

WHEELOCK COLLEGE CAMPUS CENTER AND STUDENT RESIDENCE
200 THE RIVERWAY, BOSTON, MA 02215

Technical Assignment I

Lighting Existing Conditions and Design Criteria

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EXECUTIVE SUMMARY

The lighting systems of Wheelock College Campus Center and Student Residence, designed by HLB Lighting Design, attempt to create a dynamic space while conforming to the guidelines of the IESNA and the regulations of ASHRAE/IESNA Standard 90.1. An analysis of the existing lighting conditions shows that the design is fairly successful in meeting the IESNA design criteria. The overall lighting scheme compliments the style of the architecture and enhances the experience for which the architect is striving.

The overall design is very aware of the appearance of the building from the exterior. The façade is a combination of glazing on the first and second floors and metal panel curtain walls on the upper floors. Therefore, the interior spaces and lighting on the first two stories are visible from the street and campus during the night. The designs for these spaces are meant to be showcased to the rest of campus to the south, and to The Riverway to the north.

Calculations show that the system is achieving desired illuminance levels for most of the spaces, with the exception of the cafeteria serving space and the lounge area, which are on the low side. AGI32 calculation data and IES files are located on the Y drive.

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I. GENERAL BUILDING OVERVIEW

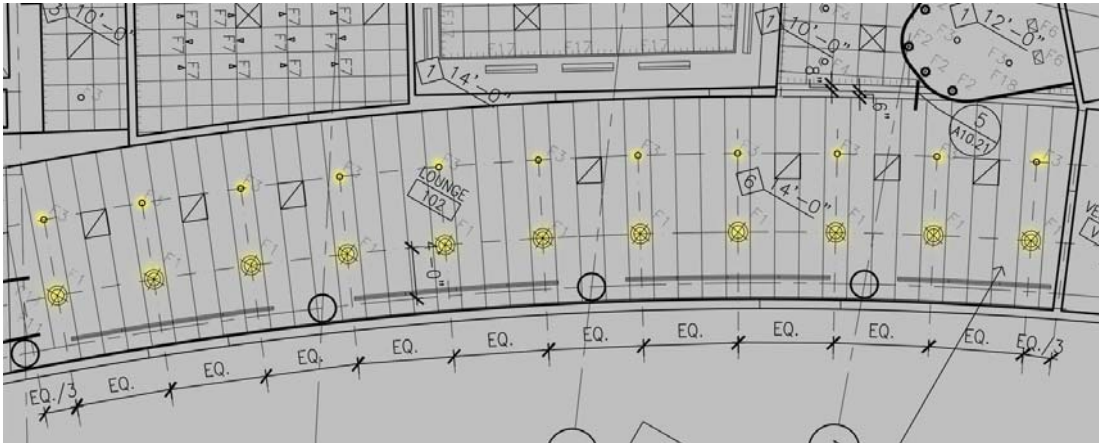
The Wheelock College Campus Center and Student Residence is a multi-functional campus building that acts as a student organization center, campus cafeteria, study lounge and student residence. The first and second floors of the building will be open to all faculty and staff, and will consist of a lounge, multipurpose area, conference room, office space, cafeteria and campus store. Since the lower levels serve so many functions it is important to be aware of the light levels and conditions required to maintain comfortable and appropriate lighting environment in those spaces. The third through sixth stories are a combination of dorm suites and one and two bed dorm rooms. The following five spaces were selected to address the variety of functions involved, as well as to showcase the fusion of architecture and light, designed to enhance the occupants' experiences in the building. The spaces discussed in detail are a lounge and conference room on the first floor, a cafeteria serving space on the second floor, an outdoor balcony on the third floor, and a typical two-bed dorm on the fourth floor.



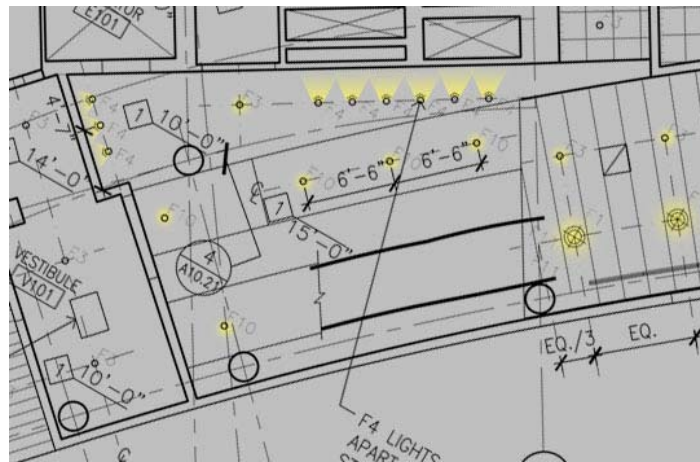
II. STUDENT LOUNGE

a. existing lighting systems

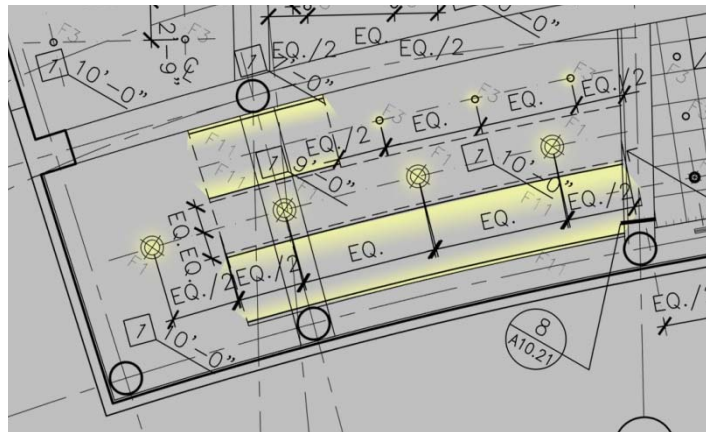
The student lounge space and main staircase of the building span the curved, south-facing interior on the first floor. The area is a main circulation space in the building, and is open to students to use for studying or relaxing during the daytime as well as in the evening. The exterior of the south facing wall is floor-to-ceiling glazing, with exterior sun shades to reduce the amount of direct sunlight in the space during the day. The ceiling height is 14'-0" over the lounge area, 15'0" over the staircase and 10'0" under the staircase. The ceiling over the lounge is suspended perforated metal panels, with gypsum wall board over the staircase. The main staircase to the second floor is medium reflectance wood, and the other walls in the space are medium reflectance wood paneling and glazing with aluminum framing. The flooring is a combination of low reflectance slate tile on the high traffic circulation areas and carpet under the seating areas. The luminaires over the lounge area are a combination of decorative halogen pendants and recessed compact fluorescent downlights. The luminaires in the staircase are a combination of compact fluorescent downlights to illuminate underneath the stairs, LED steplights and decorative halogen pendants to make the space more visually appealing and tie it in with the lounge area. The glazing is ¼" thick tempered glass, with a transmittance of 90%.

