George Mason University
Art & Visual Technology Building

Existing Lighting Conditions and Design Criteria Report

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October 5, 2007

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Executive Summary

The following Existing Lighting Conditions and Design Criteria Report analyzes the existing lighting design for the George Mason University Art & Visual Technology Building. A brief overview of the building's lighting design and control systems was found to be primarily fluorescent fixtures and to have an integrated central process with dimming, switching and addressable wall stations. Four spaces were chosen for further analysis which included the main entrance courtyard, main lobby, exhibition gallery and painting studio. Further analyses included fixtures used, light loss factors, equipment to be used (lamps and ballasts), and lighting controls.

An ASHRAE energy analysis was completed for each space. It was found that the in both the gallery and painting studio that the large amount of track lighting designed caused these spaces to be over the required watts per square foot density allowed. The large amount of walkway lighting, used primarily to promote a safe night time environment, caused the exterior space to be over the energy code. Finally, the entry lobby met by nearly 50% for that space. I predict that the reason the studio and gallery spaces were over is because the lighting design had saved energy elsewhere in the building to allow a more elaborate system in these spaces.

In order to effectively evaluate an existing system the key design criteria must be determined. Design criteria for each of the four spaces analyzed in detail was developed from the considerations outlined by the Illuminating Engineering Society of North America (IESNA) Handbook. While each of these spaces have very different tasks and needs, they all tie back into the buildings overall theme of creating an industrial creative atmosphere.

An analysis of surface finishes, glazing properties, along with the previous analyses was incorporated to create a computer model which evaluated how the existing system performed for the exhibition gallery and painting studio. Daylighting contributions in both spaces were analyzed separately from the electric lighting. It was found that daylighting had a small impact on the gallery space and was largely unaffected by the season. Meanwhile, in the painting studio daylighting played a primary role in the analysis of this space.

Finally a critique of each space was done based on the results from the research. This critique compared how the existing lighting design compared to the design criteria that was developed for each space. If the two were compared on the large scale most criteria were met by the existing system. However, some areas were not addressed or did not meet the criteria which I had set up. This is due to differing approaches to design. However, there were areas in which the lighting could enhance the space further and more efficiently.

Building Summary

Building Description:

The Art & Visual Technology building is a new three-story building to be built on the Fairfax campus of George Mason University. Innovation Hall is located to the North of the site, while Patriot Circle encloses the site to the South & West. A new campus quadrangle and Research I building are located to the east. This new building is to manly house the needs of the different disciplines within the department including drawing, digital arts, graphic design, printmaking, photography, art education, sculpture, and painting. It also consists of a prominent gallery off the main entrance to exhibit student work. The future addition, also three stories, whose program is undetermined, is to be located at the NW corner of the site and will be connected with the original building to function as one building.

This building is to represent the creativity and vision of the department that it shall contain. A large open, flexible plan will accommodate the changing needs and differing teaching styles of the art & visual technology department. In order to create an open industrial feel that is welcoming to the public this building incorporates a combination of brick and corrugated metal paneling. The large curved façade slicing thru the building will comprise of a metal frame with a brushed steel cladding. This combination of the traditional brick with an industrial feel of the metal cladding will tie this building into the campus while giving the Art & Visual technology department the uniqueness they desire.

Lighting Design:

In conjunction with large amount of exposed ceiling, the majority of lighting fixtures utilized fluorescent sources. Classrooms, offices, and studios all use a linear fluorescent direct/indirect fixture. The corridors make use of compact fluorescent downlights. The exhibit gallery and studio spaces make use of a custom suspended uni-strut grid that has track lighting mounted to it. Clearstories provide daylight to the painting and drawing studios, which are along the southern face of the building on the upper level. Outside of a few specialty fixtures, all of the lighting in the building is run off of 277V.

Exterior lighting consists of pole mounted fixtures which line the main north/south walkway. In-grade fixtures accent the main entrance along with curved metal clad wall which slices thru the building.

Lighting Controls:

Three switching panels and four dimming panels are integrated into a central processor which has an ethernet port for computer diagnostics and programming. Numerous types of wall stations, occupancy sensors and other addressable locations are linked into the central system.

General Assumptions

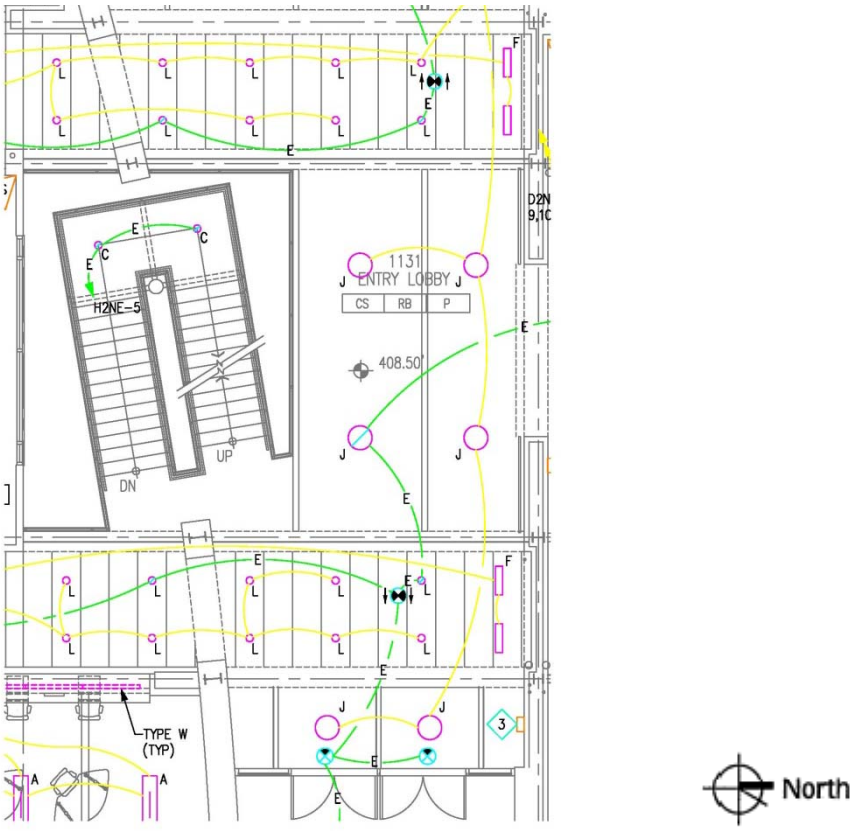
- For the ease and simplicity of the analysis ductwork, structural members and other systems exposed in areas were not considered. Space height is designed from slab to the decking above.
- A Generic display was created for the exhibit gallery to analyze the performance of the lighting system.
- Fixture locations on all track lighting was assumed in both the gallery and painting studio.
- Reflectances for all finishes in all spaces were estimated as accurately as possible with the given information.
- Lamp Lumen Depreciation for halogen sources is calculated (from 40% rated life) from Figure 6-20 in the IESNA.
- Ballast factors for metal halide sources are assumed to be 1.0
- All windows have a transmittance of 70%
- Gallery and painting studios only analyzed a couple of the track fixtures. This was done to see the performance of how one or two fixtures in different scenarios. Also, these fixtures do not provide a substantial portion of ambient light into the spaces therefore, they are not necessary to get the overall lighting for a space.
- Assume each circuit of track lighting is to have 10 fixtures on it

Entry Lobby

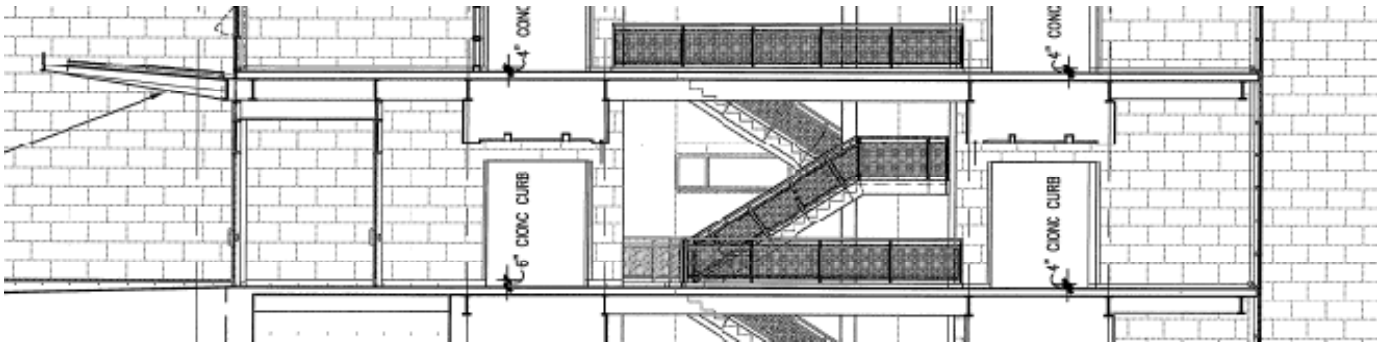
Overview:

This is the lobby to the main entrance. This long rectangular space connects the building together. The gallery space is connected to the right of the lobby while the two main corridors come off the lobby to the left. To the north of the lobby is a small student lounge with seating and a coffee table. The open staircase in the entry lobby spans from the lower level through the upper level. There is a roughly 20'x30'area surrounding the staircase which is open to above and below. The staircase is comprised of a metal handrail & frame with a ornamental guard wire mesh panel. The ceiling in the lobby is composition of systems used to tie into the adjacent spaces. The corridor ceiling style, perforated metal ceiling panels, continues across the lobby to divide the lobby ceiling into three sections. The ceiling height where the metal planking is 10'-6" above finished floor (A.F.F), while the left portion of the central lobby is exposed to the floor above 12'-0" of clear space (a total of 15'4 to the deck above). A recessed compact fluorescent downlight is utilized where the metal ceiling panels are located. In the central lobby space a compact fluorescent pendant fixture which is almost entirely direct light (97%). A surface mounted direct indirect fixture is mounted to the underside of the stair above.

