Towson Arena Addition

Towson University, Towson Maryland

Joey Becker Thesis Proposal

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Executive Summary:

The proposed thesis shall include information about the Towson Arena Addition. I will present problems that exist with the project and also my proposed solutions. Finally I will discuss three different breadth options that I will cover for this project.

I have identified problems and solutions for several parts of the building. I will do a lighting redesign of certain spaces. The emergency power system will be scrutinized as well as the current LED lighting system.

I then will go into more depth on how I plan to investigate and solve the problems of the building. I have presented a timeline of the progress I plan to make on each topic. Finally I briefly discuss breadth topics that I have chosen.

Background:

General Building Data:

Building Name: Towson Center Arena Addition

Location & Site: Towson, Maryland

Building Occupant Name: Towson University

Occupancy: Basketball Arena

Size: 116,586 square feet

Number of stories: 3

Primary Project Team:

Owner: Towson University	http://www.towson.edu/
General Contractor: Gilbane Construction	http://www.gilbaneco.com/
Architect: Hord Coplan Macht	http://www.hcm2.com/
Associated Architects: Sasaki	http://www.sasaki.com/
Civil: Site Resources, Inc.	www.siteresourcesinc.com/
Structural: Faisant Associates, Inc.	http://mysite.verizon.net/faisant/
MEP: James Posey Associates, Inc.	http://www.jamesposey.com/
Landscape: Mahan Rykiel Associates	http://www.mahanrykiel.com/
Code Consultants: Koffel Associates	http://www.koffel.com/
Lighting: Bruce Dunlop Lighting Design LLC	http://www.dunloplighting.com/
IT Consultants: Unlimited Systems Support, Inc.	http://www.ussinet.com/
Foodservice Consultants: Culinary Advisors	http://www.culinaryadvisors.com/

Dates of Construction: May 2011 – March 1, 2013

Cost: 33.5 million (overall project)

Project Delivery Method: Design – Bid – Build

Architecture:

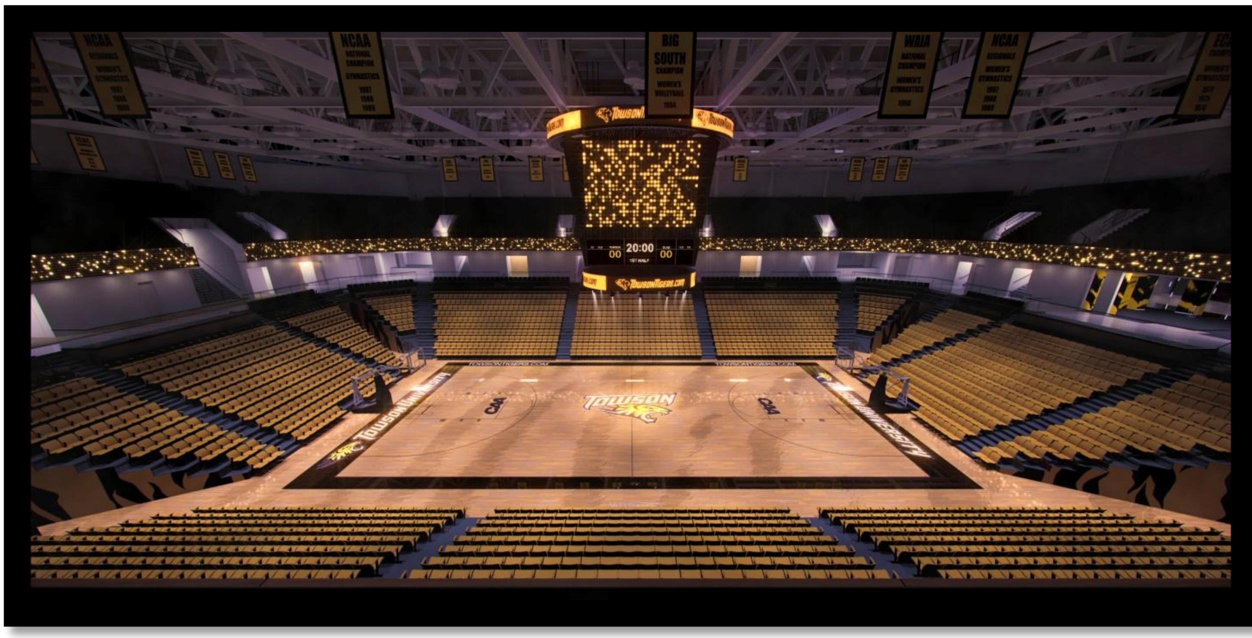
Towson University will build a new state of the art arena for basketball, gymnastics and volleyball. Tiger arena will seat over 5,000 people and also accommodates for luxury suites. A zinc, steel and glass façade gives a modern feel to the main entrance of the arena. Vertical windows help stretch the building as to make it seem taller and more profound. A large overhang covers a glass and steel façade and helps to anchor the building. Floating over the entrance the overhang gives a sense of strength to the building and exaggerates the grand scale.

