Technical Report 1

Christine Clowes
Lighting/Electrical Option
Faculty Consultant: Dr. Mistrick
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National Intrepid Center of Excellence | Bethesda, MD

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Table of Contents

Executive Summary

The following report provides a comprehensive analysis of the lighting design implemented in the National Intrepid Center of Excellence. At two stories and a total of 72,000 square feet, the building will be utilized as a state of the art facility for the research, diagnosis, and treatment of veterans with traumatic brain injuries and psychological health issues. In the coming pages, a general building critique is formulated, followed by the existing spatial and lighting conditions of four distinct spaces. These spaces consist of the following: exterior facade along Palmer Road South, lobby area from the vestibule to the reception desk, auditorium, and the open physical therapy, occupational therapy, and therapy waiting area. The current lighting designs are recorded along with specifically created design criteria for each space. A final evaluation and critique is available for each area.

The overall lighting design for these spaces seems minimal, but it provides necessary illumination and design concepts for a functional space. All of the spaces follow the common theme of an easy transition between spaces. This takes into consideration the user needs of low brightness and contrast throughout the building. Daylighting through the large curtainwall facade is efficiently employed by permitting a large amount of light to penetrate across the north-facing glass. Photosensors are effective in controlling the electric lighting in the space.

Through the analysis of each of the spaces, the addition of daylight and electric lighting provides adequate illumination onto the task surfaces. However, the unique architectural features and shape of the building create an unlimited number of design possibilities. The lighting should take advantage of these characteristics through additional accent lighting and more integrated and concealed fixtures.

The IESNA recommendations were followed fairly close (with the inclusion of daylight), and the power density exceeded ASHRAE Standard 90.1 in some areas, but made up for it in others. In further design, all lighting considerations including IESNA and ASHRAE standards will be accounted for.

General Building Lighting Evaluation and Critique

Overall, the lighting design for the entire building is very unique. The two distinct architectural areas of the building, the "bar" and the amorphous form, each have very different lighting designs. As the work area that consists of exam and medical rooms, the lighting for the L-shaped bar area is very practical. It consists of functional and specialty fixtures designed to meet illuminance criteria. The amorphous area contains more therapy and relaxation spaces, so the lighting is aimed more toward creating specific feelings or a certain mood in the area. The transition corridors try to combine these distinct concepts by using decorative and practical lighting.

For the relatively small building size, there is a considerable number of fixtures and luminaire styles utilized throughout the building. By decreasing these numbers, it will allow a cut in costs and also help the building flow better as a whole. Fixtures that are repeated or similar in various spaces unite the building.

A consistent color temperature throughout the spaces provides for a pleasant transition from one area to another. Ensuring that parts of the building are not too bright or high in contrast is very important. The lighting designer did a good job of taking the users' vision sensitive needs into consideration.

The control systems are appropriate. The general exam and office spaces utilize occupancy sensors with manual overrides, while the corridors are also on centrally controlled occupancy sensors. Most of the public therapy and exterior areas are on a timer switch with no local controls. Photosensors are utilized in the areas along the curtainwall to take advantage of the energy savings by using daylight.

Overall, the complete lighting strategy is commendable, but there are several areas that can be improved.

Outdoor Space

Palmer Road South Façade (North-Facing)

o Description

The north-facing facade is situated along Palmer Road South. The eastern portion of the elevation is flat and about 83 feet in length, while the central and western portion of the facade is a large curved wall with a total perimeter of 345 feet. Sidewalks line the road and wrap around the east facade to lead visitors around the campus. A U-shaped driveway directs cars to the building entrance. Here, a 22'x10' canopy extends toward the street protecting the entry doors.

o Drawings

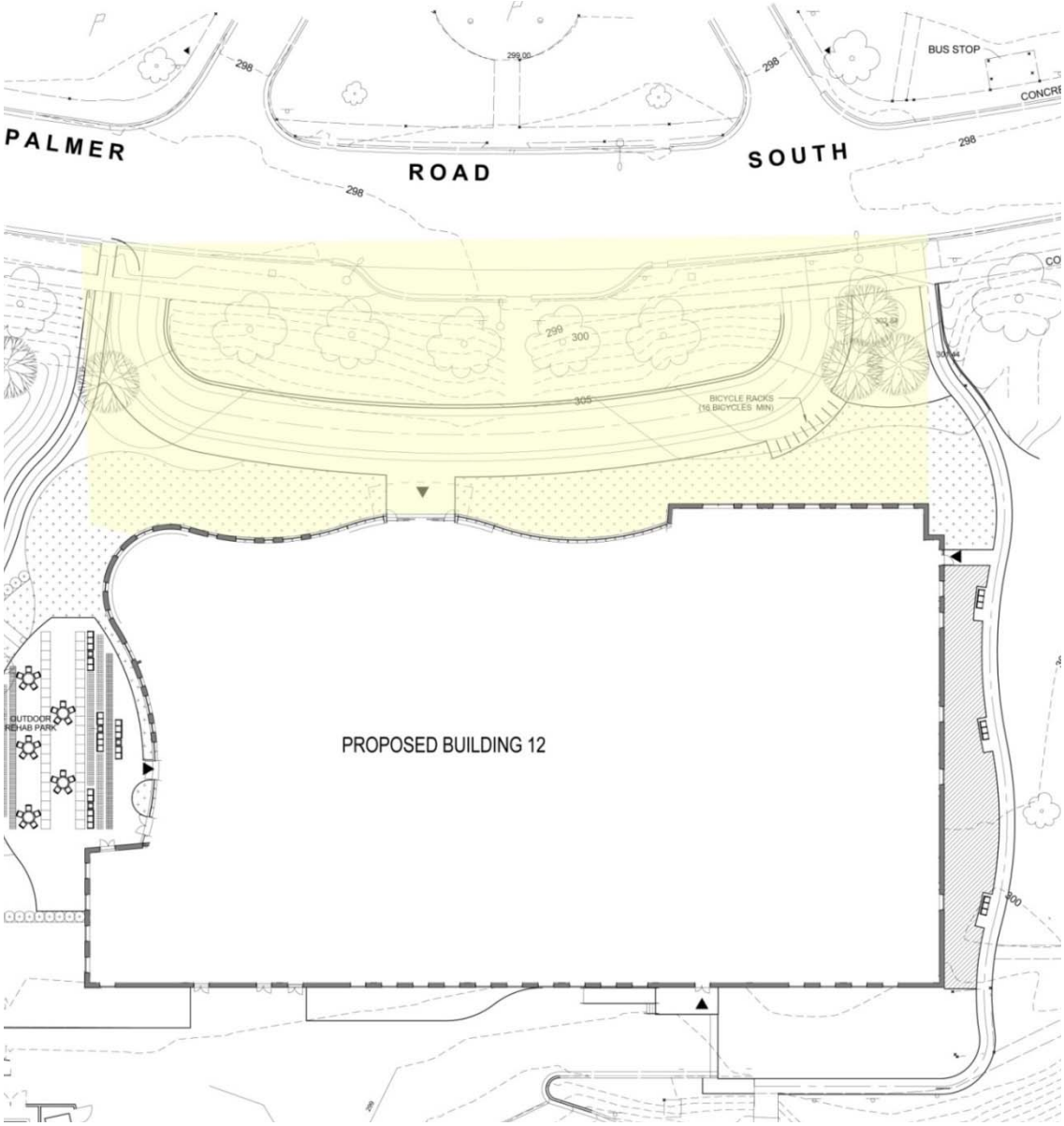


FIGURE 1: Exterior Location (NTS)

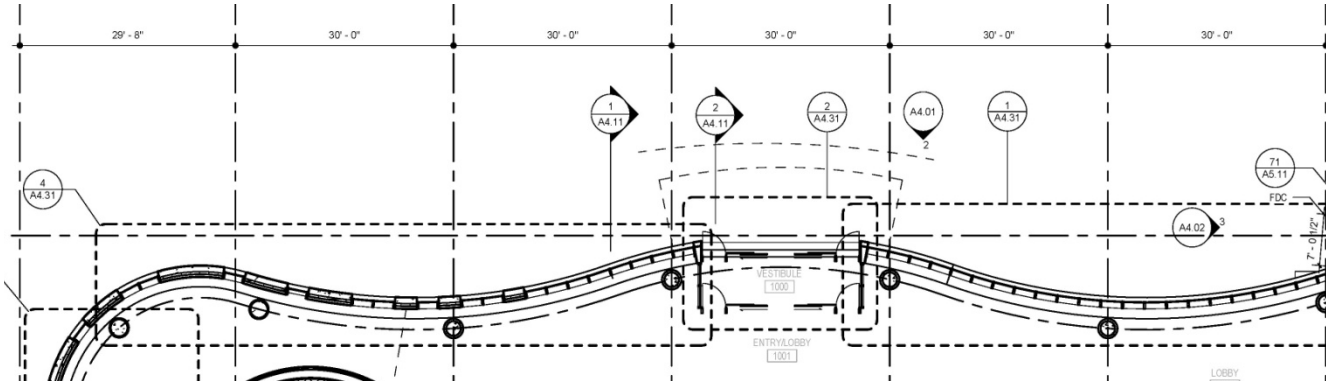


FIGURE 2: North Façade Dimensions (West Side) (NTS)

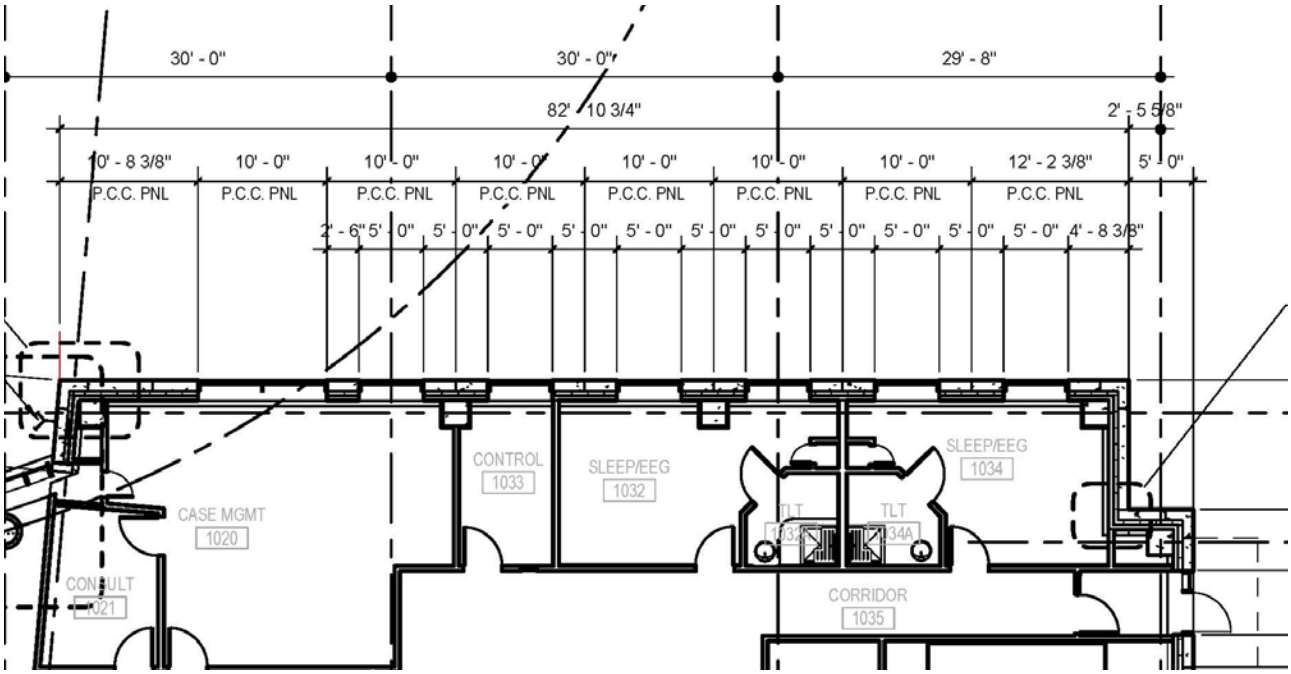


FIGURE 3: North Façade Dimensions (East Side) (NTS)

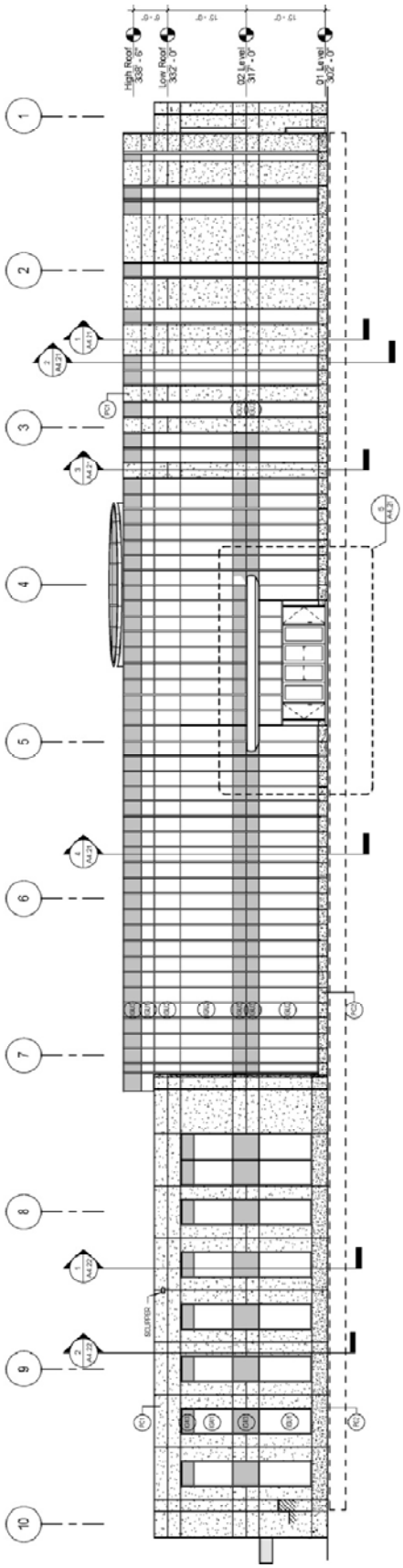


FIGURE 4: North Façade Elevation (NTS)

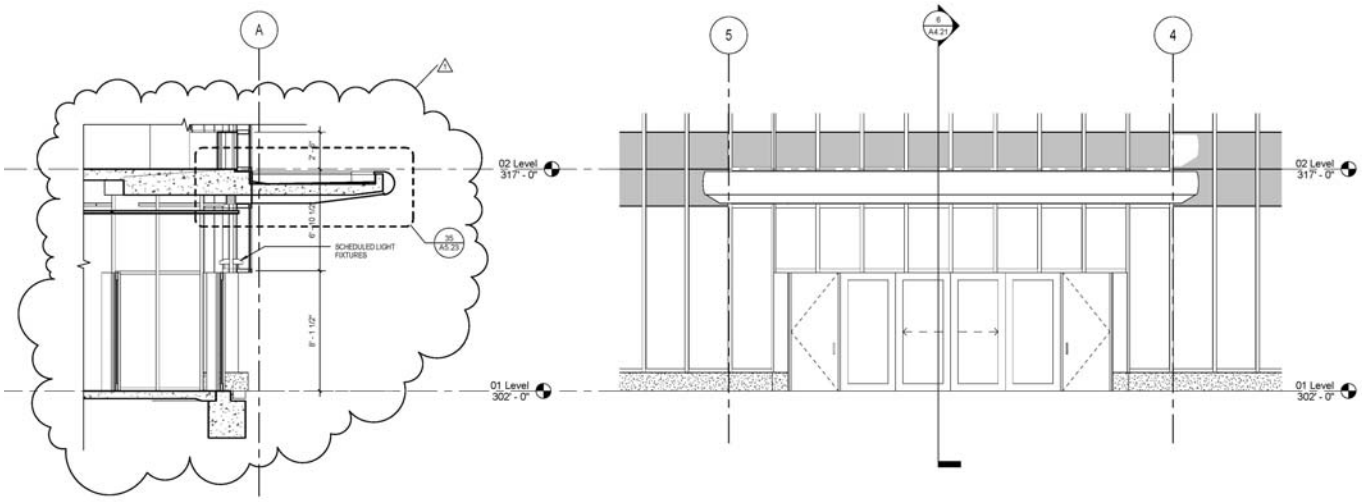


FIGURE 5: Canopy Section and Enlarged Elevation (NTS)

o Surface Materials

Facade - The east and west ends of the northern exterior wall system consist of architectural precast concrete punched with two story windows at the openings. On the east end of the facade, the windows consist of spandrel and clear vision glass. On the west end of the facade, these windows consist of spandrel glass at the top section of windows then (from top to bottom) a section of clear vision glass, and five sections of vision glass with ceramic frit. The curtainwall system located in the center of the northern facade provides four sided structural glazing with an aluminum framing system. The windows consist of spandrel glass at the top section of windows then (from top to bottom) a section of clear vision glass, two sections of vision glass with ceramic frit, two sections of spandrel glass, and a section of vision glass with ceramic frit.

Doorway - Two single aluminum doors with medium stile glass and double automatic sliding glass doors lead into the vestibule and lobby spaces.

Canopy - The canopy consists of a concrete structure covered with an aluminum plate cladding.

FIGURE 6: Material Properties

Material	Color/Style	Reflectance
PRECAST CONCRETE	CONCRETE / GRAY	0.45
ALUMINUM FRAME	ALUMINUM	0.86
ALUMINUM PLATE CLADDING	ALUMINIUM	0.86

FIGURE 7: Glass Properties

Material	Description	Transmittance	SHGCC	Shading Coefficient	Winter U-value	Outdoor Reflectance
IGU-1	CLEAR VISION GLASS WITH LGU-1 (LAMINATED GLASS) ON INTERIOR	63%	0.27	0.31	0.28	12%
IGU-2*	VISION GLASS WITH CERAMIC FRIT (40% COVERAGE) WITH LGU-1 (LAMINATED GLASS) ON INTERIOR	63% FOR GLASS 16% FOR DOTS	0.27 (FOR GLASS)	0.31 (FOR GLASS)	0.28 (FOR GLASS)	12% (FOR GLASS)
IGU-3	SPANDREL GLASS WITH LGU-2 (LAMINATED GLASS) ON INTERIOR	0% (FLOOR STRUCTURE)	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
	MEDIUM STILE GLASS (DOORS)	90% (ASSUME SINGLE PAIN CLEAR)	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE

*NOT ALL INFORMATION PROVIDED, SO ASSUMPTIONS MADE FROM COMPARISON TO OTHER PRODUCTS

o Furnishings

N/A

o Activities/Tasks

As an outdoor space, the front of the building is an entrance that should be inviting to visitors. People use the drive-through road in front of the entryway as a drop-off or pick-up area. The canopy over the front entrance is used to shield one from harsh weather conditions and sunlight. The sidewalks also provide a leisurely activity for patients.

o Lighting Design Criteria – IESNA Handbook: Building Exteriors, Entrances, Active

- Appearance of Space and Luminaires (Very Important)
  As a state of the art facility at the National Naval Medical Center, the lighting should reflect its importance. The lighting design should make the building standout and flow with the unique architectural features. Higher quality fixtures should be utilized to ensure superior performance. Light should be integrated into the site as a subtle feature through hidden fixtures. The glass should appear lit from within and emphasize surfaces that seem to glow (see Design Criteria for interior spaces). Traumatic brain injury patients are sensitive to high brightness and contrast, so these features should be mitigated as much as possible. The exterior of the building and the building entrance should be softly lit to provide a smooth transition to the interior.

- Psychological Impressions
  Strive for an impression of visual clarity throughout the area. Implement a bright, uniform lighting mode with some peripheral emphasis, such as lighting on the building façade.

  A feeling of relaxation should be the mood outside of the building. The lighting should be based on the concept of smooth verticality of the structure.

- Color Appearance (and Color Contrast) (Very Important)
  A mid to high range of CCT from about 3500K to 4000K should be specified in order to portray daylight. This will keep a consistent look of the building from day to night. The concrete, glass, and metal materials will better match the cooler tones of light. As mainly a transition and transportation space, a high CRI is not necessary. An average CRI of about 80 will be adequate around the building exterior. However, the color rendering will be appropriate for distinguishing between various colors at the site.

- Direct Glare (Very Important)
  Direct glare from the lamp sources should be eliminated by integrating the fixtures within the architecture to conceal the luminaires and through the use of glare accessories.

- Light Distribution on Surfaces (Important)
  Provide uniform, ambient light along walkways, roadway, and at the building entrance to provide for easy maneuvering and circulation around the site. Wash the concrete paneling on the façade to create light and dark shadows for a visually interesting feature. Appropriate luminaire spacing and window placement will create non-uniform levels on the vertical surface. Placing lights in the center of the façade's concrete panels with beams of light up and down will emphasize the long vertical pieces, making the building seem taller, in contrast to its very horizontal layout. Graze the metal canopy to uniformly illuminate the surface without creating reflected glare.

- Light Pollution/Trespass (Very Important)
  Avoid light pollution into the night sky by utilizing cutoff fixtures. Light building façade and architectural features from the top to avoid uplighting into the sky. Avoid spill light onto surrounding sites. Keep fixtures close to building with medium to narrow distribution to prevent light trespass.

- Modeling of Faces or Objects (Very Important)
  As main transition areas for people moving around the building, the entrance and pathways should adequately light the faces of users. This should be done through direct lighting from above and from the sides to emphasize features and expressions.

- Peripheral Detection (Very Important)
  People will continually be walking in and out of the building, and cars will be driving through. There should be adequate light to the left and right of a user walking along the sidewalk and under the canopy. This is a necessary safety feature at night so that one is aware of his/her surroundings at all times. Lighting on the site will also assist drivers in viewing people walking around the building.

- Point(s) of Interest (Very Important)
  The walkways and U-shaped roadway in front of the building should contain uniform ambient light for movement along the pathways. This will also serve as a transitional element to guide people around the site to the building entrance. Navigating around a large building, especially at night can be difficult in the absence of adequate light levels.

The entryway and canopy should also be illuminated to guide visitors into the building. This will make the entrance stand out not only as a tool for guidance, but also as an aesthetically pleasing architectural element to those passing by.

The unique architecture and curved façade should be emphasized by lighting the top edge of the building along the roof.

- Reflected Glare and Source/Task/Eye Geometry (Very Important)
  Avoid reflected glare from curtainwall façade. The abundance of windows makes it imperative for one to ensure that luminaires are not placed close to or directly aimed at the glass. This will disturb those working inside the building, people walking to and from the facility, and those driving in front of the entrance. Be sure that light around the metal canopy is also not aimed directly at the surface. The highly reflective material will create disturbing brightness.

- Shadows (Very Important)
  Shadows should be present around the building to create a visually interesting structure. The building façade should have dark and light areas to accentuate its unique architectural features. However, the pathways and building entrance should contain no shadows and provide a well-lit walkway.

