Central Bed Tower Expansion

University of Virginia | Charlottesville, VA

Technical Assignment 2

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Construction Management

Executive Summary

For Technical Report 2, a detailed analysis was performed for the construction schedule, structural system estimate, general conditions estimate, LEED/sustainability evaluation, and Building Information Modeling uses. While detailed analyses were performed for specific parts of the Hospital Bed Expansion (HBE), major factors remain to be investigated throughout the entire project.

The project schedule was reconstructed in a detailed form of 124 activities beginning with expected procurement dates for structural steel and the curtain wall system. The schedule reflects repetitive work sequences which were summarized into single floor construction sequences after the first floor of similar construction was detailed. New construction begins with the demolition of proposed renovation space as well as the installation of steel reinforcing. After steel strengthening is complete, the steel framing can begin for the remaining floors from 3-8. Once the steel tops out at the Penthouse Level, the schedule shows the remaining interior construction to begin at the 8th floor working down and out to avoid interference with other trades and finished floors. Following this schedule will lead the construction team to a rate of 2 floors per turnover, starting with the 7th and 8th floors.

Also included in this analysis are the structural systems estimate and general conditions estimate. The structural systems estimate, which includes the steel framing and the concrete elevated floor slabs, is approximately $1,803,418. Due to a lack of cost information for some of the steel reinforcing, a hard number was not achieved for this estimate, but it can be considered to add a significant cost to the final value. The detailed structural estimate breaks down each item that was included in the final number as well as the items that were lacking cost information. The general conditions estimate reached a high of $5,557,668.31. The largest contributor to this value was the project staffing costs combined with insurance and tax rates.

This report also includes LEED and BIM use evaluations. UVA is seeking to achieve 42 points which will categorize the Hospital Bed Expansion with a LEED Gold certification. The design and construction teams have set realistic goals for how they will achieve this honor. Upon reviewing the proposed LEED scorecard, only 4 more potential points could be determined to be realistic goals, but even with these 4 points, HBE would still fall into the Gold category. BIM was not used on the Hospital Bed Expansion, but if it was used, further systems analyses may have been performed to further the goals of LEED credits pursued. Because HBE is such a complex project with renovations tying into a new addition, BIM would have been an excellent tool to help mitigate any impending coordination/phasing issues. The nonlinear schedule could have been linked with a building model to simulate the real time work schedule thus reducing possible complications and missed details in the construction. This is something that UVA should consider further for future projects.

All references can be found in the Appendices.

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Detailed Project Schedule

Because HBE involves renovations of the existing hospital, it is important to create an effective schedule that does not excessively inhibit the daily routines of hospital patrons. In order to avoid such hindrances for the hospital patients and staff, a phased schedule would be advantageous to use. Although the HBE Project Team did not utilize a phasing method for this project, the schedule has been reconstructed so as to effectively explore the possibilities of doing so. Creating a quality schedule is critical in creating a successful project where all parties are pleased.

Because HBE is being built directly on top of the existing hospital lobby, a foundation will not need to be established. However, several existing floors contain steel columns that will need to be reinforced with additional steel angles in order to support the future loads from the expansion and a newly renovated wing. After site mobilization, the project schedule specifies interior demolition of the renovation areas. Following the demolition of each floor will be the installation of steel strengthening. Before the new steel structure can be erected, the column reinforcing must be complete which makes it essential to have the reinforcing done before steel hits the site on September 14, 2009.

New construction primarily begins with the erection and placement of 2nd floor steel framing and elevated slabs. The steel framing begins at the 2nd floor and then works its way up to the penthouse which is then finished prior to the lower floors. Because steel members will be erected at night and picked from the trailers hauling them (there is not laydown room on site for steel), the concrete subcontractor will be able to pour the floor slabs during the day, maintaining a smooth uninterrupted schedule.

The construction team plans to create a real time schedule where the trades are beginning at the 8th floor and working their way down and out of the building so as to prevent the tradesmen from building themselves into a corner as well as preventing the interference of different trades. Before the real time schedule can work, the upper floors will need to finish shell framing before the lower floors.

As the structural framing is still in process, the mechanical and electrical equipment will be installed on the 2nd floor, where extra time will be necessary to create new wiring connections and alter the existing equipment. After hookup, this equipment can then generate power for the other trades on site.

Because the hospital's existing elevators will not be available for the tradesmen's use, a hoist will be installed during structural framing so as other construction workers can be transported vertically through the building and begin their work. Following the method of working from the top of the building to the bottom, tradesmen will begin their work as the 8th floor ends the structural framing process. While looking at the schedule, it may be more feasible to allow tradesmen to begin working from the bottom floors. Once the façade is erected on the respective floors, a faster schedule can be accomplished by releasing the subcontractors earlier rather than later.

After the building gap has been closed and before all of the new interiors are installed on each floor, the renovation process will begin in the existing hospital. Dust walls are placed on the limits of construction

before demolition begins on the existing hospital. This schedule should result in the renovation area and bed expansion areas being in sync with their trade packages.

As the interiors are being finished, the elevators can then be installed. After the elevators are operational, the hoist can be removed so that the remaining pieces of curtain wall can be installed.

After interiors and mechanical connections are made, the commissioning process can begin on each floor. See Appendix A for the schedule.

Detailed Structural Systems Estimate

The structural system of HBE utilizes typical construction elements and design methods to achieve a stable foundation. Structural steel columns and members frame the new wing with cast-in-place (CIP) concrete acting as the floor system. Welded Wire Fabric (WWF) will serve as reinforcement for the flooring system, reducing the need for larger steel reinforcing bars (rebar). Hollow Steel Sections (HSS) frame the exterior of each floor slab which will later serve as the support system for a glass curtain wall. The HSS exterior frame was not included in this estimate due to the lack of consistency with the main steel structure.

As mentioned earlier, column reinforcing is an important aspect of this project as there is no new foundation being built. Column reinforcing is prevalent on the ground floor, 1st and 2nd floors, and the mechanical space 2M. Primarily, three different sizes of steel angles were used for column reinforcing: L8x8x1, L6x6x1, and L6x6x5/8. Although the columns have differing details that reference the method of installing new steel angles, the plate sizing will not vary outside of the three that were given. Using the steel manual, total weight in tons was found for each of these steel angles. A corresponding value could not be found in RS Means, therefore the total cost of these angles were not included in the total estimate.

Because the 2nd floor will be reserved for mechanical and electrical equipment, a different layout was assigned in order to carry the extra loading (See Drawing S1.4). The 2nd floor boasts the largest steel members for the project with sizes ranging from (2) W12x14 to (6) W36x441. The mechanical floor owns the title of "highest cost per floor" while possessing the heaviest/largest steel beams and a thick detailed floor system. The floor system consists of 6" normal weight concrete poured over a 3", 20 gage galvanized composite steel decking with 4x4 W4.0xW4.0 WWF utilized for tensile reinforcing. The floor consists of bays with the concrete sloping to a drain in the middle of each bay. This floor estimate was calculated as a flat slab to take into account expected concrete waste.

