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December 18, 2007

The Anne & Michael Armstrong Medical Education Building Thesis Proposal

Contents

Executive Summary

This thesis proposal will examine various systems associated with the Anne and Michael Armstrong Medical Education Building. Specifically, the lighting and electrical systems will be analyzed to determine the level of coordination of the systems into the building. In particular, four spaces will be considered which are the exterior space and façade, the first floor auditorium, the full height central atrium and the fourth floor anatomy laboratory.

The first in depth analysis will be the lighting systems in the building. Each of the four main spaces will be redesigned to provide an aesthetically stimulating atmosphere while also meeting the IESNA and ASHRAE 90.1 standards. Daylighting and sustainable practices will also be implemented in order to efficiently harness the considerable amount of daylight permeating into the building as well as minimize the harmful effects of building on the environment.

The electrical systems in the Armstrong building will also be evaluated in depth. It will include a protection device coordination analysis, a feeder redesign from copper to aluminum, a branch circuit redistribution of the four main spaces in the building and a redesign using photovoltaic arrays.

The breadth topics covered will be a sustainability study, an architecture study and an acoustics study. The sustainability and architectural studies will examine the implementation of different techniques to further control the fluctuating levels of natural light that enter the building throughout the day. The sustainability breadth will focus on the methods to achieve better control of daylight and the effects it has on energy savings, material savings and costs. The architectural breadth will study the impacts of these new sustainable practices on the building. The acoustical breadth will examine the acoustical reverberation times in the four main spaces in the building being analyzed and how the architecture effects the acoustics.

Background

The John Hopkins University School of Medicine designed the future Anne and Michael Armstrong Medical Education Building as one of the first of its kind in the medical education field. This building encompasses almost every necessity for students during their first two years of medical school, eliminating the need for the students to have to travel elsewhere for class, relaxing, meetings, showers, computer access and even eating.

This four storey, 110,000 square foot edifice implements cutting edge technology and ideas to meet the needs of the JHU students and faculty. The auditorium, meeting rooms and laboratories consist of high end teaching tools and conference technologies. The ground floor of the atrium, the college lounges and the reading rooms provide students places to study and unwind but also to mingle with upperclassmen to exchange ideas and also for advice on the rest of their medical school careers.

The Armstrong building, after completion in 2009, will make a strong architectural statement to its surroundings. A prominent glass curtain wall along the southern façade exudes a sense of knowledge and expertise gained within to the outside world. Its prominence entices the viewer towards the building to get a better look at the interior of the edifice. Coupled with a vast vertical element in the central atrium in the building, the Armstrong building makes a powerful statement on the JHU campus of its high tech and cutting edge design.

Lighting Depth Proposal

Problem

The juxtaposition of the ideal aesthetics and atmosphere provided by the lighting for students to learn and apply their knowledge while efficiently designing a solution to be sustainable and meet IESNA and ASHRAE 90.1 standards is essential for this building and the building industry today. As this is a high end medical education building with cutting edge technology and design implemented throughout the building, so should the lighting design be high end by providing the best atmosphere for ideas to develop. The importance of sustainable practice is important to stay on the cutting edge of the building industry but more importantly it is vital to the preservation of the natural elements for future generations.

Solution

The importance of providing a comfortable and stimulating atmosphere for the students and faculty to move into is essential when designing the lighting for the Armstrong building. The four main spaces are the main focus to providing a solution to the lighting design.

The exterior space and exterior façade should provide a safe and inviting atmosphere for the students and faculty as they arrive and leave the building. As this is the first aspect of the building they will see, the first impression must provide a comfortable and intriguing atmosphere for the person to continue towards the building.

The auditorium is the largest and most versatile space in the building as it provides a variety of functions for the building occupants. In order to properly adapt to this variety of uses, the lighting design will need a more sophisticated control setup. The space will be used with projection equipment for presentations, interactive white boards and electronic presentations for lectures as well as classroom note taking functions. In order to provide this variety of functions it will need to turn on and off light in different places to provide the necessary levels for the occupants to perform properly in the space.

The atrium is the heart of the building as it is located in the center and is the largest and the most prominent space in the building. The main staircase is located within the atrium and every circulation space emanates from the atrium making it unavoidable to avoid by any occupant in the building. The atrium also allows a substantial amount of natural light to permeate into the heart of the building from the skylight that encloses the space within the building. This is an important architectural element of the space but a potential detriment to the occupants during midday. It will be important to analyze the light levels associated with this skylight and its effects on the surrounding spaces through digital modeling.

The last space is the anatomy laboratory. The need for high light levels for the eye to accurately perform visual intensive tasks is vital to a successful space. The addition of light from the eight large windows will also contribute to the space but must be considered when providing uniformity on task planes throughout the space. The adjacent residence hall must be taken into consideration with the effects of the daylight in the space, as the residence hall is greater than twice the height of the Armstrong building.