- Sparkle/Desirable Reflected Highlights (Important)
  Sparkle can be created from within through sconces along the inner walls. This light will be visible through the glass curtainwall at night. Some reflected highlights include an intermittent washing of the façade and illuminating the curved features. Accenting some interior structural elements, such as the columns will be pleasing from the outside.

- Surface Characteristics (Very Important)
  The light colored cement walkways and entryway will diffuse the light throughout the surface. The metal canopy is highly reflective, so a little light will go a long way. The blacktop on the road surface will require higher light levels. The precast concrete façade will provide an easily luminated surface.

- Maintenance
  The fixtures should require little maintenance and have a long lamp life to reduce time between relamping. They should be rated to endure the variable weather conditions of Bethesda, MD. The fixtures should be fully enclosed (water-proof) to protect the lamp from weather and dirt. Fixtures should have simple relamping availability.

- Controls
  As an exterior space, there should be no local controls for the lighting system. All of the lighting should either be connected to a light sensor that switches the lights on when the sun begins to set, or on a timer that is connected to an astronomical controller. There should be an override switch located at the control panel. No dimming is necessary, and an all on/off setting is sufficient.

  Certain luminaires should also be designated as emergency fixtures, which will remain continuously on.

- Horizontal Illuminance (Very Important)
  The required horizontal illuminance is as follows (IESNA Handbook):
  - Entryway = 5fc
  - Walkways distant from roadways = 5 fc
  - Entrance and Exit Access lanes = 0.3 to 0.6 fc

  Deviations: none

- Vertical Illuminance (Very Important)
  The required vertical illuminance is as follows (IESNA Handbook):
  - Entryway = 3fc
  - Walkways distant from roadways = 5 fc

  Deviations: none

- Lighting Ratios (IESNA Handbook)
  - Luminance ratio should not exceed 20:1 between site and neighboring sites
  - Avg:min = 6:1 to 3:1

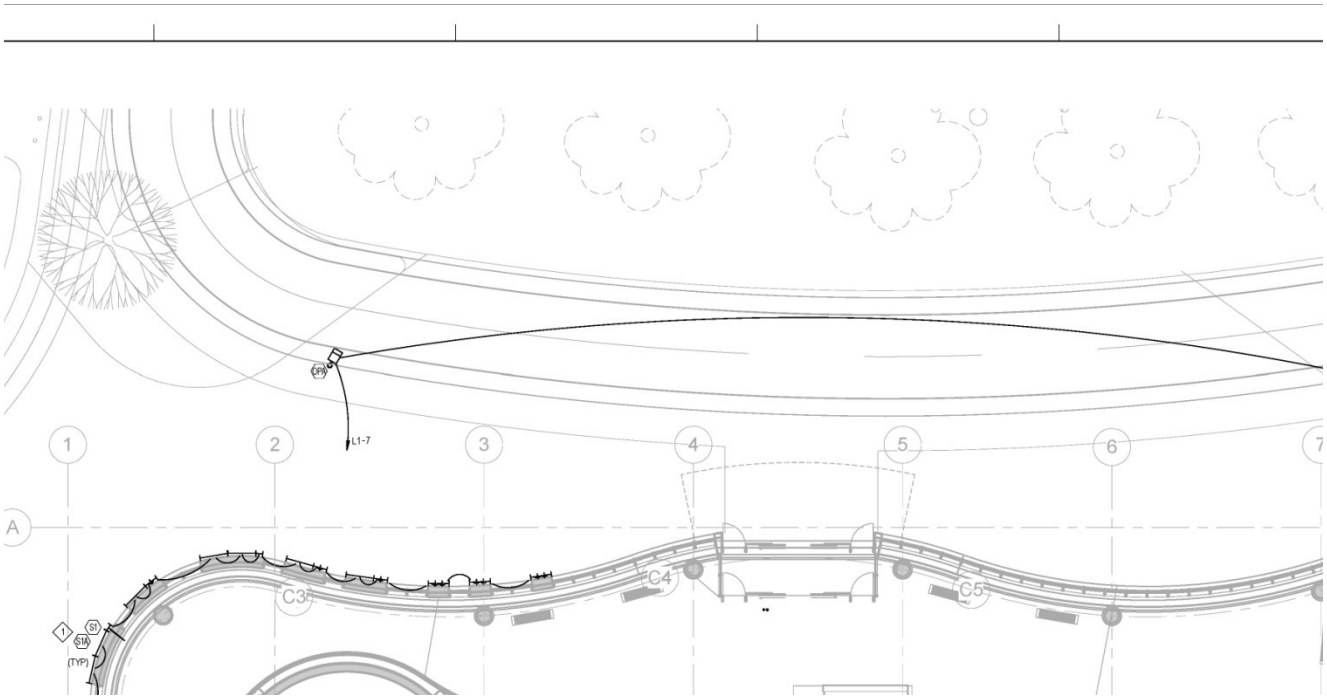
- Power Allowance
  The allowable power densities are as follows (ASHRAE 90.1 - 2007):
  - Walkways = 1 W/linear foot
  - Main Entry = 30 W/linear foot of door width
  - Overhang = 1.25 W/sq.ft.
  - Building Facade = 0.2 W/sq.ft. for each illuminated wall or surface or 5.0 W/linear foot for each illuminated wall or surface length

o Lighting Design

FIGURE 8: Exterior Rendering: Looking South (SmithGroup)

FIGURE 9: Exterior Rendering: Perspective Looking Southeast (SmithGroup)

FIGURE 10: Exterior Rendering: Section (SmithGroup)



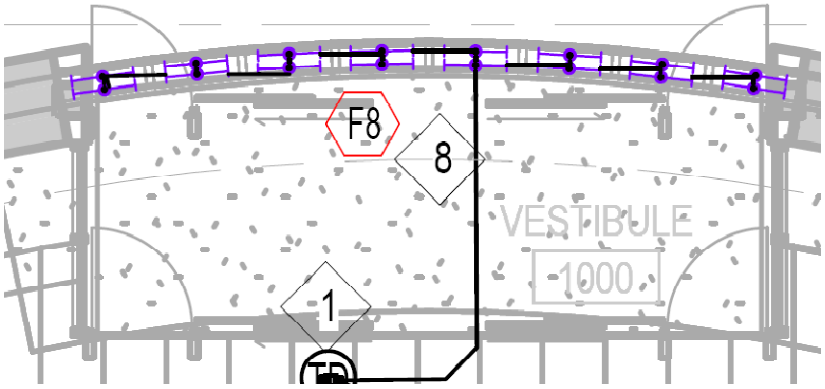


FIGURE 11: North Façade Lighting Plan (West Side) (NTS)

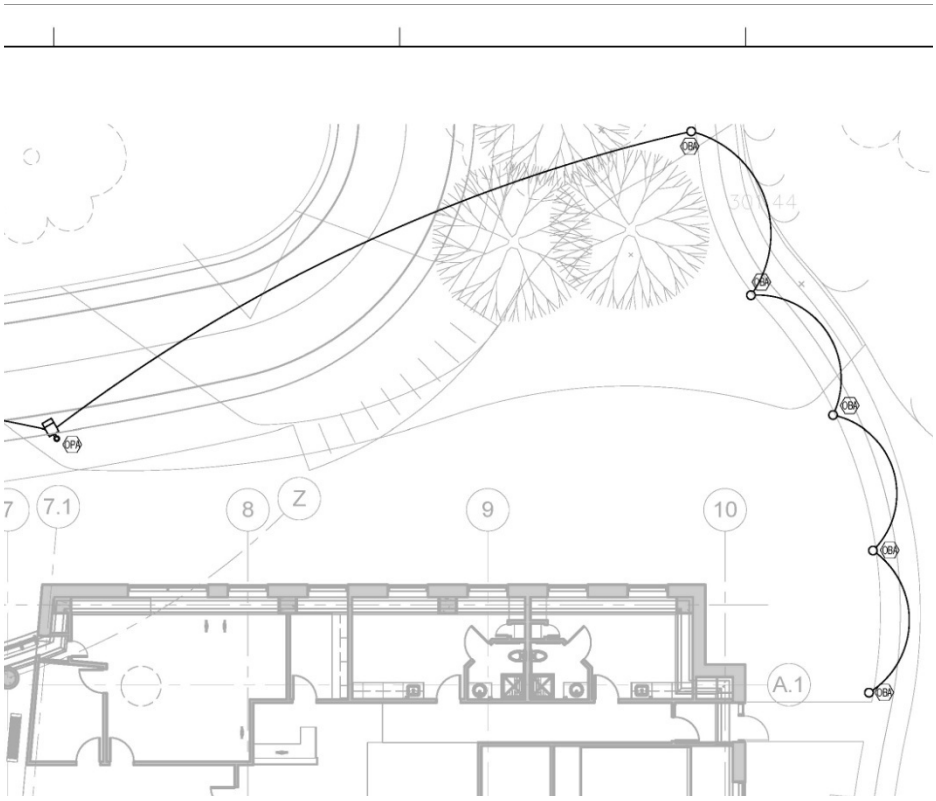


FIGURE 12: North Façade Lighting Plan (East Side) (NTS)

FIGURE 13: Luminaire Schedule

Type	Description	Manufacturer	Model	Wattage	Lamp	Voltage	Ballast/Transformer
F8	2' SURFACE COVE MOUNTED LINEAR FLUORESCENT ASYMMETRIC UPLIGHT	INSIGHT	COMPACT 5	24	(1) 24W T5HO 3500K	277	
OBA	EXTERIOR BOLLARD WITH DIFFUSING LENS, LOUVERS, AND 180 DEGREE DISTRIBUTION	BEGA	8143P-32W-CLK	32	(1) 32W CFL 3500K	277	
OPA	EXTERIOR METAL HALIDE POLE LIGHT WITH FULL CUTOFF TYPE III DISTRIBUTION	BEGA	8293MH-TYPE3	175	(1) MH175 ED17 3700K	277	
S1	1' EXTERIOR RATED LINEAR LED WITH INTEGRAL POWER SUPPLIES AND 10X60 DEGREE DISTRIBUTION	COLOR KINETICS	EW GRAZE POWERCORE	14.3	COOL WHITE LED	277	
S1A	4' EXTERIOR RATED LINEAR LED WITH INTEGRAL POWER SUPPLIES AND 10X60 DEGREE DISTRIBUTION	COLOR KINETICS	EW GRAZE POWERCORE	57.2	COOL WHITE LED	277	

FIGURE 14: ASHRAE Standard 90.1

Space	Total Area (sq.ft)	Total Watts	Allowable Lighting Power Density (W/sq.ft.)	Total Lighting Power Density (W/sq.ft.)
Exterior Canopy	220	384	1.25	1.75
Façade Lighting	1692	557.7	0.2	0.33
*Did not include walkway or road lighting because of continuation to exterior.				
		Total	1.45	2.08

o Daylighting

As an outdoor space, daylighting will always be present on the facade.

o Lighting Controls

The exterior lighting will be connected to a time controller. It is on a 7 day, 24 hour programmability with solid-state astronomical control.

o Lighting Evaluation and Critique

A curtainwall system lines a majority of the northern facade of the building. Since it is very difficult and not recommended to light glass, there are only select portions that are available to light. Therefore, the lighting design is very simplistic, but functional. Mid to upper range CCT values were utilized in order to prepare a closer match to daylight conditions. Time clock control is a sensible solution to exterior fixtures that do not require local switching.

Concrete panels located on the west end of the facade are washed with linear LED fixtures from the bottom to the top. This creates a very visually interesting feature, that shows contrast and texture. However, the light only extends up the facade to the floor of the second level, making the building seem even shorter than its minimal two stories. The very horizontal facade may benefit from a lighting design that makes the structure seem taller. In addition, the concrete panels on the east side of the north facade receive no exterior lighting. This makes the front of the building seem very unbalanced. Also, the uplight into the night sky may not follow the sky glow standards.

The canopy over the main entrance is washed with a linear fluorescent uplight. This provides a uniform wash on the metal overhang, allowing it to stand out among the surrounding glass facade. Although, a light with a little more output would also make the entry stand out more. Linear fluorescents are also not normally conducive to harsh temperatures, so another type of lamp may be more suitable.

Interior lights that are operating at night also produce a very visually stimulating lighting design.

The allowable power density is slightly than that allowed by ASHRAE 90.1, however, savings in other spaces will make up for it.

General, but functional lighting is used to illuminate the walkways and pull-through driveway in front of the building. Although, not as aesthetically pleasing, they provide adequate illumination and are a practical solution.

Circulation Space

Lobby (includes Entry / Lobby, Vestibule, Info Desk, Coffee Shop, and Reception Desk)

o Description

As the main circulation space of the building, the lobby is occupied by all who enter. It is located on the first floor of the amorphous section of the building along the north facade facing Palmer Road South. All of the walls, except for that to the east, are curved in shape.

Upon entering this irregularly shaped space, one first passes through the vestibule, as the main transition space between the exterior and interior. Two single doors on either side of the vestibule allow access to the main entryway. The Break Out Area is located to the west of this space, and entrances to the Auditorium and Media "Dive" Room are south. An information desk, coffee shop (includes kitchen area and countertop), and reception desk (includes cabinetry) are also located within the area. Other spaces, including corridors and the Interior Lobby branch off of the space to the east and south.

o Drawings

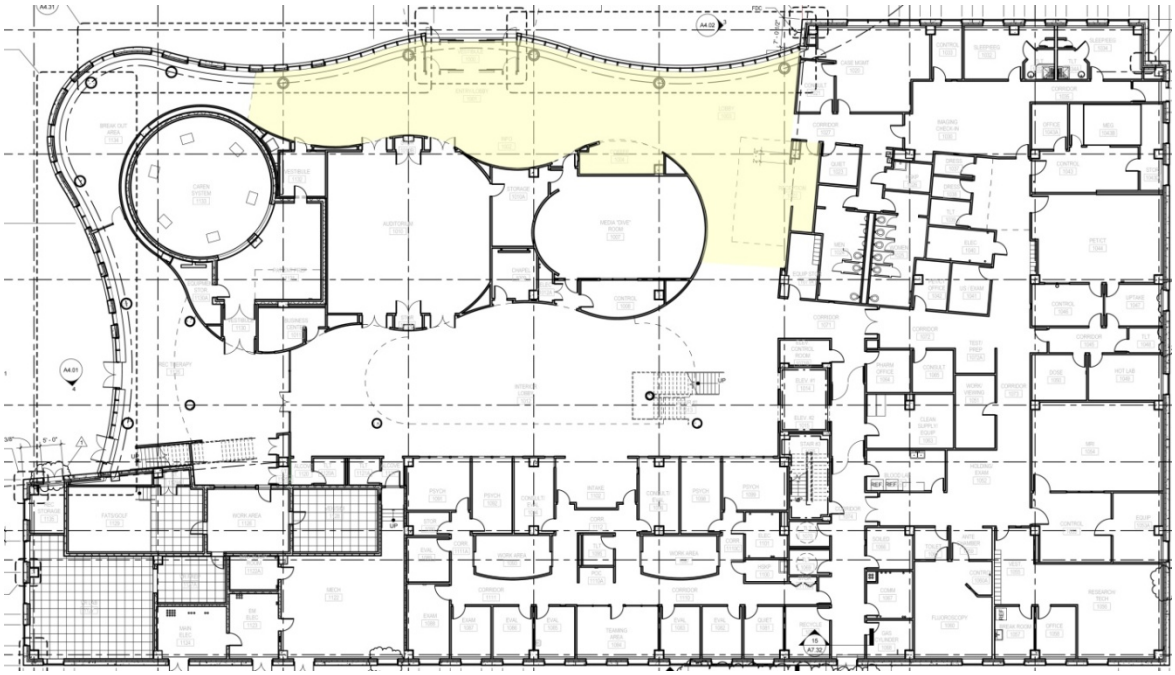


FIGURE 15: Lobby Location (NTS)

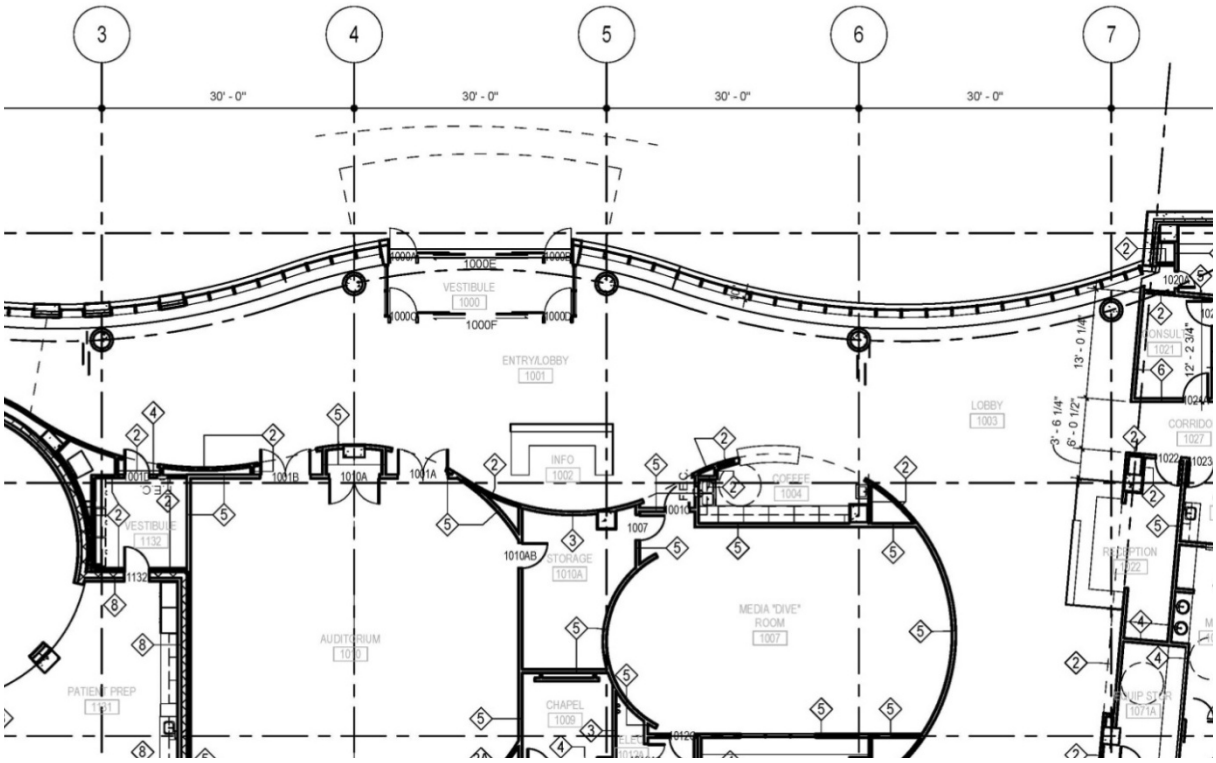


FIGURE 16: Lobby Floor Plan (NTS)

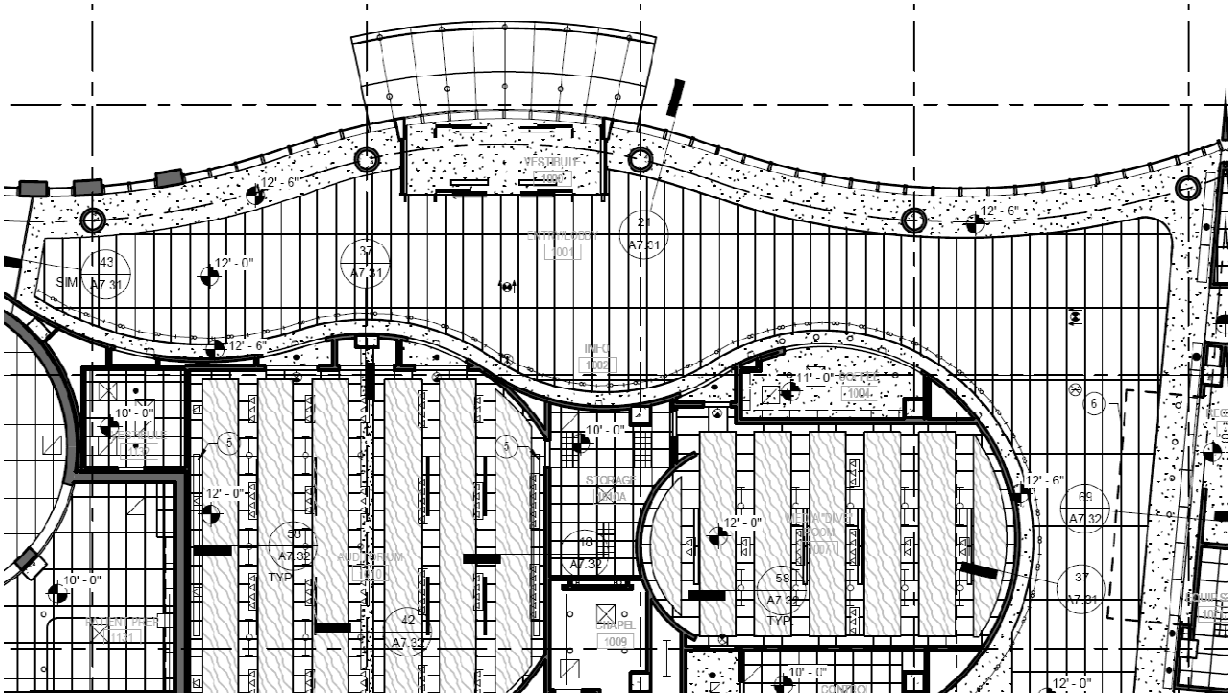


FIGURE 17: Lobby Reflected Ceiling Plan (NTS)

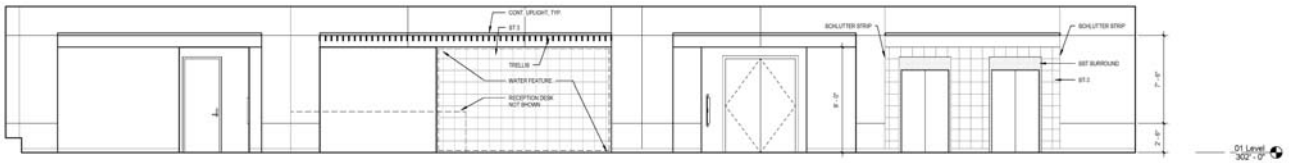


FIGURE 18: Lobby Interior South Elevation (NTS)

FIGURE 19: Lobby Interior East Elevation (NTS)

o Surface Materials

Entry/Lobby

Floor - The floor consists of slat defend and ESD control static dissipative tile (ST-1,2) in the area of the lobby surrounding the vestibule and extends to the eastern edge of the coffee shop. From this point throughout the rest of the space carpet tile (CPT-1) is used.

Base - A solid wood base satined to match the adjacent surfaces (WDB-1) is utilized.

