Hotel and Conference Center

Virginia, USA

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Lighting | Electrical
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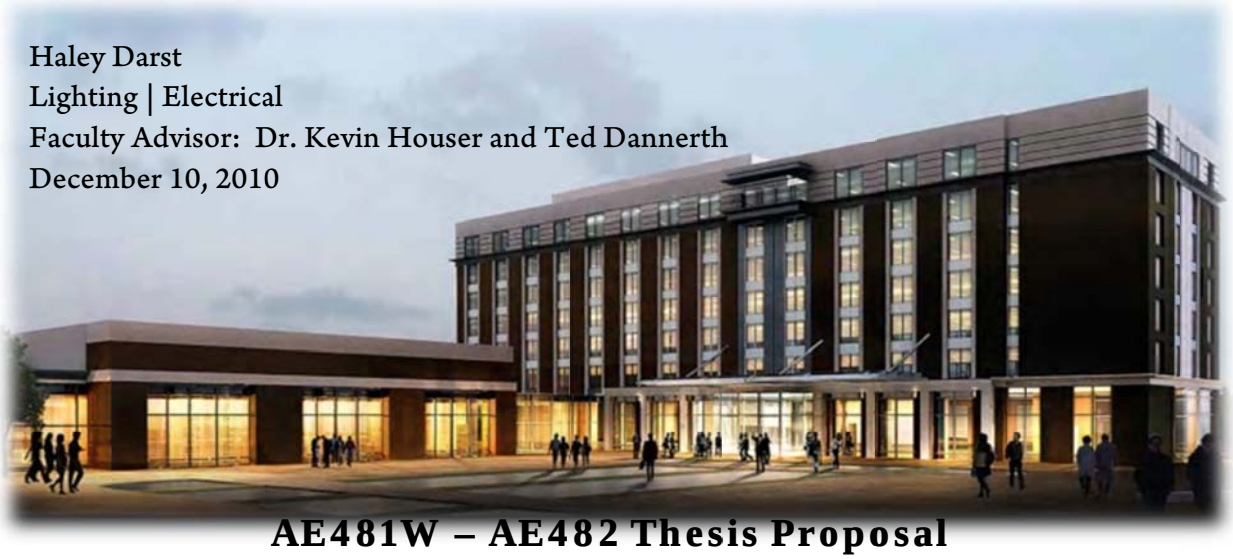

AE481W – AE482 Thesis Proposal

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Executive Summary

The following proposal includes details concerning the work to be completed in the spring 2011 semester for the AE Senior Thesis Capstone Project. It contains a background and description of the topics for redesign in the Hotel and Conference Center, a recently opened hotel on the outskirts of one of Virginia's finest universities. Explanations for lighting redesign in four spaces in the building are included, as well as two electrical depth topics and additional focuses related to other breadth topics in the program. The document contains information relating to solutions for the existing systems that may be interesting alternatives or additions to the building.

For the lighting depth, four spaces will be redesigned in the building. These four spaces include the exterior façade at the main entrance of both buildings, including the central plaza, the main hotel lobby, the lounge, and the largest ballroom in the conference center. The new lighting design incorporates concepts regarding the architect's vision of bringing the exterior Virginia landscape indoors into every space. Concepts will visually enhance the building and conform to design requirements and criteria specified by the IESNA Lighting Handbook and power density requirements in ASHRAE 90.1.

Four topics regarding the current electrical system will be analyzed. A redesign of the branch circuit distribution for the four relit spaces will be designed. A protective device coordination study and short circuit analysis will also be completed. Because the building has all copper feeders, a study using aluminum feeders will be presented to compare the two systems. Finally, an analysis of whether or not a photo voltaic array would be beneficial to the building will be investigated.

Both architectural and structural breadth topics will be carried out in the redesign of the ballroom space. It is proposed to visually enhance the ballroom by adding in clerestory windows into the room, so the architecture will change drastically inside. This will also affect the structural design of the ballroom, so a redesign of the roof framing system will need to be carried out, as well as making sure columns conform to structural height requirements.