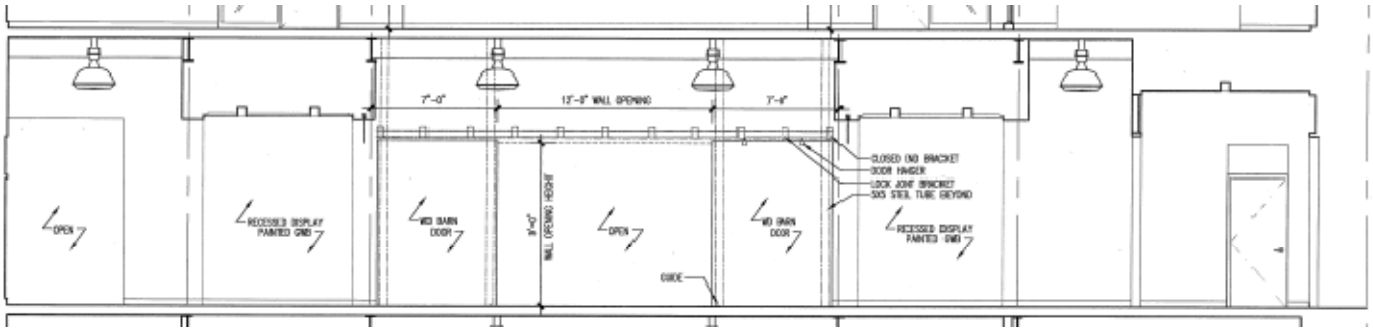
Lighting Layout:



Interior Section towards the South:



Interior Elevation Looking towards the North:



Luminaires:

	LIGHTING FIXTURES						
	FIXTURE TYPE	MOUNTING	MANUFACTURER	CATALOG OR MODEL NUMBER	LAMPS	VOLTS	REMARKS
	C	SURFACE	SHAPER	278-CFL/1/32-277-NA-AB	ONE F32PLT/835	277	WALL MOUNT ASYMMETRIC DIRECT-INDIRECT FLUORESCENT FIXTURE
	F	SEMI-RECESSED	ELLIPTIPAR	F210-T124-L-02-V-0B0	ONE F24T5HO/835	227	WALL WASH FIXTURE. PROVIDE LUTRON ECO-10 DIMMING BALLAST.
	J	PENDANT	ZUMTOBEL	#CDTT-042-UNV-CPAC1-CDSP	ONE F42PLT/835	277	LOBBY PENDANT. REFER TO ARCHITECTURAL DRAWINGS FOR LENGTHS & SUSPENSION HEIGHT.
	L	RECESSED	GOTHAM	AF-32TRT-6AR-LD-277-GEB	ONE F32PLT/835	277	TYPICAL FLUORESCENT DOWNLIGHT

Light Loss Factors:

Luminaire Type	Maintenance Category	Room Atmosphere	Cleaning Cycle	Initial Lumens	Mean Lumens	LLD	Ballast Factor	LDD	RSDD	LLF
C	III	Clean	12 months	2400	2040	0.85	0.98	0.9	0.94	0.7
F	IV	Clean	12 months	2000	1900	0.95	1	0.89	0.97	0.82
J	IV	Clean	12 months	3200	2720	0.85	0.98	0.89	0.97	0.72
L	IV	Clean	12 months	2400	2040	0.85	0.98	0.89	0.97	0.72
*RCR=3.33										

Lamps:

Philips 32W PLT compact fluorescent Ordering Code# PL-T 32W/835/4P/ALTO
Philips 42W PLT compact fluorescent Ordering Code# PL-T 42W/835/4P/ALTO
Philips 24WT5HO Ordering Code# F24T5/835/HO/ALTO

Ballasts:

32 & 42W Compact Fluorescent
Advance Transformer Electronic Rapid Start
Catalog #RCF-2S-26-H1-LD-QS

T5 24HO Linear Fluorescent
Lutron ECO-10 Dimming Ballast Programmed Rapid Start
ECO-T524-277-1

ASHRAE Standard 90.1 Power Allowances:

Lobby 1.3W/ft^2
Area 35'x46'
Total Allowed Wattage 2,093W

Power Consumed with Existing Design:

Surface Indirect/Direct 64W
Linear wall wash 96W
Fluorescent downlight 640W
Pendant 252W
Total Wattage used 1052W < 2,093W

Controls:

The lighting in this space is controlled by a two button wall station that is on the north wall as you enter the main entrance. The lighting is also tied into the automated lighting system to turn the lights on/off at programmed times.

Surface Finishes:

Floor: Sealed Concrete 40% Reflectance

Walls: Pure White-Benjamin Moore Pristine Eco Spec Interior Latex Flat 219 75% Reflectance

Ceiling: Refer to lighting plan for locations. Combination of metal plank ceiling (85% Reflectance) and exposed structure (70%).

Furnishings:

No Furnishings in this circulation space

Design Criteria:

Tasks: Circulation
Way Finding
Meeting place

Horizontal Illuminance

The IESNA handbook recommends an average of 10fc on the horizontal plane in this space.

Vertical Illuminance

The IESNA handbook recommends an average of 3fc on the vertical plane in this space.

Apperance of Space and Luminaires [Very Important]

The main lobby is the first impression of the Art & Visual technology for the occupants. It is important to provide a visually pleasing space to impress visitors to the building as well as set up the creative and innovative atmosphere for the students.

Direct Glare [Important]

It is important for those just entering the building to not have any glare hindering their ability to get oriented to the building. Also, this will be a busy area between classes and any glare could cause a disruption in the flow of people in and out of the building.

Luminances of Room Surfaces [Somewhat Important]

Utilize light distribution on surfaces to help with way finding. Have high luminances near the stairwell to guide people to it as well as down the corridor to access the elevators, which are in a remote location.

Modeling of Faces and Objects [Very Important]

Again this is the first space you experience in the building. Being able to distinguish people and objects is very important is vital in creating an inviting space.

Points of Interest[Important]

Exposed ceiling in the middle of the lobby is important to highlight to create an industrial feel. Also, this will help create the feeling of spaciousness in the space. Smaller points of interest will be the north wall as there are small recesses for displays and posters.

Shadows [Very Important]

Avoid any shadows from lighting system and exposed structural and mechanical systems.

System Control and Flexibility [Important]

Lighting needs to be integrated with the automated lighting system. Remote manual location of controls is needed to avoid any unintended switching of lights.

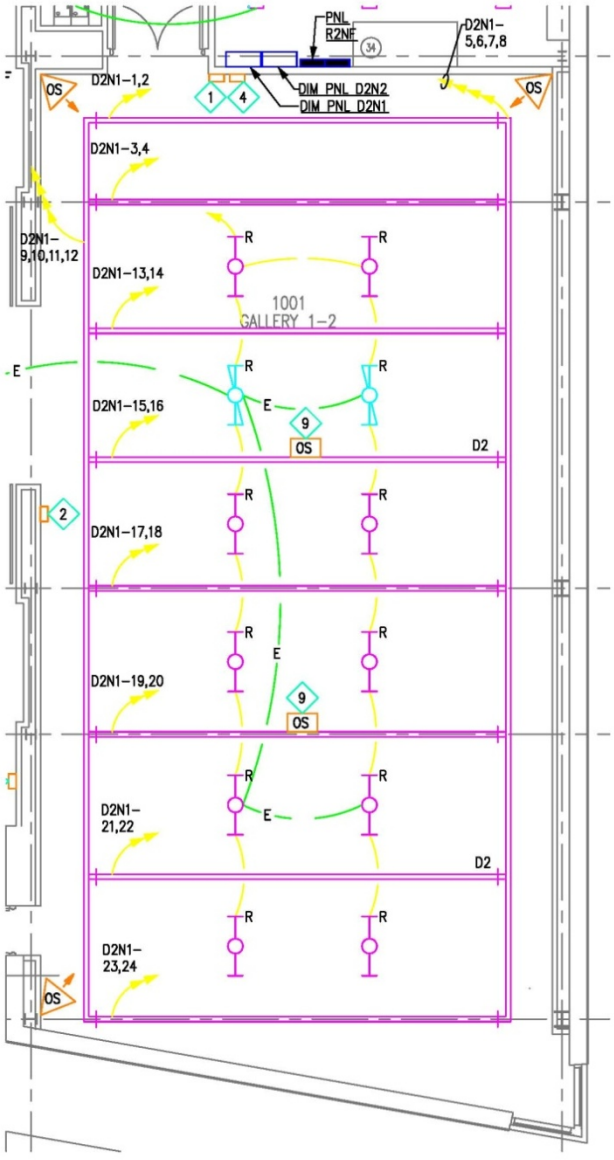
Critique of Existing Lighting Design:

