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TECHNICAL REPORT I

OCTOBER 3, 2008

a mixed-use project in the
EASTERN UNITED STATES

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Parts 1 & 2 by Space *Descriptions and Design Considerations*

Fitness Area: *A Large Work Space*

Spatial Description

The fitness areas are made up of three separate sections of one large room. In two rooms will be cardio equipment for the occupants to use, and in the last room, will be weight benches and other weight equipment. The east-facing wall is angled and made of floor-to-ceiling glass. This allows the users to look out into the courtyard immediately outside of the fitness area. Each room is about 24 feet long by 20 feet wide, with additional area by the angled glazing walls. There is also a small mechanical closet in each of the fitness rooms. Where there is a bulkhead, the ceiling height is at 8 feet above the finished floor. The cove ceiling is open to the slab above at a height of 9'-4".

Existing Lighting

Cove lighting is primarily used in the fitness areas. The fixture type is marked as type C on the drawings and is a staggered strip fluorescent fixture by Belfer Lighting containing one 28-watt T5 lamp. Each fitness area contains 16 of these fixtures. They are located inside the cove 3 feet from the wall. See the appendix for drawings and cove details. The space also utilizes six type D fixtures, which is a compact fluorescent wall washer by Lightolier. It uses one 26-watt triple tube lamp. These fixtures are spaced equidistant from each other at 3'-8" from the wall. They are washing the wall parallel to the main path of circulation (west). Each room's lighting system is identical.

Materials:

A resilient floor tile is used to coat the floor of the fitness areas. It is a rubber sports floor tile by Johnsonite, Inertia series. The walls are gypsum wall board painted an orange tone. The ceiling is the same material but painted with a beige tone. See the appendix for material descriptions.

Furnishings:

The fitness areas will be furnished with exercise equipment that suits the specific room designations. In the first room (on the left in the drawings) will be three treadmills. In the next room will be seven exercise bicycles. The last room will hold two Olympic weight benches and two smaller benches. All equipment will be oriented along the windows to allow occupants to walk through the spaces near the entrance. See the appendix for furniture information.

IESNA Design Criteria for the Fitness Areas

**IESNA does not list specific criteria for an exercise room. Most of the ratings for the criteria below have been estimated depending on function and materials.*

Appearance and Space of Luminaires – Not Important

The desired atmosphere in the fitness area is an energetic one. To achieve this, an overall uniform lighting distribution is desired. Since this space does not have an aesthetic function, the appearance of the room is not of a major concern. Granted, the space should not be perceived as unappealing, but a simple design solution can be implemented here.

Color Appearance and Contrast – Important

A CRI of 70 or above would be suitable for this space due to the absence of strong aesthetic appeal. Because the paint and surface materials are slightly warm, a slightly warm CCT is recommended (2500 – 3000 K).

Daylight Integration and Control – Important

Daylight integration can possibly be implemented near the machines by the glazing wall. This may be able to reduce the amount of luminaires that are on during daylight hours.

Direct Glare – Very Important

This will be a major concern especially in the weight lifting area. Users will be lying down on exercise benches looking up at the ceiling during their work-out. It will be important for the luminaires to be diffuse, hidden, or indirect to minimize eye strain to the occupant.

Light Distribution on Surfaces – Important

The distribution on surfaces should be uniform to provide better ambient light throughout the space.

Light Distribution on Task Plane – Very Important

Uniformity is highly desired in this space to maintain an energetic atmosphere. The task plane varies in the spaces by the differing heights of the equipment, and the floor is considered a task plane as well. For calculations, measurements will be taken from the floor level.

Luminances of Room Surfaces – Somewhat Important

The floor of this space should be darker in appearance than the other spaces because this surface will be the one closest to the observer. The other surfaces should appear brighter. With the given reflectances of the materials, this should be accomplished naturally.

Modeling of Faces/Objects – Not Important

Modeling of faces will not be important in this space because there will be no face-to-face interaction above extremely casual conditions.

Points of Interest – Not Important

There are no points of interest in this space requiring special lighting considerations or highlights.

Reflected Glare – Somewhat Important

During exercising on treadmills and exercise bicycles, the user may be viewing a screen on the equipment. Reducing the reflected glare will be somewhat of a concern for these spaces. The other materials in the room should not reflect glare due to their diffuse characteristics.