Floors 3-8 + roof are similar with a few variations (See Drawing S1.6). Floors 4,5,7,8 will be identical in reference to steel framing and floor systems. The steel members range a much smaller scale as compared to the 2nd floor. With the smallest beam being a W10x12 the largest beam only sizes to a W24x131 (small in comparison to W36x441). The elevated slab is 4 ½" lightweight concrete poured over 2", 20 gage galvanized composite steel decking with 4x4 W4.0xW4.0 WWF utilized for tensile reinforcing. Each floor contains five large and two small 4" depressed slabs to accommodate space for the bathrooms. Each main patient floor also has WT10.5x28.5 girders to reinforce the existing girders. These girder reinforcements were not considered in this estimate due to lack of cost information from RS Means.

The 3rd floor estimate only deviates from the typical floor estimate in the elevated slab. Rather than 4 ½" light weight concrete, the 3rd floor utilizes a 6" normal weight concrete poured over a 3",20 gage galvanized composite steel decking.

The 6th floor maintains the same characteristics of the typical floor framing but also includes an additional floor space (See Drawing S1.5). The 6th floor has an extra 5066 sq. ft. of floor space that is being framed. This space is an existing lobby that needs to be further framed and reinforced in order to accommodate the new patient program.

The steel columns are spliced at every 14' floor height.

There were a number of nontraditional beam and column sizes used throughout this project. In order to find an accurate cost from R.S. Means, the values were interpolated or averaged using information from supplied cost information, an assumed O&P percentage of 15% was used. Accessories such as concrete forming, steel bolts, and connection plates were not included in the estimate, as it was considered that these items would have a negligible cost associated with them.

Shear studs were not included in the estimate due to lack of cost information from R.S. Means.

A current estimated cost for the structural system is $2,011,444.76. If the steel angles, HSS framing, and WT reinforcing girders were to be included, it is expected that this dollar amount would increase above $2,300,000.00 which falls within 16% of the typical cost for shell construction on a 60,000 square foot hospital project (See Tables 1 and 2). The current project cost for HBE well exceeds a typical hospital project of this size. It is anticipated that the actual cost for the steel package well exceeds the typical $2,760,000 value due to the phasing complications and work schedule requirements set forth by the hospital.

Table 1 shows the structural systems summary estimate

Summary			$ 2,011,444.76
Steel Strengthening			
Description	Weight	Quantity (tons)	Total O&P
L8 x 8 x 1	51 lbs/ft	45.696	10%
L6 x 6 x 5/8	24.2 lbs/ft	46.0768	10%
L6 x 6 x 1	37.4 lbs/ft	12.5664	10%
Level 2M			$ 282,673.14
Description	Units	Quantity	Total O&P
Steel Members	L.F.	923.5	$ 254,248.56
Steel Deck	S.F.	5376	$ 19,407.36
Concrete	C.Y.	150	$ 3,802.50
WWF	C.S.F.	54	$ 5,214.72
Level 4,5,7,8 (Typical)			$ 189,559.77
Description	Units	Quantity	Total O&P
Steel Members	L.F.	2304	$ 164,633.25
Steel Deck	S.F.	5661	$ 16,699.95
Concrete	C.Y.	94	$ 2,735.40
WWF	C.S.F.	57	$ 5,491.17
Level 3			$ 190,550.82
Description	Units	Quantity	Total O&P
Steel Members	L.F.	2304	$ 146,166.98
Steel Deck	S.F.	5661	$ 16,699.95
Concrete	C.Y.	147	$ 3,726.45
WWF	C.S.F.	57	$ 5,491.17
Level 6			$ 276,612.11
Description	Units	Quantity	Total O&P
Steel Members	L.F.	3245.5	$ 229,091.47
Steel Deck	S.F.	10727	$ 31,644.65
Concrete	C.Y.	188	$ 5,470.80
WWF	C.S.F.	107.27	$ 10,405.19
Columns			$ 313,809.84
Description	Units	Quantity	Total O&P
Columns	L.F.	1811	$ 313,809.84

* Values provided do not indicate the actual cost for structural systems.*

** The full detailed estimate can be found in appendix B

Table 2 shows the estimate breakdown of the HBE

Building Component	% of Total Building	RS Means SQFT Estimate	Actual SQFT Cost
Substructure	2.20%	$ 264,000.00	$ 1,210,000.00
Shell	23.00%	$ 2,760,000.00	$ 12,650,000.00
Interiors	2.02%	$ 242,400.00	$ 1,111,000.00
Elevators & Lifts	2.60%	$ 312,000.00	$ 1,430,000.00
Plumbing Fixtures	2.80%	$ 336,000.00	$ 1,540,000.00
Water Distribution	7.30%	$ 876,000.00	$ 4,015,000.00
Rain Water Drainag	0.75%	$ 90,000.00	$ 412,500.00
Energy Supply	1.40%	$ 168,000.00	$ 770,000.00
Heat Generating Systems	1.60%	$ 192,000.00	$ 880,000.00
Cooling Generating Systems	1.20%	$ 144,000.00	$ 660,000.00
Other Systems	11.60%	$ 1,392,000.00	$ 6,380,000.00
Sprinklers	1.00%	$ 120,000.00	$ 550,000.00
Standpipes	0.40%	$ 48,000.00	$ 220,000.00
Electrical Service/Distributior	5.90%	$ 708,000.00	$ 3,245,000.00
Lighting and Branch Wiring	7.70%	$ 924,000.00	$ 4,235,000.00
Communication and Security	0.80%	$ 96,000.00	$ 440,000.00
Equipment & Furnshings	7.40%	$ 888,000.00	$ 4,070,000.00
Total		$ 9,560,400.00	$ 43,818,500.00
Cost/SQFT		$ 200.00	$ 916.67

Percentages provided are strictly based off of the RS Means SQFT estimate and do not reflect actual building costs.

General Conditions Estimate

The General Conditions Estimate includes items to be covered by Gilbane/Russell acting as the CM Agent for UVA. As the CM agent, Gilbane/Russell will include items into the general conditions that will only affect the current CM agent staffing. Because of this, the majority of general conditions' hard numbers for HBE will be composed of the field personnel salaries. The cost information taken from R.S. Means for field personnel adds up to $1,970,475 for the estimated 124 lined schedule duration. R.S. Means line items were chosen based upon the seniority of each field office personnel.

Other hard number line items included in the general conditions are the trailer rental, office equipment, office supplies, water, telecomm, lights & HVAC, small tools, barricades, fencing, signs, and site cleanup. Gilbane/Russell may not include some of these items in the actual general conditions as they typically would place these items with the general contractor on site. The general contractor may also own barricades and fencing for the jobsite.

Gilbane/Russell will carry insurance and bonding for the entire project and subcontractors.

There are aspects of the project that will be bought under the general contractor for HBE. Portable toilets, dumpsters, and site fencing will be included in the general contractor's bid package.

After the hard numbers have been calculated, and summed to equal $3,430,293.31, commissioning and contingency percentages were added into the subtotal. The percentages for commissioning and contingency were based upon the total project cost. Because a hard number for the total project cost could not be accurately determined, the square foot estimate cost was used. For the 130,000 s.f. addition/renovation, R.S. Means estimated the project would cost around $23.5 million based upon historical data. The estimated percentages for Commissioning and Contingency were multiplied by $23.5 million and then added to the subtotal of $3,430,293.31. The total cost for General Conditions is then estimated to be $5,557,668.31.

