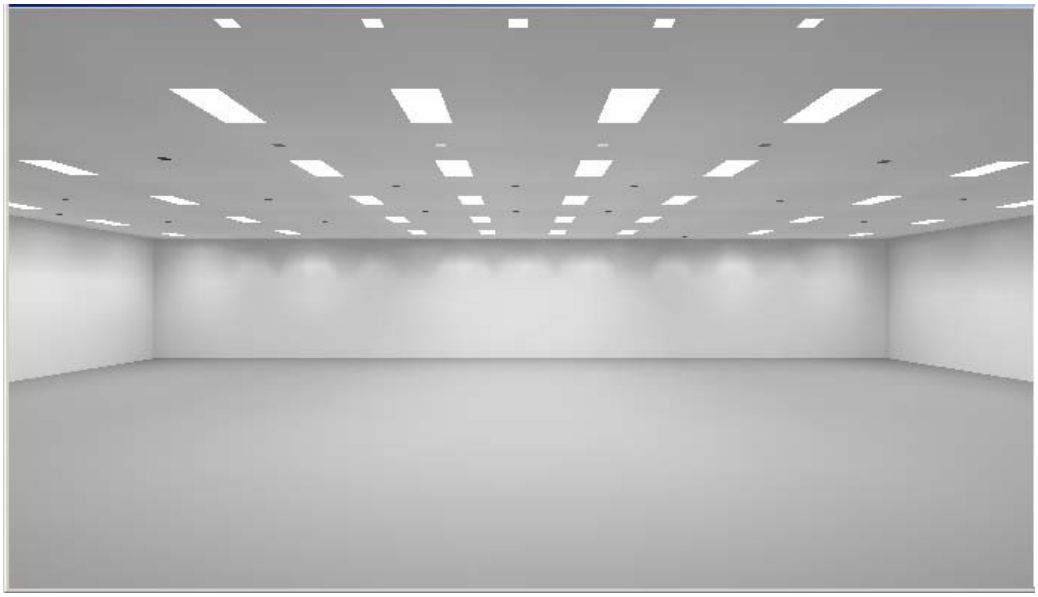

Horizontal Illuminance Levels

The horizontal illuminance level at a 2.5' work plane ranges from 6.7 fc in the corners of the room to around 82 fc in the center of the room. The light levels will increase around the perimeter of the room when the sconces and wall wash uplights are added In the task area, however the lighting level seems to be fairly uniform with an average illuminance level of around 50 fc. The 2'x4's, however will cause a direct glare issue for the occupants.

**note these values are probably a bit higher than reality due to the depth of the bulkheads and actual geometry of the room. When daylight is introduced, however, these levels will increase especially on the western side.*

