Proposal for Spring 2011

Susquehanna Center Renovations & Expansion

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Executive Summary

The following proposal will include the work to be completed in the spring 2011 semester for AE 482 – Architectural Engineering Senior Thesis. The requirements of spring semester are to complete two depth topics, within your option and then two breadth topics, which are outside your option. Within the Lighting/ Electrical option, the first topic to be completed is the re-design of the lighting systems and controls in four different spaces within the Susquehanna Center. This redesign will focus on the exterior façade, main lobby, auxiliary gymnasium, and the Fitness and Weight Room. The next depth topic is to complete an electrical system analysis. This analysis will include a protective coordination study, comprehensive short circuit analysis, and electrical analysis of the four redesigned spaces. The two breadth topics will be focused in structural systems and mechanical systems. The structural breadth will study the effects in roof bracing in the auxiliary gymnasium with the addition of skylights. The mechanical breadth will investigate the addition of solar heat gain radiation to the cooling effects in the auxiliary gymnasium due to the skylights.

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Building Overview

This project is essentially a renovation and expansion to the Susquehanna Center. The building will be upgrading its' existing auxiliary gymnasium and adding a swimming complex, weight facility, and 5,000 seat main arena. With the new renovations and additions the overall building square feet is 110,000, and will sit at the heart of Harford Community College's campus and athletic department located in Bel Air, Maryland. The estimated cost of the building is $28 million and construction on this building will not take place until April 2011 and will not be completed until August 2012. The building consists of three levels, the basement, main level, and lastly the arena level. The basement only contains space for the swimming complex and the arena level serves to act as a main concourse to seating of the main arena. The main level is particularly of interest because the four spaces chosen for lighting re-design are located on this floor and highlighted below.

Lighting Depth

The first depth topic of lighting is to re-design the lighting systems of four different spaces: exterior façade, circulation space, large work space, and special purpose space. The four spaces I have proposed to re-design according to the space types listed are the main entry and façade, the lobby, the auxiliary gymnasium, and finally the fitness and weight room. The schematic lighting design was completed for Technical Report III in the fall of 2010 and these design concepts were then presented to a panel of lighting design professionals on December 8, 2010. Their comments and feedback is included within this proposal. The lighting design in the spring 2011 semester will be complete through various types of computer software such as AGi32, AutoCAD, and 3D StudioMax.

Exterior Façade

The existing lighting design doesn't make an attempt to compliment the entrance; instead it only places emphasis the sidewalk as you enter the building. The lighting re-design will place more emphasis on the architecture on the building and highlight points of interest. This will allow the building to stand on its own a display a sense of visual curiosity, since it will be the heart and center of the campus and athletic department.

Lobby

The circulation space that divides the building in two is the lobby. The lobby directs you either to the seating of the main arena or to corridors that lead to other spaces such as the auxiliary gym and weight room. The lighting in this space will need to exude two psychological reinforcements, which are festive and public. This space will need to excite the fans upon entering and during game time, but upon exiting the main arena the lobby needs to serve as a directory space and the lighting should complement this feature and aspect of the space.

Auxiliary Gymnasium

For the large work space, the auxiliary gym lighting design will implement a daylighting system that will for a reduction in energy consumption. The existing electric light in the space is provided by 250 watt metal halide lamps. In order for the electric light to respond appropriately to the daylight condition, the re-design will utilize fluorescent high-bay fixtures with the capability of being dimmed. This will ensure a consistent uniformity at the work plane. It will be important to analyze the implications of direct and reflected glare in this space due to daylight penetrating into the space.

Weight and Fitness Room

The special purpose space, fitness and weight room is a unique space in that the ceiling height changes three times. As the ceiling height changes, so does the material. This space is also driven by uniformity, but a creative advantage can be implemented with the unique ceiling structure. The lighting should accent this feature as well as provide adequate uniform illuminance.

Lutron Presentation

Below is a bulleted list of the comments made by three lighting professionals on the schematic design concepts presented in Technical Report III. The three lighting consultants were Sandra Stashik from Grenald Waldron, Shawn Good from Brinjac, and lastly Charles Stone from Fisher Marantz Stone.

Sandra Stashik

- Need to breath, talking too fast
- Overlaid too many design schemes in colored concept
- Excitement in lobby maybe disorienting when exiting, safety issue
- Are TV requirements necessary in aux gym?
- Do more with the fitenss space incorporate ceiling and architecture

Shawn Good

- Good layout of slides, great introduction of building
- Take a moment when progressing slides to give audience chance to comprehend
- Good concepts on façade
- Will the light within the main gym highlight ceiling pursue this
- Ways to control daylight rather than electronic shades i.e. frit
- Create excitement in the weight room make people want to go in the space

Charles Stone

- Powerpoint is up there with you slow down let your slide define you
- Ratio of white background to dark pictures
- Take a breath when introducing chapters
- Perforated metal look at openness percentage in lobby
- Illuminance metrics be conscious of this in schematic design
- Slide speak for themselves
- Tell me why your using that fixture instead of stating your using it

Electrical Depth

The Susquehanna Center's electrical system is a radial system with on point designated for a service entrance in the northwest corner of the building. The service provider is Baltimore Gas and Electric (BGE), and the building receives the power through a pad mounted transformer. Since the building has been constructed and filled for a service permit, the pad mounted transformer has not been sized. The building contains two types of voltage systems and those are 480Y/277V, 3PH and 208Y/120V, 3PH and a 3200A main switchboard provides power to all equipment loads.