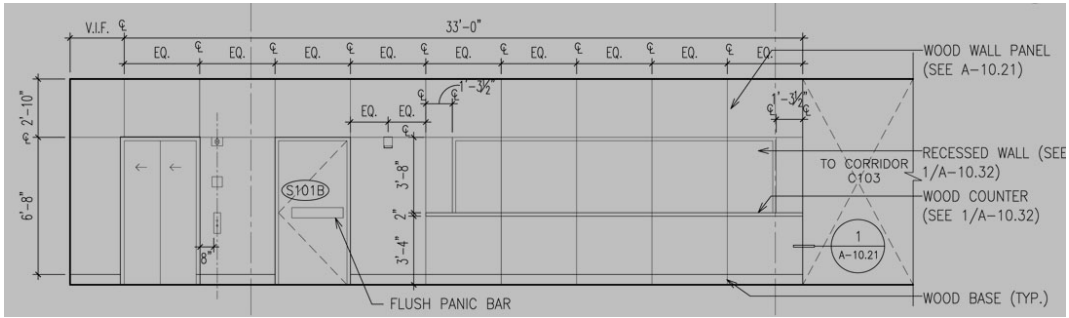


RCPs of the Lounge Space (above) and Staircase (below)

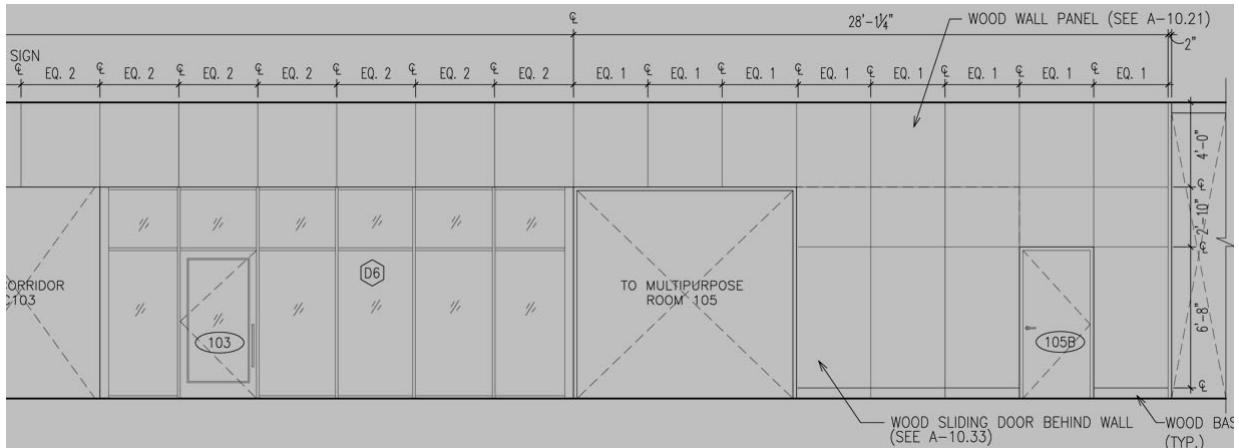


RCP of the Staircase Second Floor (below)

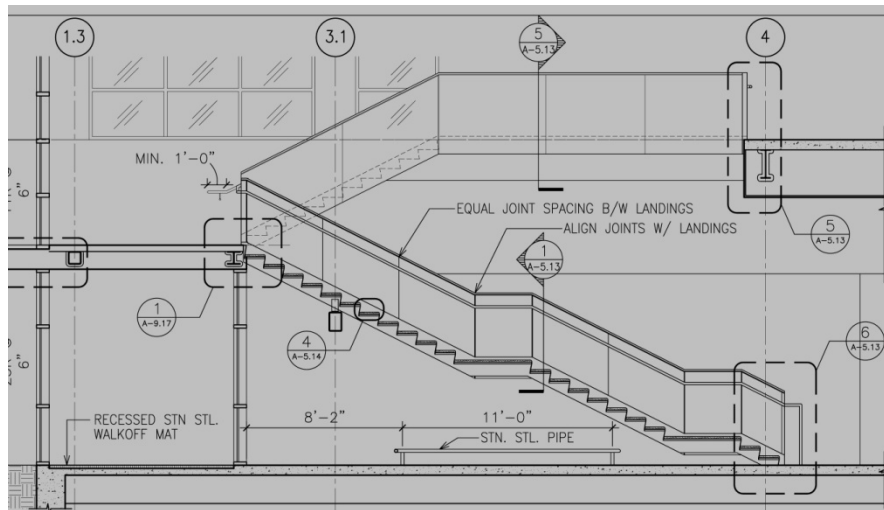




North Elevation (above), and Continued (below)



Stair Section (below)



Lounge Luminaire Schedule						
Type	Mounting	Manufacturer	Catalogue Number	Lamps	Volts	Description
F1	Pendant	DWR	Nelson Pendant Series	1-E26 100W	120V	Translucent plastic is sprayed over a wire frame to allow light through and protect the eye from glare.
F3	Ceiling Recessed	Lightolier	8021CCLW/6132BU	1-CFTR 42W	120V	6" Recessed compact fluorescent downlight with an anodized aluminum parabolic reflector.
F4	Ceiling Recessed	Lightolier	8021CW/6132BU	1-CFTR 42W	120V	6" Recessed compact fluorescent wallwasher with an anodized aluminum parabolic reflector.
F10	Ceiling Surface	Lightolier	8068WH/CS8226LPU	2-CFQ 26W	120V	9" Surface-mounted compact fluorescent downlight with a parabolic louver.
F11	Wall Recessed	Winona	LED-STEP01-RECT-M-001/HO	LED	120V	Recessed extruded aluminum LED steplight.