The current lighting design meets many of the design criterion I have developed for this space, however, it also fails to address other criterion I have made. By the use of the linear wall washer they were able to bring focus to the recessed display areas along the north wall which was one of the areas I wanted to highlight. However, they chose not to address the highlighting the stairwell which falls short of what I had wanted to achieve. One potential way to highlight the stairwell would be some sort of sconce or stair mounted fixture which would draw focus there and could be used throughout all three floors. The use of the recessed downlight and pendant fixture does model faces and objects sufficiently which is important but, if more indirect light was incorporated, potential harsh shadows, which accentuate wrinkles and imperfections, could be reduced. However, I feel that the choice to bring the corridor ceiling plan through the lobby makes the lobby disjoint and breaks the lobby into three portions. Also, takes away from the potential to create a large open lobby. I would choose to stop the metal ceiling paneling where the corridor opens up to the stairwell. The use of a pendant fixture in the lobby I felt was an appropriate choice but, I would change the fixture to something which had more uplight to illuminate the exposed structure, which is a key element within the building and space. To conclude, I feel that the current design had met most of the design critera I had set out to achieve but it created a different first impression than I had envisioned.

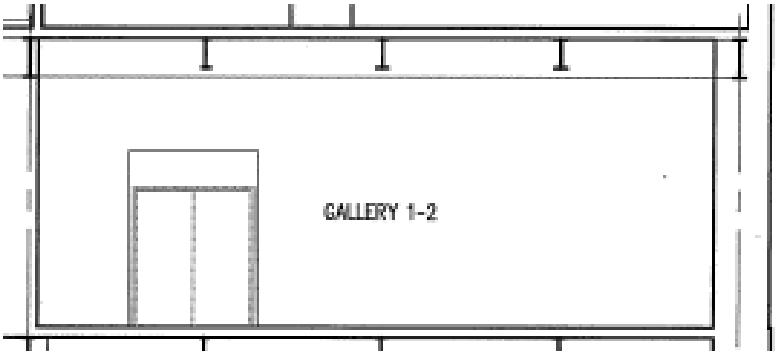
Exhibition Gallery

The exhibition gallery is located directly off the main lobby of the building. This space is roughly 72'x35' with the south wall angled outward. The exhibit gallery is to display student work for the students, staff and the general public to view. Materials to be used in the space are once again painted GWB for the walls and again the exposed ceiling. One key note to this space is that there is very little natural light as the only window is on the south east (plan) corner of the space. Direct sunlight will only enter the space in the early morning as its on the east corner of the building. A Uni-strut grid was used to attach a track lighting system. The grid hangs from 12' above the finished floor. The track lighting provides the accent lighting while a pendant direct/indirect fixture provides the ambient light for the space.

Lighting Layout:



Section looking towards the West:



Luminaires:

LIGHTING FIXTURES

FIXTURE TYPE	MOUNTING	MANUFACTURER	CATALOG OR MODEL NUMBER	LAMPS	VOLTS	REMARKS
DW	TRACK	LSI	290-00-W	ONE 100PAR/HIR/FL40	120	TYPICAL GALLERY TRACK HEAD. PROVIDE TEN (10) FIXTURES FOR INSTALLATION ON TRACK. LOCATIONS TO BE DETERMINED IN THE FIELD.
D2	SURFACE	LSI	TWO-CIRCUIT SURFACE-MTD TRACK WITH WHITE FINISH	N/A	120	TYPICAL GALLERY TRACK. MOUNT ON SUSPENDED UNIT-STRUT. PROVIDE LENGTHS, FEEDS, AND CONNECTIONS AS REQUIRED FOR COMPLETE SYSTEM.
R	STEM MOUNTED	DAYBRITE	1FD-232-SP-277	TWO F32T8/835	277	UTILITY INDUSTRIAL FLUORESCENT

Light Loss Factors:

Luminaire Type	Maintenance Category	Room Atmosphere	Cleaning Cycle	Initial Lumens	Mean Lumens	LLD	Ballast Factor	LDD	RSDD	LLF
DW	V	Very Clean	12 months	2030	-	.97	1	0.93	0.98	.88
R	III	Very Clean	12 months	5900	5600	0.95	0.88	0.91	0.96	0.73
*RCR=3.26										

Lamps:

GE 100W Par38 Halogen Source Ordering Code# 100PAR/HIR/FL40
Philips 32W T8 4' Linear Fluorescent Ordering Code# F32T8/TL835/ALTO

Ballasts:

32W T8 Fluorescent
Advance Transformer Electronic Programmed Start
Catalog# VCN-2S32-SC

ASHRAE Standard 90.1 Power Allowances:

Museum – General Exhibition 1.0W/ft^2
Area 35'x67'
Total Allowed Wattage 2,345W

Power Consumed with Existing Design:

Direct/Indirect Fixtures 768W
Track Lighting 8,000W (8 circuits of 10 fixtures at 100W each)
Total wattage used 8,768W >> 2,345W

Controls:

There are two locations for manual lighting control within this space. The first is two button wall station along the south wall near the entrance from the main lobby. The other location is along the west wall next to the set of double doors. At this location there is dimming for the track fixtures and preset controls for the space. Finally, there are occupancy sensors at three of the corners of the room.

Surface Finishes:

Floor:	Sealed Concrete 40% Reflectance
Walls:	Pure White-Benjamin Moore Pristine Eco Spec Interior Latex Flat 219 75% Reflectance
Ceiling:	Exposed structure (70%).

Furnishings:

No Furnishings in this gallery space

Design Criteria:

Tasks: View exhibits of varying medium, shape, orientation and mounting
General circulation throughout the space

Horizontal Illuminance

The IESNA handbook recommends 30fc on horizontal surfaces within an art exhibit.

Vertical Illuminance

The IESNA handbook recommends 5fc on horizontal surfaces within an art exhibit.

Appearance of Space and Luminaires [Very Important]

The fixtures within the art gallery should draw as little attention to the actual fixture themselves. The main purpose of a gallery is to look at the exhibit and the lighting system should embrace this notion rather than try and steal attention away.

Color Appearance [Imporant]

As stated previously it is important to not deter from the piece on display. Having an appropriated selected CCT source could enhance the display. However, not all displays would benefit from the same CCT, thus flexibility in this category would be beneficial.

Direct Glare [Very Important]

Important to keep the spotlights out of direct view. As long as fixtures are aimed properly this should be easily achievable.

Light Distribution on Surfaces [Very Important]

Uniformity of light distribution on the painting and other two-dimensional displays is of the utmost importance. However, for any three-dimensional displays crisp, distinct shadows can help the display have a clear distinct view.

Luminances of Room Surfaces [Important]

Luminances of non display surfaces should be low to not draw attention away.

Modeling of Faces and Objects [Very Important]

It is key to bring out the texture, depth, shape of the displays whether they are anything from paintings to sculptures. These features are what makes many art pieces interesting and unique.

Points of Interest [Very Important]

The art displays are the points of interest in the space.

Reflected Glare [Important]

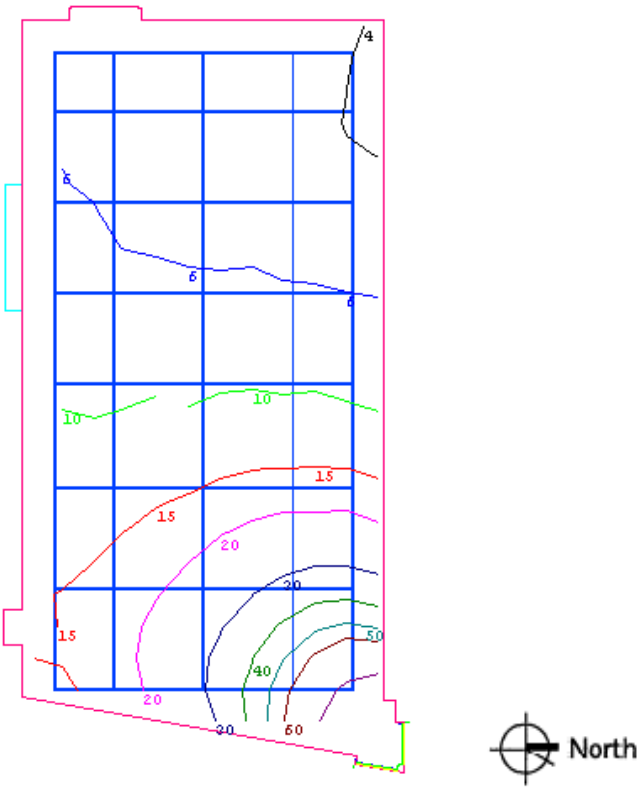
This will be an issue dependent on the finish of the display (especially glossy and glass encased). In these situations aiming will need to be done to avoid reflections of source in the display.

