Technical Assignment 1:
Lighting Existing Conditions and Design Criteria Report

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Executive Summary

The following Lighting Existing Conditions and Design Criteria Report analysis the lighting system being considered for the renovation and addition of the Franklin Care Facility. It is important to note that the information for this report was gathered from 80% design development documents. This is not a report of the actual lighting conditions of the Franklin Care Facility. Many assumptions have been made regarding issues that have not been finalized.

This report analyses a general overview of the lighting in the Franklin Care Facility as well as a detailed analysis for the physical therapy suite, main entrance lobby, chapel and courtyard. Analyses were completed taking into account design criteria recommended by the IES Handbook, the IES Lighting and the Visual Environment for Senior Living, and special needs of the individual spaces. Each space was analyzed using AGI32 rendering software. Accurate IES files were used for each luminaire type, and light loss factors calculated. Daylighting and room surface materials were also taken into account. Daylighting studies were completed for the physical therapy suite and main entrance lobby. These studies show the effect of light during the 21st of March, June, and December at 10am and again at 1pm. ASHRAE 90.1 power densities were compared to the designed power densities in the spaces.

Lighting in the Franklin Care Center should cater to the needs of the elderly. Illuminance values, glare, flicker and contrast are very important issues. Daylighting is essential in this building since it will be a living facility where the occupants will spend all of their time. Daylighting also plays an important role in cutting energy usage and working towards a green building. Most of the electrical lighting will be controlled by a DALI system, and dimming can integrate with daylight to provide correct illuminance levels while using minimum energy. The Franklin Care Center is anticipating LEED silver certification, and the lighting should be designed accordingly.

Main Goal:

To create an illuminated environment that is comfortable for the elderly and energy efficient to help the Franklin Care Facility acquire LEED green building certification.

Design Overview for the Franklin Care Facility:

Design criteria in this report has been compiled using the IES lighting handbook and IES Lighting and the Visual Environment for Senior Living.

Eye problems arise with age, making the lighting needs for an elderly facility different from those of a typical building. Generally, the elderly suffer from reduced acuity and contrast sensitivity. The illuminance seen by the eye of a typical 60 year old is one third of the same illuminance seen by the eye of a 20 year old. The best way correct this difference in an elderly facility is to raise the light levels while being sensitive to contrast and glare. In addition to higher ambient lighting levels, task lighting should be provided in all spaces where tasks requiring higher light levels will be performed.

In elderly facilities special attention should be given to hazardous areas such as stairs or changes in elevations. Lighting should be used to make these areas stand out, and be easily identified. While contrast should be created in these areas, it should be avoided in general lighting to prevent confusion. For example, higher illuminance levels can make stairs more visible, but high contrast such as scalloping on walls can create confusion. For the elderly contrast is useful to mark a hazardous area, but not for decoration.

A uniformly bright environment would be the most comfortable for the elderly. As the eye ages, it takes longer to adjust to different light levels. Adjacent rooms and corridors should not have any abrupt changes in light levels, and corridors can provide as a transition space between a room with a high light level and one with a low light level. The best lighting source to create the ideal environment, while providing high light levels, is fluorescent lighting. However, large direct fluorescent luminaries, such as 2x4 parabolic fixtures, should be avoided because the elderly can be very sensitive to the glare they produce.

Fluorescent luminaries are also a good choice to provide energy efficient lighting. T8 and compact fluorescent lamps output a relatively high number of lumens per watt. Fluorescent sources can be used to design an energy efficient lighting system, and put the building on the path to being green.

Daylighting is another source of light that is essential to energy efficient lighting and the needs of the elderly. Daylight is a readily available source of light that, when used properly, can conserve energy, produce quality interior lighting levels, improve color rendering, increase visibility, reduce glare and please the building occupants. With a dimming control system installed, daylight can be used in place of the full output of electric lighting.

The Franklin Care Center is anticipating LEED silver certification. While many components are required to receive LEED certification, it is essential to conserve energy in the lighting system. LEED credits are earned for optimizing energy performance based on the actual power density as compared to the ASHRAE 90.1 standard. Points are awarded on a percentage below standard power density basis depending on if the building is new or existing. Since the Franklin Care Center is an existing building that is undergoing renovation, the numbers for existing buildings will be used.

Existing Lighting Conditions Planned for the Franklin Care Facility:

It is important to note that the Franklin Care Center addition and renovation is in the design phase. The information contained in this report has been compiled from 80% Design Document drawings. The floor plans and lighting layouts are not final and will be revised before the project goes out to bid.

Virtually all of the lighting in the Franklin Care Facility is fluorescent or compact florescent. This source type was chosen to reduce glare and flicker, provide energy efficient lighting, and allow a DALI system to control the lighting. DALI stands for Digital Addressable Lighting Interface, it is a digital lighting system based on 120/277V fluorescent and compact florescent digital ballasts. Using DALI, each ballast is given an address and that address can be used to control the fixture either individually or in a group. Any fixture can be grouped into multiple configurations using any fashion desired (by fixture type, room, scene, etc.) The DALI system in the Franklin Care Center will run off of Lutron dimming digital ballasts. The Lutron ballasts allow the lamps to be dimmed from 100% to 10%, allowing for lighting flexibility and energy savings. The only flaw in this type of control system is that fluorescent lights have to run for 100 hours before they are able to be dimmed or the life of the lamp will be greatly reduced. Using DALI 64 ballasts are zoned and can then be grouped to work together in scenes. The grouping of the luminaries for the DALI system has not been decided upon yet, but they will have to be grouped so that when the fixtures in a room are replaced they can burn for 100 hours without being dimmed.

The majority of the interior lighting will be controlled by DALI, with the exception of the incandescent sources in the chapel and lobby, and the LED step lights. The exterior lighting will be controlled by a photo-electric cell/time clock as part of the DALI system. All of the lighting on the DALI system will be able to be centrally controlled from one location.

Daylighting elements were designed throughout the Franklin Care Center. Patient rooms are required to have windows, so they lie on the perimeter of the building. Social spaces on the interior of the building are provided with daylight through the use of windows, glazed walls, clerestories or skylights. For this report it was assumed that skylights are made of diffuse glass, and glazed windows are transparent.

Design Criteria and Existing Conditions Analysis for Specific Spaces

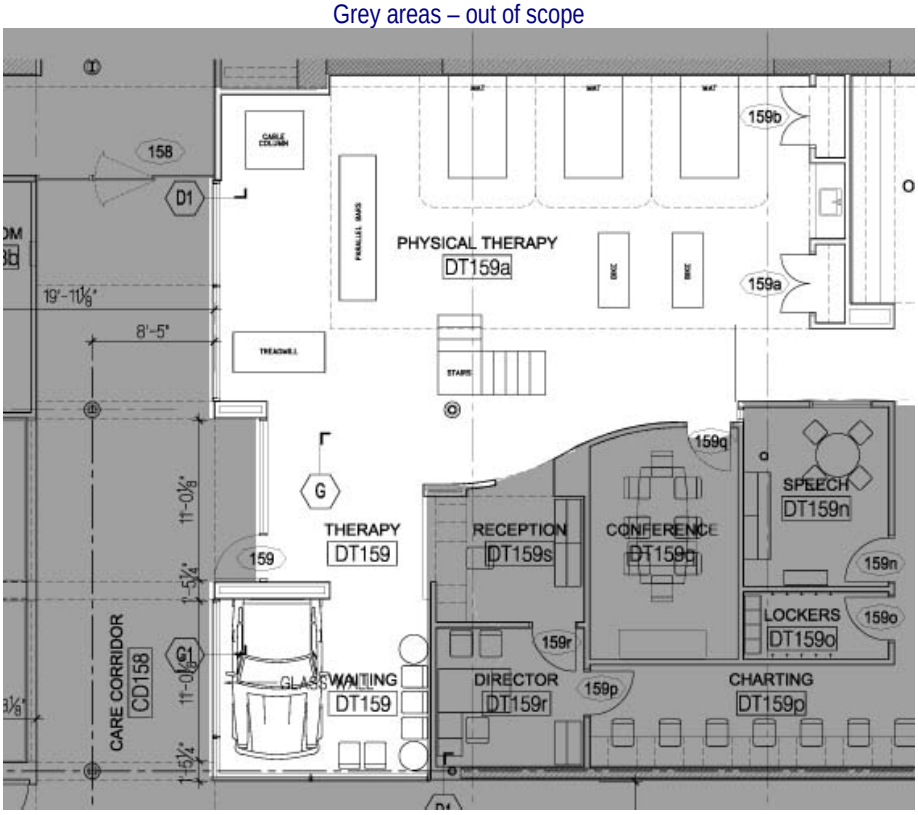
Physical Therapy Suite

Overview:

The physical therapy suite will be used for physical rehabilitation. It is similar to a small gym with exercise mats, bikes, treadmill, stairs, parallel bars and cable column. There is also a small sink and two closets in the therapy room. A divider separates the physical therapy area from the entrance to therapy and waiting area.

Physical Therapy Suite Floor Plan with Furniture

Grey areas – out of scope



Finishes:

Floor
Carpet
Brown
p=22%

Walls
Gypsum Wall board covered in beige fabric
p=52%

Ceiling
Acoustical ceiling tile
white
p=86%

*Finishes materials are final, however all reflectance values for finishes have not bee decided and are assumed

Glazing – diffuse, transmittance=40%

Design Criteria

Main Goal

To create a design that utilizes daylight and provides energy efficient electrical lighting to create a comfortable, casual environment for elderly patients to undergo physically rehabilitation.

Very important design factors:

Appearance:

The physical therapy area should provide visual cues to assist the occupant's orientation. From the entrance of the suite, the luminaries should assist the occupant on the path to either the gym or waiting area. In the gym there should be clear access to the exercise equipment. The luminaires can also be used to create a casual gym atmosphere, different from many of the medical spaces in the building.

Daylight integration and control:

The physical therapy suite is an interior room with no windows. However, for energy conservation as well as physiological well being, it is important to integrate daylight into this space. Daylight varies throughout the year in New Jersey, so a control system should be used to balance out the light levels during anytime of the year.

Color Contrast:

The difference in perceived color between a task and its background is particularly important in the gym area while using equipment where potential accidents can occur. Contrast can be more difficult to recognize for the elderly, so lamps with a decent CRI should be used to help the occupants see the gym equipment more clearly.

Flicker:

Eyes of the elderly are particularly sensitive to flicker, and for this reason HID lighting should not be used in the physical therapy area.

Luminance of room surfaces:

The surfaces in the physical therapy suite should result in a bright atmosphere to match with the daylight that will be integrated into the space. Uniform room surfaces are important since the elderly are sensitive to contrast.

Horizontal Illuminance:

The horizontal illuminance for a physical therapy area should be 50fc at the task plane. In this case there are several floor mats for exercise for which the floor can be considered the task plane. In the waiting area 10 fc should be provided.

Vertical Illuminance:

Vertical illuminance is necessary to illuminate vertical elements of gym equipment. The vertical illuminance should be a minimum of 5fc.

Important design factors:

Direct glare:

Although the physical therapy suite does not need to be designed for a visually intensive task, luminaries should be skillfully placed to prevent glare. Since the elderly are particularly sensitive to glare, large direct light sources such as 2x4 parabolic fixtures should not be used. Daylighting elements must also be carefully designed to prevent direct glare. It is important for the physical therapy suite to be a comfortable space free from glare to make the patients rehabilitation more enjoyable.