Walls - Most of the interior wall surfaces consist of a wood veneer wall covering (WC-1) with painted (P-1) aluminum at the raised ceiling along the perimeter wall. The exterior wall is comprised of a curtainwall system with an aluminum framing system. The glass is vision glass with ceramic frit with a small section of spandrel glass lining the top portion. A water feature is present along the 12 foot span of wall adjacent to the reception desk. At a height of 10 feet from the floor, a trellis spans the length of the wall behind the reception desk and water feature.

Ceiling - The center of the space consists of 24"x96" acoustic ceiling tile (ACT-1) while the raised ceiling along the perimeter wall is painted gypsum wall board.

Vestibule

Floor - The floor consists of a stainless steel entrance mat (EM-1).

Base - A metal base (MB-1) lines the perimeter of the lower wall.

Walls - Two aluminum doors with medium stile glass on each side of the north and south walls. Double automatic sliding glass doors are also present on the north and south walls.

Ceiling - The ceiling is gypsum wall board (GWB-1).

Coffee Shop

Floor - The floor is composed of slat defend static dissipative tile (ST-1).

Base - A static wood base stained to match the adjacent surface (WDB-1) is continued around the perimeter.

Walls - The walls match that of the rest of the lobby space with a wood veneer wall covering (WC-1) and painted (P-1) aluminum at the raised ceiling along the perimeter wall. Kitchen cabinets cover most of the wall space in this area. Plastic laminate (PL-1) is located above the cabinets.

Ceiling - The ceiling is covered with painted gypsum wall board (GWB-1).

Reception

Floor - The floor is covered with carpet tile (CPT-3), as a continuation from the other lobby area.

Base - The base is wood that is mdf painted to match the adjacent wall surfaces (WDB-2).

Walls - The walls are painted a color yet to be determined (P-1).

Ceiling - The ceiling is covered with painted gypsum wall board (GWB-1).

FIGURE 20: Material Properties

Material	Color/Style	Reflectance
CPT-1	PRAIRIE 59525 / DRFTWOOD 23750	0.3
CPT-3	BEIGE	0.4
EM-1	STAINLESS STEEL ENTRANCE MAT	0.7
ST-1	BROUGHTON MOOR HONED	0.3
ST-2	BROUGHTON MOOR HONED	0.3
MB-1	METAL BASE	0.6
WDB-1	WOOD BASE	0.3
WDB-2	WOOD BASE	0.3
WC-1	WOOD COVERING	0.3
P-1	CREAM	0.7
PL-1	RED LAMINATE	0.5
ACT-1	ULTIMA WHITE	0.8
GWB-1	PAINTED P-11 - EXTRA WHITE	0.8
ALUMINUM FRAME	ALUMINUM	0.86
WOOD DOORS	STAINED WOOD	0.2
DOOR FRAME	PAINTED P-1	0.65

FIGURE 21: Glass Properties

Material	Description	Transmittance	SHGCC	Shading Coefficient	Winter U-value	Outdoor Reflectance
IGU-1	CLEAR VISION GLASS WITH LGU-1 (LAMINATED GLASS) ON INTERIOR	63%	0.27	0.31	0.28	12%
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IGU-3	SPANDREL GLASS WITH LGU-2 (LAMINATED GLASS) ON INTERIOR	0% (FLOOR STRUCTURE)	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
	MEDIUM STILE GLASS (DOORS)	90% (ASSUME SINGLE PAIN CLEAR)	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE

*NOT ALL INFORMATION PROVIDED, SO ASSUMPTIONS MADE FROM COMPARISON TO OTHER PRODUCTS

o Furnishings

Benches line the exterior curtainwall on each side of the vestibule. In the northeast corner of the space, small tables and chairs provide additional lobby seating as well as a workspace. The Info and Reception desks are both furnished with chairs and computers. The Coffee area includes basic kitchen necessities.

o Activities/Tasks

As the main circulation space in the building, the lobby should help to guide people to their destination. Building users will pass through the space to reach their destination, or sit at the benches or tables to rest. At the Info and Reception desks newcomers will speak with the building employees to gain information. Normal desk activities such as reading, writing, and computer work will be prevalent. The Coffee station will require beverage preparation and service. One may also pass through the space to view and enjoy its unique features.

o Lighting Design Criteria – IESNA Handbook: Health Care Facilities, Lobby

- Appearance of Space and Luminaires (Important)
  When entering the building, the lobby is the first space in which the occupants experience. Many of the visitors will be patients as well as high ranking government and military officials who will expect high quality from this state of the art facility. The building should reflect this characteristic through high end and/or concealed fixtures. The lighting design should also be functional and provide adequate lighting for numerous tasks. This transitional space should not be extremely bright or have high contrast in order to accommodate for the sensitivities of traumatic brain injury patients.

- Psychological Impressions
  The impression of pleasantness should be present throughout the space. A uniform lighting mode with some peripheral wall emphasis should be implemented.

Many of the visitors in the space will be patients coming for treatment or analysis. The mood should be very calm and relaxing to ease nerves or tension. A concept of water or flowing natural materials is applicable.

- Color Appearance (and Color Contrast) (Very Important)
  A low CCT would naturally complement the wood walls throughout the space, however, there is also a lot of natural daylight (cooler CCT) that enters the space. In order to accommodate for both of these features, an average CCT of about 3500K is desirable. This will accent skin tones, as well. A high CRI is important in order to impress occupants and accurately see materials and objects throughout the space.

- Daylighting Integration and Control (Very Important)
  The curtainwall system lining the northern wall of this space provides a large amount of light during the day. Since the glass faces north and a majority of it consists of ceramic frit, direct sun angles are easily avoided. The abundance of light allows for little electric light to be needed in the space during the daytime. Photosensors are necessary to control ambient electric lighting through dimming the fixtures. The time of day and amount of light present in the space determines the necessary dimming levels.

- Direct Glare (Important)
  For adequate and comfortable usage of the space there should be no direct glare viewable by the users. This is especially important for patients with traumatic brain injuries because they are extremely sensitive to brightness. Direct glare from the lamp sources should be eliminated by integrating the fixtures within the architecture to conceal the luminaires and through the use of glare accessories.

- Flicker (and Strobe) (Very Important)
  As a facility for patients with traumatic brain injury, the users are very sensitive to brightness and contrast, so flicker and strobe from lights should be avoided at all costs. However, the space will just be used as a transition area, so rapid movement will not be present. Therefore, flicker will not be as noticeable, but the avoid the use of magnetic ballasts whenever possible.

- Light Distribution on Surfaces (Very Important)
  Light distribution on the wood walls should be horizontally uniform, but vertically transition from bright to dark. A gradient of vertical illumination around the columns focuses on the depth and height of the features. Non-uniformity across other vertical surfaces and the ceiling will create visual interest.

- Light Distribution on Task Plane (Uniformity)
  There are several task planes throughout the space, which include the information desk (reading and writing), coffee counter, reception desk (reading and writing), tabletops (eating, reading, and writing), and floor (walking). The locations should include uniform light distribution that provides the recommended light levels. Overhead lighting positioned to the sides is suggested.

- Luminances of Room Surfaces / Surface Characteristics (Very Important)
  Highlight the wood walls throughout the space through wall grazing. The elevated ceilings along the perimeter provide a built-in cove that will easily house fixtures to illuminate and emphasize the beautiful texture of the material. Round columns are scattered throughout the space and provide an interesting architectural feature that exposes some of the building's structural content. Lighting these elements will

create visually pleasing elements. The unique curved geometry should draw attention as well. Lining some of the smooth edges with a clean line of light or uniformly grazing them will enhance such character.

- Modeling of Faces or Objects (Very Important)
  At the many specialty areas throughout the space, there will be constant interaction between people. Facial expressions and hand motions are necessary for successful communication. Appropriate light levels will also enable TBI patients to easily interact with others. Some direct downlighting as well as sidelight from the windows or sconces is appropriate.

- Point(s) of Interest
  One of the main points of interest in the space is the vestibule, which should have appropriate lighting in order to distinguish it from the rest of the facade. Since it is located in the center of the continuous glass curtainwall, lighting should be used to make the area stand out. As an all glass structure, light should be integrated to make the material glow or stand out in a subtle way.

  The information desk is one of the first items that is seen when entering the space. Building newcomers should first approach this area to gain assistance in navigating the building. Overhead lighting or fixtures integrated in the furniture should catch visitors' attention so they immediately know the areas' purpose.

  The coffee area should have general lighting to serve customers. Countertop or under cabinet lighting will assist in adequate vision while making and distributing beverages. The serving counter should be well illuminated to exchange money, read, or write.

  The corner area that contains tables and chairs should be a comfortable and inviting place for occupants to sit and relax, socialize, read, etc. The space should contain task lighting, but have a lower lighting level than the main circulation area so that visitors feel at ease and not in the spotlight.

  As one of the interest points in the space, the reception desk should provide users with a good impression of the facility. Attractive lighting features behind the desk should be functional and pleasing to look at. The water feature located to the right of the desk should contain water that lights the attraction from behind to create an exciting visual effect. A trellis is located above the reception desk and creates an opportunity for a subtle glow of light from within the structure.

- Reflected Glare and Source/Task/Eye Geometry (Important)
  Avoid reflected glare from windows and tabletops. The abundance of windows throughout the space makes it imperative for one to ensure that luminaires are not placed close to or aimed at the glass. Tabletops may have a glossy finish, so place lights at a reasonable height and choose fixtures with glare control. For built-in tables, place light fixtures to a user's left or right, not directly in front of or behind. Attention to placement of direct fixtures is necessary in order to avoid reflected glare from the glossy floor material.

- Shadows
  Shadows should be avoided on the task planes, such as the information desk, coffee counter, reception desk, tabletops, and floor. However, shadows on the ceiling or walls would be visually interesting. The raised ceiling near the curtainwall provides a very unique and mysterious feature to the space, as one wonders what is above.

- Sparkle/Desirable Reflected Highlights (Important)
  There should be some form of sparkle throughout the space to catch a user's attention. Sconces can be utilized along the walls around doorways to adjacent spaces. This creates an additional functional quality. Highlights through visually appealing lighting effects around the info and reception desk water feature will catch a visitor's eye.

- System Control and Flexibility (Very Important)
  There should be three different control settings for the space. An "all on" setting in which all of the fixtures are on or dimmed by the photosensors. Task lighting designated to a specific area in the lobby should be left on, but general lighting throughout the main section along the windows should be dimmable and controlled by the sensors. At night, all of the task lighting should be off, with the general lighting in the space on. This provides a glow on various surfaces when viewed from the exterior at night. This also acts as a security measure when the building is unoccupied in the dark. An "all off" override setting will be utilized in special situations.

  Certain luminaires should also be designated as emergency fixtures, which will remain continuously on.

- Maintenance
  The large ceiling heights make required maintenance and relamping difficult. Choose fixtures with a long lamp life to decrease the time between relamping as well as replacement costs. The lamps should require easy disposal and have color consistency over time.

- Special Considerations (Very Important)
  Since the lobby is the main circulation space of the building, users should have no question as to how to navigate throughout the space. The points of interest should be well lit, and a path of light should guide occupants from one area to another. There is a flat panel TV screen located behind the info desk. Ensure that there is no light falling directly onto the surface of the screen.

- Horizontal Illuminance (Important)
  The required horizontal illuminance is as follows (IESNA Handbook):
  - Lobby = 5 fc
  - Tables = 10 fc (Waiting Area, General)
  - Reception and Info Desk = 30 fc (Reading, Printed tasks, 8- and 10-point type)

  Deviations: none

- Vertical Illuminance (Important)
  The required vertical illuminance is as follows (IESNA Handbook):
  - Lobby = 3 fc
  - Tables = 3 fc (Waiting Area, General)

  Deviations: none

- Lighting Ratios (Emax:Emin) - task plane (IESNA Handbook)
  - 3:1 or less between paper task and adjacent VDT screen

- 3:1 or less between task and adjacent dark surroundings
- 10:1 or less between task and remote (nonadjacent) surfaces
- 3:1 to 5:1 at info desk

- Power Allowance
  The allowable power densities are as follows (ASHRAE 90.1 - 2007):
  - Lobby = 1.3 W/sq.ft.

o Lighting Design

FIGURE 22: Lobby Rendering: Looking South (SmithGroup)

FIGURE 23: Lobby Rendering: Looking West (SmithGroup)

FIGURE 24: Lobby Rendering: Looking East (SmithGroup)

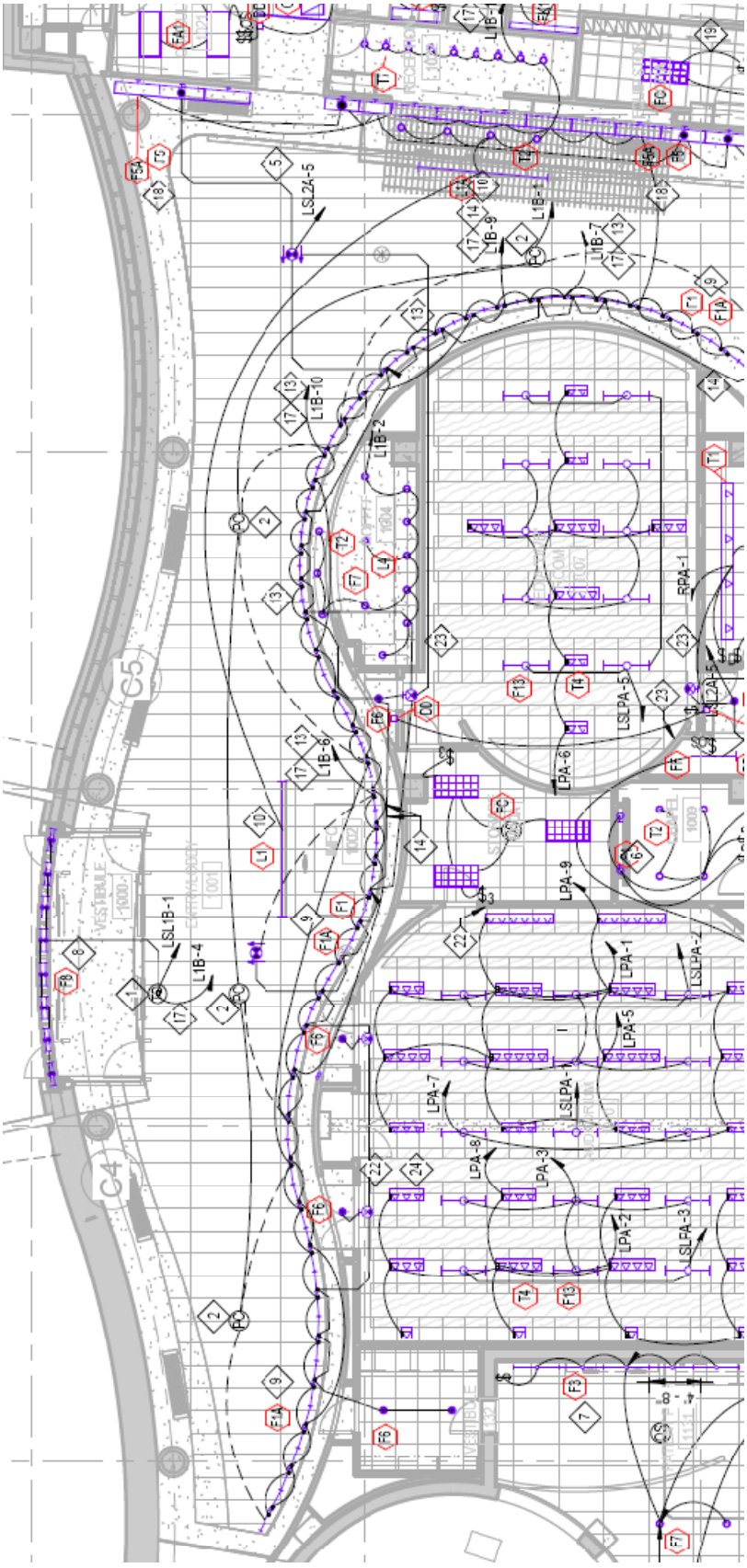


FIGURE 25: Lobby Lighting Plan (NTS)

FIGURE 26: Luminaire Schedule

Type	Description	Manufacturer	Model	Wattage	Lamp	Voltage	Ballast/Transformer
F1	3' LINEAR FLUORESCENT DOUBLE REFLECTOR ASYMMETRIC FIXTURE WITH T5HO CEILNG WASH AND T8 WALLWASH WITH VERTICAL LOUVERS	ELLIPTIPAR	STYLE 307 MODIFIED	60	(1) 39W T5HO, (1) 21W T8 3500K	277	UPLIGHT 10% DIMMING BALLAST, WALLWASH STANDARD BALLAST
F1A	4' LINEAR FLUORESCENT DOUBLE REFLECTOR ASYMMETRIC FIXTURE WITH T5HO CEILNG WASH AND T8 WALLWASH WITH VERTICAL LOUVERS	ELLIPTIPAR	STYLE 307 MODIFIED	86	(1) 54W T5HO, (1) 32W T8 3500K	277	UPLIGHT 10% DIMMING BALLAST, WALLWASH STANDARD BALLAST
F5	3' SURFACE MOUNTED LINEAR FLUORESCENT UPLIGHT WITH SOLID BOTTOM HOUSING	PEERLESS	CERRA	25	(1) 25W T8 3500K	277	
F5A	4' SURFACE MOUNTED LINEAR FLUORESCENT UPLIGHT WITH SOLID BOTTOM HOUSING	PEERLESS	CERRA	32	(1) 32W T8 3500K	277	
F6	6" DIAMETER COMPACT FLUORESCENT RECESS DOWNLIGHT WITH VERTICAL LAMP POSITION, MEDIUM BEAM, AND FLANGE INTEGRAL TO REFLECTOR	GOTHAM	AFV	32	(1) 32W TT CFL 3500K	277	
F7	6" DIAMETER COMPACT FLUORESCENT RECESS DOWNLIGHT WITH VERTICAL LAMP POSITION, WIDE BEAM, AND FLANGE INTEGRAL TO REFLECTOR	GOTHAM	AFV	32	(1) 32W TT CFL 3500K	277	
L1	INTERIOR RATED LINEAR LED ACCENT FIXTURE WITH STANDARD OUTPUT AND 10 DEGREE DISTRIBUTION. LENGTH AS INDICATED ON DRAWINGS	IO	LINE 0.75	25.2	WARM WHITE LED	277	
L1A	INTERIOR RATED LINEAR LED ACCENT FIXTURE WITH STANDARD OUTPUT AND 10 DEGREE DISTRIBUTION. LENGTH AS INDICATED ON DRAWINGS	IO	LINE 0.75	24.15	WARM WHITE LED	277	
L4	LED SURFACE MOUNTED CABINET PUCK FIXTURE WITH REMOTE POWER SUPPLIED BY MANUFACTURER	MP LIGHTING	LED51	1	WARM WHITE LED 90 CRI	120	

T2	4" DIAMETER RECESSED LOW VOLTAGE ADJUSTABLE DOWNLIGHT WITH REMODEL HOUSING	RSA	MICROGEM MLV 3055	37	(1) 37W IR MR16 60 DEG WFL	277	
T7	4" DIAMETER RECESSED LOW VOLTAGE DOWNLIGHT WTH NEW CONSTRUCTION HOUSING	RSA	MICROGEM MLV 3055	37	(1) 37W IR MR16 60 DEG NFL	277	

FIGURE 27: ASHRAE Standard 90.1

Space	Total Area (sq.ft)	Total Watts	Allowable Lighting Power Density (W/sq.ft.)	Total Lighting Power Density (W/sq.ft.)
Lobby	3740	3917	1.3	1.05

o Daylighting

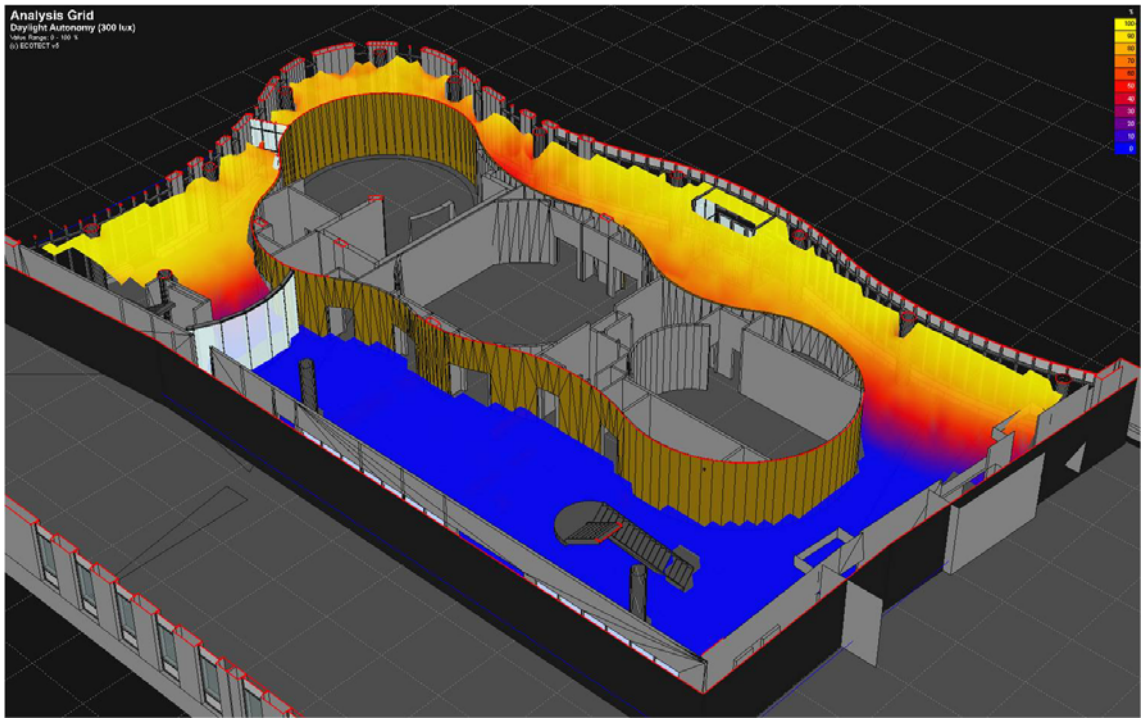


FIGURE 28: Daylight Study: Lobby (SmithGroup)

As a result of the curtainwall along the north facade, a numerous amount of daylight is present in this space. Ceramic frit glass is used to prevent direct sunlight angles and still provide exterior views. Since the glass is north-facing, adequate light (without direct south-facing sun angles) is able to penetrate into the space. Photosensors are located on the ceilings to control electric lighting during the day.

o Lighting Controls

A response from the lighting designer regarding controls is still pending, however, as such a large space, it is assumed that most of the fixtures will be on a timer. Photosensors are also present to control luminaires F1 and F1A.

o Lighting Evaluation and Critique

The lighting design for the lobby space was a very interesting and unique design. From the renderings and placement of fixtures, the lighting levels look to be accurate for the appropriate tasks throughout the space. The renderings seem a little bright, but the dimming capabilities for the uplight will decrease the luminance. Contrast, non-uniformity, and shadows among different areas is visually pleasing, and highlights some of the unique features, but it may be a little harsh for sensitive eyes. The use of photosensors to control dimming of some fixtures is necessary for adequate amounts of light during different times of day. The ability to dim also saves energy costs. An appropriate CCT of 3500K was used to complement the wood tones and daylight contribution. Quality fixtures were used to create a sophisticated first impression of the space.