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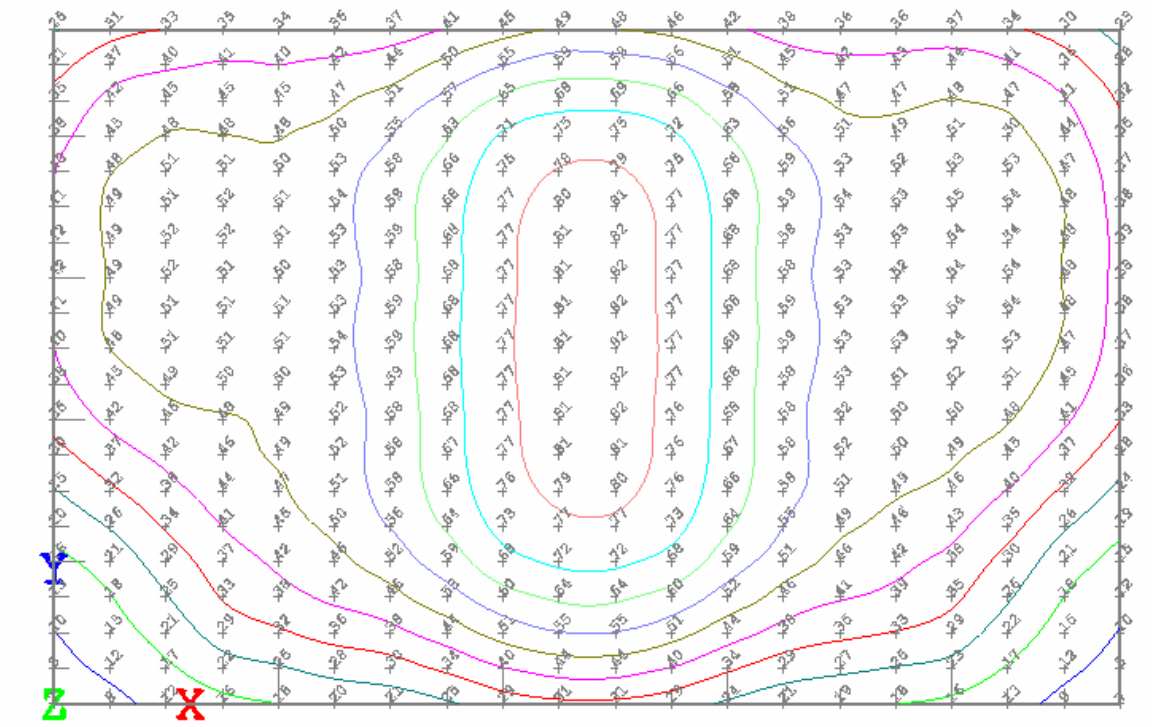
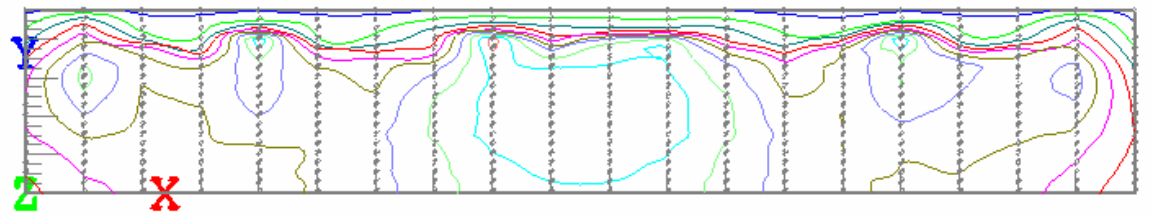


Vertical Illuminance Levels (calculated for east and north walls)

Western wall



The illuminance levels for the west wall range from 7to 30 fc from just the ambient light. This level will drastically increase when the sconces are functioning. The top portion of the wall contains some harsh "hot spots" due do the narrow beam of the downlights, but will probably be eliminated once the sconces are added. The average vertical illuminance level at a 2.5' work plane is around 22 fc.