Light Distribution on surfaces:

The gym equipment in the physical therapy suite causes risk of injury. Lighting should be uniformly distributed on the surfaces of the equipment to make it easily seen. Patterns, or contrast changes can cause confusion.

Facial Modeling:

While the physical therapy suite is for rehabilitation, it is also a social place. People will be meeting and working together, so facial modeling should be good. Inter-reflection of light from room surfaces can help create adequate facial modeling, especially with the use of daylighting.

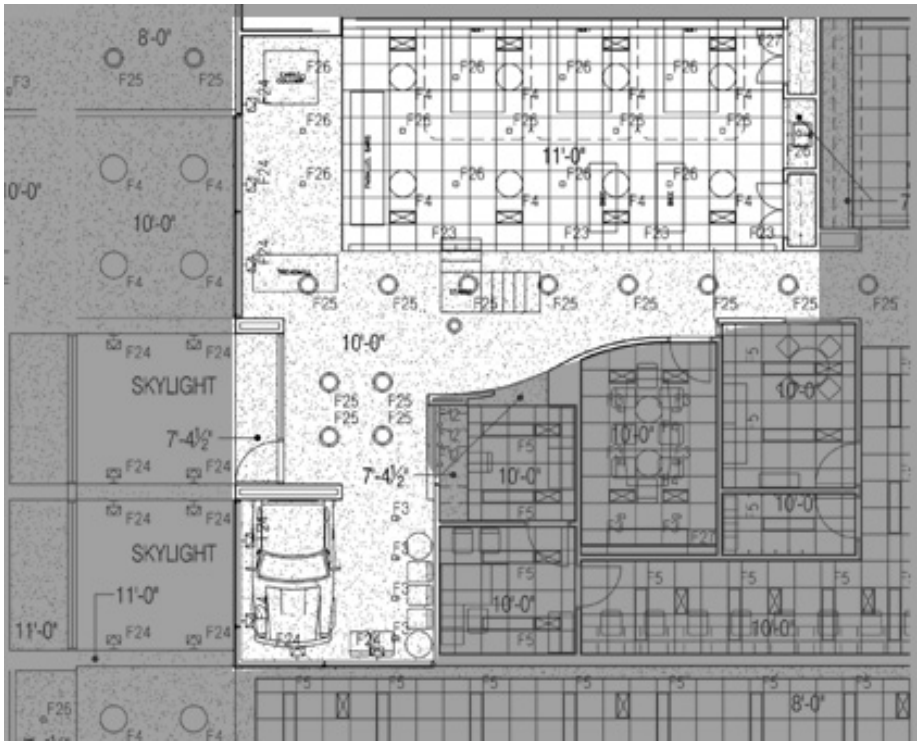
ASHRAE 90.1 Power Density: Using the space by space power density method, a physical therapy area in a health care facility should have a maximum power density of 0.9 W/sqft.

Existing Conditions

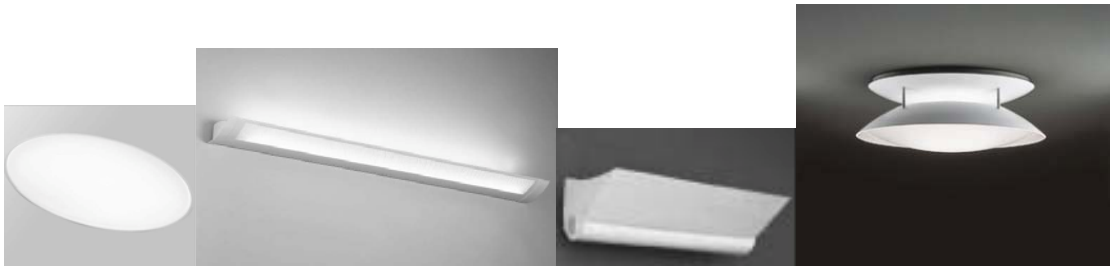
Compact fluorescent and fluorescent luminaries provide the majority of illumination to the physical therapy area. Decorative recessed fixtures are used in addition to smaller recessed compact fluorescent fixtures to provide a comfortable therapy area rather than giving the space an institutional feeling. The walls are washed by T5 fluorescent wall wash and up/downlight wall mounted fixtures. All of the lamps used in the physical therapy area have a CRI of 82 and a CCT of 3000K.

Daylighting is a vital component to the lighting of the physical therapy suite. Daylight enters the space from two welled skylights located in the adjacent care corridor. The glass of the skylight has been assumed to be diffuse and have a transmission value of 40%. The wall of the physical therapy suite facing this corridor is made of glass to allow light from the skylight to shine through. Most of the daylight enters the waiting area, with less light penetrating into the rehabilitation area. The perimeter wall washers in the rehabilitation are keep the space bright and uniformly illuminated The finishes in the physical therapy area are light, with the exception of the floor, allowing the wall washing to create a bright and inviting space.

Existing Lighting Layout



Visible Luminaires



F4 F23 F24 F25

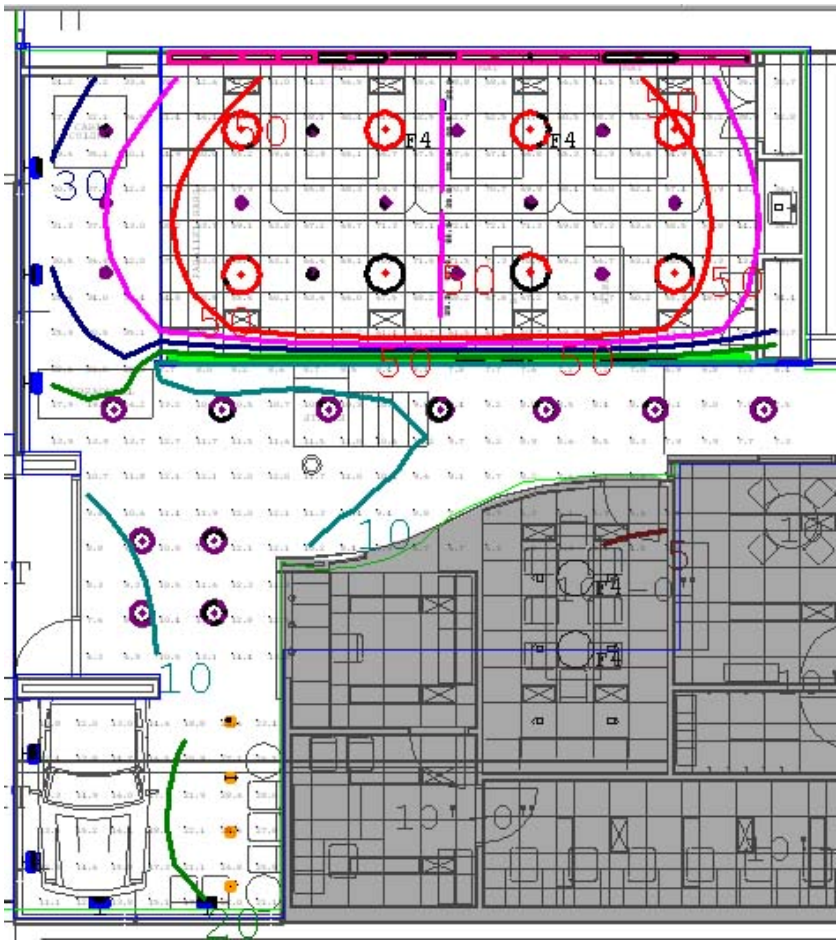
Luminaire Schedule

Fixture Label	Luminaire Type	Mounting	Source Type	Lamp Type	Number of Lamps	Ballast	CRI	CCT	Ballast Watts	Lamps per ballast	Fixture Quantitiy
F3	4.5"x4.5" Wall washeer	Recessed	Compact fluorescent	T4 triple tube	1	Integral Digital	82	3000K	32	1	4
F4	2' diameter concave	Recessed	Compact fluorescent	T4 biax	2	Integral Digital	82	3000K	75	2	8
	lensed downlight										
F23	Up/Down Light	Wall	Fluorescent	T5	1	Integral Digital	82	3000K	36	1	8
F24	2' uplight	Wall	Fluorescent	T4 triple tube	2	Integral Digital	82	3000K	81	2	7
F25	Oval downlight	Semi-Recessed	Compact fluorescent	T4 triple tube	2	Integral Digital	82	3000K	51	2	11
F26	6" lensed downlight	Recessed	Compact fluorescent	T4 triple tube	1	Integral Digital	82	3000K	32	1	13
F27	Perimeter Wallwasher	Recessed	Fluorescent	T5	1	Integral Digital	82	3000K	36	1	8

Applied Light Loss Factors

Luminaire Label	Maintenance Category	Cleaning Interval	Initial Lumens per Luminaire	Mean Lumens per Luminaire	LLD	LDD	RSDD	BF	Total LLF
F3	VI	Clean - 6 months	1800	1530	0.85	0.91	0.975	0.95	0.72
F4	V	Clean - 6 months	6300	5418	0.86	0.89	0.975	0.95	0.71
F23	II	Clean - 6 months	2600	2418	0.93	0.93	0.94	1	0.81
F24	VI	Clean - 6 months	6400	5440	0.85	0.91	0.895	0.95	0.66
F25	V	Clean - 6 months	2400	2040	0.85	0.89	0.975	0.95	0.70
F26	V	Clean - 6 months	1800	1530	0.85	0.89	0.975	0.95	0.70
F27	V	Clean - 6 months	2600	2418	0.93	0.89	0.975	1	0.81

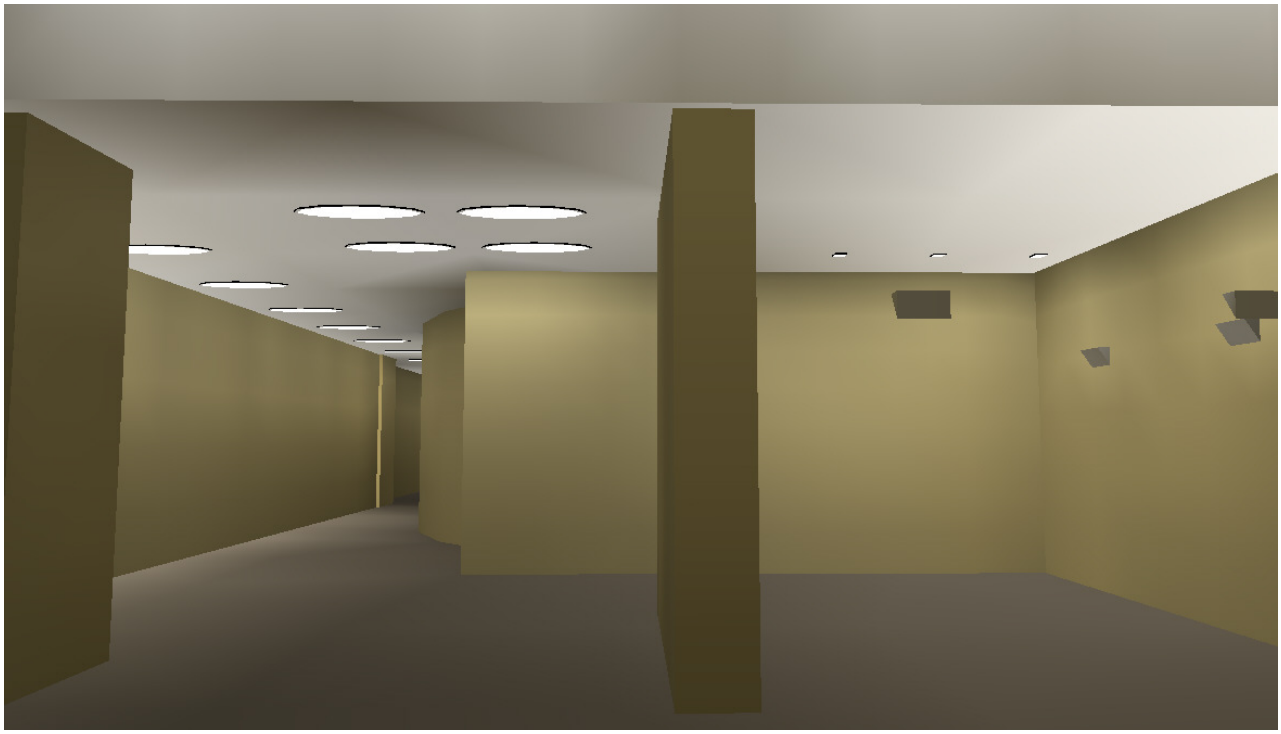
Illuminance Values of Electric Lighting



	Electric Lighting Only		Vertical Illumination (FC)
	Waiting area Illuminance (FC) at 2.5'	Rehabilitaion Illuminance (FC) at floor	In rehab area
Average	18.53	26.68	32.32
Maximum	28.6	58.2	66.2
Minimum	10.9	4.6	23.3
Avg/Min	1.7	6.23	1.39
Max/Min	2.62	12.65	2.84