Surface Materials and Reflectances	
Material	Reflectance
Medium Toned Wood Walls	55%
Perforated Metal Ceiling Panels	80%
Slate Floor Tiles	25%
Carpet	20%
Painted Gypsum Wall Board	60%

b. design considerations

- Appearance of Space and Luminaires** The lounge area is intended to possess a relaxing atmosphere, where students are able to unwind and take a break from their busy schedules. The gradual curve of the building, perforated metal panel ceiling and floor-to-ceiling glazing give the space a modern feel. There are structural columns along the glazed portion of the wall which could be accented during the nighttime. While the glazing and metal panels give off a modern feel, medium toned wood walls along the north wall add a cozy, relaxed feeling to the space. The space also has a 14' ceiling, so luminaire maintenance needs to be taken into consideration. The south wall is mostly glazing, so the space and luminaires will be visible during the day and especially at night.
- Color Appearance** Since daylight plays such an important role in the space, having a neutral color temperature of 3500K would be the best way to combine natural and artificial light during the day. Possibly having warmer color temperature of 3000K during the evening could be achieved through the use of controls with daytime and nighttime settings. Having a warmer color temperature at night would help give the space a more relaxing and comfortable feeling.
- Daylight Integration and Controls** The student lounge has a glass curtain wall spanning the south facing curve of the building. For this reason, daylight controls may be utilized to save electrical energy during the daytime through the use of dimming controls. Since students will be studying in this area, use of a controlled shading system could aid in reducing the amount of direct sunlight entering the space. Diffusing the light with a film on the glazing should be discouraged, because it reduces the view from the window and can be uncomfortable for people inside the building.
- Direct Glare** Direct glare from the luminaires is a concern, since the space is intended to have a feeling of comfort and relaxation. Direct sun glare from the southern glass wall is also a concern. Sun shades on the exterior of the building are used to reduce the direct glare from sunlight.
- Light Distribution on Surfaces** The space contains a lot of glazing, so everything inside will be clearly visible at night. Highlighting the wood paneled walls would bring out their natural beauty, and contrast nicely with the modern metal and glass in the room. A good design scheme would have portions of the wood lit uniformly while also providing depth with shadows and direct lighting.

Light Distribution on Task Plane	Since many students use the space to do homework and study, it is important for the task plane to be uniform and well lit. Also, the light distribution on the staircase should be uniform and lit well enough for the stairs to be clearly visible.
Luminance of Room Surfaces	The space will receive a lot of bright light from daylight throughout the day, which will illuminate the room surfaces. At night peripheral lighting would be a good design idea. IESNA recommends a 3:1 ratio for task and adjacent surrounding areas, and a 10:1 ratio for task and non-adjacent surfaces.
Modeling of Faces and Objects	Modeling of faces is not of great importance. This space is intended for a relaxing work atmosphere, therefore having a high vertical illuminance on the occupants' faces is not recommended.
Points of Interest	The staircase should be a main point of interest for the space, since it connects the space with the rest of the building and is the main circulation path to the second floor cafeteria. Also, the large columns along the edge of the space could be points of interest as well.
Reflected Glare	Since so much of the space is glazing, controlling reflected glare is an important issue. To reduce the amount of reflected glare in the room, the luminaires should be angled so they do not reflect to eye level.
Shadows	Some shadowing could be used to accent the height of the ceiling and columns. Shadows are not desirable on the task plane and should be avoided.
System Control and Flexibility	The lighting system in the lounge and stair space should have separate controls for daytime and nighttime activities. Since there are only two main function of the space (lounge and circulation), the lighting conditions do not need many different settings. If fluorescent lighting is used, photosensors may be used to dim the interior lamps when there is sufficient daylight entering the space.
Source/Task/Eye Geometry	Sources should be positioned to avoid reflected glare on the task plane.
Special Considerations	Spacing of luminaires may depend on ceiling organization, since the material is suspended perforated metal panels.
Illuminance (IESNA Recommendations)	IESNA recommends a horizontal illuminance of 300 lx (30 fc) for a lounge. IESNA does not recommend a vertical illuminance value for a lounge.

Lounge Assumptions						
Type	Maintenance Category	Room Atmosphere	Cleaning Intervals	Initial Lumens	Design Lumens	Distribution Type
F1	II	Clean	12 months	1680	1275	Direct/Indirect
F3	IV	Clean	12 months	2400	2064	Direct
F4	IV	Clean	12 months	2400	2064	Direct
F10	IV	Clean	12 months	1710	1420	Direct
F11	VI	Clean	12 months	37	not available	Direct

Lounge Light Loss Factors					
Type	BF	LDD	RSDD	LLD	Total LLF
F1	1.0	0.93	0.92	0.76	0.649
F3	0.98	0.87	0.97	0.86	0.711
F4	0.98	0.87	0.97	0.86	0.711
F10	0.98	0.87	0.97	0.86	0.711
F11	1.0	0.86	0.97	1.0	0.834

Lounge Power Density Calculation			
Total Lamp Wattage	Area (ft ²)	W/ft ² Existing	W/ft ² Allowance
2950	1860	1.58	1.2

Lounge Illuminance Levels			
Horizontal Calculated	Horizontal IESNA	Vertical Calculated	Vertical IESNA
13.5 fc	30 fc	N/A	N/A

Some considerations to make when designing for this space are to keep in mind daylight integration and control, direct glare, shadows and light distribution on the task plane. Daylight integration is very important due to the floor to ceiling glazing along the south wall. Since so much daylight is exposed into the space, controlling it and integrating it into the lighting system will greatly improve the room's atmosphere. Direct glare is also very important to control, both from daylight and from luminaires. Since students will be studying in the space, there should be no glare to distract them and put them in discomfort. Light distribution on the task plane should be evenly distributed and free of shadows, so it is most comfortable for students to study, read and do homework.

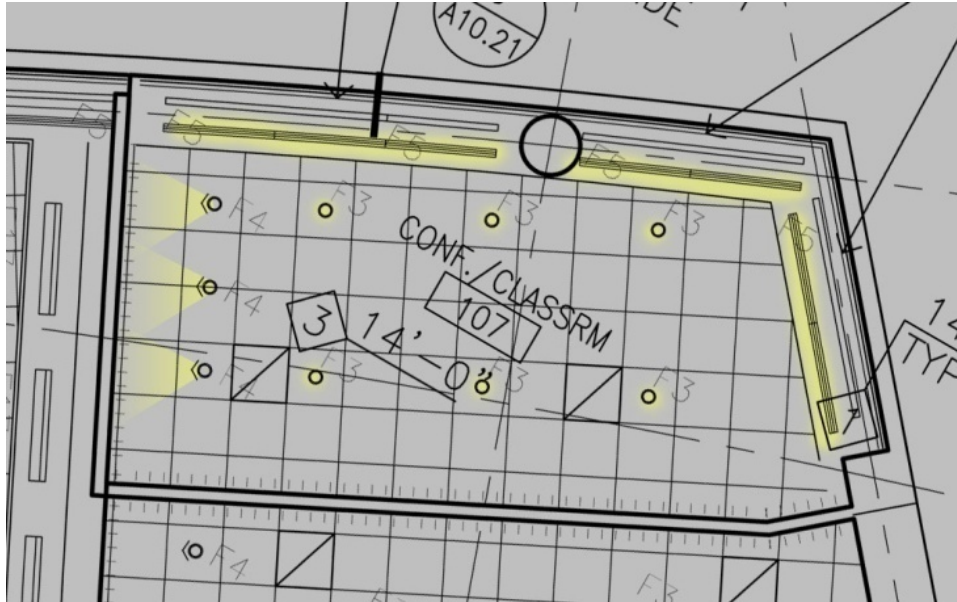
c. lighting critique

The lighting in this space is below the illuminance criteria recommended by IESNA. A reason for this may be due to daylight. The space is used most frequently during the day, when students can stop by in between classes to catch up on homework or sit down. The space receives a large amount of daylight so the luminaires do not have to be as bright during the day. The energy code is not quite met, but it is assumed the lighting designers were considering the whole building method when designing this layout, and balanced energy in other areas of the building. The selected luminaires give the space visual interest and sophistication. The pendants are stylish and provide the space with visual interest while the recessed downlights provide a greater level of illuminance discretely.

