

The Educational Activities Building

PSU Harrisburg Campus



Figure 1 Images courtesy of BCJ

Technical Assignment 2

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Option: Construction Management

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Executive Summary

The design for the Educational Activities Building project started on January 12th, 2012 and the notice to proceed construction was given on February 4th, 2013. The substantial completion is set for May 30th, 2014. The project scope includes substructure, superstructure, MEP systems rough-in, building enclosure and interior finishes. The steel erection started on the south wing first then followed by the north wing. The total construction duration is 16 months.

The next section of this report focuses on the detailed Structural Systems estimate and the assemblies MEP estimates. The structural estimate was based on a detailed quantity take-off then using RS Means Costworks to find the appropriate costs. The overall concrete cost was found to be \$566,705.41 while the steel cost was \$1,565,927.2. The combined cost of both elements is \$2,132,632.61 which brings the t cost to \$41.48 per square foot. The estimated cost was a little bit shy of the actual Reynolds estimate. The structural system cost is about 11% of the total project cost.

The site layout planning section describes the different components and procedures for 3 critical phases of the construction. The first phase is the excavation followed by the superstructure phase then the building enclosure phase. Each site plan includes a location of the different equipment needed for each phase such as a mobile crane, concrete trucks, excavator, etc.

The general conditions estimate was based on the RS Means Cost data and it included 5 major categories; field personal, temporary utilities, field offices and sheds, cleaning up and performance bond. The biggest percentage of the GC cost was the field personal at 64.9% then followed by the performance bond at 26.7%. The overall general condition cost is only 5.2% of the total project cost.

The project team has not encountered many challenges during the construction. One of the problems that were addressed with the Project Coordinator Mr. Newton a damage that had happen to the sanitary line located under the First Street on the east side of the project. Luckily it happened on June during summer break and the project team was able to solve the problem as fast as possible. Other than that the project is progressing smoothly.

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Detailed project schedule

The construction work on the Educational Activities Building project has duration of 16 months. The planning and design began on January 12th, 2012 and the substantial completion is set for May 30th, 2014. The schedule is a major driver for the project because the owner expecting the building to be ready for the student to start the academic year. Table 1 shows a breakdown of the different major phases of the project and their durations.

Table 1: Project Schedule Overview

Schedule Summary	
Phase	Duration
Design	January 12 th , 2012 - June 11 th , 2012
Notice to Proceed (Construction)	February 4 th , 2013
Substructure	March 6 th , 2013 – July 11 th , 2013
Superstructure	May 1 st , 2013 – July 17 th , 2013
MEP Rough-In	July 12 th , 2013 – January 16 th , 2014
Building Enclosure	August 2 nd , 2013 – January 9 th , 2014
Interior Finishes	September 20 th , 2013 – May 22 nd , 2014
Testing and Commissioning	December 26 th , 2013 – May 22 nd , 2014
Substantial Completion	May 30 th , 2014

The site work started on February 4th, 2013 followed by the foundations. Right after the foundations were placed the erection of the steel started, so as the slab-on-grade. The steel erection sequence moved from south to north. Based on figure 2, the 3 floors were erected upward for phase 1, 2 & 3. Then the two floors for Phase 4 & 5 followed by the one floor phases 6, 7 and 8. The metal decking will work from the penthouse and working its way to the ground floor.

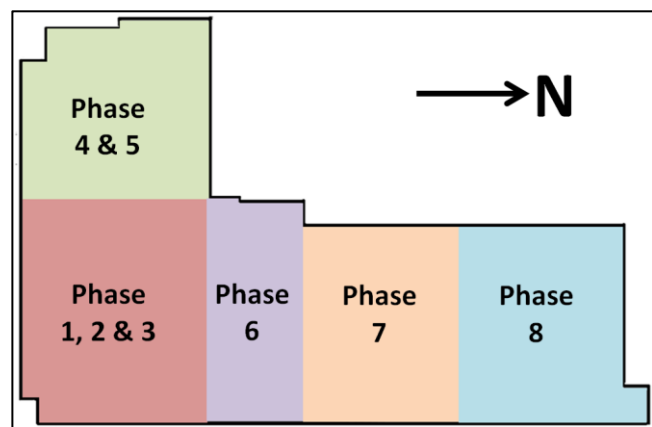


Figure 2: Structural steel erection sequences

The MEP rough-in started 5 days before the end of the superstructure phase and will last for a little over 6 months. The sequence starts from the penthouse then moves to Level two ending with the ground floor. The MEP rough-in starts with the HVAC rough-in then Fire Alarm rough-in, Plumbing rough-in, Electrical rough in and finally Sprinkler rough-in.

The next phase was the building enclosure, which started in the beginning of August and will last for 5 months. It overlaps the MEP rough-in phase and started at the North wing and moving to the South wing. Just as the MEP rough-in phase, the interior finishes started at the penthouse and is working its way to the first floor.