The depth of the electrical portion of senior thesis is to re-design the branch circuiting for the four spaces being re-designed, a hand calculated short circuit analysis and protective device coordination, and two depth topics. The two depth topics that are most relevant to my building are the system analysis using SKM software and provide a motor control center for major mechanical equipment.

Branch Circuit

The four spaces that will be re-designed for branch circuiting will be the same four spaces that I chose to re-design the existing lighting systems. Those spaces are the exterior building façade, lobby, auxiliary gymnasium, and weight and fitness room. A brief description of the existing and proposed lighting systems will be provided for each space.

- **Exterior Façade**

The exterior façade's existing lighting design only contains compact fluorescent down-lights in the canopy over top of the sidewalk along the building façade. The proposed lighting design will include LED fixtures to graze architectural shading device and the roof of the main arena. Other fixtures types include metal halide, which will be used to graze the brick of the building façade.

- **Lobby**

The lobby contains the same fixture types located in the canopy located on the exterior of the building, except that the lamp type is a 100 watt metal halide. The proposed lighting design will utilize dimmable LED fixtures in the ceiling and linear fluorescent fixture types to wash display cases, and honorary plaques.

- **Auxiliary Gymnasium**

The existing design of the auxiliary gymnasium uses 250 watt metal halide high bay fixtures. The proposed lighting design will introduce daylighting systems in the space via skylights and will be integrated with linear fluorescent high bay fixtures capable of being

dimmed. A photo-sensor will coordinate the integration between the electric light and daylight conditions.

- **Weight and Fitness Room**

  This space is a unique space in that the ceiling height changes three times from 8'-0" to 9'-0" to finally 15'-0". In each step a different fixture type is used in the existing design. Standard compact fluorescent down-lights are used in the low ceiling then fluorescent troffers, and finally linear fluorescent direct/indirect pendants. The re-design will encompass the same fixture types but in a different manner. Linear fluorescent fixtures will be used for cove lighting in the 9'-0" ceiling instead.

Protective Device Coordination Study and Short Circuit Analysis

For a single path within my electrical distribution system, a protective device coordination study will be conducted. The path will extend from the utility transformer to the main switchboard to panel MLP. The coordination of protective devices for the re-designed system components along this path will be provided and short circuit calculations by hand will also be included.

System Analysis Using SKM Software

An evaluation of the entire electrical distribution system will be conducted using the SKM software. It is important that the building electrical system ensure the economic feasibility and safety of the system. SKM will perform a short circuit analysis, protective device coordination, and arc fault study for the entire distribution system. This evaluation will demonstrate the system's ability to perform as per specifications and sufficiently supply the loads.

Motor Control Center

On the northwest corner of the building, where the service entrance enters the building there are two rooms that serve to provide space for major mechanical equipment. Also, in this corner of the building is the main electric room, where the service entrance enters the building and supplies panel MLP. This panel serves all the major mechanical loads, but the starters of each piece of mechanical equipment are located at the device. Since, the room are adjacent then I am proposing to provide a motor control center that will centralize all disconnects and starters for the major mechanical equipment in this area.