Power Density = 1.90 W/sqft

AGI32 Renderings of Physical Therapy Suite Electric Lighting Only



Waiting Area and Corridor

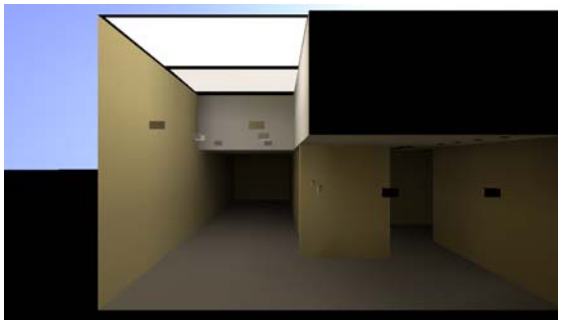
Rehabilitation Area

Existing Daylight Study:

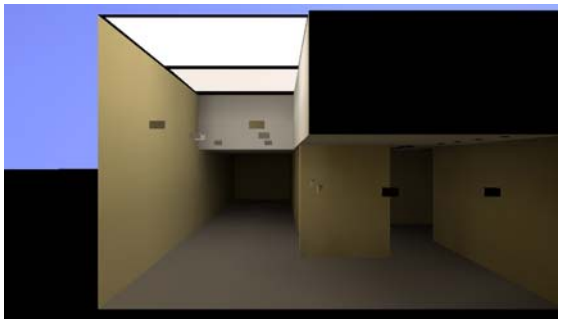
The physical therapy suite will typically be open during daylight hours, so the daylight entering the area from the adjacent corridor can benefit the space. The charts on the following page show the comparison of daylighting for 10:00 am and 1:00 pm, throughout three different dates of the year. This study assumed the skylights to be diffuse glass with a transmission value of 40%. The illuminance values obtained from this study are a little high because I eliminated the glass wall between the corridor and physical therapy. As you can see from the illuminance values below, during daylight hours an abundant amount of light is supplied into the visitors lounge, eliminating the need for direct electric lighting. A good deal of light also penetrates into the therapy area during certain times of the year. However the illuminance provided is much greater at the north end of the room near the corridor than at the opposite end. To create uniformity a flexible control system is essential to this area. A flexible control system can not only balance the space, but can be used to maintain illuminance values with the varying amount of daylight provided throughout the physical therapy area. Some electric lighting will be needed in the rehabilitation area at all times during the day to provide adequate vertical illumination.

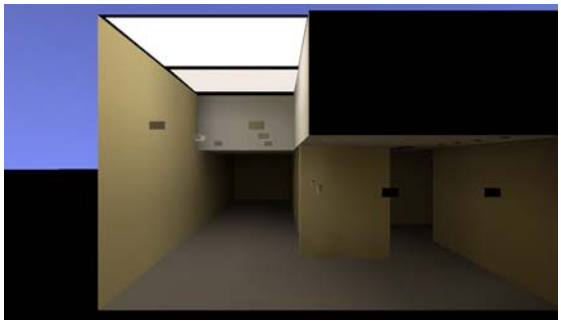
Daylight Study:

	March 21 at 10am Waiting area Illuminance (FC) at 2.5'	March 21 at 10am Rehabilitaion Illuminance (FC) at floor	Vertical Illumination (FC) In rehab area	March 21 at 1pm Waiting area Illuminance (FC) at 2.5'	March 21 at 1pm Rehabilitaion Illuminance (FC) at floor	Vertical Illumination (FC) In rehab area
Average	301.8	30.12	0.19	479.55	238.5	0.27
Maximum	863	326	0.4	1358	7558	0.5
Minimum	63.8	0	0	110	0	0
Avg/Min	4.73	0	0	4.34	0	0
Max/Min	3.53	0	0	12.29	0	0

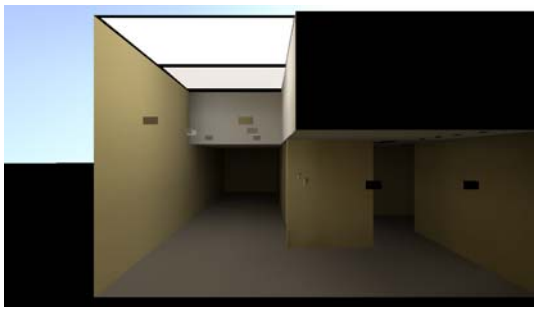


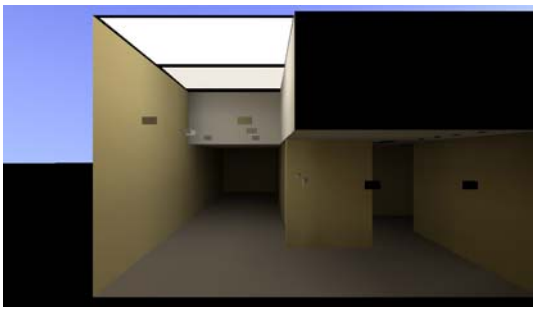
	June 21 at 10am Waiting area Illuminance (FC) at 2.5'	June 21 at 10am Rehabilitaion Illuminance (FC) at floor	Vertical Illumination (FC) In rehab area	June 21 at 1pm Waiting area Illuminance (FC) at 2.5'	June 21 at 1pm Rehabilitaion Illuminance (FC) at floor	Vertical Illumination (FC) In rehab area
Average	538.25	50.34	0.3	573.47	175.77	0.3
Maximum	1524	593	0.6	1638	9346	0.7
Minimum	124	0	0	127	0	0
Avg/Min	4.32	0	0	4.51	0	0
Max/Min	12.23	0	0	12.89	0	0





	December 21 at 10am Waiting area Illuminance (FC) at 2.5'	December 21 at 10am Rehabilitaion Illuminance (FC) at floor	Vertical Illumination (FC) In rehab area	December 21 at 1pm Waiting area Illuminance (FC) at 2.5'	December 21 at 1pm Rehabilitaion Illuminance (FC) at floor	Vertical Illumination (FC) In rehab area
Average	118.68	16.39	0.15	251.19	193	0.18
Maximum	339	247	0.5	718	3898	0.5
Minimum	25.4	0	0	54	0	0
Avg/Min	4.67	0	0	4.65	0	0
Max/Min	13.37	0	0	0	0	0





Analysis of Existing Lighting:

The type of electric lighting used in the physical therapy suite creates a uniform, comfortable environment for the patients. Fluorescent lighting is a good choice to conserve energy and reduce glare in this type of environment. However the illuminance at the task plane, which is the floor in this case, falls a little short of the minimum recommended value for a physical therapy area used by the elderly. While daylight will be present in the room for most of the operating time, the electric lighting should provide sufficient illumination levels alone incase the space needs to be used during dark hours. The illuminance in the waiting area exceeds the recommended minimum illuminance in order to provide a light level closer to that of the therapy area, reducing the adjustment time for the eye from one space to the other.

The power density for the physical therapy suite is 1.9 W/sqft, while maximum power density using the space by space method according to ASHRAE 90.1 is 0.9 W/sqft. The actual power density is 111% above the value set by ASHRAE. The power density needs to be greatly reduced to meet ASHRAE, and should be further reduced to earn LEED credit as a green building.

Daylighting elements for this space were designed to limit glare and make the light entering from the skylights as natural as possible. The light enters through the glass into a skylight well where it reflects off of the white walls before entering the building. Before entering the physical therapy suite the light passes through a glass wall with glass doors. This simulates a building with a glass exterior façade. Light is entering the room the same way it would if this room was free standing on the street. Glare is reduced in the therapy suite because the sunlight is not coming from directly above, but is entering from the side. Glare could be further reduced, especially in the corridor where the skylights are located, by using splayed wells.

The negative aspect of the daylighting technique used in the physical therapy suite is that the majority of the daylight enters into the waiting area. It would be more beneficial to have the daylight entering the physical therapy rehabilitation area where the patients will be spending the majority of their time. The physiological benefits of daylight include providing people with a “boost” which can be helpful when exercising.

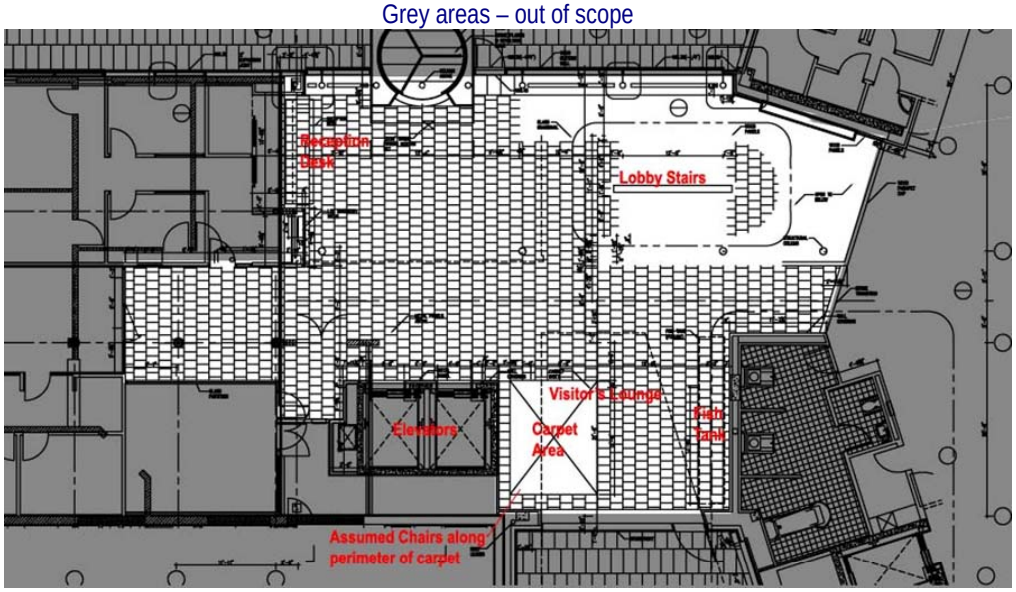
Main Entrance Lobby

Overview:

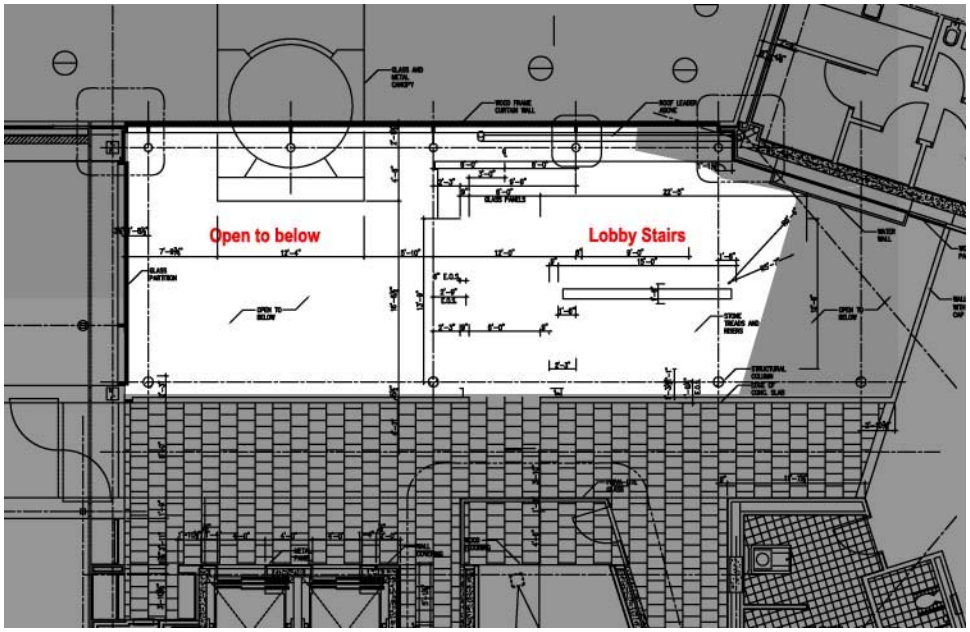
The Main Entrance Lobby provides the entrance to the home of the occupants of the Franklin Care Center. Entrance to the building is provided by a revolving glass door, which leads to a reception area. The receptionist will have a computer, and a LCD directory screen is mounted on the wall next to her desk. Once you enter the lobby, the main staircase will be on your left hand sides, and elevators straight ahead. The main entrance also includes a visitor's lounge where visitors can sit and read while waiting and access to a gift shop.

Main Entrance Floor Plan with Furniture

Grey areas – out of scope

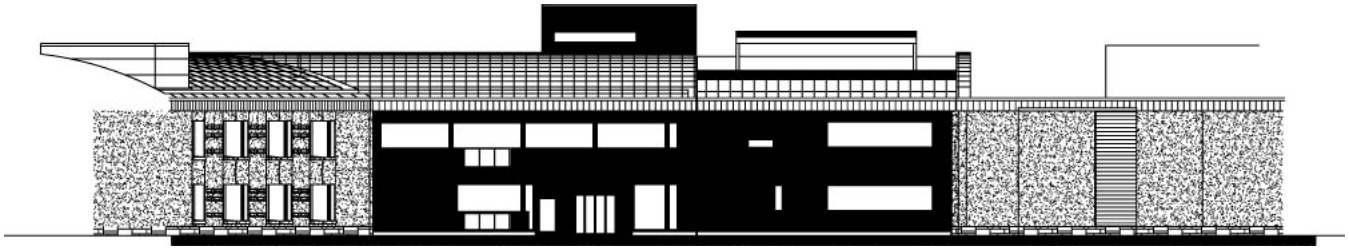


1st Floor plan

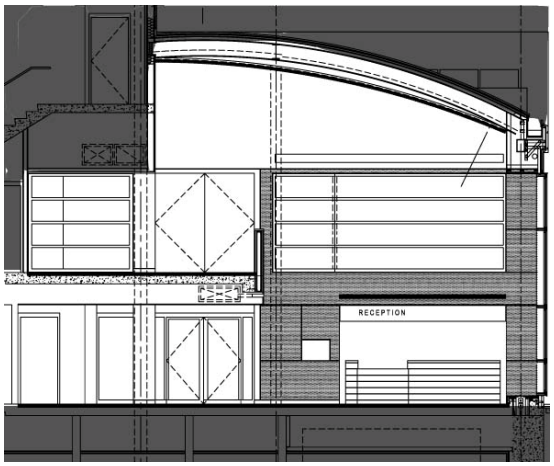


2nd floor – shows opening to first floor

Elevation and Section



Elevation from East



Section looking north

Finishes:

Floor
Carpet –
Green colored
p=25%

Walls
Paint-
white
p=66%

Ceiling
wood

p=29%

Granite
P=54%

Glazing – transmittance=40%

*Finishes materials are final, however all reflectance values for finishes have not been decided and are assumed

Design Criteria

Main Goal:

To utilize daylighting and energy efficient lighting to create a welcoming entrance space to the Franklin Care Center that also provides as a transition space adequate for the adjustment time of the elderly' eyes.

Very Important Design Factors:

Appearance (Typically Important):

Although appearance is typically considered an important factor for the lighting design of the entrance to a health care facility, I believe that appearance is a very important design factor for the Franklin Care Center. The main entrance serves as the entrance to the home of the residents of the Center, and therefore should look inviting and impressive. It is very important for the main entrance to portray a welcoming feeling rather than an institutional one. Part of the space is open to the second floor with a vaulted wood slot ceiling. This architecture should be enhanced through the lighting of the lobby.

Daylighting Integration and Control:

Daylight is particularly important to the entrance of an elderly care center. As the eye ages it has a more difficult time adjusting to different light levels. So an elderly person may have difficultly entering a dark lobby from the bright outdoors. Instead, the lobby must be used as a transition space. Integrated daylight is the easiest way to balance the light levels inside the lobby with the light levels outside. Electric lighting should be controlled on dimmers for this application, so at night the lobby lighting can be lower to match the night sky more closely.

Integrating daylight into the lobby can also save energy. The lobby is a large space that daylight can penetrate far into. The open space with vaulted ceiling will also allow daylight to enter the second floor lobby and corridor making the demand for electric lighting lower.

Horizontal Illuminance:

The illuminance in the lobby must be flexible to allow for the adjustment of occupant's eyes as they enter from the outdoors. During the day the horizontal illuminance of the main entrance should be 100fc. This is much higher than a typical lobby because it takes into account the slower adjustment of elderly people's eyes. At night the horizontal illuminance should be only 10 fc to match the low illuminance levels outdoors.

The reception area requires an illuminance of 50fc on the workplane to allow for administrative tasks and VDT use.

The visitor lounge should have a horizontal illuminance of 30fc at the workplane to allow for reading tasks.

Vertical Illuminance:

To provide good facial rendering, the vertical illuminance for the lobby and waiting area should be a minimum of 5fc.

Luminance of room surfaces:

Since the lobby will be used as a transition space from the bright outdoors into the building, the surfaces should be light to create a bright atmosphere.

Facial Modeling:
The main entrance is a very social space where people will be constantly interacting. Special attention should be given to facial modeling. The use of daylight and indirect lighting techniques should be used to create good facial modeling.
Color Contrast:
Since aesthetics are so important to the entry space, so is the color contrast. A good CRI lamp should be used to get true color, and enhance the materials of the space.
Flicker:
Eyes of the elderly are particularly sensitive to flicker, and for this reason HID lighting should not be used in the main entrance.
Light distribution on surfaces:
Light should be uniformly distributed on surfaces. Patterns, or contrast changes can be extremely distracting to the elderly. In the lobby contrast can be used to orient occupants, but should not be present unnecessarily.

Important Design Criteria:
Glare:
Direct glare should be avoided in the lobby since it can be distracting. Lighting in the lobby should be used to enhance the architecture, and glare would take away from that goal.
Source/Task/Eye geometry:
Source/task/eye geometry is more important in the visitors lounge and reception than in the main lobby area. Task lighting should be provided for a VDT at the reception desk, and adequate lighting should be provided for reading in the visitors lounge.

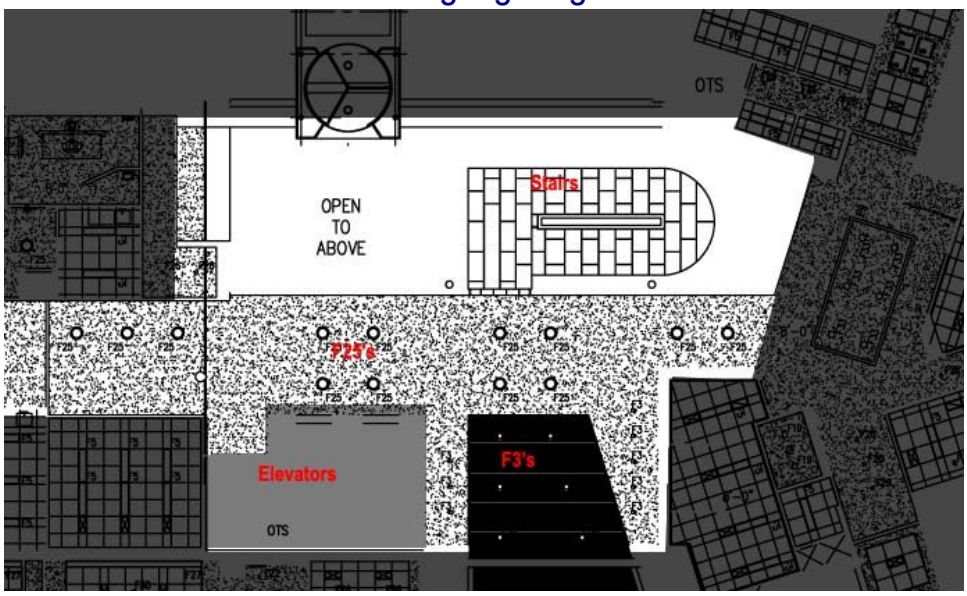
ASHRAE 90.1 Power Density: Using the space by space power density method, a lobby should have a maximum power density of 1.3 W/sqft.

Existing Conditions

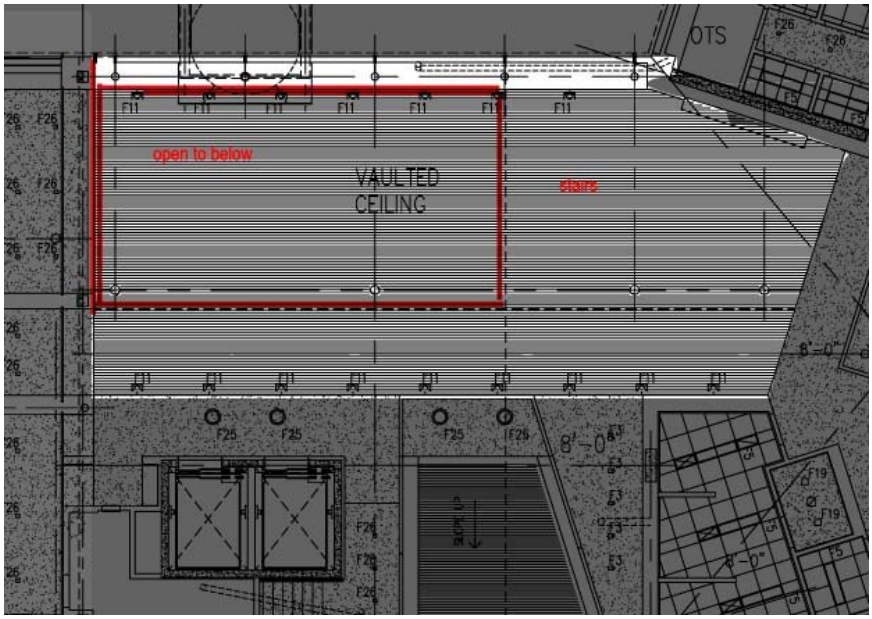
The wood slat ceiling is illuminated using 150W incandescent quartz lamps in uplights. Compact fluorescent sources are used for recessed decorative fixtures are in the main lobby circulation area, and decorative pendants in the visitor lounge. The recessed fixtures lead a visitor from the main entry to the elevator lobby and the visitor lounge. The stair lighting has not been designed yet.