The vestibule is such an essential part of the space, however, there was no lighting added to this space. Even though it is all glass and it receives some light from adjacent spaces, there is nothing surrounding it that draws a lot of attention to it from the interior.

When first entering the space, the info desk is straight ahead to the left. An LED fixture is the only source of light at that location. It is skeptical that adequate illuminance will reach the workplace with this type of luminaire. Another sort of decorative fixture may complement the area and draw more attention. Its location in front of the desk may also cause veiling reflections.

The custom fixtures used to line the curved walls indicate a highly innovative design. This provides adequate indirect light throughout the space, however, light from a more discrete source would be aesthetically pleasing. The raised ceilings could have been utilized to hide fixtures and create subtle illumnation. The luminaire uniquely washes light on the ceiling and walls, but it is in the direct view of occupants. It may present direct glare and bare lamp issues. Washing the wood wall panels appropriately enhances the use of natural materials, but the illumination of the acoustical ceiling tiles is unimpressive. These luminaires do a good job with forcing circulation throughout the space. This continuous line of light leads visitors from the entrance through to the reception desk at the end of the hall. Light from the side also helps with facial modeling.

When analyzing the coffee area, the use of downlights and under cabinet lights seems appropriate for the required illuminance light levels.

In the east corner of the space where the tables and chairs are located, there is not much electric light available for in the evenings or late at night. Only uplights are located along the east wall, providing light only upward to the raised ceiling, not allowing any to reflect back onto the task plane.

At the reception desk, many lighting systems are utilized. There is another linear LED fixture located at the desk, which matches the one located at the info desk, however, once again, there may not be adequate light

projected onto the workplane. In this location, there are downlights located above and behind the desk providing additional task lighting. The direct light may create veiling reflections on computers and the workspace.

Overall, the lighting seemed to satisfy some criteria including the allowable power density, however, there were many architectural features and materials that were not utilized or highlighted.

Special Purpose Space

Auditorium

o Description

The auditorium is centrally located on the first floor of the amorphous section of the building. It is a total of 1460 square feet and can be divided into two smaller rooms (about 730 square feet each) using moveable partitions that run north to south.

The space can be entered from one of four sets of double doors. Two of these entrances are located on the north end of the room, connecting the auditorium to the Entry/Lobby. The other two sets of doors are positioned on the south end of the space, and open onto the Interior Lobby. This allows for entering and exiting through both ends of the room from either side of the partition. Two partition pocket doors are located at the north and south ends of the space between each of the sets of entrance/exit doors for partition storage.

A Storage Room is located in the northeast corner for furniture placement.

o Drawings

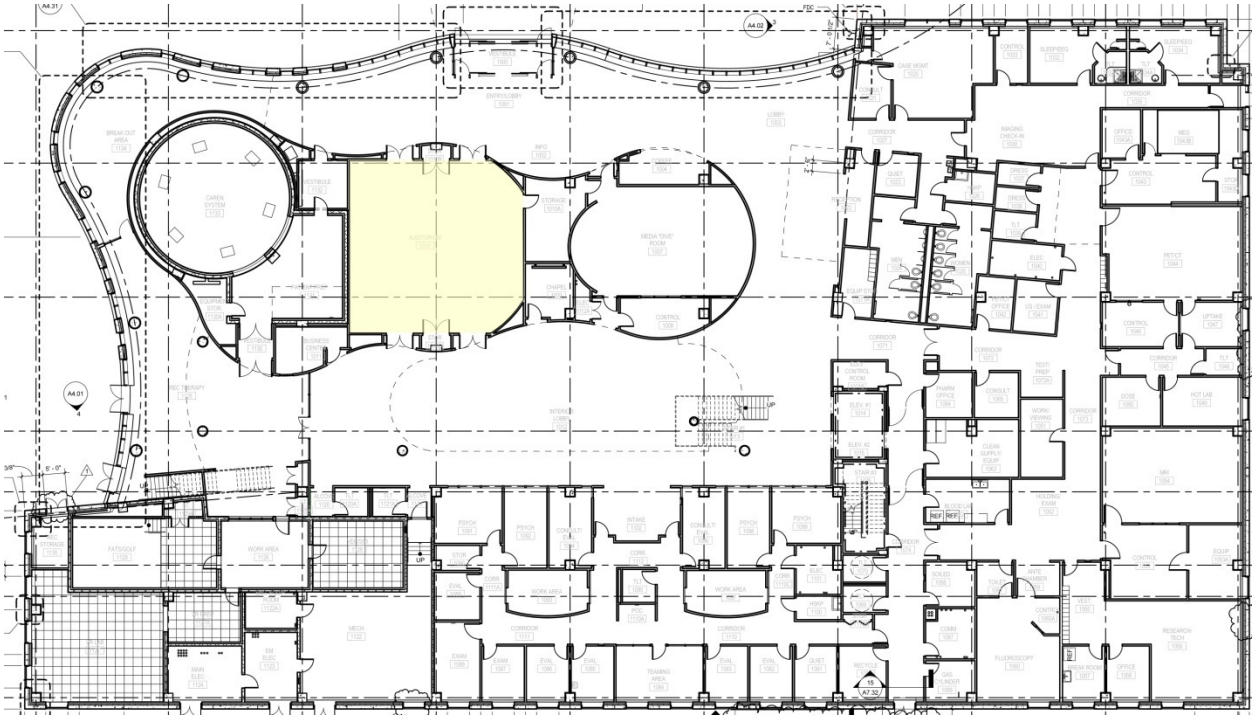


FIGURE 29: Auditorium Location (NTS)

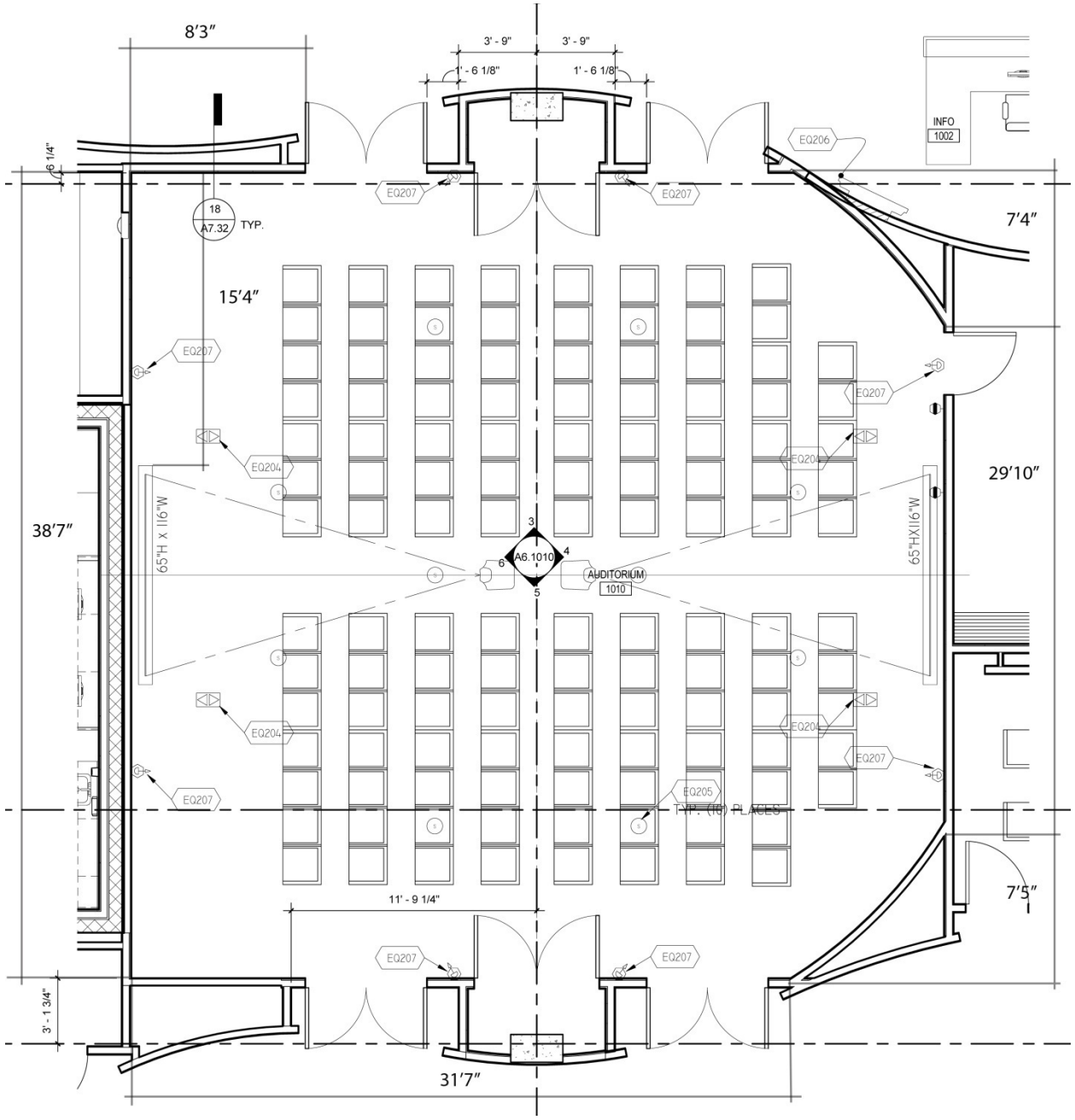


FIGURE 30: Auditorium Floor Plan (NTS)

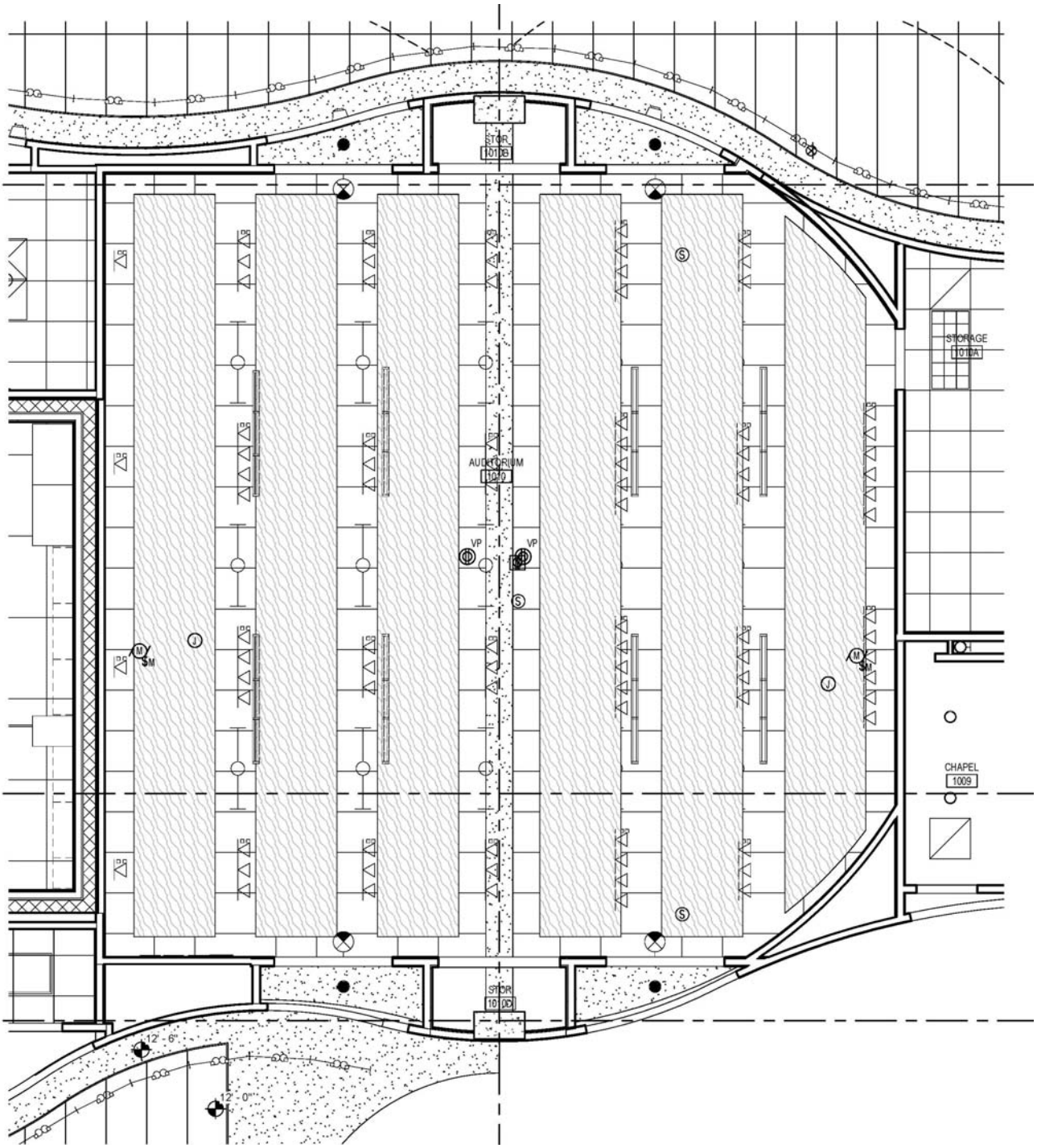


FIGURE 31: Auditorium Reflected Ceiling Plan (NTS)

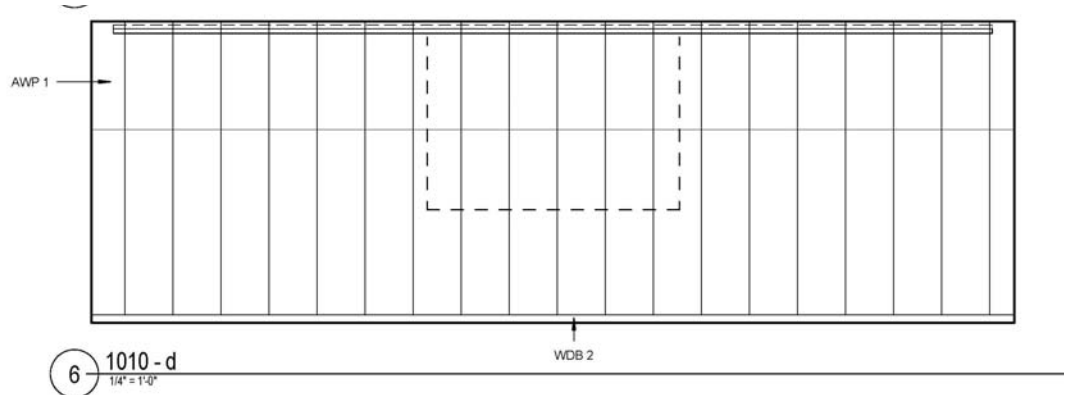


FIGURE 32: Auditorium Interior Elevation – West Wall (NTS)

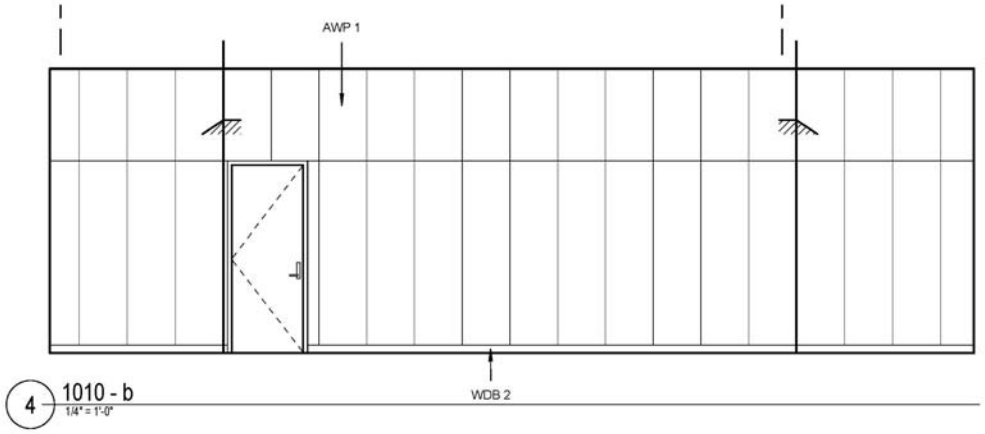


FIGURE 33: Auditorium Interior Elevation – East Wall (NTS)

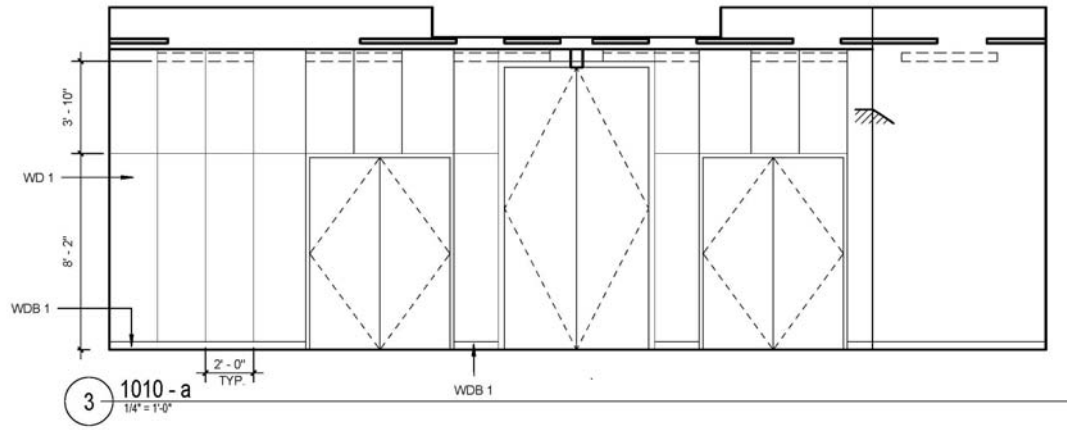


FIGURE 34: Auditorium Interior Elevation – North Wall (NTS)

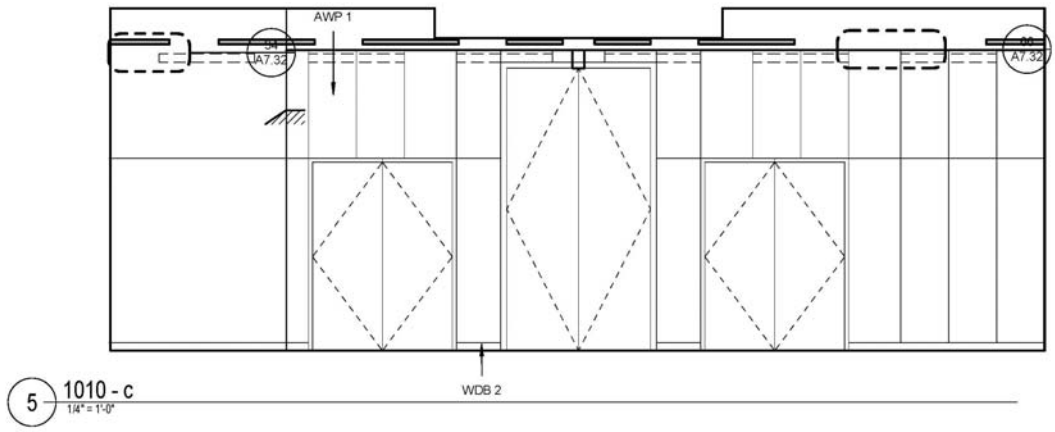


FIGURE 35: Auditorium Interior Elevation – South Wall (NTS)

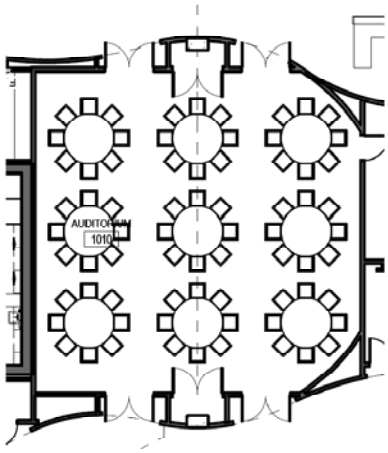


FIGURE 36: Auditorium Alternate Furniture Layout (NTS)

o Surface Materials

Floor - The floor is composed of wall to wall carpet tile (CPT-1).

Base - A wood base (WDB-1, 2) is located at the bottom of the wall around the perimeter of the room. It is either mdf painted or has a satined finish to match the adjacent surface materials.

West Wall - The upper portion of the west wall is acoustic wall panel (AWP-1) while the lower part consists of wood wall paneling (WD-1).

East Wall - The upper portion of the west wall is acoustic wall panel (AWP-1) while the lower part consists of wood wall paneling (WD-1). A stained solid core wood door with a painted hollow metal frame is positioned on the north end of the wall.

North Wall - The upper portion of the west wall is acoustic wall panel (AWP-1) while the lower part consists of wood wall paneling (WD-1). Full height solid wood double doors with a painted hollow metal frame conceal the moveable partition in the center of the wall. A set of stained solid core wood double doors with vision lites and a painted hollow metal frame are located on each side of the partition doors.

South Wall - The upper portion of the west wall is acoustic wall panel (AWP-1) while the lower part consists of wood wall paneling (WD-1). Full height solid wood double doors with a painted hollow metal frame conceal the moveable partition in the center of the wall. A set of stained solid core wood double doors with vision lites and a painted hollow metal frame are located on each side of the partition doors.

Ceiling - 12"x48" acoustic wood ceiling tile (ACWP-1) covers the ceiling in strips that run north to south. 24"x48" black acoustic ceiling tile (ACT-6) is placed in between the wood tiles.

FIGURE 37: Material Properties

Material	Color/Style	Reflectance
CPT-1	PRAIRIE 59525 / DRFTWOOD 23750	0.3
WDB-1	WOOD BASE	0.3
WDB-2	WOOD BASE	0.3
AWP-1	ACOUSTICAL PANEL - BEIGE	0.6
WD-1	WOOD WALL PANEL	0.3
ACWP-1	WOODWORKS VECTOR	0.3
ACT-6	BLACK	0
WOOD DOORS	STAINED WOOD	0.2
DOOR FRAME	PAINTED P-1	0.65

o Furnishings

The space contains a moveable stage platform for use during presentations. It has two possible seating layouts. Chairs can be placed in the center of the space facing east or west, depending on the stage location, and room division. Round tables surrounded by chairs make up the second seating configuration available in the space (see drawings).

o Activities/Tasks

Projection screens are located along the east and west walls for presentations in either or both partitioned areas. Research, clinical, and training sessions, conferences and seminars will be held in this space. The space will be occupied frequently for meetings and discussions. Internet access will be available, so computer usage is

probable. Distance learning lectures/seminars will be distributed widely by media or web conference (VTC capabilities).

