Depth Work – Part 1: Lighting Design

Grand Oaks, part of Sibley Memorial Hospital, is an affluent assisted living residence located at the corner of MacArthur Boulevard and Loughboro Road, in Washington D.C. This upper scale living community strives to combine comfortable surroundings, personalized assistance, 24-hour support, and a full range of services and activities. The building features sitting rooms with fireplaces; terraces, and other comforts to that make for a warm and home like environment. It will be in the intent of the lighting redesign to maintain the home like atmosphere that Grand Oaks is striving to uphold.

The current lighting design of the space is adequate, but there is room for improvement. The current lighting systems do not use large amounts of controls, i.e. occupancy and photo sensors, or a central global control system such as DALI or graphic eye. The current system also uses large amounts of open downlights, which can be a harsh glare source to older individuals. When redesigning the selected spaces, special attention will be paid to the visibility issues that older people deal with. These issues are outlined thoroughly in TECH #1 report. The new system will address glare, contrast ratios, and other critical design criteria set forth by the IESNA.

The first space to redesign will be the entry way and lobby. This space has some special needs because it is the transition point from the outside to the inside, and visa versa. As the eye ages, it requires a longer amount of time to adapt to changes in light levels. Therefore, the lobby needs to have high illuminance levels during the day, and lower ones at night. The next space to redesign will be the living room/library. This space serves as a formal living space where residents can read or relax by the fireplace. The next space for redesign will be the dining room addition. The current dining room is very formal and elegant, with rich wood furnishings, cove lighting and different ceiling heights. The dining room addition will have somewhat of a different feel giving the fact that there is a large area of skylights in the middle of the space. This will offer large amounts of natural daylight. The system that is designed for this space will need to incorporate different lighting and control system for day/night operation. With the use of

photosensors, a daylight dimming system can be implemented to save energy when sunlight contribution provides the proper illuminance levels. The final space to consider will be the building entry and the exterior space between the new addition and the existing building.

After presenting a schematic design proposal at Lutron to a panel of lighting designers, the feedback and comments received can be implemented in the redesign. To view a list of comments and suggestions, please visit:

http://www.arche.psu.edu/thesis/eportfolio/current/portfolios/mwm171/tech-assign.htm, , Click on the Lutron Comments Tab.

These comments and some new ideas will be used to further develop the lighting program and enhance the lighting of the various spaces. The schematic design proposal also has listed design criteria and overall aesthetic qualities that I wish to have to have within each of the spaces.

With the use of AutoCadd and AGI 32, 3-dimensional models of the selected spaces will be built. With AGI 32, illuminance levels as well as luminance ratios can be evaluated to determine not only the most efficient lighting solution, but also one that will address the visibility issues of older individuals. In addition to checking illuminance levels, AGI 32 will also be used to created realistic renderings of the proposed design solution, and give an idea of how the lighting design could look. Design criteria set forth by the IESNA handbook will be a guideline for the redesign.

Depth Work – Part 2: Electrical Design

The addition to Grand Oaks will be considered in the electrical redesign. Currently, the addition receives electrical power via four underground feeders that are extended from the main electrical switch gear located in the existing building. Emergency power is also extended via an underground feeder for egress lighting. An analysis will be done to study the cost savings of adding a section to the existing main service switchgear, and then extending a single, normal power feeder over to a main distribution panel in the addition. When doing this study, the NEC will be used and followed for calculation methods and parameters as well as to address any code issues. I will need to size the new feeder, look at the starting method for the roof top chiller (as this unit will draw many amps upon start up), and look at voltage drop issues with extending a single feeder.

I would also like to add size to the on site emergency power generation. Currently, the main building is serviced with a 150-KW diesel generator. The addition will also receive emergency power from this generator. I would like to look at the cost of upgrading to a larger generator to provide emergency power for the elevators. Given the fact that the individuals living in the residence are somewhat reliant on wheel chairs or walkers, I feel that it would be beneficial to have an emergency system that could maintain elevator operation in the case of an emergency. If I am still feeling ambitious at the end of this study, I would like to see the cost benefits of running the generator during peak hours to shave the cost of the demand charges during high demand times of the day. The generator would be used to operate the roof top chiller during peak time hours. In addition to generator size, the utility rate structure will be studied to evaluate the potential cost savings of such a thing.

Breadth Work – Part 1: Mechanical Design

For the Mechanical breadth work, I would like to look at the energy savings of using a different air distribution method for the residents' rooms. Currently, the residential rooms have fan coil units as the air distribution system. Chilled water is provided via an air-cooled roof-mounted chiller. The chiller is a hermetic helical rotary machine, featuring multiple air-cooled condenser fans, modulating compressor unloading, and independent refrigerant circuits. Hot watered is supplied via two instantaneous steam-fired domestic hot water heaters that receive steam from Sibley's Boiler Plant. I would like to see if there is an energy savings if heat pumps are used instead of fan coil units. I would also like to see if geothermal heat pumps can be used in that area and to a project of that scale. I feel that this type of system could provide a more efficient design solution and could provide and electrical savings. If the roof top chiller can either be eliminated or reduced in size, it will reduce size of the electrical feeder that is extended from the main switchgear in the existing building.

Breadth Work – Part 1: Construction Management Cost Analysis

After all the redesigns take place, I would like to look at the cost of the new systems as well as the potential energy savings of the new systems. For the lighting redesign, I will compare the cost of fixtures, installation methods, and control systems to that of what is currently installed. For the electrical redesign, I will do a cost analysis of adding a section to the main switch gear and extending a single normal power feeder, as opposed to the current design of four normal power feeders. As was mentioned in the Mechanical Breadth work section, I would like to look at the initial cost of installing a ground source heat pump system to that of the fan coil units. I suspect that the ground source will have a higher initial cost, but is likely to provide a considerable energy savings. By looking at the payback period of installing such a system, I can make a decision as to whether or not this would be a good system to implement in the building addition.

Schedule of Events

WEEK	EVENT
Jan. 11- Jan.18	Finalize fixture selections, layouts, and spacing of luminaires. Collect Cutsheets, ballast, and lamp information
Jan. 19 - Feb. 3	Work on AGI 32 models for each space, changing mesh sizes and calculation parameters to produce photorealistic renderings
Feb. 4 - Feb.12	Flex time to finish AGI 32 renderings. Daylight study for dining room spaces to look at luminance ratios and patterns of light throughout the day depending on different sky conditions, times of day, and different glass materials
Feb. 13 - Feb. 19	Electrical Redesign - Size Switchgear section, feeder, over current protection devices, and chiller starting method
Feb. 20 - Feb.26	Size Generator and determine elevators loads if they were operate on emergency power
Feb. 27 - Mar. 3	Mechanical Breadth - Find Ground Source Heat Pump Manufacturer and size units accordingly
Mar. 6 - Mar. 10	Spring Break - hopefully somewhere warm
Mar.13 - Mar. 16	Flex time - wrap up Mechanical Breadth and other loose ends
Mar. 17 - Mar. 31	Perform cost analysis, payback periods, and analyze the energy savings that can be recognized based on the implementation of the different system redesigns.
April 3 - April 7	Write the final report and work on power point for final presentation
April 10 - 11	Thesis Presentations