Tech 3

Towson Tiger Arena

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Executive Summary

Technical Report 3 identifies and highlights potential research areas within Towson Tiger Arena's design and construction. The information within this report was assembled through conversation with the Gilbane Project team and my summer experience on the jobsite. This process has led me to locate constructability challenges, schedule risks, value engineering items, and LEED implementation information.

Included in this report is a critical path schedule and analysis, which further identifies areas of constructability challenges. The critical path schedule for Towson Arena identifies several major tasks from mobilization to punch lists, with many milestones throughout. Analysis of the schedule allowed for easy identification of a problematic phase, with milestones that would impact over 60 percent of the schedule. I have proposed a Short Interval Production Schedule (SIPS) schedule for the redundant foundation and concrete work around the bowl to micromanage this process and insure the schedule is maintained and possibly accelerated.

Value Engineering (VE) was significantly important to Towson and Gilbane as the procured budget of Towson was strict. Currently, the Tiger Arena team has approved over $300,000 in VE items.

While in New Orleans for the 2012 Design-Build National Conference and Expo, I attended a discussion on Design-Build Best Practice. They discussed the synergistic elements that result in "Design-Build done right" and the key differences in collaboration that distinguish Design-Build from other delivery methods. Through a debate format, two gentlemen, one representing the owner's opinions and the other construction companies, expressed their views on a range of topics.

With the completion of this report, my focus will move to further research into the topics identified in this report. Through further investigation into these items and industry mentoring, a strong background has been formed to lead into proposal elements and breadths. This knowledge gained though all the technical reports will spark the development of my proposal and further topics of research and discussion.

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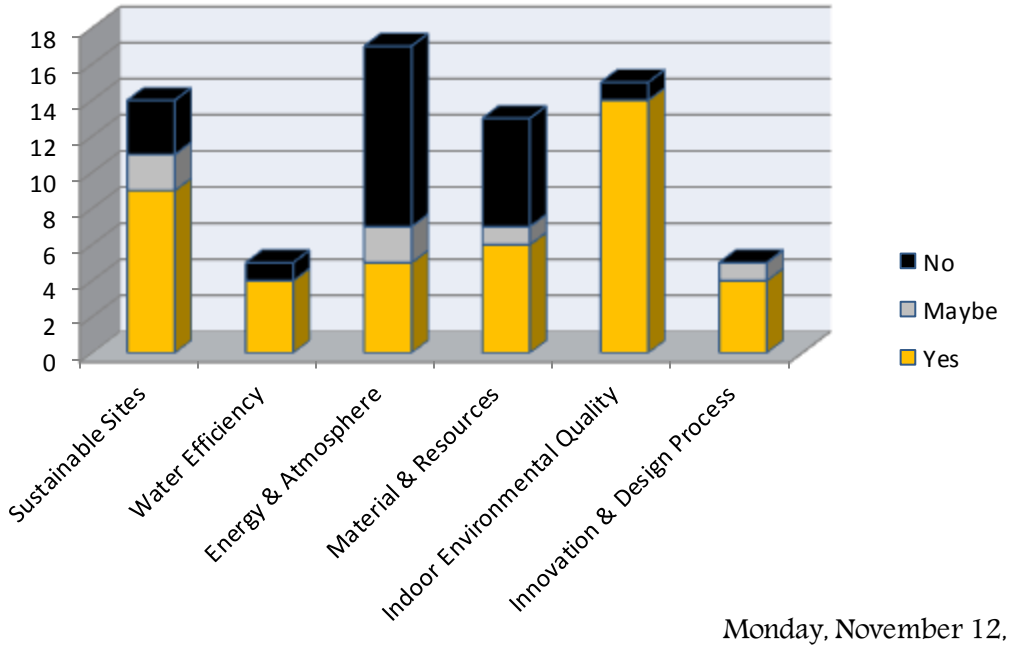
LEED Evaluation

Figure 1: Towson *GO Green* Logo, Towson.edu

Tiger Arena was specified to obtain LEED Silver certification based on LEED-NC, Version 2.2. USGBC LEED-NC Version 2.2 consists of Sustainable Sites (SS), Water Efficiency (WE), Energy & Atmosphere (EA), Material & Resources (MR), Indoor Environmental Quality (IEQ), and Innovation & Design Process (ID). With a possible 69 points plus five ID bonus points, Tiger Arena is scheduled at a mandatory Silver certification between 33-38 points.