- Lighting Design Criteria – IESNA Handbook: Auditoriums, Assembly
  - Appearance of Space and Luminaires (Somewhat Important)
    The space will be occupied by qualified researchers and presenters, so the space should have a very sophisticated feel. It is likely that donors for the building's construction may be present, so it is important that they are impressed by the space (and building as a whole). Presentations in the space may also be distributed through web conference, so this also makes it important that the space appears to be of high quality. The luminaires should also convey this impression through concealing the fixtures and using high end products.

  - Psychological Impressions
    Strive for an impression of visual clarity throughout the area (for both the presenter and audience). Implement a uniform lighting mode with some peripheral emphasis, such as lighting on the walls.

    As more of a functional workspace, the mood should be calm, so direct spotlights should be avoided. Simplicity is a concept that will work well in the space by utilizing minimal fixtures for many purposes.

  - Color Appearance (and Color Contrast) (Important)
    It is important that the space contain fixtures with a low CCT and a high CRI. The room is surrounded by wood panels on the walls and ceilings, so a CCT between 2700K and 3000K will complement the warm wood colors. The space will be occupied by large groups of people, and used for presentations. The warm color temperature will enhance the users' skin tones. Also, the warm light will create a relaxing and stress-free environment, which is especially necessary for TBI patients and presenters. There should be a high CRI of about 90 in order to enhance presentation materials.

  - Daylighting Integration and Control (Important)
    With its location in the center of the building, there are no windows present in the Auditorium. Considerations for daylight integration and control are not necessary.

  - Direct Glare (Somewhat Important)
    For adequate and comfortable usage of the space there should be no direct glare viewable by the users (presenters and audience). Direct glare from the lamp sources should be eliminated by integrating the fixtures within the architecture to conceal the luminaires and through the use of glare accessories. The ceiling panels provide a good opportunity for keeping the fixtures out of direct view.

  - Flicker (and Strobe) (Somewhat Important)
    Flicker and strobe should always be avoided, however, there are no fast-paced activities present in the space, so these problems should not be present.

  - Light Distribution on Surfaces

As mainly a workspace and interaction area, light distribution should be fairly uniform among all surfaces. However, the walls should receive a wash of light on the lower wood panels, with darker surfaces around the top acoustical panels. This will create visually interesting surroundings. The ceiling will have non-uniformity because of the variety of materials used for the panels. The wood panels should be lit from the sides or from below, with the black panels left dark, to achieve a visually stimulating environment.

- Light Distribution on Task Plane (Uniformity)
  Light distribution on the task planes in the space must be uniformly lit with appropriate illuminance levels. This lighting must be present at the podium of a speaker on either side of the room and throughout the audience for note-taking. Uniformity must also be present on tables used for meetings and conferences. Vertical illuminance on presentation boards or other displays must also be uniform for accurate viewing. When using the projection screen for presentations, light on the screen should be avoided.

- Luminances of Room Surfaces / Surface Characteristics (Somewhat Important)
  The wood material used for the lower portion of the walls should be highlighted by washing the surface. However, the acoustical wall panels located above should be left at a lower light level. This will enhance the warm feel of the room and emphasize the unique surfaces. The wood ceiling panels should also receive a soft wash of light to highlight the wood tones.

- Modeling of Faces or Objects (Somewhat Important)
  It is important that faces and objects throughout the room are easily viewed by all. Interaction during meetings and conferences makes it necessary for participants to accurately view features and expressions. An audience should have the ability to see a presenter in order to fully understand and engage in the lecture or seminar. If web conferencing is also taking place, it is imperative that adequate lighting is available. Direct lighting from above and from the sides will provide the required vertical illuminance.

- Point(s) of Interest
  A main point of interest throughout the space should be on a presenter at a podium. The drawings do not signify where the podium will be located, but it is assumed that it will be placed either to the left or right of the projection screen. In order to prevent light from falling onto the screen, a small task light will be best on the podium. However, lighting should be placed on the east and west walls in to accommodate for presentations without a projector.

- Reflected Glare and Source/Task/Eye Geometry
  Reflected glare should be avoided on all task planes, including the podium (presenter's notes), any presentation boards, the workplane of the audience or general assembly during meetings, and computer monitors used during events. Since the furniture arrangement in the space varies with the events taking place, it is difficult to place fixtures in positions that will reduce reflected glare. Specifying luminaires with glare control will help to mitigate the problem.

- Shadows
  There should be no shadows present on the workplane of the presenter and audience, as well as those assembling for a meeting or conference. Adequate ambient lighting should be present in these areas. Shadows on the upper walls and between the wood panels will create a visually pleasing environment.

- Sparkle/Desirable Reflected Highlights
  Some sparkle may be created throughout the room by the use of sconces. Placing this fixture type near the doors will also provide guidance to occupants.

- System Control and Flexibility (Very Important)
  Since the space is used for many different types of activities, the ability to control the lighting should be easily accessible for users. There should be a total of five control settings in the space. There should be an "all on" setting for general movement around the space as well as assemblies, meetings, and conferences. A video conference setting should include adequate vertical light for video cameras. There should be two presentation settings. One should be for the inclusion of a projection screen, where low light levels (dimmed) are on the audience, no light is on the screen, and a small task light at the podium for the presenter. The second presentation setting should be for a case where there is no screen present. Low light levels should be on the audience for note-taking, and high illuminance levels on the speaker at either the east or west walls. An "all off" setting is necessary for when the space is not in use.

  Certain luminaires should also be designated as emergency fixtures, which will remain continuously on.

- Maintenance
  The large ceiling heights make required maintenance and relamping difficult. Choose fixtures with a long lamp life to decrease the time between relamping as well as replacement costs. The lamps should require easy disposal and have color consistency over time.

- Special Considerations
  Ensure that when the partition divides the space, there is an adequate amount of light on both sides of the room. The lighting design should be symmetrical on both the east and west ends of the space. The fixtures chosen should have dimming capabilities in order to accomodate the various scene settings. Luminaire layout will have to work around AV equipment hung from the walls and ceiling.

- Horizontal Illuminance (Important)
  The required horizontal illuminance is as follows (IESNA Handbook):
  - Auditorium, Assembly = 10 fc
  - Conference Room, Meeting = 30 fc

  Deviations: none (assuming middle-age users)

- Vertical Illuminance
  The required vertical illuminance is as follows (IESNA Handbook):
  - Conference Room, Meeting = 5 fc
  - Projection Screen = less than 5 fc on screen

- Lighting Ratios (Emax:Emin) (IESNA Handbook unless otherwise noted)
  - 3:1 or less between paper task and adjacent VDT screen
  - 3:1 or less between task and adjacent dark surroundings
  - 10:1 or less between task and remote (nonadjacent) surfaces

- Power Allowance
  The allowable power densities are as follows (ASHRAE 90.1 - 2007):
  - Conference/Meeting/Multipurpose = 1.3 W/sq.ft.

o Lighting Design

FIGURE 38: AGI Rendering: All Fixtures On

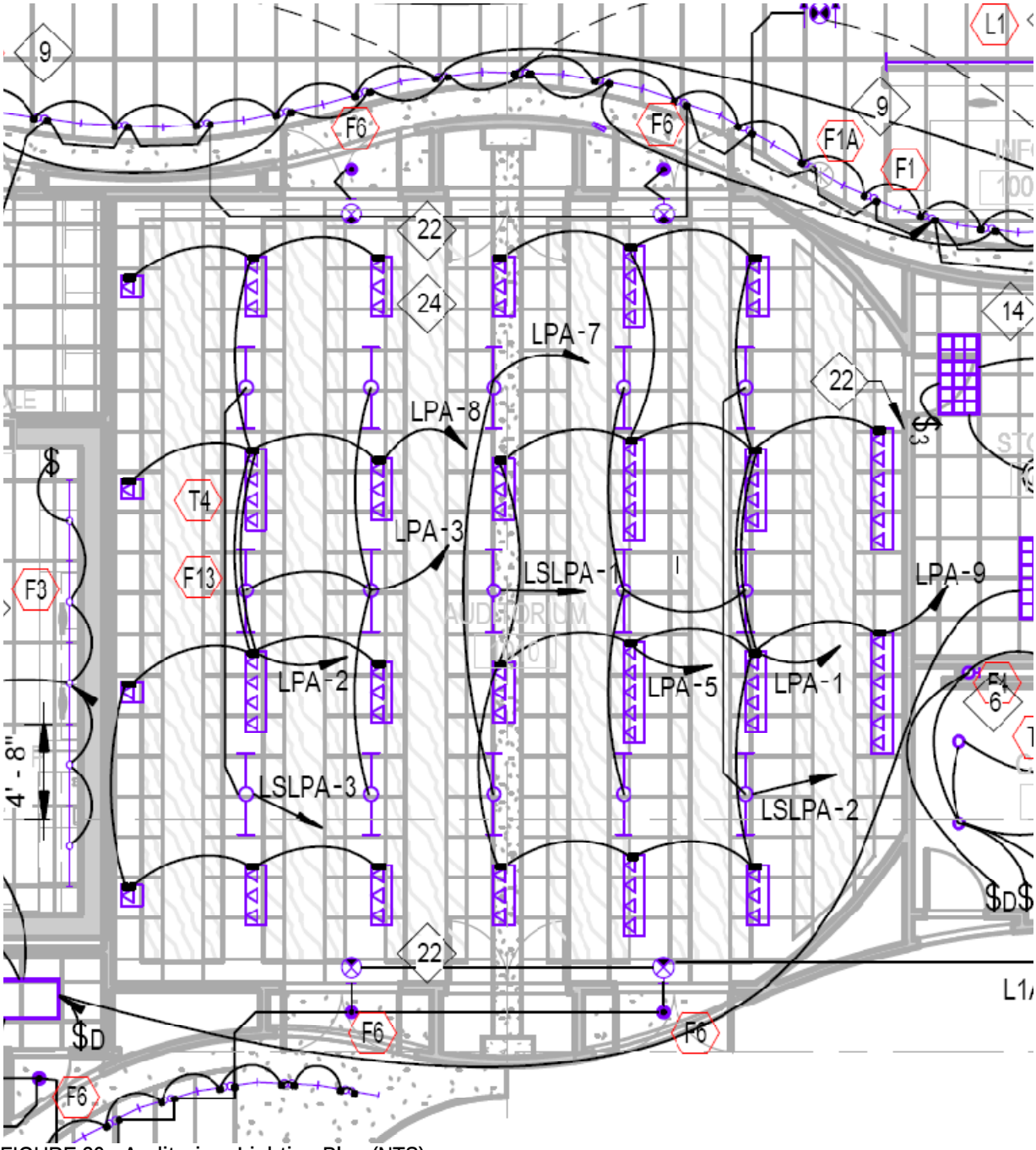


FIGURE 39: Auditorium Lighting Plan (NTS)

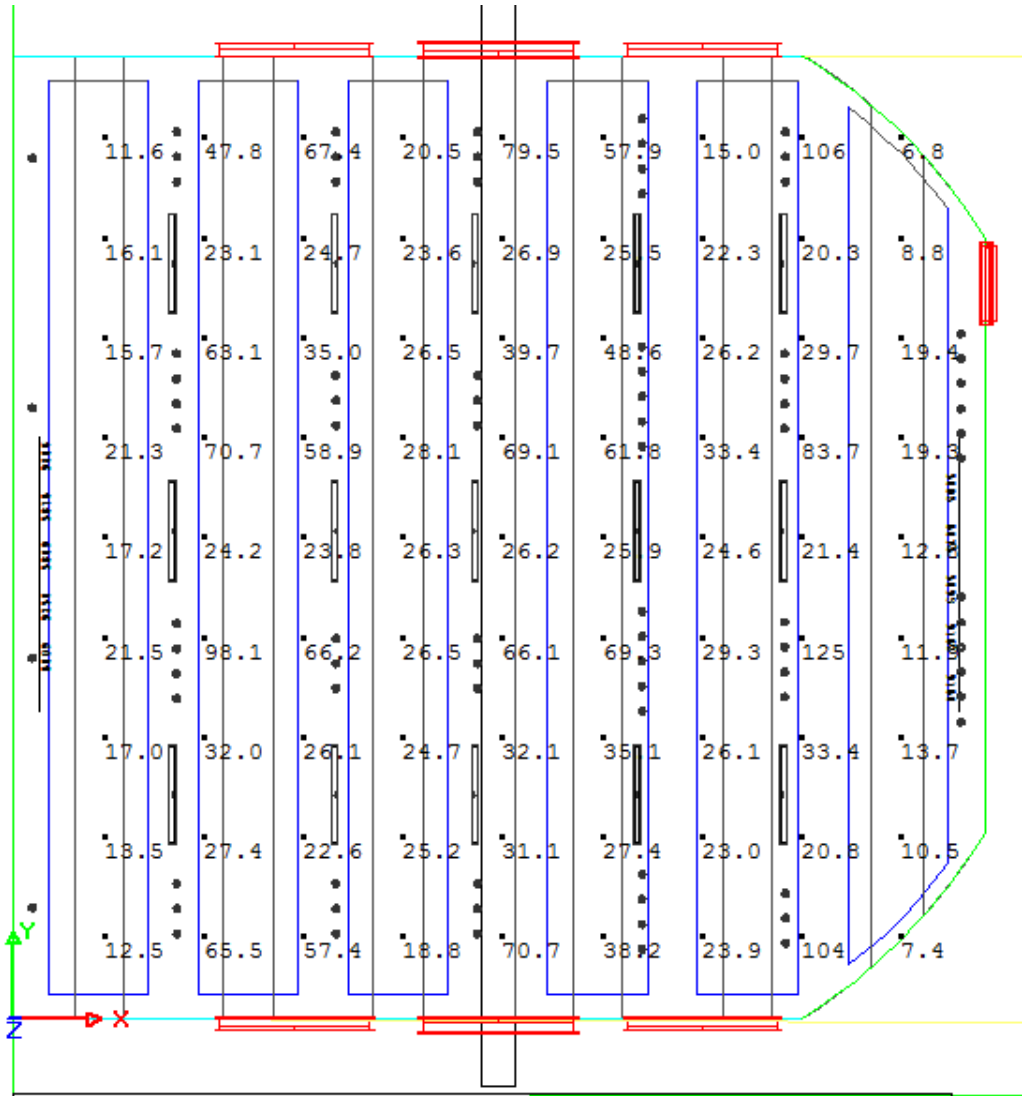
FIGURE 40: Luminaire Schedule

Type	Description	Manufacturer	Model	Wattage	Lamp	Voltage	Ballast/Transformer
F13	LINEAR FLUORESCENT PENDANT WITH DIRECT DISTRIBUTION AND SATIN LENS	SELUX	M60	54	(1) 54W T5HO 3500K	277	10% DIMMING BALLAST
T4	LOW VOLTAGE TRACK HEAD ON 2 CIRCUIT SUSPENDED TRACK	LSI	CX 16 SERIES	37	(1) 37W MR16 IR 25 DEG NFL	277	

FIGURE 41: Light Loss Factors

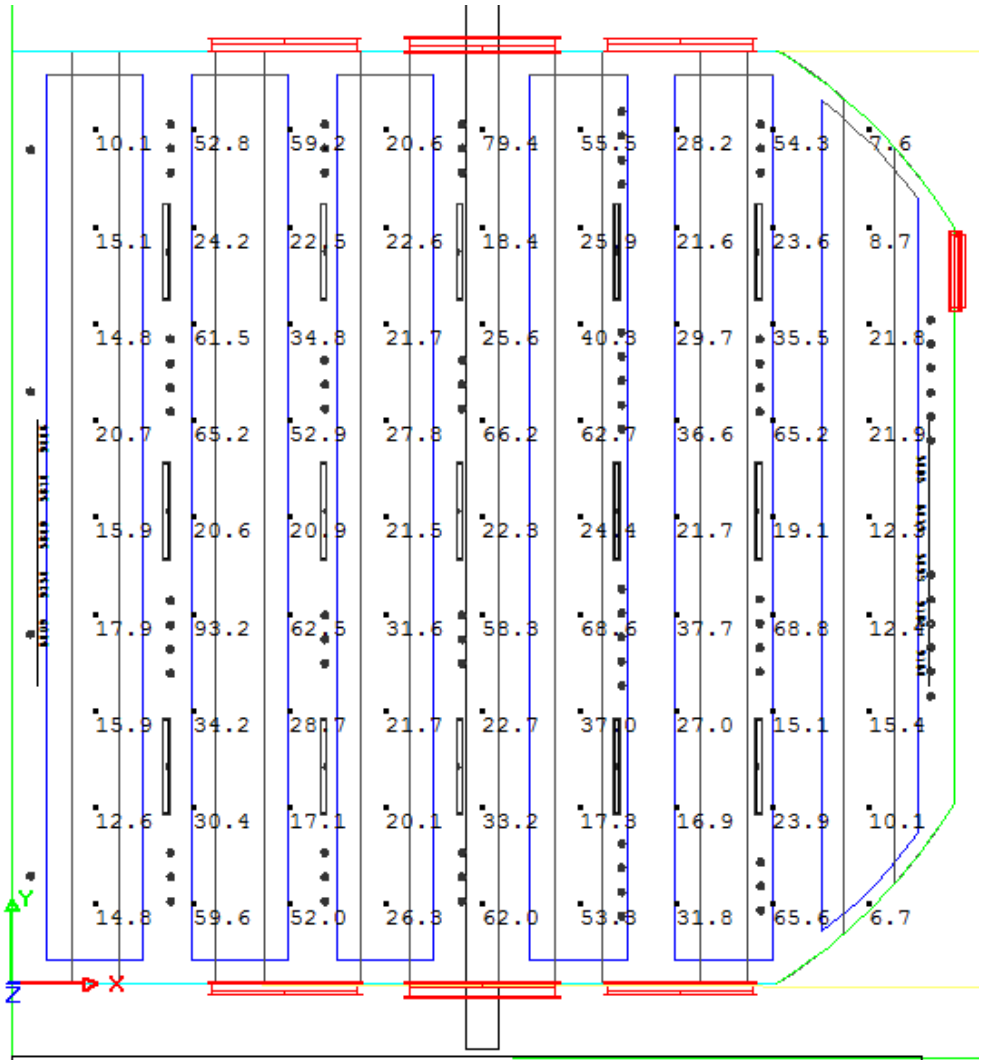
Type	Maintenance Category	Distribution Type	Degree of Dirtiness	Cleaning Cycle	Room Cavity Ratio
F13	V	Direct	Clean	12 Months	4.45
T4	IV	Direct	Clean	12 Months	4.45

Type	BF	LLD	LDD	RSDD	Total LLF
F13	1	0.95	0.88	0.97	0.81092
T4	1	0.93	0.89	0.97	0.802869



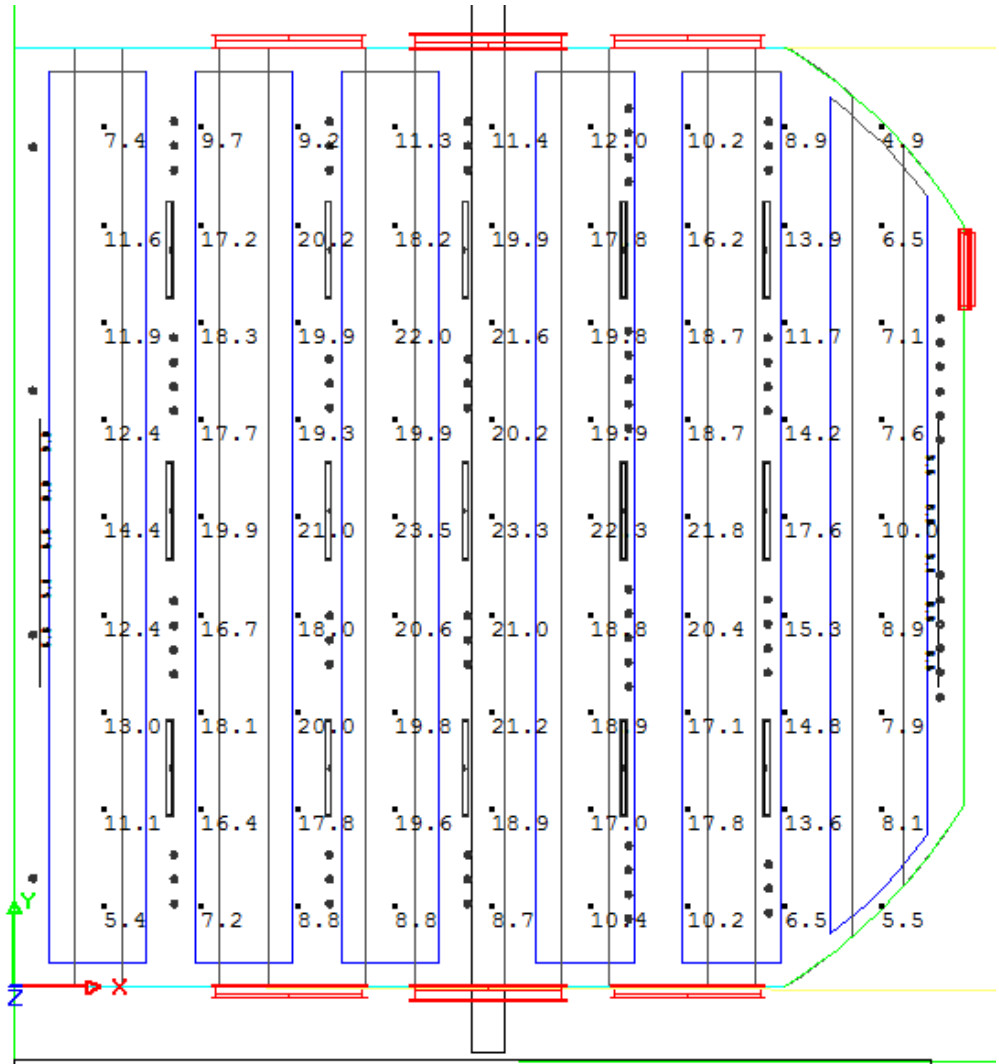
Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Max/Min
Projection Screen East	Illuminance	Fc	10.36	14.7	5.6	2.63
Projection Screen West	Illuminance	Fc	8.43	12.5	1.4	8.93
Workplane	Illuminance	Fc	35.94	125	6.8	18.35