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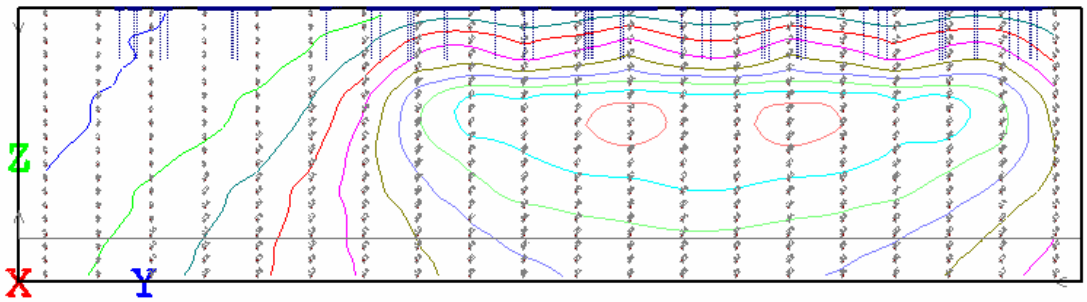
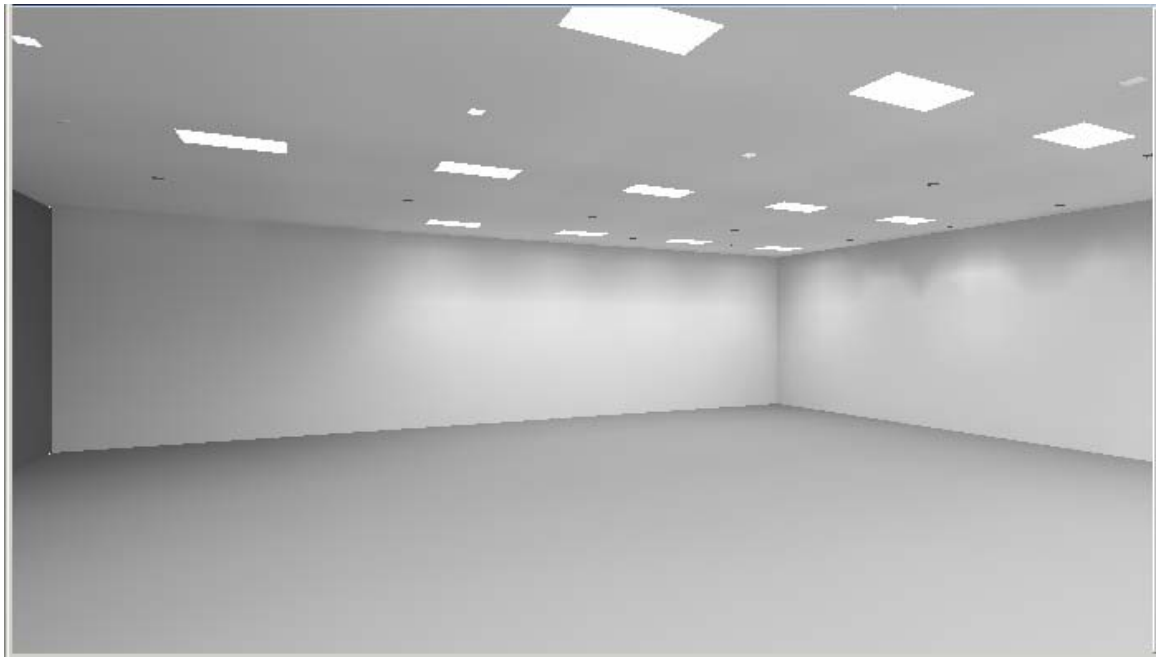
North wall



Te illuminance values for the northern wall range from around 5 to 30 fc. The overall vertical illuminance will increase dramatically by the doorway when the uplight wallwashers and sconces are added. The downlights again create some hot spots and shadowing near the ceiling plane. The average vertical illuminance at 2.5 ft is around 17 fc which is fairly good for the ambient system. The room appears to be fairly spacious which should be comfortable for a social atmosphere.



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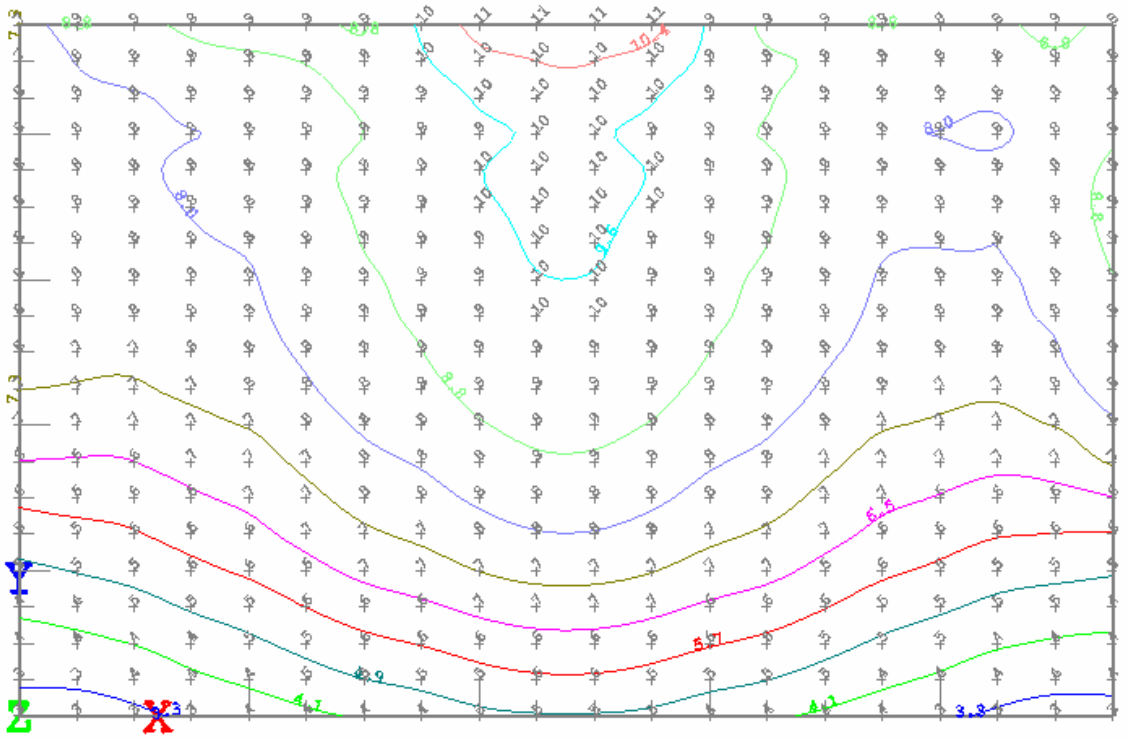
Ceiling Illuminance levels