Major National Model Codes:

NSPC 2006 – National Standard Plumbing Code/2007 Supplement

IBC 2009 – International Building Code with modifications

NFPA 101 – National Fire Protection Association



Zoning:

Floor 1 and 2 – A-4 Use, Floor 3/Mezzanine – A-3 Use and there are also B & S Uses. High rise provisions are not applicable because the highest floor is less than 75 feet above the lowest level of fire department access. The building will have a maximum building area of 60,448 square feet. The building will be sprinkled. Based on the A-3/A-4 Use Groups of 1B Construction the allowable area is unlimited, the allowable height is 160 feet and the allowable stories is eleven. To see more Baltimore County Zoning regulations please visit:

Baltimore County Citizen's Guide to Zoning

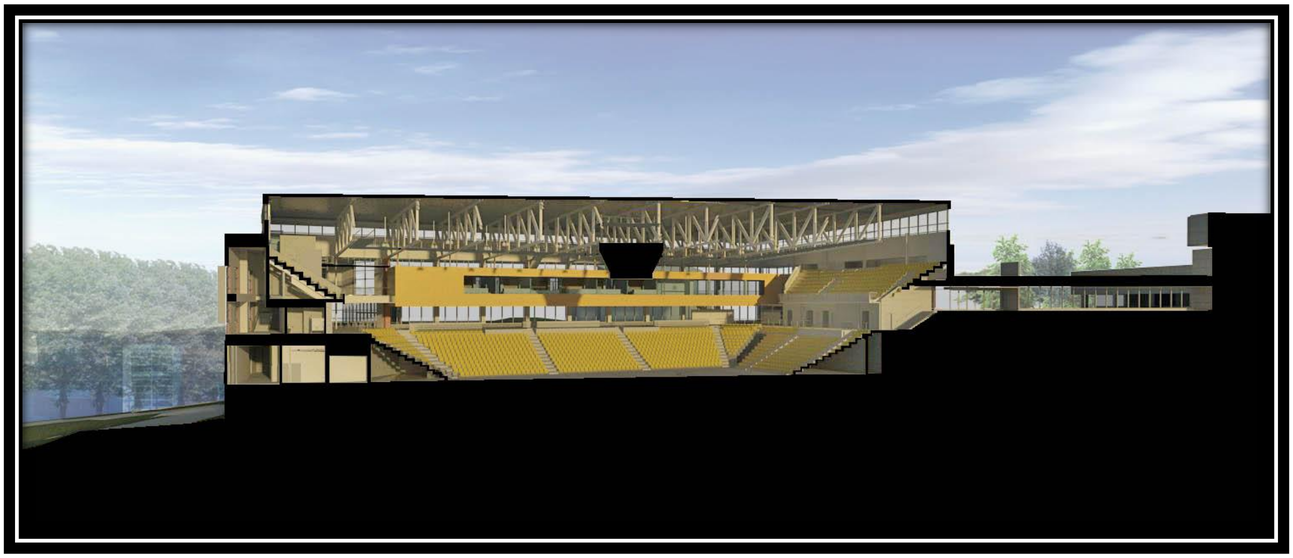
Building Enclosure:

Building façades:

Finish Carpentry backing material consists of medium-density fiberboard that complies with LEED for regional materials, VOC content, forest certification and contains no urea formaldehyde. ADA compliant all-glass entrance doors have 6 inch metal finishes and all-glass sidelights. Glazed exterior aluminum curtain walls are installed as stick assemblies. The designed basic wind speed is 90 mph for the curtain walls, and they will be tested according to ASTM E 330. Curtain Wall Type 1 and 2 are 7 ½" deep. These two wall types consist of conventionally glazed exterior aluminum curtain walls installed as stick assemblies. The U-factor will be no more than .43 Btu/sq. ft. x h x deg F per NFRC 100. Glazing will consist of 3/4 inch tempered glass that is in accordance with ASTM C1048. Sealants for glazing comply with LEED for VOC content. Low-E coatings will be used for insulating-glass units. Fire-protection-rated glazing is labeled for a temperature rise rating of 450 deg F, a hose-stream test and the fire resistance rating in minutes. The minimum glass thickness for exterior lites is not less than 6.0 mm.