During the design and preconstruction phases, Gilbane and the architect (HCM) discussed with Towson University (TU) the importance of each credit and there goals as a University. After reviewing these credits with TU and completing the LEED NC, Version 2.2 checklist, a Gold certification was estimated. With 42 "yes" credits and 6 "maybe" credits, a much more sustainable building than originally planned could be obtained. Gilbane and HCM, upon owner's approval or given credits, organized each credit into Design and Construction Submittals for tracking purposes. Currently, the project is still striving for this new Gold certification. Gilbane and HCM are working closely with the owner on the "maybe" credits to evaluate the feasibility and cost to achieve each and the potential value to TU.

Table 1: Towson LEED Point Breakdown, created by Derek Stoecklein



*"**Sustainable Sites** credits encourage strategies that minimize the impact on eco systems and water resources."*

*"**Water efficiency** credits promote smarter use of water, inside and out, to reduce potable water consumption."*

*"**Energy & Atmosphere** credits promote better building energy performance through innovative strategies."*

*"**Materials & Resources** credits encourage using sustainable building materials and reducing waste."*

*"**Indoor Environmental quality** credits promote better indoor air quality and access to daylight and views."*

Figures 2: LEED V2.2 Credit Description Images, sftool.org/learn

Critical Evaluation

LEED is more than a rating system used by the government to promote green thinking and techniques. LEED helps create high performance and efficient facilities for owners. This creates a building that promotes thinking and an environment that people want to be in and are comfortable. Additionally, this effort provides a return for the owner over the life of the building. Tiger Arena has spent a lot of its time during design to create innovative approaches for IEQ, WE, and EA.

Looking at Water Efficiency, a 49 percent modeled reduction of water compared to the 30 percent needed to achieve the credit. Additionally, a water efficient landscape has been designed. These approaches have allowed for a possible 4 out of 5 points in Water Efficiency.

LEED Facts

for New Construction (v 2.2)

Gold	**48**
Sustainable Sites	11/14
Water Efficiency	4/5
Energy & Atmosphere	7/17
Material & Resources	7/13
Indoor Environmental Quality	14/15
Innovation & Design Process	5
Points possible = 69 points	

Table 2: Towson LEED Facts, created by Derek Stoecklein

Another huge effort put forth in design and enforced by Gilbane is Indoor Environmental Quality, during and after construction. Gilbane has created a detailed IEQ plan that ensures all these measures are understood and met by each contractor prior to awarding their contracts. IEQ equates to over 20 percent of the total possible credits offered in Version 2.2 of LEED-NC. Of these 15 credits, 14 are listed as "yes" and some are mandatory according to TU. This large effort will help a great deal in creating a high performance building for TU and a comfortable environment for users.

To further illustrate the attention to detail and innovation in design, four possible credits can be earned based on exemplary performance in Sustainable Sites, Water Efficiency, and Contractor Performance. Gilbane and HCM plan to follow the submittal process closely and aggressively to insure these credits are maintained, creating a building TU will be able to use as a benchmark for future high performance building around campus.

Schedule Acceleration

Some scheduling information withheld for legal reasons….

Critical Path & Schedule Acceleration Analysis

The critical path for Tiger Arena is assembled/ identified through the card trick method, ensuring the milestones set by the team and Towson are managed. As seen in *Figure 4,* the Critical Path follows the basic construction path from site mobilization to steel erection. If you analysis this schedule you see that the building foundations and pouring the second floor slab are large activities that could have a large impact if delayed. While looking further into the schedule, I noticed a pattern or repetitive flow or work from W-S-E-N, around the bowl. These activities include forming and pour all footings, site retaining walls, SOG, and all the first floor concrete structure (Beams, Columns, and Walls). With this process in mind, I decided to look into how to plan/organize this work flow to accelerate the work and manage the flow of trades from throughout the process.

Short Interval Production Scheduling (SIPS) came to mind as a way to micro-manage the day to day production of these tasks. SIPS are an extremely detailed method of planning a repetitive process such as concrete form, rebar, pour, and stripping (FRPS). Through a greater analysis of SIPS and the process at hand, I believe it could accelerate the schedule through foundations and allow for the placement of the second floor slab earlier. Once this slab is stripped, the steel can be erected and the building can begin to take shape faster and allow for all other building trades to begin work sooner than originally scheduled.

In conclusion, the method of SIPS could improve the schedule through foundations and first floor concrete, thus accelerating the rest of the schedule and creating a buffer at the end for unforeseen schedule delays. The management needed for this would cost nothing additional to the owner and could possibly save Towson money if it allows for the completion of the Arena earlier then the initial substantial completion date.

