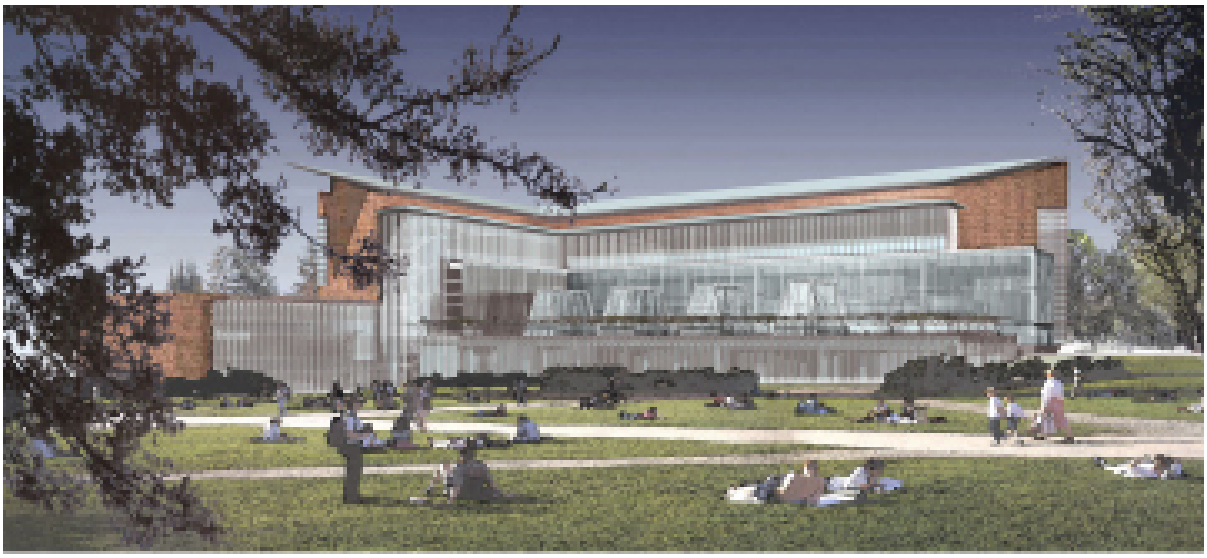
Technical Assignment #1
Lighting Existing Conditions and Design Criteria Report

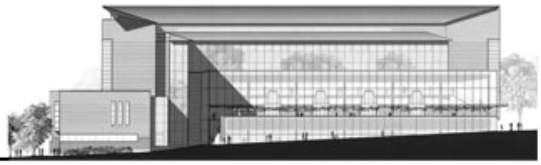


William H. Gates Hall
Seattle, WA

Katherine Jenkins
Lighting/Electrical Option

October 5, 2006

Faculty Advisor: Dr. Mistrick



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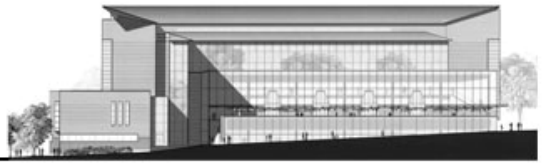


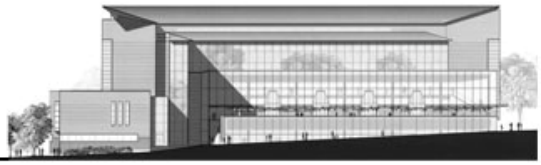
Executive Summary

The following Lighting Existing Conditions and Design Criteria Report analyzes the existing lighting system in William H. Gates Hall. While the report provides a general overview of the entire building's, lighting system, four spaces are examined in detail. These spaces include the Marion Gould Gallagher Law Library, the Senator Warren G. Magnuson & Senator Henry M. Jackson Trial Courtroom, the Jeffrey & Susan Brotman Galleria and the terrace. All information considered regarding the existing lighting design, equipment, materials and spatial considerations has been indicated below. This includes but is not limited to, the existing layout, luminaires, lamps, ballast, light loss factors, materials and their corresponding reflectances. In addition to analyzing the electric light systems within these spaces, daylighting was taken into consideration and a daylight study performed when appropriate. All of these factors were taken into consideration in determining the appropriateness and effectiveness of the different lighting systems.

In order to effectively analyze the existing lighting systems, design criteria and goals are established in order to provide a basis of quality measurement for the system. The design criteria included in this report is based on the recommendations of the IESNA Handbook. Special considerations are incorporated for each individual space in order to determine the best overall design goal and ideal standards. While each of the spaces being studied in William H. Gates Hall is vastly different from another, all spaces are evaluated on the basis that the overall design goal of the building is to incorporate a lighting design that reflects that excellence and tradition that defined the University of Washington School of Law. In addition to outlining design criteria, computerized models are used as a tool in evaluating each system.

Taking into consideration specified design criteria and the computer generated renderings, an extensive critique of each of the spaces was performed. As a whole, the majority of the outlined criteria were met in all of the four spaces. However, as with any design, there are areas that have potential for improvement or can be designed using a different approach. Such areas include, but are not limited to: accentuating distinct architectural characteristics, creating more interesting and inviting light patterns, increasing uniformity on work plane, maintaining required illuminance levels (an important factor in maintaining safety), and more extensive daylighting control and integration. As a whole, there are several opportunities to improve the design so that it is more efficient, more functional, and more aesthetically pleasing.

Special attention was also taken in verifying compliance with ASHRAE 90.1 power density and control standards. All of the spaces comply with the specified requirements with the exception of the space-by-space power density requirement of the terrace. Improvement is required within this area to reduce power consumption since the power density exceeds the given requirement.



General Building Overview

Overall Design Goal
Serving as the new home for the University of Washington School of Law (UW Law School), William H. Gates Hall provides a state of the art facility for students, faculty and visitors alike. In order to foster the essence of tradition and excellence of UW Law School, a lighting design that is conducive to a productive learning atmosphere and complementary to the outstanding new facility is necessary. The building as a whole should make a strong, yet welcoming statement among the surrounding campus.

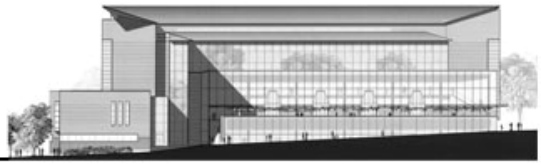
Lighting Design
In efforts to achieve desired design goals, the lighting throughout William H. Gales Hall primarily utilizes fluorescent lighting. Classrooms and seminar rooms make use of suspended indirect/direct fluorescent luminaires, as do the majority of the offices spaces, while the courtroom spaces uses primarily compact fluorescent downlighting. The circulation corridors also take advantage of compact fluorescent downlighting, as well as linear fluorescent wallwashers. Several areas make use of metal halide luminaires, primarily in the form of track fixtures and downlights. The lighting system is run off of 277 V, with the exception of a few spaces such as the conference/reception room which run off of 120 V.

Control Devices
The current lighting design of William H. Gates Hall incorporates several different types of control devices throughout the building. Office areas are control by means of a low voltage relay system, which is controlled by the building management system. Courtrooms and lecture spaces provide multi-level control of fluorescent lamps, and dimming capabilities for incandescent lighting. Throughout the entire building, occupancy sensors are utilized in all of the low use areas.

Power Density & Energy Considerations
In the current design of William H. Gates Hall, spaces were designed to a maximum allowable energy budget per the 1994 edition of the Seattle Energy Code. The maximum allowable power densities which were used in the design are: Interior Offices and administrative support – 1.2 watts per square foot; Classroom and lecture halls – 1.35 watts per square feet; Auditoriums, atrium and corridors – 1.0 watts per square foot; Exterior – 0.25 watts per square foot of building façade; Restrooms and electrical/mechanical rooms – 1.0 watts per square foot.

Lighting Design Levels
The following are the foot-candle levels used as the primary design guide for average maintained levels as outlined per the University of Washington design standards:

- 50 fc – Classrooms, offices, lecture rooms, auditoria, library study areas
- 20 fc – Restrooms, mechanical/electrical rooms, etc.
- 10 fc – Corridors, passageways, stairways, storerooms, etc.
- 2-5 fc (vertical) – Library stacks



Marian Gould Gallagher Law Library – Reading Area

Existing Lighting Overview

The current lighting design in the library main reading area is one which is very traditional to a library setting. As one enters the space, they instantly notice the four (4) large skylights, providing daylight from the terrace above. Centered below the skylights is an opening in the L1 level to the L2 floor below. A stair case connecting these two levels floats in the middle of the open space. The upper level contains large tables with table lamps for studying on one side and several computers on the other. Lighting this level are metal halide downlights and pendant mounted, asymmetric throw uplights, which are installed in the form of continuous rectangles below each of the skylights. The lower level makes use primarily of recessed compact fluorescent downlights over the reading areas and suspended direct/indirect luminaires in the stack areas. In addition to the skylights, substantial levels of daylight enter the space through the partially-glazed exterior south-facing wall.

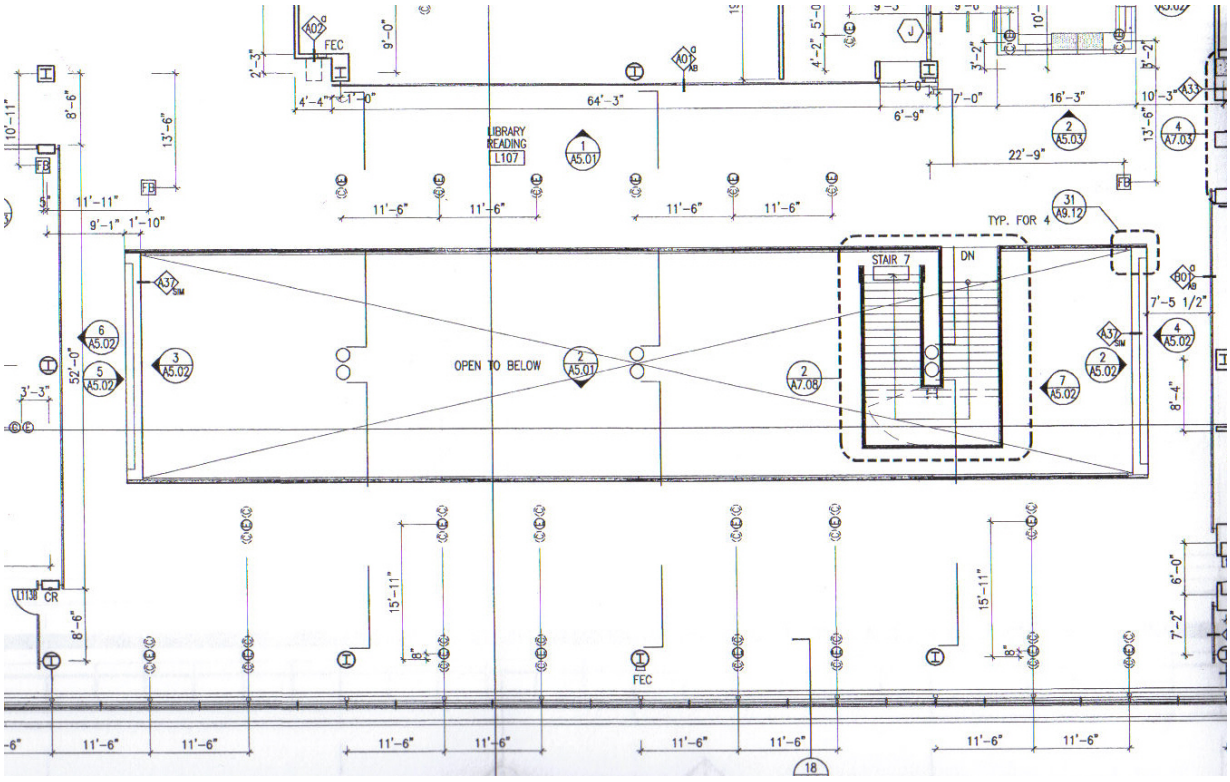
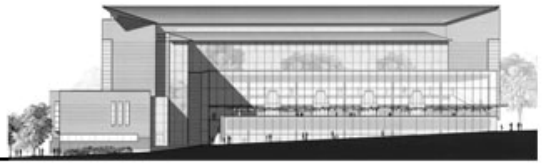


Figure 1.1 – Level L1 Library Reading Area Floor Plan



Marian Gould Gallagher Law Library – Reading Area

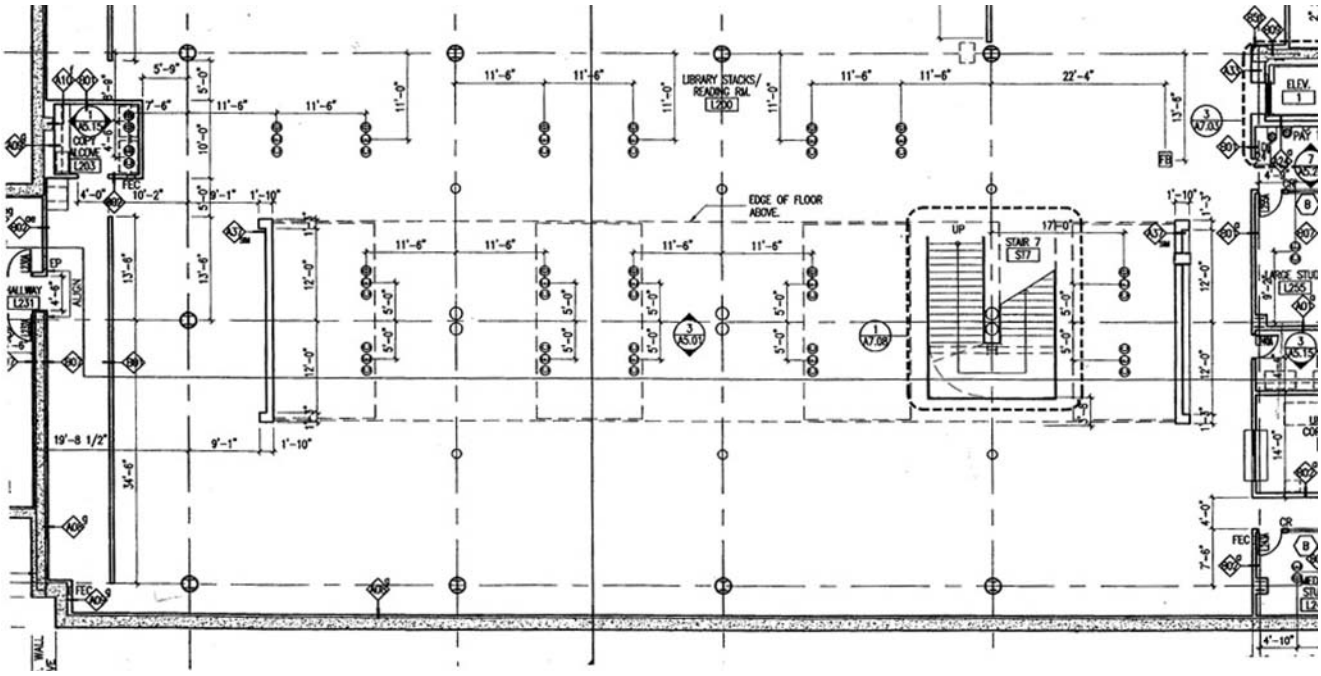


Figure 1.2 – Level L2 Library Reading Area Floor Plan

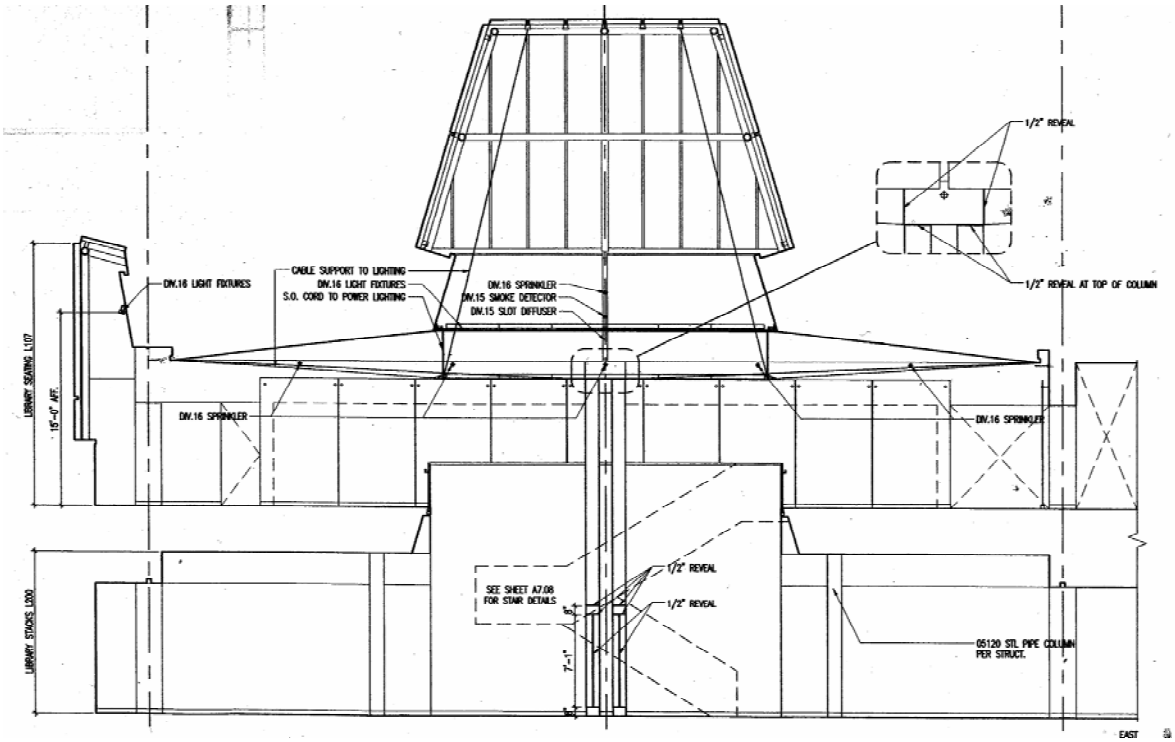
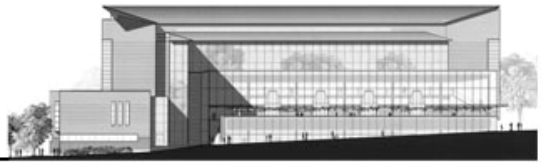