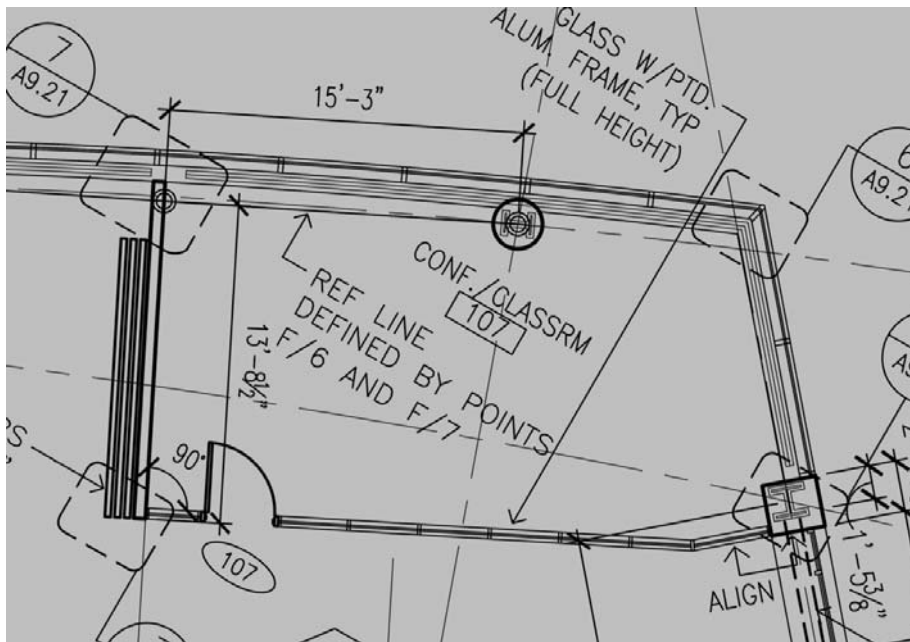
III. CONFERENCE ROOM

a. existing lighting systems

The conference room is located on the first floor, in the north-west corner of the building. The space is not quite rectangular, with interestingly angled walls and three walls of modern glazing. The room will be used by student organizations and faculty conferences, social events and classes of up to 20 people. The room is approximately 340 square feet, with a ceiling height of 14'-0". The ceiling is 2x2 acoustical ceiling tile. The west wall features a projection screen which is raised into the ceiling when not in use. The furniture in the room is a medium reflectance wooden conference table in the center, surrounded by fabric covered conference chairs. The exterior walls to the north and east, as well as the interior south wall are glazing with aluminum framing, while the west wall is gypsum wall board. The main luminaires in the room are compact fluorescent downlights in the center of the room, linear fluorescent suspended up/downlights along the edges of the room by the exterior windows and compact fluorescent wallwashers highlighting the west wall. The suspended F5 luminaires used in the conference area utilize an integrated power system which powers down the fixtures when they are not needed. They are a great option for the space because of the amount of daylight entering through the glazing. The design is highly efficient and uses a lamp and ballast combination producing maximum lumens per watt. The glazing is ¼" thick tempered glass, with a transmittance of 90%.



Conference Room RCP (above) and Conference Room Floor Plan (below)



Conference Room Luminaire Schedule						
Type	Mounting	Manufacturer	Catalogue Number	Lamps	Volts	Description
F3	Ceiling Recessed	Lightolier	8021CCLW/6132BU	1-CFTR 42W	120V	6" Recessed compact fluorescent downlight with an anodized aluminum parabolic reflector.
F4	Ceiling Recessed	Lightolier	8021CW/6132BU	1-CFTR 42W	120V	6" Recessed compact fluorescent wallwasher with an anodized aluminum parabolic reflector.
F5	Suspended	Lightolier	EG2-1-H-B -L-4'-W	1-F32 T8	120V	Suspended fluorescent up/downlight with 1" deep parabolic louver 2.5" o.c. 83% up/17% down.

Surface Materials and Reflectances	
Material	Reflectance
Medium Toned Wood Wall	55%
White Acoustical Ceiling Tile	80%
Carpet	20%

b. design considerations

Appearance of Space and Luminaires	The conference area is a modern looking room with three glass walls, the north and east to the exterior, and the south to the café space. The remaining wall is wood paneling. Furniture in the space is a 20-person dark wood conference table and conference chairs. The conference room will be used mainly for meetings and small classes. It is important that the space look professional and sophisticated because of the conference room function. The room should also be relatively free of clutter, so using recessed fixtures would be good design.
Color Appearance	Since daylight plays such an important role in the space, having a more neutral color temperature of 3500K would be the best way to combine cool natural daylight and artificial light during the day. Also, the presentation needs of the space require good color rendering, so having a CRI of 85 or higher is recommended.
Daylight Integration and Controls	The two exterior walls are glazing, so it is very important to have a daylight control system in place. Using a film on the glazing would help to reduce the amount of direct daylight entering the space, but because the space requires a presentation setting, shades are necessary to completely block daylight from entering the space.
Direct Glare	Managing the direct glare is important in the space, especially considering the amount of direct sunlight the space receives throughout the day. Managing the glare from the sunlight would be similar to the daylight integration strategies listed above.
Light Distribution on Surfaces	The space contains a lot of glazing, so everything inside will be clearly visible at night. Highlighting the gypsum wall board wall would contrast nicely with the modern metal and glass in the room. A good design scheme would have non-uniform peripheral lighting.
Light Distribution on Task Plane	Since the space will be utilized for conferences and as a classroom, it is important for the distribution on the task plane to be uniform.
Luminance of Room Surfaces	In a space like this student resource center, good luminance ratios must be utilized to meet the needs of visual tasks. The <u>IESNA Lighting Handbook</u> recommends 3:1 ratio for task to the adjacent surrounding area, and 10:1 ratio for task plane to non-adjacent surfaces.

