Executive Summary

Technical Assignment Two is a comprehensive report that investigates the difficult construction parameters associated with the Susquehanna Health Patient Tower Expansion. This 243,000 SF expansion to the Williamsport Hospital and Medical Center is a unique project that presented its own set of difficult problems which tested the construction manager as well as the design team. Hospitals are extremely sensitive places that demand the greatest level of care when operating in and around them. The location of this project is one of the main factors that decided not only how it would be constructed, but also how it would be designed.

During construction, the existing hospital will be fully operational and it is absolutely imperative that construction does not disturb any of its functions or activities. It is the intent of this report to further examine the existing conditions as well as take a more in-depth look at the ***site logistics*** that were introduced in Technical Assignment One. This site logistic study will provide information regarding crane location, critical construction and hospital traffic, spoils storage, and material lay down areas. Trades that have the greatest impact on the site logistic plan will also be examined. In this technical report it was discovered that the ambulance traffic was a major site logistical issue for the construction manager. It was concluded that the mobile cranes used on this project where the direct reason for closing a road that is critical to emergency services. As on any project, the site logistics directly affect how and when each trade will perform their work. This report will also include a ***detailed schedule*** so that the sequencing of work as well as the time frame in which it must be completed can be better understood. Similar to the site logistic study, activities that have the greatest potential impact to the schedule will be examined more thoroughly. Some of these activities include the structural and precast construction, as well as the MEP installation.

Like the site logistics and the schedule, the cost of a building can be profoundly impacted by the structural system. Included in this report is a detailed estimate of the structural steel, the concrete footers, and the slab on grade. This ***structural estimate*** will be produced using figures from RS Means CostWorks and the later compared with the actual costs of the building. These results showed that RS Means is an ineffective way to estimate a project. The result from these estimates also concluded that the structural steel framing on the third level of the building was significantly more expensive than on any other floor. In addition to the structural estimate, a ***general conditions estimate*** will outlined to project costs for supervision/personnel, construction facilities/equipment, temporary utilities and miscellaneous project costs. The last and final item that this report will cover is a brief summary of a critical issue in the industry. This topic will come from one of the discussions at the 2010 PACE Roundtable meeting held on October, 27, 2010.

After compiling research from Technical Assignment One as well as Technical Assignment two, the major focus for future research will then be geared toward schedule acceleration and discovering new methods of construction that limit the impact to the functions of the existing hospital.

Table of Contents

Detailed Project Schedule

***See APPENDIX A for the detailed schedule**

The construction of this project was scheduled and sequenced to maximize the amount of manpower while at the same time providing the quickest turnover date. L.F. Driscoll officially signed their contract with Susquehanna Health on 12/30/2008 and began actual construction on 10/22/2009. Two months prior to signing their contract, L.F. Driscoll was issued all of the design documents and has only had two reissues since then.

As discussed in Technical Assignment One, this project was the third and final major phase of construction for Susquehanna Health's Project 2012 initiative. The first and second major phases of construction included the new central utility plant and the mechanical chase way that connects the central utility plant to the existing hospital. Construction for the Patient Tower Expansion could not begin until both of these projects were completed. The flow of work for this project moves from East to West for almost every bid package on this job. Because there are a number of smaller subcontractors (relative to project size), maximizing the amount of manpower on the job site was imperative. To maximize the effectiveness of this smaller workforce, this project was divided into two separate regions as illustrated by ***Figure 1.*** Dividing the project like this allows the larger subcontractors to continue with their work without interfering by the smaller ones. From the beginning, the amount of manpower that was at the mechanical subcontractor disposal was always an area of concern for L.F. Driscoll. Dividing the project into eastern and western zones allows other trades to be able to work around the mechanical subcontractor in the event that they fall behind schedule.