The East wall of the lobby is made of glass, allowing daylight into the space. Since the east portion of the lobby is open through the second floor to the vaulted ceiling, light also enters the second floor lobby space. The glass is assumed to be transparent with a 40% transmission value.

Existing Lighting Plans



1st floor



2nd floor – shows opening to first floor

Visible Main Entrance Lobby Luminaires

F11 F25 F30

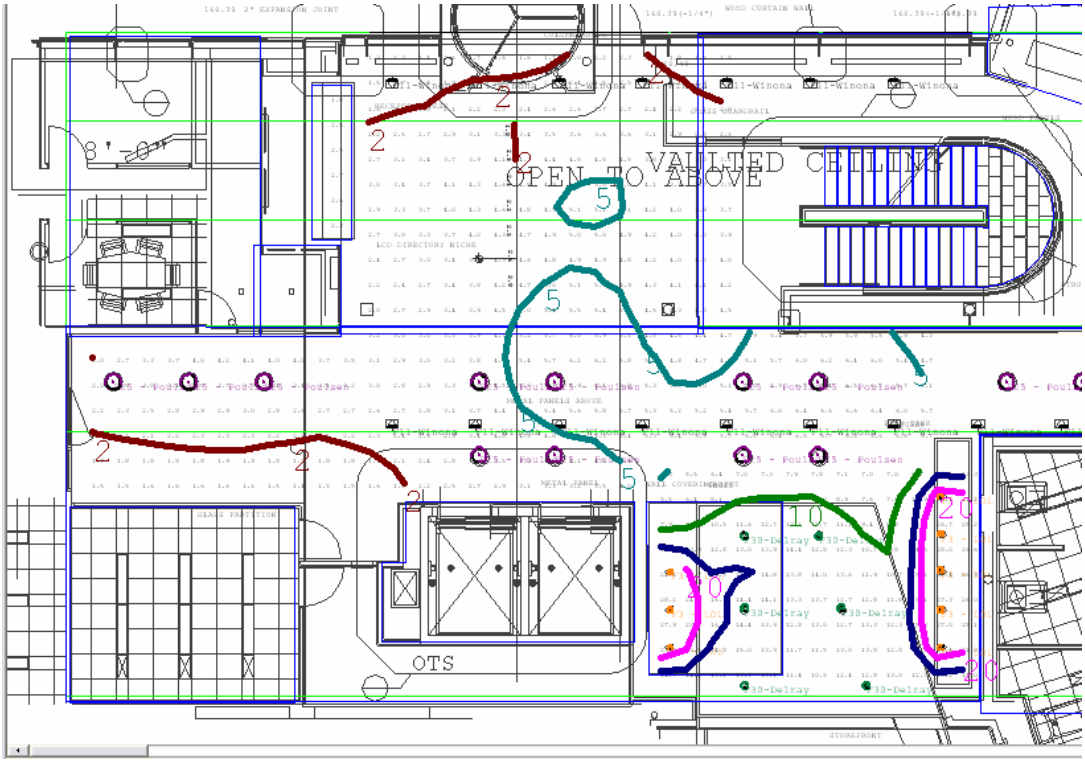
Luminaire Schedule

Fixture Label	Luminaire Type	Mounting	Source Type	Lamp Type	Number of Lamps	Ballast	CRI	CCT	Input Watts	Lamps per ballast	Fixture Quantitiy
F3	4.5"x4.5" Wall washeer	Recessed	Compact fluorescent	T4 triple tube	1	Integral Digital	82	3000K	32	1	8
F11	Assymetric Uplight	Wall	Incandescent Quartz	T3	1	N/A	100	2950K	150	N/A	16
F25	Oval downlight	Semi-Recessed	Compact fluorescent	T4 triple tube	2	Integral Digital	82	3000K	51	2	13
F30	Open apeture pendant	Suspended	Compact fluorescent	T4 triple tube	1	Integral Digital	82	3000K	32	1	16

Applied Light Loss Factors

Luminaire Label	Maintenance Category	Cleaning Interval	Initial Lumens per Luminaire	Mean Lumens per Luminaire	LLD	LDD	RSDD	BF	Total LLF
F3	VI	Clean - 12 months	1800	1530	0.85	0.91	0.98	0.95	0.72
F11	VI	Clean - 12 months	2250	1500	0.67	0.89	0.9	N/A	0.53
F25	V	Clean - 12 months	2400	2040	0.85	0.89	0.98	0.95	0.70
F30	III	Clean - 12 months	1800	1530	0.85	0.9	0.97	0.95	0.70

Electric Lighting Illuminance Values

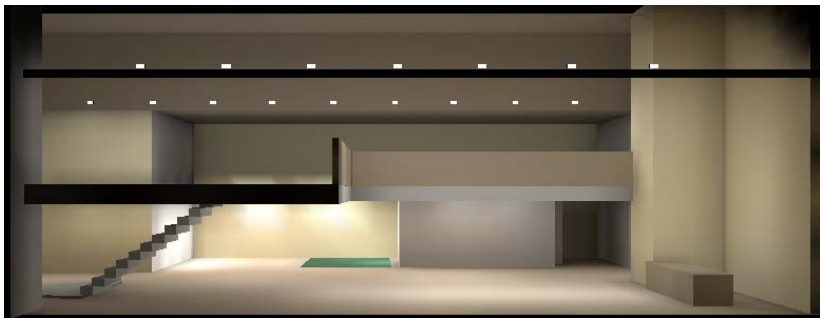


	Electric Lighting Only			Vertical Illumination (FC) in lobby
	Lobby Illuminance (FC) at floor	Visitor Lounge Illuminance (FC) at 2.5'	Reception Illuminance (FC) at 2.5'	
Average	3.73	14.28	2.4	2.28
Maximum	6.8	28.2	2.7	3
Minimum	1.3	4.8	1.8	1.6
Avg/Min	2.87	2.98	1.33	1.43
Max/Min	5.23	5.88	1.5	1.88

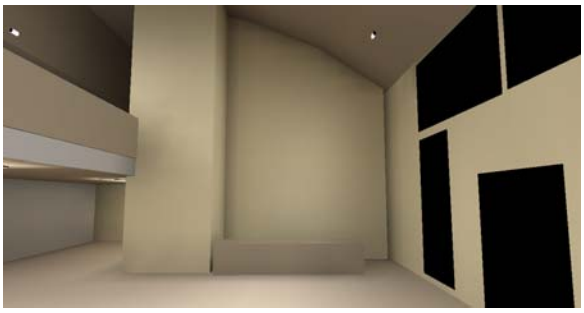
Power Density = 1.36 W/sqft

AGI32 Renderings
Main Entrance Lobby
Electric Lighting Only

Lobby and Visitor's Lounge



Lobby view from Entrance



Reception Desk

Existing Daylight Study:

The East facing wall of the lobby is made of glass with an assumed transition value of 40%. This daylighting element allows a great deal of light to enter the lobby during the day. The light color of the walls and vaulted wood ceiling allow the light to reflect off of the surfaces and provide high horizontal and vertical illuminance levels in the lobby area. Daylight also enters the second floor from the open area. Some daylight reaches the visitors lounge, but most is concentrated in the front of the main entrance area. The charts on the following page show the comparison of daylighting for 10:00 am and 1:00 pm, throughout three different dates of the year.

	March 21 at 10am				March 21 at 1pm			
	Lobby Illuminance (FC) at floor	Visitor Lounge Illuminance (FC) at 2.5'	Reception Illuminance (FC) at 2.5'	Vertical Illumination (FC) (FC)	Lobby Illuminance (FC) at floor	Visitor Lounge Illuminance (FC) at 2.5'	Reception Illuminance (FC) at 2.5'	Vertical Illumination (FC) (FC)
Average	483.81	17.66	895.78	363	201.69	6.51	523.48	120.5
Maximum	1461	60.9	1381	167	2634	18.7	2320	310
Minimum	8.6	8.1	205	1.47	0.2	3.3	113	40.2
Avg/Min	56.26	2.8	4.36	2.17	1008	1.97	4.61	3
Max/Min	169.92	7.53	6.72	0	13174	5.67	20.43	7.73

	June 21 at 10am				June 21 at 1pm			
	Lobby Illuminance (FC) at floor	Visitor Lounge Illuminance (FC) at 2.5'	Reception Illuminance (FC) at 2.5'	Vertical Illumination (FC) in lobby	Lobby Illuminance (FC) at floor	Visitor Lounge Illuminance (FC) at 2.5'	Reception Illuminance (FC) at 2.5'	Vertical Illumination (FC) in lobby
Average	641.17	19.38	163.25	326.72	229.59	6.53	132.8	106.11
Maximum	2627	62.6	173	504	3125	19.4	183	230
Minimum	1.4	8.6	147	210	0.2	3.2	87.6	39.7
Avg/Min	457.98	2.25	1.11	1.55	1147	2.04	1.52	2.67
Max/Min	1876	7.28	1.17	2.39	15629	6.06	2.1	5.8

	December 21 at 10am				December 21 at 1pm			
	Lobby Illuminance (FC) at floor	Visitor Lounge Illuminance (FC) at 2.5'	Reception Illuminance (FC) at 2.5'	Vertical Illumination (FC) in lobby	Lobby Illuminance (FC) at floor	Visitor Lounge Illuminance (FC) at 2.5'	Reception Illuminance (FC) at 2.5'	Vertical Illumination (FC) in lobby
Average	381.07	10.28	1002	243.17	55.22	3.9	87.65	48.58
Maximum	1824	30.7	1734	295	335	11.8	130	103
Minimum	2.2	5	363	166	0.1	1.7	53.6	19.6
Avg/Min	173.21	2.06	2.76	1.46	552.2	2.29	1.64	2.48
Max/Min	829.32	6.14	4.77	1.77	3352	6.94	2.43	5.29

Analysis of Existing Lighting:

Aesthetically the electric lighting in the main entrance lobby is very nice. The high reflectance vaulted wood ceiling is illuminated from beneath, enhancing the architecture of the lobby. The pendants used in the lobby and visitor's lounge are decorative and create a residential feel. The lobby lighting does not have an institutional feel, and you feel like you are entering a home community and not a health facility. However, the levels of lighting are very low. 10fc is recommended at night, but the electric lighting only provides an average of 3.73fc at the floor. The 15 – 150W quartz lamp fixtures do not provide enough light on the ceiling to reflect 10fc. To use a purely uplighting technique either more fixtures or fluorescent fixture should be used. The reception desk is only illuminated with the ambient light, providing 2.4fc, well below the suggested 50fc. Although she is located directly next to the window, task lighting is necessary for the receptionist to read and use her computer when daylight is not may not be adequate because the ratio of task to surroundings will be greater than the recommended 1:10. The pendants in the visitors lounge provide adequate ambient light, however the 14.28 illumination level is a little low for reading.