Figure 1.3 – North-South Section



Marian Gould Gallagher Law Library – Reading Area

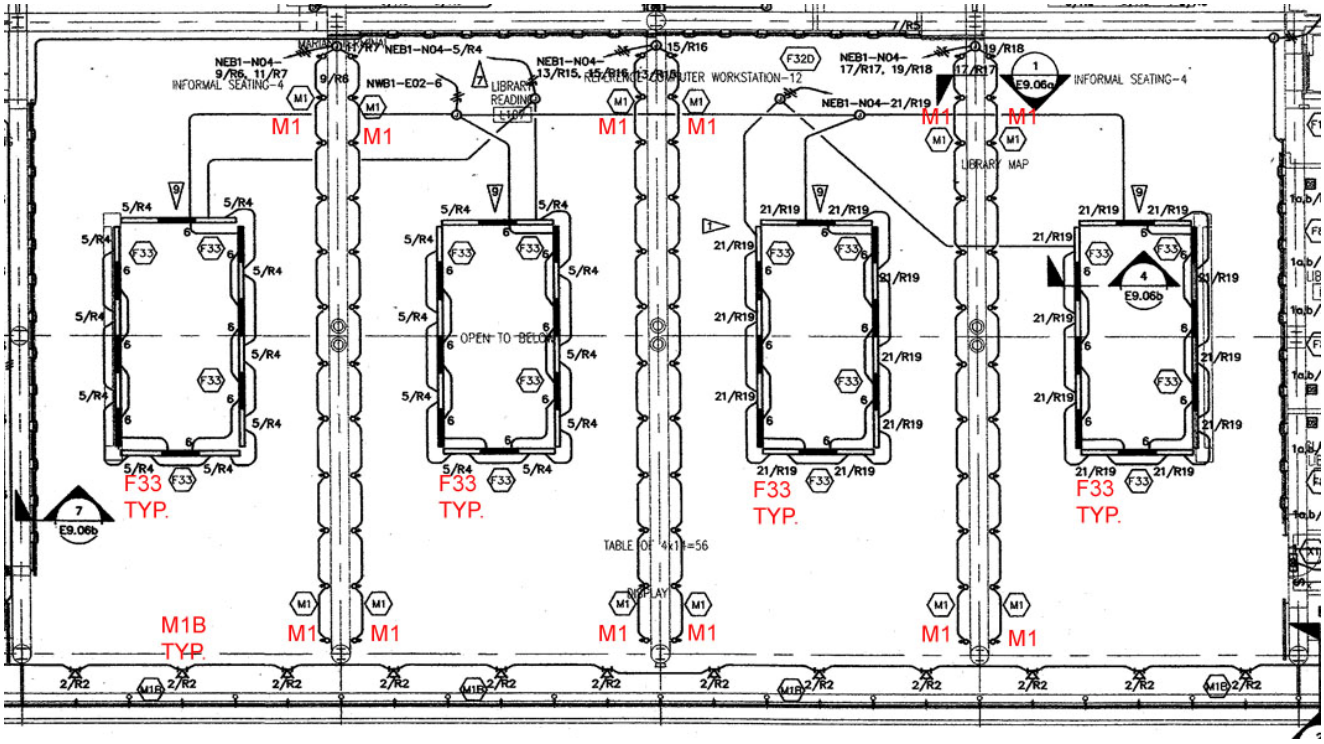


Figure 1.4 – Level L1 Library Reading Area Lighting Floor Plan

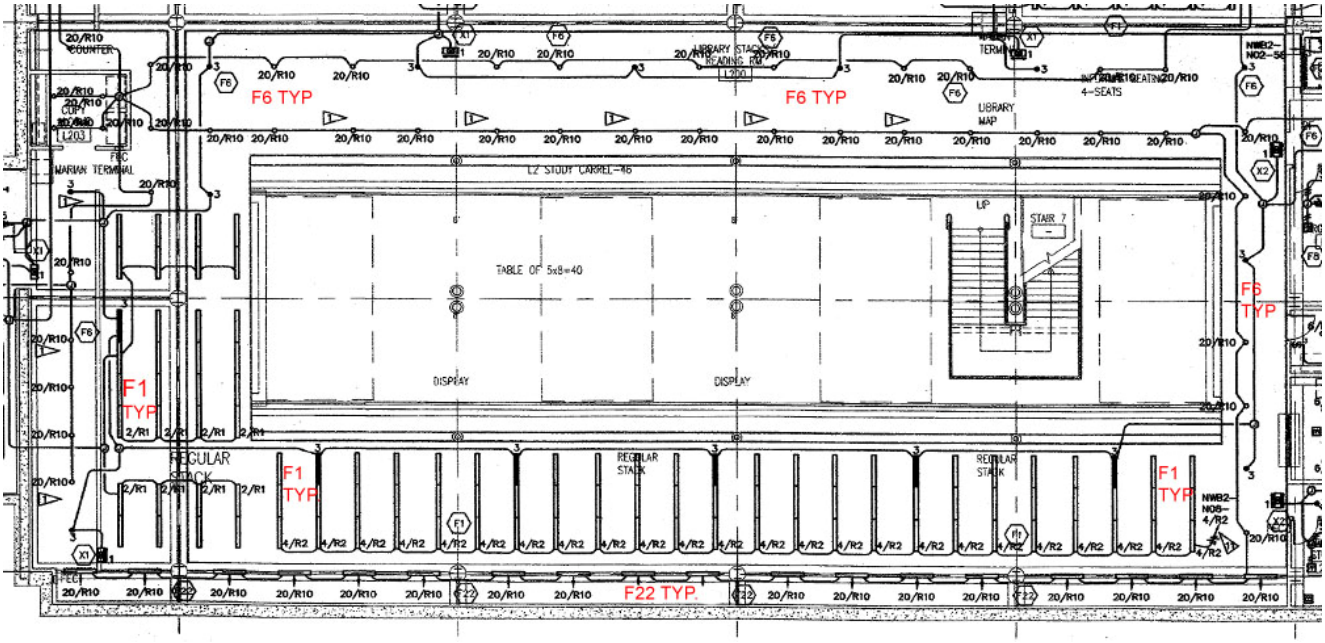
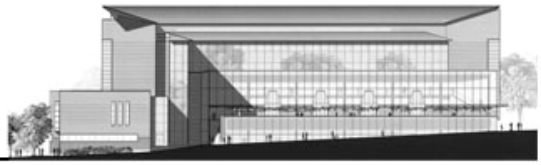


Figure 1.5 – Level L2 Library Reading Area Lighting Floor Plan



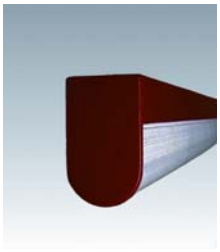
Marian Gould Gallagher Law Library – Reading Area

Furnishings

There are several different types of furnishings present in this space. On level L1, the north section of the space contains computer workstations and the south section has large study tables. On level L2, the north section contains reading chairs and the south and west sections contain book stacks.

Luminaire Schedule

Luminaire	Description	Mounting	Lamp		Ballast	CRI	CCT	Volts	Watts	Quantity
			#	Type						
F1	Direct/Indirect stack light, nominal 12' extrusions	Pendant	1	F32T8	Electronic	82	3500	277	34	104
F6	Compact Fluorescent downlight w/ vertical lamp, nominal 6" aperture	Recessed	1	CFTR32W	Electronic	82	3500	277	34	66
F22	48" Linear fluorescent wallwasher.	Recessed	1	F32T8	Electronic	82	3500	277	34	18
F33	48" asymmetric throw uplight	Pendant	1	F54T5	Electronic	85	3500	277	62	72
M1	Metal halide track fixture in architectural downlight cove	Recessed	1	CDM100/PAR38	Electronic	82	3000	277	110	72
M1B	Metal halide track fixture	Surface	1	CDM100/PAR38	Electronic	82	3000	277	110	14



F1

F6

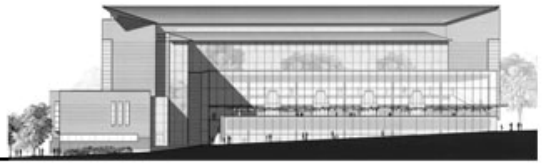
F22

F33

M1

M1B

Marian Gould Gallagher Law Library – Reading Area



Light Loss Factors

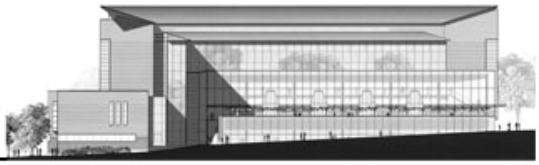
Luminaire Desig-nation	Maintenance Category	Room Atmos-phere	Cleaning Interval	Initial Lumens	Design Lumens	Ballast Factor	LLD	RSDD	LDD	LLF
F1	IV	Very Clean	12 months	2950	2710	0.88	0.92	0.95	0.94	**0.72**
F6	IV	Very Clean	12 months	900	774	1.00	0.86	0.98	0.94	**0.79**
F22	IV	Very Clean	12 months	2950	2710	0.88	0.92	0.98	0.94	**0.74**
F33	VI	Very Clean	12 months	4450	4138	0.99	0.93	0.93	0.92	**0.79**
M1	IV	Very Clean	12 months	6200	4898	1.00	0.79	0.98	0.94	**0.73**
M1B	VI	Very Clean	12 months	6200	4898	1.00	0.79	0.93	0.92	**0.68**

Control Devices

The main reading area of the library is controlled by a low voltage relay system. The system is controlled by a Master Lighting Controller Panel. In this space, two different Automatic Lighting Control (ALC) panels are accessed via the various relays. Automatic Lighting Control Panel ALC-L1B is fed by eight separate relays of the space on level L1. Six of these relays control the metal halide downlights, while the other two control the pendant linear fluorescent luminaires and the perimeter metal halide uplights. On the lower level, Automatic Control Panel ALC-L2B is fed by two separate relays (of the area being analyzed), one of which controls the pendant fixtures over the stacks, and the second which controls downlighting and wallwashing in the space.

Daylighting & Integration

A portion of the south-facing exterior wall on Level L1 incorporates Low-E insulating glass (see Architectural Finishes below) that is slanted relative to the grade. Daylight is also provides via the four (4) skylights, which also use Low-E insulating glass. There are no daylighting surfaces on Level L2. The existing lighting design does not incorporate any daylight control or integration into the current system.



Daylight Study

Figure 1.6 – Daylight Study – December, 21 - 10:00 AM & 1:00 PM

Figure 1.7 – Daylight Study – March, 21 - 10:00 AM & 1:00 PM

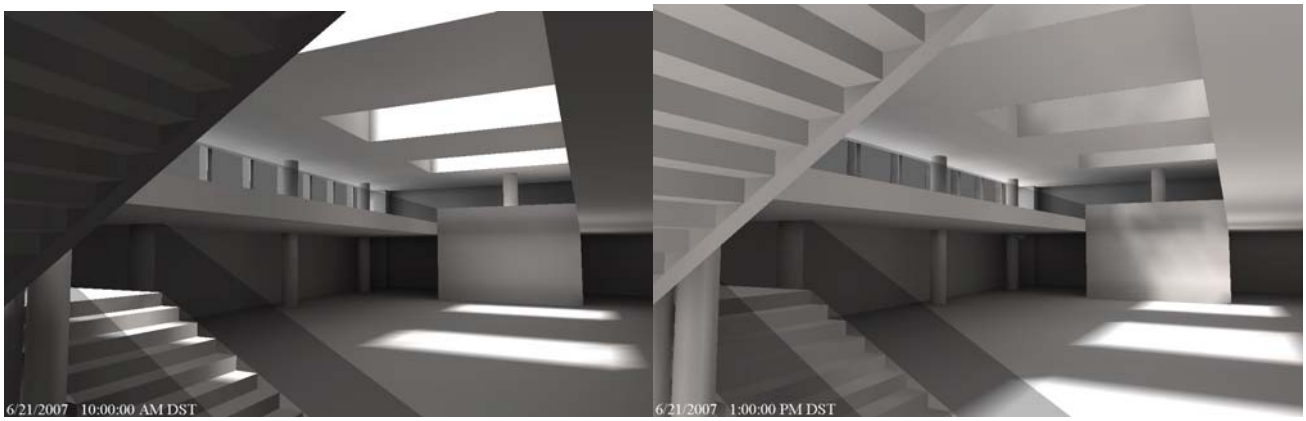
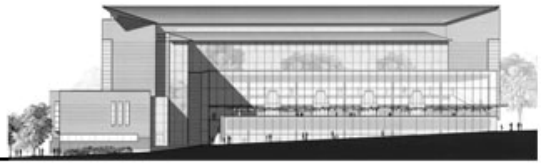


Figure 1.8 – Daylight Study – June, 21 - 10:00 AM & 1:00 PM



Design Criteria

- *Appearance of Space and Luminaires (Important)*
  The appearance of the space and luminaires is important in maintaining the desired image of the UW Law School. Luminaires should reflect the prestige and excellence of the school, while also complementing the architecture. The appearance of the space should merge together an essence of tradition with technology. Ultimately, quality of light is the most important consideration seeing that this is a very task intensive space.

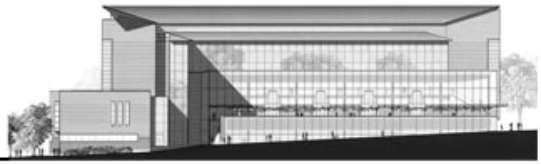
- *Color Appearance & Color Contrast (Important)*
  Color rending is important for overall visual performance. While color appearance is not overly critical in this space, a CRI of 80 should be maintained by all lamps in order to maximize color appearance and contrast of materials that will be read in the space.

- *Daylight Integration & Control (Important)*
  While daylighting integration and control would be useful in this space, it is not incorporated into the current design. The combination of the skylights and the south-facing glazed wall provide substantial amounts of sunlight to the space, especially at Level L1. By utilizing daylight controls, energy consumption within the space can be reduced, especially during the summer months when the sun is higher and greater amounts of light enter the space through the skylights. In addition to controlling the light levels of luminaires, control of window shades on the south-facing wall would be beneficial in reducing direct glare on task surfaces

- *Direct Glare (Very Important)*
  The library is a very task intensive space, whether this may be reading, writing or VDT use. For this reason, direct glare is not acceptable in this space as it will provide discomfort and be distracting to occupants of the space.

- *Light Distribution on Surfaces (Important)*
  Distribution of light on surfaces should be fairly uniform so as not to provide distractions in the space. Accents can be placed on specific points of interest within the space, which will provide a dynamic to the space.

- *Light Distribution on Task Plane (Uniformity)(Important)*
  Uniform distribution on the task plane is important to ensure ease of any task. Bright spots and reflected glare from a specular table surface should be avoided.



- *Luminances of Room Surfaces*
  Consideration should be taken in providing luminances on room surfaces that meet desired luminance ratios. The luminance ratio from VDT to adjacent surfaces should not exceed 3:1. In addition to this, a luminance ratio of 10:1 should not exceed for VDT to far background surfaces. In addition to considering luminance ratios, varying luminance levels can be used to change one's perception of the size and shape of the space. This will help to open up spaces that may seem confining in a certain direction.

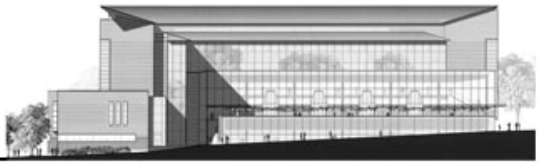
- *Modeling of Faces or Objects (Important)*
  Facial features should be lit from angles and with illuminance levels that avoid unflattering shadows on the face, especially from the eye sockets.

- *Reflected Glare (Very Important)*
  Reflected glare in the space should be avoided, especially with the use of VDT monitors. Several features of the space, including the windows and glass balcony guardrail, are conducive to producing reflected glare and should be taken into consideration in order to avoid such glare from becoming distracting to occupants and their task. Luminaire cut-off angles should be located outside of the offending zone in order to avoid this.

- *Source/Eye/Task Geometry (Very Important)*
  Due to the extensive task applications and VDT use within this space, proper placement of luminaires, as well as adequate illuminance levels, is important in order to complete task while avoiding direct or reflected glare.

- *Illuminance (Horizontal)*
  Illuminance levels on the task plane within the library should reach a minimum of 30 footcandles. This illuminance level should be uniform and provided on all task surfaces of space.

- *Illuminance (Vertical)*
  Maintaining adequate vertical illuminance levels are important in the stacks area of the library to allow for optimal recognition and ease of reading and finding desired materials from the shelves. A minimum vertical illuminance level of 30 footcandles should be maintained at all levels of the stacks.