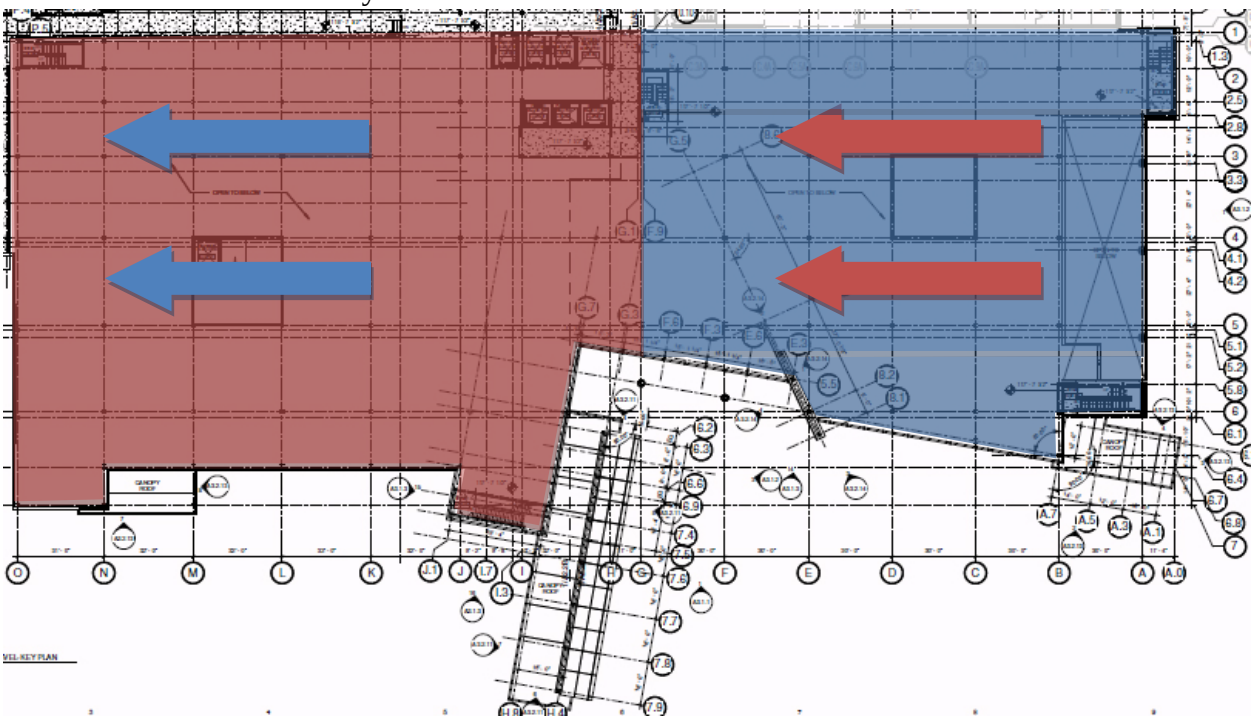

Figure 1: Steel Erection, Concrete, and Mechanical Sequence

Repetition of the sequencing of trades is also another way that the construction management team is trying to ensure that the building is delivered on time. As shown on the detailed schedule, most floors follow the same repetitive sequencing, coordination, and time frames. Commissioning will begin on September 1, 2011 and last roughly two months. The entire project is to be completed on February 2, 2012 and is to be fully occupied by March 16, 2012.