Source/Task/Eye Geometry – Somewhat Important

While performing tasks, users of this space may be looking into screens that are part of the equipment being used. It will be somewhat important to reduce the reflected glare in this space for that reason. This can be accomplished by indirect lighting or using sources that appear diffuse.

Sparkle – Not Important

Sparkle is not desired in this space.

Surface Characteristics – Not Important

This is not considered to be important because of the lack of textured materials.

System Control – Very Important

Since this facility will most likely be open to residents all day and possibly all night, it will be very important to control for occupancy where appropriate. Significant amounts of energy can be saved from the use of occupancy sensors which will turn off the lights when a room is not in use for a certain amount of time.

Illuminance (Horizontal) – Very Important – IESNA = 30 fc

Thirty footcandles is the recommended illuminance level for an exercise room. IESNA also states that the system should provide general uniformity and diffuse lighting.

Illuminance (Vertical) – Not Important = 5 fc

The IESNA Lighting Handbook does not recommend a specific level of vertical illuminance for an exercise room. Since the task is mainly personal exercise and not competitive play, this criterion is not a major concern.

Allowable Power Density:

The applicable power density for this courtyard, according to ASHRAE 90.1 2007, is interpreted to fall under *Exercise Area* and has a value of 0.9 W/ft^2.

Retail Space 1: *A Special Purpose Space*

Spatial Description

The retail space is a large, open area with its entrance on street level. The customer enters and walks up a small set of stairs to the retail space. The retail space has an area of 3,264 square feet and has perpendicular walls. The dimensions of the room are 62 feet by 58 feet. The ceiling is approximately 15 feet high. There is currently no tenant occupying the space and is not finished. The existing system of an apartment will be critiqued in its place. The design criteria will be evaluated based on the retail space being leased by a clothing store (i.e. J. Crew, American Eagle Outfitters, or something similar).

***Spatial Description of Apartment 825**

In plan, the overall apartment dimensions are rectangular, 39’ by 35’-6”. The living/dining room is about 17’ by 13’-4”. The kitchen’s dimensions are 11’ by 16’-6” and the master bedroom has dimensions of 12’-3” by 13’-3”. The resident enters the doorway into the foyer and the hallway is a 45-degree turn to the right. Walking down the hallway, one passes (on their right) a small area that leads to a bathroom and a bedroom. Continuing down the hall leads the person to the kitchen and living areas straight ahead, and the entrance to the master bedroom on their left. There is also an entrance to a den directly after the master bedroom on the left. The living room allows access to a private terrace through a sliding glass door. The kitchen also has an access to the terrace. The tallest parts of the ceiling are at 9’-6” above the finished floor and are located in the kitchen, living/dining room, and bedrooms. The ceiling in the hallway is lowered to a height of 8’-9”. In the den, there is a bulkhead at 8’-5”. See the appendix for drawing information.

***Existing Lighting in Apartment 825**

The design of the lighting system mainly uses lighting installations in the bathrooms, kitchen, and living/dining room. In the bedrooms, lighting is not installed and entirely dependent on typical means of residential illumination (i.e. floor lamps, table lamps, etc.). The kitchen has a set of track lighting with four fixtures total. These fixtures can be aimed either towards the stove or towards the island counter. There are two pendant luminaires located above the island counter. There is a surface mounted luminaire above the dining area that holds two 75-watt A-lamps. In the hallways are recessed incandescent downlights.

Materials:

Red oak flooring covers the foyer, hallway, living/dining room, and kitchen. The walls are gypsum wall board painted an unspecified color. For calculation purposes, the reflectance will be assumed to be the same as in the lobby (65%). The same thing will be done with the

ceiling color (78%). The bedrooms and bathrooms will be left out of the analysis for simplification.

Furnishings:

The living room would be furnished with a sofa, chairs, coffee table, and a television set. The dining area would have a table and a set of 4 – 6 dining chairs. The kitchen would have a stove, refrigerator, sink and dishwasher. The foyer would have a small dresser, table or set of shelves and a coat stand. In the hallway would be another set of shelves or something similar.

