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Lighting/Electrical
Technical Report #1
October 5, 2006
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Dorrance H. Hamilton Building
Philadelphia, PA

Executive Summary

This report is a summary of the existing lighting systems and the major lighting hardware including the luminaires, lamps, ballasts, etc. for the four applications from the lighting proposal memo. The four spaces are the auditorium, the 60-capacity classroom on the fifth floor, the lobby, and the grassy plaza. Analysis of these spaces was started by using the IES handbook to investigate design criteria. Luminaires were placed into schedules and light loss factors were calculated for the different fixtures. The drawings were included with the location of furnishings and other relevant items for the redesign of these spaces. The lighting design program, AGI 32, calculated the average illuminances of the walls and floor and provided renderings and pseudo color displays. After all research was finished, the material was positioned into a well-organized report.

The variety of different spaces allowed the different challenges of the lighting design to be realized. A couple examples include visual display terminal placement and lighting with no reflected glare, daylighting integration with the 60-capacity classroom and the lobby, and the placement of the luminaires to provide an aesthetically pleasing space. The auditorium and the classroom require different control devices for the various scenes applied in the spaces.

During the analysis, different aspects of the spaces and lighting design have helped to provide an efficient understanding of the existing lighting systems. The investigation of the four redesign areas (auditorium, classroom, lobby, and plaza) has provided the information to obtain a few ideas of a better design for the spaces.

AUDITORIUM (109)

- DESCRIPTION OF SPACE

  The 300-seat capacity auditorium resides on the first floor of the building. Upon entering the building through the curved façade that features large expanses of glass, one would find themselves in the lobby of the building. The auditorium entrance would then be straight ahead when in the lobby. The auditorium measures approximately 4,800 ft^2 and is approximately 15' high.

- TASK DESCRIPTIONS

  The uses of the auditorium consist of a lecture hall, demonstrations, film projections, and guest presentations. The tasks will be mainly note-taking, reading, and writing.

- FLOOR PLAN

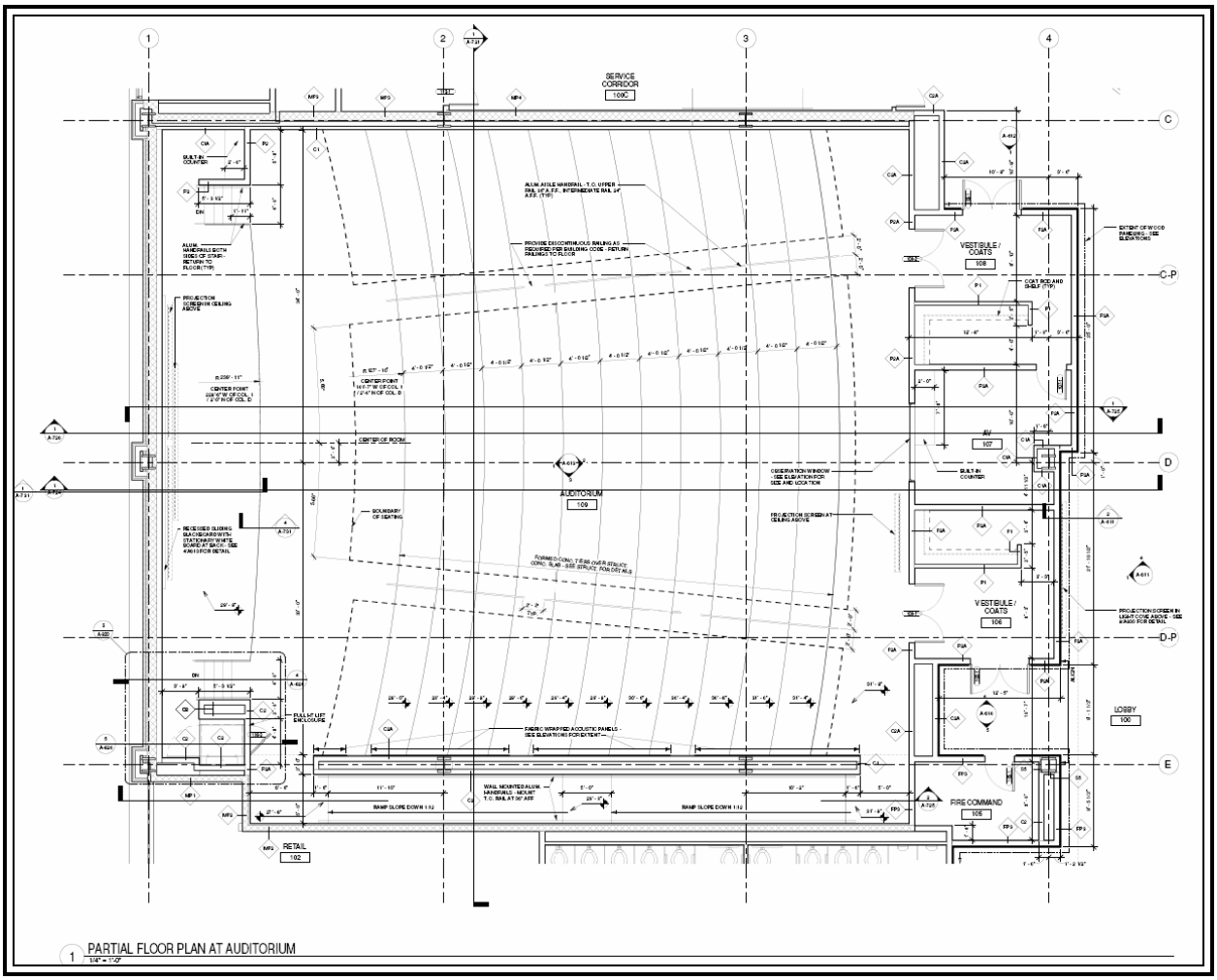

Figure 1: Partial Floor Plan at Auditorium

- SECTION OF AUDITORIUM

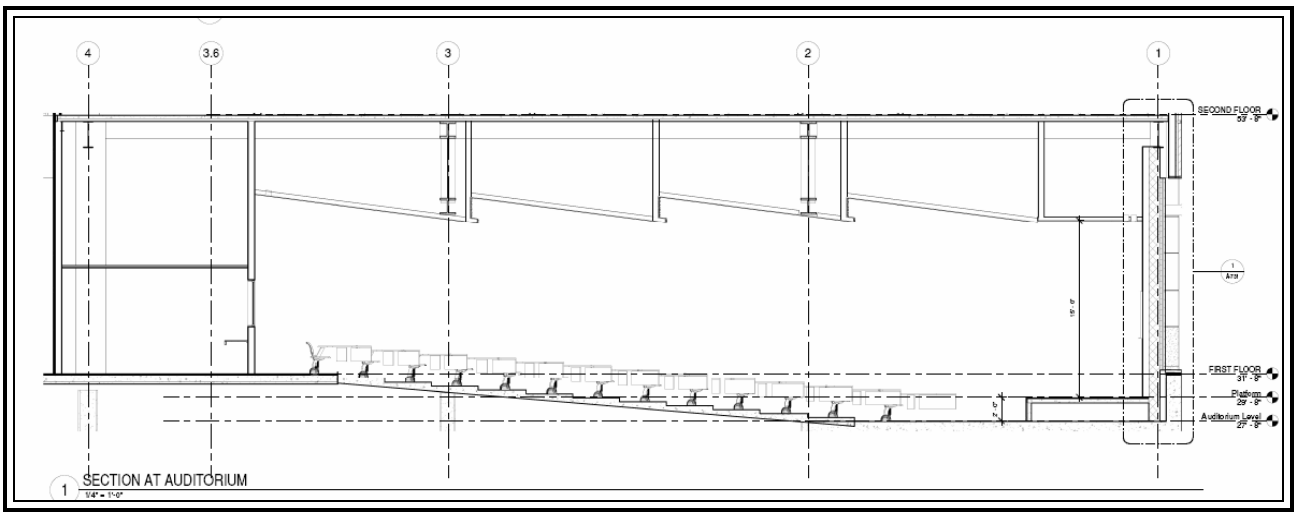

Figure 2: Section at Auditorium

- LIGHTING PLAN

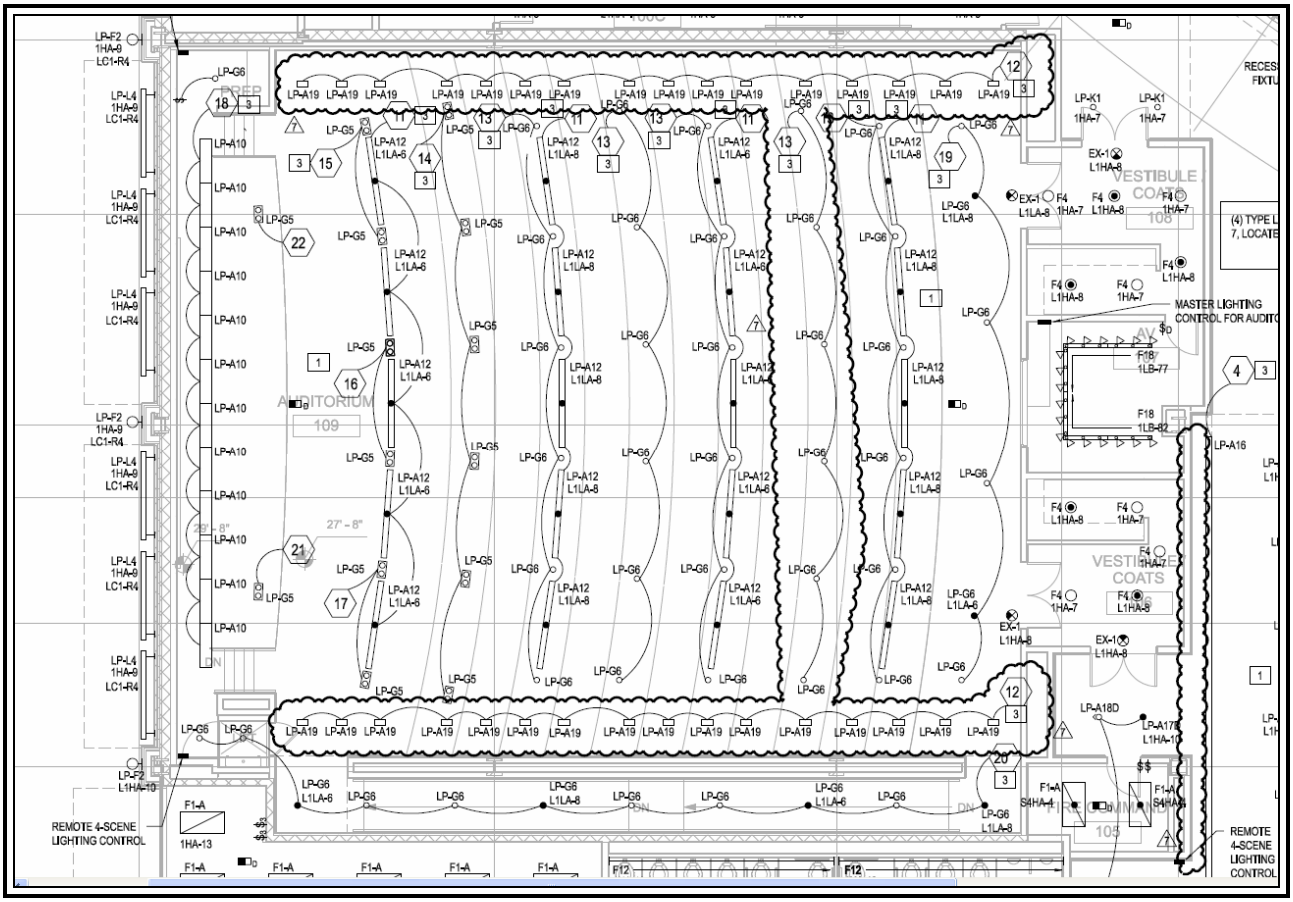

Figure 3: Auditorium Lighting Plan

- LIGHTING FIXTURE SCHEDULE

Type	No. of Fixtures	Description	Color/Finish	Mtg.	Lamping	Ballast / Transformer	Watts	Voltage	Mfr.	Catalogue No.
LP-A10	12	Linear Compact Fluorescent Wallwasher, Semi-Specular Low Iridescent Aluminum Asymmetric Reflector	Semi-Specular Low Iridescent Aluminum	Recessed	2-PL-L40W/835/4P/RS/IS	Integral Electronic Ballast with Lamp Failure Protection Circuit	80	120	Columbia; Metalux; Lithonia	FW104-140TTSM-EBTTVOLT-FWFK4
LP-A12	20	Fluorescent Luminaire, 90% Reflectance White Steel Housing, Parallel Perforated Metal Blade Baffle Finished White, with White Acrylic Lens Overlay, 2-Lamp Rows	White	Recessed	4-F32T8/TL735/ALTO	Integral Electronic Ballast	112	120	Linear; Neoray; Litecontrol	RC68-D-2-ET8-VOLT-MBP-F-BW-LO-8
LP-A19	32	Compact Fluorescent Lensed Wallwasher, Formed Metal Housing, Anodized Clear Semi-SpecularAlzak Reflector and Flange, Microprism Spread Lens	Clear Semi-Specular Alzak	Recessed	1-PL-T 32W/35/4P/ALTO	Electronic Ballast with Lamp Failure Protection Circuit	34	120	Kurt Versen	T4542
LP-G5	14	Halogen Fixture with Steel Housing, White Trim, Black Interior Finish, 45o Cutoff, Accessory Holder and Cross Baffle with White Finish	White	Recessed	2-Q75MR16/NFL	Integral 120V Primary – 12V Secondary HPF Magnetic Transformer	150	120	RSA; Modular; Contech	CO216S-WH-BK-75-YK-MAG-120-CCB16B
LP-G6	48	Low Voltage Halogen Adjustable Downlight, Anodized Clear Semi-Specular Alzak Cone and Flange, Tapered Cone, Clear Tempered Glass Lens	Clear Semi-Specular Alzak	Recessed	1-Q50MR16/WFL	Integral 120V Primary – 12V Secondary HPF Magnetic Transformer	50	120	Gotham; Portfolio; Edison Price	DLV-ADJ-MR16-4AC-T30-LD
EX-1	2	Edge Lit Exit Sign with Red Letters in a Mirrored Acrylic Face. Fixture Housing Shall Be Fully Recessed	Acrylic	Recessed	Red LEDs	N/A	N/A	120/277	Astralite, Inc.	CA-2C-R-W-BA