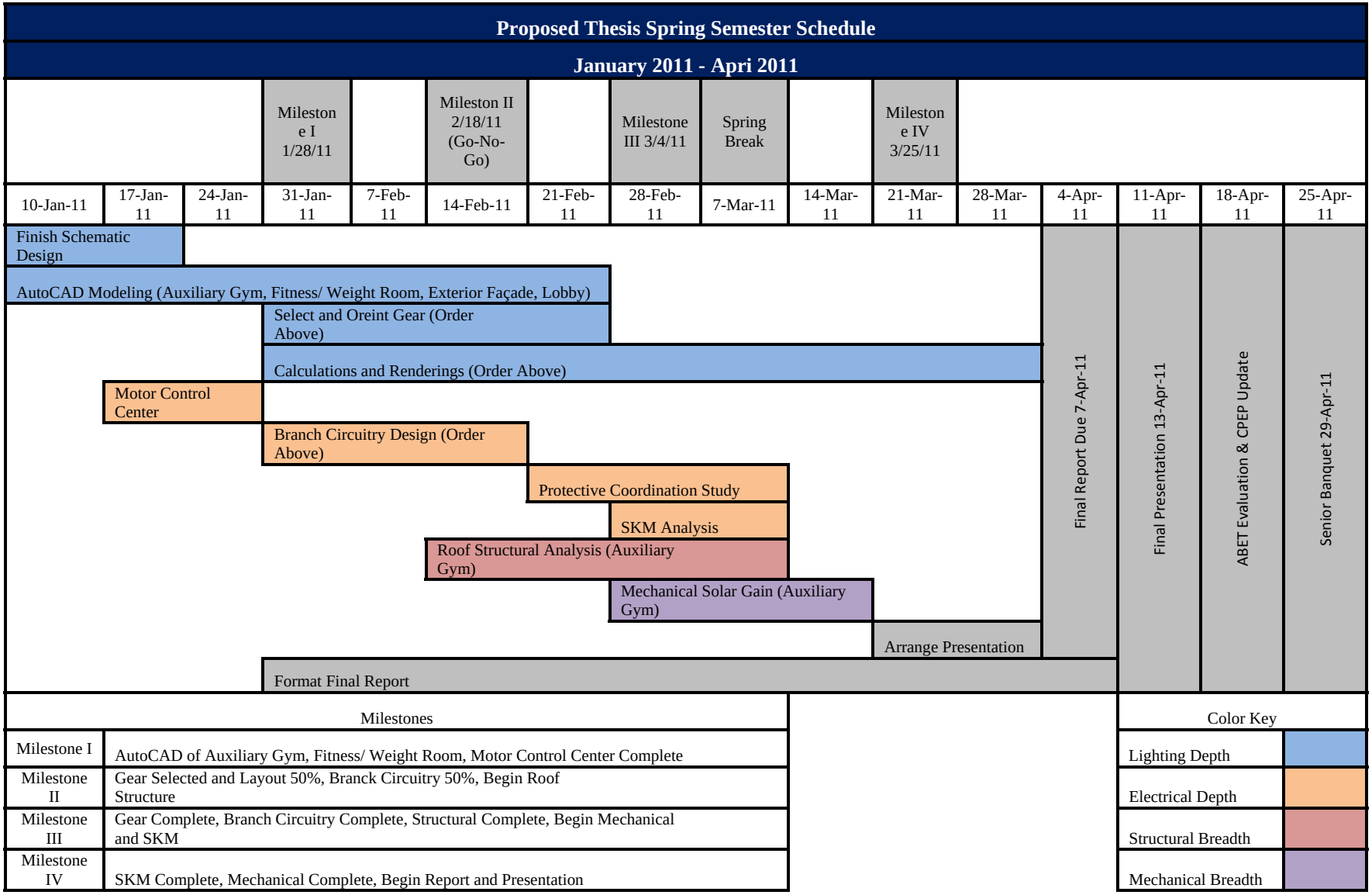
Breadth 1 – Structural

With the introduction of the daylighting system in the Auxiliary Gymnasium, the roofing structure will need to be re-designed to be able to incorporate skylights. The space as of now contains a truss system that is 4'-0" on center. The spacing of the truss system will remain at 4'-0" on center, but the portions of the truss that intersect the skylights will be removed and further analyzed. A joist will be sized to up hold the integrity of the structural system where the skylights intersect with the truss structural system.

Breadth 2 – Mechanical

This breadth will also look at the effects caused by utilizing daylight in the auxiliary gymnasium. The introduction of daylighting will increase the solar heat gain on the space, which will ultimately alter the cooling for the space. The increase in cooling load will place more demand load on the cooling coils of the air handling unit. This added load will then need to be compared to the capacity of the existing air handling unit. If the air handler cannot supply the new cooling demand load then resizing of the air handler will be a solution.

Schedule


Proposed Thesis Spring Semester Schedule
January 2011 - Apri 2011
Mileston e I 1/28/11
Mileston II 2/18/11 (Go-No-Go)
Milestone III 3/4/11
Spring Break
Mileston e IV 3/25/11
10-Jan-11
17-Jan-11
24-Jan-11
31-Jan-11
7-Feb-11
14-Feb-11
21-Feb-11
28-Feb-11
7-Mar-11
14-Mar-11
21-Mar-11
28-Mar-11
4-Apr-11
11-Apr-11
18-Apr-11
25-Apr-11
Finish Schematic Design
AutoCAD Modeling (Auxiliary Gym, Fitness/ Weight Room, Exterior Façade, Lobby)
Select and Oreint Gear (Order Above)
Calculations and Renderings (Order Above)
Motor Control Center
Branch Circuitry Design (Order Above)
Protective Coordination Study
SKM Analysis
Roof Structural Analysis (Auxiliary Gym)
Mechanical Solar Gain (Auxiliary Gym)
Arrange Presentation
Format Final Report
Final Report Due 7-Apr-11
Final Presentation 13-Apr-11
ABET Evaluation & CPEP Update
Senior Banquet 29-Apr-11
Milestones
Milestone I
AutoCAD of Auxiliary Gym, Fitness/ Weight Room, Motor Control Center Complete
Milestone II
Gear Selected and Layout 50%, Branck Circuitry 50%, Begin Roof Structure
Milestone III
Gear Complete, Branch Circuitry Complete, Structural Complete, Begin Mechanical and SKM
Milestone IV
SKM Complete, Mechanical Complete, Begin Report and Presentation
Color Key
Lighting Depth
Electrical Depth
Structural Breadth
Mechanical Breadth