IESNA Design Criteria for Retail Space 1

Appearance and Space of Luminaires – Very Important

This criterion will be most important when viewing through the store windows and at the feature display areas. A main goal is to highlights specific areas in the store to attract the customer's attention. This will be mostly at clothing displays and merchandise shelves.

Color Appearance and Contrast – Very Important

This is a major concern in the dressing areas and on the merchandise displays. High CRI values (at least 90) must be used to properly render colors of clothing and skin tones (when customers are trying on merchandise in the dressing rooms). CCTs will be chosen based on the material finishes of the store, but will most likely be on the warmer side (especially if hardwood is used for the floor).

Daylight Integration and Control – Important

This criterion only affects the window displays due to the space being significantly larger than the glazing area. Less artificial light may be able to be used during the day if the color contrast is sufficient to properly display the merchandise.

Direct Glare – Very Important

Direct glare should be minimized at the sales area and display areas. Having glare can reduce the productivity of sales people and make the customers uncomfortable.

Light Distribution on Surfaces – Somewhat Important

On surfaces not on the task plane, the distribution is not a major concern.

Light Distribution on Task Plane – Important

The distribution on the task plane for the sales area should be uniform so that the customers and sales people can do business efficiently. This will involve checking out merchandise, working a cash register or monitor, exchanging money, signing receipts, etc.

Luminances of Room Surfaces – Important

This is an important criterion in the dressing areas. Increasing the luminances of the walls and ceiling will increase the vertical light levels and thus, paint a better picture for the customer while trying on clothing. This will also increase their visual comfort.

Modeling of Faces/Objects – Very Important

Modeling of objects is a very important issue in a retail space. The items on display need to have light reaching them from many angles so that shadows are minimized and their true shape can be seen. In the dressing rooms, this will need to be

accomplished as well. Light should be reaching the customer from different directions so that they look the best they can when looking into a mirror.

Points of Interest – Important

The points of interest in the retail space will be the merchandise displays. These should be highlighted while the circulation space should be less bright creating a luminance contrast that draws the customer toward the merchandise.

Reflected Glare – Very Important

The displays by the windows will be the locations where reflected glare is the biggest issue. This is especially the case when passersby are viewing merchandise from the outside, and glare from the sun and surrounding environment affect their view. This may not be able to be controlled, so the illuminance on the inside must be at a high level. At night, the reflection on the windows could be a concern when the viewer is inside of the store.

Source/Task/Eye Geometry – Important

The key areas to keep into consideration for this criterion are the dressing rooms and display areas. Since the ceiling is fifteen feet high, this should not be a major issue.

Sparkle – Not Important

Sparkle could be a way to attract attention to certain displays, but is not entirely necessary.

Surface Characteristics – Not Important

If the walls are textured in some way, it would be visually interesting to implement a grazing effect or some other method to show off the material, but the displays are more important to showcase.

System Control – Somewhat Important

Flexibility will be crucial at the display areas, unless displays are constructed in a permanent fashion. Otherwise, the retailer may want to be able to change the location of displays which would require the lighting system to change with it.

Illuminance (Horizontal) – referencing the IESNA Handbook (rooms are assumed)

- Dressing rooms = 30 fc
- Stock room = 30 fc
- Circulation = 10 fc
- Display = 50 – 100 fc
- Show windows = 300 – 1000 fc

As is evident from the above values, the show windows need to have the highest level of light. This will combat the glare from the windows when viewing from the

outside of the building and will entice potential customers inside. General and special displays need to be highlighted compared to the surrounding spaces, but not as intensely as the show windows. It will be ideal to have these values at these specific locations so that there are different levels of brightness throughout the space.

Illuminance (Vertical) – referencing the IESNA Handbook (rooms are assumed)

- Dressing rooms = 5 fc
- Stock room = 5 fc
- Display = 10 – 30 fc
- Show windows = 50 fc

The show windows will need the most vertical illuminance out of the retail areas. Achieving a high level of vertical illuminance will be essential for proper modeling of the merchandise.

Allowable Power Density:

The applicable power density for this retail space, according to ASHRAE 90.1 2007, is interpreted to fall under *Retail, Sales Area* and has a value of 1.7 W/ft^2. This category also allows for an additional power in the amount of [1,000 W + (the floor area used for the sale of clothing $\times$ 2.6 W/ft^2)].