Table 1: Lighting Fixture Schedule (Auditorium)

- LIGHT LOSS FACTORS

Fixture Tag	Cleaning Interval	Maintenance Category	Ballast Factor	LLD	RSDD	LDD	Total LLF
LP-A10	12 Months/Clean	IV	0.99	0.89	0.97	0.88	0.75
LP-A12	12 Months/Clean	III	0.99	0.90	0.97	0.90	0.78
LP-A19	12 Months/Clean	V	0.99	0.84	0.97	0.88	0.71
LP-G5	12 Months/ Clean	V	1.00	0.95	0.97	0.88	0.81
LP-G6	12 Months/Clean	IV	1.00	0.95	0.97	0.88	0.81

Table 2: Light Loss Factors (Auditorium)

- FURNITURE
  - Recessed sliding blackboard with stationary white board at back (three equal sections)
  - Motorized projection screen enclosed in ceiling
  - Podium
  - Approximately 300 seats

- FINISHES (DETERMINED UPON ARRIVAL OF SPECIFICATIONS)
  - Ceiling: Sloped GWB planes with fascias to follow radius of seating tiers
    - Assume 85% reflectance of ceiling
  - Walls: Fabric covered acoustical panels and wood wainscot/Painted GWB
    - Assume 50% reflectance of walls
  - Flooring: Constantine Commercial Carpet, color TBD
    - Assume 30% reflectance of carpet

- EXISTING POWER DENSITY

  The existing power density in the space is calculated by using the space-by-space method. In Table 9.6.1 of the ASHRAE/IESNA 2004 Standard, the LPD for a classroom/lecture/training space is 1.4 W/ft^2. In the space, general lighting seems to be accomplished by fixtures LP-A12, LP-G5, and LP-G6. The luminaire LP-A10 illuminates the stage area and luminaire LP-A19 illuminates the side walls. The amount of watts used in this space is calculated as follows (12 fixtures)*(2 lamps/fixture)*(40 watts/lamp) + (20 fixtures)*(4 lamps/fixture)*(32 watts/lamp) + (32 fixtures)*(1 lamp/fixture)*(32 watts/lamp) + (14 fixtures)*(2 lamps/fixture)*(75 watts/lamp) + (48 fixtures)*(1 lamp/fixture)*(50 watts/lamp) = 9044 watts. With an area of 4800 ft^2, the LPD for the room is 1.88 W/ft^2. The existing power density of the space exceeds the recommended value of the IESNA for the power density of a classroom. The power density exceeds the recommended power density of a classroom; however, the space may be used as a stage for other tasks, so the power density may be alright.

- LIGHTING CONTROLS

  The auditorium contains two – four scene lighting controls located in the front of the space. The four scene controllers will provide the space with different scenes to choose from, such as scenes for lectures, demonstrations, film projections, VDT use, and presentations.

- DESIGN CRITERIA
  - *Appearance of Space and Luminaires*

    The appearance of the space and luminaires is somewhat important in the auditorium. The auditorium will hold seminars and special speakers; therefore, the luminaires need to be recessed and not visually appalling. The space should be a very respectable space in order to have an appreciation for the university and the task at hand.

  - *Color Appearance (and Color Contrast)*

    Color appearance can affect visibility and aesthetics. A color rendering index (CRI) of 70 or above is acceptable when dealing with educational facilities; however, a CRI greater than 80 may be needed in order to ensure a pleasant appearance of skin tones. Since the auditorium will have special speakers and guest lecturers, a CRI of 80 or greater will be beneficial.
  - *Daylighting Integration and Control*

    The space does not incorporate daylighting into its design.
  - *Direct Glare*

    Direct glare should not be a problem with the 15'-18' high ceilings.
  - *Flicker (and Strobe)*

    Flicker is not an issue with this type of space.
  - *Light Distribution on Surfaces*

    Harsh striated patterns of excessive brightness or noticeable shadows should be avoided. Illuminance patterns should correspond with objects of the space. Ceiling and walls should have luminances within a 3:1 ratio. The current layout should not provide a harsh pattern on any surfaces in the space.

- *Light Distribution on Task Plane (Uniformity)*
  Patterns of light on the task plane should be uniform. The desks in the room are used for reading and writing. A non-uniform pattern of light on the work plane would be distracting or confusing. The task illuminance should be higher than the immediate surroundings. With a work plane illuminance that is 1.5 to 3 times higher than those in the surrounding areas will assist in directing the occupants' attention to the task, which is very important in educational facilities. The illuminance of the speaker should also be illuminated greater than the surrounding tasks.
- *Luminances of Room Surfaces*
  User comfort and satisfaction is increased when spaces deliver both direct and diffuse light to the occupant and task. With the number of luminaires in the space, the luminances of the room surfaces are assumed to be from direct and diffused light.
- *Modeling of Faces or Objects*
  The modeling of faces or objects is somewhat important to an auditorium, especially during social activities. A CRI of 80 or higher will provide a better skin tone color.
- *Point(s) of Interest*
  The points of interest in the space include the projection screen and the podium at the front of the space. The points of interest will prosper with a slightly higher illuminance due to the fact that they will stand out.
- *Reflected Glare*
  Reflected glare is undesirable for the auditorium. It does not seem to be an issue due to the high ceilings and the surfaces being of a matte origin.
- *Shadows*
  The amount of luminaires in the room should provide few shadows in the space.
- *Source/Task/Eye Geometry*
  Extremely important to a lecture hall is the source/task/eye geometry. The angular relationships between the viewer, the task, and the luminaire are frequently critical to task visibility. This should not be an issue due to the height of the ceiling.
- *Sparkle/Desirable Reflected Highlights*
  Sparkle is not applicable to this auditorium.
- *Surface Characteristics*
  The surface characteristics of the space are somewhat important due to reflected glare. The surfaces of the space should not be a high gloss, but rather a matte to low gloss in order for the space to provide minimal reflected glare.
- *System Control and Flexibility*
  System control and flexibility is very important due to the different tasks in the space. A couple of different systems include a scene for a projection screen, a guest speaker, lectures, and general reading/writing tasks.

- *Illuminance (Horizontal)*

  The IESNA handbook calls for a horizontal illuminance of 50 lux (5 fc) on the work plane for auditoriums. The calculations of the space through modeling indicate an average horizontal illuminance of XXX lux (XX fc) with the current luminaire layout. When the projection screen is in use, a horizontal illuminance of 30 lux (3 fc) on the work plane is needed.
- *Illuminance (Vertical)*

  The IESNA handbook recommends a vertical illuminance of 30 lux (3 fc) when the projection screen is in use.

- RENDERING OF EXISTING CONDITIONS

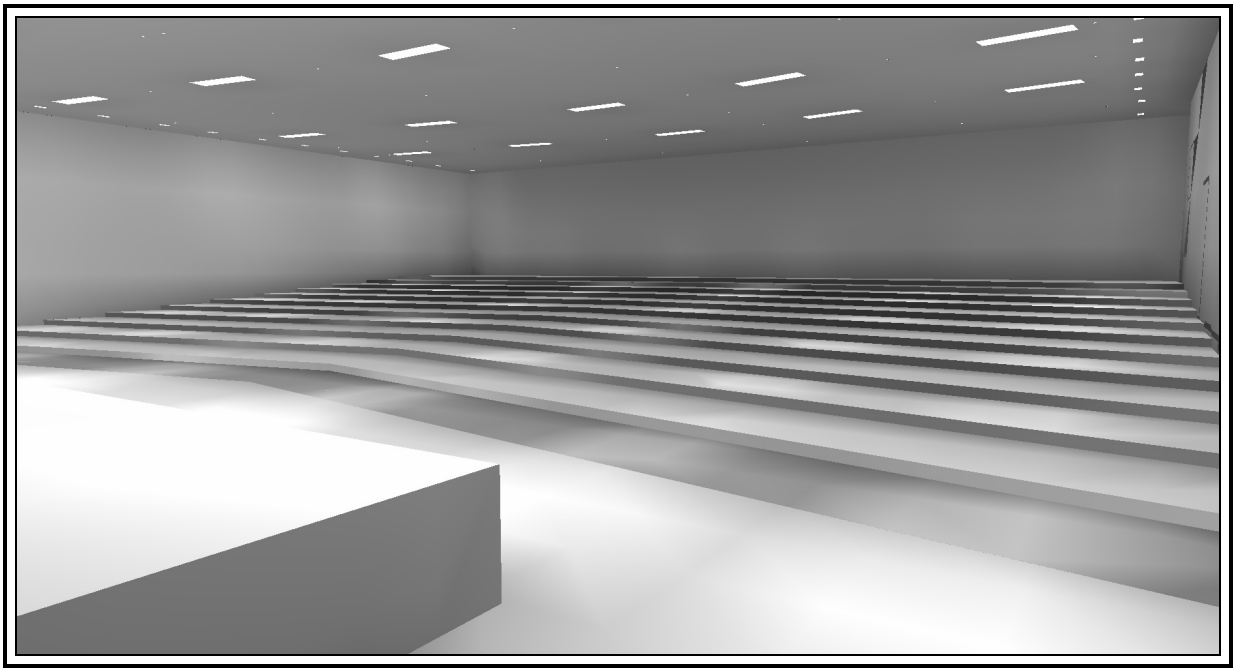

Figure 4: Rendering of Auditorium 1 (Front)

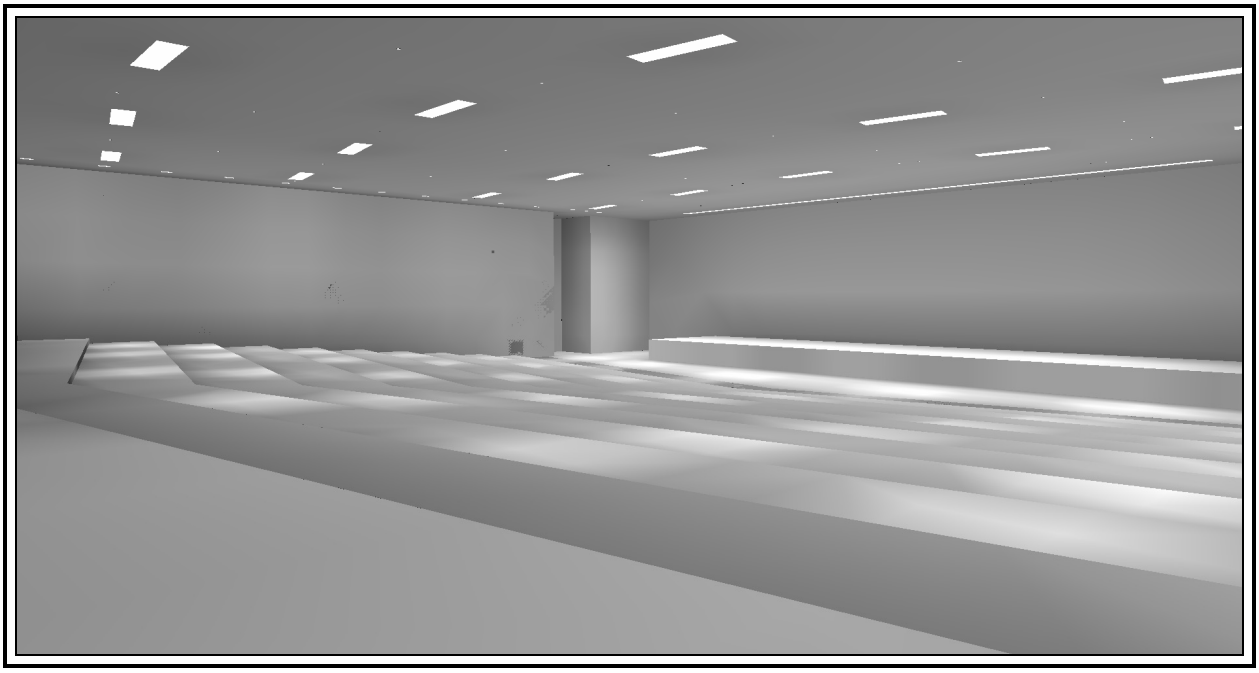

Figure 5: Rendering of Auditorium 2 (Rear)