The ceiling illuminance ranges from around 3 to 11 fc. This will appear very dark in comparison to the luminous 2x4's and downlights. It is difficult using this direct system and dark surfaces to achieve enough reflected light on the ceiling. The sconces and uplight wallwashers will help this situation, and the higher reflectance bulkheads will also provide some inter-reflected light back to the ceiling plane which will decrease the harsh luminance ratios. It will be difficult to achieve enough reflected light on the ceiling in the center of the room. I for-see a large max:min luminance ratio for this space as seen in the computer classroom. The ceiling, however is fairly high under the bulkheads, so direct glare may not be too much of a factor at this large distance. It

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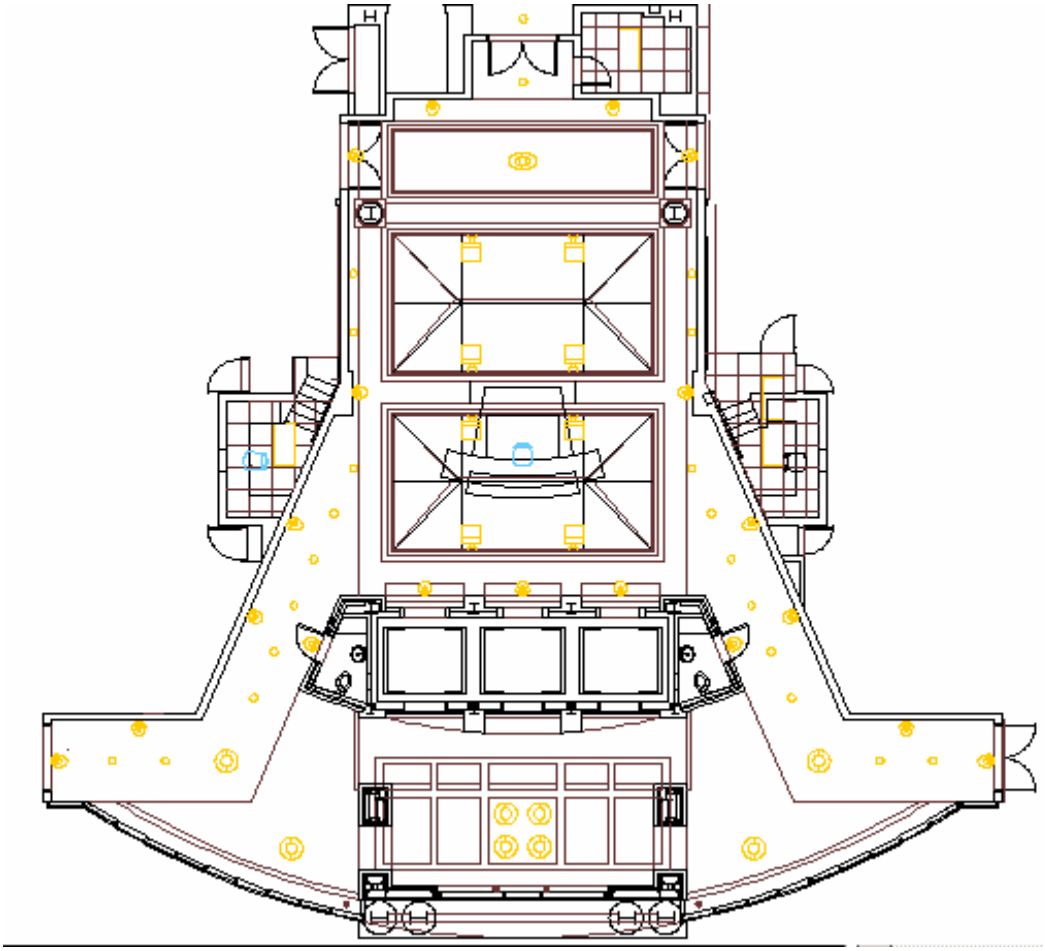
Skylight Lobby and Gallery