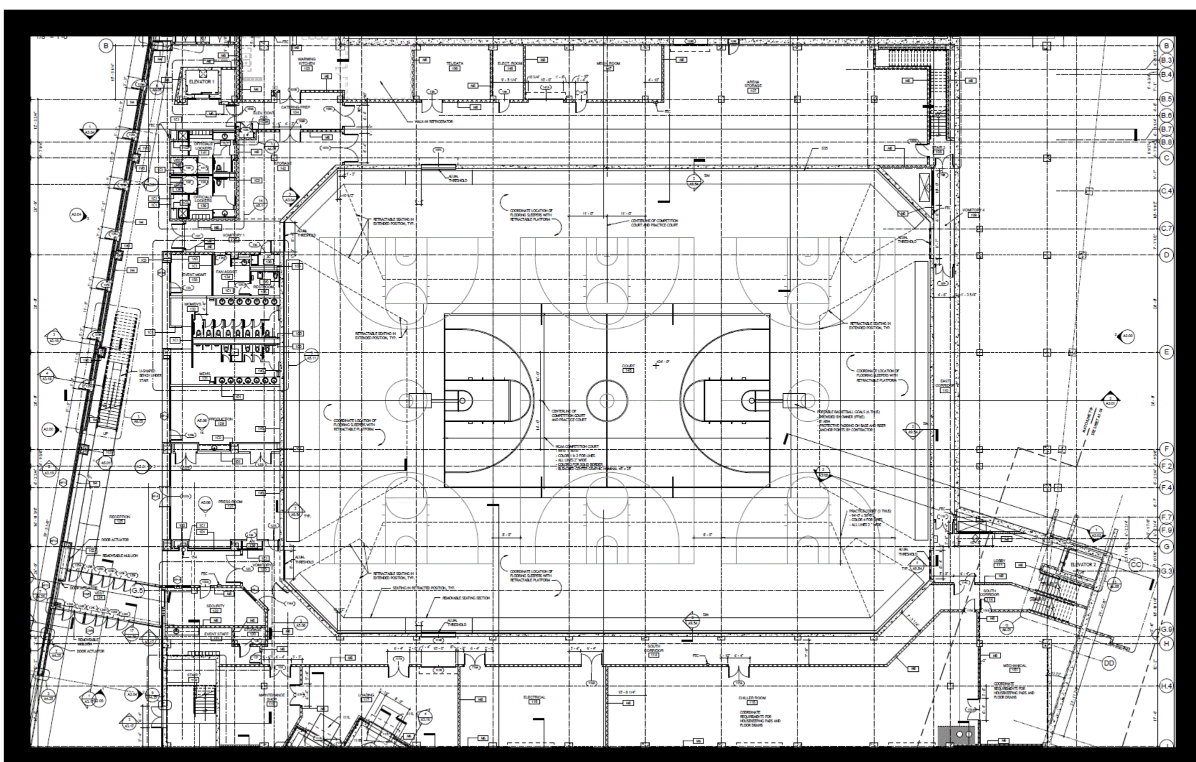
Roofing:

Coordination will be done with sheet metal flashing, trim layout, penetrations to be flashed and seams of adjacent materials. Materials comply with LEED for percentages by weight of recycled material. Copings and roof edge flashings are tested according to SPRI ES-1, and the design pressure will be indicated on the drawings. Aluminum sheet are ASTM B 209 alloy, and the finish is white or silver. Where field painting is indicated, there is a minimum dry film thickness of 0.2 mil. Roofing is a SBS-modified bituminous membrane. There is also be a vapor retarder and roof insulation. Roof insulation is 4" minimum thickness polyisocyanurate with a compressive strength of 25 psi. Roofing materials comply with LEED for solar reflectance and VOC content. The roof of the arena is flat as seen from the images. Styrene-butadiene-styrene-modified asphalt-sheet materials make up the roofing membrane sheet. There is also a smooth-surfaced roofing membrane cap sheet and a granule-surface roofing membrane cap sheet. Base flashing sheet materials include a granule-surfaced flashing sheet and glass-fiber fabric.



Sustainability Features:

Glass-fiber board is low-emitting according to ASTM D 5116 and will emit less than 0.05-ppm formaldehyde. The project fulfills Sustainable Sites Credit 8 for light pollution reduction. LEED credit 1.1 for water efficient landscaping is achieved. LEED credit 2.2 was achieved to divert 75% of construction waste from disposal. LEED credit 5.2 was achieved for having 20% of materials being extracted, processed and manufactured regionally.