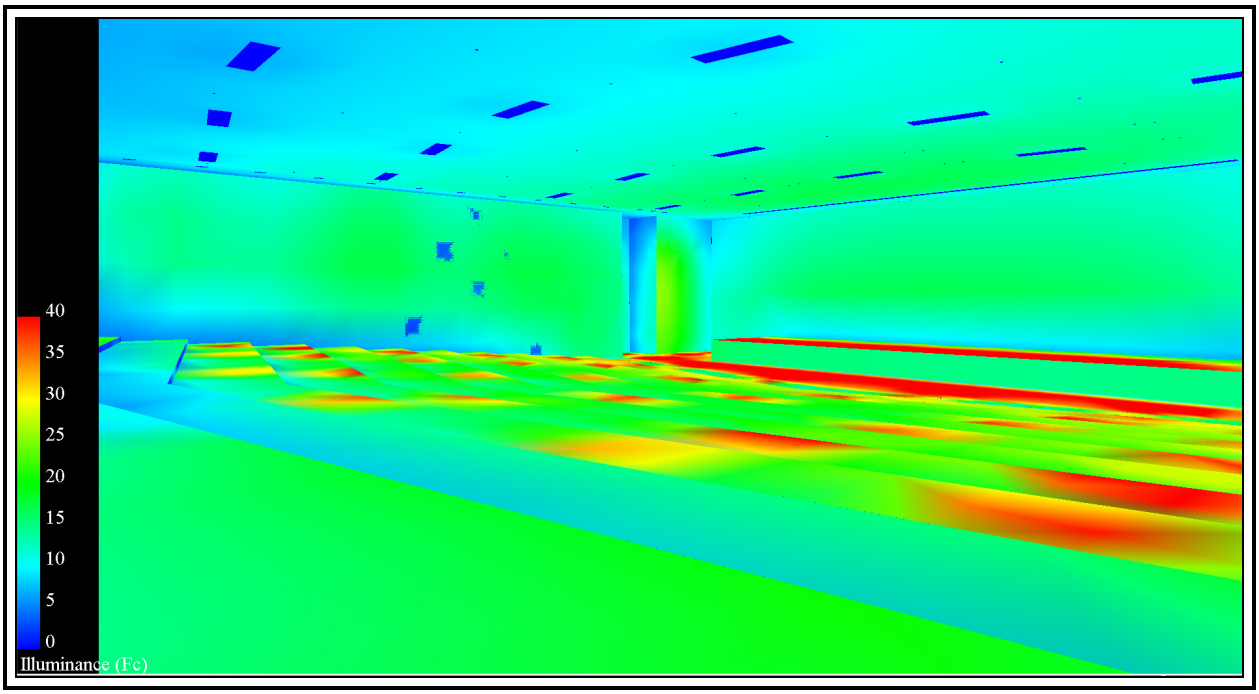

Figure 6: Pseudo Color of Auditorium (Rear)

- ILLUMINANCE AVERAGES

  The average illuminance of the floor according to the simple calculations in AGI32 is 32 footcandles. The average illuminance of the walls is 19 fc. The average illuminance of the workplane (2.5') is 43 fc. The stage area has an illuminance of 39 fc. The IESNA handbook recommends 50 fc on the work plane.

- EXISTING CONDITIONS FINAL ANALYSIS
  - The existing conditions of the space are acceptable. The existing power density measures slightly high; however, the illuminance on the workplane is low according to the IESNA handbook. The simple space renderings provide the basic visual appearance of the space and are not accountable for all light losses, such as reflectances, space geometry, and furnishings. In the AGI32 rendering, the ceiling is flat instead of sloped ceiling planes with fascias to follow the radius of the seating tiers. The lighting calculations may be slightly skewed due to this type of analysis. Reflectance values were approximated according to the space ceiling, wall, and floor finishes. The space has a high number of luminaires, but each of the luminaires is used for a specific purpose. Overall, the auditorium seems to be illuminated due to the specific tasks of the space. Also, the two – four scene lighting controllers are used to select the correct lighting scene for the correct task at hand.

Classroom (505)

- Description of Space

  The 60-person classroom is located on the fifth floor of the building. Some other spaces that accompany the classroom on the fifth floor include other classrooms, lecture halls, two skills simulation labs, storage rooms, a lobby, and a library/meeting room. The one wall of the space is a curved glass ribbon window, which has a potential for daylighting. The owner of the building is specifying dual/solar blackout shades in order to make the space VDT friendly. The space is approximately 1650 ft^2 with a 10' high ceiling.

- Task Description

  The classroom tasks will be note-taking, reading, writing, chalkboard use, and VDT use.