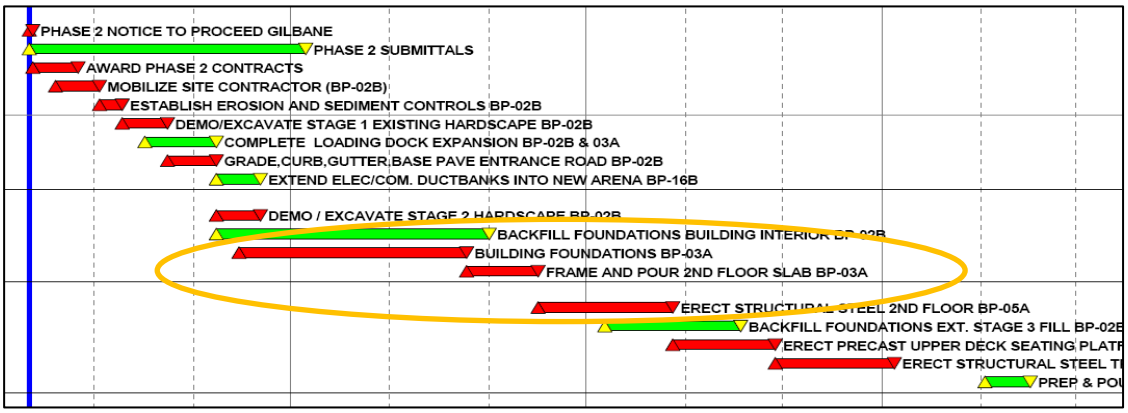


Figure 3: Milestone Schedule with Critical Path Identified, Created by Corey Sarver | Gilbane

Value Engineering

"Value Engineering (VE) is not a design/peer review or a cost-cutting exercise. VE is a creative, organized effort, which analyzes the requirements of a project for the purpose of achieving the essential functions at the lowest total costs (capital, staffing, energy, maintenance) over the life of the project. Through a group investigation, using experienced, multi-disciplinary teams, value and economy are improved through the study of alternate design concepts, materials, and methods without compromising the functional and value objectives of the client." wbdg.org

Towson Value Engineering Review

The Value Engineering (VE) process was completed by Gilbane during preconstruction, broken down into General, Civil, Structural, Architectural, Mechanical, and Electrical. Upon review of each VE with the owner and Architect/Engineer, Gilbane tracks each as approved, pending, and rejected. The overall VE process continued into the beginning of 2012 and is currently tracking at $(316,796) Accepted, $(3,023,653) Rejected, and $(245,300) Pending.

Approved VE Deducts

Architectural

Change curtain wall glass to standard vs. Starfire Ultra Clear	($82,546)
Change bathroom partition class from A to B	($28,571)

Mechanical:

Delete canvas jacket on pipe insulation	($20,000)

Electrical:

Remove software specified for power monitoring	($35,000)
Alternative Fixture type S4	($23,000)

**This list is a brief description of the larger VE items approved by Towson University and the A/E team*

Pending VE items

Currently, Tiger Arena has on pending VE item remaining; deleting all electric roller shades. The electric roller shades cover the large clear story. The window treatment package was awarded at $255,930, including O&P. The VE for the removal of the electronic shades and submitting stationary shades was estimated at $(245,300), roughly 95 percent of this contract value. Through meetings with TU and understanding their needs for shading, Gilbane and HCM believe this will be denied at a later date.