Residential Lobby: *A Circulation Space*

Spatial Description

The lobby of this mixed-use project is intended for the circulation of residents in and out of the building. One enters the space from the street level through glass doors into the vestibule. There is a waiting space in one area so that guests and residents can relax as they wait for the other to arrive. There is a reception desk with an attendant to check-in guests and serve as security. Cabinets are located behind the reception desk for storage and other purposes. At the boundary of the lobby are stairs leading the occupant to the elevators at the left, the lounge and game-room straight ahead, and the fitness area to the right. The steps also travel down to other amenities. The lobby is approximately 1,300 ft^2 in area. The ceiling height is approximately 15 feet. See the appendix for drawings.

Existing Lighting

The lobby uses a variety of luminaires and light sources for illuminating the space. Altogether, there are five different fixtures here. In the vestibule are four compact fluorescent recessed downlights by Lightolier, designated as type A in the drawings, to provide enough visibility for circulation along with one compact fluorescent recessed wall washer, designated type D, also by Lightolier. Both fixtures use 26-watt triple tube lamps.

The main open area in the lobby contains eight more CFL downlights and one additional CFL wall washer of the same type as those mentioned above.

The reception desk has three type A fixtures providing downlight along with five type D fixtures washing the wall and cabinets behind the desk.

In the waiting area, there are seventeen more type A fixtures spaced three feet away from the wall lighting the sofa and chair areas. There are eight type C fixtures, which is a staggered fluorescent strip light by Belfer Lighting, serving as cove lighting where the ceiling meets the wall. This luminaire has a white finish to match the finish of the ceiling and contains one 28-watt T5 lamp.

Over the stairs are ten type A fixtures and five type L, which is a linear accent light by Lightolier. The type L fixture contains two 50-watt PAR 30 lamps with a wide beam spread. The type L is aimed at the wall along the ascending side of the stairs. Over the descending side is the type Q luminaire, a custom decorative pendant by Bocci. This luminaire has twenty-one 10-watt halogen sources hanging down from the support, housed in spheres of cast glass. Braided metal coaxial cable connects the globe of light to the support above. See the appendix for luminaire cutsheets.

Materials:

Since the building is intended to reflect a high-end image, the materials in the lobby express cleanliness and beauty. Walking through the vestibule, one can peer through the glazing of the clear, glass doors and view the interior of the lobby. The glazing used is specified

as two sheets of ¼" laminated tempered glass. Through research, a transmittance of 0.88 or 88% was obtained. The floor of the vestibule is finished with a resilient floor tile by GreenFloors. It is a Rubber Tire Tile that comes in 12" x 12" square tiles. The floor of the main area of the lobby is finished in limestone tile which has a grayish tone and the ceiling is gypsum wall board coated in a beige tone of ICI paint (see the appendix for material images, paint colors, and estimated reflectances). The reception desk is made of wood and has been assumed to have a palomino hickory finish along with the cabinets behind the desk. The wall behind the desk is gypsum wall board painted an eggshell tone of ICI paint. All walls are eggshell unless mentioned otherwise. The opposite wall, in the waiting area, is covered with a "scrim" textured wall covering. The carpet covering the floor of the waiting area is by Masland Contract, Moki style. The wall-covering on the descending side of the stairs is shaded green.

Furnishings:

The furniture in the lobby has been specified as being provided by the Owner, so for the existing conditions in this report, the specific brands of furniture will be assumed. There are three 3-seat sofas in the waiting area, along with four armchairs, and two coffee tables. A task office chair will be behind the reception desk for the attendant/security person. See the appendix for photographs of these selected items.

IESNA Design Criteria for the Residential Lobby

Appearance and Space of Luminaires – Very Important

There is a desire to show off the materials in the space to showcase the beauty of the lobby. The lobby should feel spacious, inviting, and relaxing. To accomplish this, light should be placed along the peripherals with also enough light to illuminate the floor for circulation. The appearance of luminaires needs to enhance the idea of a beautiful space. The visible luminaires should be more modern and less industrial/high-tech.