- Floor Plan

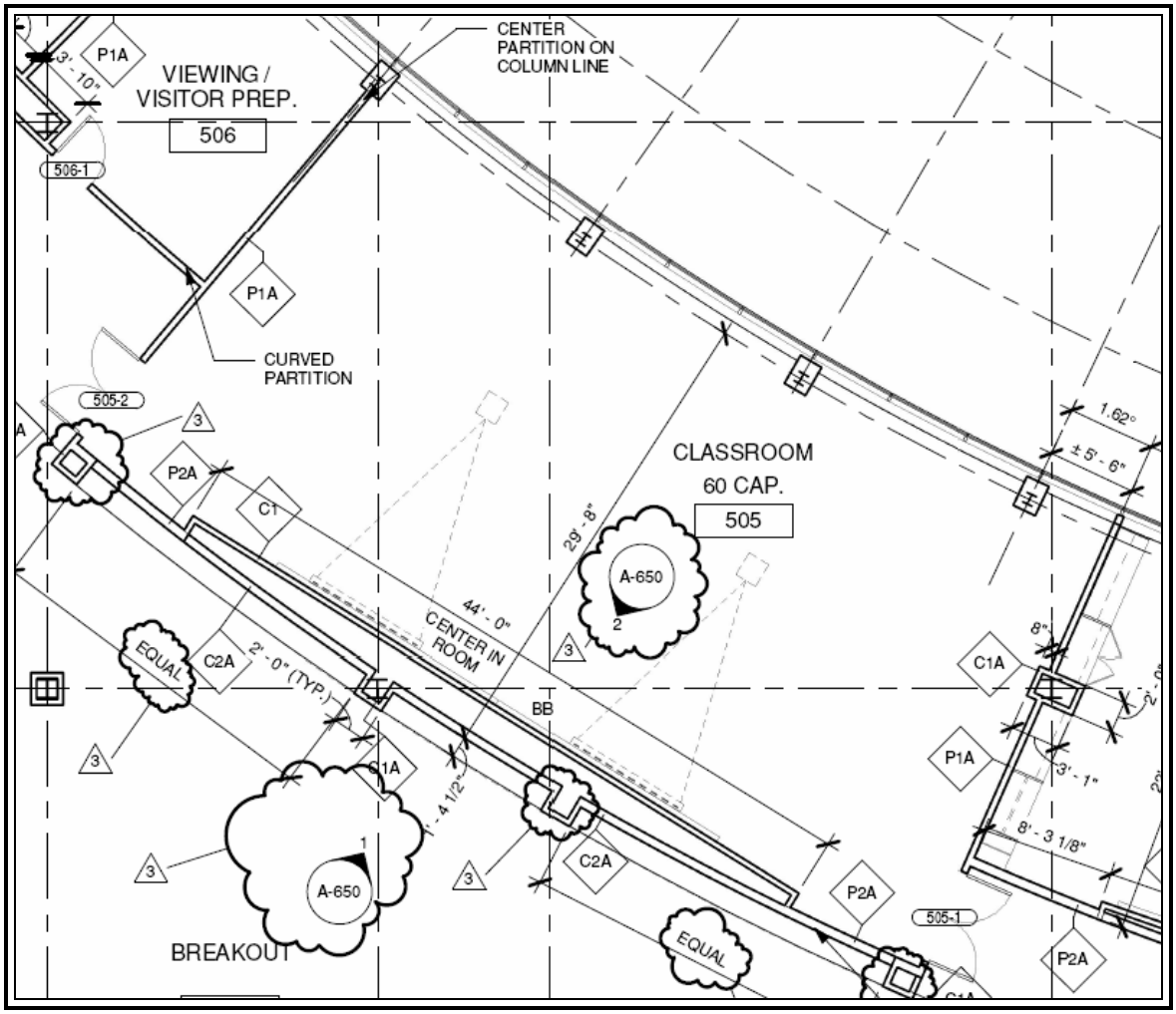

Figure 7: Partial Fifth Floor Plan

- SECTION OF CLASSROOM

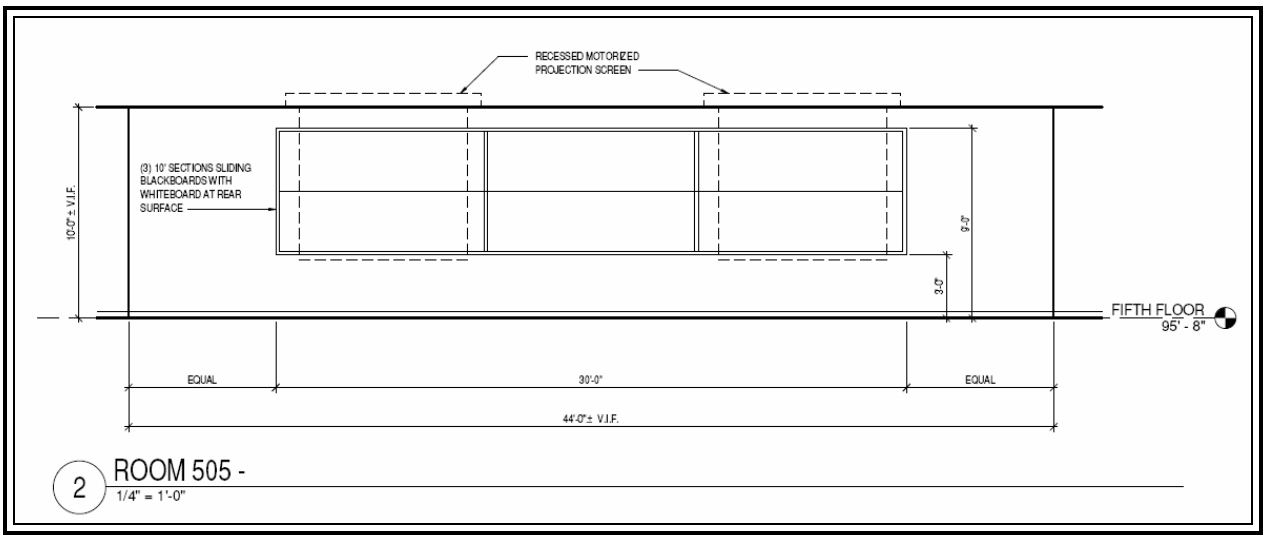

Figure 8: Section of Room 505

- LIGHTING PLAN

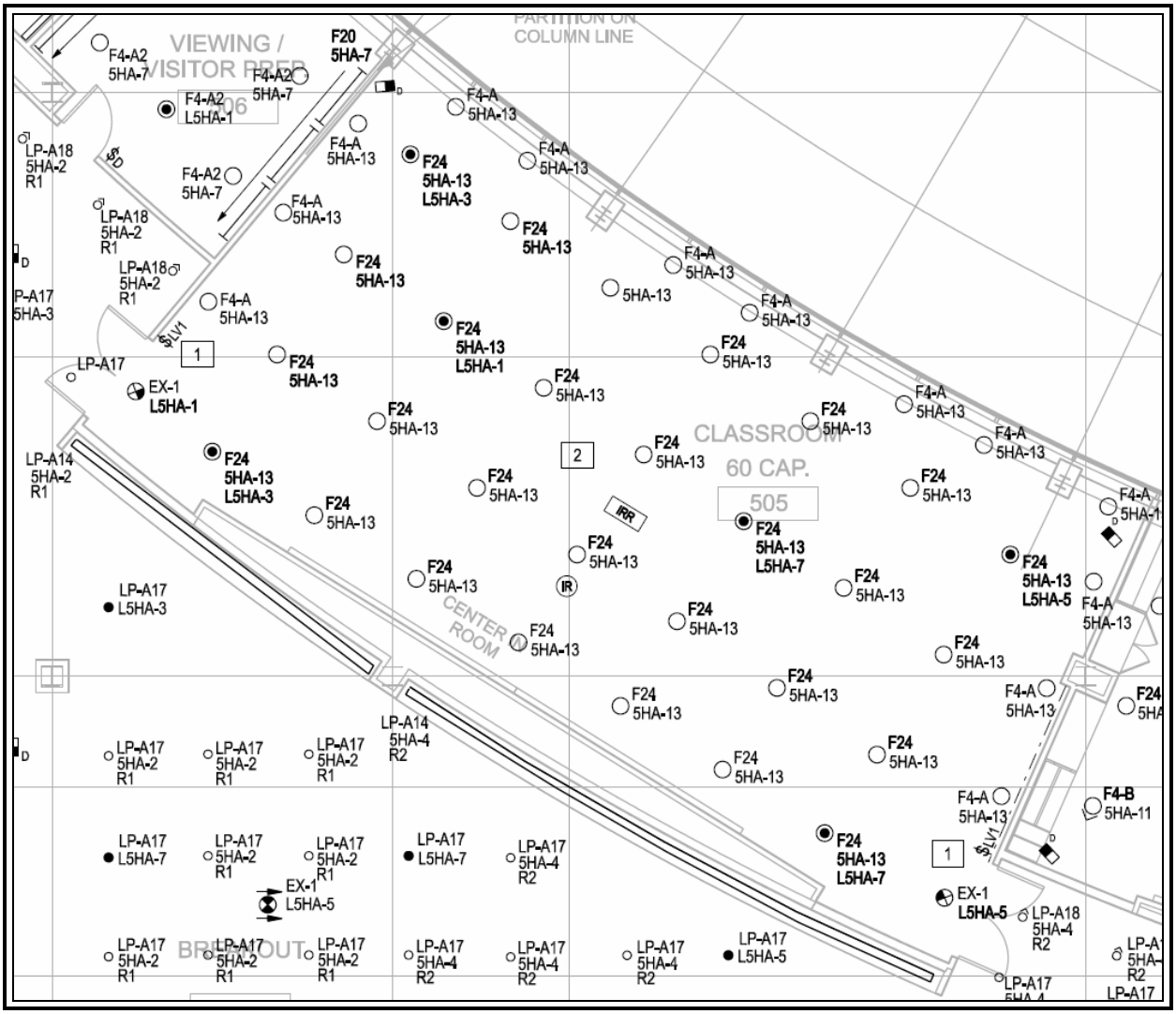

Figure 9: Partial Fifth Floor Lighting Plan

- LIGHTING FIXTURE SCHEDULE

Type	No. Fixtures	Description	Color/Finish	Mtg.	Lamping	Ballast/Transformer	Watts	Voltage	Mfr.	Catalogue No.
F4-A	13	6" Horizontal Recessed Compact Fluorescent Dimmable Down Light with Clear Alzak Reflector	Clear Alzak	Recessed in Grid	2-18W Double Twin Tube CF Lamps Type L3	Dali Ballast	50	277	Gotham; Infinity; Prescolite	AF-2/18DTT-6AR-277; PH60 Series; LF6 Series
F24	28	8" Horizontal Recessed Compact Fluorescent Down Light with Clear Alzak Reflector	Clear Alzak	Recessed in Grid	2-32W TRT CF Lamps Type L	Lutron Hi-Lume Dimming Ballast	69	277	Gotham; Infinity; Prescolite	AF-2/32DTT-8AR-277; PH85 Series; CFT Series

Table 3: Lighting Fixture Schedule (Room 505)

- LIGHT LOSS FACTORS

Fixture Tag	Cleaning Interval	Maintenance Category	Ballast Factor	LLD	RSDD	LDD	Total LLF
F4-A	6 Months/Clean	V	0.98	0.83	0.98	0.92	0.73
F24	6 Months/Clean	V	0.98	0.84	0.98	0.92	0.74

Table 4: Light Loss Factors (Room 505)

- FURNITURE
  - Recessed motorized projection screen
  - Ceiling mounted projector
  - Dual solar/blackout shades
  - (3) 10' sections sliding blackboards with whiteboard at rear surface
  - (60) desks and chairs
  - Podium
  - Large desk in front of room

- FINISHES
  - Ceiling: Acoustical Ceiling Tile 3
    - Assume 85% ceiling reflectance
  - Walls: PT
    - Assume 50% wall reflectance
  - Floor: RF1
    - Assume 30% floor reflectance

- EXISTING POWER DENSITY

  The existing power density in the space is calculated by using the space-by-space method. In Table 9.6.1 of the ASHRAE/IESNA 2004 Standard, the LPD for a classroom/lecture/training space is 1.4 W/ft^2. In the space, general lighting seems to be accomplished by fixtures F24 and F2-A. The amount of watts used in this space is calculated as follows (28 fixtures)*(2 lamps/fixture)*(32 watts/lamp) + (13 fixtures)*(2 lamps/fixture)*(18 watts/lamp) = 2260 watts. With an area of 1650 ft^2, the LPD for the room is 1.37 W/ft^2. The existing power density of the space places itself within the IESNA limits for the power density of a classroom.

- LIGHTING CONTROLS

  The classroom uses two wide view sensor microphonic-dual technology. The occupancy sensors are located in the rear of the classroom on the two corners. The Dual Technology sensor will be capable of detecting presence in the control area by detecting ultrasound and passive infrared heat changes.

- DESIGN CRITERIA
  - *Appearance of Space and Luminaires*

    The appearance of the space and luminaires is not that important when dealing with a classroom type setting. The existing luminaires are recessed with a clear alzak reflector, which are aesthetically pleasing.
  - *Color Appearance (and Color Contrast)*

    Color appearance can affect visibility and aesthetics. A color rendering index (CRI) of 70 or above is acceptable when dealing with educational facilities; however, a CRI greater than 80 may be needed in order to ensure a pleasant appearance of skin tones.
  - *Daylighting Integration and Control*

    The space incorporates a curved ribbon window on the entire wall at the rear of the room. This will be an issue during the use of the projector and screen and may even cause glare on the backboard. In relation to this, the owner will provide dual/solar blackout blinds in order to remedy this problem. If the daylighting does not cause any major glare problems, the daylighting can be used to limit the amount of energy used in the room during the day. Controls such as a photo sensor can be used to dim the luminaires in the room when daylighting is entering the room.
  - *Direct Glare*

    With the amount of fixtures in the space, direct glare can be an issue; however, the clear alzak reflector will limit the amount of glare that will bother the occupants. Another rule of thumb to be used is luminaire luminances should not be more than 100 times those of surrounding surfaces to minimize glare. A way of doing this is to use luminaires that illuminate the ceiling as well as the task and by increasing ceiling reflectance. A direct-indirect luminaire in the space may be the answer to the direct glare issue, especially because of the 10' high ceilings.
  - *Flicker (and Strobe)*

    Flicker is not an issue with this type of space.
  - *Light Distribution on Surfaces*

    Harsh striated patterns of excessive brightness or noticeable shadows should be avoided. Illuminance patterns should correspond with objects of the space. Ceiling and walls should have luminances within a 3:1 ratio. The current layout should not provide a harsh pattern on any surfaces in the space.
  - *Light Distribution on Task Plane (Uniformity)*

    Patterns of light on the task plane should be uniform. The desks in the room are used for reading and writing. A non-uniform pattern of light on the work plane would be distracting or confusing. The task illuminance should be higher than the immediate surroundings. With a work plane illuminance that is 1.5 to 3 times higher than those in the surrounding areas will assist in directing the occupants' attention to the task, which is very important in educational facilities.
  - *Luminances of Room Surfaces*

    Spaces that deliver both direct and diffuse light to the occupant and task increase user comfort and satisfaction; however, this space only delivers direct light to the occupant. A direct-indirect system may be a better design for this space in order to make the space more comfortable.

- *Modeling of Faces or Objects*

  The modeling of faces or objects is somewhat important to a classroom. A CRI of 80 or higher will provide a better skin tone color; however, a CRI of 70 is acceptable.
- *Point(s) of Interest*

  The points of interest in the space include the blackboard, whiteboard, the projection screen, and the podium. The points of interest will prosper with a slightly higher illuminance due to the fact that they will stand out.
- *Reflected Glare*

  In the proposed lighting layout for the classroom, reflected glare does not seem to be an issue. This is dependent on the type of reflectance on the desk tops and on the floor. If the reflectance is too high, this will be an issue.
- *Shadows*

  The amount of luminaires in the room should provide few shadows in the space. Even though the lighting is direct, the light will be at a different number of angles due to the number of luminaires in the room and will not cause harsh shadows.
- *Source/Task/Eye Geometry*

  Extremely important to the classroom setting is the source/task/eye geometry. The angular relationships between the viewer, the task, and the luminaire are frequently critical to task visibility. This should not be an issue due to the height of the ceiling.
- *Sparkle/Desirable Reflected Highlights*

  Sparkle is not applicable to a classroom.
- *Surface Characteristics*

  The surface characteristics of the space are somewhat important due to reflected glare. The surfaces of the space should not be a high gloss, but rather a matte to low gloss in order for the space to provide minimal reflected glare.
- *System Control and Flexibility*

  System control and flexibility is very important due to the different tasks in the space. A couple of different systems include a scene for the projection screen, blackboard and whiteboard applications, and general lecture tasks.
- *Illuminance (Horizontal)*

  The IESNA handbook calls for a horizontal illuminance of 300 lux (30 fc) on the work plane for reading and writing tasks. The calculations of the space through modeling indicate an average horizontal illuminance of 550 lux (55 fc) with the current luminaire layout. When the projection screen is in use, a horizontal illuminance of 30 lux (3 fc) on the work plane is needed.
- *Illuminance (Vertical)*

  The IESNA handbook recommends a vertical illuminance of 30 lux (3 fc) when the projection screen is in use.

- RENDERING OF EXISTING CONDITIONS

Figure 10: Rendering of Classroom

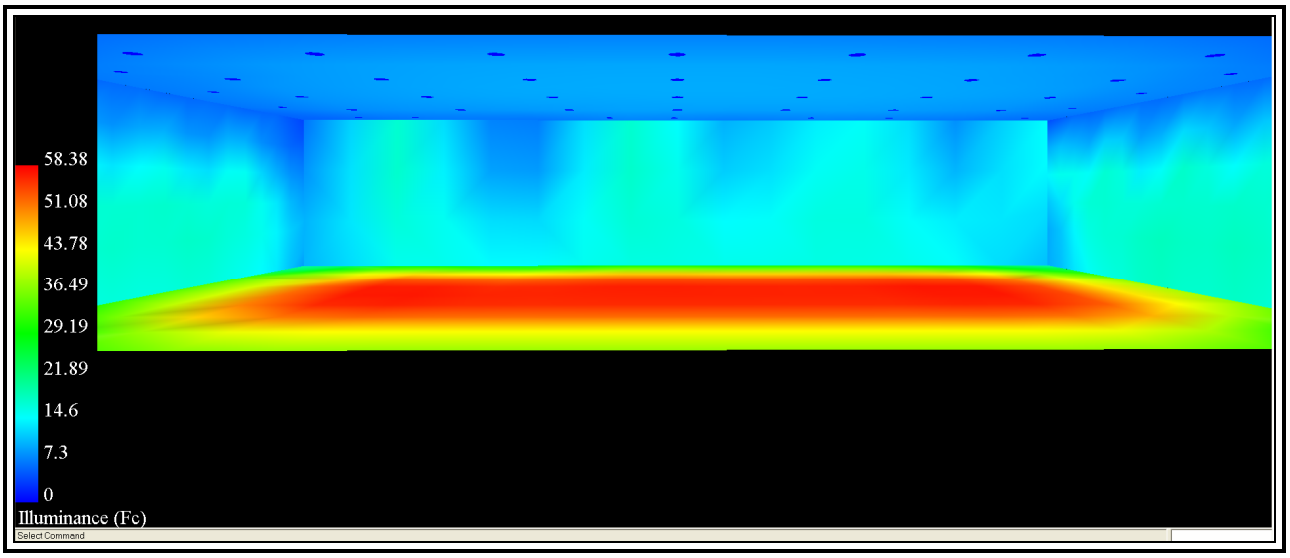

Figure 11: Pseudo Color of Classroom

- ILLUMINANCE AVERAGES

  The average illuminance of the floor according to the simple calculations in AGI32 is 46.29 fc. The average illuminance of the walls is 13.91 fc. The average illuminance of the workplane (2.5') is 54.87 fc. The average illuminance of the space is extremely too high. The IESNA handbook recommends only 30 fc on the work plane.

- EXISTING CONDITIONS FINAL ANALYSIS

  The existing conditions of the space are acceptable. The existing power density measures to specifications; however, the illuminance on the workplane is too high. The simple space renderings are not accountable for all light losses, such as reflectances, space geometry, and furnishings. The rear wall of the space will also have ribbon windows, which will provide daylight into the space. The windows have black out shades on them in order to provide the room with a specific scene during use of the projector. The space has a high number of luminaires with forty-one, so a couple of fixtures may be taken out. Overall, the room seems to meet the sufficient needs of the space with the different scenes the space needs to provide to the user.

LOBBY

- DESCRIPTION OF SPACE

  The lobby is located on the first floor of the building. Upon entering the building through the curved façade that features large expanses of glass, one would find themselves in the lobby of the building. The auditorium entrance would then be straight ahead when in the lobby. The lobby will be mainly used for a circulation space although the space will have plasma screens in it. A small retail space is located in one corner of the lobby. The lobby is 75' wide by 120' long and approximately 9000 ft^2. The ceiling is 15' high.

- TASK DESCRIPTION

  The space will be mainly use for circulation to the rest of the building. Another task of the space will be the plasma VDT screens located throughout the space.

