

Tech Assignment 1

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Penn State Recreation Hall Wrestling and Student Fitness Center

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Penn State Recreation Hall Wrestling & Student Fitness Center Addition & Renovation
University Park, PA



Executive Summary

This report provides an overview of the Penn State Recreation Hall Wrestling & Fitness Center Addition and Renovation. It includes a general schedule for both the addition and renovation, a parametric and square foot estimate, a summary of the building systems and methods used during construction of the project.

The Rec Hall project is a fast track project with Gilbane Building Company acting as the Construction Manager. The owner, Penn State, holds a Cost + A Fee contract with the CM. The CM holds all contracts, Fixed Price/Lump Sum, with the subcontractors. The project began on April 1, 2005 and is expected to be completed on October 15, 2006 for a price of \$13.3 million.

The Rec Hall Addition will be a silver rated LEED building. In order to obtain this rating many steps have been taken both in design as well as construction. These steps include a design that minimizes energy loss and recycling procedures during construction.

The foundation for Rec Hall is made of mini-piles, pile caps, grade beams and foundation walls. Upon this wide ranged foundation sits a steel skeleton building with CMU infill walls.

The mechanical system consists of four Air Handling Units to provide the addition with sufficient outside air. Four Fan Coil Units will provide the renovated area with the appropriate air supply.

The electrical system is fed from the main campus feed of 480/277. The voltage enters the new 1000Amp, 480V, 3 phase switchboard. Prior to entering the various panel boards throughout the building the voltage is reduced to 120/208 in order to provide electricity to the lighting fixtures and outlets.

The D4 cost estimate varied a great deal when compared to the actual related bid packages for the Rec Hall project. Among the various reasons that could cause this, is the fact that D4 assumed a heavy concrete foundation, such as a mat footing, and did not account for mini-piles. Also the D4 estimate does not include the cost for the large glass curtain wall on the front side of the building.

The owner for this project is a very safety aware organization whom expects a high quality building to be delivered on schedule. This emphasis on safety and quality extends from the president of Penn State, Graham Spanier, down to Penn State project managers.

Although relatively small, this project is presenting many obstacles. The largest of these difficulties is the completion of construction in areas that are still in operation. In order to accommodate this joint phasing, a night shift will be implemented at certain times throughout the project

Project Schedule Summary

The parametric schedule prepared for this assignment focuses on the general tasks involved in the construction of Rec Hall, with a start date of April 1, 2005 and final completion date of October 15, 2005. These tasks include the foundation system, structural skeleton, enclosure events and interior finish responsibilities. The tasks were also divided into the renovation phase and addition phase. The tasks involved in the renovation phase are dependent on the activities that take place in the building; therefore the dates for these tasks are subject to change and require a large float to allow for such changes. The focus when scheduling activities for the addition phase was enclosure. Enclosure needed to be complete by winter in order to allow interior finishes to continue as well as limit the cost for temporary heating of the building. Please reference the "Parametric Schedule" link found in the Tech 1 Assignment page.

Building Systems Summary

The Recreation Hall Addition and Renovation project required the abatement of asbestos in the renovation area. All existing pipe fittings in this area contained asbestos in the insulation at the pipe fittings. Lead paint was not a problem in the renovation phase of this project. A lead checking pencil was used to test for the presence of lead paint in the CMU's that were to be removed during renovation, and the results were negative.

The structural steel frame for the building consists of tube steel columns with W-Shaped beams which support the steel joists. Three diagonal steel bracing members were specified in the design of the building. The bracing members extend from the slab on grade to the roof decking. The steel members were erected with a 100 Ton Demag mobile crane with a boom of length 164'. The steel was erected by bays. In order to erect steel in this method the crane was positioned in four locations, three for the addition phase of the building and one location for the trellis in the rear of the building. The crane location for the addition phase of the building began at the North side of the addition, then at the West face of the addition and finally at the South side of the building. The trellis was erected with the crane located in the existing parking lot on the Burrowes side of the building.

The cast in place concrete was placed through four main methods, direct chute, pump truck, conveyor truck and Georgia buggies. The direct chute method was used to place the pile caps, grade beams and piers. The pump truck was used for certain sections of the slab on grade and the elevated slab. The conveyor truck was used to place the foundation walls and sections of the slab on grade. The Georgia buggies were used to place the slab on grade in the renovation area. The formwork for the cast in place concrete consisted of metal panels and various sizes and types of lumber.

There is no pre-cast concrete in the Rec Hall project, but there is pre-cast stone at various locations on the façade as well as at the bench seats located in the trellis area.