Site Layout Planning

***See APPENDIX B for Site Logistic Plans**

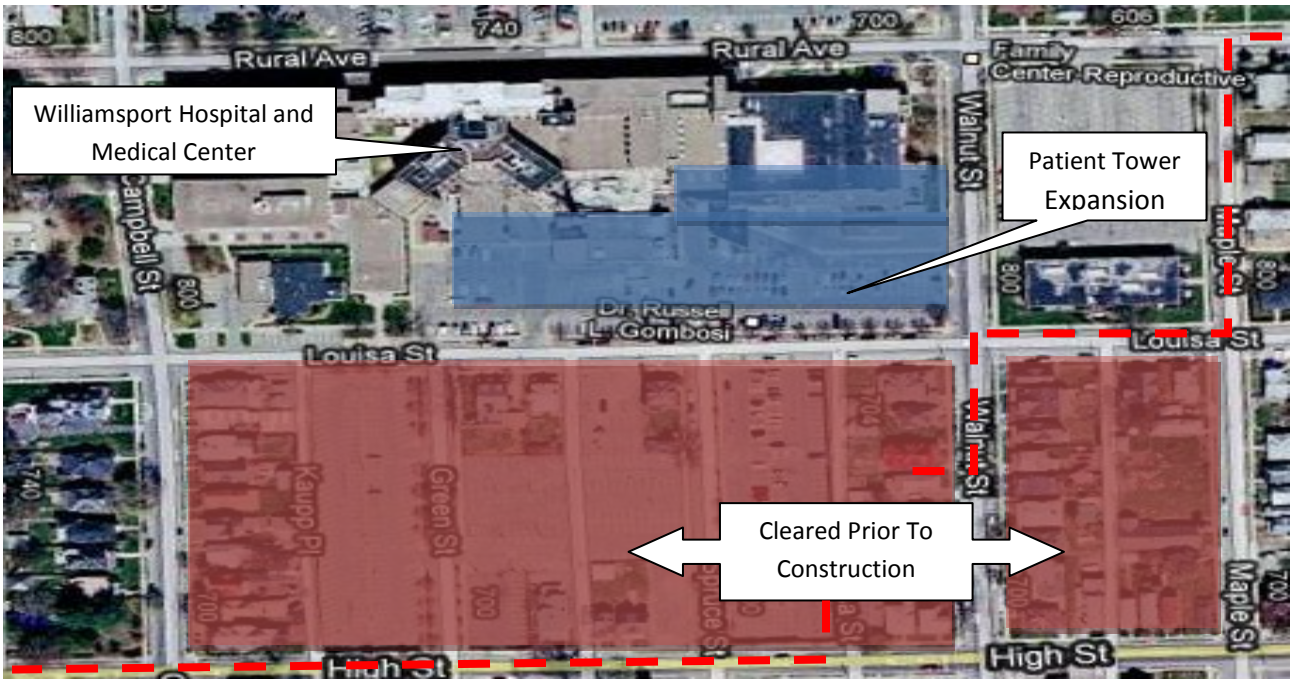

Figure 2 Construction Traffic
Image Provided by Google Earth

The Patient Tower Expansion is located adjacet to the Williamsport Hospital and Medical Center and ties into the newly constructed Central Utility Plant. Because hospitals need a vast amount of utilties, the subsurface investigation of all these lines becomes a bit of a problem. Gas, water, storm and sanitary lines run all throughout the site. All existing electrical lines run through the Central Utiliy Plant and ties in directly to the first floor electrical room of the Patient Tower's core. Although this is not the most active side of the Williamsport Hospital, the area in which the project is located is critical to the staff and patients that park there. Auxillary parking around the hospital will be used to acomidate most motorists; however, L.F. Driscoll will provide some teporary parking to help aliviate some of the parking demands. One of the most critical traffic plans is the ambulence acess to the emergency department located on the northeatern side of the Williamsport Hospital. Due to material deliveries and crane placement, the section of Walnut St. between Rurual Ave. and Louisa St. must be closed off. This presents a couple complications that will later be adressed. All site deliveries are to be delivered from Walnut St. Because the front of the hospital is the most active zone, delivery trucks and subcontrators are not permitted to drive in front it. All site personell are encouraged to use High St. as much as possible when entering the site and surrounding areas.

SUPERSTRUCTURE LAYOUT

During the superstructure phase, large amounts of materials will be flowing into the site. This is particularly problematic for the hospital's emergency traffic which will have to reroute all ambulances from Walnut St. to Maple St. The site itself has more than enough room to facilitate all the material, trailer, and spoils needs. Steel, concrete, and precast concrete represent the largest amount of the materials that will be entering the site. Out of these three materials, only concrete and structural steel need a considerable amount of laydown area. Precast never touch the ground and are immediately lifted off the truck and installed as soon as they enter the site. To speed the construction and increase the flexibility of the project, two different crawler cranes will be used. Structural steel with be hoisted into place using a 165 ton Demag AC 120 mobile crane and the precast panels will be hoisted into place with a 240 Ton Liebherr LTM 1200-5.1 track crane. Both of these cranes have more than enough reach to make all critical picks for this project.