- FLOOR PLAN

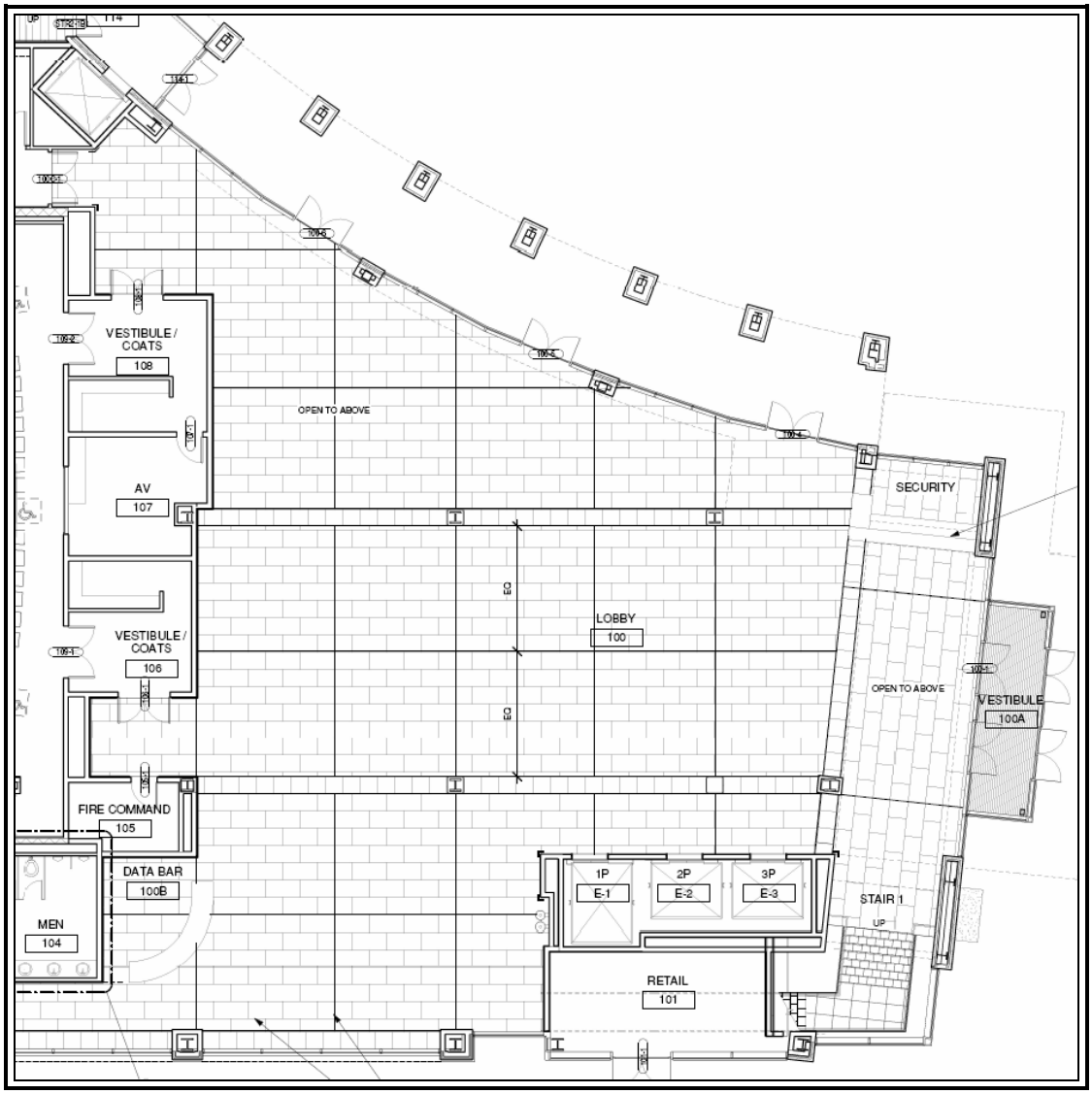

Figure 12: Partial First Floor Plan

- LOBBY ELEVATION @ SOUTH CORRIDOR ALONG LOCUST STREET

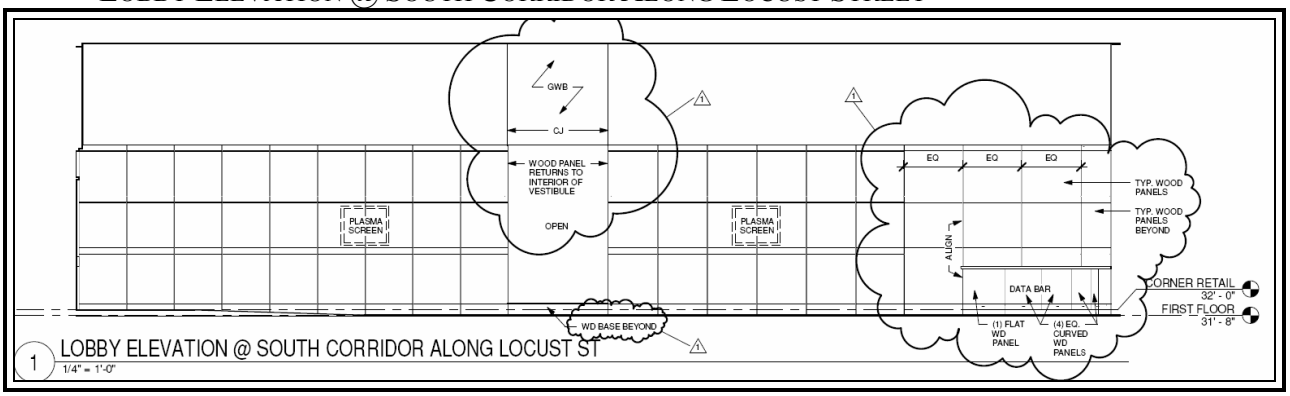

Figure 13: Lobby Elevation A

- LOBBY ELEVATION LOOKING SOUTH

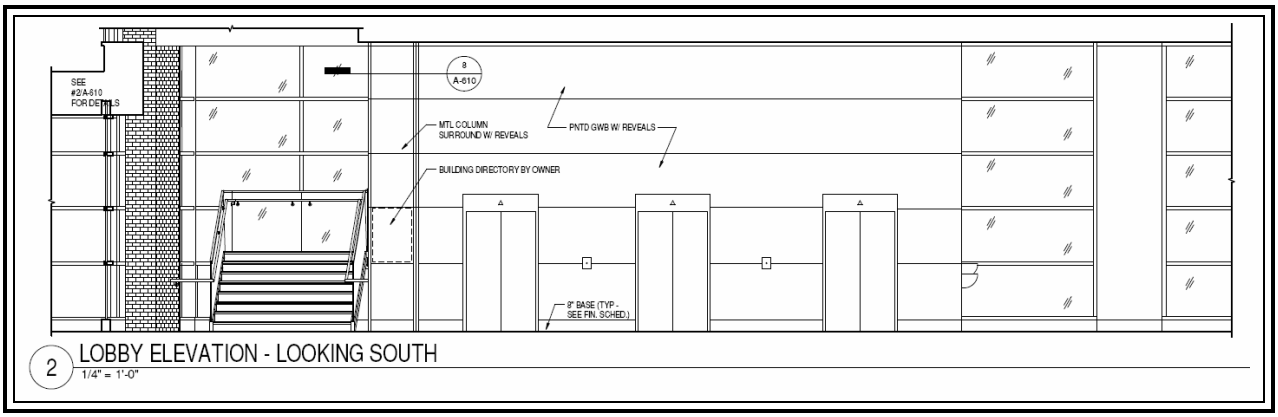

Figure 14: Lobby Elevation B

- LOBBY ELEVATION @ SECOND FLOOR OPENING

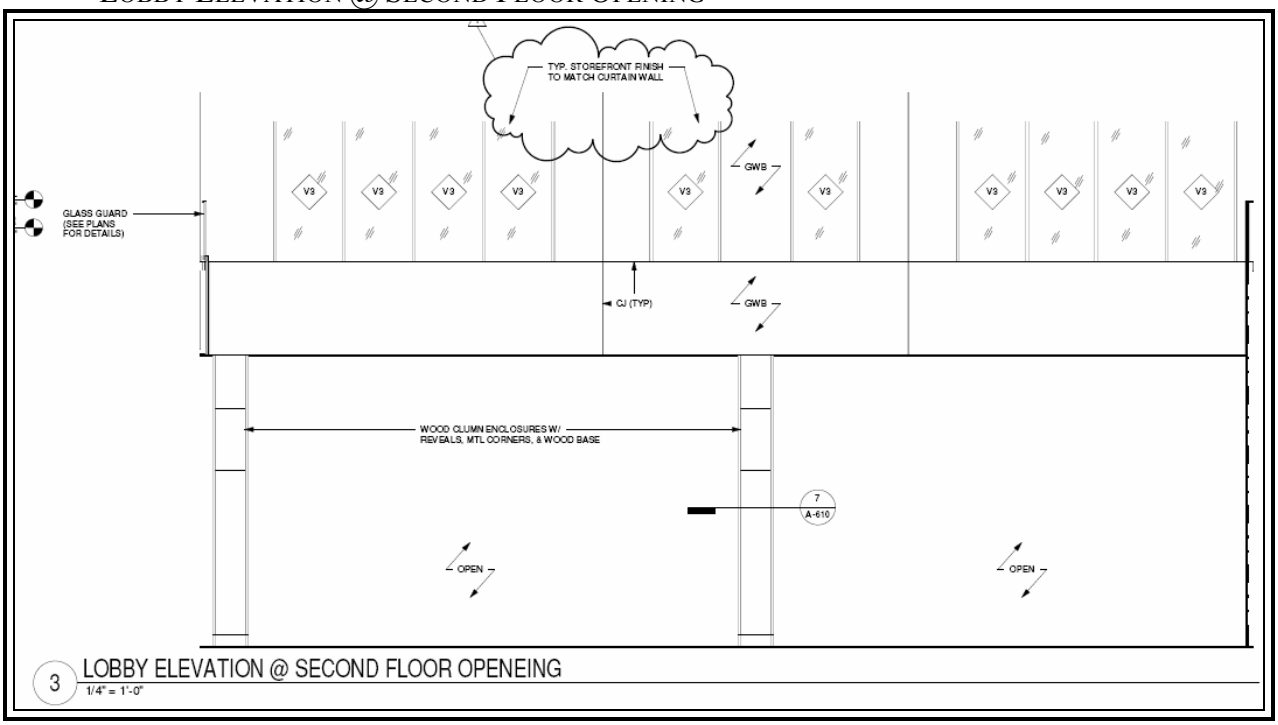

Figure 15: Lobby Elevation C

- LOBBY ELEVATION LOOKING EAST

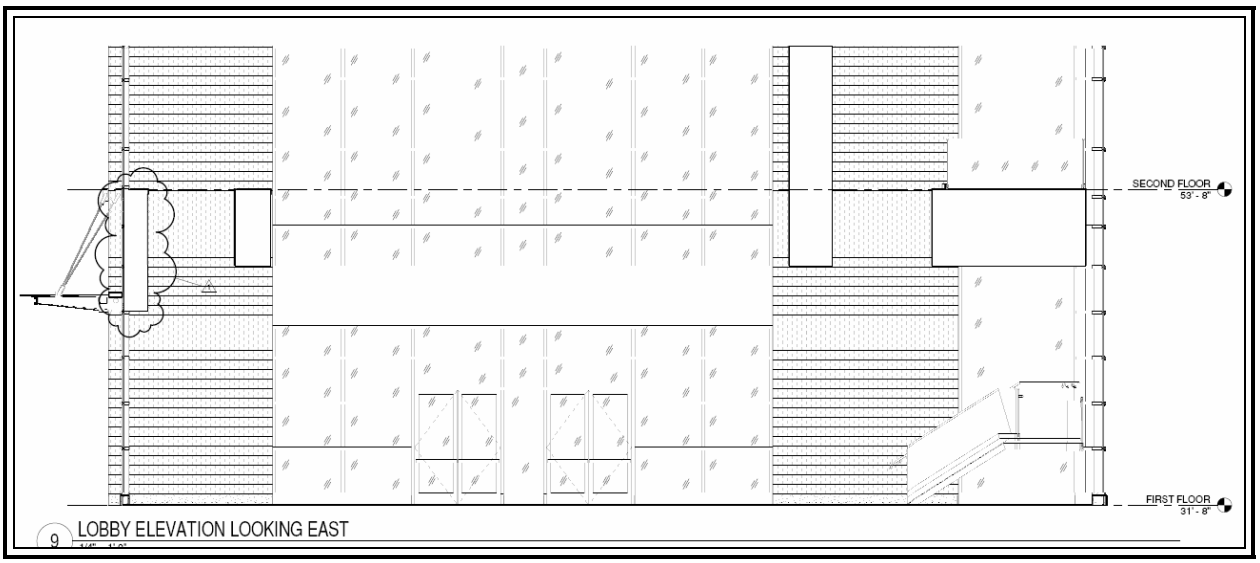

Figure 16: Lobby Elevation D

- LIGHTING PLAN

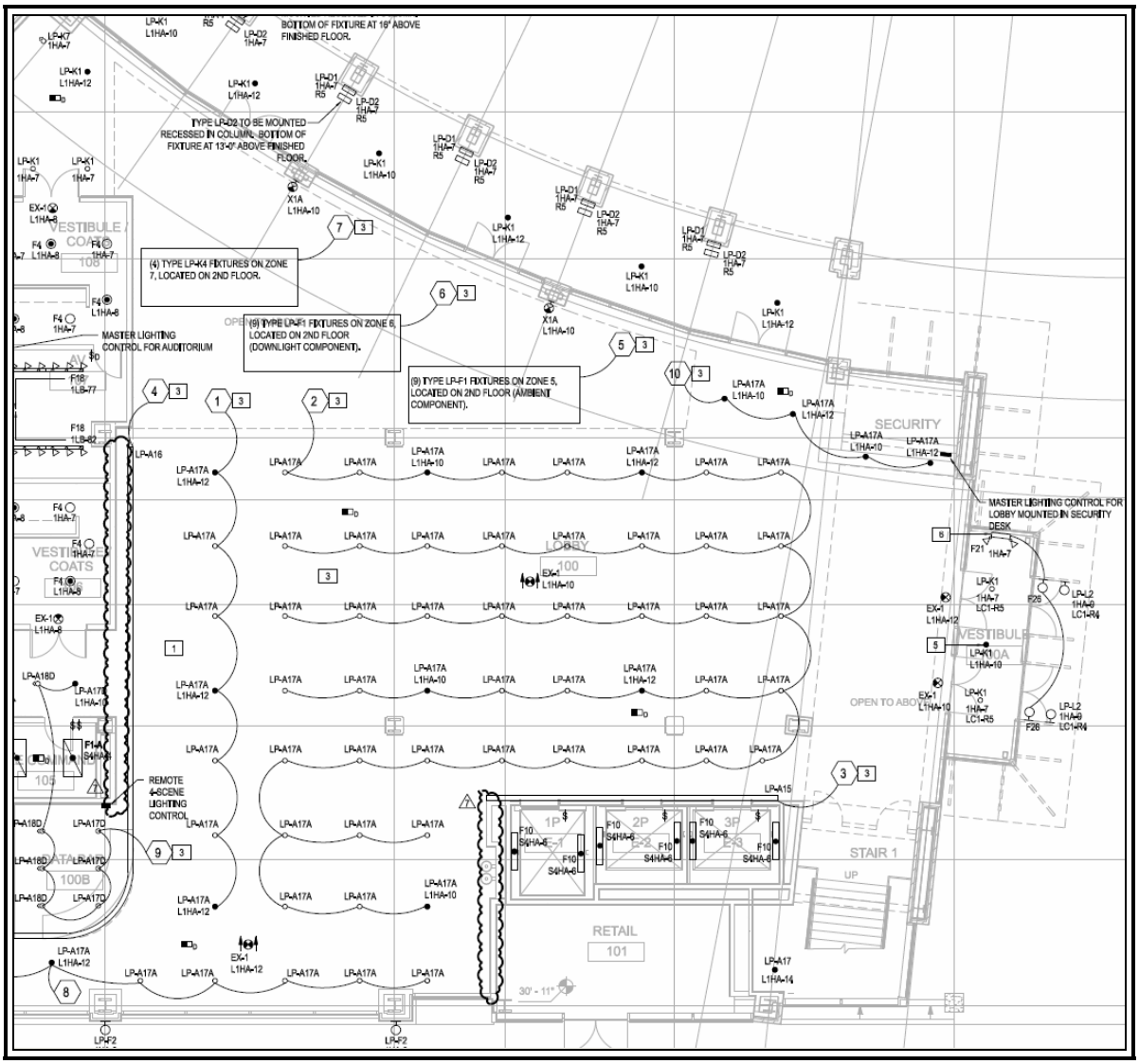

Figure 17: Partial First Floor Lighting Plan

- LIGHTING FIXTURE SCHEDULE

Type	No. Fixtures	Description	Color/Finish	Mtg.	Lamping	Ballast /Transformer	Watts	Voltage	Mfr.	Catalogue No.
LP-A17A	79	Compact Fluorescent Dimmable Downlight, Clear Semi-Specular Low Iridescent Alzak Cone and Flange Reflector	Clear Semi-Specular Low Iridescent Alzak	Recessed	2-PL-T 26W/35/4P/ALTO	One Two-Lamp Electronic Dimmable Ballast (Lutron SE Series) with 5% Dimming and with Lamp Failure Protection Circuit	58	120	Gotham; Edison Price; Kramer	AF-2/26TRT-8AR-LD-277-DMHL-LUTRON SE SERIES
LP-D1	5	Compact Fluorescent Step light with Diffuse Aluminum Asymmetric Reflector, Regressed Gasketed 3/16" Acrylic Lens	Diffuse Aluminum Asymmetric Reflector	Recessed	1-PL-T 32W/835/4P/ALTO	Integral 0ºF Start Electronic Ballast with Lamp Failure Interruption Circuit	34	277	Engineered Lighting Products; Devine; FC Lighting	132-TTCP-LOW TEMP 277 BALLAST
LP-D2	5	Compact Fluorescent Uplight with Diffuse Aluminum Asymmetric Reflector, Modified with Flush Acrylic Lens Covering Aperture	Diffuse Aluminum Asymmetric Reflector	Recessed	2-PL-T 32W/835/4P/ALTO	Integral 0ºF Start Electronic Ballast with Lamp Failure Interruption Circuit	68	277	Engineered Lighting Products; Devine; FC Lighting	232-TTCP-FL-LOW TEMP 277 BALLAST
LP-K1	12	Metal Halide Downlight, Clear Diffuse Alzak Cone and Return Flange	Clear Diffuse Alzak	Recessed	1-CDM35/PAR 30L/FL	Integral Electronic Ballast	50	277	Edison Price; Gotham; Portfolio	ARC30/6-39-277-ECOL
LP-K7	1	Metal Halide Lensed Wallwasher, Clear Diffuse Alzak Cone and Return Flange, 40o X 70o Glass Spread Lens	Clear Diffuse Alzak	Recessed	1-CDM35/PAR 30/SP	Integral Electronic Ballast	50	277	Edison Price; Gotham; Portfolio	ARCWL30/5-39-277-ECOL
LP-L2	2	Metal Halide Adjustable Accent Light, Clear Tempered Glass Spread Lens, Lockable Aiming Knuckle, Canopy Mounting, Satin Aluminum Paint Finish	Clear Tempered Glass Spread Lens	Surface	1-CDM35/PAR 30/FL	Integral HX-HPF Ballast	50	277	BK Lighting; Lumiere; Vision 3E	SE-61-SAP-10-B-PC35-277
EX-1	5	Edge Lit Exit Sign with Red Letters in a Mirrored Acrylic Face. Fixture Housing Shall Be Fully Recessed	Acrylic	Recessed	Red LEDs	N/A	N/A	120/277	Astralite, Inc.	CA-2C-R-W-BA

Table 5: Lighting Fixture Schedule (Lobby)

- LIGHT LOSS FACTORS

Fixture Tag	Cleaning Interval	Maintenance Category	Ballast Factor	LLD	RSDD	LDD	Total LLF
LP-A17A	12 Months/Clean	V	0.99	0.86	0.97	0.88	0.73
LP-D1	12 Months/Clean	V	0.99	0.87	0.97	0.88	0.74
LP-D2	12 Months/Clean	V	0.99	0.87	0.97	0.88	0.74
LP-K1	12 Months/Clean	V	0.98	0.93	0.97	0.88	0.78
LP-K7	12 Months/Clean	V	0.98	0.93	0.97	0.88	0.78
LP-L2	12 Months/Clean	V	1.00	0.86	0.97	0.88	0.73

Table 6: Light Loss Factors (Lobby)

- FURNITURE
  - Plasma VDT screens
  - Seating
  - Security space
  - Retail space

- FINISHES
  - Ceiling: GWB soffits/banding and acoustical ceiling tile 1: Armstrong "Optima Vector" #3900, 24"x24"x7/8", NRC 0.90, 15/16" Prelude grid, color white
    - Assume 90% ceiling reflectance
  - Walls: WP1, wood paneling/Painted GWB/Painted GWB with reveals & SS corner guards

        - Assume 50% wall reflectance
    - Floor: FT1: Cotto D'Este Porcelain Tile "Buxy", Cendre Natural Finish, rectified edge, in 2'x2' and 2'x4' x 5/8" thick tiles
        - Assume 40% floor reflectance

- EXISTING POWER DENSITY

  The existing power density in the space is calculated by using the space-by-space method. In Table 9.6.1 of the ASHRAE/IESNA 2004 Standard, the LPD for a lobby is 1.3 W/ft^2. In the space, general lighting seems to be accomplished by fixture LP-A17A. The luminaires LP-K1, LP-K7, and LP-L2 illuminate the walls of the space. Luminaires LP-D1 and LP-D2 provide lighting for the columns on the outside of the lobby area and are not included in the power density calculation. The amount of watts used in this space is calculated as follows (79 fixtures)*(2 lamps/fixture)*(26 watts/lamp) + (12 fixtures)*(1 lamp/fixture)*(50 watts/lamp) + (1 fixture)*(1 lamp/fixture)*(35 watts/lamp) + (2 fixtures)*(1 lamp/fixture)*(35 watts/lamp) = 4813 watts. With an area of 9000 ft^2, the LPD for the room is 0.46 W/ft^2. The existing power density of the space falls below the recommended value of the IESNA for the power density of a lobby. The power density may not be as high because of all the daylight entering the space. The lobby is mainly used for a circulation space, so the power density does not need to be to the recommended value.