After all of the percentages have been added into the general conditions, a total GC value is $5,557,668.31. Time and City Index adjustment factors have not yet been taken into consideration from R.S. Means Costworks. See Appendix E for the complete general conditions estimate.

LEED Evaluation

The University of Virginia has designed the Hospital Bed Expansion to achieve a LEED Gold rating. Contributing to this accreditation are innovative design ideas and strict guidelines for construction waste.

UVA is expecting to receive (9) credits for Sustainable Sites with a possibility of (4) additional credits. The projected awarded points are realistic and should be easily obtained with the roof renovation and construction. Because the project site is in a city-like area, it would be hard to expand upon brownfield redevelopment unless a lot of time and thought is put into how to achieve this with such a limited area. It might be unrealistic to hope for the Alternative Transportation, Low-Emitting and Fuel-Efficient Vehicles credit. If UVA were to achieve this, there would need to start an initiative across all of the hospital staff to drive different cars; it's possible that this could be done in the future, but more time will need to be dedicated to the process.

(4) out of (5) credits are being attempted for Water Efficiency. Innovative Wastewater Technologies should be further researched by the designer, as there are a few simplistic methods that could prove beneficial in achieving this credit for a limited cost.

The majority of points for Energy & Atmosphere are not being attempted; only 5 points are being attempted and none are in the possible category. This credit category has much potential for HBE. There is room for on-site renewable energy sources on the hospital; cost for solar panels should be researched to weigh the cost of materials and installation versus long term operating costs. If the facilities management were to take time and measure the rate of energy usage, it would be easy to achieve the Measurement & Verification point.

The Materials & Resources category has an appropriate amount of points being sought after. The only extra credit that may be worthwhile to pursue is Materials Reuse (5%) from the existing hospital. It may be difficult to find materials that are able to salvaged, but it is something that should be considered before disposing of all equipment and cabinets.

The most points of any category are being sought after in the Indoor Environmental Quality category. Because carpet systems are not being used for the addition or renovation, the corresponding point cannot be achieved. The IAQ management plan will require documentation throughout the project of ductwork that is being protected from dust and other resins.

It is expected that HBE will earn all Innovation & Design points. This is something that will need to be monitored throughout the project, but is should be easily attained.

There are only a few additional credits are considered to be worthwhile in pursuing. On-Site Renewable Energy is something that should be considered by the design and construction team as well as Measurement & Verification, and Materials Reuse (5%). This would only increase the LEED rating by 4

points which will not be enough to reach the Platinum rating, but it is still worthwhile to chase these points in order to exhaust all possible ways of achieving a zero energy footprint.

The LEED scorecards can be found in Appendix D.

			Current LEED Summary
Yes	?	No	Category
9	4	1	Sustainable Sites
4		1	Water Efficiency
5		12	Energy & Atmosphere
8		5	Materials & Resources
11		4	Indoor Environmental Quality
5			Innovation & Design Process
42	4	23	Project Totals

Table 3 shows the current LEED point summary

			Projected LEED Summary
Yes	?	No	Category
9	3	2	Sustainable Sites
5			Water Efficiency
8		9	Energy & Atmosphere
8	1	4	Materials & Resources
11		4	Indoor Environmental Quality
5			Innovation & Design Process
46	4	19	Project Totals

Table 4 shows the proposed LEED point summary

Building Information Modeling Use Evaluation

Despite the coordination challenges, the Building Information Modeling (BIM) process does not play an integral part, if it is used at all, in the progress of HBE. As mentioned earlier, HBE has many impending coordination and phasing issues involved. Considering this, the benefits in using BIM for this project outweigh the cost of implementing the process considerably. The surrounding hospital building projects should also utilize BIM in order to alleviate the coordination issues amongst all of the construction. Using BIM would not only aid in the mitigation of lost time for construction phasing, but if used during design, it could also benefit the structural engineer in analyzing the appropriate existing steel members that would need to be reinforced. The mechanical and electrical engineers would also benefit from the systems analyses, as they would then see the details of tie-ins for the existing fixtures.

The seemingly biggest benefit in using BIM for construction would be the phasing of construction sequences and turnover sequences. As seen in the schedule explanation, the work sequence is not linear and by no means simple. If the building model could be linked with the schedule, inefficiencies could be found and resolved before even moving into the field.

It is a complicated process when hospitals move into their new space while buying new hospital equipment. It would be best if the owner could work with the construction manager to make the turnover as smooth as possible.

After construction, when the hospital is turned over to UVA, the compilation of these models and data would be given to the owner who would then have a useful tool in maintaining the hospital systems.

If BIM were to be implemented on HBE, there is not necessarily a need for every aspect of the process map (See Appendix H). To initiate the process, the building program will be developed by the owner; soon after, the architect will begin schematic designs. In this stage it would be useful to develop a rough cost estimation to give the owner/designers an idea of the project cost. Virtual prototypes can be created with an engineering analysis to compare alternative engineering systems. Once Design Development begins, cost estimation does not become a vital factor for UVA. However, a 3D model can be used amongst the designers to mitigate the instances of system discrepancies. During the construction phase, the cost estimation becomes an important factor again, and the 4D model is introduced with a virtual model and integrated schedule. After completion of the project, all of the model information can be compiled for the owner's use after construction.

PRIORITY (HIGH/ MED/ LOW)	GOAL DESCRIPTION	POTENTIAL BIM USES
High	Eliminate design clashes prior to moving into construction	3D Coordination
High	Run systems analyses to improve system designs for potential LEED credits	System Analyses
Med	Phased site plans to allow planning for smooth transitions of phased construction	Site Use Planning
High	Phased schedule and model to ensure the most efficient work sequence and tie in cost to materials	3D Coordination/ Phase Planning/Cost Estimation
Low	Operator's building information	Building Maintenance Scheduling/Record Modeling