The mechanical system consists of four Air Handling Units for the addition area and four Fan Coil Units for the renovation area. Two mechanical rooms are located in

the addition phase of the project, located directly between the addition and the existing building, one on the first floor and the second directly above it on the mezzanine level. Both the AHU's and the FCU's precondition outside air to the building. The heating system makes use of the existing campus steam line through a steam-to-heating hot water converter. The cooling system employs the campus chilled water distribution feed, which is supplied from an on campus chiller plant. The fire suppression system is a wet system with quick response sprinkler heads.

The electrical feed to the building is 480/277 and is provided from the existing high voltage utility feed. Upon entering the building the voltage will be reduced to 120/208 by two transformers. The existing switchgear will be replaced with a 100 amp, 480V, 3 phase switchboard.

The masonry consists of veneer brick for the façade and CMU's for infill walls. The CMU's are connected to the structural steel with steel angles as well as structural ties. The brick is connected to the CMU's through the use anchors which are part of the horizontal reinforcement.

The curtain wall on the Rec Hall project is composed of high performance low E clear argon filled insulated glass units of two types, Grit pattern and Spandrel glass. The design for the curtain wall was coordinated between the curtain wall trade, DM Products, and the Architect/Engineer, L. Robert Kimball.

The support used while excavating on this job was a temporary system. A ditch box was used at areas where the excavation required such safety precautions. There was no dewatering required for the site.

Project Cost Evaluation

Construction/Total Costs

Type of Cost	Area Covered Ft ²	Total Cost \$	Cost/SF \$/SF
Construction Cost	48,381	8,785,892	181.60
Total Cost	48,381	13,300,00	274.90

Building Systems Costs

System	Area Covered Ft ²	Total Cost \$	Cost/SF \$/SF
Electrical	48,381	926,000	19.14
Mechanical	48,381	1,207,100	24.95
Structural	19,794	739,800	37.38
General Trades	48,381	2,002,400	41.39

Parametric Estimate (Produced by D4 Cost 2002)

The numbers generated by D4 Cost 2002 were based on an existing Renovation/Addition project. The project was the Kemper Arena located in Kansas City MO, constructed in July 1996. This fast track job was constructed between June 1996 and November 1997. The size of the project was 75,000 SF and housed various sports. The following chart compares the numbers obtained from D4 and the actual cost for each bid package.

Package	D4 Estimate \$	Actual Rec Hall Cost \$
Concrete	1,047,996	512,155
Masonry	151,186	755,000
Metals	4,873,697	1,103,252
General Trades	2,511,754	2,002,400
Conveying Systems	103,082	126,800
Mechanical	1,271,339	1,207,100
Electrical	398,582	926,000
Site Work	3,088,015	1,785,285
Total	13,445,651	8,417,992

Discussion:

Although D4's estimate is very close to the actual total cost of the Rec Hall project, when I compared the costs of the bid packages included in D4's estimate the difference is significant. The concrete package was much higher in D4's estimate than the actual cost at Rec Hall. I assume the reason for this large difference is that the building D4 based the estimate on, Kemper Arena, made use of a concrete foundation, either spread footings or a mat footing where the Rec Hall project required mini-piles, a cost of \$407,000. The estimated masonry cost was much smaller than that of the actual cost. I assume this is due to the fact that Rec Hall has a large quantity of veneer brick, both on the façade of the building as well as the interior of the building, which is very uncommon for gymnasium buildings. The next noteworthy difference in costs is the electrical package. I feel this difference is due to the large amount of electrical work found at the Rec Hall due to the large volume of electric fitness equipment. D4's estimate of the site work was much larger than the actual cost required for site work at Rec Hall. This is due to the fact that the area the addition will be constructed was previously a parking lot. Therefore, the excavation required to level the area for construction was minimal. Among the costs that were not included in D4's estimate was the cost for a curtain wall which amounts to \$1,136,600 at Rec Hall.

Square Foot Estimate (Produced Using RS Means)

Type of Building	Exterior Wall Type	Frame Type	SF Area	Cost/SF
1 Story Gymnasium	Face Brick With Concrete Back-Up	Rigid Steel	19,794	131.95
		Total:	19,794	\$2,611,957
		Actual:	19,794	\$5,441,397

Adjustments:

No adjustments need to be made

Discussion:

The large difference between the estimate obtained through the use of RS Means and the actual cost for the addition of Rec Hall is caused mostly by the same differences found in the comparison to D4. The RS Means estimate does not consider the specialty construction such as the cost for the curtain wall and foundation systems. The actual cost used for the addition on Rec Hall also includes the cost for the trellis in the rear of the building, which is not a common element in the construction of gymnasiums.

Local Conditions

There are three common methods of construction in the State College area. The first two methods address the façade of the buildings, which are High Performance Architectural Curtain Walls and Veneer Brick. The reason both of these types of facades are used so often is the availability of these materials as well as the blending into the surrounding buildings. The third method is using mini-piles as a foundation system. The reason for this method of mini-piles is due to the type of subsurface in this region. The type of subsurface in the State College region is that of clays, fines and Limestone Karst. These conditions are the reason for the frequent forming of sinkholes in the area. The use of mini-piles allows the building to be structurally sound if a sinkhole does form under the building. Parking for construction workers is very difficult to accommodate. Most contractors working in the region are forced to park at Lot 44 on Penn State Campus, where they are shuttled in some form to the job site.