- LIGHTING CONTROLS

  The lobby uses five wide view sensors with microphonic-dual technology. The occupancy sensors are located throughout the space. The Dual Technology sensor will be capable of detecting presence in the control area by detecting ultrasound and passive infrared heat changes. A photo sensor may provide the space with energy savings during daylight periods when the lighting is not needed. The master lighting control for the lobby is mounted in the security desk.

- DESIGN CRITERIA
    - *Appearance of Space and Luminaires*

      The appearance of the space and luminaires is extremely important when lighting with a lobby to this new "new heart of campus". The appearance of the space and luminaires has to be aesthetically appealing. The architecture can be highlighted along with the double height space.
    - *Color Appearance (and Color Contrast)*

      Color appearance can affect visibility and aesthetics. A color rendering index (CRI) of 70 or above is acceptable when dealing with educational facilities; however, a CRI greater than 80 may be needed in order to ensure a pleasant appearance of skin tones.
    - *Daylighting Integration and Control*

      The space incorporates an expansive curved glass façade on the entire northeast wall. This will be an issue for the use of the VDT on the walls and may cause glare on the screen. Some type of curtain blocking the daylight reaching the plasma screens may be needed in order to cut down on reflected glare. The daylighting can be used to limit the amount of energy used in the room during the day. Controls such as a photo sensor can be used to dim the luminaires in the room when daylighting is entering the room.

- *Direct Glare*

  With the height of the ceilings at 17' high, direct glare should not be a problem in the lobby. The only issue that is of concern is the windows. Some type of curtain may be needed over the glass windows.
- *Flicker (and Strobe)*

  Flicker is not an issue with this type of space.
- *Light Distribution on Surfaces*

  Harsh striated patterns of excessive brightness or noticeable shadows should be avoided. Illuminance patterns should correspond with objects of the space. Ceiling and walls should have luminances within a 3:1 ratio. The current layout should not provide a harsh pattern on any surfaces in the space.
- *Light Distribution on Task Plane (Uniformity)*

  Uniformity is not an issue with this type of space.
- *Luminances of Room Surfaces*

  User comfort and satisfaction is increased when spaces deliver both direct and diffuse light to the occupant and task. With the number of luminaires in the space and daylighting, the luminances of the room surfaces are assumed to be from direct and diffused light.
- *Modeling of Faces or Objects*

  The modeling of faces or objects is somewhat important to a lobby. A CRI of 80 or higher will provide a better skin tone color. Another consideration should be that light will hit the face at all angles. In this space with all the different light sources including daylight, the modeling of faces or objects should not be a problem.
- *Point(s) of Interest*

  The points of interest in the space include the entrances, exits, plasma screens, circulation paths, retail space, and security space. The points of interest will prosper with a slightly higher illuminance due to the fact that they will stand out, such as the entrances and exits.
- *Reflected Glare*

  In the proposed lighting layout for the lobby, reflected glare seems to be a problem for the plasma screens. Again, a curtain of some type may be needed to keep reflected glare off of the VDT.
- *Shadows*

  The amount of luminaires in the room should provide few shadows in the space. Shadows are undesirable in the space.
- *Source/Task/Eye Geometry*

  The source/task/eye geometry is somewhat important to a lobby application. The angular relationships between the viewer, the task, and the luminaire are frequently critical to task visibility. This should not be an issue due to the height of the ceiling. If this is not achieved, people could trip or fall and hurt themselves.
- *Sparkle/Desirable Reflected Highlights*

  Sparkle is not applicable to this application.
- *Surface Characteristics*

  The surface characteristics of the space are somewhat important due to the appearance of the space. The surfaces of the space should be a high gloss, grand looking material. The space should appear to be high class.