For my circulation space, I have chosen to select the fourth floor elevator lobby/gallery. The space will definitely present challenges with system integration. Above the circulation desk exists two pyramid skylights which essentially acts as one with a column through the center. The hallways surround the 4 story glass curtain wall extending to the floors below.

Basic Dimensions:

Main Gallery: = 44.5'x23'x16.5' (under bulkheads) to about 30 under the skylights)
Hallways: 7' wide and about 32' long.

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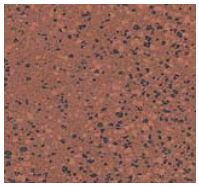
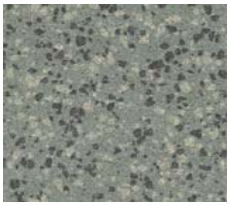
Materials:

Walls: *The walls are lined with a combination of marlite map system (40 series) honey cherry paneling and wild cherry paneling. The bulkheads are GWB painted with a duron high gloss pistachio paint. At the base of the columns is a 1"x8" wooden baseboard (stained to match the dark cherry) On either side of the elevators is a red brick wire cut veneer. The skylights are lined with GWB pained with the duron high gloss pistachio paint. .*

Decorative wood panel (Marlite Map System (40 series) honey cherry and wild cherry)
ρ assumed = .44 *ρ assumed = .30*


Baseboard (Gossen Corp "deep dimension" 943 pine stained to match cherry panel)
ρ assumed = .65

Floor: *The floor consists of two types of stone tile colors of carpet set in distinct patterns as shown in floor plans.*
(PST-1 = Porcelain Stone tile (Crossville) redrock polished 1'x1' grid,. PST-2 = jadestone)
ρ assumed = .18 *ρ assumed = .2*

Ceiling: *The ceiling consists of gypsum wallboard painted with duron high gloss pistachio paint.*
ρ assumed = .83

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Skylight glass: *The inner layer is tempered safety glass (clear) with a transmittance of around .93. The outer layer is tempered safety glass tinted green with a transmittance of around 82. The skylight system does also have electronically controlled roller shades.*

Existing lighting system is as follows:

- ***Ambient:*** *6" downlights 2 lamp F26DBX 4 pin 4100 k on 277 Volts exist in the outlining hallways (same as in classroom). In the corners of the hallways and in the atrium, Rebelle circular ceiling mounted fixtures (1) 50 W Metal Halide Ed-17 on 277 V. In the cove opposite the elevator bay is 1 Rebelle elliptical ceiling mounted fixture.*

- ***Wall Wash:*** *Decorative Rebelle wall sconces (1 lamp F39Bx @ 120 V) accentuate the perimeter of the room and above the doorways. Three fixtures are centered above the elevators.*

- ***Skylights:*** *Eight wall mounted Kim Design Director 175 W metal halide (ED18 Mogul on 277V) up-lights illuminate the 12' wells.*