ASHRAE 90.1 Power Density Evaluation

AHRAE 90.1 Power Allowance: 1.9 W/ft^2 Total Watts: 21,316 W
Existing Power Density: 0.9 W/ft^2 Total Area: 25,000 ft^2

The existing design meets ASHRAE 90.1 standards

Architectural Finishes
Surface Materials & Reflectances

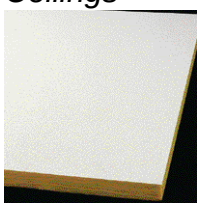
Floors

Carpet
Manufacturer: Prince Street Carpets
Color: Get Your Goat (Tan)
Reflectance: 17%

Walls

Paint
Manufacturer: Benjamin Moore
Color: Eggshell
Finish: Matte
Reflectance: 85%

Ceilings

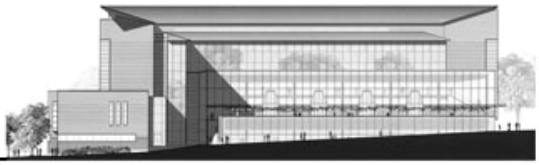


Acoustical Ceiling Tile
Manufacturer: Armstrong World Industries Inc.
Color: White
Reflectance: 89%

Glazing

PPG Sungate 100 Low-E- Glass

Transmittance			Reflectance		U-Value		K-Value		Shading Coeff.	Solar Heat Gain Coeff.	Light to Solar Gain
Ultra-violet %	Visible %	Total Solar Energy %	Visible Light %	Total Solar Energy %	Winter Night time	Summer Daytime	Winter Night time	Summer Daytime			
35	73	44	12	20	0.31	0.3	1.76	1.7	0.59	0.52	1.4



Existing Lighting System Analysis

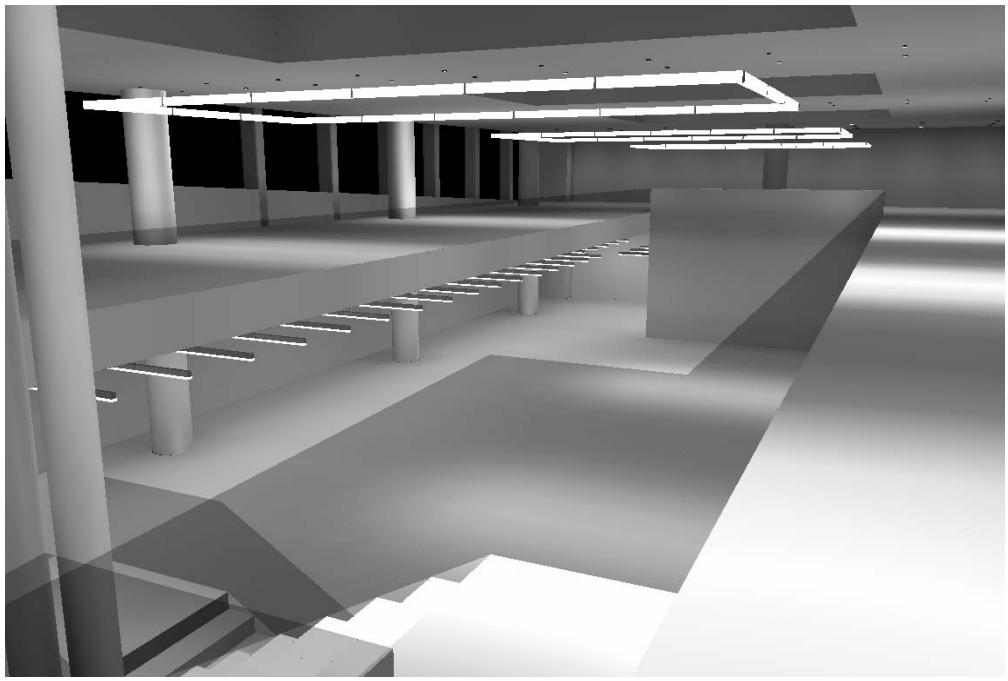


Figure 1.9 – AGI Rendering 1

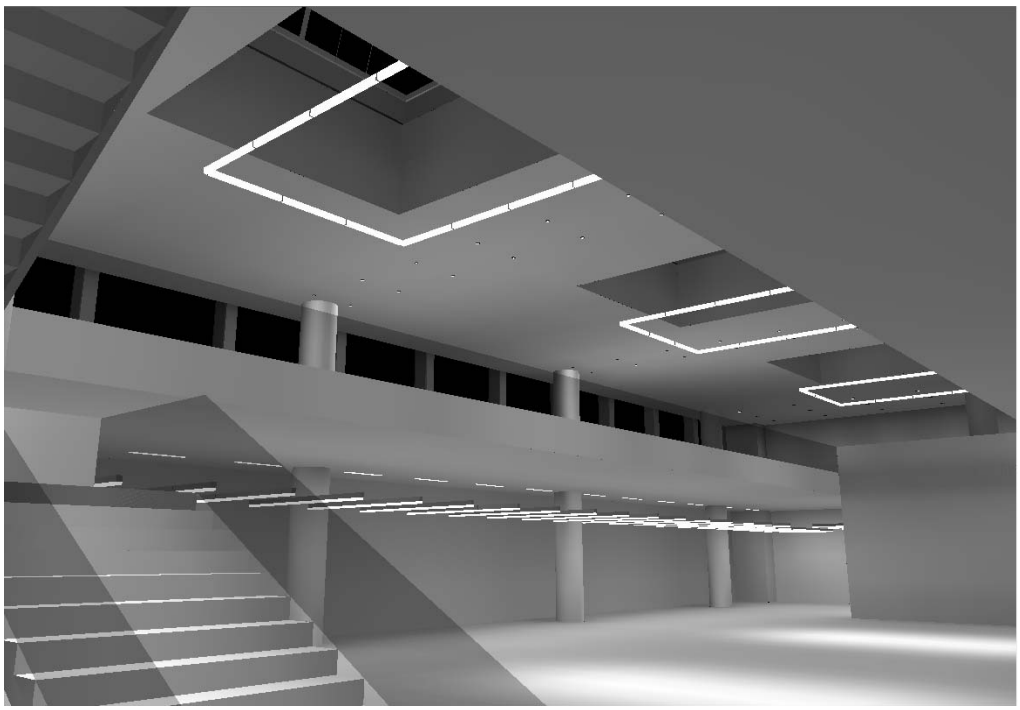
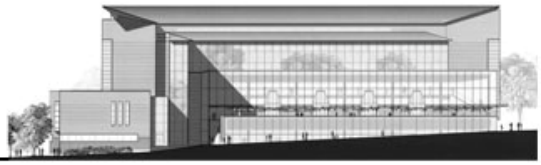


Figure 1.9 – AGI Rendering 2



Marian Gould Gallagher Law Library – Reading Area

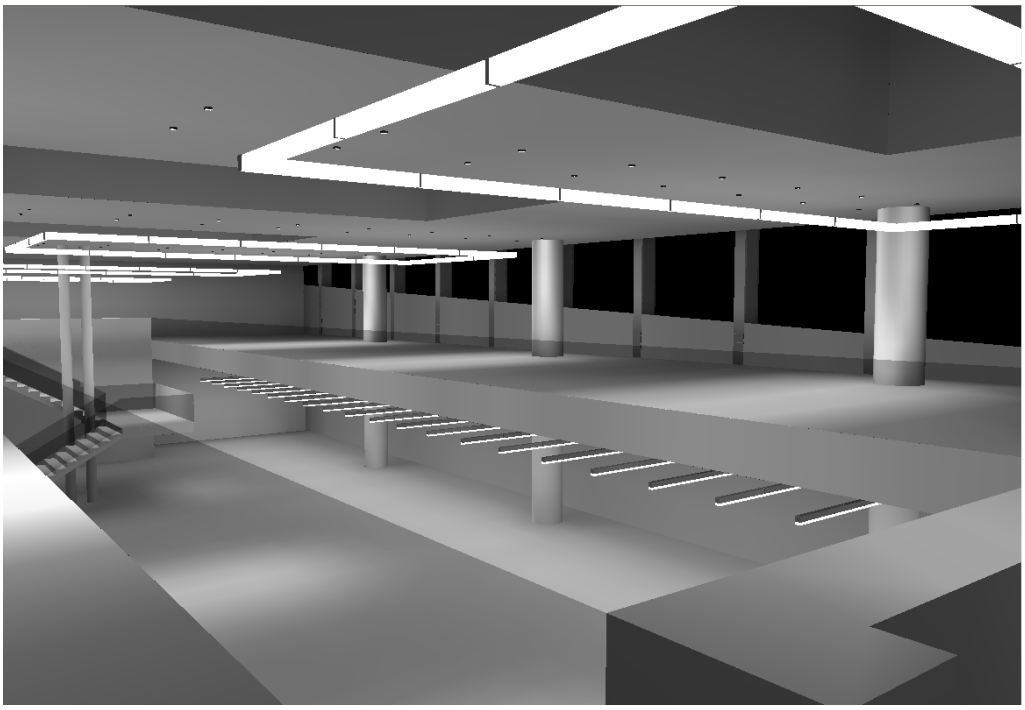
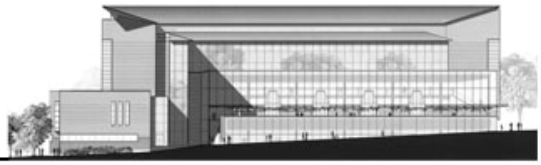


Figure 1.9 – AGI Rendering 3

Illuminance Values (fc)

L1 – Floor		L1 - Task Plane		L1 - Ceiling		L1 - Face (vertical)	
Average	31.49	Average	20.13	Average	20.55	Average	16.67
Max	85.6	Max	38.1	Max	39	Max	17.5
Min	4.0	Min	5.0	Min	3.9	Min	15.8
Avg/Min	7.87	Avg/Min	4.03	Avg/Min	5.27	Avg/Min	1.06
Max/Min	21.40	Max/Min	7.62	Max/Min	10	Max/Min	1.11
L2 – Floor		L2 – Task Plane		L2 -Ceiling		L2 - Stacks (vertical)	
Average	41.85	Average	28.64	Average	22.82	Average	59.98
Max	83.4	Max	37.9	Max	48.7	Max	68.2
Min	12.3	Min	21.4	Min	3.8	Min	49.6
Avg/Min	3.40	Avg/Min	1.34	Avg/Min	6.01	Avg/Min	1.19
Max/Min	6.78	Max/Min	1.77	Max/Min	12.82	Max/Min	1.38



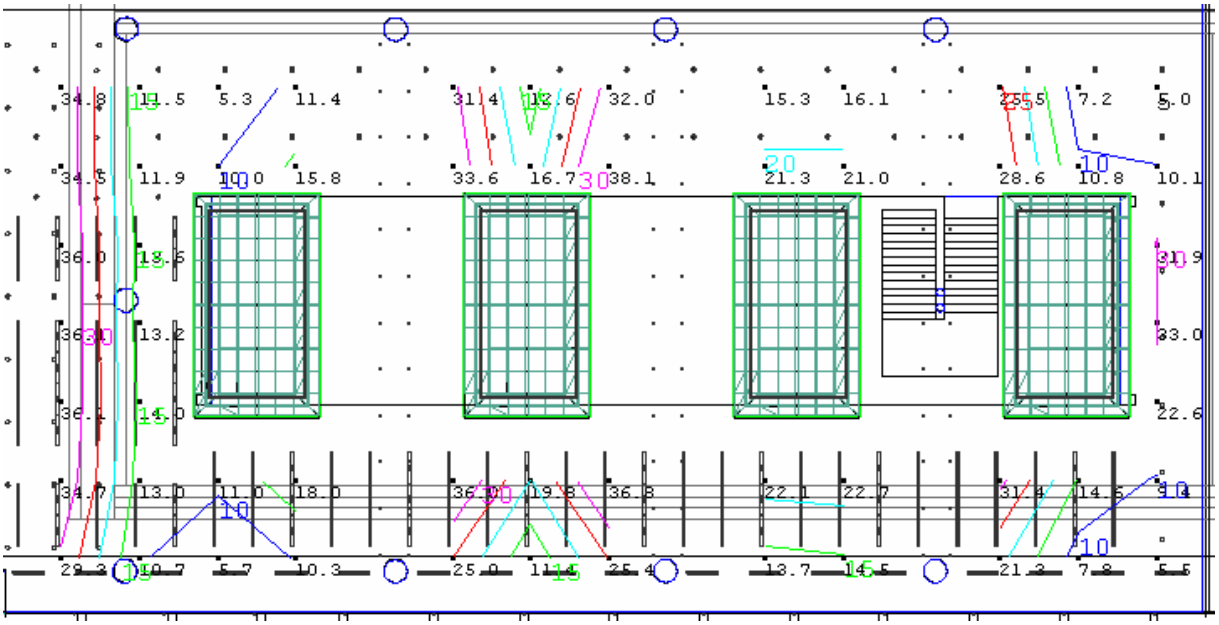


Figure 1.12 – Level L1 Work Plane Illuminance Contours

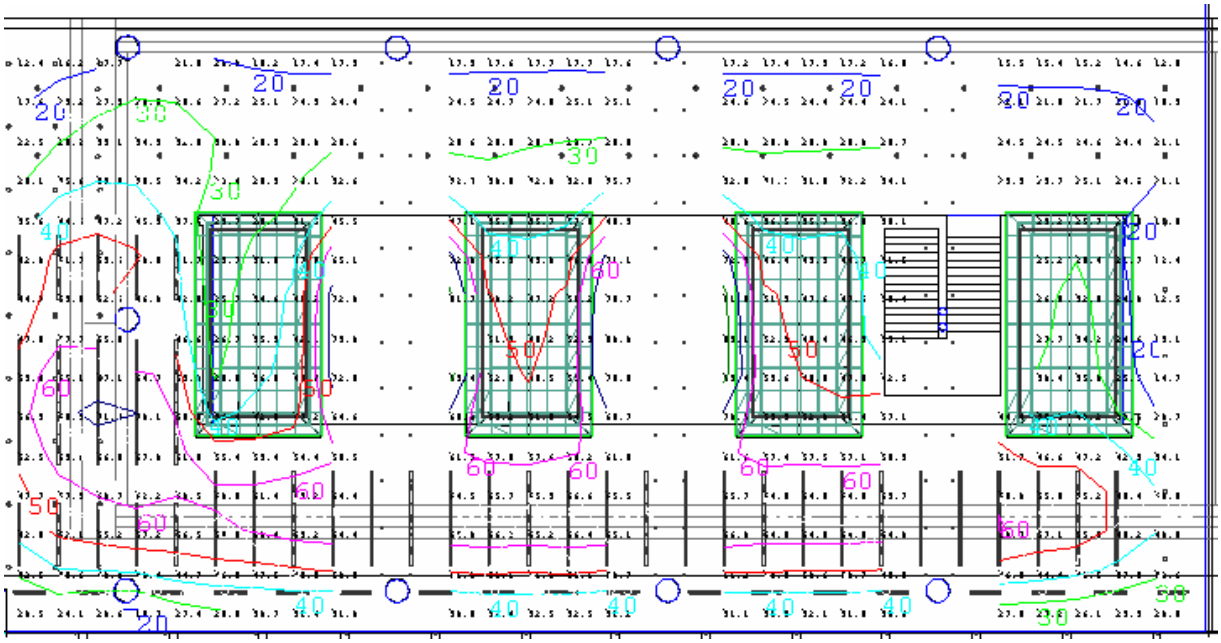
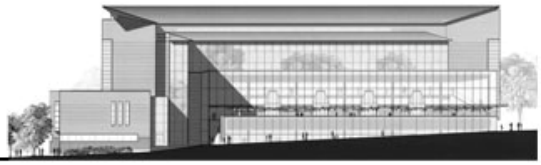


Figure 1.13 – Level L2 Work Plane Illuminance Contours



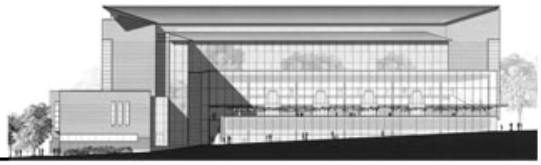
Critique of Existing Conditions

The previously outlined design criteria for the library space were set in order to optimize performance and functionality of the lighting design. While many of the design criteria goals were effectively met in the current design of the library, there are a few areas in which the system does not quite meet the outlined standards. First, work plane illuminance levels and uniformity are not ideal for the extensive reading and writing task that will take place within the space. Average illuminance levels of approximately 20 fc, falls slightly short of the desired 30 fc. In addition to this, the lines of metal halide downlights seem to cause several hot spot areas, especially on level L1. The areas below these luminaires have much higher illuminance levels and will cause glare issues on work planes below.
The vertical illuminance in the library are appropriate for the given task, with levels of approximately 60 fc in the stacks area and 20 fc in the reading area.

One of the single most important aspects of this space is the integration of the skylights and glass facades. As observed in the daylighting study, the skylights provide high levels of ambient level to the space year round, with more direct sunlight entering the space during the summer months. While daylight controls are not integrated into the current design of the space, they would be beneficial in reducing energy consumption during daylight hours. In addition to photosensor control, control of blinds over south-facing windows would be beneficial in reducing unwanted direct glare on work surfaces.

The space meets design goals regarding power density and controls. Complying with ASHRAE 90.1 standards, the power density of the space is well below the maximum allowable power consumption. Controls provided in this space allow for automated control of luminaires in the space based on operating hours of the library.

Overall, the appearance of the space and incorporated lighting design is very typical of a library. Using recessed commercial fixtures in conjunction with suspended direct/indirect luminaires, the lighting design works well with the function and architecture of the space, with exception of the suspended luminaires linked into rectangular shapes. This luminaire configuration competes with the architecturally dominate skylights above and takes away from its architectural integrity.