- *System Control and Flexibility*

  System control and flexibility is not very important due to the one task in the space. One system should be sufficient for viewing the plasma screens, and circulation. The only system control could be used with the daylight integration in order to decrease the system energy used.
- *Illuminance (Horizontal)*

  The IESNA handbook calls for a horizontal illuminance of 50 lux (5 fc) on the work plane for circulation. The calculations of the space through modeling indicate an average horizontal illuminance of XX lux (X fc) with the current luminaire layout.
- *Illuminance (Vertical)*

  The IESNA handbook recommends a vertical illuminance of 30 lux (3 fc) for this space. The entrances and exits should have a vertical illuminance of 50 lux (5 fc).

- RENDERING OF EXISTING CONDITIONS

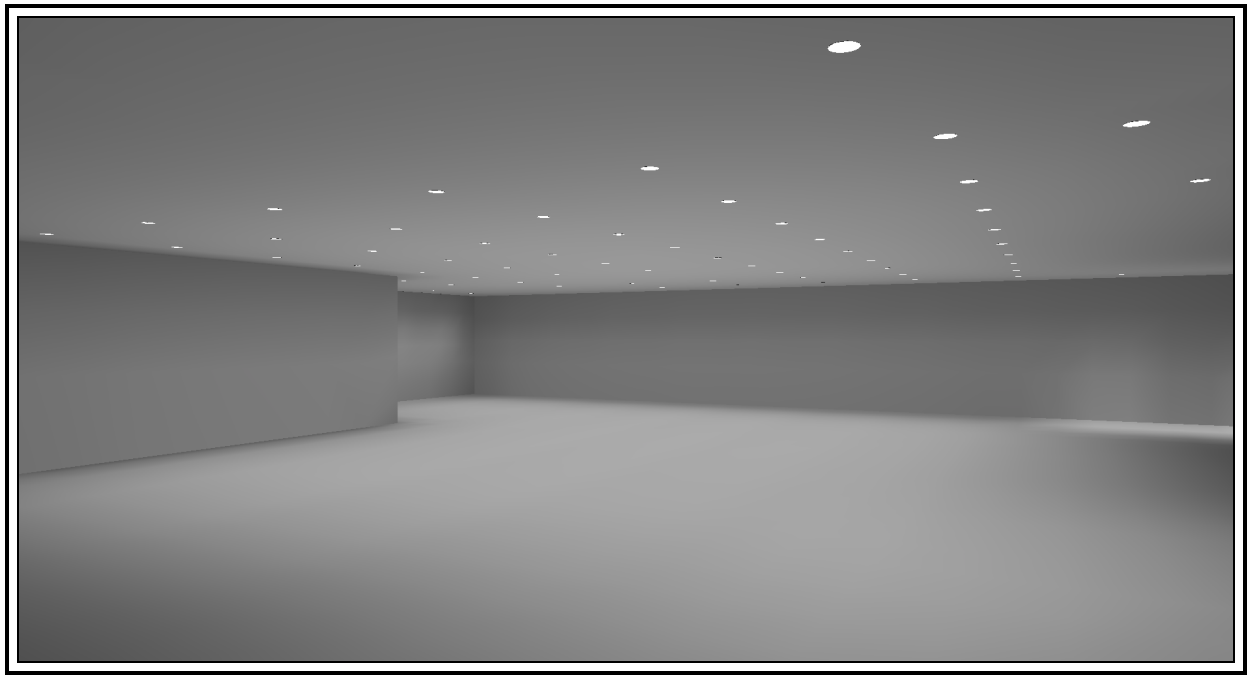

Figure 18: Rendering of Lobby 1(Security)

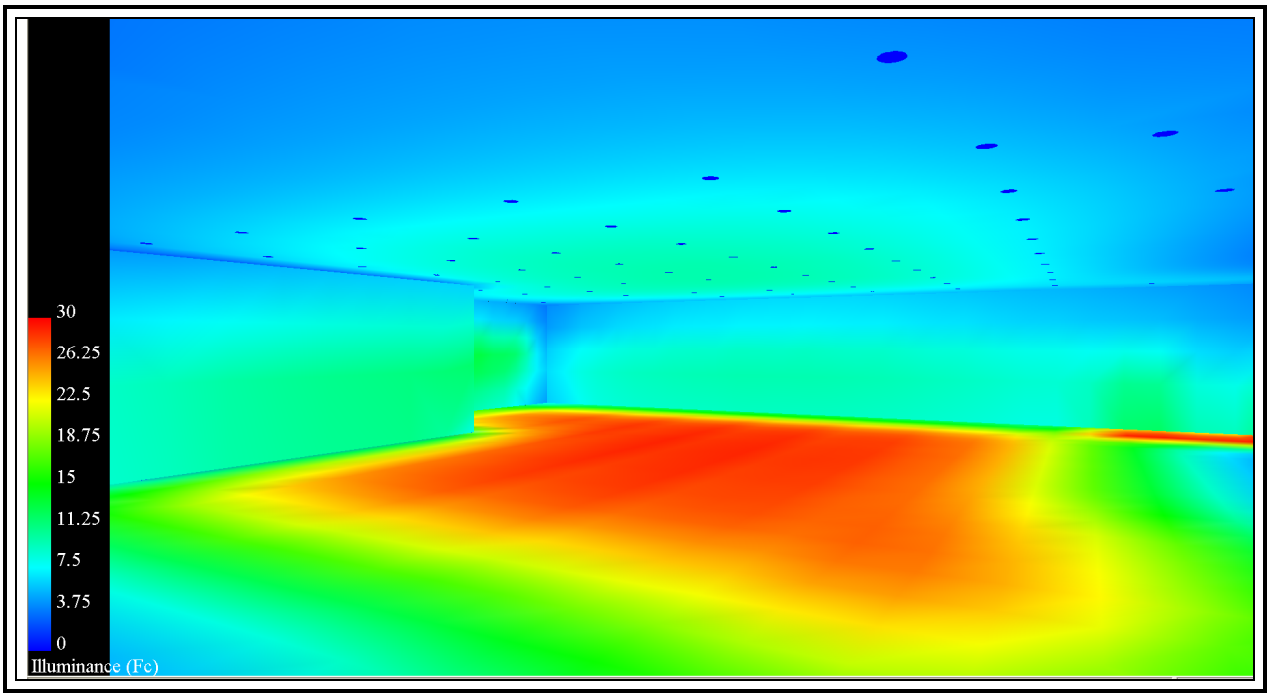

Figure 21: Pseudo Color of Lobby (Security)

- ILLUMINANCE AVERAGES

  The average illuminance of the floor according to the simple calculations in AGI32 is 19 fc. The average illuminance of the walls is 6 fc. The IESNA handbook recommends only 5 fc on the work plane.

- EXISTING CONDITIONS FINAL ANALYSIS

  The existing conditions of the space are acceptable. The existing power density measures to specifications; however, the illuminance on the workplane is too high. The simple space renderings provide the basic visual appearance of the space and are not accountable for all light losses, such as reflectances, space geometry, and furnishings. The curved front façade and side façade of the space will be glass, which will provide a significant amount of daylight into the space. The renderings provide a view of the space in the night. Reflectance values were approximated according to the space ceiling, wall, and floor finishes. The space has a high number of luminaires, but each of the luminaires is used for a specific purpose. Overall, the lobby seems to be illuminated due to the specific task of the space (circulation).

PLAZA

- DESCRIPTION OF SPACE

  The main entrance to the Dorrance H. Hamilton Building faces a grassy plaza where students and faculty can meet and interact informally. The facility's curved façade will feature large expanses of glass that will open on the plaza outside. The transparency of the building carries through the entire ground floor, allowing people on the street to look into the lobby, through the building and out to the plaza. The plaza includes walkways, a statue, seating areas, and an open grass area. The plaza is approximately 60,000 ft^2.

- TASK DESCRIPTION

  The space will be mainly use for circulation to the building. The plaza allows students and faculty to meet and interact informally.