Modeling of Faces and Objects	To accommodate a high level of social interaction required for the conference and presentation modes of the room, good facial rendering is very important. Installed fixtures should be able to provide high quality illumination of faces and objects in this space.
Points of Interest	A point of interest in this space is the wood paneled wall to the west. The projection screen retracts from the ceiling, so when it is not being used there will be a blank wall.
Reflected Glare	Reflected and direct glare from luminaires should be avoided to maintain a comfortable work environment for occupants.
Shadows	Shadows on the work plane are undesirable and should be avoided. Eye socket shadows on faces should also be avoided for presentation and social meeting settings.
System Control and Flexibility	Since the space has multiple functions, there should be a lot of controlled scenes for different occasions. Some of these scenes should be presentation, conference and classroom. The lighting should remain flexible to the different scenes and allow the mood of the room to change accordingly.
Source/Task/Eye Geometry	Sources should be positioned to avoid reflected glare on the task plane.
Special Considerations	Spacing of luminaires may depend on ceiling organization, because the material is 2x2 acoustical ceiling tile.
Illuminance (IESNA Recommendations)	The horizontal illuminance levels for the conference room should be 300 lux (30fc). Vertical illuminance levels should be around 50 lux (5 fc) for good facial rendering.

Conference Room Assumptions						
Type	Maintenance Category	Room Atmosphere	Cleaning Intervals	Initial Lumens	Design Lumens	Distribution Type
F3	IV	Clean	12 months	2400	2064	Direct
F4	IV	Clean	12 months	2400	2064	Direct
F5	II	Clean	12 months	2950	2710	Semi-Indirect

Conference Room Light Loss Factors					
Type	BF	LDD	RSDD	LLD	Total LLF
F3	0.98	0.87	0.97	0.86	0.711
F4	0.98	0.87	0.97	0.86	0.711
F5	0.88	0.93	0.92	0.95	0.715

Power Density Calculation			
Total Lamp Wattage	Area (ft ²)	W/ft ² Existing	W/ft ² Allowance
629	340	1.85	1.3

Conference Room Illuminance Levels			
Horizontal Calculated	Horizontal IESNA	Vertical Calculated	Vertical IESNA
38.13 fc	30 fc	3.35	5 fc

Aspects to be considered when designing in this space are daylight integration and control, direct glare, light distribution on the task plane, and facial rendering. There are two glass walls to the exterior on the north and east side of the room, so an abundance of daylight is exposed to the space. Controlling the daylight entering the space and integrating it into the lighting system will greatly improve the room's atmosphere. Direct glare is also very important to control, both from daylight and from luminaires in the space. Since there will be a lot of desk tasks performed in the space, there should be no glare to distract the occupants and put them in discomfort. Light distribution on the task plane should be evenly distributed and free of shadows, so it is most comfortable for students and faculty to read, write and perform other tasks. Facial rendering is important for presentations and conferences where communication and recognition of facial expressions is significant.

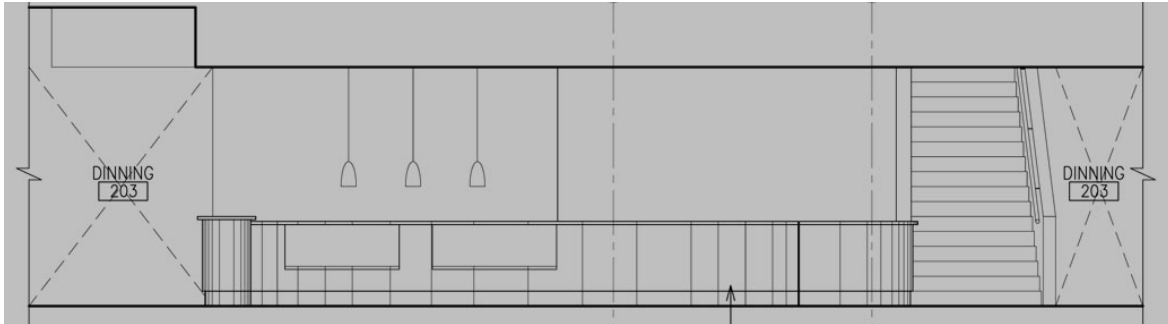
c. lighting critique

The lighting in the conference room meets the illuminance criteria recommended by IESNA. The energy code required by ASHRAE 90.1 is over by a little bit, but may be balanced in other areas of the building. The recessed luminaires provide adequate illuminance levels without adding visual clutter to the space. The wallwashers provide an interesting accent to the otherwise plain wood paneled west wall. The use of suspended fluorescent luminaires parallel to the windows creates even light level throughout the day and provide visual interest from the exterior at night.

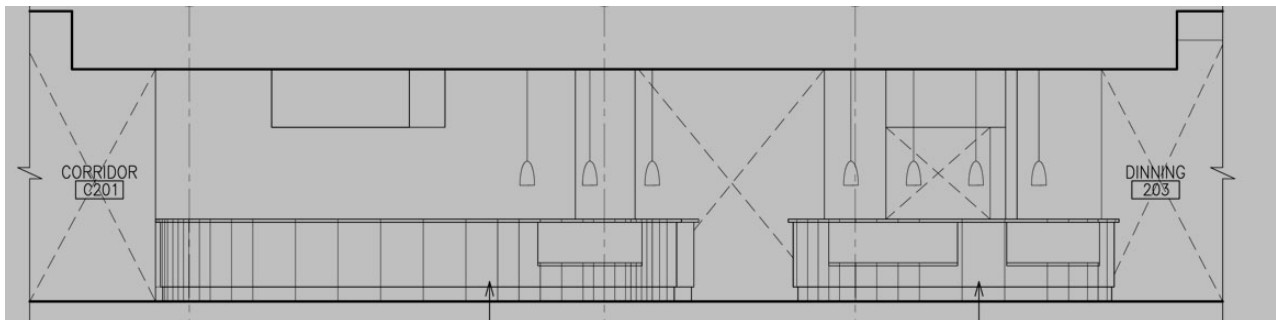
IV. CAFETERIA SERVING AREA

a. existing lighting systems

The main campus cafeteria serving area is located on the second floor of the building. Students will gather here to eat breakfast, lunch and dinner. The space features curved serving bars, round condiment stations, and kitchen and cooking areas. In the center of the space is a specialty bar, with made-to-order items. The space will also have movable tables and chairs for students to eat. The ceiling height is 8'-0" and is suspended 2x4 acoustical ceiling tile. The north and south sides are open to the hallway, while the east and west walls are painted gypsum wall board. The luminaires are a combination of track mounted decorative pendants, and recessed downlights. The T4 halogen pendants illuminate the space over the serving counters, while the compact fluorescent downlights add uniform ambient light over the kitchen preparation areas and throughout the space.



Serving Elevation East (above) and Serving Elevation West (below)



Cafeteria Serving Area Luminaire Schedule						
Type	Mounting	Manufacturer	Catalogue Number	Lamps	Volts	Description
F2a	Pendant	Wilmette	600-MO-CNG-C	50W T4 Halogen	120V	Monorail mounted halogen pendant.
F3a	Ceiling Recessed	Lightolier	D7A02-8022FCL-S7142BU	1-CFTR 42W	120V	6" Recessed compact fluorescent downlight with an anodized aluminum parabolic reflector and decorative Vetro dropped glass ring.
F12	Ceiling Recessed	Lightolier	8097FWHW/7132BU	1-CFTR 42W	120V	7" Recessed compact fluorescent downlight with anodized aluminum parabolic reflector.