Background | Hotel and Conference Center

Construction on the $50 million dollar Hotel and Conference Center began in the fall of 2008 and finished in the summer of 2010. The building recently opened and is an 8-story, 174,000 square foot facility located on the outskirts of one of the country's most respected universities in Virginia. Although the exterior façade of the building does not boast any discrepancies from the architecture of the university, the handsome interior spaces display the epitome of bringing the campus landscape indoors. Rich colors and woodwork dominate each of the spaces alike, reminding one of the outdoors and the campus setting which provided inspiration to the interior décor. The Hotel and Conference Center provides a luxurious and warm atmosphere to all patrons, whether residing in the hotel or merely attending a business or private event in the conference center. The elegant inn houses 148 guest rooms, a lounge and bar area, a restaurant, ballroom, 24-hour fitness facility, and various meeting rooms in the conference center. Hotel guests not only become immersed in the sophisticated atmosphere, but are reminded of the spirit and vivacity of the university when visiting the facility.

Four spaces within the building will be studied as a part of the thesis assignment in the spring. These four spaces include the exterior façade, main hotel lobby, the lounge, and the ballroom. Each of these spaces will be further discussed in the proposal. A plans of the building with each location of the spaces is included below.

Figure 1: First Floor Plan

Depth Proposal | Lighting

[Problem] *Current Lighting Design*

The Hotel and Conference Center in Virginia has a distinct, urbane atmosphere. It is seen through the architecture, interior design, and the lighting design. Sources and luminaires throughout the building are all specific to the direct use of each individual space, yet cohesively form a unique and elegant ambiance for guests. Both halogen and linear fluorescent fixtures lamps with warm color temperatures are the most common lamp types utilized. Special care and attention was on all facets of the architecture and how the building was going to orient guests. Through the use of coves, branding walls, decorative luminaires, and accent lights, guests feel welcome and relaxed as light remains on the peripherals and away from the guests in most spaces. Dimming systems were also an important consideration of the building, allowing energy savings and a more intimate setting during the evening.

Four spaces will be redesigned for the thesis project in the spring. These include the exterior facades of both the hotel and conference center portions of the hotel, the main lobby of the hotel, the lounge, and the large ballroom in the conference center space. New lighting designs in each space will focus on the architect's concept of bringing Virginia's outdoor landscape indoors. Integrating the idea of nature and the beautiful wooded landscape of the university into the lighting design will complement the interior décor of the facility and tailor the architect's vision for the building.

IESNA recommendations and power density allowances from ASHRAE 90.1.2007 levels will be closely followed and accounted for in each lighting design.

[Solution] *Overall Design Concept*

"Our concept is to blur the line between interior and exterior and to pull the outdoors indoors."
-Gensler Architecture Group

The Hotel and Conference Center is located outside of one of Virginia's most prestigious universities. Situated in rural Virginia, the site includes dozens of beautiful cedar trees and landscaping, common to the university as well. Through the use of colors and finishes, the natural landscape has already physically been brought into the building. Deep olive greens, bright oranges and reds, and rich gold hues all evoke the ideas of nature inside the building. Floor finishes and architectural shelving units and millwork made from wood and quarry stone all exhibit the natural wooded landscape. Effective lighting design in each space can help to enhance the unique materials and finishes implemented, and further accentuate the interaction between surfaces and light.

<u>Exterior Facades</u>
Guests of the Hotel and Conference Hotel arrive at the building and drive around a central courtyard located in front of the facility. The central plaza is made up of planters, benches, and even incorporates walkways to encourage guest interaction with the exterior space. The exterior facades of both buildings include a variety of materials, such as brick, glass, and metal canopies and spandrel panels. Although the architectural design does not differentiate itself much from the rest of the university's buildings, through the use of light, the Hotel and Conference Center can stand alone as an icon reflecting the natural beauty of Virginia.

