Physical Therapy Suite

Overview:

The physical therapy suite will be used by the patients for physical rehabilitation. It is similar to a small gym with exercise mats, bikes, a treadmill, stairs, parallel bars and a cable column. There is also a small sink and two closets in the therapy room. A small waiting area is located adjacent to the gym for patients to sit while waiting for their doctor.

Design Criteria

Main Goal

To create a design that utilizes daylight and provides energy efficient electrical light to create a comfortable, motivational 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.

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.

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 carefully chosen and 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. 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.

Design Concept

The physical therapy suite should be a comfortable, motivational space for the occupants of the Franklin Care Center to receive therapy. The walls in this space were beige fabric, but were changed in this redesign to buttermilk color paint, and one wall in the gym to light blue in order to create a brighter, more motivational atmosphere. Cove lighting was chosen to provide comfortable indirect light to the physical therapy suite. Part of the walls in the waiting area and corridor were lowered by one foot to create space for cove fixtures. These fixtures are concealed by a fascia. The cove runs down the corridor to the suite, guiding patients to other therapy areas. Adequate illumination is provided in the corridor area from the cove lighting. The cove also wraps around into the waiting area where table lamps were added in to maintain the residential theme of the building. From the table lamps and the cove lighting, sufficient illumination is provided for reading in the waiting area. Cove lighting was also chosen to provide ambient light the gym area since there was a change in ceiling height, an easy place to locate cove fixtures. The indirect lighting from the cove will provide the gym area with glare free illumination. However the cove lighting alone did not provide enough illumination for safety in the gym area. Glare reducing louvered recessed linear fixtures were added to the gym area with the 11 foot ceiling. These fixtures were chosen because they are glare reducing and energy efficient. The smaller part of the gym area with the lower ceiling needed additional illumination since it receives little light from the cove. Here compact fluorescent downlights were used. The downlights chosen are louvered to conceal the lamp and reduce glare.

Finishes

Walls: visitor's area
And corridor area
Buttermilk
P=76%

Gym wall:
Clear day
P=81%

Floor: Brown carpet
P=24%

Ceiling:
Acoustical ceiling
tile
P=86%

Equipment

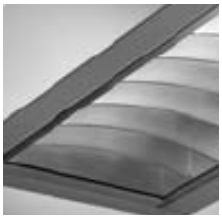
Luminaire Schedule

Fixture Label	Description	Fixture Cat No.	#	Lamp Type	Lamp Cat. No.	CRI	CCT	Ballast Type	Ballast Cat. No.	Lamps per ballast	Fixture Quantitiy
F3	CFL recessed mounted circular downlight	Erco 22151	2	Triple Tube	Sylvania CFTR32W/GX24Q/830	82	3000	DALI dimming	Sylvania QTP2x32CF/UNV DALI	2	4
F5	CFL table lamp	Louis Poulsen P4 1/2	1	A19	Sylvania 100A/CL/DL/RP	100	n/a	n/a	n/a	1	2
F7	Cove mounted fluorescent covelight	Prudentail SC-1T5-04	1	T5	Sylvania FP28/830/ECO	82	3000	DALI dimming	Sylvania QTP1x28T5/UNV DALI	1	25
F15	Recessed flourescent linear downlight	Focal Point FAVB-PL-1T5	1	T5	Sylvania FP28/830/ECO	82	3000	DALI dimming	Sylvania QTP1x28T5/UNV DALI	1	8