Statement of the Problem:

The Towson Arena Addition project has four spaces that I have scrutinized and plan to redesign the lighting. The electrical system's emergency power capabilities will be assessed. Also, the four lighting solutions will need an electrical redesign as well. Finally, I will determine the cost savings of switching all of the current LED fixtures to other sources such as fluorescent.

The four spaces for a lighting redesign will be the court, the reception on the first floor, the press room and the exterior northeast entrance. The court will need a lighting solution to accommodate games, physical education classes and sudden darkness. I will design the reception to have three lighting design solutions. The press room design will have a psychological impression to go along with its design solution. The exterior will easily bring the spectators into the building through the use of an effective lighting design.

The electrical system shall be redesigned as well. The emergency power system will be examined, and I will decide if a better solution exists. The spaces that I plan to redesign with new lighting solutions will need to have their electrical design assessed for safety and code compliance. The branch circuits will need to be examined for the arena's electrical system serving these spaces. I would also like to perform a short circuit analysis of the building's electrical system.

The final problem that I would like to address is the replacement of LED sources with other more cost effective light choices. When a project is value engineered, lighting can be the first system to be cut. LEDs can be quite expensive and it would not be out of the ordinary for a project to replace them with other lamp types.

Proposed Solution(s) of the Problem:

The court will be addressed by having a system to meet the NCAA basketball requirements for illuminance. The luminaires will need to be designed in zones to allow for the illumiance values needed for a physical education class while saving energy. Finally shutters will need to be installed on the luminaires so that the court can be blacked out during introductions of the opposing teams.

The reception will have three design solutions. Each design will achieve a different level of social interaction within the space. There will be a solution where social interaction is not as important, and the users of the space are directed through with lighting. The other end of the spectrum will require a lighting solution that makes lighting a conversation piece as soon as a user enters the space. It will be designed to jump out at the user. The final solution will give the users the most comfort in meeting and staying in the space. The goal is to allow users to enjoy the space during pregame, halftime or other recesses when the arena is being used.

The press room will have the psychological impression of being private to help the speakers feel comfortable presenting in front of numerous reporters. This will be achieved by providing enough vertical illumination to allow the speakers to see the audience. This will make the interactions more personable.

The northeast entrance of the arena will be designed to have ample vertical illumination to allow for facial recognition of the users. There will also be a prominently illuminated entrance of the building that will let the users know exactly where to go. Luminaires will be positioned as to create a line of light to the entrance as well. The line of light will be made up of posts and also linear lighted handrails.

The existing emergency power system consists of three generators. I will check the needs of the building versus the existing system's capabilities. Then I will determine if there is a better solution. The spaces that will receive a lighting redesign will be examined for protection devices and wire sizing. The branch circuits and panelboard sizing will be examined and redesigned if necessary. I will also perform a short circuit analysis of the Towson Arena's electrical system.

The final solution will be addressing a new lighting design without LED fixtures. I will research replacement luminaires and lamp types that will give similar light levels and effects to the spaces. Then I will run illuminace and power density calculations to determine if the new design meets code and recommended light levels.

Solution Method:

In order to find cogent solutions to the design of the four spaces I will need to first research the illuminance values, power densities, codes and any other design concerns that are of interest to the spaces. Once I have the criteria for each space I can begin to look for equipment to use and decide how I want to place the luminaires. Finally I will create renderings, illuminance calculations with software. Power density calculations will also need to be done to comply with ASHRAE. I will then need to either fine tune my design until I find an acceptable solution.

For the emergency power system I will go through the existing building and determine the needs for code. Once I determine the requirements set forth in the National Electric Code I can assess whether the current system is adequate for the existing building or possible expansion. I would then like to research other emergency power setups to attempt to find a better and more cost-effective solution.

In the spaces that I redesign with my lighting solutions will need to be examined for safety and code compliance. I will first find the needs of my new proposed lighting system. I will also check the current ability of the existing system. Where upgrades are needed I will make adjustments and redesign the wiring, panelboards or overcurrent protection devices. After I have a new electrical system for my new lighting design I will run a short circuit analysis.

In order to find effective replacements for LED fixtures in the arena I will first need to identify all of the existing LED fixtures used in the arena. I will then need to identify all of the spaces where these fixtures exist. Once I have the spaces I can research design criteria for a new system. I will need to research illuminance values, power densities and any other design concerns for the spaces. Next I will need to research equipment that will adequately replace the existing LED system and satisfy the design criteria I have researched. Then I will need to do a power density and illuminance level calculation for the spaces. The best way to present the information would be to show a cost comparison. I would therefore have to research the cost for the existing and new system I have designed.