System Control and Flexibility [Very Important]

Flexibility within this space is key to be able to effectively light all types of work and layouts for the space. Control of fixtures is very important to have the ability to turn on and off fixtures and dim them as needed. Also, the ability to easily re-aim fixtures for new displays will keep the lighting design working as intended.

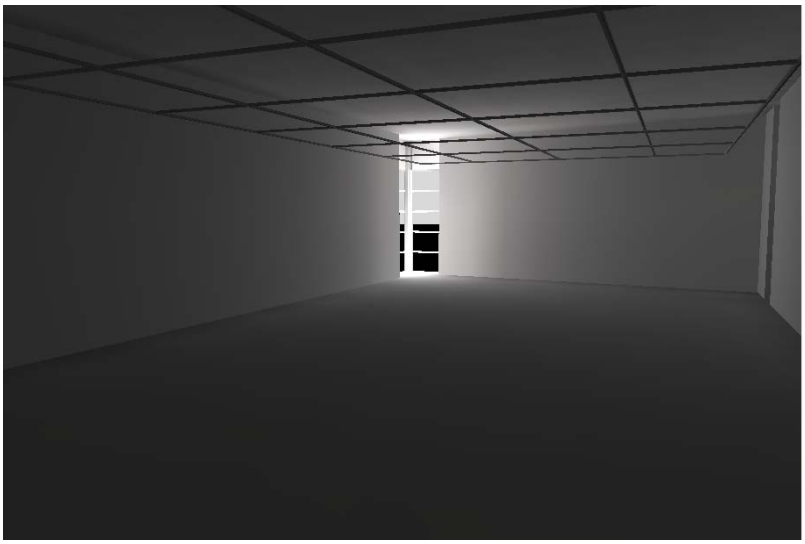
AGI Analysis:

Daylighting Analysis September 4th 11:00am

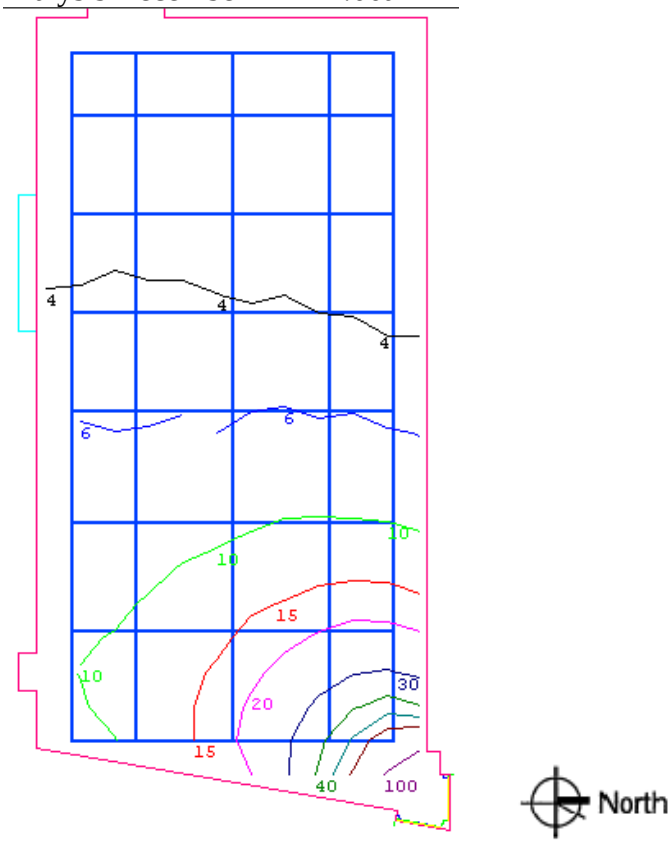


Illuminance Calculation Grid on Floor
Average: 34.4fc • Minimum: 3.5fc

AGI Rendering

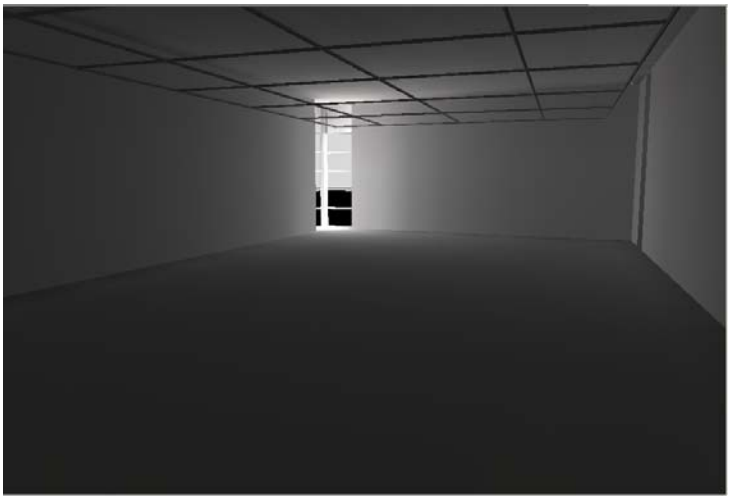


Daylighting Analysis December 27th 11:00am

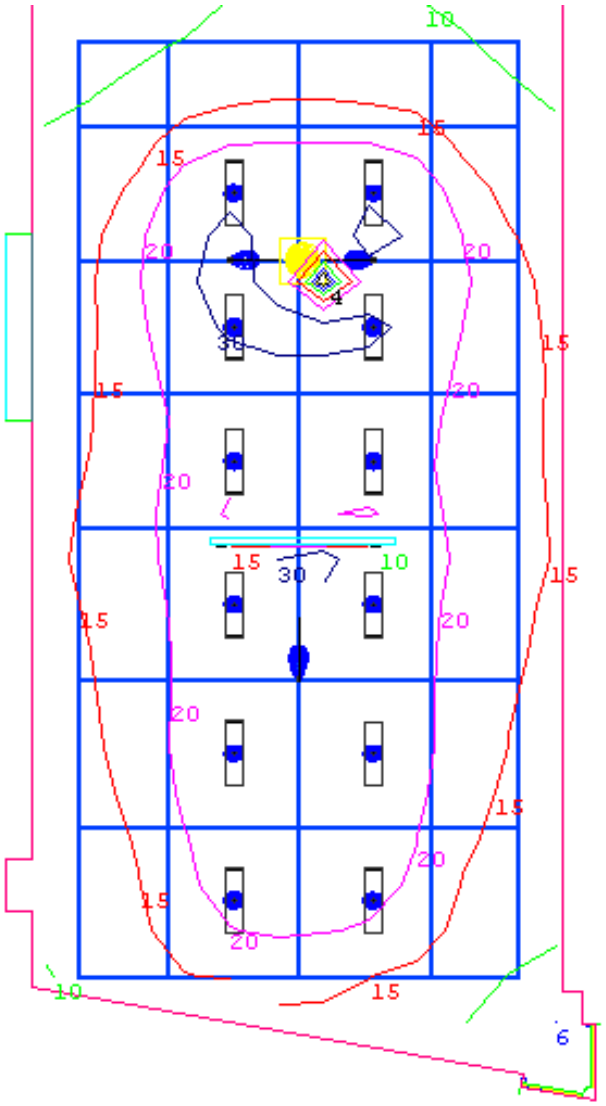


Illuminance Calculation Grid on Floor
Average: 11.3fc • Minimum: 2.4fc

AGI Rendering

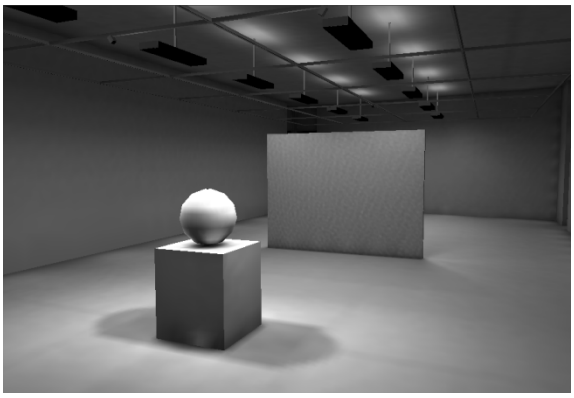


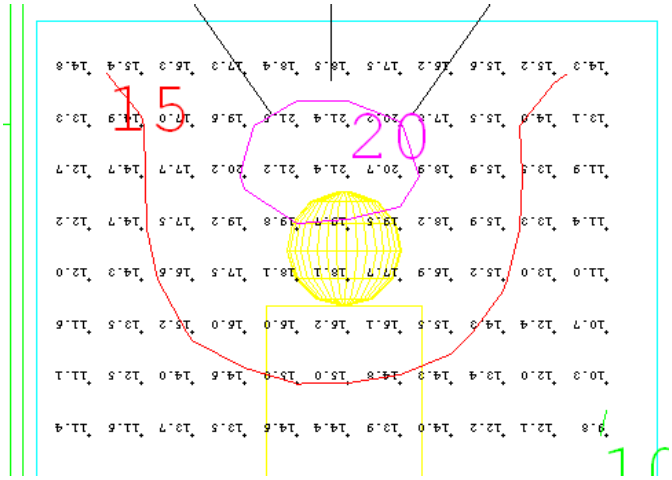
Electric Lighting Analysis:



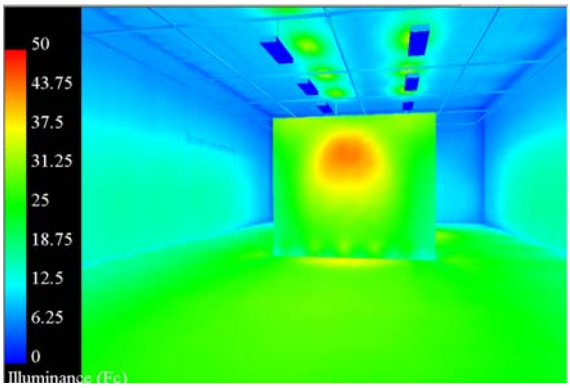
Illuminance Calculation Grid on Floor
Average: 17.5fc • Minimum 6.3fc

AGI Rendering

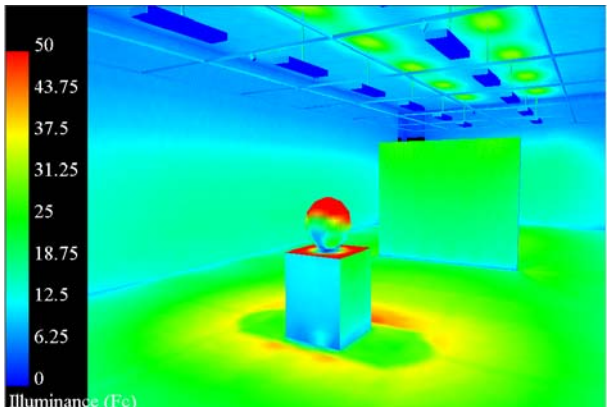




Illuminance Calculation Grid on Vertical Display
(12'wide by 9' high)from one track fixture
Average: 15.4fc • Max: 21.5fc • Minimum 9.8fc



Pseudo Color of Illuminance Levels on
a Vertical display from electric lighting



Pseudo Color of Illuminance Levels on
a Vertical display from electric lighting

Critique of Existing Lighting Design:

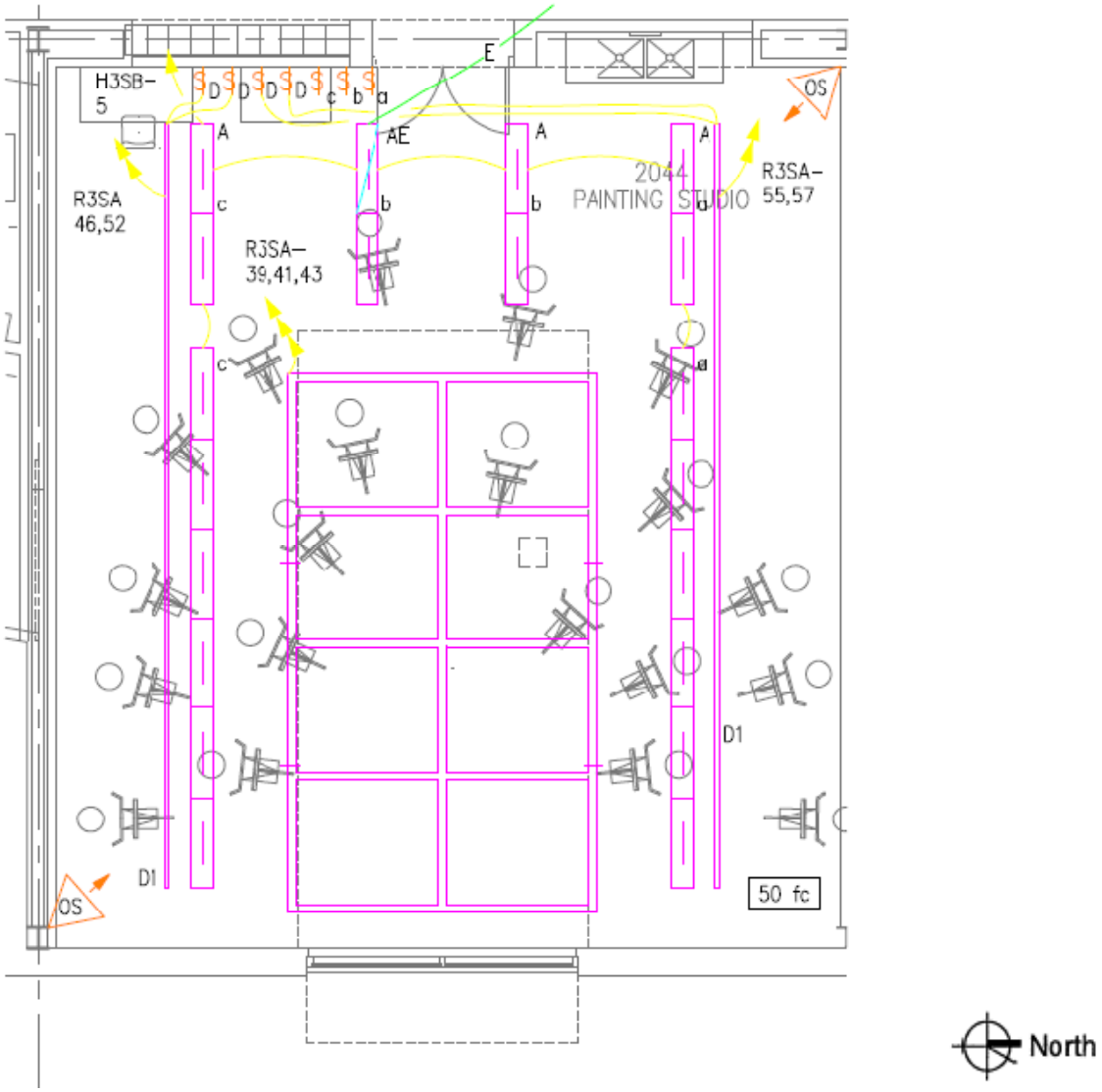
The existing lighting system comprised of a direct/indirect pendant fixture and track lighting fulfills certain portions of the design criteria and falls short or takes a different approach in other areas. The largest factor in this lighting design is the use of a large unistrut grid to mount the track lighting from. While this system does effectively provide accent lighting to the displays in the space it also clutters the space by creating a lot of activity in the ceiling area and also makes the space feel shorter. This clutter I feel takes attention away from the art on display and sends it upward at the uni-strut grid system. Since the indirect fixtures used have little up light (roughly 10%) the volume above the grid turns into somewhat of a “black hole”. I would abandon use of the suspended grid to open the space and to also help display the exposed mechanical and structural systems to create the industrial feeling which is desired. With use of dimming fixtures and multiple switching a flexible control system was created that can effectively light for many situations.

The overall system, although I did not model all of the track fixtures, would probably be well above target illuminances in the space On each horizontal piece of the grid there is to be 10 track head fixtures to be field installed. This would lead to an additional 80 fixtures in this space. This seems more than necessary for the size of the space and number of possible displays which could fit in the gallery. I presume that not all the fixtures are used at once and multiple scenes are set up within this space. Due to the large variability in how the track lighting fixtures are to be used it is misleading to come to a single conclusion about this space. However, I am going to assume that there are 4 different scenes set up that each have 20 track fixtures per scene.