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- ***Control:*** *I am still in the process of investigating this issue. Most fixtures seem to be on Emergency egress power and are not switched, however a shut-off system must be utilized.*

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LOBBY/GALLERY SUMMARY

Area = 1612 Sqft								
	Average Reflectance							
Walls	Floor	Ceiling						
0.4	0.2	0.7						
Power Density Allowable @ 1.8 w/sqft acc. To IES								
2902 watts								
			Power Density					
Fixture	# of fixtures	Lamp	Voltage	# of lamps	Lamp watts	Ballast (typical for lamp type)	Ballast	Total watts
(A8) hall f	2	1 TTT CPF	277	1	39	Advance CFL program start	2	82
(A5) dec	1	1 TTT CPF	277	1	39	Advance CFL program start	2	41
B2 (DL)	21	F26DBX(4P)4100K	277	2	26	Advance CFL program start	2	1176
A9(sconce)	16	1 TTT CPF	120	1	39	Advance CFL program start	2	656
sky up	8	ED 28 175 W MH	277	1	175	Advance Metal Halide	16	1528
Total								**3483**

***The classroom meets the power density requirements: 3144 w< 3888w**

Light Loss Factors (with clean environment every 6 months)						
Fixture	Maint Cat	LDD	LLD	RSDD	Ballast Facto	Total LLF
Hall way fix	V1	0.92	0.95	0.92	0.97	0.78
DL	IV	0.85	0.85	0.92	1	0.66
sky uplight	VI	0.75	0.85	0.8	1	0.51
decorative	II	0.9	0.85	0.92	1	0.70
sconce	II	0.98	0.95	0.92	0.97	0.83

Design Criteria

The skylight lobby will be the building's showcase. The walls in this area will be designated as "wall of honor" displaying plaques and names of donors. The architect wanted to light up the skylight at night so it "glows: looking from I-95. For design criterion, I used the general gallery area for a museum in IES.

General

Horizontal Illuminance: (category C) = 300 lux
Vertical illuminance (category A) = 30 lux. (This level will definitely be increased due to large amount of plaques on walls)

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Above Circulation Desk:
Horizontal Illuminance (category D) = 500 lux
Vertical illuminance (category B) = 50 lux

**There could be a larger illuminance required because of the visual impairment of the occupants.*

Appearance of Spaces and Luminaires (very important)

This space will be the major showcase for the building and thus aesthics is very important. The appearance of the room needs to set a certain mood for the occupants and be an "attention getter". Architectural details should be enhanced through the lighting design. The space serves as the threshold for the presentation spaces in the building and thus should communicate a transitional quality. Visual adaptation should be considered; people should be gradually introduced to the space. A certain degree of spaciousness should be achieved by keeping a uniform peripheral lighting scheme and keep brighter luminances at end of corridors to guide people through the space. Because of the disabilities of the occupants, circulation patterns for the room should be clearly defined for those who are partially sighted. Attention should be brought to the doorways and the presentation screen by utilizing areas of high wall luminance and illuminance and there should be a good contrast with surrounding areas.

Color Appearance (important)

There is a large amount of daylight that will be entering the space due to the skylights, therefore the CCT of the ambient lighting should be on the bluer end of the spectrum to avoid color clashing. From an aesthic standpoint, however, a color difference may help define the lighting "zones" in the room and accent the architectural details. The ambient lamps should be designed to have a CRI of 80+ for good color appearance of surfaces in the space.

Daylight Integration (very important)

Daylight integration should be considered when considering veiling reflections on glossy flooring surfaces and wall paneling. In many cases, however, the owner specified many glossy surfaces for the partially-sighted for safety purposes. The large pyramid skylights serve as the ambient light source for the space, and thus should be analyzed carefully. The skylights should perhaps be splayed in order to maximize efficiency of the wells, and should utilize low-emissivity glazings to minimize heat gain in the space. Since the secretary is sitting directly beneath the skylights, they perhaps could also utilize a control system to minimize the amount of direct sunlight into the space for human comfort purposes.