CONTRACTOR CRITIQUE

L.F. Driscoll has had no problems in dealing with the many site logistical concerns for this project. However, no job that is built near a hospital is ever perfect and can always be improved upon. The ambulance traffic is a critical issue that could be dealt with more effectively than simply closing Walnut St. Due to the heavy precast panel and structural steel picks made on the northeastern side of the building; these cranes had to be located very close to the road. This made Susquehanna Health very nervous about the emergency service traffic and allowed L.F. Driscoll to shut the road down. The construction in that general area also made Susquehanna Health want to close the street as well. Bringing in and utilizing a tower crane would eliminate the need for the crawler crane and thus allowing Walnut St. to be open. However, there was little that could be done to put the owner at ease for the general construction in that area. This was the only area in the site logistics that I feel could be improved upon on this project.

Detailed Structural Estimate

***See APPENDIX C for the Detailed Structural Estimate**

The structure of this building is a steel moment frame with a footing and pier cap foundation system. Tables 1 and 2 below show a summary of the detailed estimate performed. Table 1 shows a cost comparison between the actual cost of each trade and the detailed estimate put together for this technical assignment. As it is clearly seen, each estimate comes in a little short of the actual cost. The estimated CIP concrete system was the least accurate and falls within 23% of the actual cost. The structural steel estimate on the other hand was a little more accurate and fell within 9.7% of the actual cost of the system. Reasons why these numbers differ will be later discussed in this section.

		ACTUAL		ESTIMATED
	TOTAL	$/SF	TOTAL	$/SF
CIP CONCRETE	$3,351,150	$12.24	$2,559,402.66	$10.53
STRUCTURAL STEEL	$4,019,000	16.53	$3,626,623.14	$15.50

Table 1: Actual Cost vs. Estimated Cost

Table 2 is a brief snap shot of the superstructure of the building. All detailed estimates for this project were compiled using RS Means Costworks 2010. From this table it is clearly seen that CIP concrete makes up the largest cost for the structure of this building. CIP concrete is present makes up all of the footings, piers, concrete floors, and the two slab on grades. Steel beams also make up a large part of the cost of the superstructure. As seen in APPENDIX C, the third level is the most costly of any of the other floors. As stated in Technical Assignment 1, the third floor is comprised of neurosurgery and cardiovascular operating rooms. This floor is designed to be extremely seismically isolated. To meet all of the seismic requirements set by the third party consultant, O'Donnell & Naccarato increased beam size as well as the number of beams on this floor.

ESTIMATE SUMMARY		UNIT COST	UNIT	QUANTITY	COST
31100	CONCRETE FORMWORK	$2.50	SFCA	1231.32	$7,695.10
32100	CONCRETE REINFORCING STEEL	$2,973.45	TON	12.45	$37,012.31
33000	CAST-IN-PLACE CONCRETE	$545.76	CY	4607.66	$2,514,695.25
51223	STEEL COLUMNS	$1,882.83	TON	497.60	$936,897.44
51223	STEEL BEAMS	$2,658.50	TON	707.46	$1,880,790.74
53133	STEEL DECKING	$4.60	SF	175779.00	$808,934.96
				TOTAL	$6,186,025.79

Table 2: Superstructure Cost

As stated earlier, there were some were significant differences between the actual and the estimated costs. Some of these errors came from the fact that RS Means does not provide cost data for all the beams on this project. To obtain a reasonable guess as to the price per linear foot, interpolation was used for beams and columns that fell between the two numbers that were provided. For some of the larger beams, a price

was developed from setting up a proportion with the closest sized beam. These methods of obtaining the costs of beams that were not provided by RS Means gives a rough idea of where the cost should be. However, these methods are not exact and do produce some error. The major source of error was seen on the concrete estimate. Part of the error came from the estimates provided by RS Means. The estimate used for the CIP concrete had labor included in the cost. This method was used to test which method was more accurate the included labor or the estimate that separated labor from materials. However, through a survey taken with two concrete subcontractors, the number used was found to be significantly low. The location factors that are built into this program did not list Williamsport, Pennsylvania. The next closest place to get the location factor from was Philadelphia, Pennsylvania which could have produced some incorrect figures. From these estimates, it has been concluded that RS Means is designed to give a rough idea of the cost of a project. However, it should not be used to do detailed estimates in the real world.