FIGURE 42: Calculations: Workplane with All Fixtures



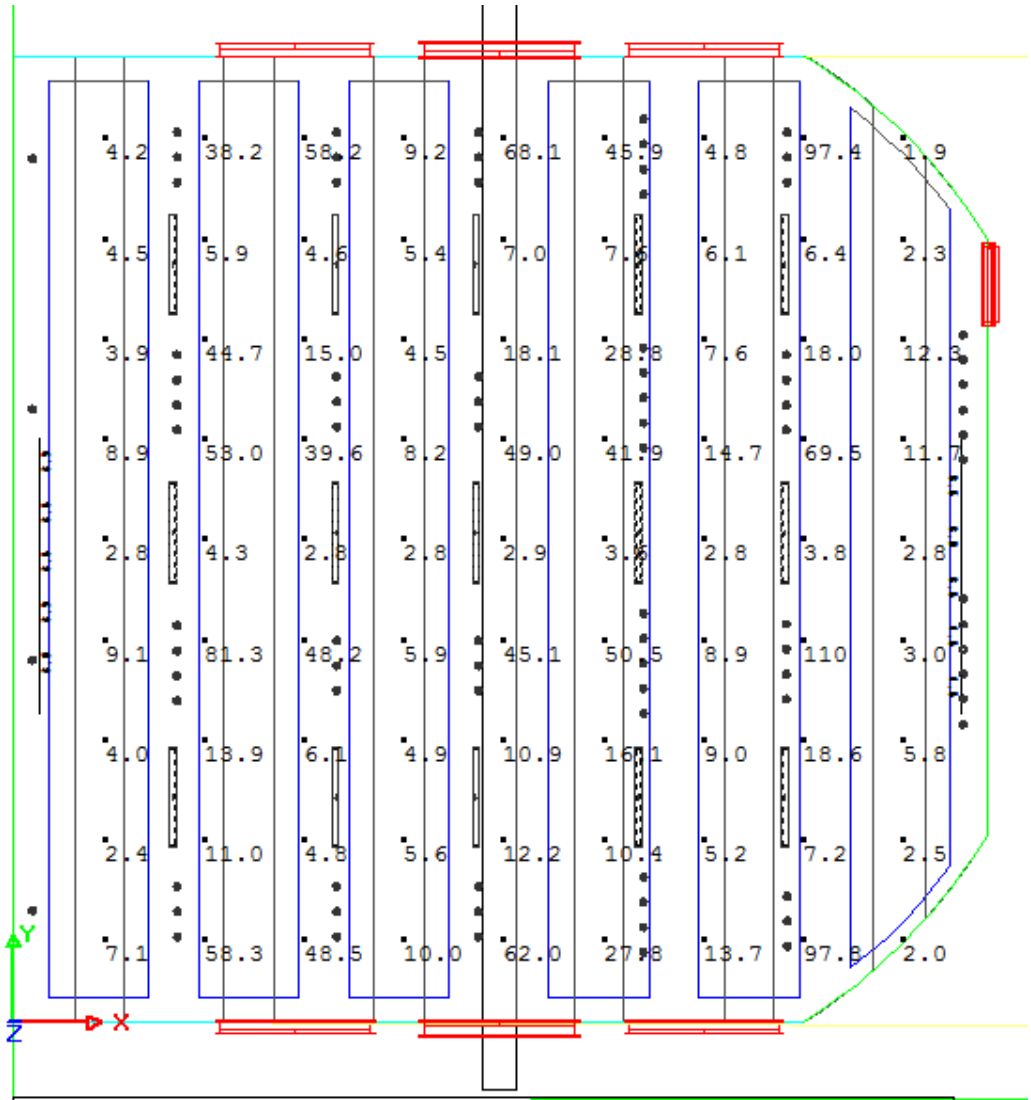
Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Max/Min
Floor	Illuminance	Fc	32.79	93.2	6.7	13.91
Projection Screen East	Illuminance	Fc	10.35	14.7	5.6	2.63
Projection Screen West	Illuminance	Fc	8.42	12.5	1.3	9.62

FIGURE 43: Calculations: Floor with All Fixtures



Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Max/Min
Projection Screen East	Illuminance	Fc	5.95	9.9	2.0	4.95
Projection Screen West	Illuminance	Fc	4.38	7.7	0.4	19.25
Workplane	Illuminance	Fc	15.01	23.5	4.9	4.80

FIGURE 44: Calculations: Workplane with F13 Fixtures Only



Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Max/Min
Projection Screen East	Illuminance	Fc	4.43	4.9	3.6	1.36
Projection Screen West	Illuminance	Fc	4.05	5.0	1.0	5.00
Workplane	Illuminance	Fc	20.93	110	1.9	57.63

FIGURE 45: Calculations: Workplane with T4 Fixtures Only

FIGURE 46: ASHRAE Standard 90.1

Space	Total Area (sq.ft)	Total Watts	Allowable Lighting Power Density (W/sq.ft.)	Total Lighting Power Density (W/sq.ft.)
Auditorium	1460	3992	1.3	2.73

o Daylighting

The Auditorium is located on the interior of the building, so no daylight is present.

o Lighting Controls

A response from the lighting designer regarding controls is still pending, however, as a space designed for various usages, it is assumed that there will be various lighting scenes available.

o Lighting Evaluation and Critique

For a space with so many functions, the lighting design has been kept very simple. Only two fixtures types are used throughout the space, but they are very flexible in terms of usage. A comprehensive control system, which is still undetermined (waiting for control schedule from lighting designer), will enable appropriate lighting and levels for various tasks.

In this space, it seems that the main focus of the lighting design was for a functional, not aesthetic use. There was no lighting on surfaces other than the task/floor plane. This was a smart move in terms of costs and energy consumption, however, for a space that will be possibly occupied by well-known researchers and governmental officials, there should be some accent lighting throughout the space. The wood paneling on the ceiling and walls would create a very pleasant visual environment.

Since an accurate aiming diagram was also not available, it is difficult to accurately critique this space. In order to gain base calculations, all fixtures were aimed straight down at the workplane. As evident in the rendering, this provided harsh hot spots on the floor, which is not favorable for tasks of reading and writing, which will more than likely take place during meetings, conferences, or presentations. It is assumed that once installed, the fixtures will be appropriately aimed to create a more uniform illuminance level on the task plane. However, the average illuminance value is about 38 fc, which meets the target value of 30 fc required for reading and writing. While this value is higher than necessary, it is probable that not all of the lights will be on at once. With the dimming of some fixtures, the footcandle value will fall more in the appropriate range.

Several other calculations were completed with different switching systems. Just the linear fluorescent fixtures created an average of 15 fc uniformly on the workplane and about 5 fc on the vertical projection screen. This creates the assumption that a similar control scene may be used for projection screen presentations. When the track fixtures were solely calculated, they produced an average of 20 fc non-uniformly on the workplane and about 4 fc on the projection screens. This shows that some of the linear luminaires will be placed away from the screens during presentations, but still used for an even light distribution. The track fixtures may then be added for downlight closer to the vertical presentation. As a result of the non-uniformity created by the track lights, it seems hard to believe that they will ever be used just by themselves.

Once again, the absence of a control schedule made it difficult to determine the reasoning behind the layout and number of fixtures used in the room. The large number of fixtures on the east wall may be illuminating wall hangings, while the luminaires on the west side of the room will probably be aimed at a speaker. This was concluded because of the large uninterrupted wall and orientation of the chairs in the space.

After further analysis of the AV systems and light levels, it was noticed that the recommendation of 50 fc for video teleconferencing was not achieved. There are 8 video cameras located throughout the space, however, it seems as if they are just used for general videotaping of seminars and lectures, not for communication.

The total allowable power density was exceeded, however, the savings in other spaces will make up for this excess.

Large Workspace

Auditorium

o Description

The large workspace is centrally located on the second floor of the northern portion of the building. It is a total of 4100 square feet, and is an irregular shape with mostly curved walls.

The Therapy Waiting Room is entered from the General Therapy Info space and consists of seating for patients. It is adjacent to and accessible by the office and exam spaces located in the "bar" section of the building.

The Physical Therapy space extends along the northern facade curtainwall. Exercise equipment is located along the exterior wall for excellent outside views. Evaluation rooms, the Art/Music space, and Central Park can be accessed from this area.

The circular shaped Occupational Therapy room contains no north wall, creating a large, open transition space to the PT room. The area includes many pieces of furniture, equipment, and kitchen space. Large glass windows are located on the southern wall area, looking down onto the first floor Interior Lobby.

o Drawings

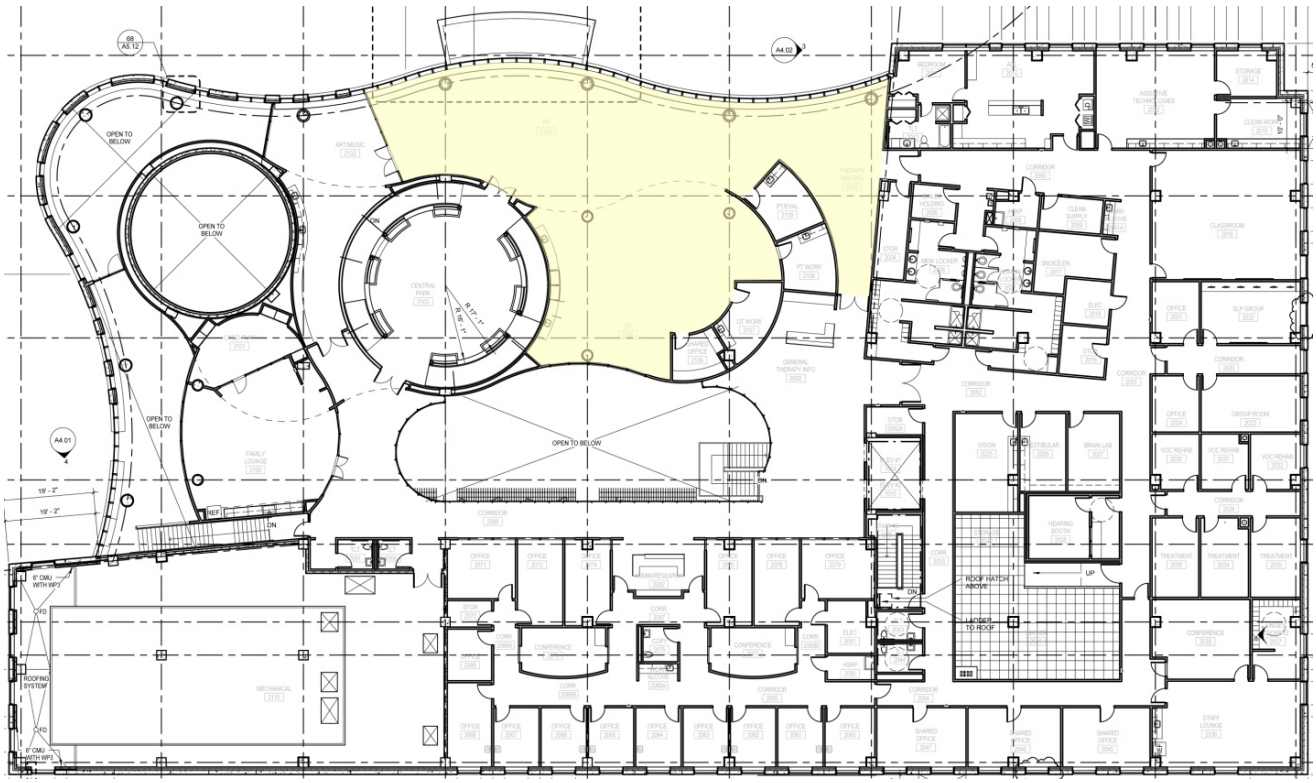


FIGURE 47: PT/OT Location (NTS)

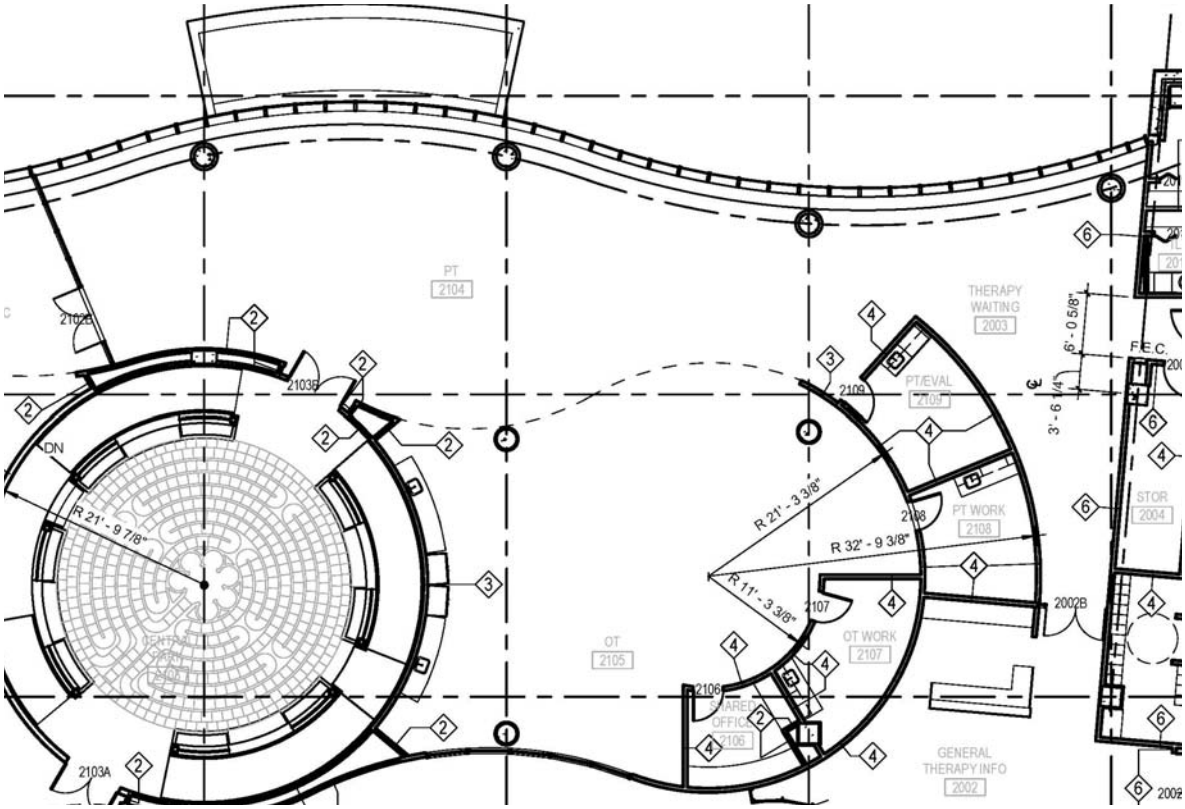


FIGURE 48: PT/OT Floor Plan (NTS)

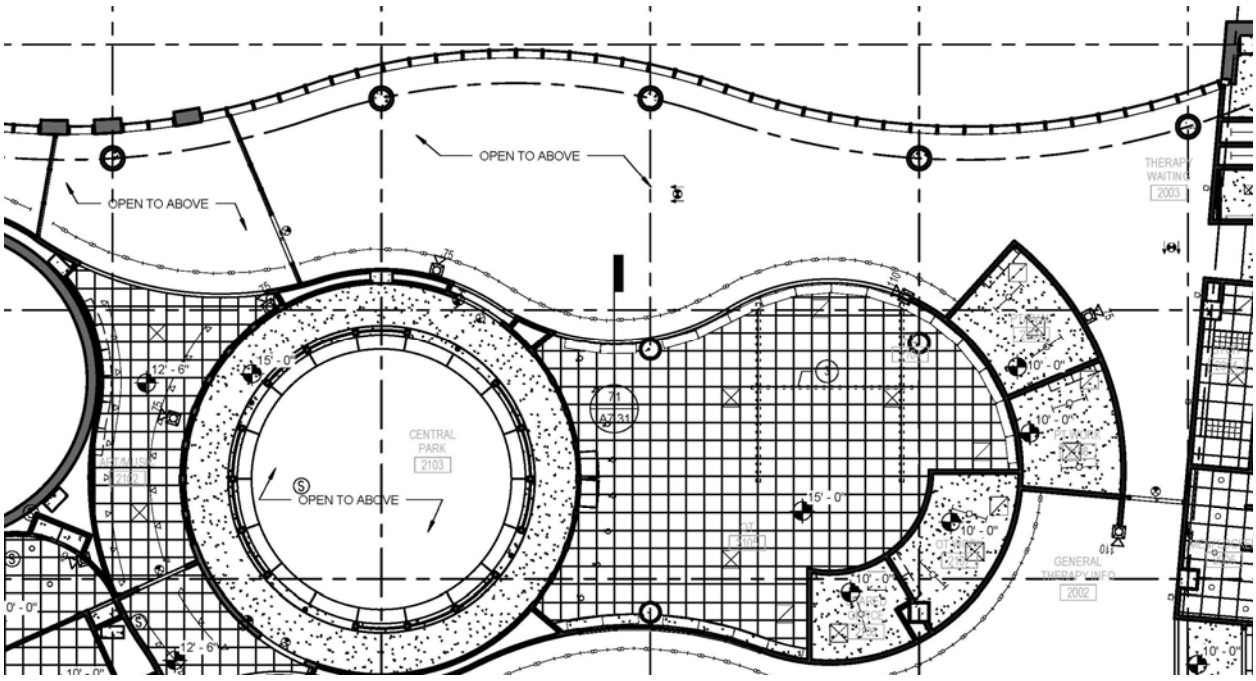


FIGURE 49: PT/OT Reflected Ceiling Plan - Second Floor (NTS)

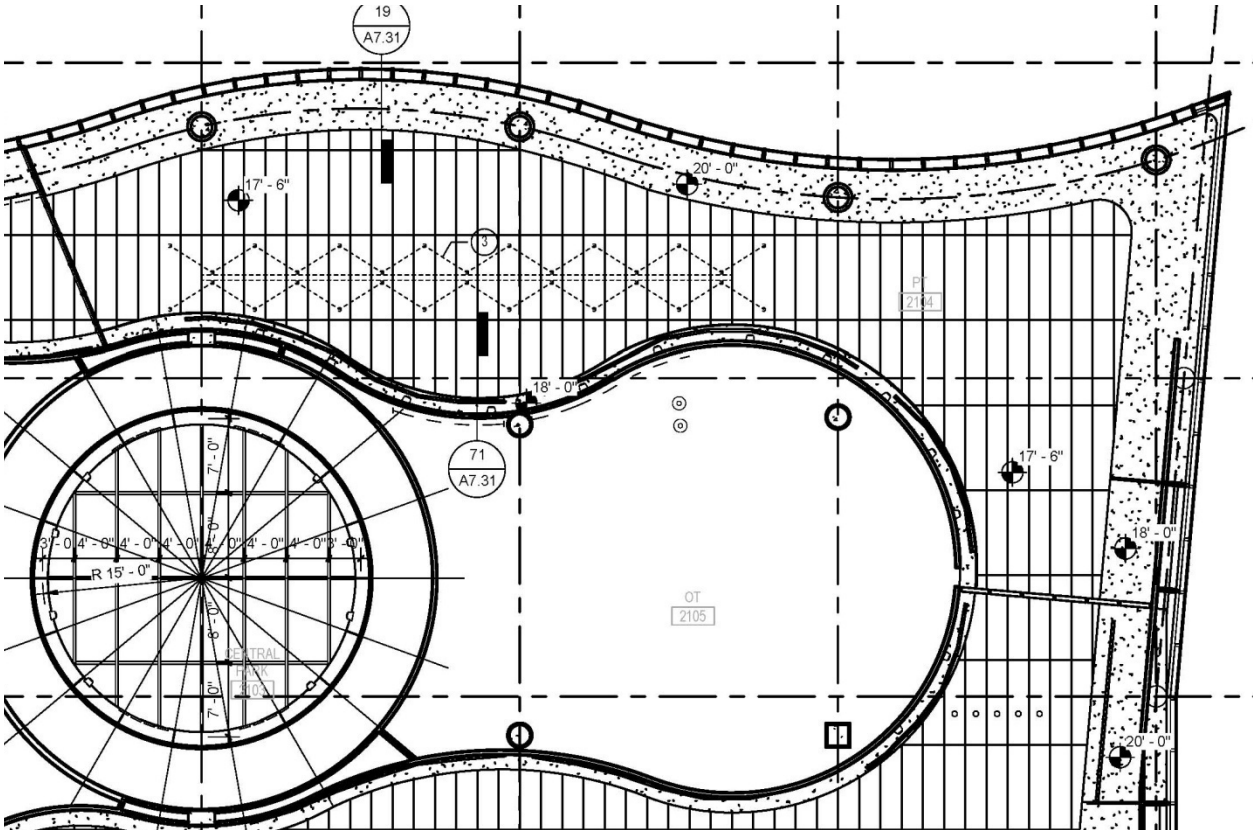


FIGURE 50: PT/OT Reflected Ceiling Plan - Low Roof (NTS)

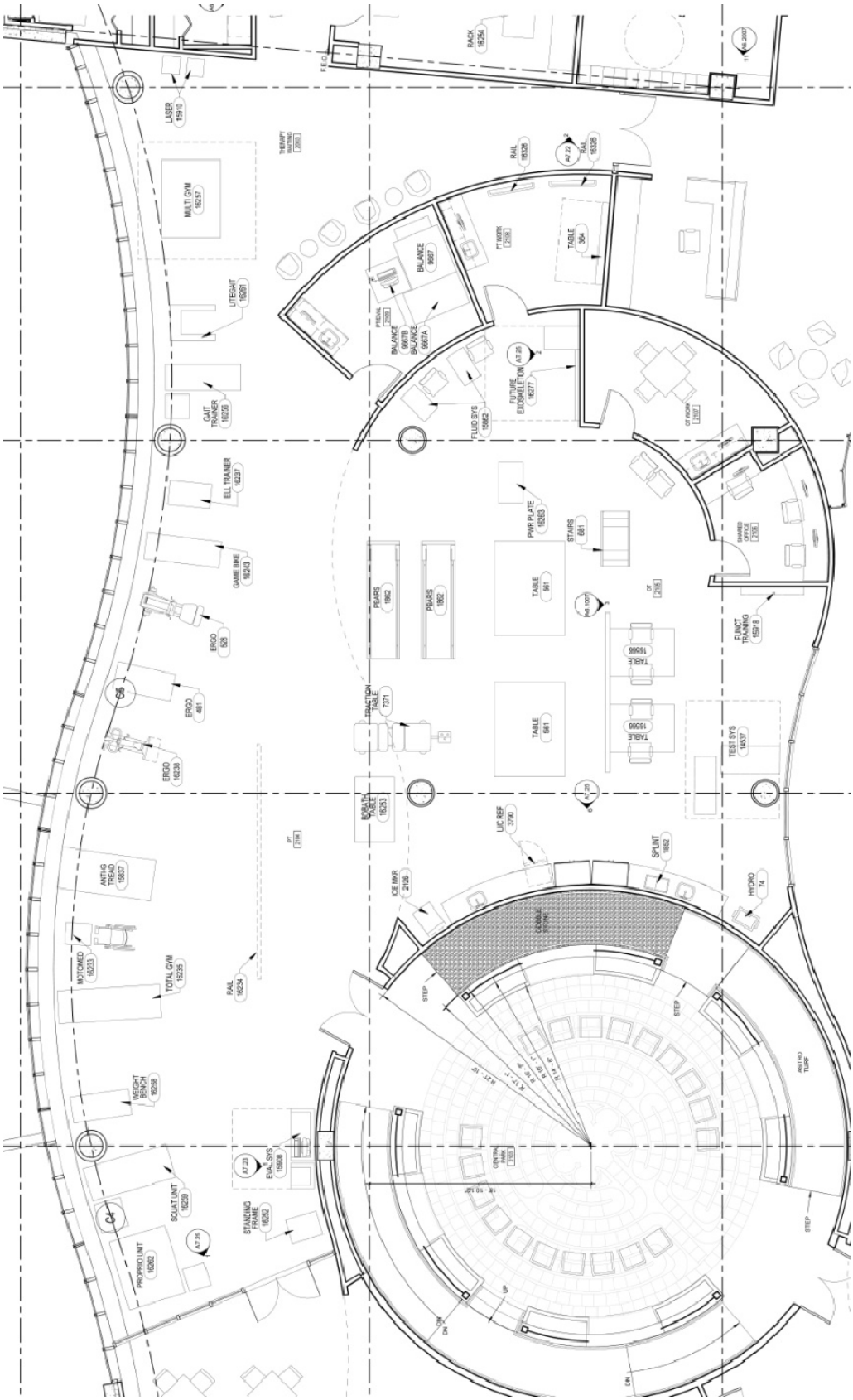


FIGURE 51: PT/OT Equipment and Furniture Locations (NTS)