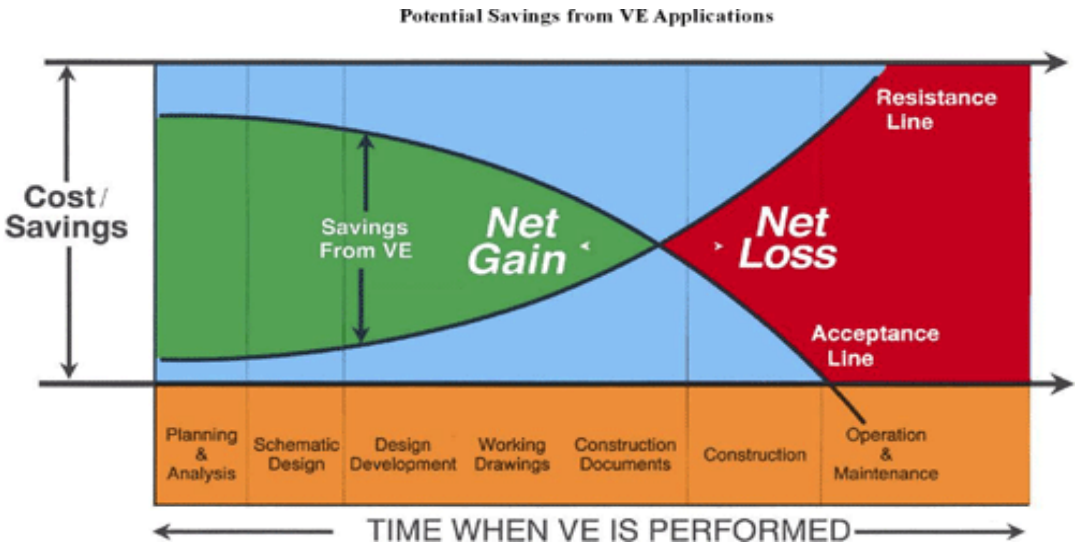


Figure 4: VE Savings Timeline, *wbdg.org*

Other VE Consideration

Understanding the importance to save money, keeping the owner's needs in mind, Gilbane, HCM, and TU discussed many other VE ideas with overall time and cost savings. Many of these ideas where studied hard by the University but through much consideration where rejected. With a potential savings of roughly $3MM more dollars through these VE ideas, TU had a large decision on what was important to them and what they want from this arena at the end of the project. Although none of the items sacrificed quality for cost, Towson was mind set on the materials and finishes they wanted and would not budge in the matter. This effort put forth by the design team and TU has created some savings, and allowed Towson to purchase items they could not originally without running over the procured amount set forth by UMB.

Critical Industry Issues

DBIA 2012 Conference & Expo, Design- Build (DB) Best Practices Lecture
Rex Huffman & Craig Unger

The lecture was conducted in a debate format where Craig Unger represented owners and Rex Huffman represented the construction managers. This session was conducted to:

- Discuss on the synergistic elements that result in "Design-Build done right"
- Learn best practices from both the private and public sector related to successful Design-Build delivery
- Understand the key differences in collaboration that distinguish Design-Build from other delivery methods
- Discover the value that results from utilizing best practices on your next project

Six major topics where debated during the hour and half session by both representatives. I will list each topic along with major points or opinions of each party. (C) will represent Rex Huffman and the construction managers, (O) will represent Craig Unger and the owners. All the discussions below are based on a DB approach ONLY; the (*) comments represent my interpretation of the "Best Practices" as recommended by DBIA.

1. **Who should be the leading party in ALL Design-Build deliveries?**

   (C) They should be led by the contractors always.

   (O) No preference more worried about the best team for the job.

   *The contractor leads 80 percent of all currant DB contracts; this is believed to be due to the bonding capacities of the contractor vs. the design team

2. **How much emphasis should be put on Qualifications in Best Value practice?**

(C) "Low bid, low Bid", price should drive selection

(O) The qualifications should be important in the selection process vs price/cost

*Design to Budget" technique; owner sets a budget, allowing them to use qualifications to select companies

3. **Should owners disclose the selection criteria and weights?**

(C) Yes they should, need to know what is most important to owner

(O) NO… Loses flexibility, the contractor will fine tune there proposals and regurgitate the information that owner asks

*Do a debrief by owner to contractor to tell them why the lost/won and what the contractor should look to do in the future to help the out

*It's important that the owner sticks to the proposed important values/measuring scales to keep level playing field

*Eliminate the guessing by the contractor as to what the owner actually wants

*The owner may make a bad selection criterion and limit the teams and the capability to get a better value product

4. **How important should past performance be in selection and evaluation?**

(C) "It's not fair," if we can bond a project that should be good enough. The past performance and references are too subjective

(O) Lets owners evaluate the performance of how well the contractors have done on past projects. It's very important. Make sure the past experience is relevant

5. **Shortlisting on proposals; should it be done and should discussion with the shortlisted teams be allowed?**

   (C) No and No. Everyone should have the same fighting chance

   (O) Like the shortlisting process and believe in discussion during shortlisting

   *DBIA believes 3 teams should be shortlisted

6. **Should stipends be offered to losing bidders?**

   (C) Yes, proposals are expensive and stipends will help offset some of the cost to create a proposal. Shows that the owner is serious about the job

   (O) Why pay the contractor to compete. What do we get out of the stipend

   * DBIA does not view adding a stipend as a justification to demand more from proposals