Visible Luminaires

F3

F5



F15

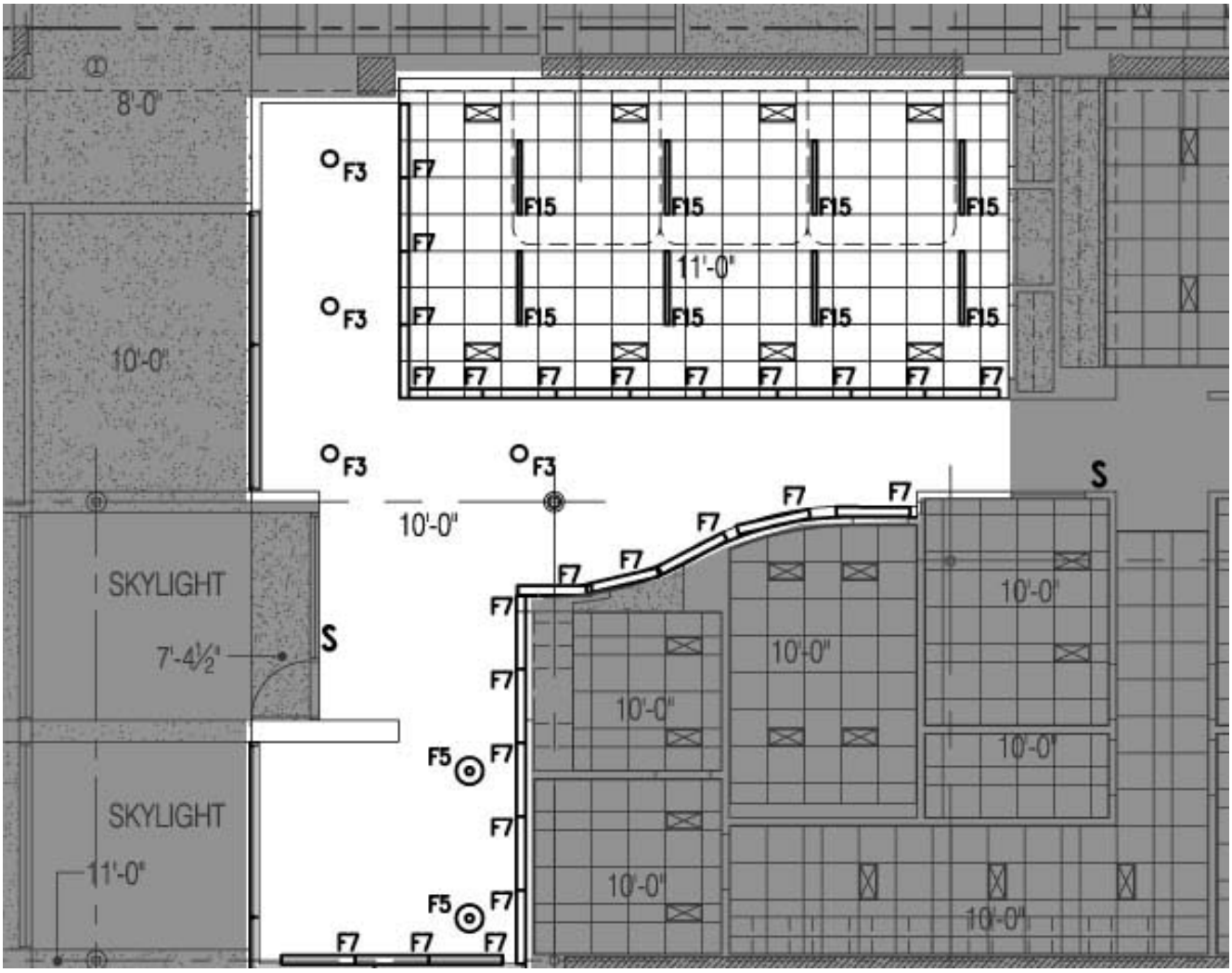
Light Loss Factors

Luminaire Label	Maintenance Category	Cleaning Interval	Initial Lumens per Luminaire	Mean Lumens per Luminaire	LLD	LDD	RSDD	BF	Total LLF
F7	VI	Clean - 6 months	2900	2697	0.93	0.91	0.91	1	0.77
F3	II	Clean - 6 months	4800	4128	0.86	0.97	0.98	1	0.82
F15	II	Clean - 6 months	2900	2697	0.93	0.97	0.98	1	0.88
F5	III	Clean - 6 months	1550	1472.5	0.95	0.95	0.96	1	0.87