Surface Materials and Reflectances	
Material	Reflectance
Counters	50%
White Acoustical Ceiling Tile	80%
Tile Floor	30%
Painted Gypsum Wall Board	60%

b. design considerations

Appearance of Space and Luminaires	The serving area of the cafeteria needs to be a functional and fun place for students to eat and socialize. The atmosphere should be relaxed and youthful. The architectural design of the space is very open, with counters on the east and west side and in the center of the space. There are also circular condiment stations and movable tables and chairs throughout the space. The flooring is tile, and the walls are painted gypsum wall board.
Color Appearance	This space is in the center of the building, with two eating areas with glass curtain walls on either side. Since the area between the serving space and glazing is open, a lot of natural light will be entering the space from the north and south. Using neutral color temperature of about 3500 would be comfortable for the occupants and blend with cool exterior light better than warmer color temperatures. The light should also have a good color rendering index to enhance the colors of the food being served.
Daylight Integration and Controls	Since the space does not have any direct access to daylight, controls and integration are not as large of a consideration as some of the other spaces. Some daylight will act as ambient luminance during the day, but controls are not necessary to block light. Using a dimming system during the day to reduce energy consumption may be utilized to integrate the daylight and interior light.
Direct Glare	Direct glare could be a problem in the food preparation areas and serving areas when the kitchen staff is trying to prepare and serve meals. The contrast between the bright glare and the background could potentially be dangerous if the staff cannot see what they are doing when using sharp cutlery.
Light Distribution on Surfaces	Light distribution throughout the room should be non-uniform to promote relaxation and pleasantness.
Light Distribution on Task Plane	Light distribution on the serving areas and in the food preparation surfaces should be uniform. It would be difficult to get a uniform light distribution on the dining tables, because they are mobile and can be moved around the space.
Luminance of Room Surfaces	Emphasis should be placed on the food serving areas. Some peripheral emphasis would also be good design to add to the pleasantness of the space.

Modeling of Faces and Objects	Good facial and object rendering is important in this space. The students will need to see the food they are purchasing, and the staff will need to see it to prepare it. People eating in the space will also be socializing, and will need some degree of facial rendering to be comfortable in the room.
Points of Interest	Points of interest in the space are the serving counters and condiment stations. Attention should be drawn to the serving counters through use of higher illuminance in those areas.
Reflected Glare	Reflected glare can be an issue on the sneeze guards over the food serving area. Since the sneeze guards are a reflective material, it is important to place the luminaires so they will not reflect into people's vision as they are getting food.
Shadows	Shadows interfere with task visibility because they place details in darkness. Shadows on the task plane are undesirable and should be avoided because they can be dangerous in the preparation areas.
System Control and Flexibility	It is not necessary to have a lot of controls in this space, because it is not a multi-functional space. Having possible daylight controls to save energy is the only system that may be applicable.
Source/Task/Eye Geometry	Sources should be positioned to avoid reflected glare on the task plane.
Special Considerations	The space has 2x4 acoustical ceiling tile, so luminaires should be placed according to the ceiling layout.
Illuminance (IESNA Recommendations)	The horizontal illuminance will range from 300 lux (30 fc) over the serving areas but can reduce to 100 lux (10 fc) over the dining area. The vertical illuminance should be around 30 – 50 lux (3-5 fc)

Cafeteria Serving Area Assumptions						
Type	Maintenance Category	Room Atmosphere	Cleaning Intervals	Initial Lumens	Design Lumens	Distribution Type
F2a	IV	Clean	12 months	950	-	Direct
F3a	IV	Clean	12 months	2400	2064	Direct
F12	IV	Clean	12 months	2400	2064	Direct

Cafeteria Serving Area Loss Factors					
Type	BF	LLD	RSDD	LDD	Total LLF
F2a	1.0	0.87	0.97	1.0	0.844
F3a	0.98	0.87	0.97	0.86	0.711
F12	0.98	0.87	0.97	0.86	0.711

Power Density Calculation			
Total Lamp Wattage	Area (ft ²)	W/ft ² Existing	W/ft ² Allowance
2555	2048	1.24	1.4

Illuminance Levels			
Horizontal Calculated	Horizontal IESNA	Vertical Calculated	Vertical IESNA
12.8 fc avg	10-30 fc	3.37	3-5 fc

Ideas that were considered when designing this space were color appearance and rendering, light distribution on the task plane, and source/task/eye geometry. Using neutral color temperature of about 3500 would be comfortable for the occupants and blend with cool daylight entering the space. The light should have a color rendering index higher than 80 to enhance the appearance of the food being served. Light distribution on the serving areas and in the food preparation surfaces should be uniform. Sources should be positioned to avoid reflected glare on the task plane, which could hinder the staff preparing the food.