Senator Magnuson & Jackson Trial Courtroom

Existing Lighting Overview

As the largest room in the building, the Senator Warren G. Magnuson & Senator Henry M. Jackson Trial Courtroom serves as both a classroom and a mock courtroom, providing students with realistic legal setting. Upon entering the room, one notices the tiered radial configuration centered about the judge's stand. The ceiling mimics the tiered levels of the floor, stepping-up in unison with each floor level. The lighting design within the space primarily utilizes compact fluorescent downlights and highlights the walls with linear fluorescent wallwashers. Located above the central 'podium,' the ceiling houses fluorescent cove luminaires.

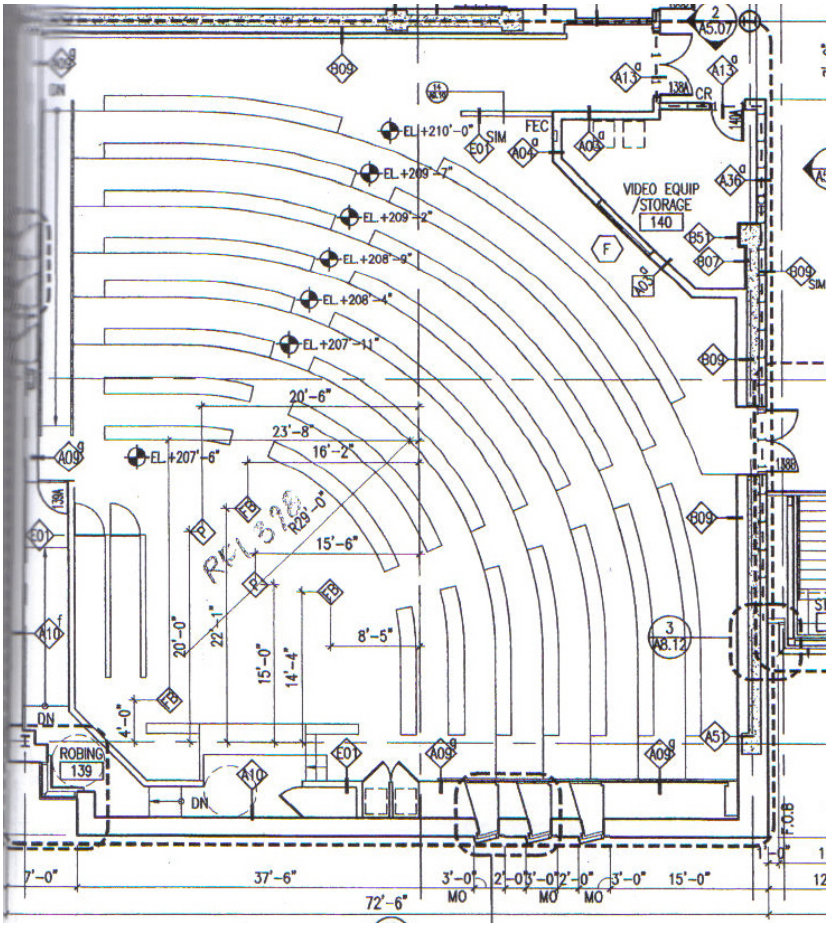
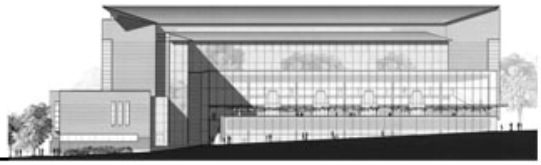


Figure 2.1 – Trial Courtroom Floor Plan



Senator Magnuson & Jackson Trial Courtroom

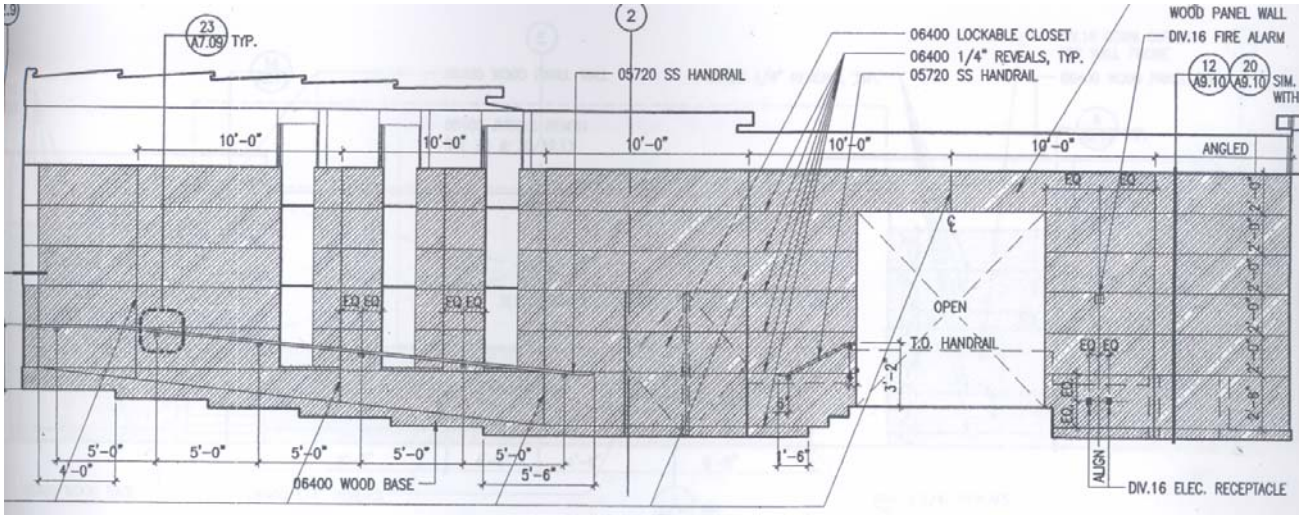


Figure 2.2 – Section

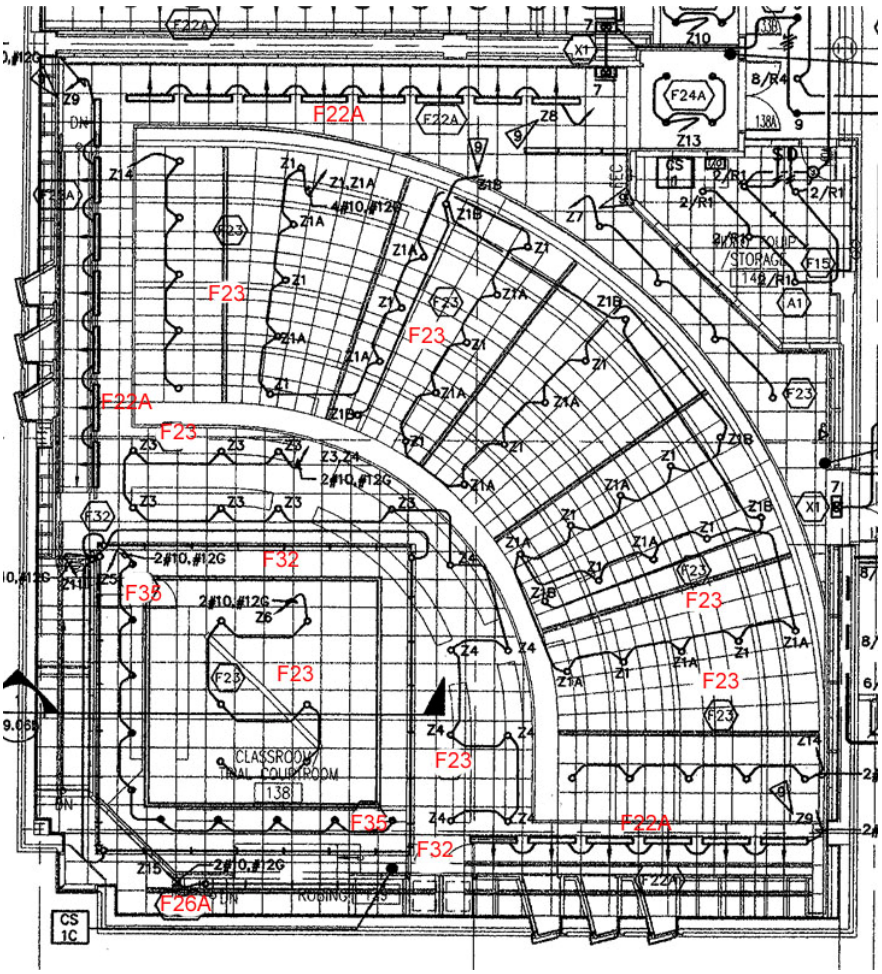
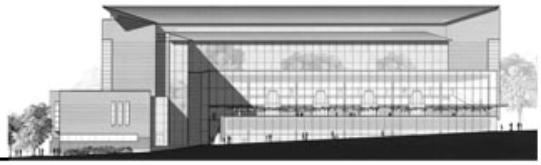


Figure 2.3 – Trial Courtroom Lighting Floor Plan

Senator Magnuson & Jackson Trial Courtroom



Furnishings

Furnishings in this space include the radial desk and chairs, as well as the judge's stand, jurors stand and seating for both. All furnishings within this space are fixed in place with the exception of the chairs.

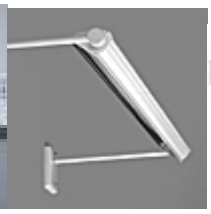
Luminaire Schedule

Luminaire	Description	Mounting	Lamp		Ballast	CRI	CCT	Voltages	Watts	Quantity
			#	Type						
F22A	48" Linear fluorescent wallwasher.	Recessed	1	F32T8	Electronic Dimming	82	3500	277 V	34	21
F23	Compact Fluorescent downlight w/ horizontal lamps, nominal 8" aperture	Recessed	2	CFTR32W	Electronic Dimming	82	3500	277V	34	65
F24A	Compact Fluorescent lensed wallwasher, nominal 6" aperture	Recessed	1	CFTR32W	Electronic Dimming	82	3500	277V	34	4
F26A	48 "Adjustable asymmetric wallwasher	Surface	1	F54T5/HO	Electronic Dimming	85	3500	277	62	4
F32	48" Fluorescent Strip for uplight cove	Surface	1	F32T8	Electronic Dimming	82	3500	277	34	28
F35	Compact Fluorescent wallwasher w/ horizontal lamp, nominal 7 1/4" aperture	Recessed	1	CFTR42W	Electronic Dimming	82	3500	277	34	10

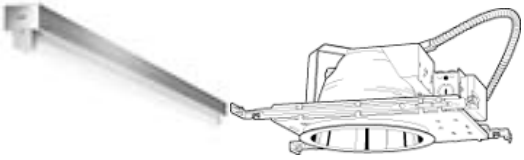
F22A

F23

F24A

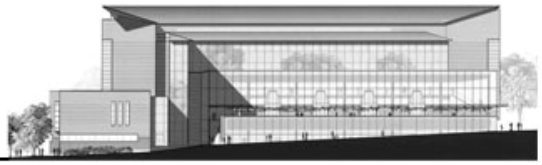


F26A



F32

F35



Senator Magnuson & Jackson Trial Courtroom

Light Loss Factors

Luminaire Designation	Maintenance Category	Room Atmos-phere	Cleaning Interval	Initial Lumens	Mean Lumens	Ballast Factor	LLD	RSDD	LDD	LLF
F22A	IV	Very Clean	12 months	2950	2710	0.88	0.92	0.98	0.94	0.745
F23	IV	Very Clean	12 months	900	774	1.00	0.86	0.98	0.94	0.792
F24A	V	Very Clean	12 months	900	774	1.00	0.86	0.98	0.93	0.784
F26A	IV	Very Clean	12 months	4450	4138	0.99	0.93	0.98	0.94	0.848
F32	I	Very Clean	12 months	2950	2710	0.88	0.92	0.98	0.97	0.768
F35	IV	Very Clean	12 months	3200	2752	1.00	0.86	0.98	0.94	0.792

Control Devices

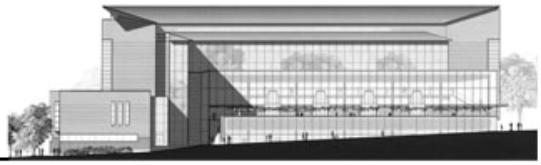
The trial courtroom space is controlled through means of a sixteen zone multi-scene controller, all of which are controlled through the same dimming rack. Eight of the sixteen zones throughout the space control downlighting, five control wallwashing, and two control cove lighting. The remainder two zones are responsible for the up and down functions of the motorized screen. These zones are programmed into and controlled locally by a master low voltage, six scene, preset control.

Daylighting & Integration

Minimal levels of daylight are provided through the six windows located in the trial courtroom space. Three of these windows are located on the south-facing wall and the other three on the west-facing wall. The amount of daylight the space receives is minimal, and therefore does not utilize a daylight control system,

Design Criteria

- *Appearance of Space and Luminaires (Important)*
  The appearance of the space and luminaires is important in maintaining the desired image of the UW Law School. Luminaires should reflect the prestige and excellence of the school, while also complementing the architecture. Since the space seconds as a trial courtroom and will be visited by many professionals from the legal world, it is important to provide an impressive space that closely mimics the appearance of an actual courtroom.



Senator Magnuson & Jackson Trial Courtroom

- *Color Appearance & Color Contrast (Important)*
  Color rending is important for overall visual performance. A color rendering index of 80 should be maintained by all lamps in order to maximize color appearance of materials within the space. Special consideration should be taken to the extensive use of wood paneling within the space, so not to wash out the wood material. Warmer color temperatures should be used to avoid this.

- *Daylight Integration & Control*
  There are minimal affects of daylighting within this space. There are only six small windows within the space which provide daylight and the levels provided are fairly minimal. For this reason, daylight integration and control is not necessary.

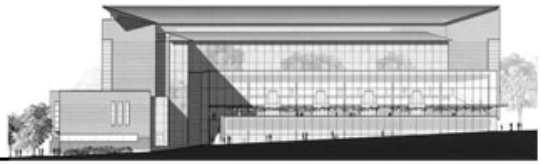
- *Direct Glare (Very Important)*
  This space doubles as both a classroom and trial courtroom, and will include many tasks such as reading, writing, VDT use, trials and presentations. For these reasons, direct glare is not acceptable in this space, as it will provide discomfort and be distracting to occupants of the space.

- *Light Distribution on Surfaces (Important)*
  Distribution of light on surfaces should be fairly uniform as not to provide distractions in the space. Accents can be placed on specific points of interest and walls within the space, which will provide a dynamic to the space.

- *Light Distribution on Task Plane (Uniformity)(Very Important)*
  Uniform distribution on the task plane is important to ensure ease of any task. Bright spots and reflected glare from a specular table surface should be avoided. This is particularly important for not only the student desk but for the judge's stand and litigation table as well.

- *Luminances of Room Surfaces*
  Consideration should be taken in providing luminances on room surfaces that meet desired luminance ratios. The luminance ratio from VDT to adjacent surfaces should not exceed 3:1. In addition to this, a luminance ratio of 10:1 should not exceed for VDT to far background surfaces.

- *Modeling of Faces or Objects Very (Important)*
  Facial features should from angles and with illuminance levels that avoid unflattering shadows on the face, especially from the eye sockets. It is especially important to optimize facial modeling when the space is used for trial purposes. Avoiding shadows on the judge and clerk area, litigants table, podium and witness stand is ideal.



- *Reflected Glare (Very Important)*
  Reflected glare in the space should be avoided, especially with the use of VDT monitors. Luminaire cut-off angles should be located outside of the offending zone in order to avoid this.

- *Source/Eye/Task Geometry (Very Important)*
  Due to the extensive task applications and VDT use within this space, proper placement of luminaires, as well as adequate illuminance levels, is important in order to complete task while avoiding direct or reflected glare. Particular attention should be paid in the judge, witness and litigation areas.

- *Illuminance (Horizontal)*
  Illuminance levels on the task plane within the space should reach a minimum of 30 fc for classroom applications. This illuminance level should be uniform and provided on all task surfaces of space. During court trial applications, the horizontal illuminance should ideally reach levels of approximately 50 fc.

- *Illuminance (Vertical)*
  Maintaining adequate vertical illuminance levels is important for facial modeling in the front of the space and for trial applications. A vertical illuminance level of 30 fc should be maintained.