Direct and Reflected Glare (some-what important)

Glare is a very interesting issue in this case. Reflected glare on glossy surfaces is in some cases desirable for the partially blind. For safety purposes, when moving around a large space, it is beneficial for them to see these reflections so they know the depth of the space. It will be difficult to

determine exactly how far you can go with utilizing glare, however due to the diverse range of disabilities of the occupants. A lot of visitors to the space will have no sight disability at all.

Direct and reflected glare should be eliminated when lighting displays. The occupants of the space may be extremely sensitive to bright objects, so it is very critical to eliminate direct glare. Most of the displays will be vertical secular plaques, so it will be very important to orient the lighting elements accordingly. Optical control devices should be used.

Light Distribution on Surfaces (some-what important)

The wood paneling on the perimeter walls is fairly glossy which my cause some reflected glare. The bulkheads and skylights will cause some shadowing as well. The space, however should achieve a certain spacious quality, thus uneven light distribution could be utilized.

Light Distribution on task plane (important)

A fairly even light distribution on the circulation desk is desirable, however it will be difficult to deliver enough light to the desk using daylight alone. The desk should not be open during night hours, however, special task lighting should be integrated with the lighting layout..

Modeling of Faces and Objects (important)

Since the space is used for a welcome/transitional space, the secretarial staff should be lit well. Diffuse and reflected light will be "sometimes" be provided by the skylights above, however a separate lighting scheme should exist for visual tasks at the desk.

Points of Interest (very important)

The major point of interest in the room is the "wall of honor" on the northern wall of the space. Careful consideration should be taken when lighting a vertical display and the luminaries should be angled accordingly.

Shadows (important)

Shadowing should definitely be controlled to keep distraction low, but may be utilized to accentuate displays in the room. Sharp shadows should be avoided in the egress ambient atmosphere for safety purposes. The bulkheads and skylights may also cause shadowing and lighting should be localized beneath them.

Surface Characteristics (very important)

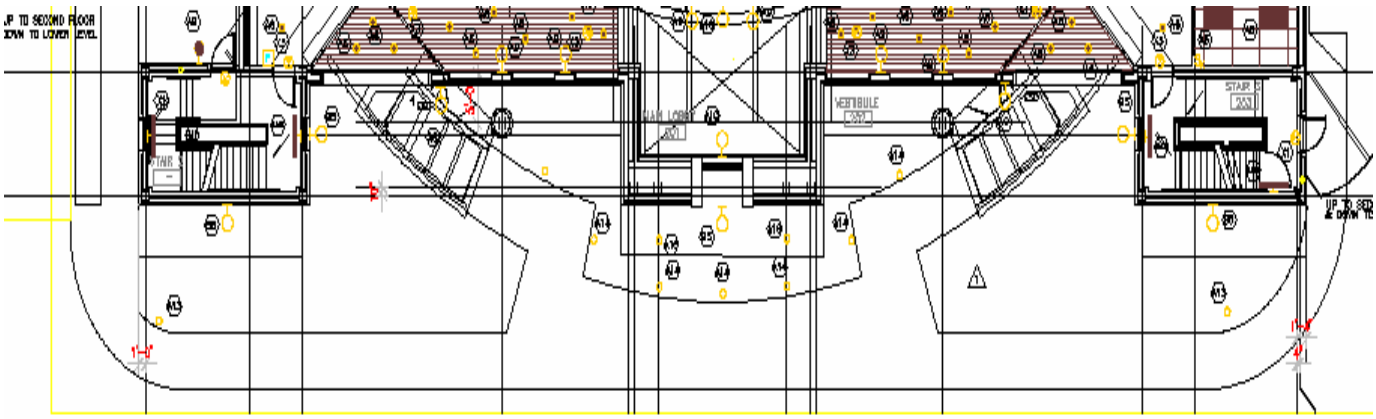
As stated before, The surfaces in the space are somewhat dark and glossy which could have a huge impact on the overall lighting levels and reflected glare. The walls themselves should be illuminated with a source to increase vertical illuminance and to increase luminance ratios. For aesthic reasons, the wall material could be accentuated with the lighting design to communicate a theme throughout

the space. The floor is fairly dark and glossy, but this was used as a tactic to guide the occupants through the space.