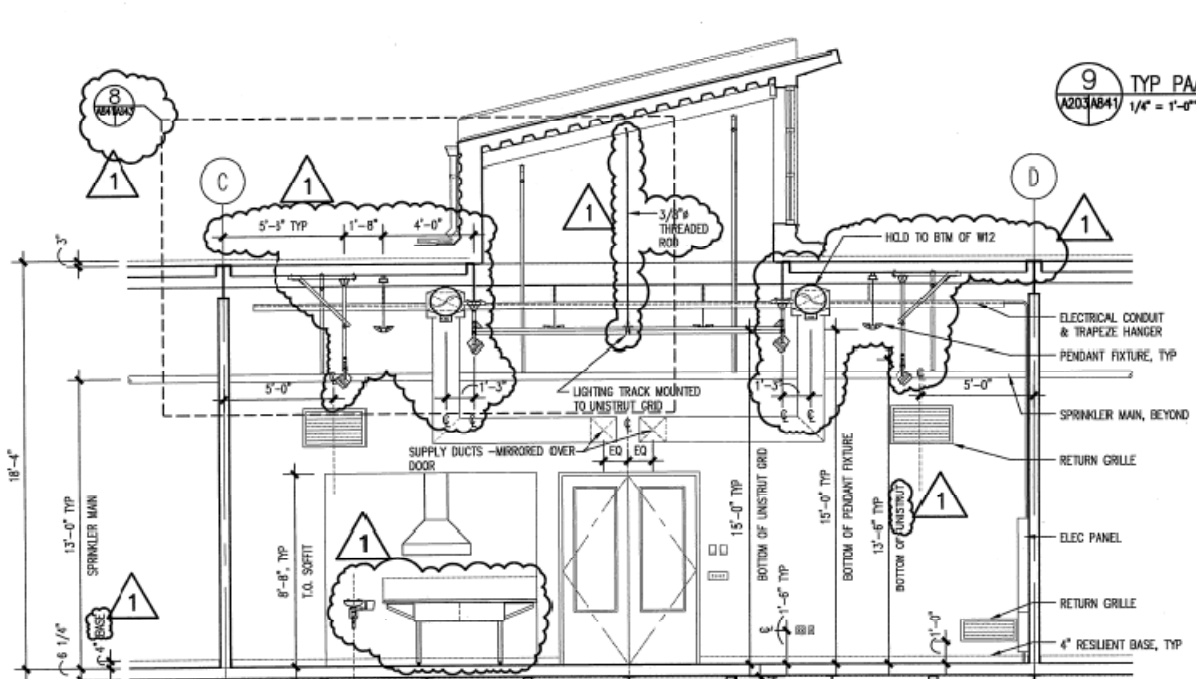
Painting Studio

The space I intend to use for my large work space is one of the Painting Studios (Rm 2046). The space is roughly 36'x41' in area with an exposed 16' ceiling. Another key feature to the space is the clear-story which allows additional natural light into the space. In this space the main activity is student's painting. The space appears to be quite open with the main furniture to be movable stools and canvases for painting purposes. There is also a stationary desk along the main wall along with a set of two sinks for cleaning paint supplies. Materials to be used in the space are painted GWB for the walls and then as stated before the ceiling is exposed.

Lighting Layout:



Section Looking West:



Luminaires:

	LIGHTING FIXTURES						
	FIXTURE TYPE	MOUNTING	MANUFACTURER	CATALOG OR MODEL NUMBER	LAMPS	VOLTS	REMARKS
	A	CABLE	PEERLESS	10CRM8-2-32-LENGTH-277-GEBRS-SCT-F2-24-C100-ACG (ALUMINUM FINISH)	TWO F32T8/835	277	TYPICAL STUDIO, OFFICE AND CLASSROOM LINEAR PENDANT. REFER TO ARCHITECTURAL DRAWINGS FOR LENGTHS & SUSPENSION HEIGHT.
	D1	SURFACE & UNISTRUT	LSI	ONE-CIRCUIT SURFACE-MTD TRACK WITH SILVER FINISH	N/A	120	TYPICAL CRITIQUE AREA TRACK. MOUNT ON SUSPENDED UNIT-STRUT. PROVIDE LENGTHS, FEEDS, CONNECTIONS AS REQUIRED FOR COMPLETE SYSTEM.
	DS	TRACK	LSI	290-00-S	ONE 100PAR/HIR/FL40	120	TYPICAL STUDIO TRACK HEAD. PROVIDE FIFTY (50) FIXTURES FOR INSTALLATION ON TRACK. LOCATIONS TO BE DETERMINED IN THE FIELD.

Light Loss Factors:

Luminaire Type	Maintenance Category	Room Atmosphere	Cleaning Cycle	Initial Lumens	Mean Lumens	LLD	Ballast Factor	LDD	RSDD	LLF
A	II	Clean	12 months	5900	5600	0.95	0.88	0.94	0.91	0.72
DS	V	Clean	12 months	2030		.97	1	0.89	0.97	.83
*RCR=4.9										

Lamps:

GE 100W Par38 Halogen Source Ordering Code# 100PAR/HIR/FL40
Philips 32W T8 4' Linear Fluorescent Ordering Code# F32T8/TL835/ALTO

Ballasts:

32W T8 Fluorescent
Advance Transformer Electronic Programmed Start
Catalog# VCN-2S32-SC

ASHRAE Standard 90.1 Power Allowances

Classroom/Lecture/Training 1.4W/ft^2
Area (35'x40')
Total Allowed Wattage 1,960W

Power Consumed with Existing Design

Indirect fixtures 1,280W
Track Lighting 7,000W (7 circuits of 10 fixtures at 100W each)

Controls:

Both automatic and manual controls are utilized in this space. Each circuit of track heads on linear track is on its own separate dimmer switch. Each column of linear pendants is also controlled individually. Occupancy sensors on opposite wall corners automatically control the lights.

Surface Finishes:

Floor:	Sealed Concrete 40% Reflectance
Walls:	Pure White-Benjamin Moore Pristine Eco Spec Interior Latex Flat 219 75% Reflectance
Ceiling:	Exposed structure (70%).

Furnishings:

No Furnishings in this gallery space

Design Criteria:

Tasks:

Teaching
Painting
Viewing Models/displays

Horizontal Illuminance

The IESNA handbook recommends 100fc on horizontal surfaces within a painting studio.

Vertical Illuminance

The IESNA handbook recommends 30fc on vertical surfaces within a painting studio

Apperance of Space and Luminaires [Very Important]

Important that the space is welcoming and that the space creates a feeling of creativity and ingenuity. The space and luminaires should have an artistic unique flare.

Color Appearance [Somewhat important]

Since the main task to be done in this space is painting, the color appearance should be similar to that of daylight to create a natural appearance.

Daylight Integration and Control[Very Important]

This is one of the most crucial criteria for this space. Large windows along the east wall in combination with an expansive clearstory allow a vast amount of daylight into the space. Control of this daylight is necessary to provide an easy, efficient working space.

Direct Glare[Important]

Direct sunlight during the morning hours is a source of a large amount of direct glare within this space.

Light Distribution on Task Plane [Very Important]

A uniform and bright light distribution is required on the task plane(easel) in this space

Luminances of Room Surfaces [Somewhat important]

Walls, exposed building systems need to be bright in order to create a feeling of spaciousness. Lighting these surfaces will “open-up” the space.

Modeling of Faces and Objects[Very Important]

It is key to bring out the texture, depth, shape of the objects to be painted

Source/Task/Eye Geometry[Very important]

Shadowing onto the students’ easels due to their bodies must be avoided to ensure a uniform lit working surface.

System Control and Flexibility

The lighting system should incorporate daylight sensors to allow automatic dimming during the day to save energy and keep from over lighting the space.

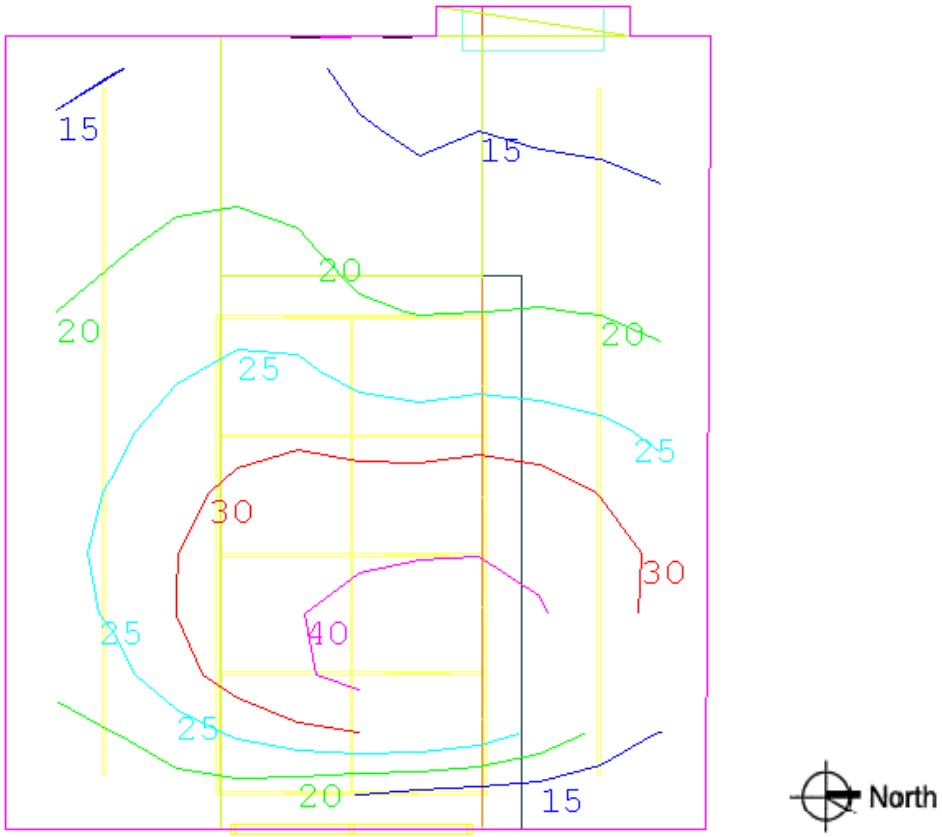
Another element essential to the controls is manual dimming to have the flexibility to create a particular aesthetic to the space.