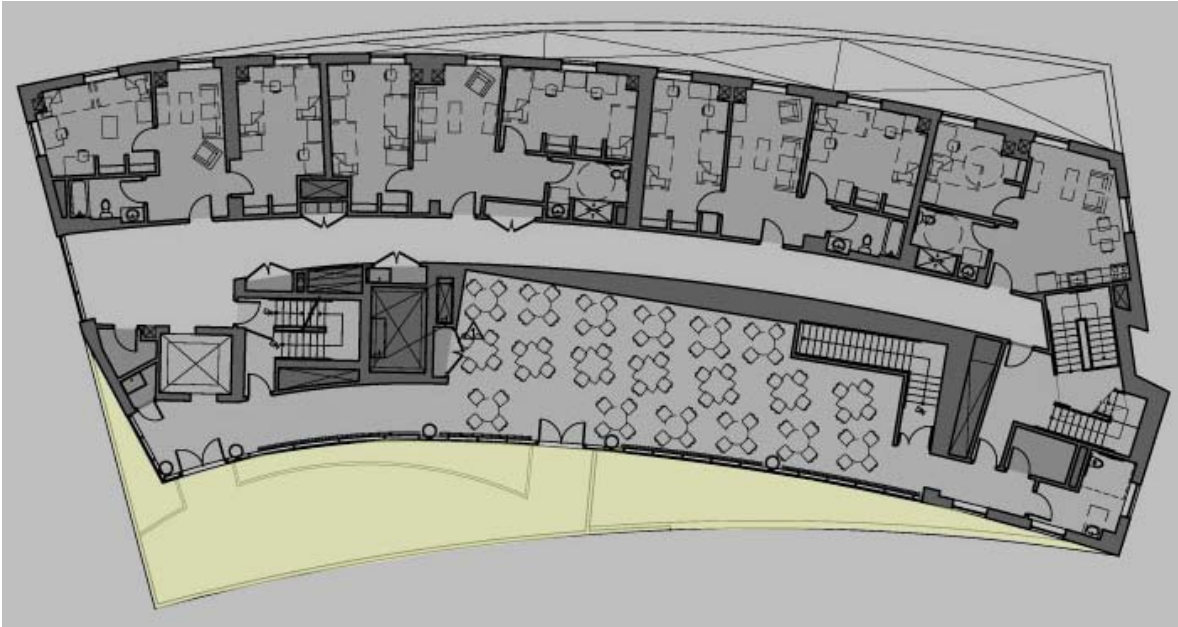
c. lighting critique

While the average illuminance for the space was well below the recommended IESNA value, the individual spaces were generally lit to their target illuminances. The preparation and serving areas averaged about 23 fc, while the dining area average was about 10 fc. Even though the distribution is uneven, the serving and preparation areas still need more illuminance to fall under the guidelines of the IESNA code. The space does meet the energy requirements set by ASHRAE 90.1. Using track lighting over the serving area incorporates an element of fun in the space. Simple downlights provide illuminance without adding visual clutter over the preparation and circulation areas.

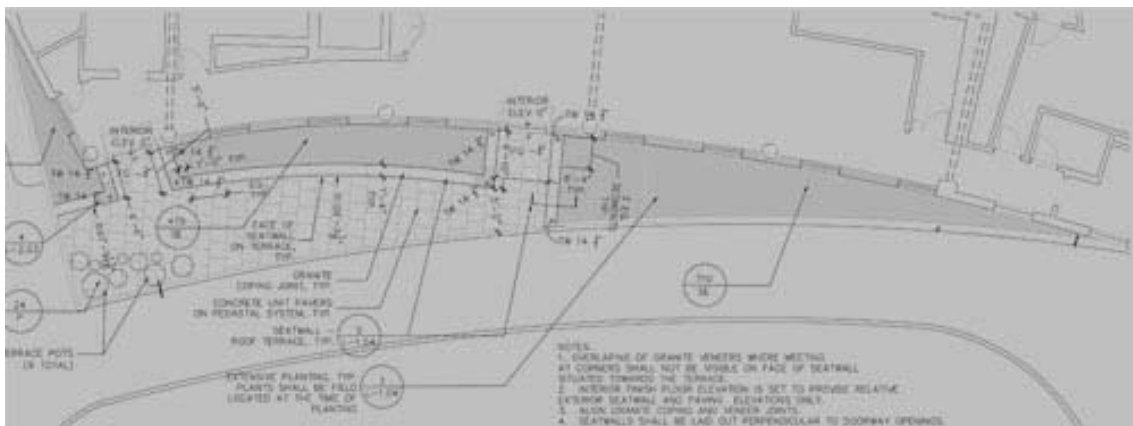
V. THIRD FLOOR DECK

a. existing lighting systems

The third floor outdoor deck is located on the south facing side of the building. The deck features vegetation areas, potted plants and a glass railing. The exterior wall is glazing with aluminum framing. Students will be able to use this space for studying and relaxing. The flooring is roof pavers, and the vegetation boxes are concrete unit pavers on a pedestal system with granite coping at the joints which may be used as seating for occupants. There is currently no lighting system in place on the roof deck, but it would be an ideal place to illuminate during the evening for students to sit and relax.



Third Floor Deck Plan (above) and Landscape Plan (below)



Surface Materials and Reflectances	
Material	Reflectance
Concrete Planters	25%
Concrete Unit Pavers (flooring)	25%

b. design considerations

Appearance of Space and Luminaires	The third floor deck is a relaxing space where students can sit outside and unwind. The lush vegetation areas and view of Wheelock's campus provide a peaceful atmosphere, while wall seating is provided so students can sit down. The wall to the interior is glazing with aluminum framing, so students are able to see the space from inside the building, as well as the passersby who are able to view the space from the ground. There is currently no lighting system in place on the roof deck, but it would be an ideal place to illuminate during the evening for students to enjoy.
Color Appearance	The space is adjacent to a glass curtain wall and an interior dining area; it is important that the color temperature be similar to the indoor space. The assumed color temperature of the interior space is 3500K, so the outdoor deck should be similar. Color rendering is not very important in this space due to the lack of tasks being performed. A CRI of 70 or above would be sufficient.
Daylight Integration and Controls	This is an exterior space, so daylight controls are not necessary.
Direct Glare	Direct glare from daylight and luminaires should be taken into consideration when designing for the space.
Light Distribution on Surfaces	For safety reasons some degree of uniformity must be maintained throughout the space. However, to create visual interest and textures of the landscaping of the space, non-uniform lighting should be utilized.
Light Distribution on Task Plane	There are no required visual tasks for this area, so light distribution on the task plane is not important.
Luminance of Room Surfaces	Some non-uniform peripheral lighting would enhance the space, although it may be difficult to achieve since most of the peripheral of the space is glazing. Having non-uniformity throughout the surfaces of the room would create a textured and visually interesting space.
Modeling of Faces and Objects	Facial recognition is beneficial for conversations between students on the deck. Having some vertical illuminance would help with modeling faces.

Points of Interest	A points of interest in the space is the vegetation. Highlighting some of the landscaping would be a good design idea and give the space a three dimensional feel.
Reflected Glare	Reflected glare from the glass windows and railing surrounding the space may be a problem and should be considered when designing for the space.
Shadows	The use of shadows in this space may be used to enhance the dimensions of the space and give it more visual interest.
System Control and Flexibility	The deck space does not require many system controls since it only has one function. Having photometric or time clock controls would be a good idea to turn the luminaires on at twilight.
Source/Task/Eye Geometry	Sources should be positioned to avoid reflected glare on the task plane.
Special Considerations	There is a lot of landscaping in the area, and the plants will be increasing in size yearly, so being aware of projected plant growth in subsequent years is important.
Illuminance (IESNA Recommendations)	The recommended horizontal illuminance level for the outdoor deck space area around 50 lux (5 fc), and the vertical illuminance levels are 30 lux (3 fc).

Power Density Calculation			
Total Lamp Wattage	Area (ft ²)	W/ft ² Existing	W/ft ² Allowance
N/A	750	N/A	0.2

Illuminance Levels			
Horizontal Calculated	Horizontal IESNA	Vertical Calculated	Vertical IESNA
N/A	5 fc	N/A	3 fc

c. lighting critique

There is currently no lighting in this space. Topics to consider when designing for the outdoor deck space would be light distribution on surfaces and points of interest. The light distribution should be non-uniform to enhance the three dimensional aspects of the space and the landscaping. Points of interest to highlight are the landscaping and the potted plants on the deck.