Table 5 shows the proposed goals using BIM

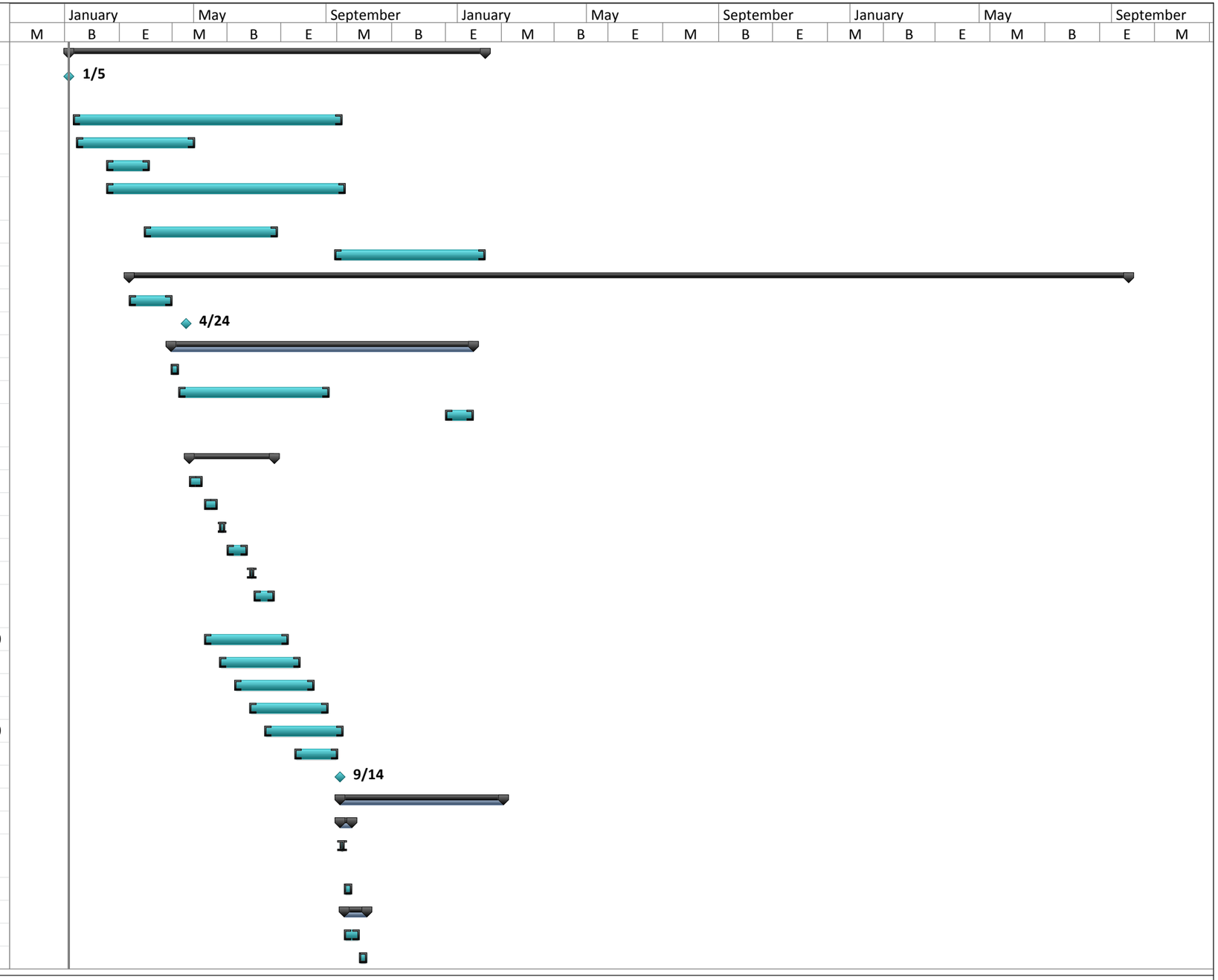
**The BIM tables and process map were taken from the Penn State BIM Execution Plan.

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
x	PROGRAMMING	x	DESIGN AUTHORING	x	SITE UTILIZATION PLANNING	x	BUILDING MAINTENANCE SCHEDULING
x	SITE ANALYSIS	x	DESIGN REVIEWS		CONSTRUCTION SYSTEM DESIGN		BUILDING SYSTEM ANALYSIS
		x	3D COORDINATION		3D COORDINATION	x	ASSET MANAGEMENT
		x	STRUCTURAL ANALYSIS		DIGITAL FABRICATION	x	SPACE MANAGEMENT / TRACKING
		x	LIGHTING ANALYSIS	x	3D CONTROL AND PLANNING		DISASTER PLANNING
		x	ENERGY ANALYSIS		RECORD MODELING	x	RECORD MODELING
		x	MECHANICAL ANALYSIS				
			OTHER ENG. ANALYSIS				
		x	SUSTAINABLITY (LEED) EVALUATION				
			CODE VALIDATION				
x	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)	x	PHASE PLANNING (4D MODELING)		PHASE PLANNING (4D MODELING)
	COST ESTIMATION	x	COST ESTIMATION		COST ESTIMATION		COST ESTIMATION
	EXISTING CONDITIONS MODELING	x	EXISTING CONDITIONS MODELING	x	EXISTING CONDITIONS MODELING		EXISTING CONDITIONS MODELING

Table 6 shows the proposed BIM Use Plan

Appendix A – Detailed Project Schedule

ID	Task Name	Duration	Start	Finish
1	**Procurement**	**277 days**	**Mon 1/5/09**	**Tue 1/26/10**
2	Structural Steel and Curtain Wall Purchased	0 days	Mon 1/5/09	Mon 1/5/09
3	Prepare Structural Steel Shop	178 days	Fri 1/9/09	Tue 9/15/09
4	Prepare CW Shops/Embed	80 days	Mon 1/12/09	Fri 5/1/09
5	Fabricate Trusses/Beams	30 days	Mon 2/9/09	Fri 3/20/09
6	Fabricate Deck/Misc. Structural Members	160 days	Mon 2/9/09	Fri 9/18/09
7	Approve Structural Steel Shop	90 days	Mon 3/16/09	Fri 7/17/09
8	Fabricate Curtain Wall System	100 days	Wed 9/9/09	Tue 1/26/10
9	**New Construction**	**665 days**	**Mon 3/2/09**	**Fri 9/16/11**
10	Job Set Up	30 days	Mon 3/2/09	Fri 4/10/09
11	Owner Move-Out	0 days	Fri 4/24/09	Fri 4/24/09
12	**Penthouse**	**201 days**	**Fri 4/10/09**	**Fri 1/15/10**
13	Set Equipment Pad	5 days	Fri 4/10/09	Thu 4/16/09
14	Interior Penthouse MEP	100 days	Fri 4/17/09	Thu 9/3/09
15	Install & Connect AHU-1, AHU-2	20 days	Mon 12/21/09	Fri 1/15/10
16	**8th Floor (Typical)**	**57 days**	**Mon 4/27/09**	**Tue 7/14/09**
17	Construct Dust Partition	10 days	Mon 4/27/09	Fri 5/8/09
18	Demo MEP/Cut N Cap	10 days	Mon 5/11/09	Fri 5/22/09
19	Demo Existing Exterior	5 days	Mon 5/25/09	Fri 5/29/09
20	Demo Existing Int.	15 days	Mon 6/1/09	Fri 6/19/09
21	Install Temp Electric	4 days	Mon 6/22/09	Thu 6/25/09
22	Install Structural Steel Reinforcing	13 days	Fri 6/26/09	Tue 7/14/09
23	**7th Floor (Typical)**	**56 days**	**Mon 5/11/09**	**Mon 7/27/09**
24	**6th Floor (Typical)**	**55 days**	**Mon 5/25/09**	**Fri 8/7/09**
25	**5th Floor (Typical)**	**54 days**	**Mon 6/8/09**	**Thu 8/20/09**
26	**4th Floor (Typical)**	**53 days**	**Mon 6/22/09**	**Wed 9/2/09**
27	**3rd Floor (Typical)**	**53 days**	**Mon 7/6/09**	**Wed 9/16/09**
28	Prepare Building Pad	30 days	Mon 8/3/09	Fri 9/11/09
29	Steel Hits Site	0 days	Mon 9/14/09	Mon 9/14/09
30	**Structure**	**110 days**	**Mon 9/14/09**	**Fri 2/12/10**
31	**2M Floor**	**9 days**	**Mon 9/14/09**	**Thu 9/24/09**
32	Install Stub Columns and Decking	4 days	Mon 9/14/09	Thu 9/17/09
33	Pour Deck 2M	5 days	Fri 9/18/09	Thu 9/24/09
34	**3rd Floor**	**15 days**	**Fri 9/18/09**	**Thu 10/8/09**
35	Steel Structure and Deck	10 days	Fri 9/18/09	Thu 10/1/09
36	Pour Deck	5 days	Fri 10/2/09	Thu 10/8/09