   *Contractors are not allowed to protest under a stipend

   *Ownership of the design may belong to the owner if a stipend is issued, depending on contract

Problem Identification & Technical Analysis

When considering research topics, I began by looking into the construction issues I evaluated in Tech II. When performing this, I realized that one of the biggest challenges on this project was the congestion in the bowl, and how if controlled, the flow and duration of major MEP work. With this in mind, the phrase "raise the roof" came to mind. I decided to use this as my guidelines for my technical analysis topics and have come to the follow three topics; fabric duct system, prefabricating electrical conduit, and moving the other side of the roof with a Green Roof system. I believe these topics will flow well together and through deeper evaluation could help with the issue of congestion in the bowl.

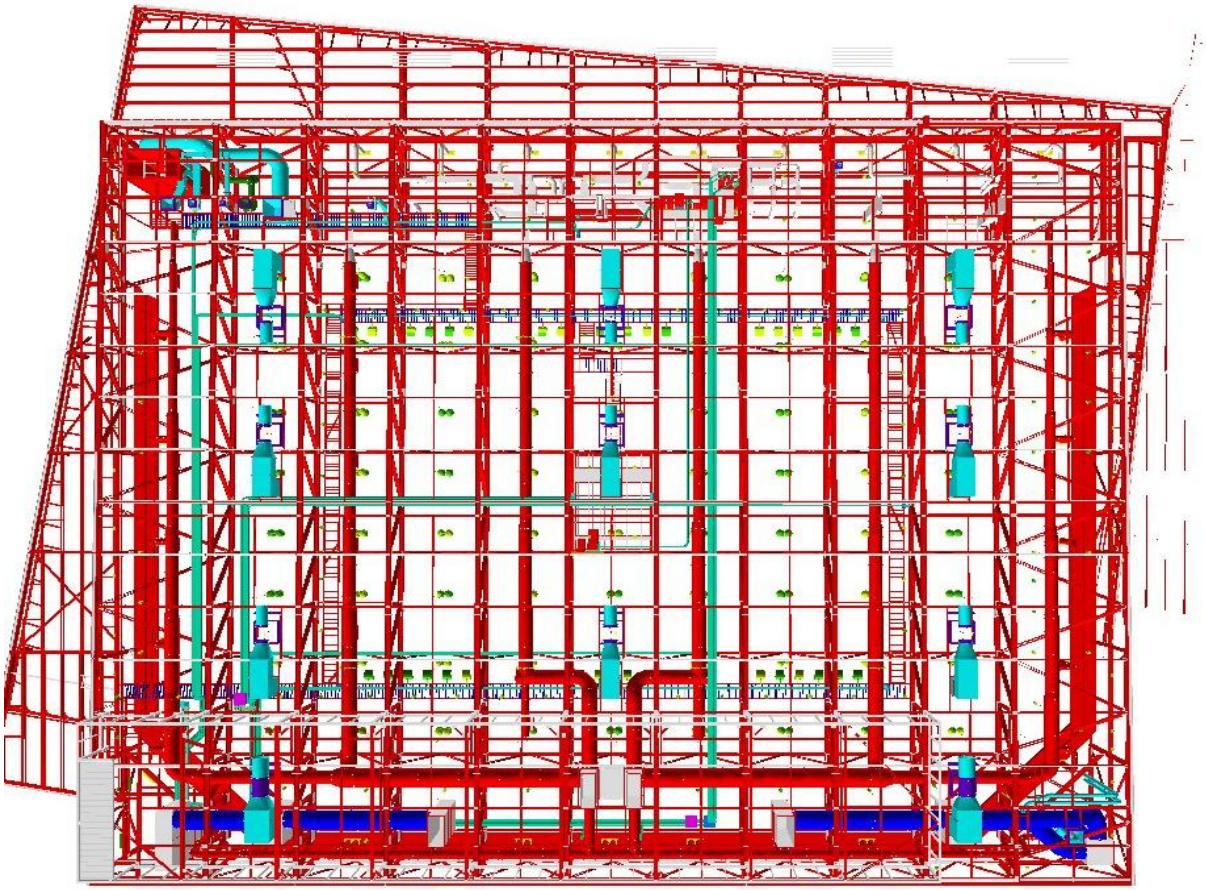


Figure 7: Plan View of Tiger Arena Trusses and MEP: Courtesy of Gilbane Coordination Model

Fabric Duct

Fabric duct has many advantages over the traditional sheet metal duct work. These include cost, flexibility in design and appearance, lighter, easier, safer and faster to install, and requires less staging room. The benefits listed are just a few that come to mind and through a deeper evaluation, the actual value will be analyzed compared to that of the originally design metal duct. In addition to the construction advantages, there are potential for mechanical advantages that I will also explore through future analysis.