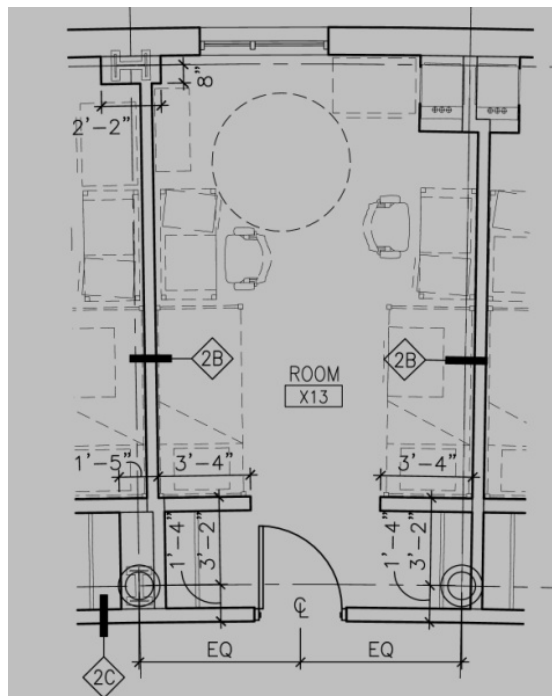
VI. TYPICAL DORM ROOM

a. existing lighting systems

The typical two-bed student dorm rooms are located on the fourth and fifth floors of the building. The dorm rooms are used as sleeping, studying and living areas for student residents. The rooms feature two beds, two closets and two desks. The rooms are approximately 240 square feet, with 8'-0" ceiling height, but the square footage may vary due to the shape of the building. The walls are gypsum wall board, and the ceilings are suspended gypsum wall board. The luminaires in the dorm rooms are simple surface mounted fixtures. There are two luminaires in the center of the room for general ambient light, and one over each closet for task lighting.



Typical Dorm Room RCP (above) and Furniture Plan (below)



Typical Dorm Room Luminaire Schedule						
Type	Mounting	Manufacturer	Catalogue Number	Lamps	Volts	Description
F13	Ceiling Surface	Tiella	800FM360LS-CF	2-CFT 13W	120V	11" Surface-mounted compact fluorescent downlight with a frosted glass diffuse white lens.
F14	Ceiling Surface	Tiella	800FM360SS	1-T4 G9 40W	120V	6" Surface-mounted halogen downlight with a frosted glass diffuse white lens.

Surface Materials and Reflectances	
Material	Reflectance
Painted Gypsum Wall Board	60%
Carpet	20%

b. design considerations

Appearance of Space and Luminaires	The design allows a lot of room for students to add their unique touch, so the walls and ceiling are plain, painted gypsum wall board. The luminaires are simple and meant to provide the space with ambient light. The closets and desks are medium reflectance wood.
Color Appearance	A warmer color temperature of 3000K would be good design criteria for this space. Warmer color makes the room feel cozier and livable. Good color rendering is important to make the space comfortable for the inhabitants. A CRI of 75 or above would be acceptable.
Daylight Integration and Controls	The space only has one window, so daylight can be controlled by the digression of the inhabitants through shades, blinds or curtains.
Direct Glare	Direct glare in the space is undesirable, since students will be studying, reading and doing homework in the space. For a comfortable work plane, direct glare should be eliminated.
Light Distribution on Surfaces	Harsh light distributions on surfaces should be avoided, but having a non-uniform lighting scheme would be acceptable.
Light Distribution on Task Plane	It is important to have uniform light distribution on the desks. Students will be studying and reading there, and non-uniform light levels would distract from the task.
Luminance of Room Surfaces	The most important surfaces to be lit in the space are the desk area and the closet. The task plane is located on the desk, and it is where students will be doing most of their homework and studying.
Modeling of Faces and Objects	Modeling of faces is important in the space. People will be interacting with each other in the room, so under-eye shadows and bad facial recognition is not encouraged.
Points of Interest	There are no significant points of interest in this space.
Reflected Glare	Reflected glare can be distracting to people performing desk tasks, and is discouraged. The window is the only source of reflected glare in this space, so it is not a big issue.

Shadows	Shadows are not desirable on the task plane and should be avoided.
System Control and Flexibility	The room does not require any controls.
Source/Task/Eye Geometry	Sources should be positioned to avoid reflected glare on the task plane.
Special Considerations	There are no special considerations for this space.
Illuminance (IESNA Recommendations)	Horizontal illuminance levels for the desk work plane are 300 lux (30 fc), and for the remainder of the room are 100 lux (10 fc). The vertical illuminance levels should be 30-50 lux (3-5 fc).

Typical Dorm Room Assumptions						
Type	Maintenance Category	Room Atmosphere	Cleaning Intervals	Initial Lumens	Design Lumens	Distribution Type
F13	IV	Clean	12 months	1600	1376	Direct
F14	IV	Clean	12 months	510	unavailable	Direct

Typical Dorm Room Loss Factors					
Type	BF	LDD	RSDD	LLD	Total LLF
F13	0.98	0.87	0.97	0.86	0.711
F14	1.0	0.87	0.97	1.0	0.844

Power Density Calculation			
Total Lamp Wattage	Area (ft ²)	W/ft ² Existing	W/ft ² Allowance
138	240	0.575	1.1

Typical Dorm Room Illuminance Levels			
Horizontal Calculated	Horizontal IESNA	Vertical Calculated	Vertical IESNA
7.26 fc	10-30 fc	6.08 fc	3-5 fc

Important aspects to consider when designing a living space are color temperature and rendering, modeling of faces and glare. Designing with warm color temperatures gives the space a relaxing, cozy appearance, whereas using cooler temperatures makes the space feel cold and harsh. Facial recognition and rendering is also very important in a residential space. Glare is undesirable and should be avoided in the space to prevent the occupants from becoming uncomfortable because of high contrasts between surfaces.

c. lighting critique

The calculations determined the illuminance levels for the space to be below the recommended IESNA guidelines. The designers may have anticipated the use of task lighting on the desk areas, and assumed the ambient lighting could be less bright. The energy codes were under the ASHRAE 90.1 standards by a significant amount. When calculating the energy usage of the building, the savings in energy in the dorm rooms are able to make up for other spaces which go over the code. The surface mounted luminaires provide the room with illuminance without adding any personality, which makes it easier for the students living there to add their personalities to a blank slate.

VII. RELEVANT COMPUTER FILES

AGI 32 calculation files may be found in the Y drive in the following folders:

Y:\akc5002\Tech Report I\AGI Calculations

Lounge Space: Lounge.AGI
Conference Room: ConferenceRoom.AGI
Cafeteria Serving Area: Serving.AGI
Typical Dorm Room: Dorm.AGI

All loss factors were factored into the AGI calculations.

The IES files used for the calculations may be found in the Y drive in the following folders:

Y:\akc5002\Tech Report I\IES Files

The IES files are named according to their fixture number. Some of the luminaire IES data was unavailable. Alternate fixtures with similar light distributions were used in those cases.