DALI Equipment

	Description	Cat. No.	Quantity
Power Supply	Wattstopper ezDALI Power Supply	DPS150-2	1
Wall Control	Wattstopper ezDALI Group and Scene Control	DLCSS4-2	2
Photosensor	Wattstopper Photosensor	LS-301	2

Luminaire Layout



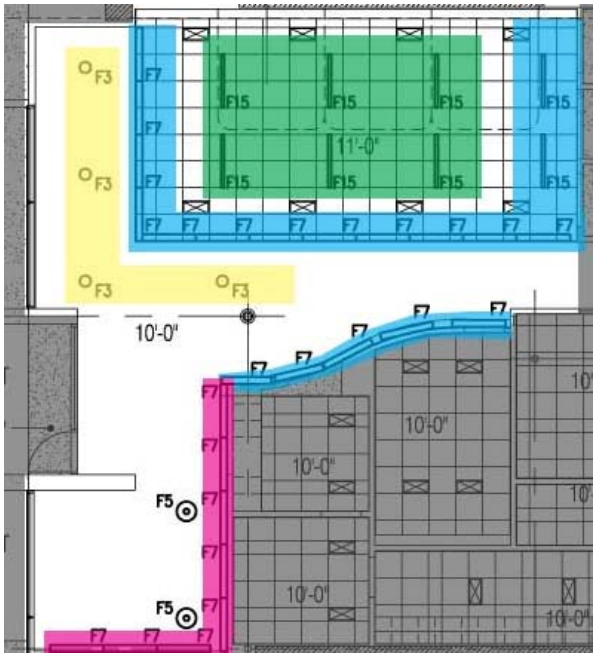
Control Zones

Two skylights are located in the corridor outside of the physical therapy suite. The glass entrance wall to the suite allows some of this light to penetrate into the physical therapy area. A daylight study was conducted under the following sky conditions to determine the amount of light entering the physical therapy area:

Date	Sky condition	Time
21-Mar	Clear sky	10am, 12pm, 2pm, 4pm
	Overcast sky	10am, 12pm, 2pm, 4pm
21-Jun	Clear sky	10am, 12pm, 2pm, 4pm
	Overcast sky	10am, 12pm, 2pm, 4pm
21-Dec	Clear sky	10am, 12pm, 2pm
	Overcast sky	10am, 12pm, 2pm

It was observed that a sufficient amount of illumination was often provided in the waiting area and front of the gym area (where the ceiling height is 10'), but a decent amount of illumination was never provided in the gym area with an 11' ceiling height. To integrate daylight efficiently, the cove fixtures in the waiting area and the downlights in the front area of the gym will be put on two separate Wattstopper photosensors. Two Wattstopper ezDALI Group and Scene Controllers will be used to manually control the fixtures. These will be placed at each entrance to the physical therapy suite, one by the door and one in the suite's corridor. Each group will be able to be dimmed separately using the group control function. Two scenes will be set, one for daytime and one for nighttime.

The fluorescent fixtures in the gym area (DALI group 2 as seen below), will be dimmed to 85% output during the day. This was based on the amount of illumination needed on the day with the least amount of daylight entering the physical therapy suite. Photosensors will control the lighting nearest the windows since those areas will receive large amounts of daylight at certain times and electric lighting will be necessary at varying levels, or not at all. Dali group 4's photosensor will be set to maintain 44fc because the goal of 50fc is not achieved at that point with electric lighting only. At night these photosensors will output their zones at 100% since no daylight will be present.



DALI Control Groups

Dali Group 1	**Selected F7 and F15 fluorescent fixtures**
Dali Group 2	**F7 fixtures in waiting area**
Dali Group 3	**Selected F15 fixtures for dimming**
Dali Group 4	**F3 compact fluorescent downlights**