Solution Method

The design of the lighting will be assessed through accurate AutoCAD 2008 models imported into AGI32. Daylighting studies will be utilized in AGI32 in order to accurately measure the effects of natural light on the three spaces (the auditorium does not have daylighting issues). Calculation grids will be used to accurately measure these lighting levels along with the electric lighting in the spaces. Materials will also be added to the models in order to determine the asthetics of the space and to give a general idea of the look of the space.

Tasks and Tools

The first task will be to implement any necessary and desired changes from the schematic design presentation to Dr. Mistrick and the lighting professionals at Lutron.

The next task will consist of fixture selection. Lamps, wattages, ballasts and controls will be necessary to accurately provide the appropriate light levels for the four spaces. A preliminary analysis of the other building systems will be needed in order to ensure proper integration of the fixtures into the spaces.

The last task will be the integration of computer software (AGI32, AutoCAD) to calculate and assess the design and make any necessary changes to provide the best design.

Electrical Depth Proposal

Proposal

The redesign of the lighting systems in the building will require an assessment and redesign of the electrical systems in the four spaces in the building. Along with this will be a study of the sustainability of the electrical systems in place.

Solution

To look at and study the sustainability of the electrical system, an analysis will be done of the sizing of the existing copper feeders and comparing them to an aluminum feeder design. To address the large amount of daylight entering the building, the electrical study will also cover a photovoltaic system to analyze the effectiveness of the system in the geographical location.

Solution Method

In order to accomplish this electrical study, the calculations done will be compared to the 2005 National Electric Code. Certain components of the electrical system will be relocated to adjust to the new design.

Tasks and Tools

The first task will be to calculate the new lighting levels for the four main spaces of the building.

These values will then be incorporated into the existing electrical design and the next task will be to resize the necessary electrical equipment (panelboards, protective devices, wiring, etc.) to support these loads according to NEC 2005.

The last task will be to assess the sustainability of the different conductors and the photovoltaic system. The costs will be estimated for the different conductors and the photovoltaic system. The photovoltaic system will also have a further cost analysis to assess the payback period and the location and structural stability of the location on the building.

LEED/Sustainable Breadth

The Armstrong building is not currently a LEED design and is not attempting to reach LEED certification. A large factor in the decision not to attempt LEED certification was the large glass curtain wall on the southern façade of the building. During heavy midday daylight levels, electrochromic glass will tint to restrict light and ultraviolet light from entering the building. This will help to control the lighting levels as well as the heat buildup in the spaces.The implementation of proper material selection to control the daylight and mechanical loads associated with this prominent architectural feature along with materials and systems integrated throughout the rest of the building can achieve points to reach certification. With controllable lighting, air quality, mechanical loads, materials renewable energy sources and other components, the building will be able to apply sustainable practices to reach LEED certification.

Architecture Breadth

The redesign of the glass materials to use an adjustable electrochromic glass window will alter the exterior view of the skin of the building in particular the southern façade. During heavy midday daylight levels, the electrochromic glass will get darker and the rest of the time the windows will be transparent. The acoustics of the building will also affect the architecture of the spaces. This component along with the other sustainable materials on the exterior and interior to improve the sustainability and the lighting of the building will combine to help reshape the interior and exterior of the building and increase the functionality of the building as a whole.

Acoustical Breadth

The atrium and the auditorium are the two largest spaces in the building and therefore will hold the largest amount of people causing the largest amount of noise in the building. It will be very important to the practical use of these two spaces to maximize the sound absorption in the spaces to optimize the use of the spaces. This acoustical component will be a major factor in the design and aesthetics of the space.

Time Schedule

Time Schedule															
	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15
Task	1/14-1/20	1/21-1/27	1/28-2/3	2/4-2/10	2/11-2/17	2/18-2/24	2/25-3/2	3/3-3/9	3/10-3/16	3/17-3/23	3/24-3/30	3/31-4/6	4/7-4/13	4/14-4/20	4/21-4/27
Construct 3D models in AutoCAD									SPRING						
Finish 3D models in AutoCAD									BREAK						
Fixture Selection - ies files, cut sheets, ballast information									!						
Import 3D models into AGI32 - material designation and calculations															
Finalize Fixture Layout - Recalculate Lighting Loads															
Resize feeders, panelboards, protection devices. Collect manufacturers information															
Finalize Fixture Schedule and Complete Power and Lighting Plans															
Perform Over Current and Short Current Analysis															
Design PV Array System															
Begin LEED Breadth															
Begin Acoustical Breadth															
Assess implementation and cost benefits of LEED and Acoustical Breadth															
Finish LEED and Acoustical Breadth and start Architectural Breadth															
Begin Report															
Finalize report and prepare Presentation															
Finalize Presentation															