ASHRAE 90.1 Power Density Evaluation

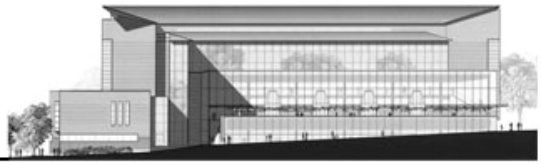
ASHRAE 90.1 Power Allowance: 2.0 W/ft^2 Total Watts: 4,600 W
Existing Power Density: 0.82 W/ft^2 Total Area: 5,600 ft^2

The existing design meets ASHRAE 90.1 standards

Architectural Finishes
Surface Materials & Reflectances

Floors

Carpet
Manufacturer: Prince Street Carpets
Color: Get Your Goat (Tan)
Reflectance: 17%
Walls



Senator Magnuson & Jackson Trial Courtroom

Paint
Manufacturer: Benjamin Moore
Color: Eggshell
Finish: Matte
Reflectance: 85%

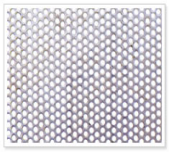
Cherry Wood Paneling
Manufacturer:
Color: Cherry
Reflectance: 13%

Acoustic Fabric Panels
Manufacturer: Maharam
Color: Grey (008)
Reflectance: 23%

Ceilings

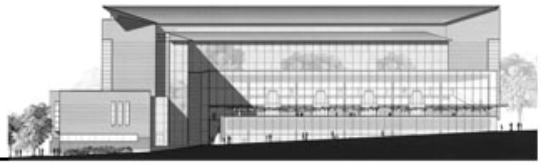
Acoustical Ceiling Tile
Manufacturer: Armstrong World Industries Inc.
Color: White
Reflectance: 89%

Paint
Manufacturer: Benjamin Moore
Color: Eggshell
Finish: Matte
Reflectance: 85%



Acoustical Metal Panel:
Manufacturer: Armstrong Metal Works
Color: Silver
Reflectance: 30%

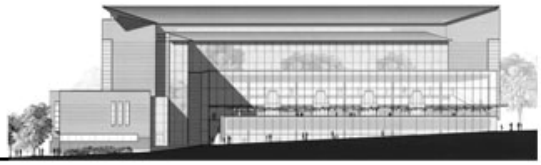
Birch Wood Paneling
Manufacturer:
Color: Birch
Reflectance: 30%



Existing Lighting System Analysis

Figure 2.4 – AGI Rendering 1

Figure 2.5 – AGI Rendering 2



Senator Magnuson & Jackson Trial Courtroom

Illuminance Values (fc)

Judge Face (vertical)		Speakers Face (vertical)		Ceiling	
Average	24.40	Average	27.60	Average	16.32
Max	24.40	Max	27.60	Max	21.3
Min	24.40	Min	27.60	Min	3.5
Avg/Min	1.00	Avg/Min	1.00	Avg/Min	4.66
Max/Min	1.00	Max/Min	1.00	Max/Min	6.09
Judge Desk		**Work Plane**		**Floor**	
Average	35.94	Average	67.05	Average	19.53
Max	36.70	Max	90.0	Max	27.60
Min	34.70	Min	32.6	Min	10.60
Avg/Min	1.04	Avg/Min	2.06	Avg/Min	1.84
Max/Min	1.06	Max/Min	2.76	Max/Min	2.60

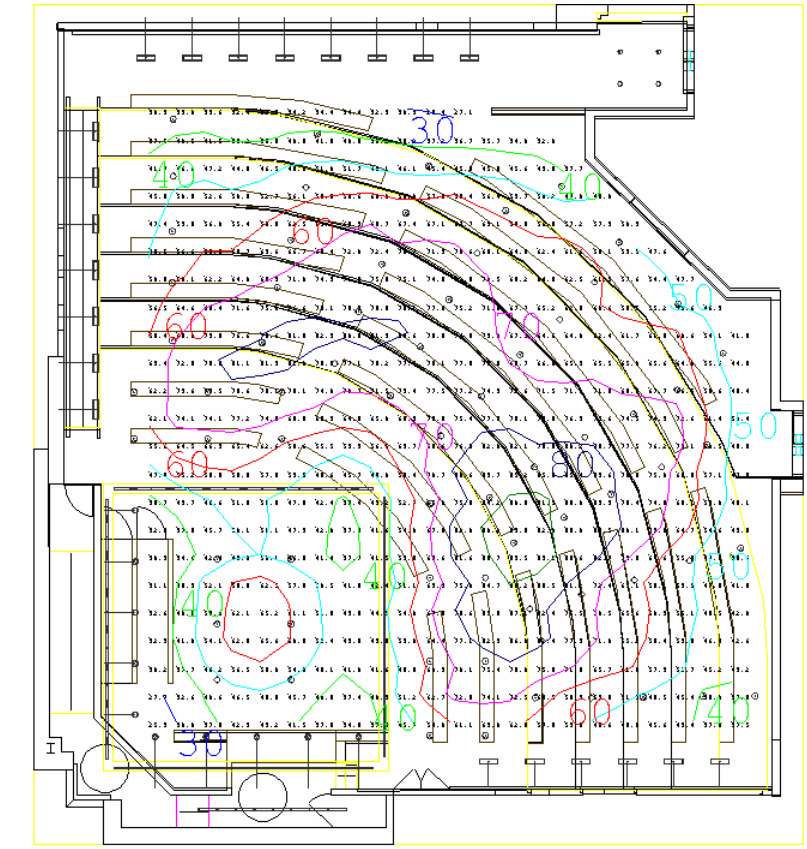
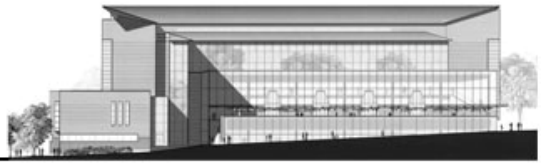


Figure 1.6 – Trial Courtroom Work Plane Illuminance Contours



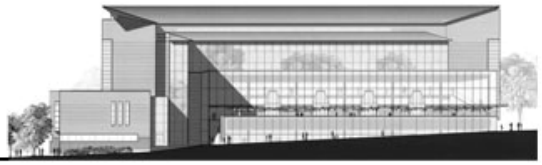
Critique of Existing Conditions

After analyzing the Magnuson & Jackson Trial Courtroom lighting design, it is apparent that the majority of the outlined design criteria and goals have successfully been fulfilled. Illuminance levels throughout the space prove to be sufficient for the desired task, with the average work plane illuminance averaging 67 fc and the judge's podium work plane illuminance averaging 37 fc. Both of these levels exceeded the ideal levels for classroom applications. The illuminance levels on the judge's podium, however, could be slightly increased for optimal performance during trial applications. In addition, vertical illuminance levels for facial model of the judge are approximately 24 fc. Vertical illuminance levels in the center of the presentation space average 27 fc. These values are fairly close to the ideal 30 fc of vertical illuminance suggested in the design criteria. Uniformity levels on the work plane and floor are acceptable, with neither exceeding a uniformity ratio of 3:1.

The space meets design goals regarding power density and controls. Complying with ASHRAE 90.1 standards, the power density of the space is well below the maximum allowable power consumption. Controls provided in this space allow for multi-scene local control. Preset scenes adjust light levels through different combinations of lighting zones.

The visual appearance of the space is very traditional and formal, which in part is due to the use of the cherry wood paneling. This formal appearance of the space can be optimized by correctly highlighting the wood paneling. Accenting of this material is accomplished through the use of fluorescent wallwashers on several sides of the room. In addition to using patterns to accent this feature of the room, one should consider to color temperature of the lamps so not to "wash out" the wood color and grains. In this space the luminaires utilized lamps with color temperatures of 3500K. This CCT may be slightly high for the best rendering of the wood, and the possibility of lowering this temperature to closer to 3000 K should be considered.

Architecturally speaking, one of the most dominant features within this space is the ceiling. The tiered, multi-level ceiling gives the room a feeling different from that of any other space in the building. The ceiling provides opportunity to veer away from the conventional ceiling layouts of classrooms. The existing lighting design effectively uses the ceiling to provide desired light levels throughout the room, without interfering with its distinct components.



Existing Lighting Overview

The two story Brotman Galleria extends from the eastern most end of the building at the main entrance and lobby to the central core of the building, where it joins with the student lounge area. The entire length of this space is accompanied by a two-story glazed aluminum curtain wall, which then extends to enclose the lounge area, as well as the lobby. Due to the extreme influx of daylight into the Galleria, minimal electric lighting is required. The existing lighting design utilizes linear fluorescent wallwashers along the length of the corridor to provide sufficient illuminance levels during night hours. In addition to this, compact fluorescent uplights and metal halide downlights are incorporated into the curtain wall design in order to provide additional task and ambient lighting.

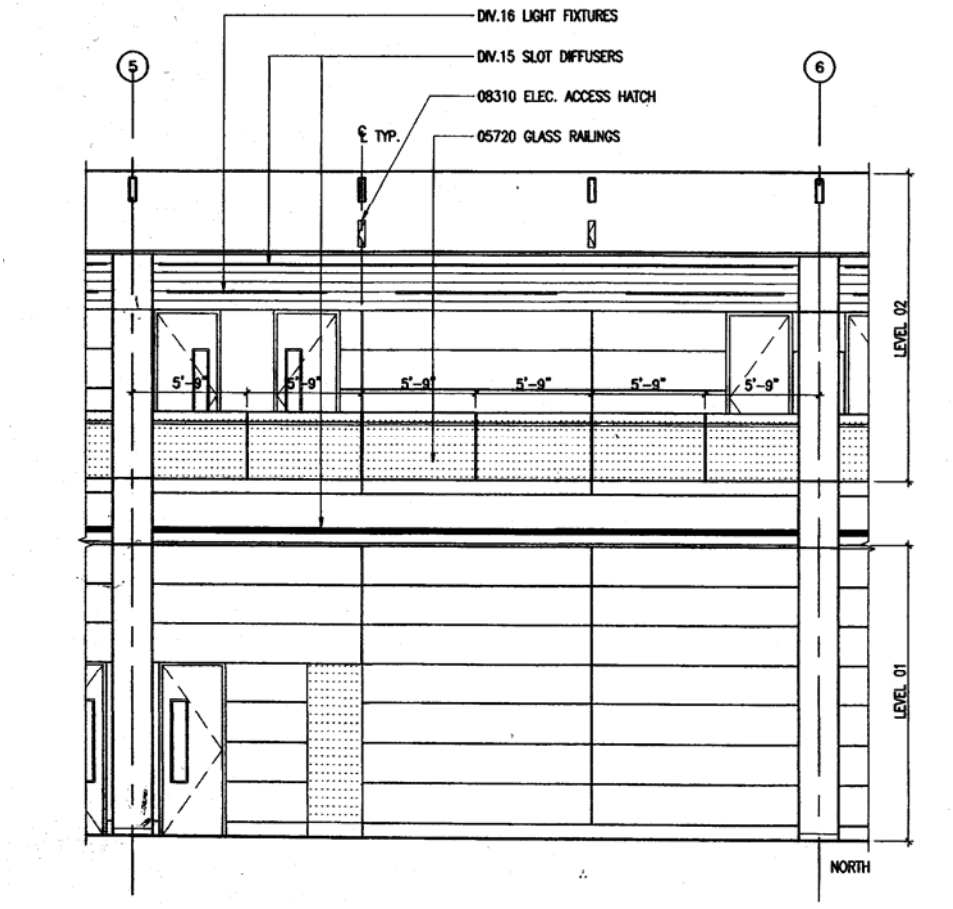
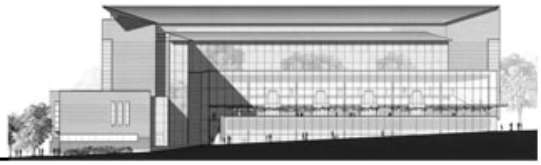


Figure 3.1 – Brotman Galleria Typical Bay Interior Elevation



Jeffrey & Susan Brotman Galleria

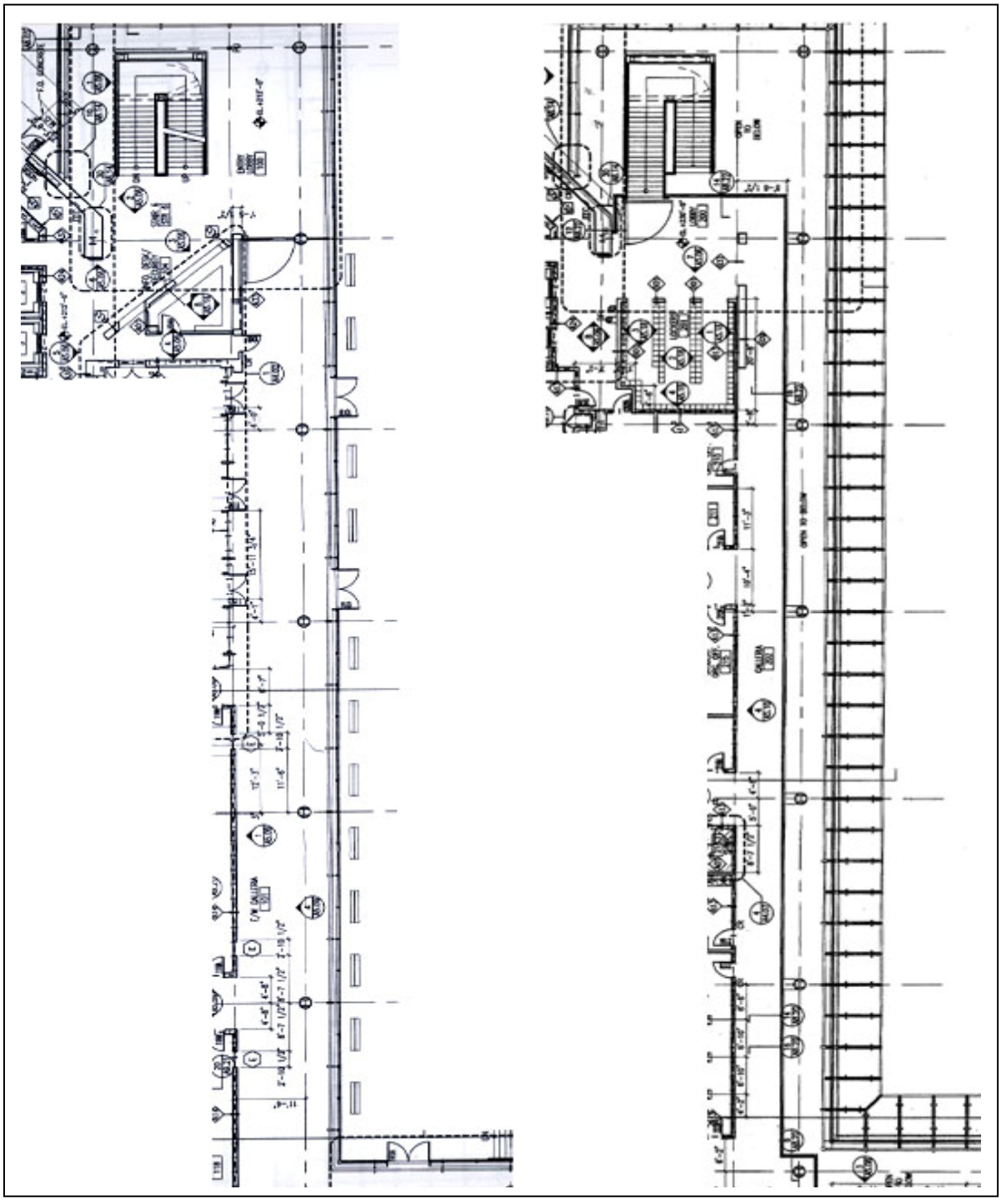
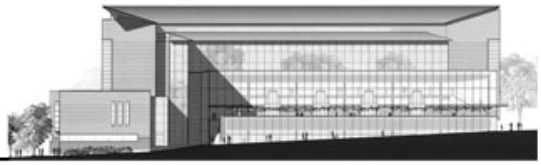