***F5 table lamps are controlled by switches on the fixtures**

DALI Scenes

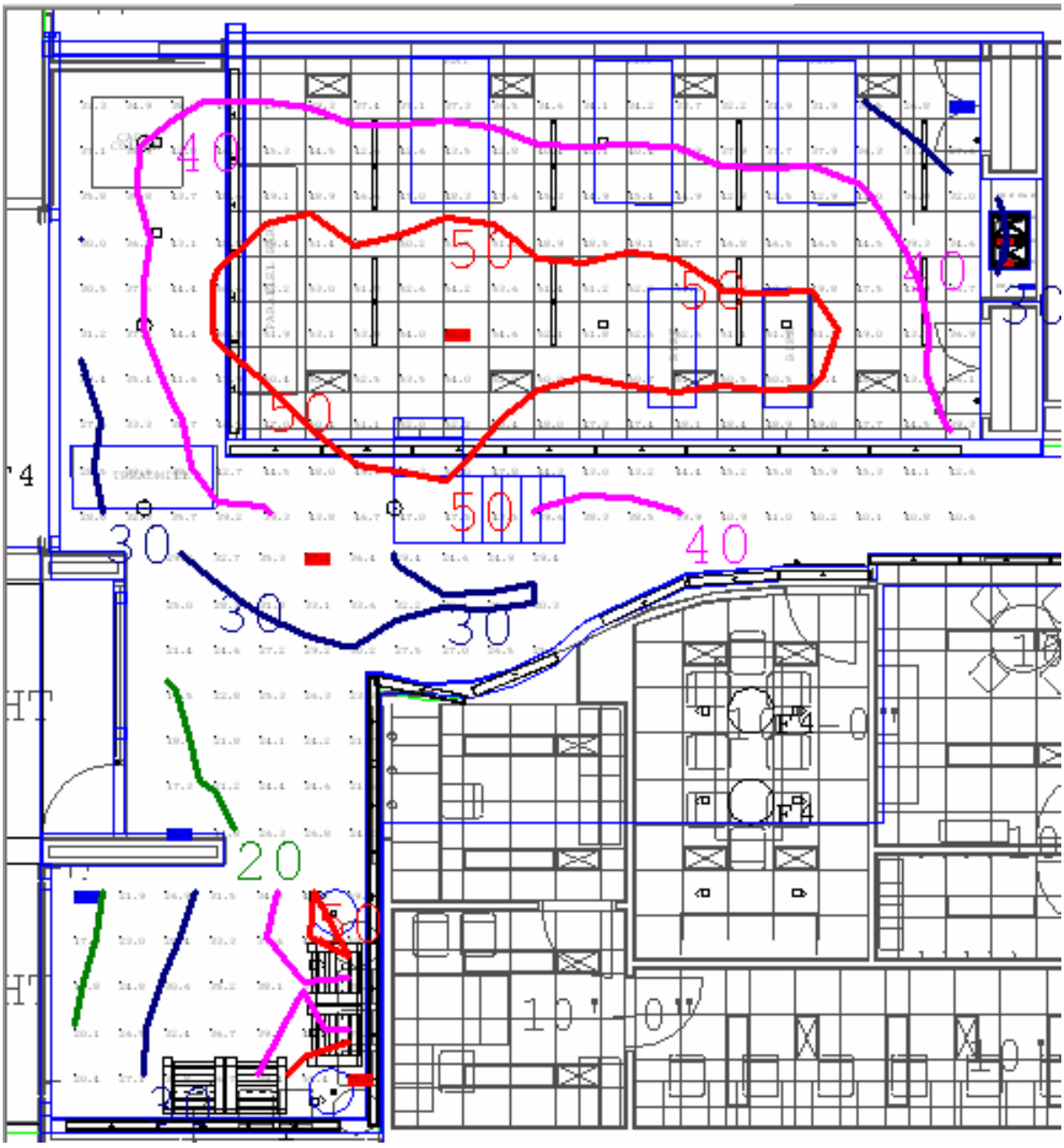
	Day time	Night time
Dali Group 1	100%	100%
Dali Group 2	85%	100%
Dali Group 3	Photosensor control to maintain 30fc	Photosensor = 100%
Dali Group 4	Photosensor control to maintain 41fc	Photosensor = 100%