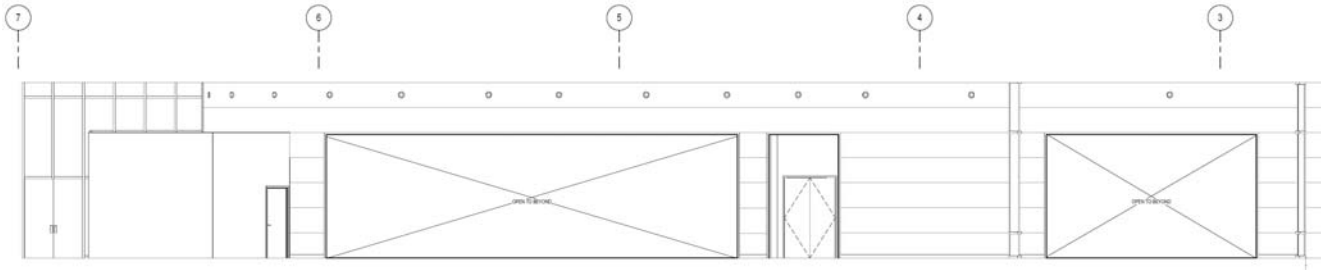


FIGURE 52: PT/OT Interior South Elevation (NTS)

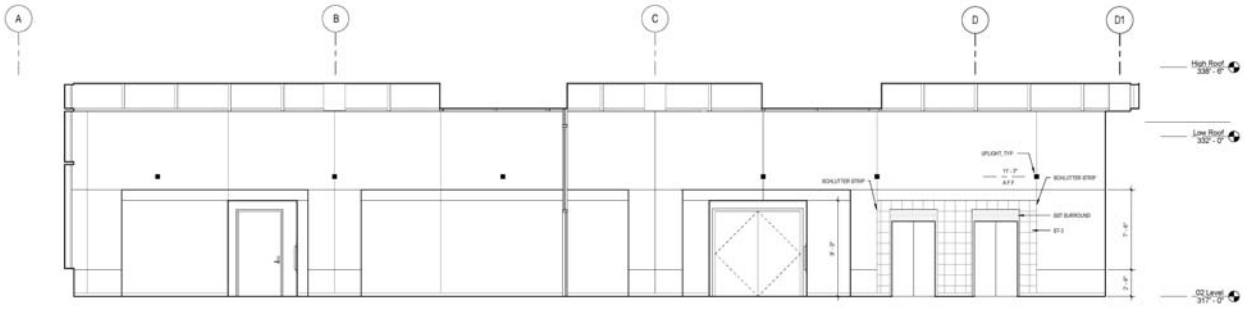


FIGURE 53: PT/OT Interior East Elevation (NTS)

o Surface Materials

Therapy Waiting

Floor - The floor consists of two types of rubber sport floor (RF-2,3).

Base - A mdf painted wood base (WDB-2) is utilized along with a 4" linoleum rubber base (RB-2) in some areas.

Walls - Most of the interior wall surfaces consist of a wood veneer wall covering (WC-1) with painted (P-1,10) aluminum at the raised ceiling along the perimeter wall. A 6.5 foot east-facing clerestory is located at the top of the east wall. The upper section is spandrel glass and the lower is composed of clear vision glass. Double aluminum doors with vision lites and a surrounding storefront wall act as a partition between the General Therapy Info space.

Ceiling - The center of the space consists of 24"x96" acoustic ceiling tile (ACT-3) while the raised ceiling along the perimeter wall is painted gypsum wall board (GWB-1).

PT

Floor - The floor consists of three types of rubber sport floor (RF-1,2,3). A narrow horizontal strip through the center of the space presents a unique pattern on the ground.

Base - A mdf painted wood base (WDB-2) lines the perimeter of the lower wall.

Walls - Most of the interior wall surfaces consist of a wood veneer wall covering (WC-1) with painted (P-1) aluminum at the raised ceiling along the perimeter wall. Painted accents are also present (P-15). The exterior wall is comprised of a curtainwall system with aluminum framing. The glass is vision glass with ceramic frit with small sections of spandrel and clear vision glass lining the top portion. Double stainless steel clad aluminum doors lead into the Art/Music space. Stained solid core double doors with a painted hollow metal frame provide access into Central Park. A stained solid core door with a narrow lite and a painted hollow metal frame provides entrance into the PT/EVAL room.

Ceiling - The center of the space consists of 24"x96" acoustic ceiling tile (ACT-3) while the raised ceiling along the perimeter wall is painted gypsum wall board (GWB-1).

OT

Floor - The floor consists of three types of rubber sport floor (RF-2,3,4).

Base - A mdf painted wood base (WDB-2) is continued around the perimeter.

Walls - The walls are painted (P-1) with alternate color accents (P-15). Cabinetry is also present in this space. The southern wall curve contains a clear vision glass window overlooking the first floor Interior Lobby. Stained solid core doors with a narrow lite and a painted hollow metal frame provide entrance into smaller adjacent rooms.

Ceiling - The center of the space consists of 24"x24" acoustic ceiling tile (ACT-2) while the raised ceiling along the perimeter wall is painted gypsum wall board (GWB-1).

FIGURE 54: Material Properties

Material	Color/Style	Reflectance
RF-1	20 CHARCOAL	0.1
RF-2	BEIGE	0.4
RF-3	RED	0.3
RF-4	DARK BLUE	0.2
WDB-2	WOOD BASE	0.3
RB-2	20 CHARCOAL	0.1
WC-1	WOOD COVERING	0.3
P-1	CREAM	0.7
P-10	DARK RED	0.4
P-15	BLUE	0.5
ACT-2	ULTIMA WHITE	0.8
ACT-3	OPTIMA WHITE	0.8
GWB-1	PAINTED P-11	0.8
ALUMINUM DOORS	ALUMINUM	0.86
WOOD DOORS	STAINED WOOD	0.2
DOOR FRAME	PAINTED P-1	0.65

FIGURE 55: Glass Properties

Material	Description	Transmittance	SHGCC	Shading Coefficient	Winter U-value	Outdoor Reflectance
IGU-1	CLEAR VISION GLASS WITH LGU-1 (LAMINATED GLASS) ON INTERIOR	63%	0.27	0.31	0.28	12%
IGU-2*	VISION GLASS WITH CERAMIC FRIT (40% COVERAGE) WITH LGU-1 (LAMINATED GLASS) ON INTERIOR	63% FOR GLASS 16% FOR DOTS	0.27 (FOR GLASS)	0.31 (FOR GLASS)	0.28 (FOR GLASS)	12% (FOR GLASS)
IGU-3	SPANDREL GLASS WITH LGU-2 (LAMINATED GLASS) ON INTERIOR	0% (FLOOR STRUCTURE)	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE
	MEDIUM STILE GLASS (DOORS)	90% (ASSUME SINGLE PAIN CLEAR)	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE	NOT AVAILABLE

*NOT ALL INFORMATION PROVIDED, SO ASSUMPTIONS MADE FROM COMPARISON TO OTHER PRODUCTS

o Furnishings

Chairs and end tables are located throughout the Therapy Waiting Room. Numerous pieces of exercise equipment occupy the PT area. The OT space contains several tables/desks and various types of therapy equipment.

o Activities/Tasks

The PT space provides an area for large movement activities and requisite equipment. Exercises and activities will take place throughout the area. Patients will be evaluated on their abilities and progress completing various movements. People will be moving around the space from one machine to another, conversing, and possibly reading forms or directions.

The OT space is used to evaluate a patient's cognitive abilities. Tasks such as screening patients, which includes an interview and a basic evaluation of functional abilities will take place.

The Therapy Waiting area will be used for patients and their families to sit and wait for treatment. They will most likely be reading or conversing among one another.

o Lighting Design Criteria – IESNA Handbook: Health Care Facilities, Occupational Therapy, Work Areas, General / Physical Therapy Departments, Gymnasiums

- Appearance of Space and Luminaires (Very Important)
  Located on the second level, the physical therapy (PT), occupational therapy (OT), and waiting areas are not one of the first space that one sees upon entering the building. While it will still be a highly occupied space, only certain patients will use it. Well known researchers and officials will not enter the space as frequently. Therefore, the appearance of the space and luminaires is not as critical, in terms of high end fixtures. However, the space should still convey similar qualities to that of the lobby at night. When lights can be seen from the outside in the dark, the two levels should look comparable in terms of lighting types/fixtures. The lighting design should also be functional and provide adequate lighting for numerous

tasks. It should not be extremely bright or have high contrast in order to accommodate for the sensitivities of traumatic brain injury patients.

- Psychological Impressions
  The impression of relaxation should be present throughout the space for patients forgoing treatment and analysis. A non-uniform lighting mode with some peripheral wall emphasis should be implemented. Visual clarity is also important for proper and safe use of machines and equipment. A uniform lighting mode with some peripheral emphasis is suggested. A blend of the two of these impressions would create a quality lighting design for the space.

  Many of the visitors in the space will be patients coming for treatment or analysis. The mood should be very calm and relaxing to ease nerves or tension. However, the space should also seem fun and exciting. Since exercising will take place in the area, the concept of movement would be appropriate.

- Color Appearance (and Color Contrast) (Very Important)
  As mentioned above, when viewed from the outside at night, both the lobby and PT spaces should complement one another in terms of color appearance. A low CCT would naturally enhance the wood walls throughout the space, however, there is also a lot of natural daylight (cooler CCT) that enters the space. In order to accommodate for both of these features, an average CCT of about 3500K is desirable. This will accent skin tones as well as the concentrated wall colors throughout the space. A high CRI is important in order to accurately view the exercise equipment and for carrying out therapy exams and assessments. There are also many colors throughout the space that are integrated into the wall and floor materials.

- Daylighting Integration and Control (Very Important)
  The curtainwall system lining the northern wall of this space provides a large amount of light during the day. Since the glass faces north and a majority of it consists of ceramic frit, direct sun angles are easily avoided. The abundance of light allows for little electric light to be needed in the space during the daytime. Photosensors are necessary to control ambient electric lighting through dimming the fixtures. The time of day and amount of light present in the space determines the necessary dimming levels. Daylight studies should be implemented in order to determine how far the light actually penetrates into the space. There are also clerestories located on the upper east wall where the ceiling is raised above the ACT. A majority of the light through those windows is shed into the low roof area. Some of the daylight does penetrate below into the waiting area. The space will not see direct sun angles because of the height and location of the elements.

- Direct Glare (Important)
  For adequate and comfortable usage of the space there should be no direct glare viewable by the users. This is especially important for patients with traumatic brain injuries because they are extremely sensitive to brightness. Direct glare from the lamp sources should be eliminated by integrating the fixtures within the architecture to conceal the luminaires and through the use of glare accessories.

- Flicker (and Strobe) (Very Important)
  As a facility for patients with traumatic brain injury, the users are very sensitive to brightness and contrast, so flicker and strobe from lights should be avoided at all costs. Although the movement in the exercise

space will be slow, light sensitive patients may notice the changes. Avoid the use of magnetic ballasts in all fixtures.

- Light Distribution on Surfaces (Important)
  Light distribution on the wood walls should be horizontally uniform, but vertically transition from bright to dark. A gradient of vertical illumination around the columns focuses on the depth and height of the features. Non-uniformity across other vertical surfaces and the ceiling will create visual interest. There are several colored walls throughout the space that could be highlighted through a uniform wash of light. Some of the floor patterns change between the interconnected spaces. These designs could be further enhanced with a unique lighting configuration.

- Light Distribution on Task Plane (Uniformity) (Important)
  There are several task planes throughout the space, which include the seating area chairs/tables (reading), PT exercise machines and floor spaces, countertops, tabletops (reading, writing, and analysis), and floor (walking). The locations should include uniform light distribution that provides the recommended light levels. Overhead lighting positioned to the sides or local task lighting is suggested.

- Luminances of Room Surfaces / Surface Characteristics (Very Important)
  Highlight the wood walls throughout the space through wall grazing. Wash the solid color walls located in the waiting and OT areas. The elevated ceilings along the perimeter provide a built-in cove that will easily house fixtures to illuminate and emphasize the beautiful texture of the material. Round columns are scattered throughout the space and provide an interesting architectural features that exposes some of the building's structural content. Lighting these elements will create visually pleasing elements. The unique curved geometry of the should draw attention as well. Lining some of the smooth edges with a clean line of light or uniformly grazing them will enhance such character. As previously mentioned, the materials are similar to those in the lobby, and should implement similar techniques.

- Modeling of Faces or Objects (Important)
  While in use, there will be constant interaction between people. Doctors and nurses will use body motions to demonstrate equipment and assist patients in training. Facial expressions and hand motions are necessary for successful communication. Appropriate light levels will enable TBI patients to easily interact with others. Some direct downlighting as well as sidelight from the windows or sconces are appropriate for vertical illumination.

- Point(s) of Interest
  One of the main points of interest in the space is the exercise equipment. Located along the curtainwall glazing, during the day, there is adequate illumination. However, in the evenings and at night, there needs to be a source of light for the area. A form of indirect or side lighting will prevent direct glare of those using equipment in which they must lay down.

  In the occupational therapy space, there is additional exercise and assessment equipment, tables, and countertops that require adequate light levels.

The waiting area that contains end tables and chairs should be a comfortable and relaxing place for patients to wait for therapy. The space should contain task lighting, but have a lower lighting level than the main circulation area so that visitors feel at ease and not in the spotlight.

- Reflected Glare and Source/Task/Eye Geometry (Somewhat Important)
  Avoid reflected glare from windows and tabletops. The abundance of windows throughout the space makes it imperative for one to ensure that luminaires are not placed close to or aimed at the glass. Tabletops may have a glossy finish, so place lights at a reasonable height and choose fixtures with glare control. For built-in furniture, place light fixtures to a user's left or right, not directly in front of or behind.

- Shadows
  Shadows should be avoided on the task planes, such as the exercise equipment, around the seats in the waiting area, tables/desks, countertops, and floor. However, shadows on the ceiling or walls would be visually interesting. The raised ceiling near the curtainwall provides a very unique and mysterious feature to the space, as one wonders what is above. There are also several walls that are unique colors, so shadows will create an even larger variety of tones.

- Sparkle/Desirable Reflected Highlights
  There should be some form of sparkle throughout the space to catch a user's attention. Sconces can be utilized along the walls around doorways to adjacent spaces. This creates an additional functional quality acting as a circulation symbol. Highlights through visually appealing lighting effects around the transition areas between the OT, PT, and adjacent spaces will catch a visitor's eye.

- System Control and Flexibility
  There should be three different control settings for the space. An "all on" setting in which all of the fixtures are on or dimmed by the photosensors. Task lighting designated to specific areas in the PT and OT areas should be left on, but general lighting throughout the PT and waiting area should be dimmable and controlled by the sensors. At night, all of the task lighting should be off, with some of the general PT space lighting on. This provides a glow on various surfaces when viewed from the exterior at night. This also acts as a security measure when the building is unoccupied in the dark. An "all off" override setting will be utilized in special situations.

  Certain luminaires should also be designated as emergency fixtures, which will remain continuously on.

- Maintenance
  The large ceiling heights make required maintenance and relamping difficult. Choose fixtures with a long lamp life to decrease the time between relamping as well as replacement costs. The lamps should require easy disposal and have color consistency over time.

- Special Considerations (Very Important)
  There is an abundance of not only exterior, but also interior glass throughout the space. In addition to the added illumination from daylight, adjacent spaces will provide some spill light as well. The points of interest should be well lit, and a path of light should guide occupants from one area to another.

- Horizontal Illuminance (Important)
  The required horizontal illuminance is as follows (IESNA Handbook):
  - Occupational Therapy = 30 fc
  - Physical Therapy = 30 fc (Waiting Area, General)

  Deviations: none

- Vertical Illuminance (Important)
  The required vertical illuminance is as follows (IESNA Handbook):
  - Occupational Therapy = 5 fc
  - Physical Therapy = 5 fc (Waiting Area, General)

  Deviations: none

- Lighting Ratios (Emax:Emin) - task plane (IESNA Handbook)
  - 3:1 or less between task and adjacent dark surroundings
  - 10:1 or less between task and remote (nonadjacent) surfaces

- Power Allowance
  The allowable power densities are as follows (ASHRAE 90.1 - 2007):
  - Physical Therapy = 0.9 W/sq.ft.
  - Exam/Treatment = 1.5 W/sq.ft.
  - Lounge (waiting area) = 0.8 W/sq.ft.