The power density of the electrical lighting is 1.36 w/sqft, while the maximum lighting density for a lobby using the space by space method according to ASHRAE 90.1 is 1.3 w/sqft. This makes the power density for the designed lighting 4.6% over what it should be. A more energy efficient system would be ideal.

During daylight hours a good deal of light is provided through the glazed exterior wall. This should be sufficient for the adjustment of occupant's eyes as they transition from outdoors to indoors. The light colored surfaces allow the light to reflect and penetrate into the entire lobby space. Since the daylight will be entering from the side of the room rather than the top, glare should be minimized. However, the receptionist is seated adjacent to the glazed wall. Direct light can cause glare on her VDT screen, and blinds should be provided on the window next to her desk. Enough daylight does not enter the visitors lounge to create glare in the space. It is important that the lobby lighting is on a flexible control system. During most of the day the pendants should probably remain on at some level, but the uplights can most likely be turned off since the daylight will light the ceiling.

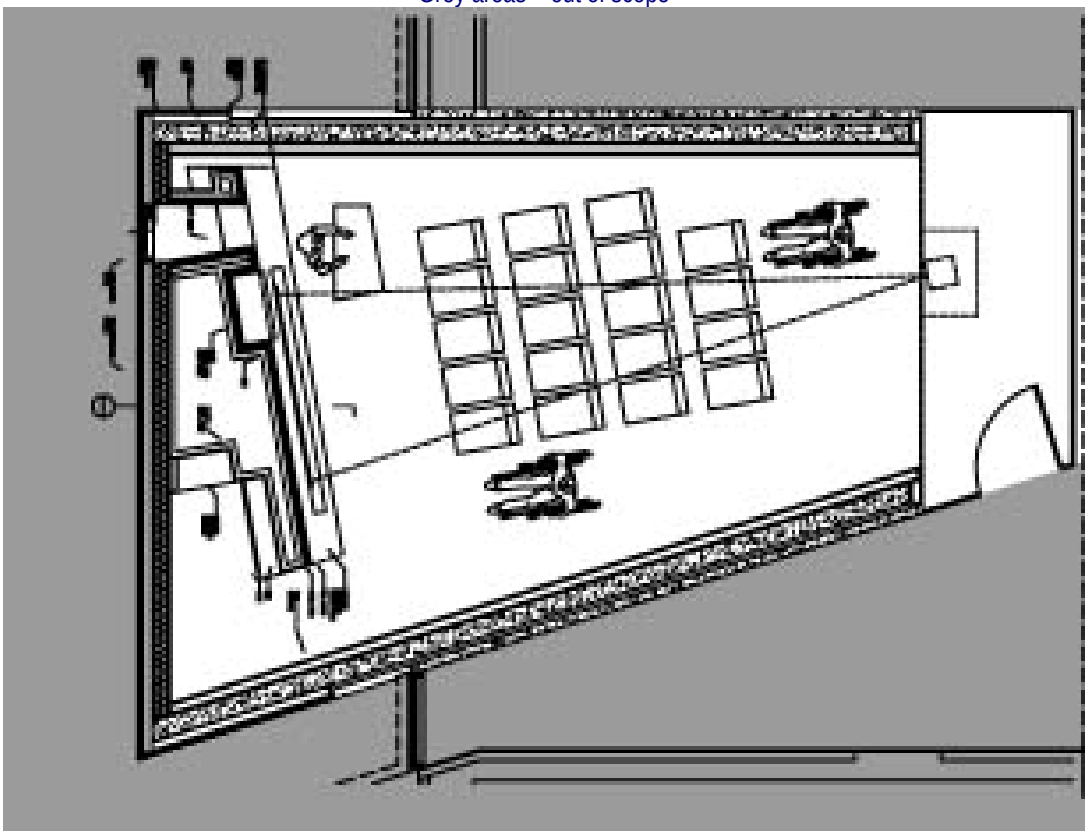
Chapel

Overview:

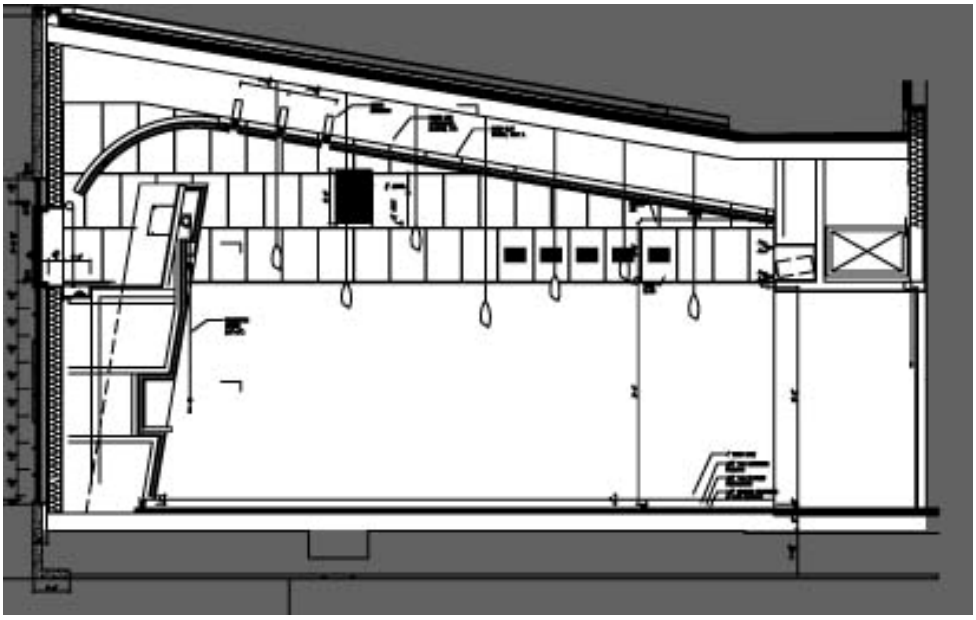
A small chapel is located on the second floor of the Franklin Care Center. It has seating for 19 people in chairs as well as handicapped access and seating for wheelchairs. The leadership area is located in the front of the church and has a projection screen. There are no windows in the chapel, so all of the lighting is electric. Since the chapel was designed when the Franklin Care Center was first built, and is not in the scope for the renovation that is now in the design phase, the location of some luminaries has been assumed. The fixtures types are known and the location of some fixtures have been derived from section plans.

Chapel Floor Plan with Furniture

Grey areas – out of scope



Section



Finishes:

Ceiling and Floor
Wood
p=29%

Walls
white paint
p=66%

*Finishes materials are final, however all reflectance values for finishes have not been decided and are assumed

Design Criteria

Main Goal:
To provide a flexible lighting system that enhances the architecture of the chapel and makes the space more meaningful.

Very Important Design Criteria:
Congregational area
Horizontal Illuminance:
Horizontal illuminance of 10fc is the minimum acceptable for the congregational area. 30fc is a better illuminance level for the task of reading. A flexible system that allows the illuminance level in the congregational area to change throughout the ceremony would be ideal.
Vertical Illuminance:
A high level of vertical illuminance is not needed in the congregational area. 3fc is adequate.

Color appearance:
Color rendering in the chapel area should be used to create a strong contrast between the task of reading and the background of the church.
Direct glare:
Direct glare should be avoided in the congregational area since it will affect the task of reading.
Flicker:
Flicker can be distracting and take away from the worship service. HID lighting and magnetic ballasts should not be used.

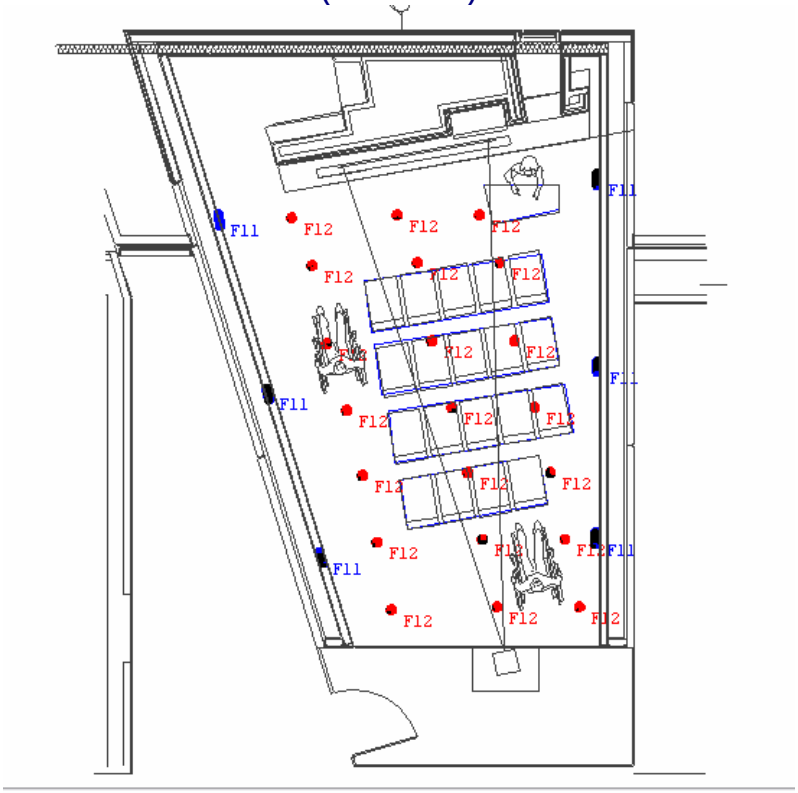
Leadership area
Appearance:
The leadership area is the focus of the chapel. Luminaries should be laid out orienting visitors towards the leadership area. This area should also be aesthetically appealing since it will be where the congregations' attention is focused during the services.
Color Contrast:
Color rending in the leadership area is important to separate the task of reading from the background. It is also important for the congregations to easily distinguish the leader from his background.
Flicker:
Flicker can distract the leader and take away from his leading of the worship service.
Luminance of surfaces:
The surfaces in the leadership area should direct the congregation's attention towards that direction. While the surfaces should be uniform, they should be brighter than the other surfaces in the chapel.
Shadows:
Task lighting should be used to provide illuminance on the leaders reading material and eliminate shadows that may make the task of reading difficult.
Source/task/eye geometry:
The leadership area will be the brightest area of the church, but the placement of the fixtures that the light is coming from must be carefully planned. The geometry should be used to enhance visual interest.

ASHRAE 90.1 Power Density: Using the space by space power density method, a worship space should have a maximum power density of 2.4 W/sqft.

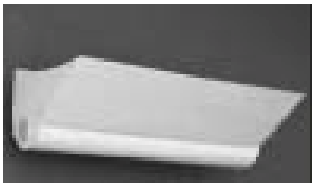
Existing Conditions

The existing conditions are based on lighting specifications and section drawings. Incandescent quartz uplighting fixtures are used to provide ambient light and enhance the architecture of the chapel. Decorative pendants hang at varying lengths throughout the congregational area providing both light and decoration.