Color Appearance and Contrast – Very Important

It will be important to showcase the materials in the lobby – wood, limestone, yellow-toned paint, carpet, and the furnishings. Warm CCTs (2500 – 3000 K) will be needed to better portray the reception desk and cabinets, as well as the yellow-toned paint. The brown and green-striped carpet will also appear more vivid under lamps with warmer CCTs. Lamps with high CRIs (at least 80) are also needed to better render the materials. For the desired inviting/relaxing atmosphere, it is necessary to have better aesthetic appeal.

Daylight Integration and Control – Somewhat Important

The vestibule is not a significant source of daylight to the rest of the lobby; therefore, daylight integration will not be a major factor. Luminaires in the vestibule and immediately outside of it can possibly be dimmed or switched off during daylight hours to reduce electric energy use.

Direct Glare – Not Important

The ceiling in the lobby is fairly high (approximately 15 feet) so direct glare will not be a major issue. If accent lighting is used it will be important to angle the beam away from the occupant's line of vision.

Light Distribution on Surfaces – Somewhat Important

Uniformity across surfaces is not highly desired. Accenting the walls in a somewhat uniform manner in terms of rhythm is desired, but not necessarily a wash. The floor should be somewhat uniform to minimize very light and very dark spots on the floor, but it does not need to be completely uniform due to the relatively low illuminance level required for circulatory purposes.

Light Distribution on Task Plane – Important

As mentioned above, the floor does not need to be completely uniform, but should not have strong contrasts of light and dark spots. In the waiting area, the floor should not be uniform, but should provide enough light near the sofas and chairs to allow the occupants to browse reading material at their leisure without noticeable

differences in light levels across the page. On the reception desk and cabinets behind, a uniform light distribution is desired so the attendant can work in an efficient manner.

Luminances of Room Surfaces – Very Important

It is desired to have the peripherals illuminated to create interest away from the center of the open lobby.

Modeling of Faces/Objects – Important

Modeling of faces is important for casual meeting and interaction with the reception attendant/security person, and thus would need the proper vertical illuminance to allow this. In the waiting area, vertical illuminance can be accomplished through the use of luminaires at the human scale (i.e. floor lamps, sconces, etc.).

Points of Interest – Somewhat Important

A goal is to draw people's attention to the reception desk for direction and assistance. This can be accomplished by making the reception area lighted more than the surrounding spaces. In the waiting area, it is important to make people feel invited into the space. This can be highlighted, but not overdone, so that the waiting area is not overbearing compared to the other areas in the lobby.

Reflected Glare – Not Important

This is not considered to be an issue because the materials do not have glossy finishes and would not reflect specularly back to the viewer.

Source/Task/Eye Geometry – Not Important

For the most part, the task and source are far enough apart to not hinder one's eyesight. Luminaires with very large intensities will not be used and will not reflect back to the viewer excessively.

Sparkle – Not Important

Sparkle is not needed in this space. Reflected highlights may grab the viewer's attention but it would only serve the purpose of decoration. Since the occupants would be regular visitors (residents and guests), the necessity of making the audience admire reflected highlights is not there.

Surface Characteristics – Not Important

The limestone tile is the only material with a unique texture and since it is located on the floor, it will not require grazing.

System Control – Somewhat Important

The system should be controlled from the reception area and other non-public locations. Different modes are not necessary due to the need to maintain illuminance levels for those passing through and to sustain the lighted environment.

Illuminance (Horizontal) – Referencing the IESNA Handbook

Ten footcandles should be on the floor to allow the occupants to pass through the space comfortably. Enough light must be at the floor plane to see well enough to walk around the space. A goal is to have twenty footcandles on the reception desk so that the attendant can read and write at a comfortable level, signing guests in and performing other tasks. Another goal is to have five to ten footcandles in the waiting area. This is allowing a reduced level from the main lobby area so that users of this space can feel more relaxed, but still leisurely browse through reading material.

Illuminance (Vertical) – Referencing the IESNA Handbook

Three footcandles will be acceptable for the vertical illuminance in the main lobby area, but in the reception area it should be increased to about five to improve the facial recognition when the attendant is interacting with residents and guests.

Allowable Power Density:

The applicable power density for this lobby, according to ASHRAE 90.1 2007, is interpreted to fall under *Lobby* and has a value of 1.3 W/ft^2.