Prefabricating Electrical Conduit

Through the year, prefabrication has become more and more popular with cost, time, quality and safety in mind. These four topics are very important to every owner and contractor. With the known congestion in the bowl due to the amount of work schedule at one time, quality and safety are at risk. Through the use of prefabrication, the electrical contractor (BK TRULAND) will be able to assemble conduit runs in their shop and coordinate "just-in-time" delivery.

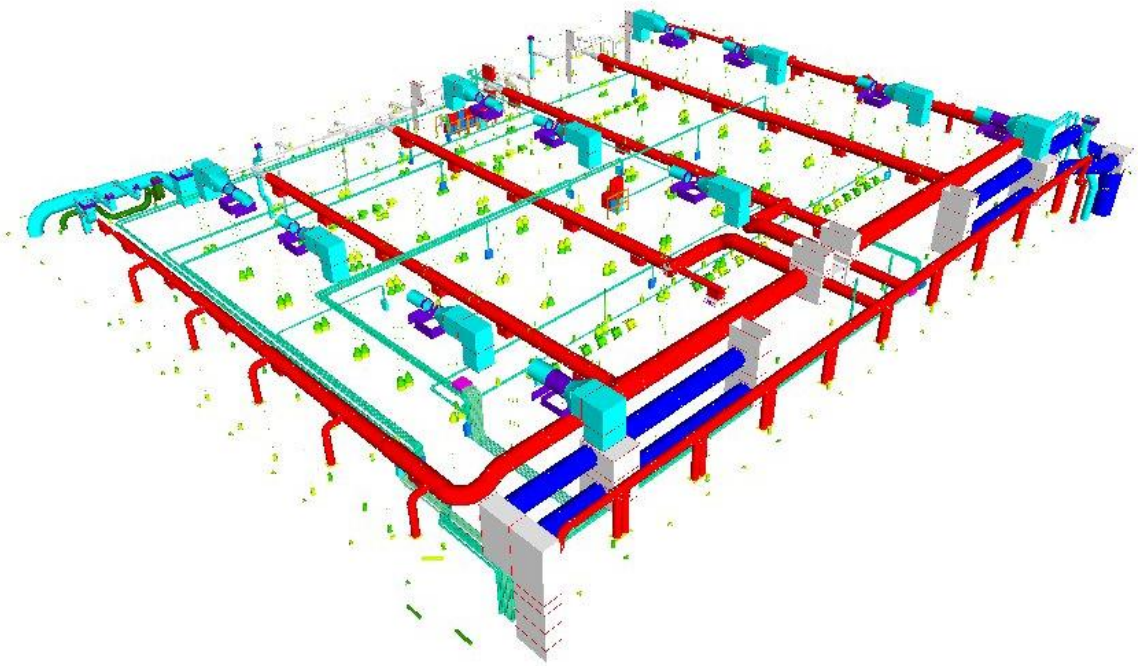


Figure 5: Model of the Mechanical & Electrical equipment in the trusses, courtesy of Gilbane

Green Roof System

Looking to the other side of the roof, we have a build-up white roof system. This is considered one of the more typical systems around the control to help control the heat island effect and maintain a more controlled atmosphere inside the building. An issue that Tiger Arena faced during the installation of the roof was meeting the tapered requirements for proper drainage. With a proposed Green Roof system, this slope issue would not exist and the water would be better controlled from run-off. Tiger Arena has a dramatic slope to its roof, dropping almost 10' from South to North. The issue of excess run off may occur during larger rainfalls. Through analysis of green roof systems and the average rainfall of the area, the proposed system may help with this potential issue as well as a possibility of storm water retention. Towson currently has a green roof system on their Performing Arts Center (PAC) and considers it a leap towards their *GO Green* initiatives as a sustainable campus. With the addition of another green roof on their newest and currently greenest building, this will add in their pursuit of lowering greenhouse gases and becoming more sustainable.

Figure 6: View from East Elevation of Roof Slope, taken by Derek Stoecklein

References

Gilbane Project Data

http://www.wbdg.org/resources/value_engineering.php

http://www.sftool.org/Learn

DBIA National Conference & Expo