Figure 3.2 – Level 1 Galleria Floor Plan

Figure 3.3 –Level 2 Galleria Floor Plan



Jeffrey & Susan Brotman Galleria

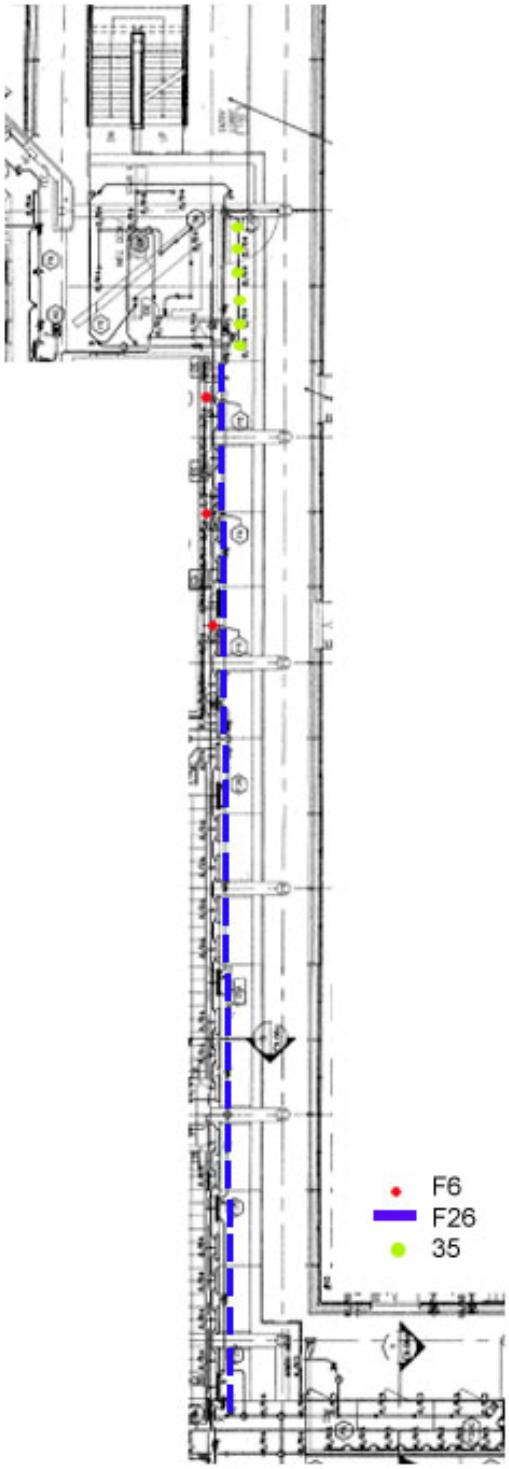


Figure 3.4 –Level 1 Galleria Lighting Floor Plan

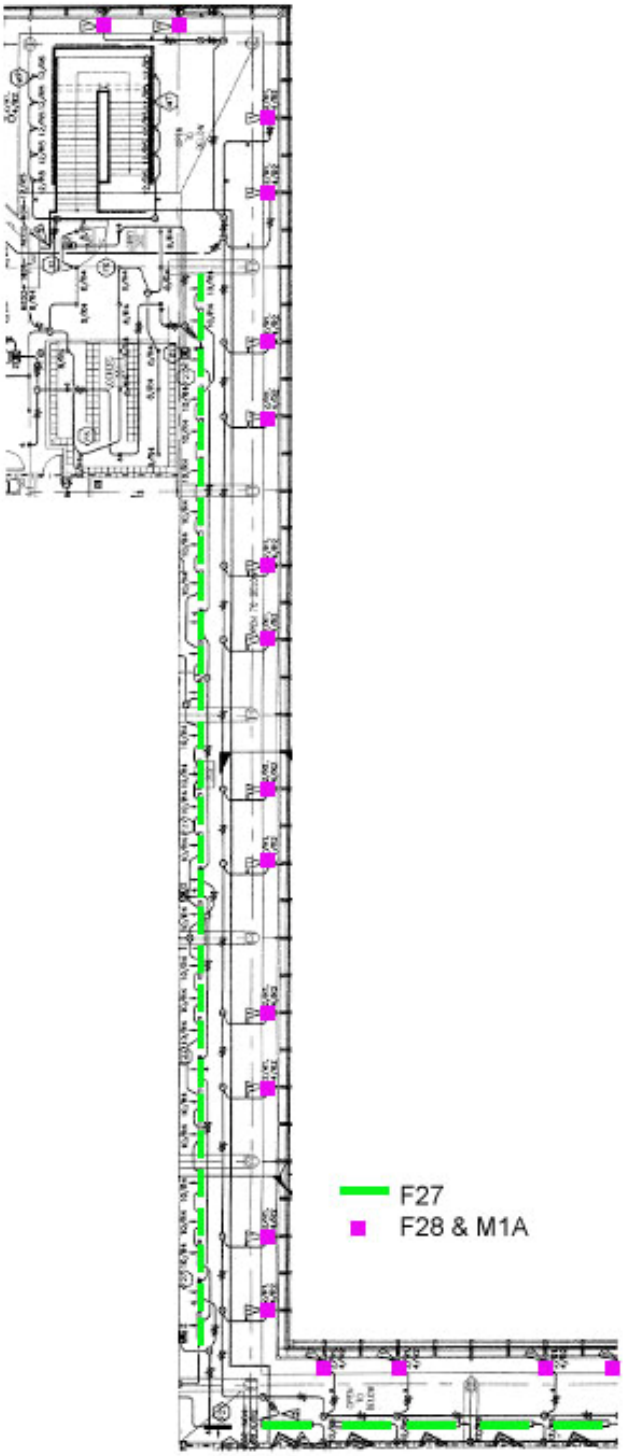
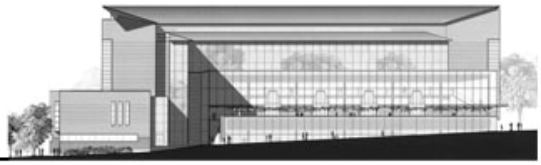


Figure 3.5 –Level 2 Galleria Lighting Floor Plan



Jeffrey & Susan Brotman Galleria

Furnishings

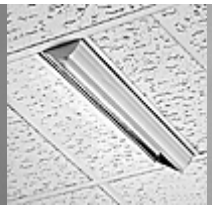
There are no furnishings within the main galleria circulation space. The student lounge located at the west end of the galleria makes use of a built-in bench, as well as tables and chairs.

Luminaire Schedule

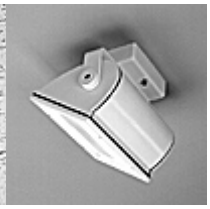
Luminaire	Description	Mounting	Lamp		Ballast	CRI	CCT	Voltages	Watts	Quantity
			#	Type						
F6	Compact Fluorescent downlight w/ vertical lamp, nominal 6" aperture	Recessed	1	CFTR32W	Electronic	82	3500	277	34	3
F26	48" Adjustable asymmetric wallwasher	Surface	1	F54T5/HO	Electronic	85	3500	277	62	28
F27	48" Adjustable wallwasher, w/ snap in parabolic baffle	Semi-Recessed	1	F28T5	Electronic	82	3500	277	30	29
F28	17.5" Adjustable asymmetric uplight	Surface - to column	2	CFTR32W	Electronic	82	3500	277	34	12
F35	Compact Fluorescent wallwasher w/ horizontal lamp, nominal 7 1/4" aperture	Recessed	1	CFTR42W	Electronic	82	3500	277	34	12
M1A	Metal halide track fixture	Surface - to column	1	CDM100/PAR38	Electronic	82	3000	277	110	12

F6

F26



F27



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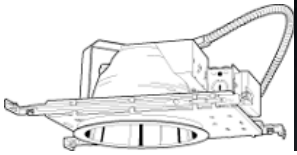
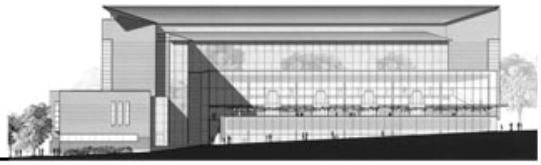


F35

M1A



Light Loss Factors

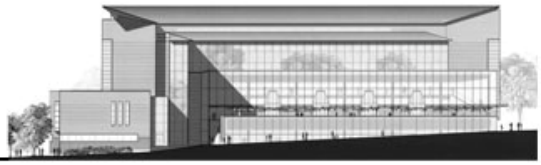
Luminaire Desig-nation	Mainten-ance Category	Room Atmos-phere	Cleaning Interval	Initial Lumens	Design Lumens	Ballast Factor	LLD	RSDD	LDD	LLF
F6	IV	Very Clean	12 months	900	774	0.88	0.86	0.96	0.94	0.683
F26	IV	Very Clean	12 months	4450	4138	0.99	0.93	0.96	0.94	0.831
F27	IV	Very Clean	12 months	2600	2418	0.98	0.93	0.96	0.94	0.822
F28	VI	Very Clean	12 months	900	774	1.00	0.86	0.88	0.92	0.696
F35	IV	Very Clean	12 months	3200	2752	1.00	0.86	0.96	0.94	0.776
M1A	IV	Very Clean	12 months	6200	4898	1.00	0.79	0.96	0.94	0.713

Control Devices

The Brotman Galleria and surrounding areas are controlled by a low voltage relay system. The system is controlled by a Master Lighting Controller Panel. In this space, two different Automatic Lighting Control (ALC) panels are accessed via the various relays. Automatic Lighting Control Panel ALC-1A feeds relay circuits located on the first floor. This includes linear fluorescent wallwashers and compact fluorescent downlights. The luminaires on the second floor run relays to ALC-2B. This includes relays from the compact fluorescent uplights, metal halide downlights, compact fluorescent downlights, and linear fluorescent wallwashers.

Daylighting & Integration

Daylighting is a very integral part of this space. The south-facing wall of the galleria, as well as the east-facing wall of the lounge area, incorporates the use of Low-E insulating glass (see Architectural Finishes below). The existing lighting design incorporates daylight controls by means of a low voltage relay system. This system controls the luminaires on the first floor and second floor on two separate ALC panels.



Daylight Study

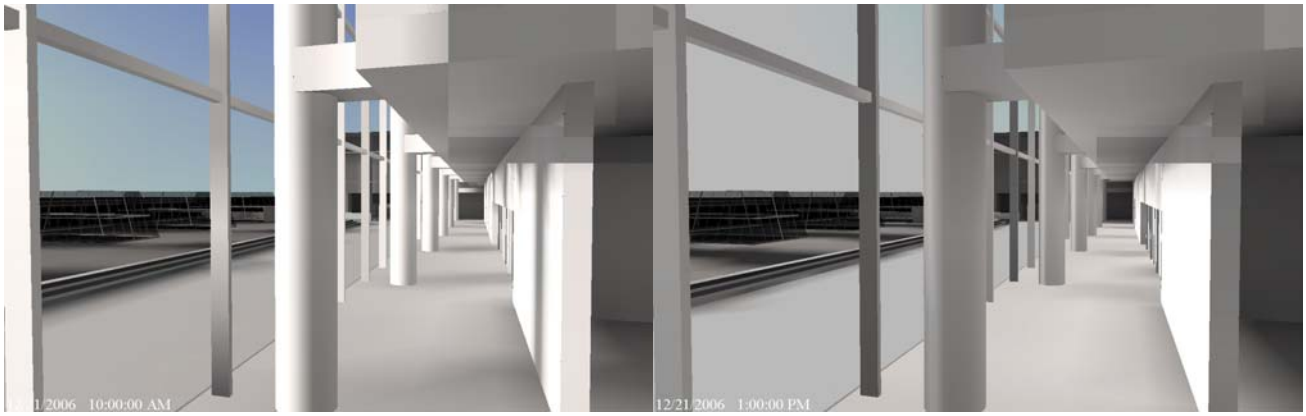


Figure 3.6 – Daylight Study – December, 21 - 10:00 AM & 1:00 PM

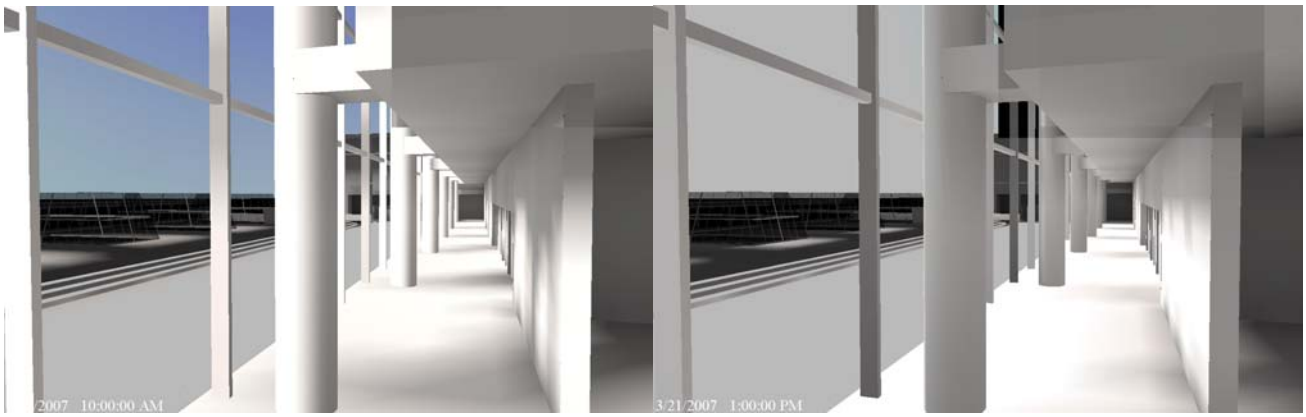
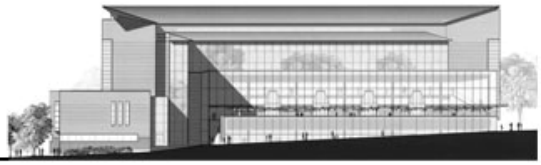


Figure 3.7 – Daylight Study – March, 21 - 10:00 AM & 1:00 PM

Figure 3.8 – Daylight Study – June, 21 - 10:00 AM & 1:00 PM



Design Criteria

- *Appearance of Space and Luminaires (Important)*
  The galleria is the most public space in the building and serves as the primary circulation corridor for the building. When passing through this space, light levels should be high enough to provide a safe environment, while still providing a visual comfort. The space is lined with glass on one side and is capped with high ceilings. While luminaires should be appropriate for the architecture of the space, they should also be chosen for efficiency and aesthetics. In addition, this space provides a view into the building, and this should maintain a look and feel that is inviting to the campus community.

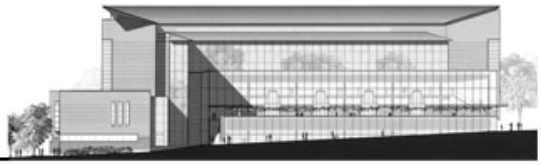
- *Color Appearance & Color Contrast*
  Color rending is important for overall visual performance. While, color appearance is not critical in this space, a CRI of 80 should be maintained by all lamps in order to maximize color appearance and contrast of materials in the space. Special consideration should be given to the use of wood paneling within the space, so not to wash out the wood material. Warmer color temperatures should be used to avoid this.

- *Daylight Integration & Control (Very Important)*
  Given that the south and east-facing walls are flanked with glass in this space, daylight control and integration is very important. By utilizing daylight controls and photosensors, energy consumption within the space can be reduced. Special consideration should be given to the type of glazing materials used on the curtain wall as to help minimize negative effects of direct sunlight, while still allowing an influx of ambient light.

- *Direct Glare (Very Important)*
  The primary culprit of the direct glare in this space will be daylighting. Direct sunlight entering the space can potentially create and uncomfortable visual environment for pedestrians passing through the space.

- *Light Distribution on Surfaces*
  Accents of light can be used within this space to create a visually interesting appearance, especially during night hours when the main wall of the galleria can be viewed from outside of the building.

- *Light Distribution on Task Plane (Uniformity)*
  Uniform distribution on the task plane, which in the galleria is the floor, is important to ensure safety of passage through the space.



- *Luminances of Room Surfaces (Important)*
  The galleria space is a long, straight corridor. In order to eliminate the tunnel effect associated with such spaces, varying luminance levels should be used. Also, light in the space should be used to help direct pedestrians through the space by means of different luminance levels of surfaces.

- *Modeling of Faces or Objects (Important)*
  In order to insure safety in circulation through this space, adequate vertical illuminance levels for facial modeling and recognition should be provided.

- *Reflected Glare (Important)*
  Reflected glare in the space will become an issue during nighttime hours when luminaires are most likely to be reflected in the glass curtain wall. This should be avoided by paying special attention to placement of luminaires.

- *Illuminance (Horizontal)*
  Illuminance levels on the floor should be maintained at a minimum of 5 fc for simple orientation. This illuminance level should be uniform throughout the length of the space.

- *Illuminance (Vertical)*
  Minimum vertical illuminance level throughout the galleria should be 3 fc for facial modeling purposes. Illuminance levels of 30 should be provided on wall areas where items are being accented.

ASHRAE 90.1 Power Density Evaluation

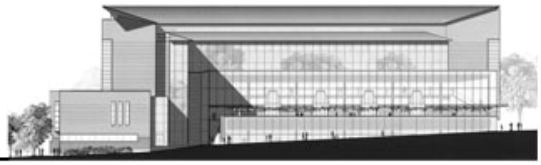
AHRAE 90.1 Power Allowance: 0.8 W/ft^2 Total Watts: 4,844 W
Existing Power Density: 0.8 W/ft^2 Total Area: 6,000 ft^2

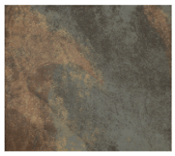
The existing design meets ASHRAE 90.1 standards

Architectural Finishes
Surface Materials & Reflectances

Floors

Carpet
Manufacturer: Prince Street Carpets
Color: Get Your Goat (Tan)
Reflectance: 17%





Slate Tile
Manufacturer: Vermont Structural Slate Co.
Color: Heathermore Clear Gray
Reflectance: 28%

Walls

Paint
Manufacturer: Benjamin Moore
Color: Eggshell
Finish: Matte
Reflectance: 85%

Birch Wood Paneling
Manufacturer:
Color: Birch
Reflectance: 30%

Ceilings

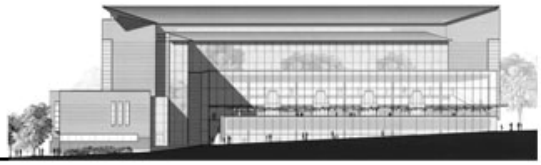
Acoustical Ceiling Tile
Manufacturer: Armstrong World Industries Inc.
Color: White
Reflectance: 89%

Paint
Manufacturer: Benjamin Moore
Color: Eggshell
Finish: Matte
Reflectance: 85%

Glazing

PPG Sungate 100 Low-E- Glass

Transmittance			Reflectance		U-Value		K-Value		Shading Coeff.	Solar Heat Gain Coeff.	Light to Solar Gain
Ultra-violet %	Visible %	Total Solar Energy %	Visible Light %	Total Solar Energy %	Winter Night time	Summer Daytime	Winter Night time	Summer Daytime			
35	73	44	12	20	0.31	0.3	1.76	1.7	0.59	0.52	1.4