Project: Updated Schedule
Date: Fri 12/9/11

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline	
Split	External Tasks	Inactive Summary	Manual Summary	Progress	
Milestone	External Milestone	Manual Task	Start-only		
Summary	Inactive Task	Duration-only	Finish-only		

ID	Task Name	Duration	Start	Finish
37	**4th Floor (Typical)**	**17 days**	**Fri 10/2/09**	**Mon 10/26/09**
38	Steel Structure and Deck	10 days	Fri 10/2/09	Thu 10/15/09
39	Pour Deck	7 days	Fri 10/16/09	Mon 10/26/09
40	**5th Floor (Typical)**	**17 days**	**Fri 10/16/09**	**Mon 11/9/09**
41	**6th Floor (Typical)**	**16 days**	**Fri 10/30/09**	**Fri 11/20/09**
42	**7th Floor (Typical)**	**16 days**	**Thu 11/12/09**	**Thu 12/3/09**
43	Spray Fireproof	60 days	Mon 11/23/09	Fri 2/12/10
44	**8th Floor (Typical)**	**17 days**	**Wed 11/25/09**	**Thu 12/17/09**
45	**Penthouse (Typical)**	**10 days**	**Mon 12/7/09**	**Fri 12/18/09**
46	Install MEP Risers	30 days	Thu 12/17/09	Wed 1/27/10
47	**High Roof**	**28 days**	**Mon 12/14/09**	**Wed 1/20/10**
48	Steel Structure and Deck	23 days	Mon 12/14/09	Wed 1/13/10
49	Penthouse Roof Curbs	5 days	Thu 1/14/10	Wed 1/20/10
50	**Low Roof**	**13 days**	**Wed 1/13/10**	**Fri 1/29/10**
51	Steel Structure and Deck	8 days	Wed 1/13/10	Fri 1/22/10
52	Pour Deck	5 days	Mon 1/25/10	Fri 1/29/10
53	Top Out	0 days	Fri 1/22/10	Fri 1/22/10
54	**Façade**	**331 days**	**Mon 1/25/10**	**Mon 5/2/11**
55	Installation of Hoist	1 day	Mon 1/25/10	Mon 1/25/10
56	Curtain Wall Construction Front	57 days	Tue 1/26/10	Wed 4/14/10
57	Penthouse Façade	20 days	Thu 4/15/10	Wed 5/12/10
58	Install Metal Panels East corners	10 days	Mon 4/26/10	Fri 5/7/10
59	Install metals Panels West Corners	10 days	Mon 5/3/10	Fri 5/14/10
60	Removal of Hoist	1 day	Mon 4/11/11	Mon 4/11/11
61	Complete East/West Curtainwall	15 days	Tue 4/12/11	Mon 5/2/11
62	**Roof**	**30 days**	**Tue 1/26/10**	**Mon 3/8/10**
63	Roofing	30 days	Tue 1/26/10	Mon 3/8/10
64	**New Interior**	**510 days**	**Mon 10/5/09**	**Fri 9/16/11**
65	**2M Floor**	**171 days**	**Mon 10/5/09**	**Mon 5/31/10**
66	Layout for New Interior	1 day	Fri 10/9/09	Fri 10/9/09
67	Above Ceiling Mech R/I	50 days	Mon 10/12/09	Fri 12/18/09
68	Above Ceiling Elec R/I	70 days	Mon 10/12/09	Fri 1/15/10
69	Above Ceiling Plumbing R/I	17 days	Mon 10/12/09	Tue 11/3/09
70	FRP Equipment Pads	7 days	Mon 10/5/09	Tue 10/13/09
71	Set Switchgear	6 days	Mon 10/26/09	Sat 10/31/09
72	Ext. Framing for New Int.	12 days	Mon 12/14/09	Tue 12/29/09

Project: Updated Schedule
Date: Fri 12/9/11

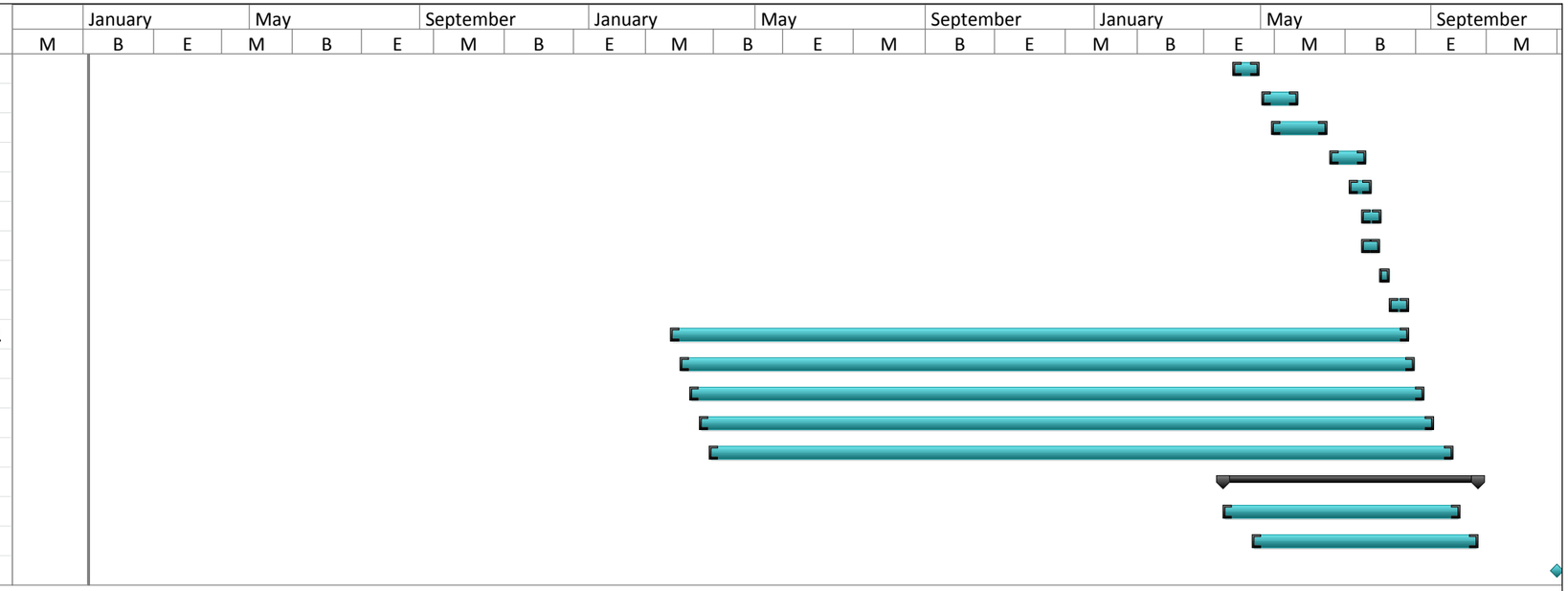
Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