Tasks and Tools:

Lighting Solution

Task 1: Lighting Research for Design Criteria

a) Find the illuminance values for each space
b) Find the power densities from ASHRAE per space
c) Make note of other design considerations from the 10th edition IESNA handbook

Task 2: Choosing Equipment

a) Make choices for lamp types needed per space
b) Research equipment with photometric data that will meet design criteria

Task 3: Calculate with software

a) Use AGi32 to test for compliance with IES guidelines
b) Calculate power density for each space
c) Capture renderings to better explain findings

Emergency Power Solution

Task 1: Determine needs for existing Towson Arena

a) Find the size of the current electrical Towson Arena system
b) Find the classification of the building for the NEC

Task 2: Determine acceptability of current system

a) Compare the current system to code for compliance
b) Determine of current emergency power system has any inadequacies

Task 3: Find better and more cost-effective emergency power system

a) Research more depth on current emergency power system
b) Research available emergency power systems
c) Come up with rough cost estimates for each emergency system for a comparison

Lighting Solution Electrical Redesign

Task1: Finish lighting solution

a) Finalize lighting solution for each space
b) Define electrical needs for new systems' designs

Task 2: Determine Spaces' electrical needs

a) Run calculations to determine the size of each new lighting system
b) Find the limits of the current system through calculations
c) Consult code for existing systems' compliance
d) Make adjustments and redesigns where necessary
e) Run short circuit analysis of new electrical system for each space

Task 3: Present Findings

a) Gather data for existing and new electrical systems
b) Show comparison of existing versus new electrical system per space

LED Replacement

Task 1: Identify LED fixtures & Spaces

a) Find LED fixtures in the fixture schedule
b) Find the number of LED fixtures in each of the spaces
c) Find the classification of each space for light levels and power densities

Task 2: Find replacement fixtures and lamps for existing LED systems

a) Find similar lamp and luminaire types for each LED fixture used
b) Find ies software and check light levels and power densities in AGi32
c) Finalize a new system that will meet the design criteria

Task 3: Cost Comparison

a) Find the cost of the existing LED lighting system
b) Find the cost of the new LED replacement lighting system

Timetable:

Joey Becker		Lighting Solution			Emergency Power Solution			Lighting Solution Electrical			LED Replacement			COUNT
Timetable		Task 1	Task 2	Task 3	Task 1	Task 2	Task 3	Task 1	Task 2	Task 3	Task 1	Task 2	Task 3	
Week 1	1/8-1/14	X			X						X			3
Week 2	1/15-1/21		X		X						X			3
Week 3	1/22-1/28		X			X						X		3
Week 4	1/29-2/4			X		X						X		3
Week 5	2/5-2/11			X			X	X				X		4
Week 6	2/12-2/18			X			X	X				X		4
Week 7	2/19-2/25						X		X				X	3
Week 8	2/26-3/3						X		X				X	3
Week 9	3/4-3/10	SPRING BREAK												0
Week 10	3/11-3-17								X				X	2
Week 11	3/18-3/24								X				X	2
Week 12	3/25-3/31									X			X	2
Week 13	4/1-4/7									X			X	2
Week 14	4/8-4/14													0
Week 15	4/15-4/21													0
Week 16	4/22-4/28													0
Week 17	4/29-4/5													0

Additional Issues:

The biggest issues that I will encounter will be software, finding adequate ies files, researching emergency power systems and finding LED cost information. There are always issues with file saving and renderings. Elumit is a great site, but I will have to sift through many ies files in order to find suitable replacements for LED fixtures. Also, LEDs don't have the best record of even having ies files. I am quite inept with emergency power systems, so there will be a steep learning curve at first for this portion of my thesis. The LED cost information will be tedious to find. Perhaps I can contact certain reps to help me find correct data.

Breadth Topics:

I would like to do a further study into three aspects of the Towson Arena Addtion in addition to those already discussed. I would like to investigate the daylighting system, structural roof framing system and acoustic system in the court.

The Towson Arena has lots of glazing and even a clerestory letting light into the court area. I want to determine the effectiveness of the current design. I would like to show the energy savings from the use of daylight harvesting. I would also like to do a daylight study of the court to see the effects of glare and overall illuminance levels.

The current design has a 190' span across the court. This is a large span, and a strong structural system is needed to support the roof. There is also a unique clerestory that feeds light into the arena. I would like to further investigate this roof framing system and see how it could possibly be improved.

The arena will serve many purposes including a basketball court, volleyball court, physical education facility, concert arena and graduation ceremony stage. Acoustics will be very important for these different uses. Concerts, graduation ceremonies and sporting events all require different acoustic levels. I want to explore the adequacy of the current acoustic system.