Existing Lighting System Analysis

Figure 3.9 – AGI Rendering 1

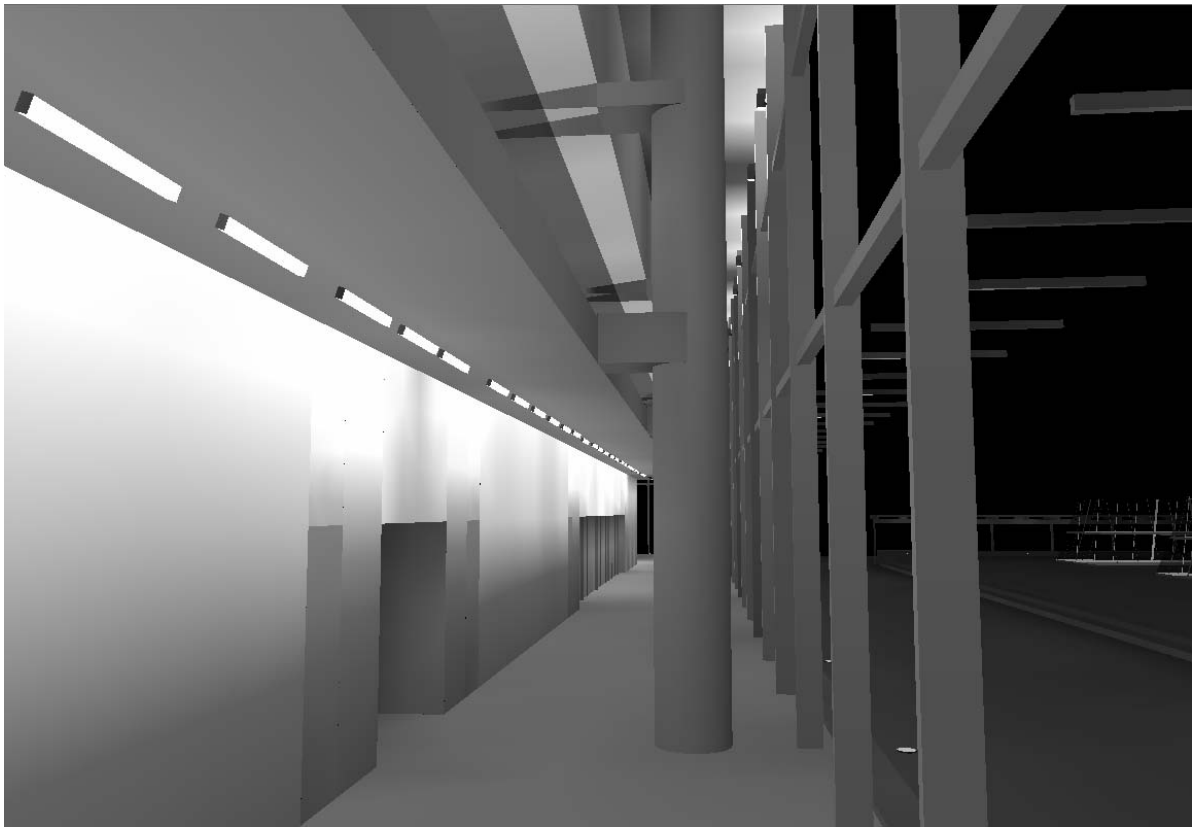
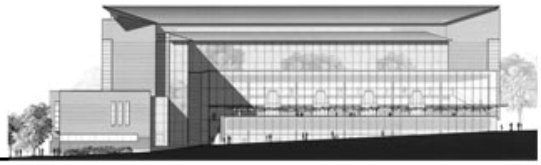


Figure 3.9 – AGI Rendering 2



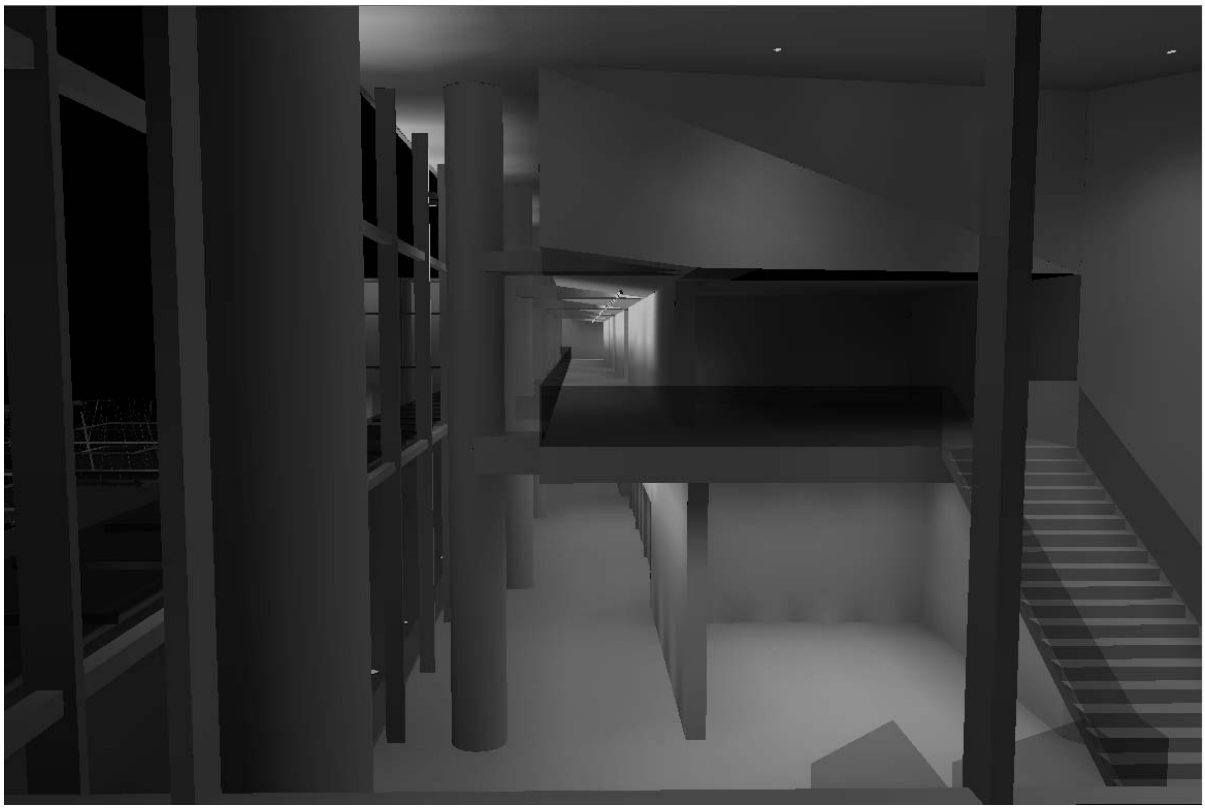
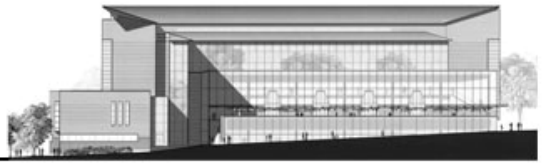


Figure 3.11 – AGI Rendering 3

Illuminance Values (fc)

Lobby Floor		Galleria Level 1 Floor		Galleria Level 2 Floor		Galleria Level 1 Wall (vertical)		Galleria Level 2 Wall (vertical)	
Average	7.44	Average	8.75	Average	10.02	Average	8.41	Average	10.93
Max	16.90	Max	16.00	Max	12.60	Max	20.20	Max	12.60
Min	4.10	Min	1.90	Min	2.60	Min	3.90	Min	9.10
Avg/Min	1.81	Avg/Min	4.61	Avg/Min	3.85	Avg/Min	2.16	Avg/Min	1.21
Max/Min	4.12	Max/Min	8.42	Max/Min	4.85	Max/Min	5.18	Max/Min	1.40



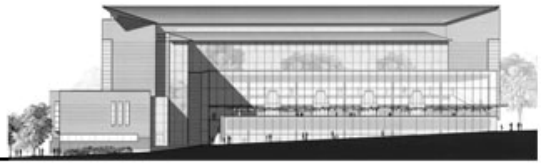
Critique of Existing Conditions

The majority of the previously outlined design criteria for the galleria space were met according the analysis conducted. Illuminance levels on the work plane, which in this case is the floor, meet the required 5 fc with an average illuminance of 8 fc on the first floor and 10 fc on the second floor. The distribution of light on these surfaces is fairly uniform as to provide a safe atmosphere for circulation throughout the building. The vertical illuminance along the north walls of the galleria also meet the minimum required levels outlined in the design criteria. Light levels on the first floor average approximately 8 fc and the second floor averages close to 11 fc. These vertical illuminance levels meet the general 3 fc requirement, however, if there were any points of interest along these walls (i.e. pictures) the illuminance levels would need to be much higher. The distribution along these walls is also fairly uniform. However, given the length and monotony of the space, a varying distribution pattern may be more desirable in order to give the space some character.

With the extensive amount of exterior glass located in this space, daylight control and integration of the space is very important. As observed in the daylighting study, the glazed curtain walls provide high levels of direct and ambient light into the space, with deeper penetration during winter months when the sun is lower in the sky. While photosensor daylight controls are not integrated into the current design of the space, they would be beneficial in reducing energy consumption during daylight hours.

The space meets design goals regarding power density and controls. Complying with ASHRAE 90.1 standards, the power density of the space just meets the maximum allowable power consumption. However, due to the location and function of this space, it is likely that the lights will remain on during all hours of the day. To compensate for this, separate nighttime settings should be integrated, as to reduce power consumption during late night hours when the building is not occupied.

After conducting an analysis of this space, it appears as though the lighting system was designed ultimately for function, providing adequate light levels to navigate throughout the space. While wall washers are used to highlight the one wall within the galleria, the design does not seem to make use of the full potential of this space. The single long wall of the galleria and the space's open view to the surrounding campus should be seen and utilized as a blank canvas, on which an image of the law school and its new facility should be painted and projected to the community.



Terrace

Existing Lighting Overview

The central terrace of William H. Gates Hall serves as an outdoor gathering place for students. The trellis-covered bench area lines the south and east edges, while the four central skylights are surrounded by an elevated grass area. The terrace lighting system serves predominantly to provide sufficient light levels on the ground, which is addressed through the use of compact fluorescent step lights. These luminaires are used to light the steps and area surrounding the elevated grass space. In addition to this, metal halide in-ground uplights line the edges of the adjacent building, and metal halide plant lights accent the trellis area. The four trapezoidal skylights are fitted with linear fluorescent strip luminaires in order to provide the desired glow of this distinct architectural feature. Lighting from the adjacent Brotman Galleria, also spills into the space, providing additional night time lighting.

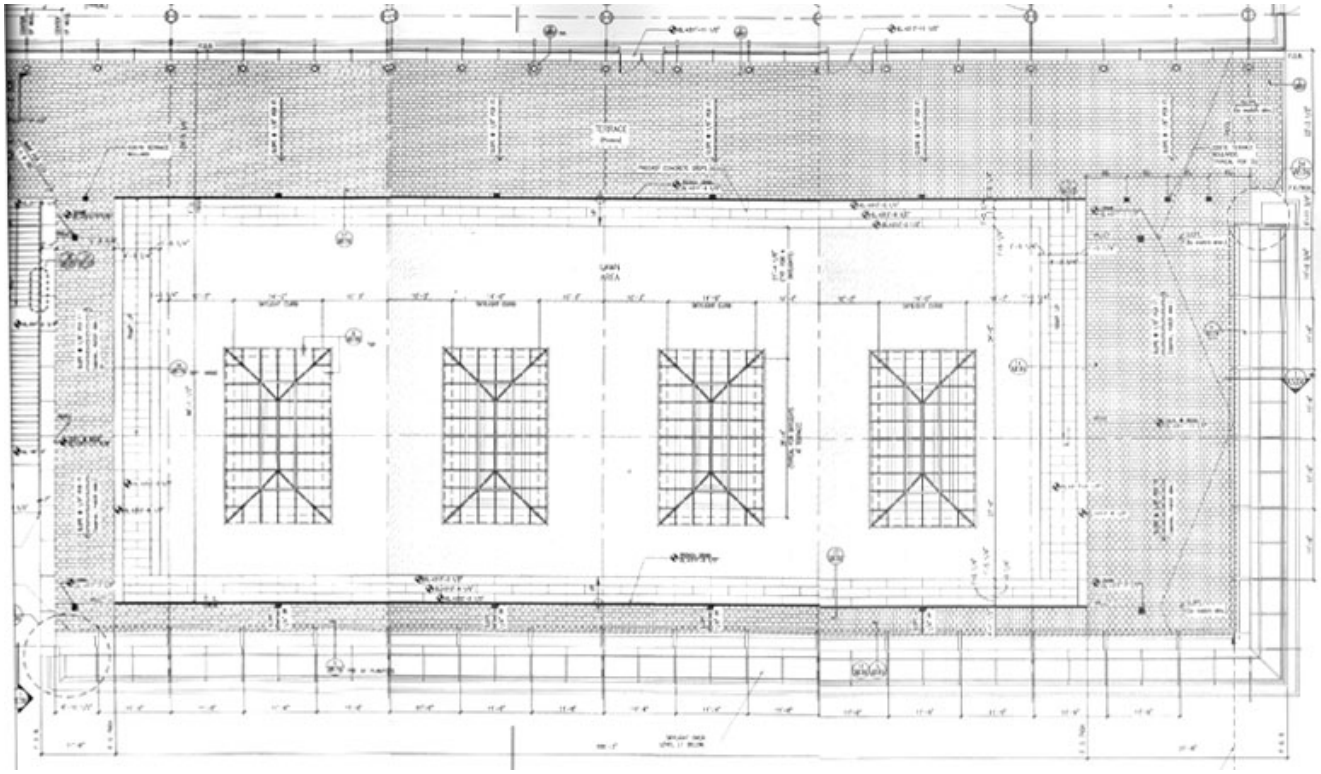
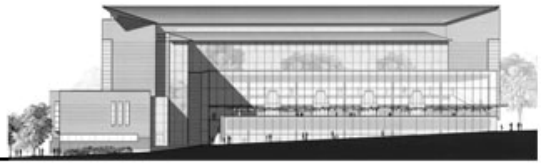


Figure 4.1 – Terrace Floor Plan



Terrace

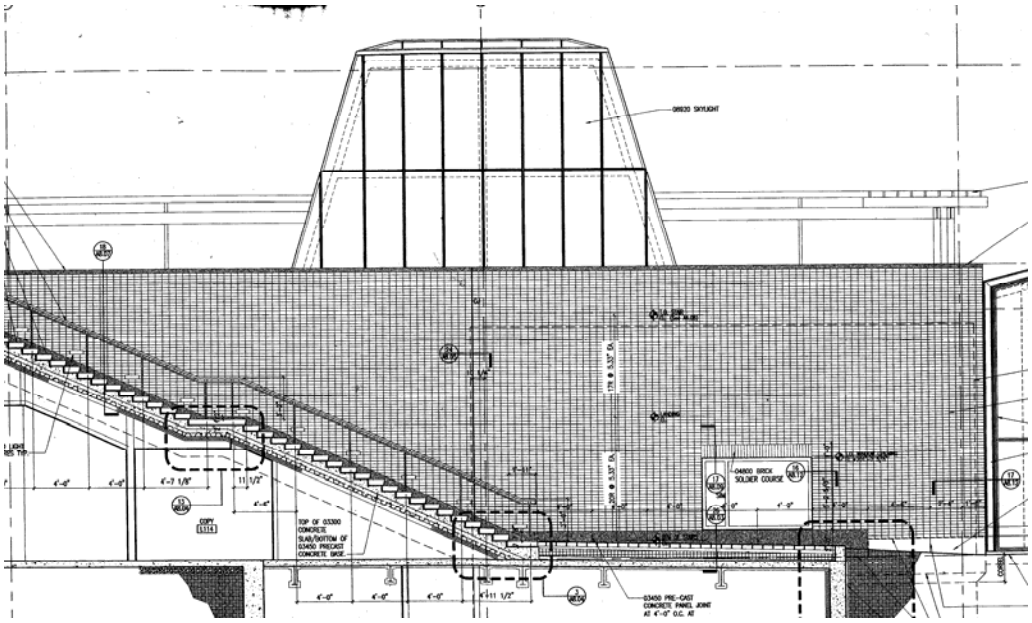


Figure 4.2 – Terrace Section

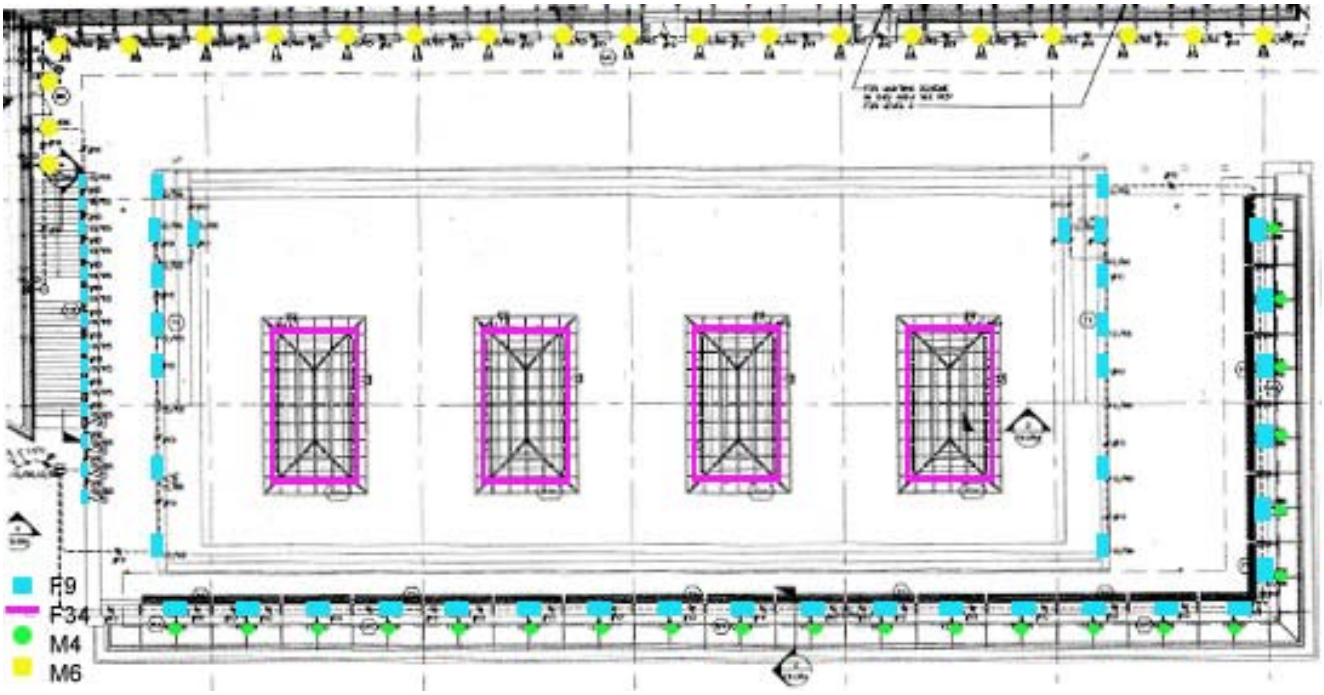
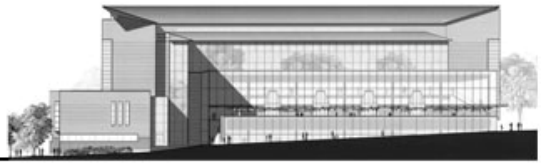


Figure 4.3 –Terrace Lighting Floor Plan



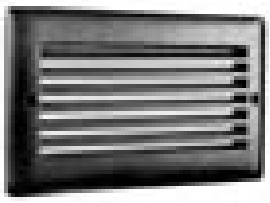
Terrace

Furnishings

There are no furnishings within this space.