Inspiration of natural light for the exterior façade includes an image of a sunburst, shining through the clouds. This image mirrors the concept of uplight and accentuating forms and textures of the clouds, much like grazing brick on the exterior of the building. However, the proposed lighting design of the exterior façade will consider both light trespass and light pollution, as to preserve the natural wooded landscape around the site. Minimal uplight will be applied on the middle tier of the hotel tower, possibly utilizing dark skies friendly fixtures. Sconces along the first floor levels of the building will graze light upwards and downwards while still providing adequate light levels at the pedestrian level and architecturally enhance the textures of the facades. Most of the light on the exterior will be at a pedestrian level, promoting safety and a sense of welcoming onto the site. The metal canopy of the

hotel will provide higher levels of light for guests to drive up to and gather their bags. Orientation onto the site is also important to help guide guests to the main entrance of the building. Canopy lighting will illuminate the entrance area of the building as a focal point and therefore signal to guests the main doors of the building.

After receiving comments from the panel of lighting designers at the Lutron sponsored event, closer consideration of the lighting in the outdoor plaza will be considered for redesign in the spring, as this space also adds to the overall image of the building.

Lobby

Upon arrival at the Hotel and Conference Center, the main lobby serves as a particularly important space for guests and staff as it sets the tone for the rest of the Hotel and Conference Center. An inviting ambiance is wanted, and the lighting design should do enhance this and also complement the wood millwork and rich finishes and colors in the Lobby. Guests enter the main lobby through the vestibule and make their way to the front desk and check-in area. There are also seating areas throughout the main lobby, providing relaxation for guests and serving as waiting areas. These seating nooks are ideal for those waiting to enter either the Restaurant or Lounge. Floor to ceiling windows provide daylight into the space during the day.

Because the lobby is a place of orientation for hotel guests, the source of inspiration for the lighting is of a daylit path through the woods. Conceptually this represents the notion of leading people on a path, much like the lighting in the lobby should lead people throughout the hotel. Signage displays are seen in the lobby, signaling to guests where different areas of the hotel are located; these will be backlit. A cove over each seating area will make the areas feel more relaxed as light will not directly be on the occupants. Small decorative elements on tables will provide task lighting to those wanting to relax and do work in the seating areas. Keeping light on the walls and away from the occupants is generally wanted to create a relaxing and much more intimate atmosphere. Any artwork located on walls provides opportunities for accent lighting, and track lighting may be implemented for this purpose.

At the front desk, the light levels should be higher than the rest of the lobby. Modeling of faces and objects is important at a front desk, especially when dealing with guests' money. In any way, illuminating people's faces is important and can be done by pendants or downlights over the desk. Light will graze the surface of the desk to enhance the wooden finish. Illuminating the desk with a striplight for general task lighting will be necessary for the staff's day-to-day activities. The sign on the wall behind the front desk will be backlit for display.

Lighting in the lobby will mirror that of the Flynn impression of Privacy or Intimacy. Therefore, low light levels will be implemented in the direct locale of the guests. Lighting should be non-uniform and brighter away from the guests.

Lounge

The Lounge in the Hotel and Conference Center is a more private space in the hotel for guests. It is a space separated from the rest of the hotel where guests can enjoy fine food and spirits at the bar during the late afternoon and evening hours. Situated on the northernmost part of the building, floor to ceiling glazing spans almost the entirety of the façade, allowing daylight to penetrate into the space. Guests of the Hotel and Conference Center can enter the Lounge through the main lobby and corridor on the first floor. A set of double doors on the western wall provides access to the outdoor terrace.

Rich colors and finishes from the main Lobby were also utilized in the Lounge. Granite countertops, leather furniture, and custom woodwork help to create an impressive atmosphere that is both elegant and sophisticated.

Three schematic designs were created in the Lounge based on the architect's image of incorporating the outdoor context indoors. These three designs are light as a canopy, light and reflections, and light and transparency. Based on comments from the lighting designers at the Lutron event, each design concept should be analyzed a step further in order to implement any one of them into next semester's redesign.

a. Light as a Canopy: For this schematic design, the effect of light softly glowing over a canopy of trees was used as an inspiration. Methods to create this effect have not exactly been determined, but thoughts of using a leaf-pattern architectural screen over top of the central bar could be used in conjunction with a downlight system. This will hopefully create a dappling effect of leaves on the floor and create sparkle from above. Because this space is also a more private and relaxing area of the hotel, focal points are wanted around the room to have light away from the guests. Washing the face of the bar and illuminating the shelving of the bar are two ways to achieve visual interest away from customers. Because adequate light levels must be met on the dining tables and to ensure usage of laptops or light reading, downlights may be applied as a simple yet effective system.

b. Light and Reflections: This schematic design uses reflection as a means to emphasize light away from guests. A cove light applied above the bar will more or less "reflect" or mirror a glowing element below the central bar at the feet of guests in the space. Illuminated shelving in the bar will highlight the point of sales and main purpose of the space. Low levels of light in decorative elements on each dining table will create a more private space for guests in the room. General ambient light will be created using downlights.