o Lighting Design

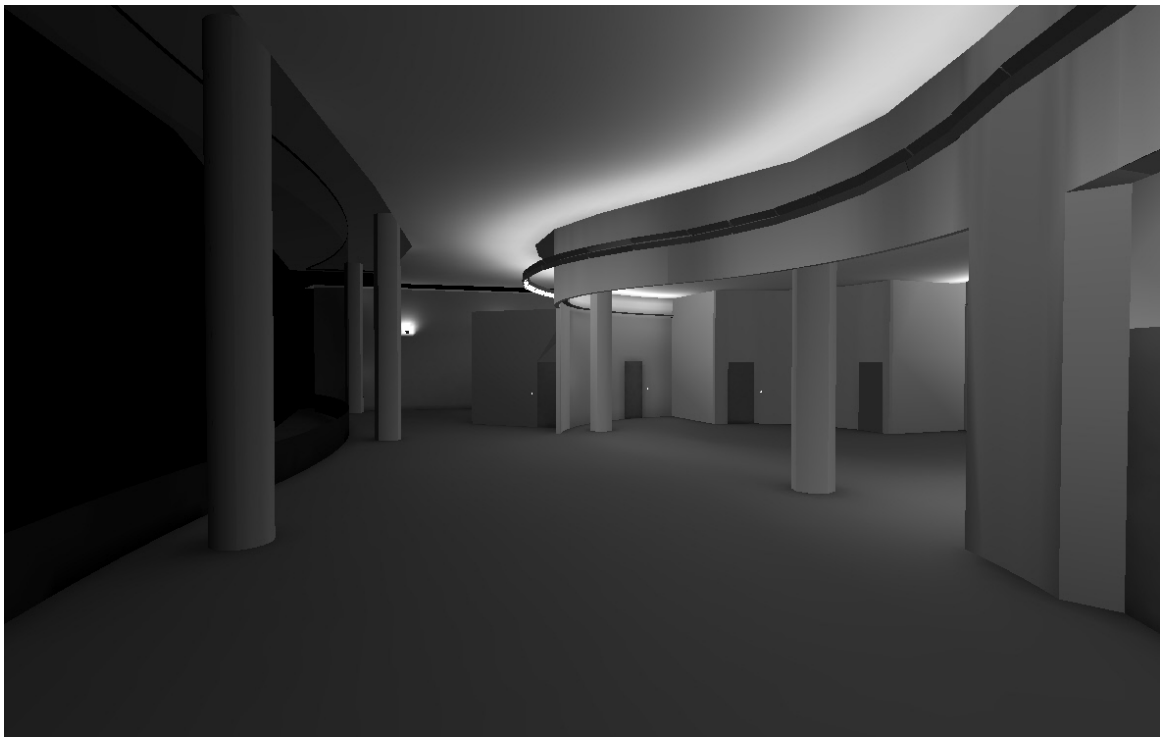


FIGURE 56: AGI Rendering: Looking East

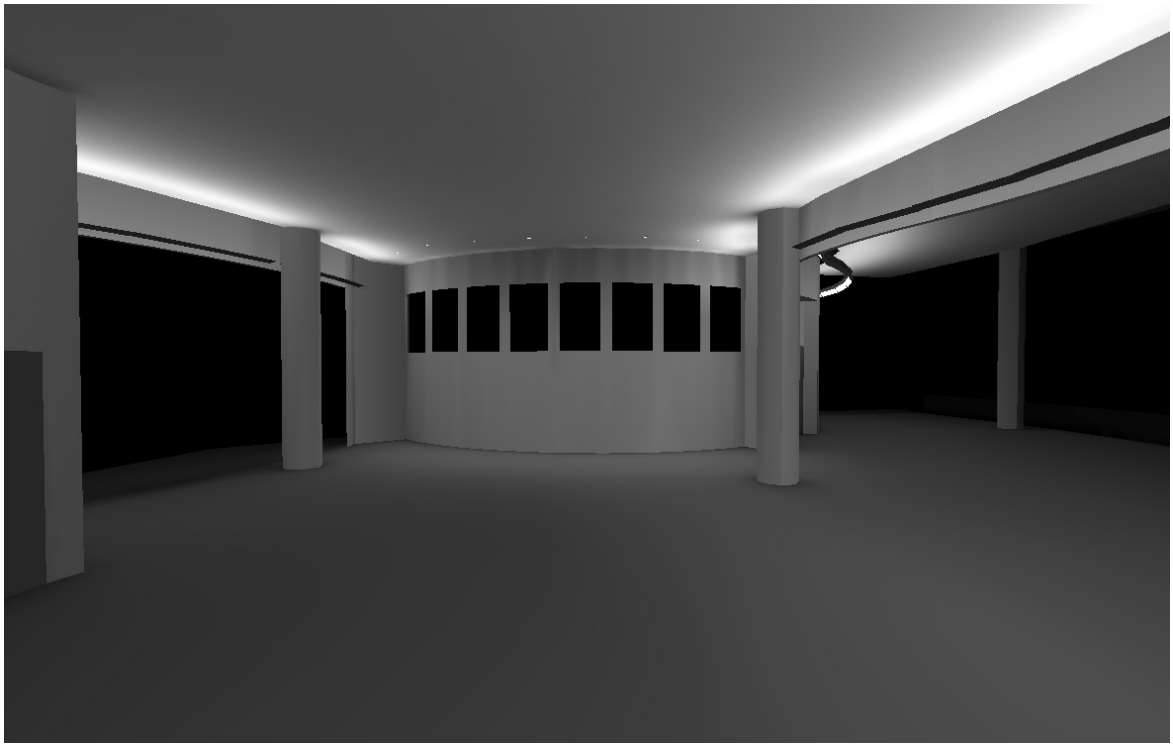


FIGURE 57: AGI Rendering: Looking West

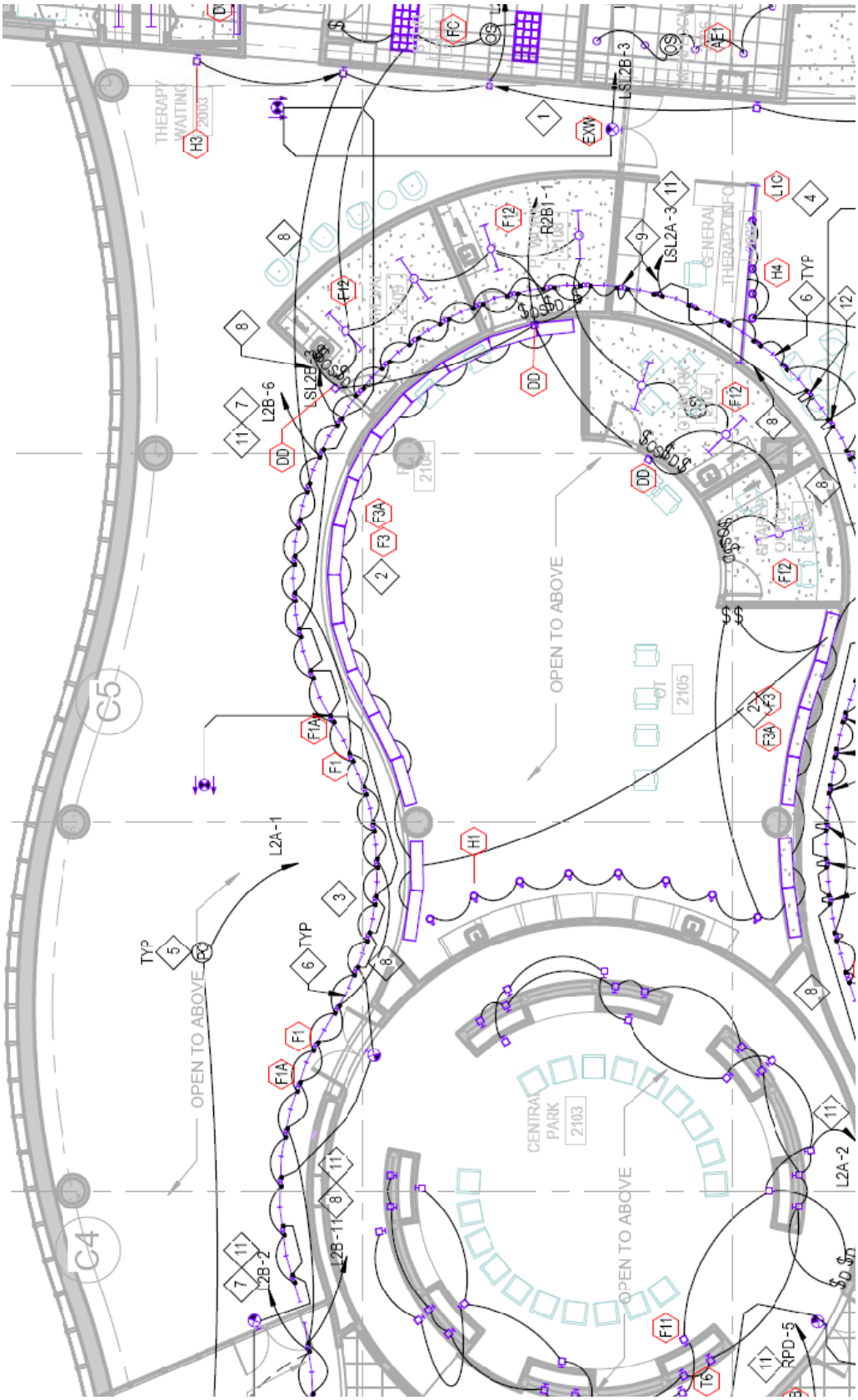


FIGURE 58: PT/OT Lighting Plan (NTS)

FIGURE 59: Luminaire Schedule

Type	Description	Manufacturer	Model	Wattage	Lamp	Voltage	Ballast/Transformer
DD	WALL-RECESSED RED LED MARKER LIGHT WITH DIFFUSE LENS	LUMUX	SL410SS-120-SS-RED	6	INTEGRAL RED LED	120	
F1	3' LINEAR FLUORESCENT DOUBLE REFLECTOR ASYMMETRIC FIXTURE WITH T5HO CEILNG WASH AND T8 WALLWASH WITH VERTICAL LOUVERS	ELLIPTIPAR	STYLE 307 MODIFIED	60	(1) 39W T5HO, (1) 21W T8 3500K	277	UPLIGHT 10% DIMMING BALLAST, WALLWASH STANDARD BALLAST
F1A	4' LINEAR FLUORESCENT DOUBLE REFLECTOR ASYMMETRIC FIXTURE WITH T5HO CEILNG WASH AND T8 WALLWASH WITH VERTICAL LOUVERS	ELLIPTIPAR	STYLE 307 MODIFIED	86	(1) 54W T5HO, (1) 32W T8 3500K	277	UPLIGHT 10% DIMMING BALLAST, WALLWASH STANDARD BALLAST
F3	3' LINEAR FLUORESCENT ASYMMETRIC COVE FIXTURE	LEDALITE	INCOVE II	39	(1) 39W T5HO 3500K	277	
F3A	4' LINEAR FLUORESCENT ASYMMETRIC COVE FIXTURE			54	(1) 54W T5HO 3500K	277	
H1	4" DIAMETER OPEN RECESSED METAL HALIDE DOWNLIGHT WITH MEDIUM DISTRIBUTION	GOTHAM	ATH	39	(1) 39W T4 3000K	120	
H3	SURFACE MOUNTED METAL HALIDE ASYMMETRIC UPLIGHT WITH WEDGE SHAPE HOUSNG, FORWARD THROW DISTRIBUTION, AND INTEGRAL BALLAST	SPI	EIW SERIES	150	(1) 150W T6 3000K	277	

FIGURE 60: Light Loss Factors

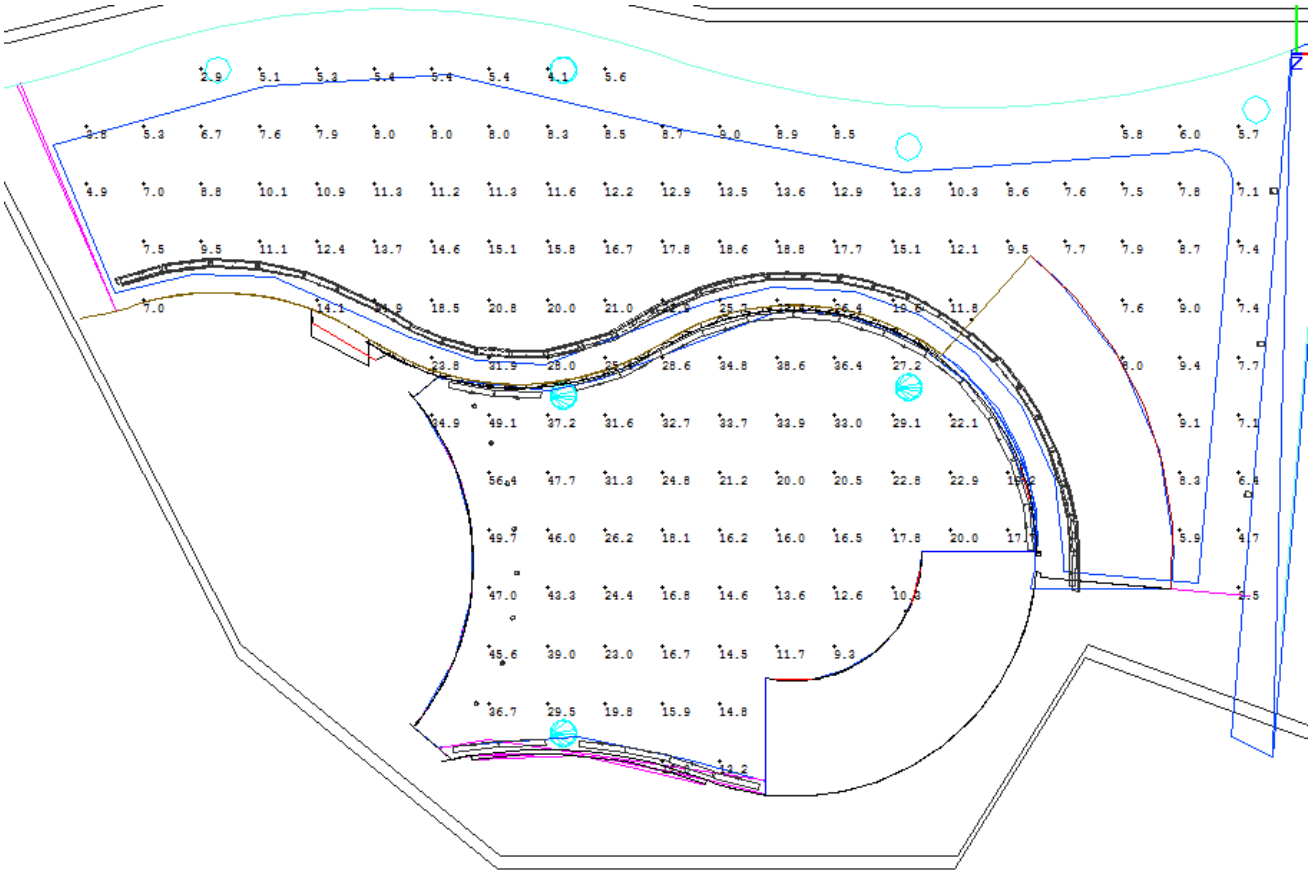
Type	Maintenance Category	Distribution Type	Degree of Dirtiness	Cleaning Cycle	Room Cavity Ratio
DD	V	Direct-Indirect	Clean	12 Months	3
F1	VI	Direct-Indirect	Clean	12 Months	3
F1A	VI	Direct-Indirect	Clean	12 Months	3
F3	VI	Indirect	Clean	12 Months	3
F3A	VI	Indirect	Clean	12 Months	3
H1	IV	Direct	Clean	12 Months	3
H3	VI	Indirect	Clean	12 Months	3

Type	BF	LLD	LDD	RSDD	Total LLF
DD	Not Available	Not Available	0.88	0.92	0.8096
F1	0.9	0.88	0.86	0.92	0.6266304
F1A	0.88	0.9	0.86	0.92	0.6266304
F3	1	0.95	0.86	0.88	0.71896
F3A	0.99	0.95	0.86	0.88	0.7117704
H1	1	0.88	0.89	0.97	0.759704
H3	1	0.7	0.86	0.88	0.52976

FIGURE 61: The following numbers were calculated by using two separate AGI calculations. They are the sum of vision glass that is 63% transmissive and covers 60% of the glass, and ceramic frit that is 16% transmissive and covers 40% of the glass.

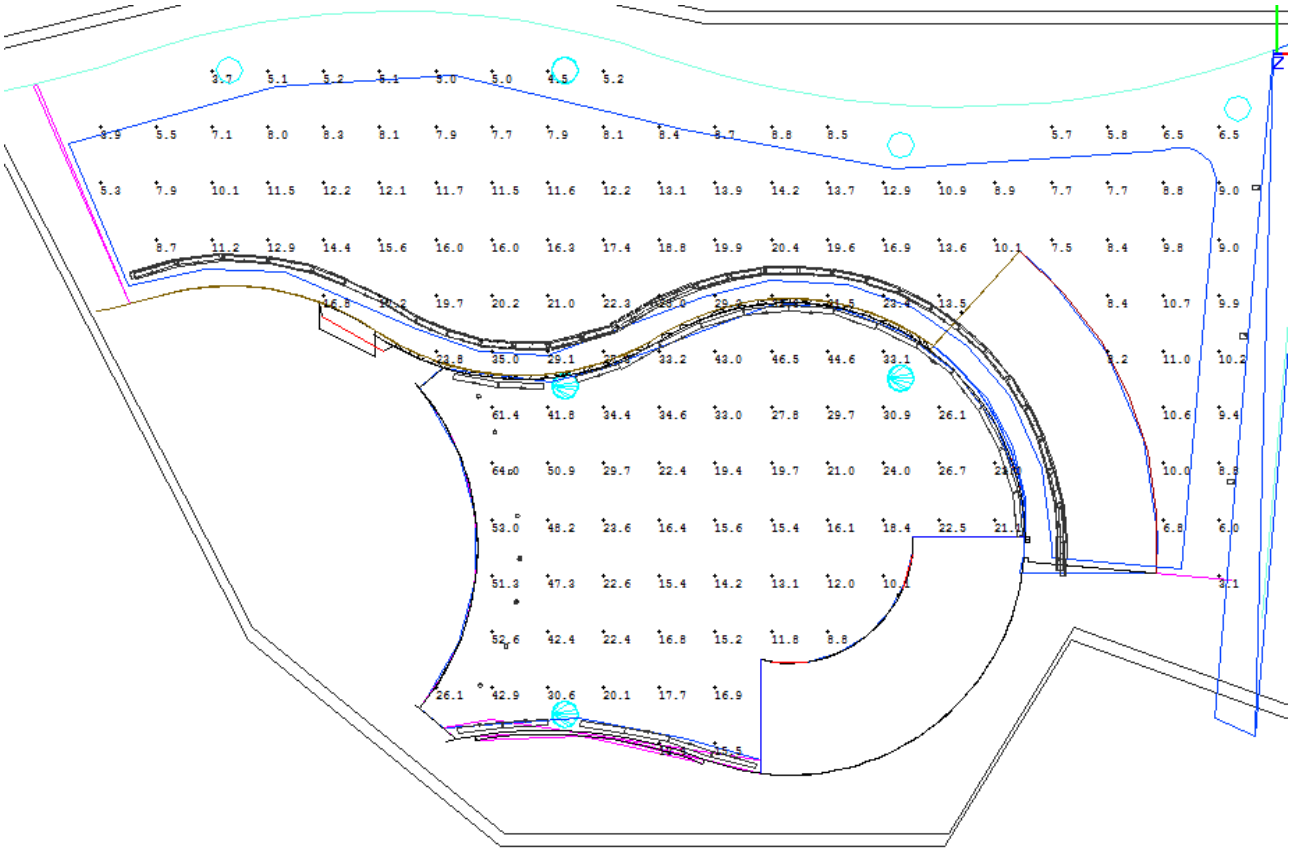
Combination of Ceramic Frit and Clear Vision Glass																						
			6.1	8.8	9	9	8.8	7.6														
5.9	8	10.1	13.2	12.6	12.7	12.5	12.3	12.4	14.1	13.6	14.3	14.7									8.5	3.8
7.4	11.1	14.7	17.6	18.8	18.9	18.4	17.9	17.8	18.5	19.4	20.6	21.4	21.3	20.2	9.5	15.6	13.5	12.4	12.4	12.7	9.9	
	14.5	19.7	23.4	25.8	26.9	26.3	25.6	25.6	26.5	28.4	30.8	32.3	31.6	29.7	26.2	21.1	16.8	14.7	14.8	15.4	10.8	
	14.9	21.2	25.7	28.6	31.4	33.4	34.4	34.8	36.5	39.4	42.2	44.5	44.8	39.6	32	23.6		12.4	14.9	15.7	10.3	
					35.1	38.3	44.1	43.3	45.1	49.9	59.4	68	70.6	63.6	34.6				15.3	17	9.8	
							78.6	72	54.6	62.4	81	89.6	89.6	78.8	60.3				14.6	16.8		
							116.9	118.1	71.6	65.5	62.7	52.1	49.2	57	53.7	51			12.9	15.1		
								124.4	71.8	42.6	37.2	36.9	38.4	43	50.3	51.5				13.6		
								113.9	63.5	36.2	30.6	29.8	30	32.2	38.9	42.5				9.1		
								111.3	61.5	35.2	29.5	27.1	23.8	21.2								
							85.9	101.5	55.7	37.1	33.1	28.3	17									
							69.2	64.7	43.7	34.1	34.9	29.7										
											25.2	27.1										
Max	**124.4**																					
Min	**3.8**																					
Ave	**34.274**																					

The following were calculated in AGI using a combined window glass transmittance of 44.2% (ceramic frit on curtainwall was 16% transmissive and covered 40% of the window, while visible glass was 63% transmissive and covered 60% of the window)



Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Max/Min
Floor	Illuminance	Fc	17.03	56.4	2.5	22.56

FIGURE 62: AGI Calculations: Floor with All On



Calculation Summary						
Label	CalcType	Units	Avg	Max	Min	Max/Min
Workplane	Illuminance	Fc	18.24	64.0	3.1	20.65

FIGURE 63: AGI Calculations: Workplane with All On

FIGURE 64: ASHRAE Standard 90.1

Space	Total Area (sq.ft)	Total Watts	Allowable Lighting Power Density (W/sq.ft.)	Total Lighting Power Density (W/sq.ft.)
Physical Therapy	1960	2042	0.9	1.04
Occupational Therapy	1500	1458	1.5	0.97
Waiting Area	640	450	0.8	0.70
		Total	3.2	2.716961735

o Daylighting

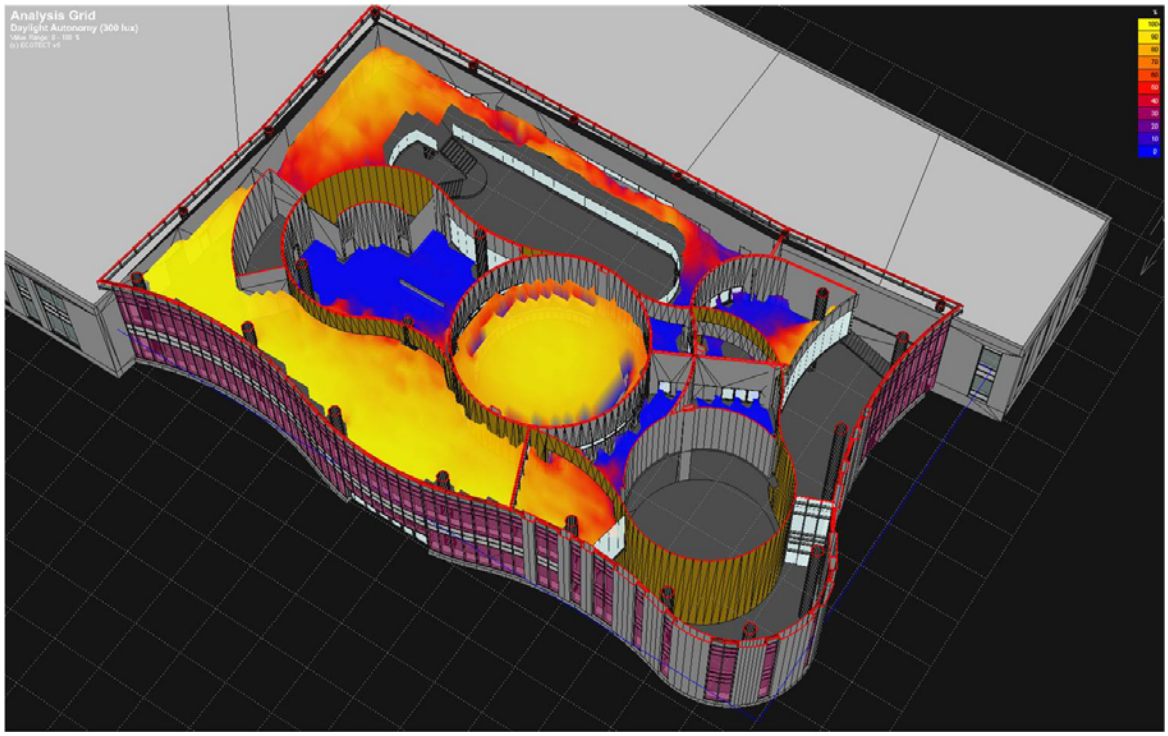


FIGURE 65: Daylight Study: PT/OT/Waiting Area (SmithGroup)

As a result of the curtainwall along the north facade, a numerous amount of daylight is present in this space. Ceramic frit glass is used to prevent direct sunlight angles and still provide exterior views. Since the glass is north-facing, adequate light (without direct south-facing sun angles) is able to penetrate into the space. Clerestories are also present on the east wall to produce light further into the space. Photosensors are located on the ceilings to control electric lighting during the day.

o Lighting Controls

A response from the lighting designer regarding controls is still pending, however, as such a large space, it is assumed that most of the fixtures will be on a timer. Photosensors are also located in the PT space and control luminaires F1 and F1A.

o Lighting Evaluation and Critique

Lighting throughout the space is appropriate for providing a relaxing atmosphere for patients through peripheral wall lighting. The appropriate mid to low color temperatures are utilized. Upon awaiting further control information, it is assumed that most of the lighting in connected to a timer switch. In order to utilize the daylight, luminaires located near the curtainwall windows are controlled by photosensors.

According to the AGI calculations and IESNA recommendations, the lighting level throughout the space is not appropriate for the activities taking place. Due to the daylight contribution there will be adequate light levels in the physical therapy and waiting area during the day. However, the partial wall and lower ceilings that separate the PT and OT spaces prevent daylight from spilling into the occupational therapy area, which benefit from slightly more illumination. At night, as viewed in the calculation grids, there are not sufficient light levels to accommodate for general workspace tasks.

In regards to the daylighting throughout the space, the clerestory located along the east wall actually provides more light into the space than one would assume. Due to its location on the raised ceiling, it is surprising that, according to the daylghting study, the contribution on the workplane is adequate.

In the waiting area, the only electric lighting available is from the sconces located along the east wall. At 11', and with large ceiling heights, the uplight is not reflected back onto the workplane. Along the opposite wall, there is no illumination above the chairs for reading/writing capabilities, other than daylight during the morning and afternoon hours.

Along the curved wood wall in the PT space, the custom fixtures are utilized to provide both a wall and ceiling wash in the space. This matches the style and use of luminaires located in the lobby directly below on the first floor. At night, the view from the exterior will be drawn to the consistency in design. This is a clean and functional technique that provides indirect lighting in the space; however the cove created from the raised ceiling along the perimeter provides the perfect opportunity to conceal fixtures. Washing the wood walls is an effective way to exhibit the natural materials, but highlighting the acoustical ceiling tiles is not very aesthetically pleasing.

In the OT space, the downlights above the countertop provide task lighting. The light levels are fairly uniform in this area, but there are slightly more footcandles than necessary. In the other occupational areas, the surrounding cove fixtures provide a fairly uniform amount of ambient light throughout the space that are a little lower than recommended.

Overall, the lighting seems very minimal, but functional. The space could use some more ambient light at some of the task planes when daylight is not available. The lighting design also meets the ASHRAE Standard 90.1 allowable power density.