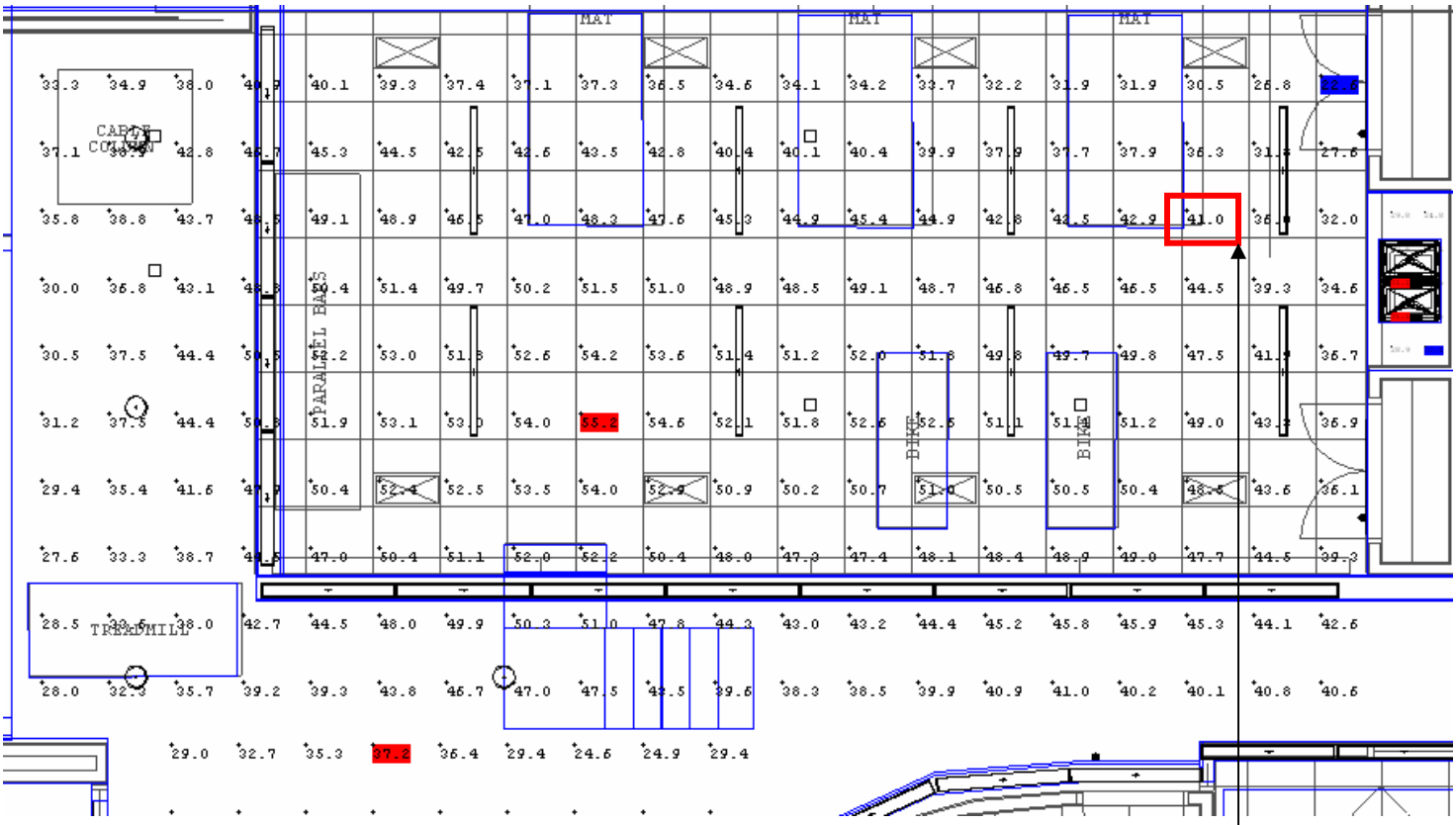
Circuiting

Luminaire	input watts	# used	volts	amps per ballast	total VA load
F3	70	4	277	0.6	664.8
F5	100	2	120	n/a	200
F7	32	25	277	0.31	2146.75
F15	32	8	277	0.31	686.96
Power supply	1.5	1	277	n/a	1.5
				TOTAL VA	**3700.01**