Special Considerations[Very Important]

The stools and easels are not stationary. They could be arranged in any configuration. The lighting design needs to be able to accommodate this ever changing variable.

AGI Analysis

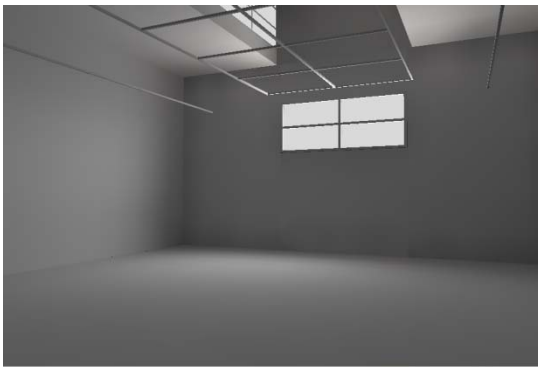
Daylighting Analysis September 4th, 11:00am



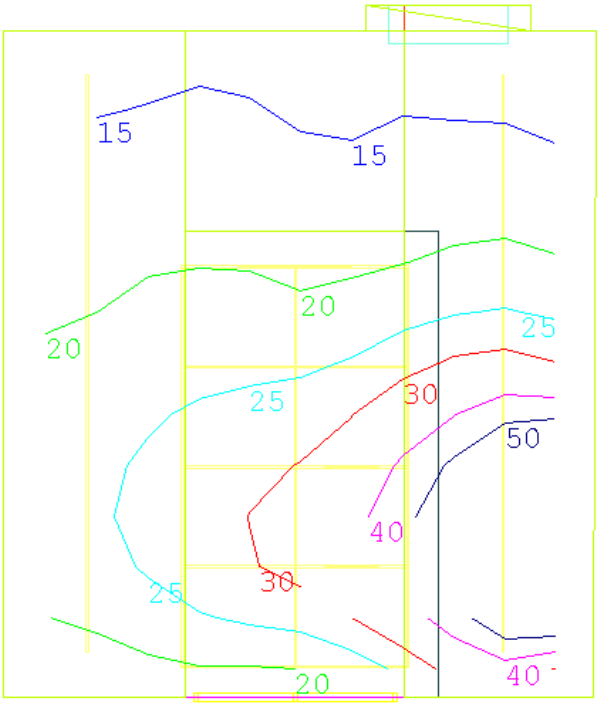
Illuminance Countours on Floor
Average 23.0fc • Minimum: 10.1fc

AGI Rendering of Clearstory

AGI rendering of general space conditions



Daylighting Analysis December 27th, 11:00am

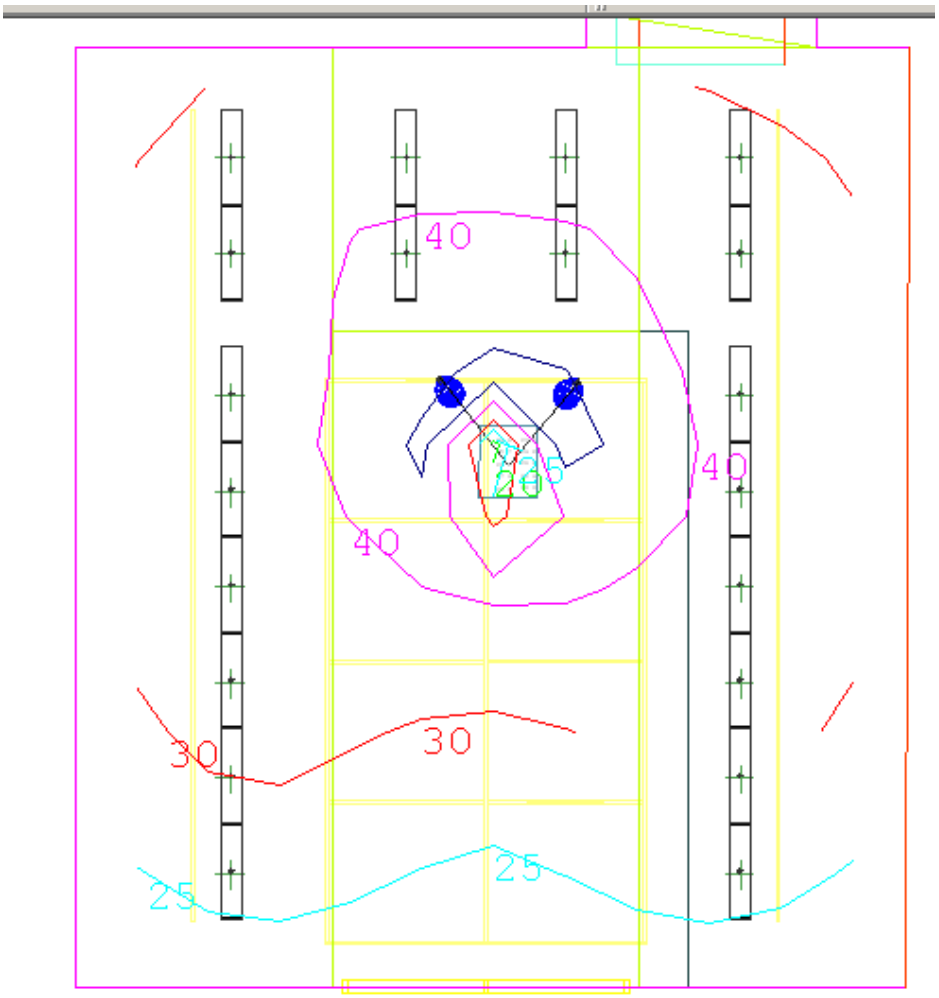


Illuminance Countours on Floor
Average 27.3fc • Minimum: 12.7fc

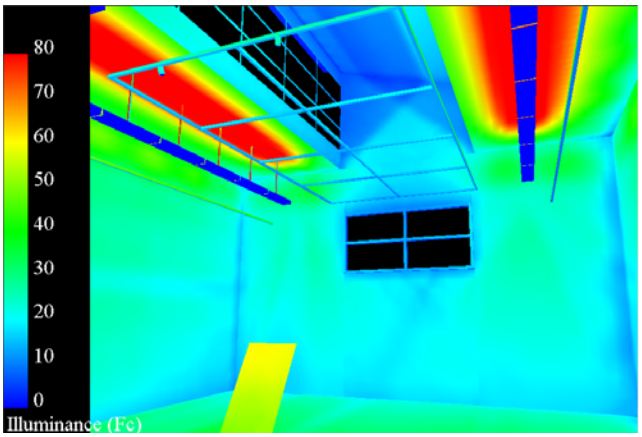
AGI Rendering of Clearstory

AGI rendering of general space conditions

Electric Lighting Renderings:



Illuminance Countours on Floor
Average 33.6fc • Minimum:17.6fc



Pseudo Color of Illuminance Levels
without daylight
Direct Illuminance Countours on work plane
Average 26.6fc • Minimum:23.5fc

Illuminance Levels
without daylight

Critique of Existing Lighting Design:
The painting studio utilizes the suspended track lighting on the uni-strut grid similar to that of the gallery space. In addition to track lighting an indirect/direct linear pendant fixture is used for ambient lighting. The track lighting is formed in a large grid and also in two long strips in the room. The track lighting allows for uniform work surfaces (usually easels) to be easily accomplished almost anywhere due to large flexibility of aiming and numerous sources lighting the same area. Although the unistrut grid and track lighting does provide an industrial feel to the space I feel that by introducing a suspended grid shrinks the space and makes it feel smaller than it is. This would be especially evident at night where daylight is no longer entering the clearstory which illuminates much of the upper portion. For this reason individual task lighting or another system may be a better solution. The indirect pendant fixture works well by providing general illumination by sending light upward. This creates a spacious feeling by creating a well lit perimeter and ceiling. Currently there is no acknowledgement to controlling the daylight which enters this space. As seen in the purely

daylight analyses, daylight can provide enough light to light the space for general use. However, depending on the time of year and time of day strong patterns of light can be produced on the wall from the direct sunlight. To help the users control their environment better I would incorporate some motorized shading system and have the clearstory controlled separately from the wall window. The current design does an effective job on have a flexible lighting system that can be controlled many ways by the use of dimmer switches and separate switches for each set row of fixtures. With track lighting supplementing the pendant lighting work plane foot candle levels reach in the neighborhood of 65-70. With the addition of daylight, total illuminance on the work plane is right around the targeted 100fc.