1st Floor Courtyard: *An Outdoor Space*

Spatial Description

Located immediately outside of the fitness areas is the courtyard. This can be accessed through the game room and lounge adjacent to the fitness rooms. The courtyard is an open space where residents can go out and spend time in a relaxing environment. This space is approximately 135' in length and has a minimum width of 9' where the glazing of the fitness rooms protrudes into the space. See the appendix for related drawings.

Existing Lighting

The lighting in the courtyard consists of six wall mounted exterior luminaires containing one 70-watt metal halide lamp. These are placed on the solid walls outside of the fitness areas as well as the classroom, lounge, and game room.

Materials:

The ground of the courtyard is made of different rectangular-cut stones. These consist of washed river stones, granite bands, and paver stones in three different colors (named Sierra Tan, Mountain Green, and Appalachian Gray). The outer wall of the courtyard is a concrete barrier.

Furnishings:

Assumptions to be made regarding courtyard furnishings consist of benches and tables positioned in the area directly outside of the lounge and game room. Landscape elements are also in the outer regions of the courtyard such as trees and small plants.

IESNA Design Criteria for the Courtyard (treated as a Garden)

Appearance and Space of Luminaires – Very Important

For the most part, luminaires should be concealed as appropriate, especially in planting areas. Having the outdoor fixtures hidden will provide a more serene atmosphere and allow the visitor to view the courtyard in a more natural state.

Color Appearance and Contrast – Very Important

This applies more to the rendering of plant material and the ground materials and should be high enough to render these colors effectively. Since there will not be a predominant flower population, a very high CRI is not needed. A value between 70 and 80 would be suitable.

Daylight Integration and Control – Not Important

Exterior luminaires should not be on during daylight hours.

Direct Glare – Very Important

To make this space visually comfortable, direct glare should be minimized. When luminaires are placed within the visual angle of the occupant, they should not be aimed in such a way that would cause glare to occur.

Light Distribution on Surfaces – Important

To make this space visually appealing during functions and when it is being used for casual lounging, it will be important to use the different surface textures to achieve this. Grazing and other methods can be implemented to make different materials stand out to the viewer.

Light Distribution on Task Plane – Important

Because users of this space will need to have a safe and clear visual perception of the floor for walking around, the ground should be illuminated at uniform level in the main circulation areas.

Luminances of Room Surfaces – Not Important

Surfaces should not appear too bright so that there is a smaller contrast between them with the night sky.

Modeling of Faces/Objects – Not Important

Modeling of faces will not be a major concern in this space because high-scale social functions will not be an activity. Proper modeling of plants will be a goal, however.

Points of Interest – Somewhat Important

Plant material such as trees and shrubs will be points of interest as well as entrances.

Reflected Glare – Somewhat Important

The only concern will be reflected glare off of the glazing in the fitness areas, lounge, and game room. Position and angles of luminaires will need to be taken into account to decrease the occurrence of this.

Source/Task/Eye Geometry – Somewhat Important

The main task will be navigating through the space. The ground will be the primary task plane. Since the paver stones will not reflect light specularly, this should not be an issue.

Sparkle – Not Important

Surface Characteristics – Important

Revealing the textures of the different surface materials will make the space more visually appealing. This will be a design goal.

System Control – Not Important

Exterior luminaires will most likely be on during all nighttime hours. It will be important to choose energy efficient fixtures. Some lighting could be switched off depending on the purpose and location in the courtyard.

Illuminance (Horizontal) – Referencing the IESNA Handbook

Since the courtyard is not an actual "garden," the light level could be set at between 5 and 10 footcandles. This will allow proper illuminance on the ground to view a walking path, but will improve the lighting conditions if there are small gatherings here. Other sections under "garden" recommendations suggest illuminance levels of less than 3 footcandles, but these activities do not apply to this courtyard.

Illuminance (Vertical) – Referencing the IESNA Handbook

Three footcandles would be sufficient for this space, but should be increased to 5 fc to better facial recognition.

Allowable Power Density:

The applicable power density for this courtyard, according to ASHRAE 90.1 2007, is interpreted to fall under *Building Grounds: Plaza areas and Special feature areas* and has a value of 0.2 W/ft^2.