System Control and Flexibility (very important)

The lighting systems should coordinate with the daylight level in some way. The skylights will be the dominant light source in the space and the electric lighting should correspond accordingly. The secretary should have some person control over his or her work station. The switching system perhaps should not be visible to avoid tampering. Some type of automatic control system should be considered.

Outdoor Plaza



For my outdoor space, I have chosen to evaluate the plaza in front of the main entrance to the building along East Wells Street. The space is layout symmetrically around the from sliding door entrance with two semi-circular handicapped ramps on either side. An exposed aggregate finish concrete sidewalk leads up to the building on both sides of the main entrance. The plaza contains five landscaped areas around the sidewalks and ramps.

Existing lighting system:

Landscape

- *12" HID (1 ED-17 175 W metal halide) embedded flush mounted up lights accentuate the glass curtain wall and landscaped area.*
- *Rebelle orchestra bollard lights (1 ED-17 175 W MH) line the ramps and sidewalks leading up to the building.*

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Facade

- *Kim lighting wall director wash light (ED-28 175 W MH @ 277 V) accentuate the brick façade*

Ambient

- *Rebelle circular cantilevered 18 ft high post mounted lights (1 ED-17 175 W MH on 277 V) illuminate the side walks leading to the building.*

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			Plaza				
Building facade area = 4320 Sqft							
Area(entrance) = 945 Sqft							
Total Power Density Allowable acc. to ASHRAE							
3915 watts							

Power Density

Fixture	# of fixtures	Lamp	Voltage	Lamp watts	Ballast (typical for lamp type)	B watts	Total watts
faç uplights	2	ED-18 MH	277	175	Advance metal halide	16	382
bollards	7	ED-17 MH	277	175	Advance metal halide	16	1337
sconces	7	ED-28 MH	277	175	Advance metal halide	16	1337
Total							**3056**

The plaza meets the power density requirements: 3056<3915

Light Loss Factors (assumed)

Fixture	Maint Cat	LDD	LLD	B Factor	Total LLF
faç uplights	VI	0.85	0.9	0.9	0.59
bollards	IV	0.85	0.9	0.9	0.59
posts	IV	0.75	0.9	0.9	0.46
sconces	VI	0.85	0.9	0.9	0.59

Design Criteria

The basis for design for the front plaza is to light the façade of the building and to show the delineation of the curved glass curtin wall , but at the same time give a soft light for the pedestrians from the sidewalk going into the building I used IES active building entrances and plaza design criteria.

The front plaza will serve as the main entrance to the building and therefore must act as the "first impression" to those visiting the building. The architectural features of the glass curtain wall and brick façade should be accentuated. The atmosphere should be pleasant for the pedestrians and attract attention where necessary. Because of the disabilities of the occupants, circulation patterns for the room should be clearly defined for those who are partially sighted.

70 + CRI for Entrances

- *Target vertical illuminance value assuming bright surroundings with medium dark surfaces = 100 lux*
- *Entrances Horizontal illuminance requirement = 30 lux*
- *Façade floodlighting: 20-150 lux (depending on brightness of materials)*
- *Power density limits are .25 W/sq foot on façade and 33 W/lin ft for entrance*
- *Avoid discomfort glare by keeping fairly uniform distribution and low luminance of luminaires in field of view (Keep luminance ratios below 20:1)*
- *Minimize non-target illumination*
- *Viewing angles from 45-85 degrees*
- *Limit flux above horizon by using good cut-off*

Computer Files

P:/thesis/lighting/classroom (lightscape solution files)
P:/thesis/lighting/multipurposeroom (lexicon solution files)

Conclusion

In conclusion, I feel I have a grasp on the types of lighting systems used in the National Research and Training Institute for the Blind and how they perform based on the IES criteria and needs of the occupants. I still need to perform a more in-depth analysis of the gallery and plaza systems' performances due to the unique architectural geometry and detail. I intend to build 3-d models of the spaces and analyze the daylight system with computer software.