   Suggestions at the Lutron event included suggesting the use of a little bit of a more specular or reflective surface on the tables, to really create the sparkle and reflection wanted for this lighting design scheme. This must be carefully designed so as not to create any annoying reflected glare from the surfaces.

c. Light and Transparency: For this design, semi-transparency and the element of mystery was the inspiration. In order to create this effect it was noted that the seating area directly behind the bar is a completely separate entity from the rest of the bar, sort of hidden behind the bar wall. A semi-transparent bar shelving could be used to engage guests to see what's hidden behind the bar. Small, semi-transparent glass tiles could be placed at each seat of the bar, glowing from the bottom with a soft light and creating a neat effect with customers' drinking glasses as they're placed on top of these glass tiles. Semi-transparent, decorative elements in the direct locale of guests could be placed on the dining tables. For more ambient and peripheral focus, several methods were taken into account including square downlights, washing the face of the bar with light, and a light cove above the central bar.

Again, developing each schematic design a bit further is needed before selecting one as the best overall design.

Ballroom:
The Hotel and Conference Center can highlight various social events in its Ballroom, including themed events, cocktail receptions, company outings, anniversary parties, reunions, and wedding receptions. Capacities vary in the room, as two operable partitions can separate the Ballroom into one, two, or three salons. The Ballroom accommodates up to 579 guests in a reception setting, 611 as a theater, and as many as 456 in a banquet setting.

Three separate presets were considered for the lighting design of the Ballroom, as function and how the space will be utilized for events is important. Flexibility and controls are extremely significant for the lighting design solution as well.

The source of inspiration for this space was a dark cave, suddenly illuminated by daylight. Just like a cave in nature, a ballroom in a conference center shuns the daylight. However, adding in daylight into the space could really enhance the overall atmosphere during certain types of events, specifically long conferences. With the use of clerestories, daylight will be integrated into the Ballroom, as well as a

shading device system in case daylight is not wanted for any reason. Controls will, again, be an important consideration with the development of this room.

First, a more public lighting design was created in the Ballroom. The clerestories were assumed to be open, allowing daylight to come into the room. Uniform perimeter lighting was included to make the space feel more open and spacious during public events or company outings. A double tiered cove lighting system with a uniform glow inside the coves was also included in the design. To add an element of sparkle, decorative chandeliers were added in each of the cove systems.

During a private event, such as a reception or reunion, the lighting design will alter slightly. Shades on the clerestories can be programmed to be down if daylight is not wanted. To make the room more intimate and add visual interest, sconces along the perimeter will glow with warm light. Low levels of perimeter lighting and low levels of light from the coved system will also add to a more intimate scale during reception events. The decorative chandeliers in the coves will remain on to add sparkle and add a focal point to the space.

Themed parties and bar mitzvahs, as well as other very festive and social events, can also have the option of utilizing a system which incorporates color into the lighting design. Colored light around the perimeter and in the coves not only make the event more memorable, but add to a more fun and exciting space during these events. Adding sparkle and more intimacy into the room is done by the use of the decorative chandeliers and sconces along the perimeter.

Professional Design Comments - Lutron

On December 8, 2010, Technical Report 3 (Schematic Lighting Design Presentation) was presented to a group of three lighting design professionals at Lutron's headquarters in Lehigh Valley. Feedback from all of the designers, including questions and comments, was given to each student and recorded. A summary of the comments made after the presentation are given below.