Circuit	Load (VA)	Wire Size	Conduit	Breaker Size
PT-1	3500.01	2#12 AGW, 1#12 GRD	3/4"	20A
PT-2	200	2#12 AGW, 1#12 GRD	3/4"	20A

Illuminance Values
Electric Light Only

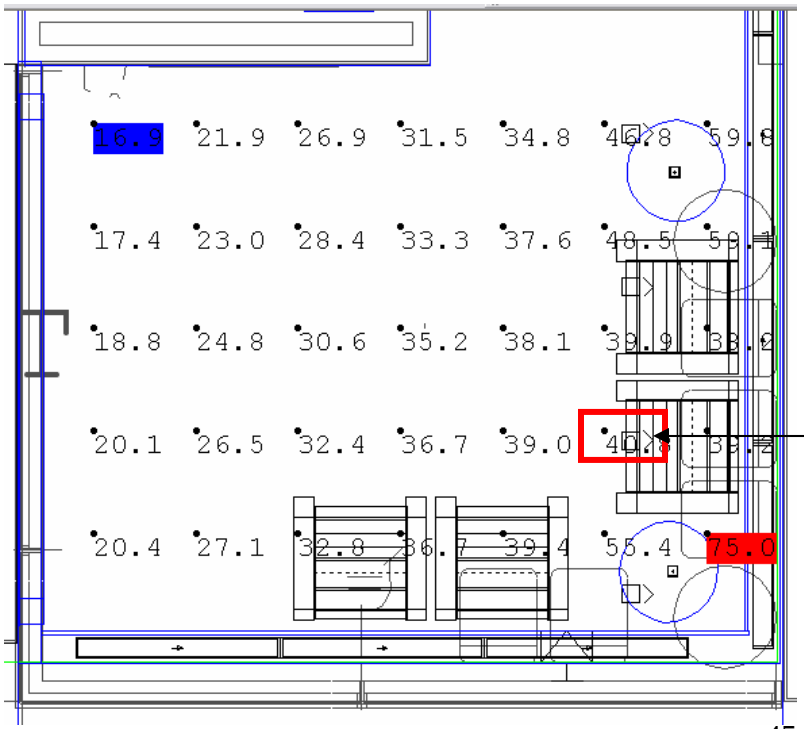




Gym Area

Goal: 50fc
Achieved: 45.1fc

Critical point



Waiting Area
Goal: 30fc
Achieved: 35.23

Critical point

Power Density

Fixture Label	Description	Lamp #	Lamp Type	Ballast Type	Lamps per ballast	Fixture Quantitiy	Input Watts	power
F3	CFL recessed mounted circular downlight	2	Triple Tube	DALI dimming	2	4	70	280
F5	CFL table lamp	1	A19	n/a	1	2	100	200
F7	Cove mounted fluorescent strip	1	T5	DALI dimming	1	25	32	800
F15	Recessed flourescent linear downlight	1	T5	DALI dimming	1	8	32	256
							Total Watts	1536
							Square footage	1500
					Total Power Density W/sqft			1.02
					Decorative Power Density W/sqft			0.13
					Physical Thearpy Power Density			0.89

Allowable power density = 0.9 W/sqft
Achieved power density = 0.89 W/sqft
0.13 W/sqft decorative
The achieved power density is 1.1% below the value set by ASHRAE 90.1.

Basic Rendering

Conclusions

The lighting in the physical therapy suite meets all light level requirements, providing adequate illumination for safety. The use of indirect lighting and louvered fixtures will avoid undesirable glare in both in the gym area and waiting lounge. Through the use of indirect lighting and new, lighter colored materials a more motivational space was created for exercise. Table lamps in the waiting area enforce the residential atmosphere in the physical therapy suite.

DALI control with the use of photosensors integrates daylight effectively into the space. Although the power density is only 1.1% below the ASHRAE value, there will be additional energy savings from dimming. A preset scene is available for day, which uses the photosensors, and another scene is available for night which does not use the photosensors. The group control boxes also provide a manual override for when necessary.