Luminaire Schedule

Luminaire	Description	Mounting	Lamp		Ballast	CRI	CCT	Voltages	Watts	Quantity
			#	Type						
F9	12" compact fluorescent step light with louver	Recessed	1	CFT13W	CF Integral Ballast	82	3500	277	13	51
F34	4' Fluorescent asymmetric throw cove uplight	Surface	1	F32T8	Electronic	82	3500	277	34	48
M4	Metal Halide plant light	Surface	1	CDM39/PAR20	Electronic	81	3000	277	110	22
M6	In-ground metal halide uplight, nominal 11-11/16" diameter	Recessed in-ground	1	39W T6 CDM/TC/830	Integral Electronic	81	3000	277	110	22



F9

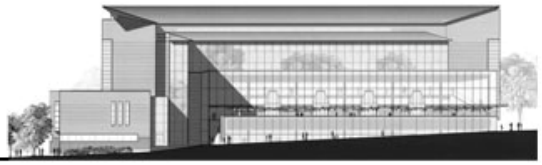
F34

M4

M6

Light Loss Factors

Luminaire Desig-nation	Mainten-ance Category	Room Atmosphere	Cleaning Interval	Initial Lumens	Design Lumens	Ballast Factor	LLD	RSDD	LDD	LLF
F9	IV	Dirty	12 months	900	774	1	0.86	0.73	0.72	**0.452**
F34	I	Dirty	12 months	2950	2710	0.88	0.92	0.73	0.83	**0.49**
M4	IV	Dirty	12 months	2000	1600	1	0.80	0.73	0.72	**0.42**
M6	V	Dirty	12 months	3300	2600	1	0.79	0.73	0.78	**0.449**



Terrace

Control Devices
The exterior terrace lighting system is controlled by a low voltage relay system. The system is controlled by a Master Lighting Controller Panel. In this space, two relays feed to Automatic Lighting Control Panel ALC-1A. The system is controlled by a time switch that is set to astronomical sunset and sunrise per ASHRAE 90.1.

Daylighting & Integration
Several surfaces within this space allow for the influx of daylighting into adjacent areas. All glass contained within this area is Low-E insulating glass, including the four skylights and the glazed aluminum curtain wall of the south and east faces of the building.

Design Criteria

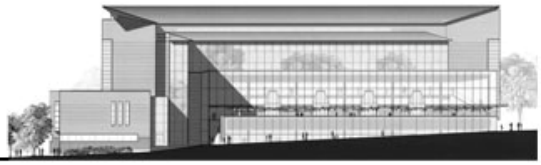
- *Appearance of Space and Luminaires (Very Important)*
  The terrace space is very typical of an outdoor terrace with a trellis-covered seating area lining a central, raised grass area around four trapezoidal skylights. In order to minimize the impact of the space, luminaires should be recessed into surfaces and all hardware hidden from visual sight.

- *Color Appearance & Color Contrast*
  Color rending is important for overall visual performance. While, color appearance is not critical in this space, a CRI of7 should be maintained for ease in facial modeling. The desired mood of the outdoor space can be greatly affected by the color temperature. In addition, notice should be taken to the color temperature of the adjacent areas through the glass walls.

- *Direct Glare (Very Important)*
  Direct glare should be avoided as not to provide visual discomfort. Caution should be taken when using in-ground uplights so that direct glare from the lamp into the eye can be avoided. This can become a dilemma when such fixtures are located in circulation areas.

- *Light Distribution on Surfaces (Very Important)*
  Light distribution on surfaces should be used to help accent specific architectural elements within the space in effort to make an overall artistic statement. Light distribution of exterior spaces should consider adjacent spaces and lighting, as well as the appearance of the surrounding community.

- *Light Pollution and Trespass(Important)*
  Upward light spill into the sky should be avoided. The location of the building site is fairly isolated from other buildings, and therefore, concerns of light trespass are reduced.



Terrace

- *Modeling of Faces or Objects (Very Important)*
  Facial recognition is important to maintain safety within the area.

- *Reflected Glare*
  Reflected glare of luminaires on glass curtain wall should be avoided. Luminaires should not be located or angled so that such reflections will occur.

- *Shadows (Important)*
  In order to maintain a feeling of safety during the night within this space dark shadows should be avoided, especially in the main circulation areas of the terrace.

- *Illuminance (Horizontal)*
  Illuminance levels in main circulation areas should be maintained at a minimum of 5 fc to maintain safety. Other areas, such as the areas east, south and west of the skylights should have minimum illuminance levels of 3 fc.

- *Illuminance (Vertical)*

A vertical illuminance of 3 fc should be maintained for facial rendering and safety.

ASHRAE 90.1 Power Density Evaluation

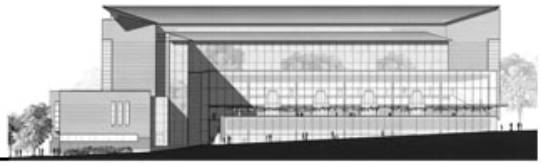
AHRAE 90.1 Power Allowance: 0.25 W/ft^2 Total Watts: 7135 W
Existing Power Density: 0.37 W/ft^2 Total Area: 19,300 ft^2

The existing design does not meet ASHRAE 90.1 standards

Architectural Finishes
Surface Materials & Reflectances

Wood Trellis
Color: Brown
Reflectance: 24%

Concrete
Color: Gray
Reflectance 35%:



Terrace

Grass
Color: Green
Reflectance: 9%

Glazing
PPG Sungate 100 Low-E- Glass

Transmittance			Reflectance		U-Value		K-Value		Shading Coeff.	Solar Heat Gain Coeff.	Light to Solar Gain
Ultra-violet %	Visible %	Total Solar Energy %	Visible Light %	Total Solar Energy %	Winter Night time	Summer Daytime	Winter Night time	Summer Daytime			
35	73	44	12	20	0.31	0.3	1.76	1.7	0.59	0.52	1.4

Existing Lighting System Analysis

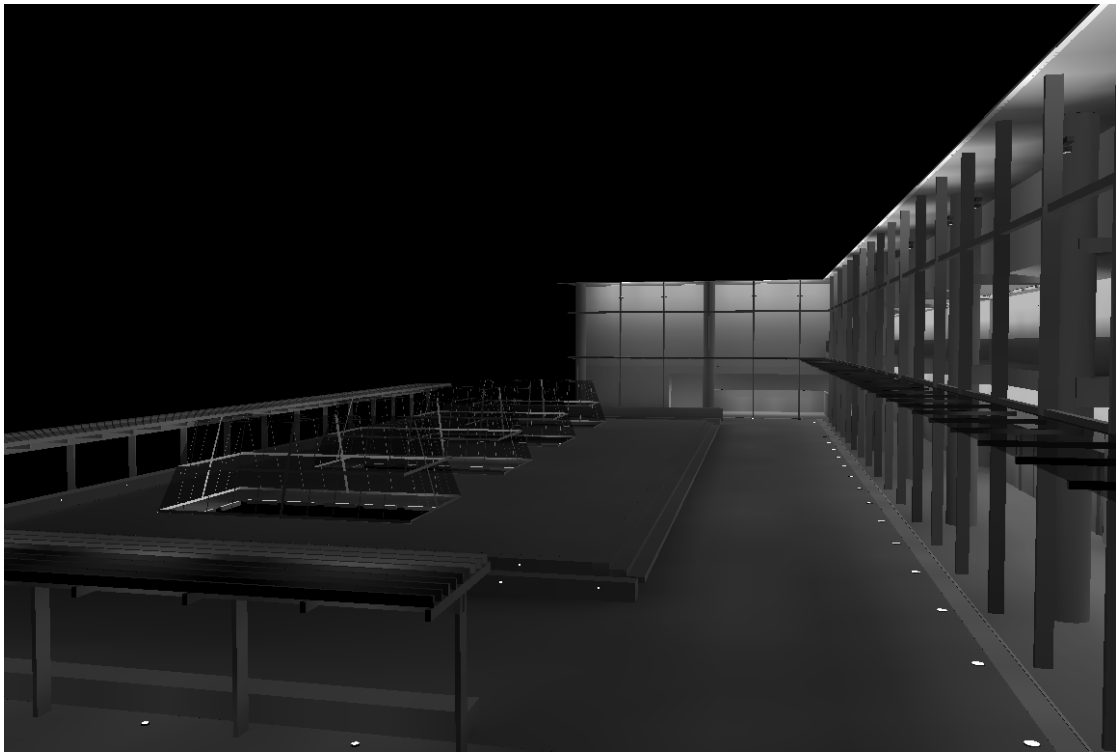
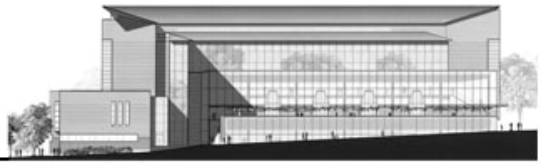


Figure 4.4 – AGI Rendering 1



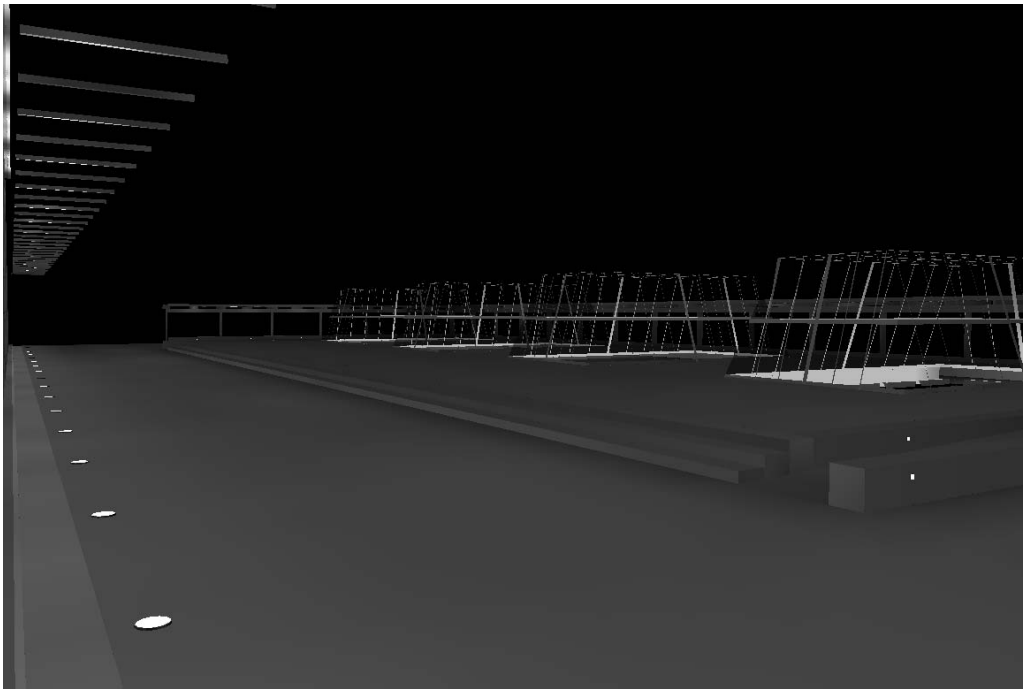


Figure 4.5 – AGI Rendering 2

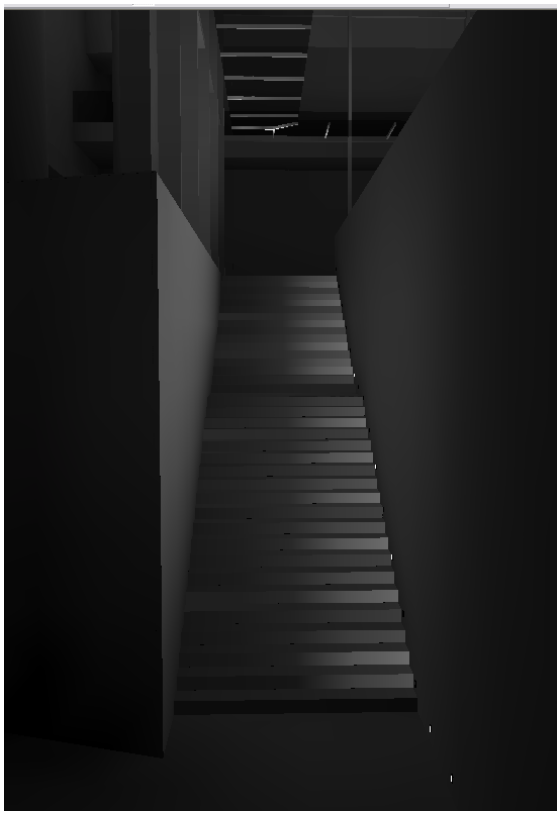
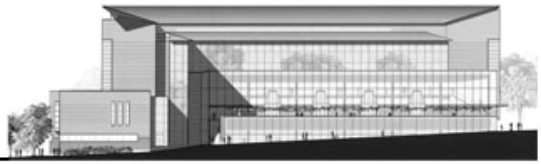


Figure 4.6 – AGI Rendering 3



Terrace

Illuminance Values (fc)

Stairs		Terrace Ground		Face - Vertical	
Average	0.86	Average	1.07	Average	1.09
Max	1.40	Max	1.70	Max	1.20
Min	0.40	Min	0.50	Min	1.00
Avg/Min	2.15	Avg/Min	2.14	Avg/Min	1.09
Max/Min	3.50	Max/Min	3.40	Max/Min	1.20

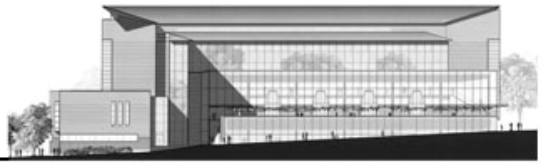
Critique of Existing Conditions

The majority of the previously outlined design criteria for the terrace space were met according the analysis conducted. However, one area in which the current terrace lighting design is not to standards is the illuminance levels. Design criteria specified a minimum illuminance of 5 fc on the floor of main circulation areas and 3 fc on other floor surfaces and for vertical illuminance. Calculations showed that light levels were inadequate for all of these areas. Measurements were taken on the ground in the main circulation area, on the stairs, and at the vertical plane of a face, and none provided illuminance levels greater than 1.70 fc. Increasing the illuminance levels of these areas is necessary in order to insure safety.

In addition to concerns regarding illuminance level, attention should be given to concerns such as shadows and direct glare. Overall, the presence of large shadows seems to be minimized, with the exception of over the stairs. The exterior staircase area provides very minimal light levels, and receives large shadows from the building above, creating an uncomfortable area. Pedestrians passing through this area forfeit a level of safety. In addition, there are some concerns surrounding the in-ground uplight luminaires and direct glare. Located along the edge of the building, these lights are located in areas which pedestrians may pass through, in which case they will experience the discomfort associated with direct glare.

Another area of concern is in meeting the requirements of ASHRAE 90.1. Timer schedules are provide to meet control requirements, however, power density requirements are not satisfied. While ASHRAE 90.1 specifies the allowable maximum power density to be 0.25 W/sq ft, the space consumes slightly more than this at 0.37 W/sq ft. Exceeding the standard in this situation can mostly likely be correlated to the large quantities of low output fixtures used (i.e. step lights), which fail to even provide the recommended illuminance levels.

Overall the appearance of the space is inviting and interesting. A combination of different approaches of accent and task lighting were used, while providing the overall ambient lighting from the spill of the adjacent interior spaces.



Appendix A

Relevant computer files used within this Lighting Existing Conditions and Design Criteria Report can be found in the following location on the Penn State AE server:

P:\kaj172\ AE481W\Tech1

IES Files

F9.IES	F27.IES	M1.IES
F22.IES	F28.IES	M1A.IES
F22A.IES	F32.IES	M1B.IES
F23.IES	F33.IES	M4.IES
F24A.IES	F34.IES	M6.IES
F26.IES	F35.IES	M7.IES
F26A.IES		

AGI32 Files

Courtroom.A32	Courtroom.rsf
Galleria.A32	Galleria.rsf
Library.A32	Library.rsf
Terrace.A32	Terrace.rsf