Charles Stone (*Fisher Marantz Stone*)

- Overall:
  - Very well prepared
  - Sophisticated use of drawing inspiration from nature and telling us WHY
  - Awareness of technical metrics noted but try to incorporate and make it apparent throughout entire presentation
  - Images got better as design progressed, although the initial image of the road and nature was the weakest-use a different one; however, the overall collection of images was great, and made case for why the image was chosen and how it was applied inside
- Exterior Façade:
  - Don't do too much uplighting because of light trespass; may need to minimize or it may not be allowed at all in the area
- Lobby:
  - Didn't like the red "zone indicators" (references blood, wine, etc)
  - White sketch on black background seems literal, but can be seen as flat; the lighting techniques applied were clear on top of the sketches
  - Said "track lighting to highlight artwork" but instead say "Art provided the opportunity for accent lighting and I used track lighting to do so" (ie always say what you're going to do and how you're going to do it)
- Lounge:
  - Slide 24 (image of current design) does not do justice for architect and does not make me want to order a martini. The image portrays a problem and a chance to say how to fix it.
  - Downlight usage is cliché; say something about "need to provide enough horizontal footcandles on task plane" – don't say hardware!
  - Images and case of why you use them is great – really brought the concept into the room
  - Reflection Concept: coves both above and below central bar, but try to incorporate maybe a specular tabletop; explore other ways to convey concepts

  - Transparency Concept: concept image was not the best one
- Ballroom:
  - Concept image was weak (figured it was difficult to find one for this design)
  - Control shade needed for daylight
  - Always tell less and tell why
  - Private Mood: knows why sconces were used but explain it like, "...bring intimacy scale to the room, sparkle, visual interest, etc"

Sandra Stashik (*Grenald Waldron Associates*)

- Overall:
  - Good pace, good presentation
  - Started with the architect's idea and said how want to incorporate it into the lighting design really showed understanding
- Exterior Façade:
  - Are you accentuating horizontal or vertical? Said you would accentuate horizontal but ignored it – choose one
  - Entrance is most important beacon – make stronger statement for orientation of guests. Maybe use downlights or maybe something else
- Lobby:
  - Very helpful use of orienting us to the lobby entrances and access points – really showed the consideration of the entire space as a whole
  - Highlighting the important features of the lobby in red didn't bother me
  - Reception desk: didn't light the faces of staff and guests – reinforce design concepts with images; want to make people look friendly and not just light the desk itself
- Lounge:
  - Transparency Concept: concept was there and pulled in images but the overall concept image was not effective
  - Square, glowing downlights in transparency concept added to the transparency but were glossed over
- Ballroom:
  - Noted lots of functions can occur here, so the initial importance of the use of controls was good
  - Adding color to the more "fun" and festive events was nice
  - Introducing daylight is great, but say that you need to control it and reinforce other designs (daylight shades, projection use, etc)

Shawn Good (*Brinjac Engineering*)

- Overall:
  - Started with architect's concept, owner bought it, and followed it and it made the presentation very strong
  - Overall, great presentation
- Exterior Façade:
  - Saw vertical emphasis but verbally said horizontal
  - Talk about the plaza out front as it is key to the view to the lobby
- Lobby:
  - Loved the breakdown of the space, but focused on the reception desk too much and didn't return to the initial breakdown at all
  - Red or not red "zones" was fine
- Lounge:
  - Images for concepts were great (even Transparency one)
  - Canopy of Light Concept: not fully achieved
  - Reflection Concept: look at materials (multiple smaller surfaces) and reflections from specular materials; top and bottom coves worked well
  - Transparency Concept: bar was a good image but not totally related back to space; there are other ways to explore this concept and this concept could be related to in other spaces

- Ballroom:
  - Overall, good job
  - Images were good and explanation was good – ties into presentation

Solution Method:

After receiving feedback from the lighting designers at the Lutron event, their input and suggestions will help in the advancement of final design solutions in each of the four spaces of the Hotel and Conference Center. Computer programs will be used to create three dimensional models, calculate lighting metrics, and create photorealistic renderings. Solutions of the spaces will include documentation materials, such as manufacturer's cutsheets, luminaire schedules, lighting plans, any needed details, and lighting renderings.