Client Information

The client for the Recreation Hall Wrestling and Fitness Center is The Pennsylvania State University. Penn State decided to build an addition onto Rec Hall to facilitate the growing number of students attending University Park. The number of fitness areas on campus is not adequate for the number of students using these facilities. In order to solve this problem Penn State chose to add to an existing fitness facility. Along with the addition Penn State also opted to renovate areas of the existing building which were in need of improvement. The majority of these areas are for the sports teams whom are housed at Rec Hall, particularly the Penn State Wrestling team who will receive a renovated wrestling room.

The owner has very high expectations on cost, schedule, quality and safety. Although all are significant to the owner, safety is the most important aspect of the project for Penn State. Following safety in importance is schedule and quality. Although cost is extremely crucial, Penn State is willing to pay more to see a job completed on time, of high quality and with no accidents. An occasion that demonstrates this feeling, is that President Graham Spanier visited the job site and while speaking with Gilbane's project manager he enquired about the progress of work, if there were any incidents on the job and the overall quality of the work, and did not mention the budget of the job.

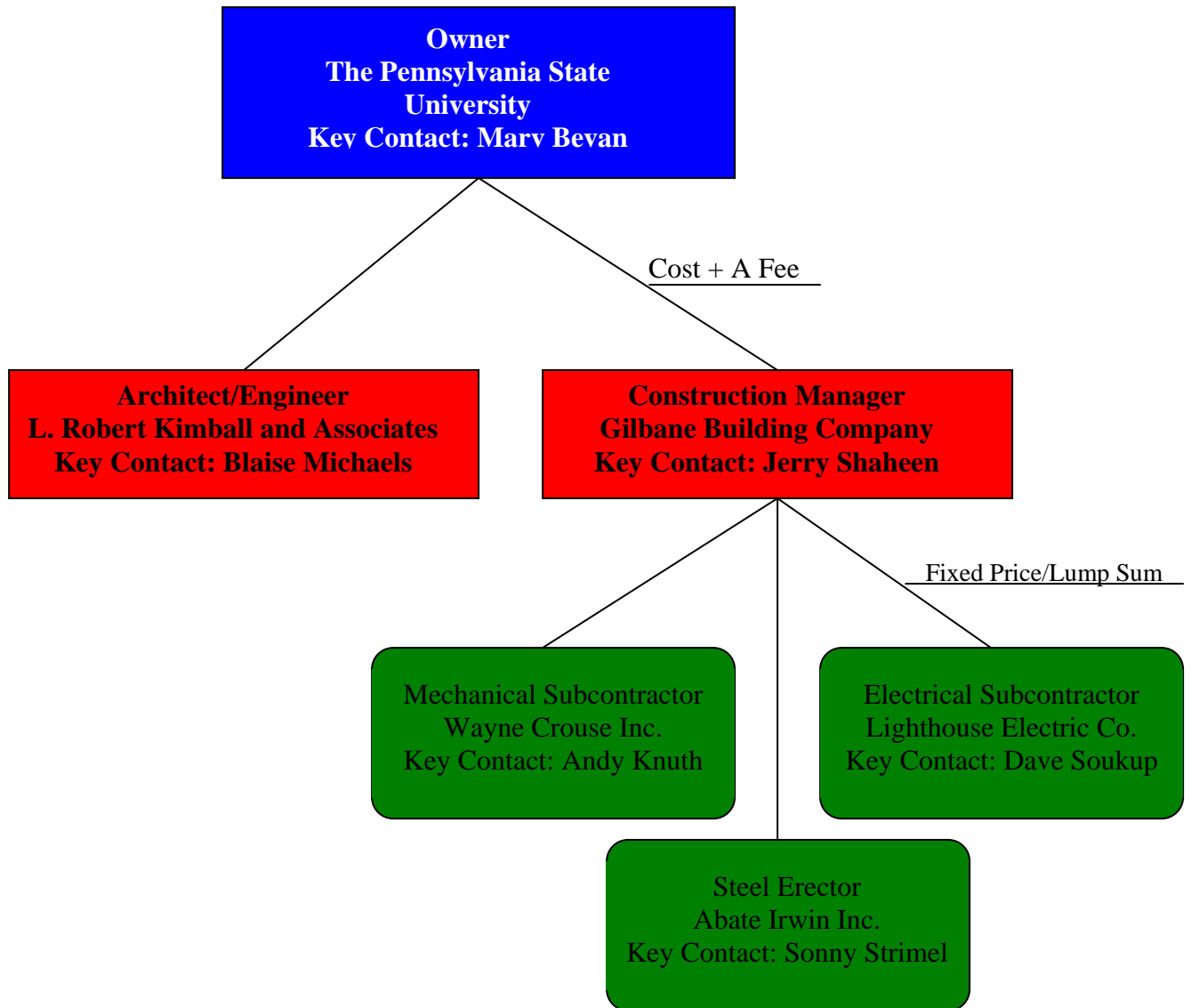
Sequencing is very important to the owner, as the building continues to be in operation during construction. While scheduling work to be performed, both for the addition phase and renovation phase, the project team must also keep in mind the building's occupants. This requires the sequencing of work to be very detailed and to be completed in the allotted time.