- SITE PLAN

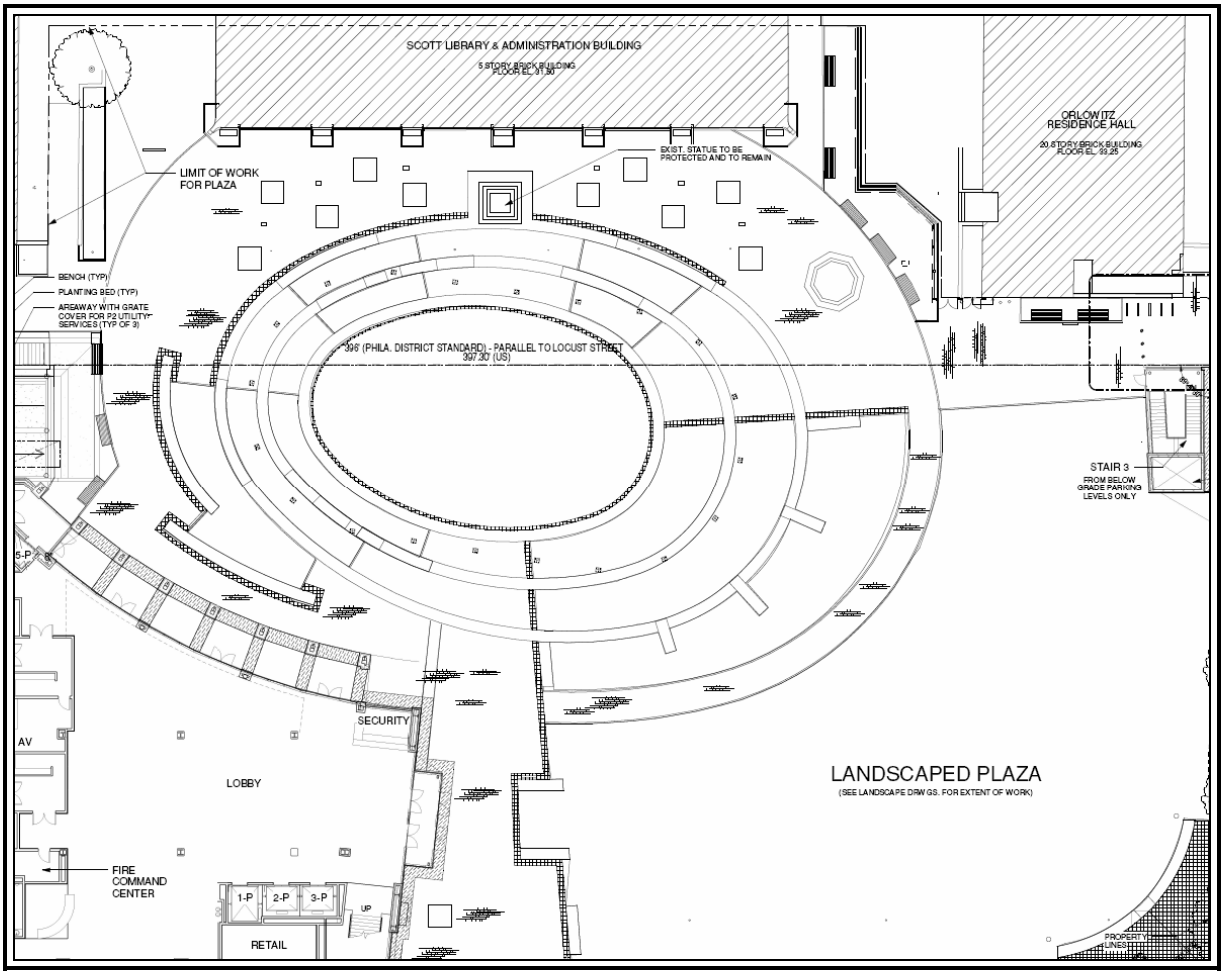

Figure 22: Partial Site Plan

- SITE LIGHTING PLAN

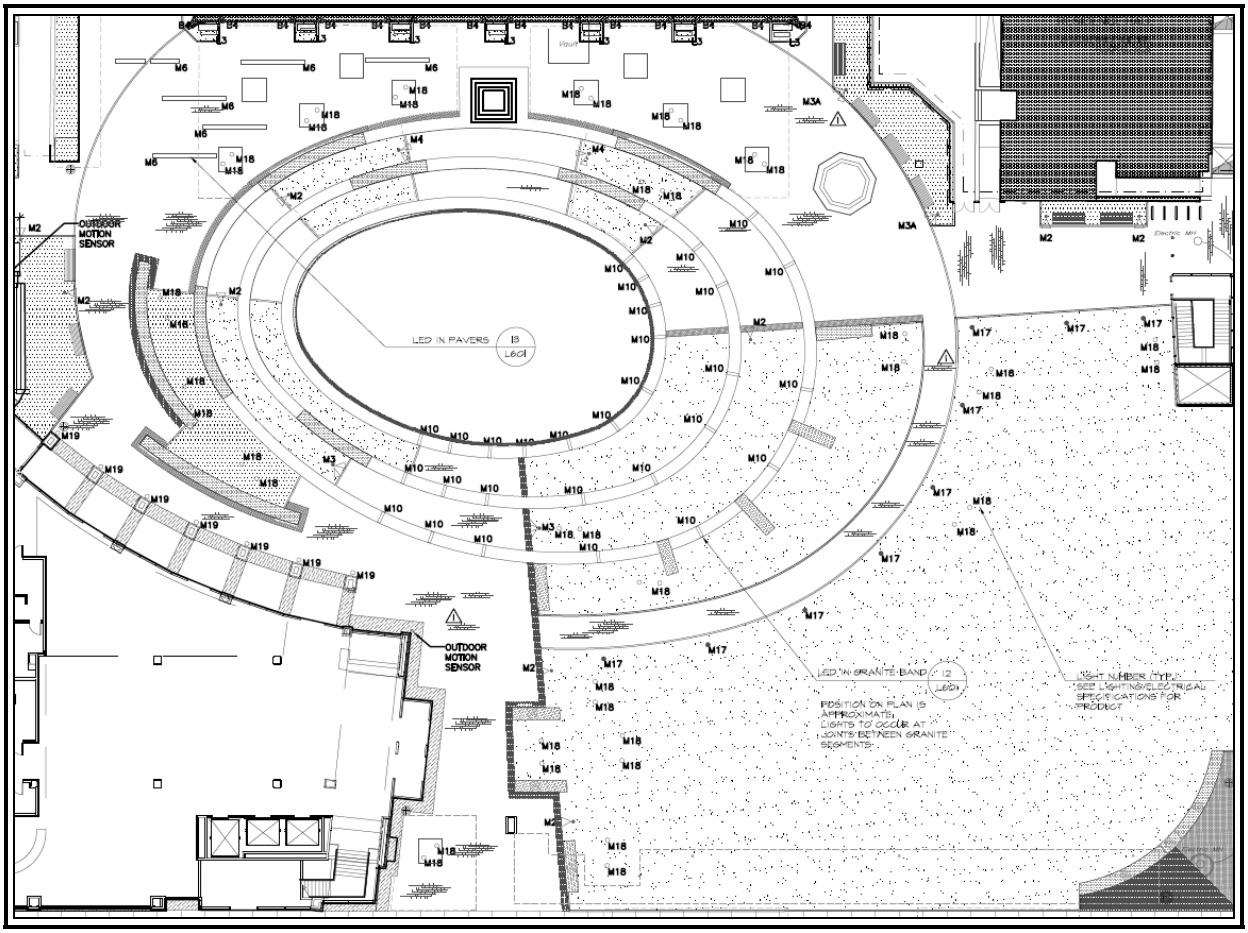

Figure 23: Site Lighting Plan

- LIGHTING FIXTURE SCHEDULE

Type	No. Fixtures	Description	Mtg.	Lamping	Ballast /Transformer	Watts	Voltage	Mfr.	Catalogue No.
L3	7	Metal Halide Floodlight with Cast Aluminum Housing, Specular Aluminum Reflector with Spot Optics, Cast Aluminum Snoot, Sculpture Glass Lens, Anti-Glare Screen,	Surface	1-CDM70/T6/830	Electronic Ballast in Wall Bracket	95	277	ERCO	34057.023 + 34981.024 + 74473.000
M2	9	Single Metal Halide Floodlight Mounted on Pole @ 20' Above Ground with Cast Aluminum Housing, Cast Aluminum Snoot with Safety Glass Lens, Anti-Glare Screen	Pole	1-CDM70/T6/830	Remote Electronic Ballast in Pole	95	277	Luminaire: ERCO; WEEF; BEGA Pole: HAPCO; WEEF	Luminaire: 34057.023 + 34957.023 + 74403.023 + 74476 (FLOOD)-MOD REMOTE BALLAST Pole: 78-008-CUSTOM FINISH
M3	2	Two Metal Halide Floodlights with Cast Aluminum Housing & Snoot, Accessory Holder with Sculpture Lens, Anti-Glare Screen, Side Mount Adapter Sleeve for Mounting to 20' Pole	Pole	2-CDM70/T6/830	Remote Electronic Ballasts in Pole	190	277	Luminaire: ERCO; WEEF; BEGA Pole: HAPCO; WEEF; BEGA	Luminaire: (2) 34057.023 + 34957.023 + 74403.023 + 74476 Pole: 78-008-CUSTOM FINISH
M3A	2	Same as Type M3 except Provide One Floodlight Luminaire with Flood Lens Accessory and One Floodlight Luminaire with Standard Spot Optics and Clear Glass Lens	Pole	2-CDM70/T6/830	Remote Electronic Ballasts in Pole	190	277	Luminaire: ERCO; WEEF; BEGA Pole: HAPCO; WEEF; BEGA	(1) 34057.023 + 34957.023 + 74403.023 + 74476 (FLOOD) – MOD REMOTE BALLAST (1) 34057.023 + 34957.023 – MOD REMOTE BALLAST Pole: 78-008-CUSTOM FINISH
M4	2	Metal Halide Floodlight with Cast Aluminum Housing & Snoot with Safety Glass Lens, Anti-Glare Screen, Side Mount	Pole	2-CDM70/T6/830	Remote Electronic Ballast in Pole	190	277	Luminaire: ERCO; WEEF; BEGA	(1) 34057.023 + 34957.023 + 74403.023 + 74476 (FLOOD) – MOD REMOTE BALLAST

		Adapter Sleeve for Mounting to 20' & 12' Pole						Pole: HAPCO; WEEF; BEGA	(1) 34057.023 + 34957.023 – MOD REMOTE BALLAST Pole: 78-008-CUSTOM FINISH
M6	7	LED Strip Light with Stainless Steel Housing, 64 White LEDs, Tempered Glass Lens with Internal Translucent White Coating	Recessed	64 White LEDs	Remote Power Supply	8	120	Hess America; Winona	LEDIA LL-OD-36-WHITE-15FT-REMOTE POWER SUPPLY 24-02166
M10	29	Led Strip Light with Stainless Steel Housing, 64 White LEDs, Tempered Glass Lens with Internal Translucent White Coating	Recessed	64 White LEDs	Remote Power Supply	8	120	Hess America; Winona	LEDIA LL-OD-36-WHITE-REMOTE POWER SUPPLY 24-02166
M17	9	Metal Halide Bollard with Machined Aluminum Housing Modified to Accept a Metal Halide Lamp	Ground	1-CDM35/PAR30L /M/FL	Integral Electronic Ballast	50	277	Modular	MXT-441 MOD FOR METAL HALIDE LAMPING
M18	42	Metal Halide Tree Uplight, Machined Aluminum Face Plate, 4-1/8" Diameter Flush Tempered Glass Lens	Ground	1-CDM35/PAR30L /M/FL	Integral HPF Ballast	50	277	BK Lighting; KIM; Lumiere	HP2-PAR3035-TR-61-FINISH-11-277-AH
M19	7	Metal Halide In-Ground Uplight, Machined Aluminum Face Plate, 4-1/8" Diameter Aperture, Double Tempered Lens Assembly	Ground	1-CDM35/PAR30L /M/SP	Integral HPF Ballast	50	277	BK Lighting; KIM; Lumiere	HP2-PAR3035-TR-60-FINISH-11-277-AH-ICEE

Table 7: Lighting Fixture Schedule (Plaza)

- LIGHT LOSS FACTORS

Fixture Tag	Cleaning Interval	Maintenance Category	Ballast Factor	LLD	RSDD	LDD	Total LLF
L3	12 Months/Clean	IV	1.00	0.90	1.00	0.88	0.79
M2	12 Months/Clean	IV	1.00	0.90	1.00	0.88	0.79
M3	12 Months/Clean	IV	1.00	0.90	1.00	0.88	0.79
M3A	12 Months/Clean	IV	1.00	0.90	1.00	0.88	0.79
M4	12 Months/Clean	IV	1.00	0.90	1.00	0.88	0.79
M6	12 Months/Clean	V	1.00	0.96	1.00	0.88	0.85
M10	12 Months/Clean	V	1.00	0.96	1.00	0.88	0.85
M17	12 Months/Clean	V	1.00	0.88	1.00	0.88	0.77
M18	12 Months/Clean	V	1.00	0.88	1.00	0.88	0.77
M19	12 Months/Clean	V	1.00	0.88	1.00	0.88	0.77

Table 8: Light Loss Factors (Plaza)

- FURNITURE
  - Statue
  - Seating areas
  - Walkways
  - Grassy Area

- FINISHES
  - Granite, asphalt, and grass

- EXISTING POWER DENSITY

  The existing power density in the space is calculated by using the space-by-space method. In Table 9.4.5 of the ASHRAE/IESNA 2004 Standard, the LPD for a plaza is 0.2 W/ft^2. The amount of watts used in this space is calculated as follows (7 fixtures)*(1 lamp/fixture)*(70 watts/lamp) + (9 fixtures)*(1 lamp/fixture)*(70 watts/lamp) + (2 fixtures)*(2 lamps/fixture)*(70 watts/lamp) + (2 fixtures)*(2 lamps/fixture)*(70 watts/lamp) + (2 fixtures)*(2 lamps/fixture)*(70 watts/lamp) + (7 fixtures)*(1 lamp/fixture)*(8 watts/lamp) + (29 fixtures)*(1 lamp/fixture)*(8

watts/lamp) + (9 fixtures)*(1 lamp/fixture)*(35 watts/lamp) + (42 fixtures)*(1 lamp/fixture)*(35 watts/lamp) + (7 fixtures)*(1 lamp/fixture)*(35 watts/lamp) = 4278 watts. With an area of 60,000 ft^2, the LPD for the space is 0.07 W/ft^2. The existing power density of the space falls below the recommended value of the IESNA for the power density of a plaza. The power density is not as recommended because the plaza has approximately 35,000 ft^2 of grassy area that is included into the plaza. If you take away this grassy area, the LPD for the space is 0.17 W/ft^2, which is the recommended LPD for a plaza.

- LIGHTING CONTROLS

  The lighting controls of the space will turn on the luminaires as the daylight fades into night. The space is on low voltage digital time switch. The low voltage time switch will provide the plaza with sufficient light for circulation during the evening hours.

- DESIGN CRITERIA
  - *Appearance of Space and Luminaires*

    The appearance of the space and luminaires is extremely important when lighting a plaza to this new "new heart of campus". The appearance of the space and luminaires has to be aesthetically appealing. The statue, walkways, and seating areas need to be lighted.
  - *Color Appearance (and Color Contrast)*

    Color appearance can affect visibility and aesthetics. This is not an important issue; however, a color temperature of 4100K is preferred because of the granite and asphalt materials.
  - *Daylighting Integration and Control*

    Daylighting is not an issue with this type of space.
  - *Direct Glare*

    Direct glare is not an issue with this type of space.
  - *Flicker (and Strobe)*

    Flicker is not an issue with this type of space.
  - *Light Distribution on Surfaces*

    Harsh striated patterns of excessive brightness or noticeable shadows should be avoided. Illuminance patterns should correspond with objects of the space.
  - *Light Distribution on Task Plane (Uniformity)*

    Uniformity is an issue with this type of space because the entrance to the buildings and walkways should be uniformly illuminated. If these are not uniformly illuminated, then someone may trip or fall and be injured.
  - *Luminances of Room Surfaces*

    This is not an issue with this type of space.
  - *Modeling of Faces or Objects*

    The modeling of faces or objects is somewhat important to a plaza at night. A CRI of 80 or higher will provide a better skin tone color. Another consideration should be that the area should be illuminated in order to provide sufficient light on a stranger's face.

  - *Point(s) of Interest*

The points of interest in the space include the entrances and exits of buildings, walkways, statue, and grassy plaza. The points of interest will prosper with a slightly higher illuminance due to the fact that they will stand out, such as the entrances and exits to the surrounding buildings and walkways.

- *Reflected Glare*

  Reflected glare is not an issue with this type of space.
- *Shadows*

  Shadows are undesirable during the nighttime when someone is trying to walk from one building to another.
- *Source/Task/Eye Geometry*

  The source/task/eye geometry is somewhat important to a walkway application at night. The angular relationships between the viewer, the task, and the luminaire are frequently critical to task visibility. If this is not achieved, people could trip or fall and hurt themselves.
- *Sparkle/Desirable Reflected Highlights*

  Sparkle is not applicable to this application.
- *Surface Characteristics*

  The surface characteristics of the space are somewhat important due to the appearance of the space. The surfaces of the space should be a high gloss, grand looking material. The space should appear to be high class.
- *System Control and Flexibility*

  System control and flexibility is not very important due to the one task in the space. The system could be on a timer or a photocell receptor in order to come on at dusk.
- *Illuminance (Horizontal)*

  The IESNA handbook calls for a horizontal illuminance of 50 lux (5 fc) on the work plane for circulation. The calculations of the space through modeling indicate an average horizontal illuminance of XX lux (X fc) with the current luminaire layout.
- *Illuminance (Vertical)*

  The IESNA handbook recommends a vertical illuminance of 30 lux (3 fc) for this space. The entrances and exits should have a vertical illuminance of 50 lux (5 fc).

- EXISTING CONDITIONS FINAL ANALYSIS

  The existing conditions of the space are acceptable. The existing power density measures to specifications when the grassy area of the plaza is subtracted from the total area. The renderings were left out due to the fact that the rendering would only provide an area with light sources and not be of any value. The area will provide an outlook from the lobby of the building and will provide a circulation area of campus. Overall, the space has sufficient light sources installed for the task of circulation during the nighttime hours.