Tasks and Tools:

1. Finalize designs of the four spaces in the building, using comments from the lighting professionals.
2. Select equipment (luminaires, lamps, ballasts, etc).
3. Layout lighting designs in AutoCAD and place in AGI32 for lighting calculations. Analyze these and alter designs when necessary.
4. Record light loss factors and calculation summaries of each space. Make sure desired outputs are met from both IESNA recommendations and ASHRAE 90.1 lighting power density requirements.
5. Create luminaire schedules for each space.
6. Generate photorealistic images of each space using Autodesk 3D Studio Max, applying correct materials and material properties.

Depth Proposal | Electrical

Because four spaces are being redesigned for lighting, the branch circuit distribution of each of the spaces will also be redesigned. These four spaces include the exterior façade, main hotel lobby, lounge, and ballroom. A short circuit analysis and protective device coordination study will be conducted for the electrical portion of the project as well. Protective devices for the redesigned system along the path must be shown on a single-path through the distribution system. Short circuit calculations from the service entrance up to one distribution panel will be done, including the trip curves for the devices. Two other electrical depth topics will also be investigated, including changing the copper feeders to aluminum and the addition of a photo voltaic array. Both of these are addressed below.

Depth Topic 1 | Copper feeders vs Aluminum Feeders

The feeders in the Hotel and Conference Center are all copper. An analysis determining the feasibility for changing them to aluminum will be studied for economic impacts, as aluminum feeders tend to be a cheaper alternative. Equivalent sizes of aluminum wires will need to be calculated and the prices of both copper and aluminum feeders will need to be researched for comparison. A final decision will be made based on the research set forth above about which feeder is more practical for the building.

Depth Topic 2 | Photo Voltaic Array

Since the Hotel and Conference Center is located in a more rural area, the addition of a photo voltaic array will be investigated, designed, and laid out on the roof of the building to see if it is advantageous or not for energy savings. A designated location on the roof will need to be determined, as will the actual sizing and number of panels on the roof. Cost estimates of all materials will be researched in order to determine the benefits of implementing the array, both first costs of the system versus the energy savings as the system depreciates over time. An overall decision of whether or not to include the addition of the equipment will be made.

Breadth Topic 1 | Architectural

With the proposed addition of clerestories in the ballroom for added daylighting, this will drastically change the overall architectural image of the space. Views to the beautiful wooded landscape of Virginia will be created with the addition of the clerestories. This actually goes hand-in-hand with the image that the architect wanted to create for the hotel: blurring the line between exterior and interior. Clerestories will also add visual relief to guests if attending an all-day conference event where exposure to daylight typically never occurs.

Breadth Topic 1 | Structural

In order to add the clerestories in the ballroom, the ceiling height must be increased. This also changes the height of the roof area, so redesigning the framing will need to be done. Checking columns for the extra height will also need to be accounted for in the analysis.

AE 482 Spring Semester Schedule		
Week	**Focus**	**Specific Activity**
Winter Break	Lighting	Revise schematic designs for all spaces
		Delete unnecessary information in Revit model
		Save separate Revit models of each space
01/10/2011	Lighting/Architectural	Alter designs of spaces in 3D CAD
		Import models into AGI32 and 3DS Max and apply materials
		Begin structural analysis of Ballroom
01/17/2011	Lighting	Begin selecting luminaires
		Import IES files into AGI32 and begin lighting calculations in other spaces
		Continue structural analysis of Ballroom
01/24/2011	Lighting/Electrical/Structural	Continue lighting calculations
		Begin electrical depth study #1
		Finalize structural analysis of Ballroom
01/31/2011	Lighting/Electrical	Import model of Ballroom in lighting software
		Begin PV Array analysis
02/07/2011	Electrical	Continue PV Array analysis
		Lighting branch circuit redesign/coordination studies
02/14/2011	Lighting/Electrical	Lighting renderings
		Finish branch circuit redesign/coordination studies
02/21/2011	Electrical	Finalize PV Array analysis
02/28/2011	Electrical	Finalize electrical depth #2
03/07/2011		Spring Break – Punta Cana!
03/14/2011	Lighting	Finalize lighting renderings
03/21/2011	General	Start preparing final presentation
		Start organizing and preparing final report
03/28/2011	General	Finalize report
04/07/2011	General	Final Reports Due
04/11/2011-04/15/2011	General	Final Presentation Week