ID	Task Name	Duration	Start	Finish
73	In-Wall Elec R/I	20 days	Tue 3/9/10	Mon 4/5/10
74	Frame Drywall Partition	10 days	Tue 4/20/10	Mon 5/3/10
75	Framing Inspection	2 days	Tue 5/4/10	Wed 5/5/10
76	Close In- Inspection	2 days	Thu 5/6/10	Fri 5/7/10
77	Hang Sheet Rock	5 days	Mon 5/10/10	Fri 5/14/10
78	Frame/Hang Drywall Ceilings	11 days	Mon 5/17/10	Mon 5/31/10
79	Float, Tape & Finish Sheet Rock	5 days	Mon 5/17/10	Fri 5/21/10
80	**8th Floor (Typical)**	**386 days**	**Mon 2/22/10**	**Mon 8/15/11**
81	Layout for New Interior	7 days	Mon 2/22/10	Tue 3/2/10
82	Electric Feeders	16 days	Wed 3/3/10	Wed 3/24/10
83	Above Ceiling Elec R/I	80 days	Thu 3/25/10	Wed 7/14/10
84	Above Ceiling Mech R/I	74 days	Mon 5/24/10	Thu 9/2/10
85	Frame Drywall Partition	38 days	Tue 6/1/10	Thu 7/22/10
86	Above Ceiling Plumbing R/I	64 days	Mon 6/14/10	Thu 9/9/10
87	Install Pneumatic Tube	10 days	Mon 6/28/10	Fri 7/9/10
88	Install Hollow metal Door Frames	1 day	Fri 7/23/10	Fri 7/23/10
89	Framing Inspection	2 days	Mon 7/26/10	Tue 7/27/10
90	Frame Drywall Ceilings	15 days	Wed 7/28/10	Tue 8/17/10
91	In-Wall Mech R/I	30 days	Mon 8/9/10	Fri 9/17/10
92	In-Wall Elec R/I	50 days	Mon 8/9/10	Fri 10/15/10
93	In-Wall Plumbing & Med Gas R/I	30 days	Mon 8/9/10	Fri 9/17/10
94	Overhead M&P Insulation	30 days	Mon 8/9/10	Fri 9/17/10
95	Above Ceiling Inspection	2 days	Thu 9/9/10	Fri 9/10/10
96	Hang Drywall Ceilings	10 days	Mon 9/13/10	Fri 9/24/10
97	In-Wall M&P Insulation	15 days	Mon 9/6/10	Fri 9/24/10
98	Close In- Inspection	2 days	Thu 9/23/10	Fri 9/24/10
99	Hang Drywall	15 days	Mon 9/27/10	Fri 10/15/10
100	Float, Tape & Finish Sheet Rock	15 days	Mon 10/18/10	Fri 11/5/10
101	Elevators	70 days	Mon 11/8/10	Fri 2/11/11
102	Install Med Gas Manifold	1 day	Mon 11/8/10	Mon 11/8/10
103	Prime & First Coat Paint	8 days	Mon 2/14/11	Wed 2/23/11
104	Devices & Plates	19 days	Thu 2/24/11	Tue 3/22/11
105	Registers/Grilles/Diffusers	15 days	Wed 3/23/11	Tue 4/12/11
106	Light Fixtures	21 days	Wed 3/23/11	Wed 4/20/11

Project: Updated Schedule
Date: Fri 12/9/11

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

ID	Task Name	Duration	Start	Finish
107	Ceramic Tile	15 days	Mon 4/11/11	Fri 4/29/11
108	Plumbing Fixtures	20 days	Mon 5/2/11	Fri 5/27/11
109	Casework/Countertops	30 days	Mon 5/9/11	Fri 6/17/11
110	Owner Systems	20 days	Mon 6/20/11	Fri 7/15/11
111	Install Flooring	12 days	Mon 7/4/11	Tue 7/19/11
112	Fire Alarm Devices	10 days	Wed 7/13/11	Tue 7/26/11
113	Install Doors & Hardware	9 days	Wed 7/13/11	Mon 7/25/11
114	Fire marshall Inspection	5 days	Tue 7/26/11	Mon 8/1/11
115	Punchlist	10 days	Tue 8/2/11	Mon 8/15/11
116	**7th Floor (Typical)**	**381 days**	**Mon 3/1/10**	**Mon 8/15/11**
117	**6th Floor (Typical)**	**380 days**	**Mon 3/8/10**	**Fri 8/19/11**
118	**5th Floor (Tyipcal)**	**380 days**	**Mon 3/15/10**	**Fri 8/26/11**
119	**4th Floor (Typical)**	**380 days**	**Mon 3/22/10**	**Fri 9/2/11**
120	**3rd Floor (Typical)**	**385 days**	**Mon 3/29/10**	**Fri 9/16/11**
121	**Commissioning**	**132 days**	**Mon 4/4/11**	**Tue 10/4/11**
122	Equipment Start-Up	123 days	Mon 4/4/11	Wed 9/21/11
123	Commissioning	117 days	Mon 4/25/11	Tue 10/4/11
124	**Substantial Completion**	0 days	Thu 12/1/11	Thu 12/1/11



Project: Updated Schedule
Date: Fri 12/9/11

Task	Project Summary	Inactive Milestone	Manual Summary Rollup	Deadline
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