Existing Light Layout (Assumed)



Visual Chapel Luminaires



F11

F12

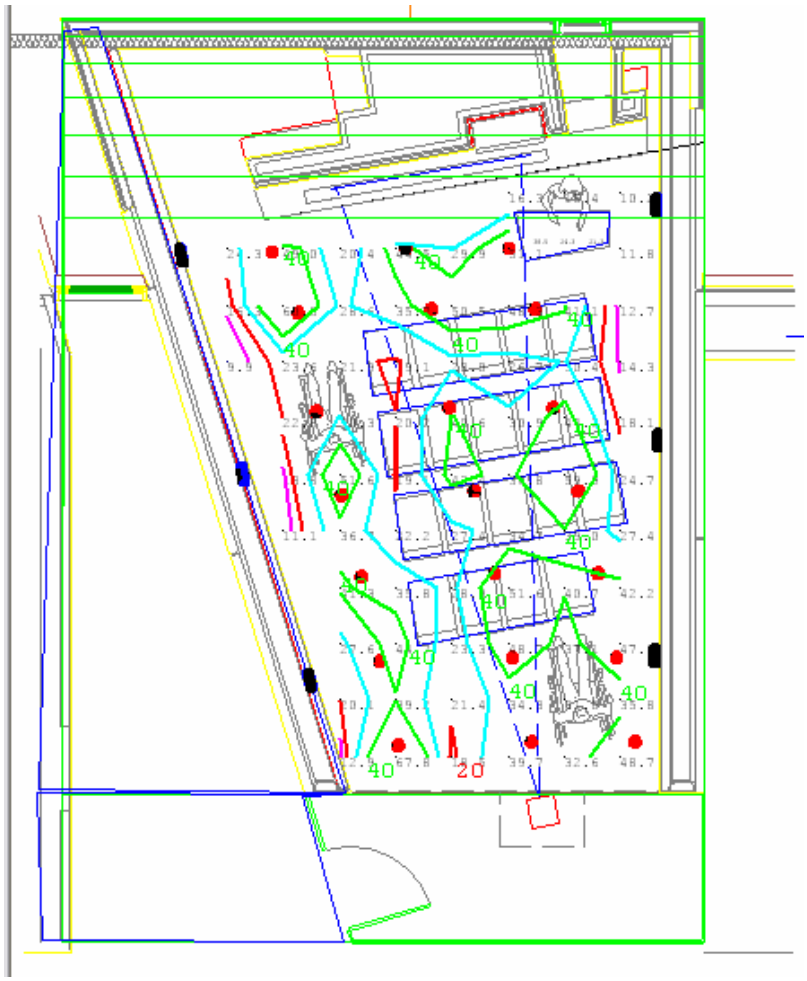
Luminaire Schedule

Fixture Label	Luminaire Type	Mounting	Source Type	Lamp Type	Number of Lamps	Ballast	CRI	CCT	Input Watts	Lamps per ballast	Fixture Quantitiy
F11	Assymetric Uplight	Wall	Incandescent Quartz	T3	1	N/A	100	2950K	150	N/A	16
F12	Low voltage monopoint	Suspended	Halogen	T4	1	N/A	100	3000K	50	N/A	16

Applied Light Loss Factors

Luminaire Label	Maintenance Category	Cleaning Interval	Initial Lumens per Luminaire	Mean Lumens per Luminaire	LLD	LDD	RSDD	BF	Total LLF
F11	VI	Clean - 12 months	2250	1500	0.67	0.89	0.9	N/A	0.53
F12	III	Clean - 12 months	950	850	0.89473684	0.9	0.98	N/A	0.79

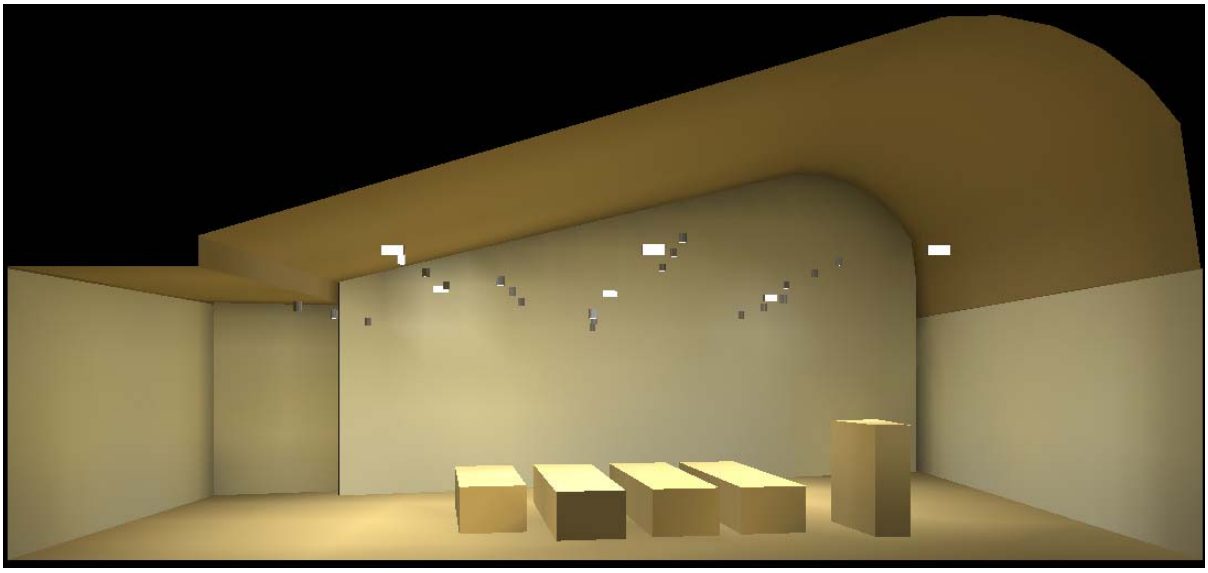
Illuminance Values

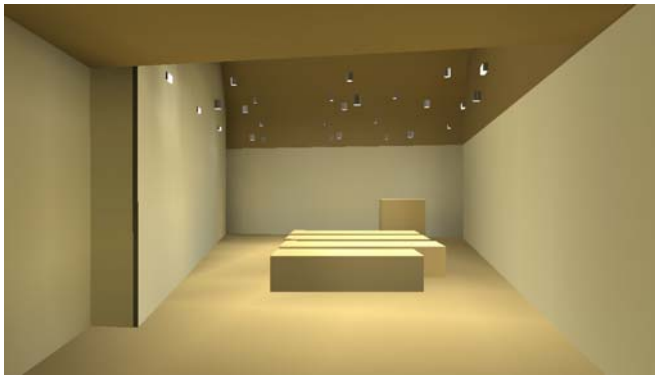


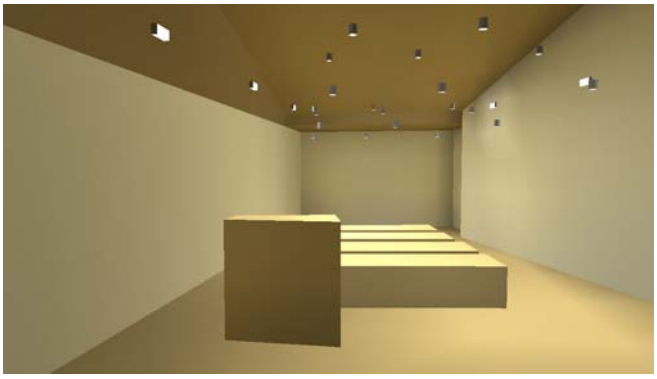
	Congregational Illuminance (FC) at 2.5'	Vertical Illumination (FC) in congregation	Leadership Illuminance (FC) at 3.5'	Vertical Illumination (FC) at leadership
Average	31.93	11.31	28.03	6.55
Maximum	67.8	15.3	38.5	7.5
Minimum	9.9	8.6	21.3	5.6
Avg/Min	3.23	1.32	1.32	1.17
Max/Min	6.85	1.78	1.81	1.34

Power Density = 3.42 W/sqft

AGI32 Renderings
Chapel







Analysis of Existing Lighting:

The suspended halogen fixtures aesthetically enhance the chapel. Halogen was a good source to choose because of the good color rendering, and ability to be dimmed from the moment of installation. A dimming control system allows the illumination level to be changed for different uses of the chapel as well as during the service. It would be inconvenient to use fluorescent sources that must be burned at full output for 100 hours before dimming. The uplights along the perimeter of the church enhance the architecture of the wood ceiling, and the reflected light provides vertical illumination throughout the chapel. Adequate light levels are provided in both the congregation and leadership area. However, there is no difference in lighting between the two different areas of the church. Perhaps more illumination should be used to enhance the leadership area and call attention to the front of the church. Accent lighting would be a good choice to distinguish the leadership area from the congregational area.

The power density for this space is 3.46W/sqft, which is 40% greater than the maximum for a worship area using the space by space ASHRAE method. The power density could be lowered by incorporating fluorescent sources or using a more efficient fixture instead of a decorative pendant.

Courtyard

Overview:

The buildings of the Franklin Care Center create a courtyard wrapped around the central two story building. The courtyard is entered through doors either in the corridors or patient lounges. Walkways guide people through the courtyard, and provide as the shortest route between two sides of the Franklin Care Center.

Design Criteria

Main Goal:

To provide a comfortable transition space for the elderly while limiting light pollution.

Very Important Design Criteria:

Illuminance Levels:

Eye adjustment to illuminance levels is an important design factor in the courtyard. Since the eye of an elderly person takes more time to adjust to a new light level, the illuminance level in the courtyard should be similar to that of the corridors and lounges that it can be entered from. During the daylight hours, courtyard lighting can remain off, and the illuminance levels in the rooms near the entrances to the courtyard should be high. At night, the illuminance levels provided by the exterior courtyard lighting should be similar to interior light levels, typically around 15fc. Although the recommended illuminance is 6fc, a higher horizontal illuminance should be provided since this is an elderly facility.

Light Pollution:

To achieve a green building, light pollution and trespass should be minimal. For a courtyard, light trespass is not an issue because the building surrounds the space and blocks the light from crossing the property line. However, the lighting should be designed so that no excess light pours into the sky. To minimized the light pollution, semi-cut off or cut off exterior fixtures should be used.

Direct Glare:

Exterior lighting must always be designed for safety. A safe environment must be free of glare to prevent accidents at night.

Modeling of Faces:

In addition to a shortcut through the building, the courtyard may also be used as a social space for the occupants of the Franklin Care Center to get some air. Social interaction requires decent facial modeling provided by the lighting to prevent harsh shadows such as eye socket shadows.

Color Appearance and Color Contrast:

Color rendering can be difficult at night; however it is essential for a courtyard. Color rending will help ensure safety in the courtyard and make it a more enjoyable social area. HID lighting should be avoided because of its poor color rendering ability.