This job required both dual and joint phasing. This project required joint phasing in the wrestling room and existing fitness center. In these areas a night shift was implemented to complete plumbing work. The cause for this type of phasing was that the hot and cold water lines were located in these rooms and required replacement prior to the start of renovation in these areas. Dual phasing was put into place at the connection between Unit C and the wrestling room and fitness center area on the ground floor. At this location complete demolition was required. In order to maintain safety for the building occupants these areas were closed off with temporary partitions.

The keys to completing this project to the owner's satisfaction are producing a high quality building on schedule. In order to accomplish this, the building enclosure must be accomplished by December in order to allow finish work to begin during the winter months.

Project Delivery System

The Recreation Hall project is a fast-track job with a Construction Manager, Gilbane Building Company, managing the construction. The reason this project is considered a fast-track job is that the site work and the driving of piles had to begin prior to the completion of the Civil and Structural Drawings in order to obtain completion on the assigned date. The following chart illustrates the organization of all companies involved in the project.



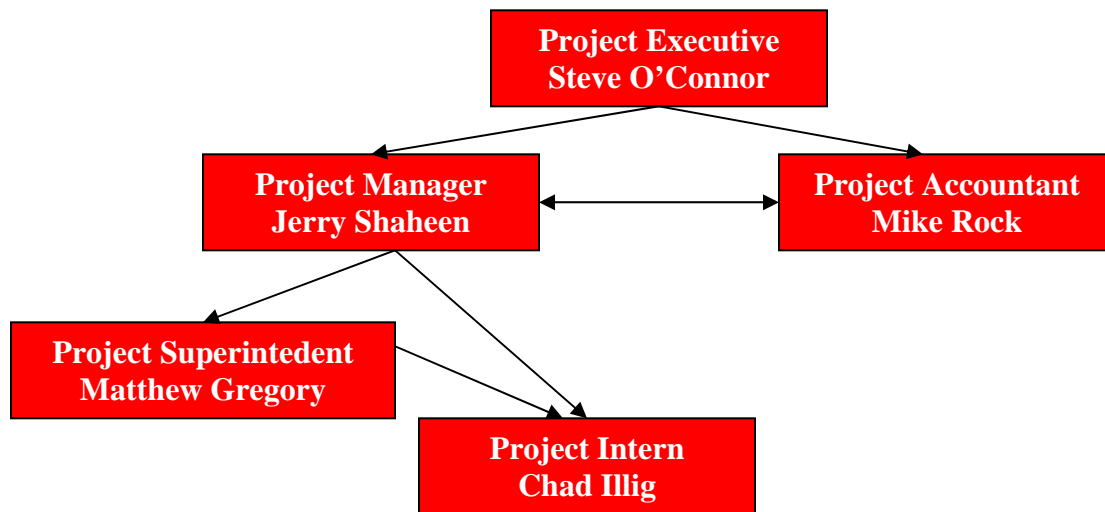
The bidding process began with a list of pre-qualified bidders developed by Penn State. Only companies who were on this list were able to assemble an estimate and bid on the project. There were enough bids for each scope of work to cause a competitive bid

process. The bids were then reviewed and the lowest bidding contractor was awarded a contract.

Bonds required for this project were bid bonds of 5%, performance bonds and labor and material bonds. Each subcontractor was responsible for their own insurance. The insurance was to cover the following:

- 1.) Statutory workers' compensation
- 2.) Commercial General Liability
- 3.) Automobile Liability
- 4.) Excess Umbrella Liability

Staffing Plan



Gilbane's structure for project management on the Rec Hall project is lead by the project executive. The project executive oversees all Gilbane jobs in the State College area, currently consisting of four projects. Directly under the project executive is the project accountant and project manager. The project accountant is also involved with all four projects in the State College area. The project manager is solely assigned to the Rec Hall project. He spends the majority of his time in the company trailer located on-site tending to submittals, RFI's and communication with the owner. The project superintendent focuses on overseeing the construction work being performed on a day to day basis. He assures quality is of standard, safety practices are in place as well as work is being performed on schedule.