Appendix B – Detailed Structural Systems Estimate

Structural Detailed Estimate									Total:	$ 2,015,181.02
Level 2M										
Description	Summary	Unit	Quanitity	Total Length	Material	Labor	Equipment	Total	Total O&P	
Structural Steel										
W12 x 14		L.F.	2	30	$ 16.95	$ 2.66	$ 1.78	$ 21.39	$ 25.21	$ 756.30
W18 x 35		L.F.	28	392	$ 42.85	$ 3.53	$ 1.77	$ 47.80	$ 54.65	$ 21,422.80
W36 x 302		L.F.	2	64	$ 365.00	$ 3.28	$ 1.64	$ 369.92	$ 407.56	$ 26,083.84
W36 x 361		L.F.	6	144	$ 424.50	$ 3.78	$ 1.64	$ 429.92	$ 494.41	$ 71,195.04
W36 x 395		L.F.	2	57	$ 458.50	$ 3.78	$ 1.64	$ 463.92	$ 533.51	$ 30,409.96
W36 x 441		L.F.	6	178	$ 504.00	$ 3.78	$ 1.64	$ 509.92	$ 586.41	$ 104,380.62
HSS6 x 6 x 3/8		L.F.	5	58.5						$ -
Floor										
Steel Deck	3",2Θ gage	S.F	5376	N/A	$ 2.58	$ 0.41	$ 0.04	$ 3.03	$ 3.61	$ 19,407.36
Shear Studs	3/4"Θ x 6"	Each	1244	N/A						
Concrete	6" NW	C.Y.	150	N/A		$ 13.00	$ 4.86	$ 17.86	$ 25.35	$ 3,802.50
WWF	4x4-W4.0xW4.0	C.S.F.	53.76	N/A	$ 47.00	$ 27.50		$ 74.50	$ 97.00	$ 5,214.72
Level 4,5,7,8 (Typical)										
Description	Summary	Unit	Quanitity	Total Length	Material	Labor	Equipment	Total	Total O&P	
Structural Steel										
W10 x 12		L.F.	13	26	$ 14.50	$ 3.91	$ 2.61	$ 21.02	$ 25.57	$ 664.82
W12 x 14		L.F.	35	664	$ 16.95	$ 2.66	$ 1.78	$ 21.39	$ 25.21	$ 16,739.44
W12 x 16		L.F.	12	180	$ 20.05	$ 2.66	$ 1.78	$ 24.49	$ 28.16	$ 5,068.80
W12 x 26		L.F.	4	104	$ 31.50	$ 2.66	$ 1.78	$ 35.94	$ 41.06	$ 4,270.24
W14 x 22		L.F.	15	244.5	$ 26.50	$ 2.66	$ 1.56	$ 30.72	$ 35.33	$ 8,637.70
W14 x 26		L.F.	7	62.5	$ 31.50	$ 2.37	$ 1.58	$ 35.45	$ 40.33	$ 2,520.63
W14 x 30		L.F.	11	25	$ 36.50	$ 2.60	$ 1.74	$ 40.84	$ 46.42	$ 1,160.50
W16 x 26		L.F.	10	285	$ 31.50	$ 2.34	$ 1.57	$ 35.41	$ 40.27	$ 11,476.95
W24 x 55		L.F.	4	104	$ 66.50	$ 3.06	$ 1.53	$ 71.09	$ 80.03	$ 8,323.12
W24 x 68		L.F.	3	102	$ 82.50	$ 3.06	$ 1.53	$ 87.09	$ 97.53	$ 9,948.06
W24 x 131		L.F.	18	507	$ 159.50	$ 3.23	$ 1.62	$ 164.35	$ 189.00	$ 95,823.00
WT10.5 x 28.5		LBS	4	3876						$ -
HSS12 x 8x 3/8		L.F.	4	20						$ -
Floor										
Steel Deck	2",2Θ gage	S.F	5661	N/A	$ 2.01	$ 0.39	$ 0.04	$ 2.44	$ 2.95	$ 16,699.95

Shear Studs	3/4"Θ x 5"	Each	1232	N/A						
Concrete	4 1/2" LW	C.Y.	94	N/A		$ 14.90	$ 5.55	$ 20.45	$ 29.10	$ 2,735.40
WWF	4x4-W4.0xW4.0	C.S.F.	56.61	N/A	$ 47.00	$ 27.50		$ 74.50	$ 97.00	$ 5,491.17
Level 3										
Description	Summary	Unit	Quanitity	Total Length	Material	Labor	Equipment	Total	Total O&P	
Structural Steel										
W10 x 12		L.F.	13	26	$ 14.50	$ 3.91	$ 2.61	$ 21.02	$ 25.57	$ 664.82
W12 x 14		L.F.	35	664	$ 16.95	$ 2.66	$ 1.78	$ 21.39	$ 25.21	$ 16,739.44
W12 x 16		L.F.	12	180	$ 20.05	$ 2.66	$ 1.78	$ 24.49	$ 28.16	$ 5,068.80
W12 x 26		L.F.	4	104	$ 31.50	$ 2.66	$ 1.78	$ 35.94	$ 41.06	$ 4,270.24
W14 x 22		L.F.	15	244.5	$ 26.50	$ 2.66	$ 1.56	$ 30.72	$ 35.33	$ 8,637.70
W14 x 26		L.F.	7	62.5	$ 31.50	$ 2.37	$ 1.58	$ 35.45	$ 40.33	$ 2,520.63
W14 x 30		L.F.	11	25	$ 36.50	$ 2.60	$ 1.74	$ 40.84	$ 46.42	$ 1,160.50
W16 x 26		L.F.	10	285	$ 31.50	$ 2.34	$ 1.57	$ 35.41	$ 40.27	$ 11,476.95
W24 x 55		L.F.	4	104	$ 66.50	$ 3.06	$ 1.53	$ 71.09	$ 80.03	$ 8,323.12
W24 x 68		L.F.	3	102	$ 82.50	$ 3.06	$ 1.53	$ 87.09	$ 97.53	$ 9,948.06
W24 x 131		L.F.	18	507	$ 159.50	$ 3.23	$ 1.62	$ 164.35	$ 189.00	$ 95,823.00
WT10.5 x 28.5		LBS	4	3876						$ -
HSS12 x 8x 3/8		L.F.	4	20						$ -
Floor										
Steel Deck	3",2Θ gage	S.F	5661	N/A	$ 2.58	$ 0.41	$ 0.04	$ 3.03	$ 3.61	$ 20,436.21
Shear Studs	3/4"Θ x 6"	Each	1232	N/A						
Concrete	6" NW	C.Y.	147	N/A		$ 13.00	$ 4.86	$ 17.86	$ 25.35	$ 3,726.45
WWF	4x4-W4.0xW4.0	C.S.F.	56.61	N/A	$ 47.00	$ 27.50		$ 74.50	$ 97.00	$ 5,491.17
Level 6										
Description	Summary	Unit	Quanitity	Total Length	Material	Labor	Equipment	Total	Total O&P	
Structural Steel										
W10 x 12		L.F.	27	54	$ 14.50	$ 3.91	$ 2.61	$ 21.02	$ 25.57	$ 1,380.78
W12 x 14		L.F.	35	664	$ 16.95	$ 2.66	$ 1.78	$ 21.39	$ 25.21	$ 16,739.44
W12 x 16		L.F.	13	187.5	$ 20.05	$ 2.66	$ 1.78	$ 24.49	$ 28.16	$ 5,280.00
W12 x 26		L.F.	4	104	$ 31.50	$ 2.66	$ 1.78	$ 35.94	$ 41.06	$ 4,270.24
W14 x 22		L.F.	20	282	$ 26.50	$ 2.66	$ 1.56	$ 30.72	$ 35.33	$ 9,962.50
W14 x 26		L.F.	10	85	$ 31.50	$ 2.37	$ 1.58	$ 35.45	$ 40.33	$ 3,428.05
W14 x 30		L.F.	11	25	$ 36.50	$ 2.60	$ 1.74	$ 40.84	$ 46.42	$ 1,160.50