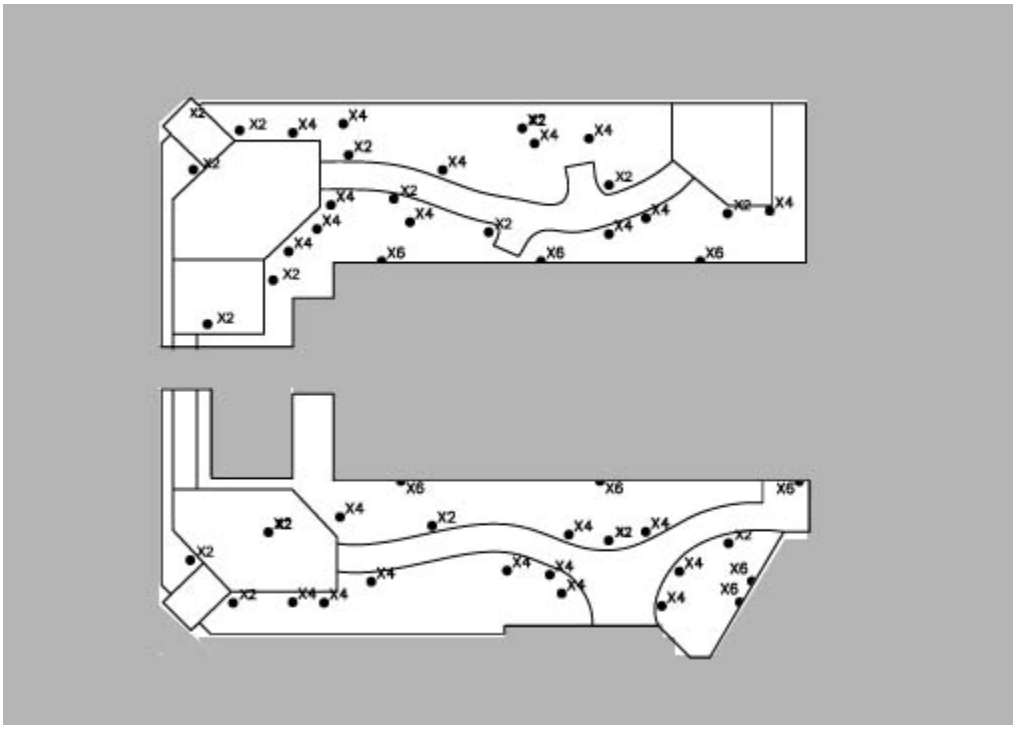
Peripheral Detection:
Enough vertical illumination should be provided in the courtyard to allow a person to detect nearby movement or a person getting close.
Shadows:
Shadows cast by outdoor lighting should not interfere with the safety of the space. If a shadow is cast across the walkway where a stick or stone is laying, it can cause a patient to trip. The walkway should be uniformly illuminated to reduce any hazards.
Source/Task/Eye Geometry:
Patients will be walking or traveling through the courtyard in wheelchairs or motorized chairs. Source/task/eye geometry should be provided so these tasks can be carried out with ease.

ASHRAE 90.1 Power Density: Using the space by space power density method, a exterior building walkway should have a maximum power density of 1W/linear ft of walkway.

Existing Conditions

Semi-cutoff compact fluorescent bollards and sconces are used in the courtyard. They are from the same series of luminaries provided by a manufacturer, so they look aesthetically pleasing together. The bollards are placed randomly along the path of the walkway, and the sconces are mounted on the 2 story building that separates the courtyard into two spaces. Adjustable compact fluorescent burial fixtures are used in a random pattern to provide more light on the walkway. These fixtures are flush with the ground.

Existing Lighting Layout



Visible Courtyard Luminaires

X2 X4 X6

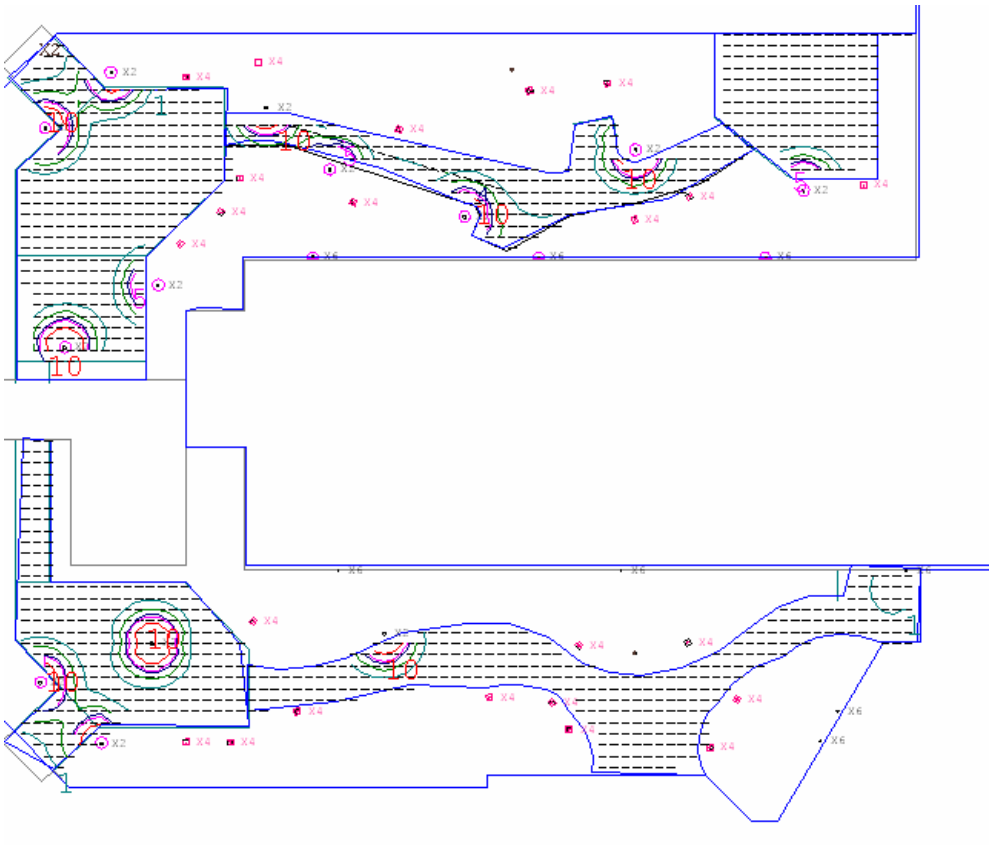
Existing Luminaire Schedule

Fixture Label	Luminaire Type	Mounting	Source Type	Lamp Type	Number of Lamps	Ballast	CRI	CCT	Ballast Watts	Lamps per ballast	Fixture Quantitiy
X2	Semi-cutoff bollard	Grade	Compact fluorescent	T4 triple tube	1	Integral Digital	82	3000K	45	1	13
X4	Up light	Burial	Halogen	MR16	1	N/A	100	1950	50	N/A	23
X6	Sconce	Building mount	Compact fluorescent	T4 triple tube	2	Integral Digital	82	3000K	47	2	8

Applied Light Loss Factors

Luminaire Label	Maintenance Category	Cleaning Interval	Initial Lumens per Luminaire	Mean Lumens per Luminaire	LLD	LDD	BF	Total LLF
X2	VI	Dirty - 12 months	3200	2729	0.8528125	0.74	0.95	0.59
X4	VI	Dirty - 12 months	960	800	0.83	0.74	N/A	0.56
X6	VI	Dirty - 12 months	1200	1020	0.85	0.74	0.95	0.58

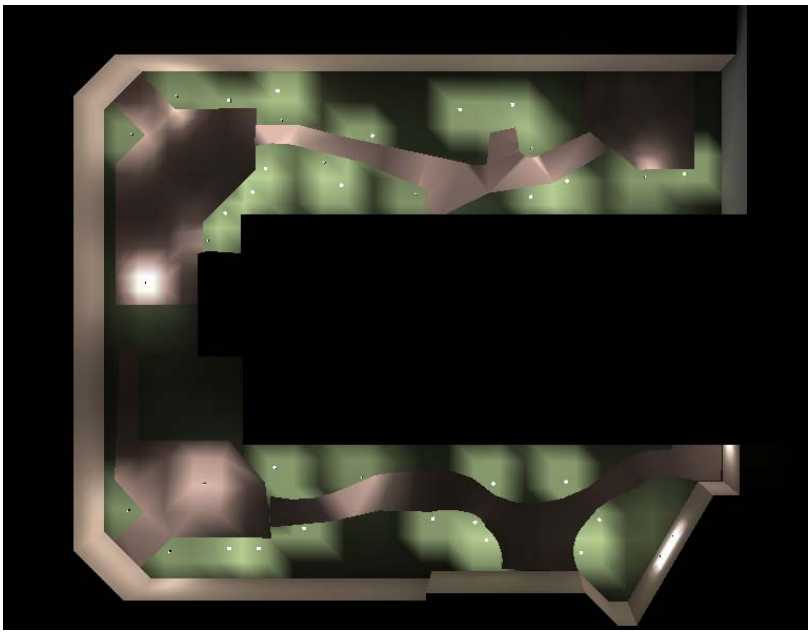
Existing Illuminance Levels

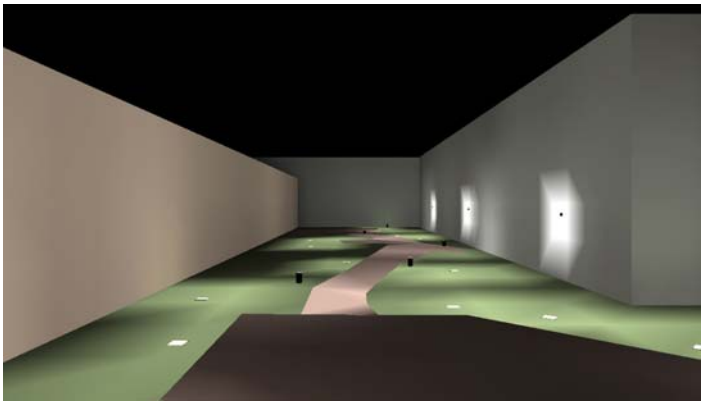


	Walkway Illuminance (FC) at ground	Vertical Illumination (FC) on walkway
Average	1.34	2.34
Maximum	25.8	5.4
Minimum	0.1	0.9
Avg/Min	13.4	2.6
Max/Min	258	6

Power Density = 4.22 W/ linear ft

AGI32 Renderings
Courtyard
Electric Lighting Only





Analysis of Existing Lighting:

The lighting for the courtyard is not uniform. Light is clustered in certain areas, but often provides more illumination on the grass area than on the walkway. While the sconces do their job by providing vertical illumination and decoration, the adjustable burial fixtures do not provide much light on the walkway. Area fixtures may be a better choice to provide a more uniform illumination on the walkway. The average horizontal illuminance of the existing design is only 1.34 fc which is much too low for a transition area in an elderly care facility. At night when the interior light levels are between 10 to 25fc occupants will have a very difficult time adjusting to this low light level quickly. The power density per linear foot of walking is 1 W according to ASHRAE 90.1. This

courtyard has a power density of 4.22 W/linear ft. It appears that a lot of the light produced by the fixtures is being lost in the grass area rather than on the walkway. The lighting for this area should provide greater illuminance levels while creating a uniform walkway with a low power density.

Summary of Findings

The Franklin Care Center has many good daylighting elements that will help cut energy costs to the building. Using daylight integrated with a DALI system, the illumination can be controlled so that energy is never wasted on unnecessary excess illumination. However, the electrical lighting in the Franklin Care Facility should provide a more energy efficient design to cut energy usage even when the lighting needs to be at full output. I assume that this lighting design is not final, so it is a good place to start and cut back on energy usage from there. If the spaces could even cut the power density to 5% below ASHRAE's value, one LEED point would be earned since this is an existing building.

The electrical lighting in the Franklin Care Center is aesthetically appealing and has been designed to enhance the architecture of the space. The uplighting techniques used in the lobby and chapel will create a very nice effect when combined with the wood ceiling. The fixture choices create more a residential feeling than portraying a medical institution. This is very important to make the occupants of the health center feel comfortable and at home.