General Conditions Estimate

***See APPENDIX D for the General Conditions Estimate**

The general conditions for the Susquehanna Health Patient Tower Expansion are worth roughly $6.7 million, which accounts for 8.5% of the total project costs. Table 3 is a summary of the total general conditions estimate put together for this report. This estimate is based on approximations and does not reflect the actual contract values for this project. The actual contract amount for the general conditions is $6,730,989. This number is slightly higher than the one developed for this report due to the fact that the actual contract amount included such items as office furniture, trivial office supplies, and other non-important items. This estimate focuses on key general condition items and does not include smaller less important items.

LINE ITEM	UNIT RATE	UNIT	QUANTITY	COST
SUPERVISION AND PERSONNEL	$135,760.91	MONTH	35	$4,751,632.00
CONSTRUCTION FACILITIES & EQUIPMENT	$10,178.06	MONTH	35	$356,232.00
TEMPORARY UTILITIES	$5,058.00	MONTH	35	$177,030.00
MISCELLANEOUS COSTS	$40,266.40	MONTH	35	$1,409,324.00
TOTAL	$191,263.37	MONTH	35	$6,694,218.00

Table 3 – General Conditions Estimate Summary

It is the intent of this section of the report to provide a quick snap shot of the general conditions for this project. Therefore, this estimate was broken down into four major categories: Supervision and Personnel, Construction Facilities and Equipment, Temporary Utilities, and Miscellaneous Costs. ***The Supervision and Personnel*** section includes the weekly costs of the twelve major representatives from the construction manager L.F. Driscoll Co. The ***Construction Facilities and Equipment*** section includes the monthly and lump sum costs of the office rental, temporary storage, temporary fire extinguishers, dumpsters and final cleaning, etc. Most of the Temporary Utilities for this project are being provided by Susquehanna Health. As outlined in Technical Assignment One, Susquehanna Health has just purchased a state of the art cogeneration system that has saved them a significant amount of money when it comes to power and other utilities. This intern has driven down the cost of temporary utilities on this project.

As seen in Figure 2, supervision and Personnel accounts for the majority of the general conditions. A more in-depth look at general conditions can be found in Appendix D.