W16 x 26		L.F.	12	342	$ 31.50	$ 2.34	$ 1.57	$ 35.41	$ 40.27	$ 13,772.34
W16 x 31		L.F.	3	102	$ 37.50	$ 2.60	$ 1.74	$ 41.84	$ 47.92	$ 4,887.84
W18 x 40		L.F.	11	356	$ 48.50	$ 3.53	$ 1.77	$ 53.80	$ 61.15	$ 21,769.40
W21 x 50		L.F.	3	93	$ 60.50	$ 3.19	$ 1.60	$ 65.29	$ 73.86	$ 6,868.98
W24 x 55		L.F.	5	138	$ 66.50	$ 3.06	$ 1.53	$ 71.09	$ 80.03	$ 11,044.14
W24 x 68		L.F.	5	170	$ 82.50	$ 3.06	$ 1.53	$ 87.09	$ 97.53	$ 16,580.10
W24 x 131		L.F.	18	507	$ 159.50	$ 3.23	$ 1.62	$ 164.35	$ 189.00	$ 95,823.00
W27 x 84		L.F.	4	136	$ 102.00	$ 2.85	$ 1.43	$ 106.28	$ 118.56	$ 16,124.16
WT10.5 x 28.5		LBS	4	3876						$ -
HSS12 x 8x 3/8		L.F.	4	20						$ -
Floor										
Steel Deck	2",2Θ gage	S.F	10727	N/A	$ 2.01	$ 0.39	$ 0.04	$ 2.44	$ 2.95	$ 31,644.65
Shear Studs	3/4"Θ x 5"	Each	2242	N/A						
Concrete	4 1/2" LW	C.Y.	188	N/A		$ 14.90	$ 5.55	$ 20.45	$ 29.10	$ 5,470.80
WWF	4x4-W4.0xW4.0	C.S.F.	107.27	N/A	$ 47.00	$ 27.50		$ 74.50	$ 97.00	$ 10,405.19
Steel Strengthening (Typical Length = 14')										
Description	Weight	Unit	Quanitity	Total Length	Material	Labor	Equipment	Total	Total O&P	
Ground Floor - 2M (Height = 14' Typical)										
L8 x 8 x 1	51 lbs/ft	Ton	64	896	10%					
L6 x 6 x 5/8	24.2 lbs/ft	Ton	136	1904	10%					
L6 x 6 x 1	37.4 lbs/ft	Ton	24	336	10%					
Column Schedule (Typical Floor Height = 14')										
Description	Summary	Unit	Quanitity	Total Length	Material	Labor	Equipment	Total	Total O&P	
W14 x 90		L.F.	17	238	$ 109.00	$ 3.17	$ 2.12	$ 114.29	$ 127.78	$ 30,411.64
W14 x 99		L.F.	46	644	$ 120.00	$ 2.83	$ 1.42	$ 124.25	$ 142.89	$ 92,021.16
W14 x 109		L.F.	20	280	$ 127.00	$ 3.77	$ 1.68	$ 132.45	$ 152.32	$ 42,649.60
W14 x 120		L.F.	8	112	$ 145.00	$ 2.44	$ 1.63	$ 149.07	$ 166.02	$ 18,594.24
W14 x 132		L.F.	4	56	$ 161.00	$ 2.70	$ 1.63	$ 165.33	$ 190.13	$ 10,647.28
W14 x 145		L.F.	16	224	$ 177.00	$ 2.95	$ 1.48	$ 181.43	$ 200.78	$ 44,974.72
W14 x 176		L.F.	4	56	$ 213.00	$ 2.57	$ 1.72	$ 217.29	$ 240.33	$ 13,458.48
W14 x 193		L.F.	4	56	$ 233.00	$ 3.08	$ 1.54	$ 237.62	$ 273.26	$ 15,302.56
W14 x 211		L.F.	8	112	$ 253.00	$ 3.08	$ 1.54	$ 257.62	$ 296.26	$ 33,181.12
W14 x 342	Stub Columns	L.F.	6	33	$ 326.00	$ 3.56	$ 1.64	$ 331.20	$ 380.88	$ 12,569.04
TS6 x 6x 3/8		L.F.	28	392						$ -

Appendix C – General Conditions Estimate

General Conditions

Category	Item	Units	Quantity	Material	Labor	Equip	Total Cost	Total Inclu. O&P	Subtotal
Project Coordination									
Field Personnel	Field Engineer (Avg)	Week	129		$ 1,215.00		$ 1,215.00	$ 1,875.00	$ 241,875.00
Field Personnel	Field Engineer (Max)	Week	129		$ 1,400.00		$ 1,400.00	$ 2,150.00	$ 277,350.00
Field Personnel	Project Manager (Max)	Week	129		$ 2,275.00		$ 2,275.00	$ 3,500.00	$ 451,500.00
Field Personnel	Superintendent (Avg)	Week	129		$ 1,850.00		$ 1,850.00	$ 2,850.00	$ 367,650.00
Field Personnel	Superintendent (Max)	Week	129		$ 2,100.00		$ 2,100.00	$ 3,225.00	$ 416,025.00
Field Personnel	Timekeeper (Avg)	Week	129		$ 1,085.00		$ 1,085.00	$ 1,675.00	$ 216,075.00
Temporary Electricity									
Water Bill/month	Average	Month	28	$ 62.00			$ 62.00	$ 68.00	$ 1,904.00
Field Offices and Sheds									
Trailer	32'x8' Rented	Month	28	$ 193.00			$ 193.00	$ 213.00	$ 5,964.00
Office Equipment	Rental Average	Month	28	$ 155.00			$ 155.00	$ 171.00	$ 4,788.00
Office Supplies	Average	Month	28	$ 85.00			$ 85.00	$ 93.50	$ 2,618.00
Telephone Bill	Average	Month	28	$ 80.00			$ 80.00	$ 88.00	$ 2,464.00
Lights & HVAC		Month	28	$ 150.00			$ 150.00	$ 165.00	$ 4,620.00
Construction Equipment									
Small Tools	Maximum	Total							$ 70,000.00
Temporary Barricades									
Barricades	W/ Reflective tape	Each	30	$ 525.00			$ 525.00	$ 580.00	$ 17,400.00
Temporary Fencing									
Chain Link	11 ga, 6' high	L.F.	300	$ 3.25	$ 1.77		$ 5.02	$ 6.50	$ 1,950.00
Temporary Project Signs									
Signs	High Intensity Reflected	S.F.	150	$ 26.50			$ 26.50	$ 29.50	$ 4,425.00
Progress Cleaning									
Cleanup of floor area	Continuous per day	M.S.F.	20000	$ 1.70	$ 37.00	$ 3.75	$ 42.45	$ 67.00	$ 1,340,000.00
Final by GC	End of job	M.S.F.	39.627	$ 2.71	$ 51.50	$ 5.20	$ 59.41	$ 93.00	$ 3,685.31

								Subtotal	$ 3,430,293.31
Square Foot Project Estimate = $23,637,500									
General Commissioning									
Commissioning	O&M, Training, Minimum	Project						1.00%	$ 236,375.00
Contingency Allowances									
Contingency	Construction Phase	Project						8.00%	$ 1,891,000.00
								Total	$ 5,557,668.31

Appendix D – LEED Scorecard

Appendix E – BIM Process Map

Appendix F – Hand Calculations