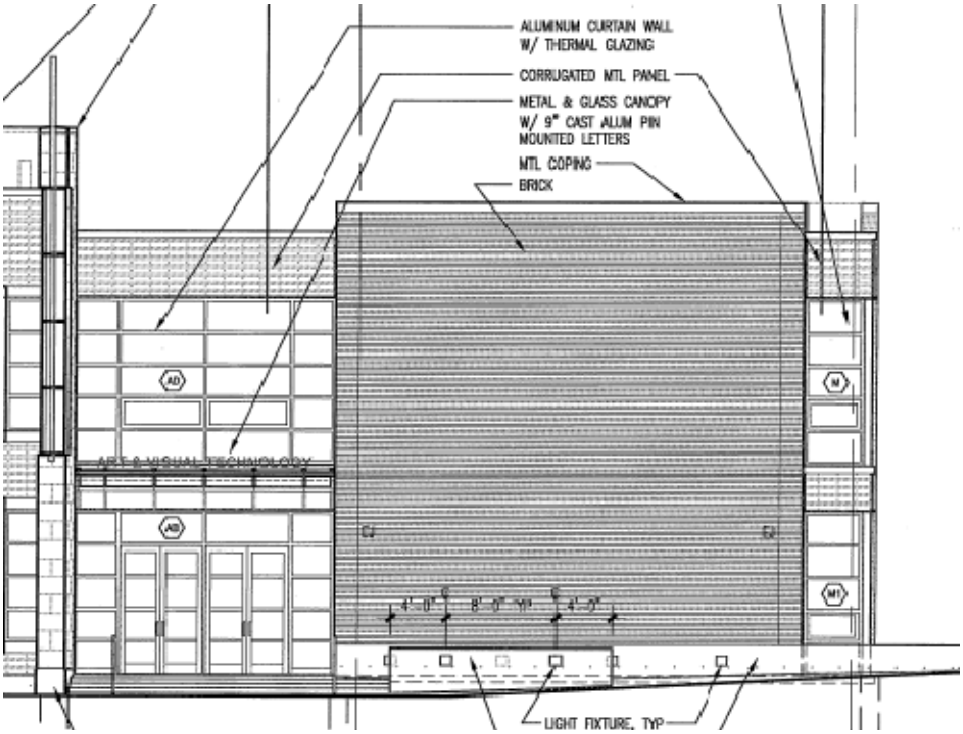
For this part of the assignment I chose to model a sample work easel with two of the track fixtures to analyze the performance. Similarly to the gallery, this space is scheduled to have a large quantity of track fixtures, seventy in total. Rather then creating a lot of easels and pointing the seventy fixtures at them, I thought it best to just do one case for the accuracy of the analysis.

Main Entrance Courtyard

For my exterior space I intend to use the main entrance courtyard area/façade. There is a curved wall that cuts through the building which delineates the main entrance. The wall that extends past the walkway is intended to showcase the department flag/logo. The main entrance itself has a canopy with the building name on it. Coming up to the building there is a set of stairs along with a ramp off to the right. This area that I have shown on the drawing has the opportunity to create a visually stimulating first impression of the building.

Lighting Layout:

Elevation of Main Entrance:



Luminaires:

	LIGHTING FIXTURES						
		MOUNTING	MANUFACTURER	CATALOG OR MODEL NUMBER	LAMPS	VOLTS	REMARKS
	X1	CONCRETE BASE	HESS AMERICA, SE'LUX	HESS–CA450–150–MH–7–A–13RT–SG SE'LUX–"RITORNO"" SERIES WITH SQUARE SHADE AND CUSTOM COLOR	ONE CMH150/T6/G12/3K	277	PEDESTRIAN PLAZA POLE FIXTURE
	X3	IN–GROUND	HYDREL, KIM LIGHTING, LUMASCAPE	M9420–A–P3035–277–WWD–ENTRIES –GEB–BL	ONE CMH35PAR30/FL30	277	
	X4	IN–GROUND	HYDREL, KIM LIGHTING, LUMASCAPE	M9410–A–32TRT–277–WWD–ENTRY–GEB–BL	ONE F32PLT/835	277	
	X5	RECESSED	GARDCO, FC LIGHTING, BEGA	946–C–32TRF–277–NP	ONE F32PLT/835	277	SCOOP–STYLE FLUORESCENT STEPLIGHT

Light Loss Factors:

Luminaire Type	Maintenance Category	Room Atmosphere	Cleaning Cycle	Initial Lumens	Mean Lumens	LLD	Ballast Factor	LDD	RSDD	LLF
x1	V	**medium**	**12 months**	**2200**	**1760**	**0.8**	**1**	**0.82**	**-**	**0.66**
x3	**V**	**medium**	**12 months**	**14,000**	**11,000**	**0.79**	**1**	**0.82**	**-**	**0.65**
x4	V	medium	12 months	2400	2040	0.85	0.98	0.82	-	0.68
x5	V	medium	12 months	2400	2040	0.85	0.98	0.82	-	0.68
***RCR=4.9**										

Lamps:

Philips 32W PLT compact fluorescent Ordering Code# PL-T 32W/835/4P/ALTO
Philips 35W PAR 30 FL Ordering Code CDM35/PAR30L/M/FL
GE ConstantColor 150W CMH T6 Ordering Code# CMH150TU/830/G12

Ballasts:

32W Compact Fluorescent
Advance Transformer Electronic Rapid Start
Catalog #RCF-2S-26-H1-LD-QS
35W CMH
GE CMH Electronic Ballasts
BLS/E/35W/CMH
150W CMH
GE CMH Electronic Ballasts
BLS/E/150W/CMH

ASHRAE Standard 90.1 Power Allowances

- Tradable Surfaces
  Walkways less than 10 feet Wide 1.0 W/linear foot
  Palaza areas .2W/ft^2
  Stairways 1.0W/ft^2
  Main entries 30W/linear foot of door width
  Canopies 1.25W/ft^2

- Non-Tradable Surfaces
  Building Facades 0.2W/ft^2 or 5.0 W/linear foot of illuminated wall

Power Consumed with Existing Design
1350W used along the walkway • 319linear feet = 319W available
96 W used in plaza are; • 1200ft^2 = 240W available

0 W used in stairways • 92ft^2 = 92W available
0W used in doorways • 12linear feet = 360W available
0W used in canopy • 225ft^2 = 281W available

Tradable Total

1444 W used • 1292W available

Non-Tradable Total

268 W used in façade lighting • 1350ft^2 = 270W available

Controls:

Exterior lighting is controlled through a time clock and photocell.

Surface Finishes:

Ground:	Concrete walkway, planter area
Pedestrian Walls:	Architectural concrete
Facade:	Corrugated Metal Paneling, Brick, Glass façade with aluminum mullions

Design Criteria:

Tasks:

Circulation

Horizontal Illuminance

The IESNA handbook recommends 0.5fc on horizontal surfaces at the main building entrance.

Vertical Illuminance

The IESNA handbook recommends 0.3fc on horizontal surfaces at the main building entrance.

Apperance of Space and Luminaires

The appearance of space and luminaires is very important.

Color Appearance [Important]

Use color appropriate fixtures when lighting façade. Cool temperatures when lighting the metal cladding and warmer temperatures for lighting any brick areas. Use temperatures with cooler temperatures to utilize scotopic/mesopic field of vision.

Light Distribution on Surfaces

Important to help with way finding to help those find their way to the main entrance of the building. This is achieved by having brighter sources as you get closer to the entrance.

Light Distribution on Task Plane

Important to create a uniform levels of light on walkway for safety. In particular the stairs in front of the main entrance need to be adequately illuminated to prevent a tripping hazard.

Modeling of Faces and Objects[Very Important]

As people walk by the building at night is important for them to be and feel safe. The modeling of faces and objects puts people at ease because they can see other people and other objects they are approaching.

Points of Interest[Important]

Points of interest in the façade courtyard area include the main entrance and glass/steel canopy with building name. Another key feature to the entry courtyard is the curved façade which creates the southern boundary to the main entrance space. Both of these features are to be illuminated for aesthetics and way finding. Finally, I would want to illuminate the display banner which is at the end of the curved façade. This is good opportunity to showcase the department and create a "beacon" within this area.

Direct Glare[Important]

As there will be many people traversing the site without going in the building it is important to provide adequate lighting along the walkway. All fixtures used to illuminate the walkways should avoid direct views of the lamp as glare more easily perceived at night.

Critique of Existing Lighting Design:

The existing exterior lighting system meets almost all of the technical requirements I produced. One area in which I would consider a different strategy would be the approach to the stairs. The current system doesn't address them. I would consider putting a fixture in the riser portion of the step or on the underside of the handrails. The current selection for the lamping of the X4 and X5 fixture I would change to a longer life source, most likely ceramic metal halide for the ease of maintenance and re-lamping. All the lighting in the courtyard area is on the pedestrian scale with low wattage sources lining the path up to the building. I think these are a good choice to light the walkways but, they fail to address lighting up any portion of the facade including the department display banner. In conjunction with that lighting the building name on the glass and steel canopy is another area in which I would like to address. This would help people identify where they were as well as identify what

building it is. In summary, the exterior lighting takes care of the technical needs of the building, safety and general lighting, but does little to enhance the building and department. A similar design taken the next step would yield a great result.