## BREADTH TOPIC #1

ANALYZE THE STRUCTURAL COLUMNS WHICH SUPPORT THE FIELD LIGHTING FIXUTRES

The *Penn State Ballpark* follows the same construction duration that has come to be accepted for sports facilities. Excavation of the 22 acre site began in June 2005 and the construction will end in May 2006 with the first game to be played in June 2006 for the minor league franchise. This means that approximately $25 million will be put in place in a twelve month time period. Furthermore, any delays in design or construction could have an immediate impact in finishing the project by May 2005.

The structural system package was released for bid in late May 2005 and bids were received by the middle of June 2005. The structural system package included 600 tons of structural steel with the interesting figure that 86 tons of that estimate was allocated to the structural columns which support the light fixtures as depicted below.

**Ballpark rendering with the area highlighted which will be analyzed.**

The area highlighted on the first base side is typical for the third base light fixtures as well. The design includes three (3) W14x132 columns with cross-bracing members connecting the structural bays. The overall height of the W14x132 members varies between the first and third base side because there is a sixteen (16) foot elevation difference; this is due to the fact that there is a basement level on the first base side but not on the third base side. Although the rendering appears to have the same structural support for the scoreboard in left field, this is not true. The structural supports for the

scoreboard are being designed in conjunction with the scoreboard manufacturer, Daktronics Inc.

Barton Malow Company, the construction manager for the project, has developed a strong niche in the sports construction market including minor league baseball facilities. Because this project is not a design-build project with the construction manager having control of the architect, Barton Malow can only advise design changes. During the bid review period and post-bid meetings, Barton Malow suggested that these columns could be altered to support the same structural loading as well as achieve the same aesthetic look for the architect. One of the concerns proposed by Barton Malow and stated earlier was the fact that this area of the project accounted for 15% of the entire structural steel package. Furthermore, from past projects of similar size, Barton Malow has learned that the columns which support the main light fixtures of the stadium can be designed under 100 lbs/ft.

Because the structural steel package is on the critical path of the project and costs saving measures are often needed, I will analyze the structural columns which support the field lighting fixtures in terms of:

1. Value engineering methods to determine if an alternative structural member (ex. HSS) can be used to lessen the steel tonnage and decrease the cost while supporting the same loading.
2. Constructability methods to determine if the columns can be altered, but still achieve the aesthetic smooth appeal required by the architect.

In order to be able to accomplish the three (3) items listed above, I will need to first understand the design process of a structural engineer and how the design relates to the architects design intent. In order to accomplish this, I will discuss the design steps taken by a structural engineer with the professors in the structural option within the architectural engineering department at Penn State University as well as discuss the design intentions with the structural designer from DLR Group. This will allow afully understand the design requirements and intent before I begin to technically critique the field lighting structural supports on the first and third base line.

Next, I will contact Barton Malow Company and ask for information about the field lighting structural supports on past minor league baseball projects. I will need to ask for the following information when talking to them:

1. Size of the structural members in the described area.
2. Shape of the structural members in the described area.

Once I receive this information, I can begin determining possible alternatives to the field lighting structural supports. Using my knowledge of AE 401 (basic steel design), I will

determine the size and shapes of the steel members needed to support the field lighting fixtures for *Penn State Ballpark*. In order to determine if the aesthetic look is affected with the alternative design, I will model alternative design in AutoCAD.

Once my technical analysis has been completed and modeled, I hope to have successfully found an alternative way to design the field lighting fixture structural supports. This will ultimately allow for cost savings in the structural steel package, but might allow for a quicker erection time in this area due to lighter and less steel members. Furthermore, I will be able to use the knowledge I have learned from performing this analysis when value engineering ideas might be needed on future projects and the project team might need suggestions in how to achieve the same look with lighter steel members.