Part 3 *Evaluation and Critique of Existing Lighting Systems*

Building in General:

Overall, the building lighting systems are very diverse due to the variety of types of spaces within the building. The types range from residential apartments to commercial retail and include many others as well. Some of the spaces are not finished and await the leasing and fit-out of the spaces by other companies (in the retail spaces and large gym floor). A main theme of the building, however, is a high-end aesthetic. This is mostly evident in the residential lobby, amenities, and apartments and is accomplished by the material choices throughout. The purpose of the lighting in these areas is to help express this theme.

Fitness Area:

The primary lighting component in the fitness area is indirect lighting which is produced from the ceiling cove in each room. Fluorescent strip fixtures are placed in a staggered alignment in the cove space and reflect light off of the cove walls and into the space. This creates a comfortable type of distribution because it does not throw light directly onto the users which could seem harsh in a fitness environment. The IESNA Lighting Handbook recommends a horizontal illuminance of 30 footcandles. The average illuminance calculated in AGI 32 was found to be 24.11 footcandles. This value is a little lower than what is recommended, but not by a significant amount. Performing the calculations with a refined and higher-quality 3D model may find the average to vary within a small range. For this trial, however, the value is sufficient.

Another component in the lighting system is a group of recessed wall-washers along the main path through the rooms. This provides lighting on the peripherals to add illuminance to the room and to make the space seem larger, increasing comfort in the user.

A simpler, and possibly less expensive, method could have been taken in designing the lighting system for the fitness area, but when the occupancy is taken into account (high-end apartment owners); it seems to be very appropriate. Typical 2’ x 4’ fluorescent troffers would not provide a more comfortable and visually pleasing atmosphere. From the first pseudo color rendering of the space (see the appendix), the first cardio room appears to be less lighted than the others. This may be due to the additional space required for the entry to the room and that it has only one adjacent room providing spill light. Measures to evenly distribute the illuminance should be taken for personal efficiency and aesthetic reasons. Alternative solutions will be explored to maintain or improve uniformity and energy efficiency as well.

Apartment 825:

The main areas in the apartment that have designed lighting are the kitchen, dining area, and hallways. The area that needs the highest illuminance is the kitchen due to the tasks performed here (cutting foods, cooking, etc.). The recommended level by IESNA is 50 footcandles. When all four track fixtures are directed (tilt angle = 35, orient = 0) onto the kitchen island, the average illuminance is only 17.2 footcandles. This is not sufficient for the task of cutting with a sharp knife especially if the contrast of the task and background is poor. For the rest of the apartment the lighting levels seem sufficient because the tasks require low levels. This is mostly for walking through the hallway and casual entertaining and relaxing in the living room. The levels in the living room can be adjusted based on the presence of portable luminaires such as table lamps and floor lamps, which will be needed if the resident wishes to read at a comfortable level. See the appendix for rendering information.

Since this space will not be proposed to be re-designed, nothing further will be said. The re-design of the retail space depends on what type of store occupies it and the layout of displays, pay stations, fitting rooms etc. Efforts will be focused on the proper illumination of merchandise and other task planes, as well as balancing light levels between merchandise and pathways so that the occupant is drawn to merchandise, while being able to comfortably navigate through the store.

Residential Lobby:

In the lobby, the main goal is for a general illuminance of the space to allow for circulation across the floor. This is achieved through the use of downlights throughout the space. Walls are accented with wall washing fixtures to add illumination and visual interest to the peripherals. The focus in this space for the re-design solution will be to have the appropriate illuminance levels (discussed in Design Considerations) on specific surfaces and to control the difference in illumination from one area to another so that appropriate focal points are created while allowing the occupant to visually adjust in a comfortable manner. For example, luminances in the lobby will be studied so that areas in the room are not considered to be over-powering to the occupant. Lighting the peripherals will be an important tool in providing the right feel to the space and this will be explored through different methods.

1st Floor Courtyard:

For functions to be held outside in this area, the space will need more illumination. There are only six fixtures providing light in this area and only on the side where people will be walking or standing. The plant material on the opposite side of the courtyard will need to be illuminated so that occupants can have a pleasant visual response. The lighting seems to be mostly for viewing at night away from the building, or for viewing through windows at night when residents are exercising or in the lounge

and game room. For the re-design, it will be assumed that there will be small events or gatherings in the courtyard at night to provide a purpose for additional lighting.