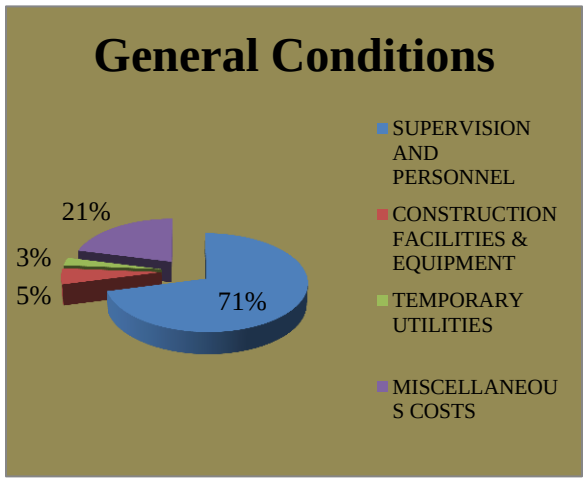

Figure 2: General Conditions Percent Break-Down

Appendix A: Detailed Project Schedule

Appendix A: Site Logistic Plan

Appendix C: Detailed Structural System Estimate

Appendix D: General Conditions Estimate

SUPERVISION & PERSONNEL				
LINE ITEM	UNIT RATE	UNIT	QUANTITY	COST
VICE PRESIDENT	$3,632.36	WEEK	120	$435,883.00
PROJECT EXECUTIVE	$1,164.13	WEEK	125	$145,516.00
SENIOR PROJECT MANAGER	$4,904.71	WEEK	135	$662,136.00
PROJECT MANAGER	$2,815.26	WEEK	152	$427,919.00
PROJECT MANAGER	$2,251.22	WEEK	152	$342,186.00
ASSISTANT PROJECT MANAGER	$2,135.68	WEEK	152	$324,624.00
SENIOR SUPERINTENDENT	$4,811.42	WEEK	152	$731,336.00
SUPERINTENDENT	$4,176.44	WEEK	152	$634,819.00
SAFTEY MANAGER	$2,597.68	WEEK	152	$394,848.00
MEP/BIM COORDINATOR	$2,951.13	WEEK	110	$324,624.00
PROJECT SCHEDULER	$627.79	WEEK	95	$59,640.00
ADMINISTRATIVE ASSISTANT	$1,763.82	WEEK	152	$268,101.00
			TOTAL	$4,751,632.00

CONSTRUCTION FACILITIES & EQUIPMENT				
LINE ITEM	UNIT RATE	UNIT	QUANTITY	COST
TRAILER/OFFICE RENTAL	$2,800.00	MONTH	35	$98,000.00
TEMPORARY SHANTY/STORAGE	$14,800.00	LS	1	$14,800.00
SINAGE	$7,550.00	LS	1	$7,550.00
TEMPORARY FIRE EXTINGUISHERS	$200.00	MONTH	18.5	$3,700.00
TOOLS	$686.00	MONTH	26.5	$17,982.00
FIELD XEROX MACHINE	$2,400.00	MONTH	18.5	$44,400.00
DUMPSTERS & FINAL CLEANING	$425.00	EA	230	$97,750.00
SILT FENCE	$205.71	MONTH	35	$7,200.00
CONSTRUCTION SITE FENCE	$1,285.71	MONTH	35	$45,000.00
JERSEY BARRIERS WITH FENCE	$357.14	MONTH	35	$12,500.00
SAFETY SUPPLIES	$7,350.00	LS	1	$7,350.00
RADIOS	$114.29	MONTH	35	$4,000.00
			TOTAL	$360,232.00

TEMPORARY UTILITIES				
LINE ITEM	UNIT RATE	UNIT	QUANTITY	COST
DRINKING WATER	$264.29	MONTH	35	$9,250.00
ELECTRICAL	$2,158.00	MONTH	35	$75,530.00
TEMPORARY WATER	$158.57	MONTH	35	$5,550.00
TELEPHONE SERVICE	$951.43	MONTH	35	$33,300.00
TEMPORARY TOILETS	$1,277.14	MONTH	35	$44,700.00
SECURITY SYSTEM	$105.71	MONTH	35	$3,700.00
FIELD IT SET-UP	$1,666.67	WEEK	3	$5,000.00
			TOTAL	$177,030.00

MISCELLANEOUS COSTS				
LINE ITEM	UNIT RATE	UNIT	QUANTITY	COST
ICRA PROTECTION	$11,208.00	MONTH	35	$392,280.00
PERMITS	$734.29	MONTH	35	$25,700.00
TRAVEL EXPENSES	$3,839.54	MONTH	35	$134,384.00
MISC. FIELD EXPENSES	$229.34	MONTH	35	$8,027.00
WINTER PROTECTION	$13,333.33	MONTH	15	$200,000.00
BLUEPRINTING	$3,571.03	MONTH	35	$124,986.00
PROGRESS PHOTOS	$628.57	MONTH	35	$22,000.00
DELIVERY/SHIPPING EXPENSES	$350.00	MONTH	35	$12,250.00
INSURANCE	$13,991.34	MONTH	35	$489,697.00
			TOTAL	$1,409,324.00

GENERAL CONDITIONS SUMMARY				
SUPERVISION & PERSONNEL	$135,760.91	MONTH	35	$4,751,632.00
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