The testing and commissioning will start on December 26th of this year and will last till the last week of the construction schedule. The substantial completion is set for May 30th, 2014 however the owner will move in the first floor on May 8th to work on the furniture and equipment.

See Appendix A for the Detailed Project Schedule

Detailed Structural Systems Estimate & Assemblies MEP Estimates

The Educational Activities Building project is a structural steel frame building with concrete slab over metal decking built on top of concrete footings. The detailed structural systems estimate was performed by doing quantity take off for each structural component. Including footings, slab-on-grade, structural steel frame, metal decks and slab on metal decks. The steel reinforcement, formworks and placing were considered for the concrete work. RS Means Costworks 2013 was used to match these elements with their prices. The cost of material, labor and equipment were taken into account when this estimate was performed. The estimated structural system total cost is \$2,132,632.61 which results in \$41.48 per square foot. Table 2 categorizes the structural system cost into two CSI division, concrete (\$566,705.41) and structural steel (\$1,565,927.2). The cost concrete was 15% shy of the Reynolds estimated cost while the cost of structural steel was 8% less than Reynolds estimated cost. That's might be due to using different cost data or some associated costs. The total project cost is \$19.4 million which makes the percent of structural system cost 10.99%.

Table 2: Estimate breakdown based on structural element

CSI Division	Structural Element	Estimated Cost (\$)	Cost (\$) per SF	Actual Cost (\$)
5	concrete	566,705.41	11.02	666,674
3	Structural Steel	1,565,927.2	30.46	1,704,433
	Total	2,132,632.61	41.48	2,371,107

Notes:

- There are 14 different types of concrete footings used for the building foundations. The total concrete volume and reinforcement rebar weight were calculated. The concrete used for the footings is 4500psi normal weight concrete.
- Slab-on-grade is 3500psi normal weight concrete with two different thicknesses, 5 and 6 inches. Both types of slabs utilize 6x6-W2.9xW2.9 welded wire reinforcement.
- Most of the steel structural is wide flange beams and columns with various sizes and few channels and hollow structural sections beams.
- The second level and penthouse have 2" 20 gauge galvanized metal deck while the roof has a 1 ½" 20 gauge galvanized metal deck. All metal decks are covered with a 3.25" layer of light weight concrete with 6x6-W1.4xW1.4 welded wire reinforcement.

Assumptions:

- Concrete is placed by using pumped.
- The cost of few steel beams was not found due to their size so the next bigger beam cost was used to represent their price.
- No profits or overhead were included in the estimate.
- The concrete formworks are used 4 times.
- When calculating the reinforcement for the footings, a 1" edge space was assumed.

As for the assembly estimate the total was about \$3,079,058 and that's about a million dollar shy from the actual estimate. The biggest part of the actual estimate is the HVAC system at \$1,931,375, followed by the Electrical system at \$1,622,283 then Plumbing at \$524,837.

See Appendix B for the Detailed Structural Systems Estimate & MEP Assembly Estimates

See Appendix C for the Quantity Take-Off

Site Layout Planning

Excavation:

The pedestrian and traffic flow were taken into consideration when creating the excavation site plan. The existing one story building will be occupied by students and faculty while the new building is being constructed. There's a 6' high fence surrounding the construction site. Two office trailers will be used on this project and they are located south of the project, across from the old building. The temporary power will be taken from an existing power line near the trailers. An existing parking lot is located right next to the trailers and it will be utilized for temporary parking. As mentioned in technical assignment 1 there will be 3 gates, one is located on the south west side and will be mainly used by workers. The second gate is located on the south east and will be used as the main entrance for trucks and deliveries, while the north east gate will serve as the main exit; this is ideal due to the location of these two gates on First Street. Two ramps will be used on the construction site one is located on the west side of the south wing and the other ramp is located on north of the north wing.

Superstructure:

Same as excavation all trucks and deliveries must enter through the south east gate and leave the site through the north east gate. The steel erection will start from the south wing and ending at the north wing. A mobile crane with a swing radius of 60' will be utilized for the erection process. The steel laydown area is located within the crane limit for easy access. When erecting the south wing, the crane crew has to be extra cautious as the existing nearby building will be occupied.

Building Enclosure:

For the building enclosure the same mobile crane will be used to construct the west exterior walls while scaffolding will surround the south, east and north walls to ensure an efficient and fast construction of the building exterior. The materials laydown area will be located in the same place where the steel laydown area had been. This is a very important phase because multiple trades will be on site doing work so there must coordinate with each other to avoid causing any delays.

See Appendix D for the Site Plans

General Conditions Estimate

The general conditions cost of the Educational Activities Building project is estimated to be \$1,016,492.35 for the entire construction schedule of 16 months. This results in \$63,530.77 spending on general conditions for each month. Table 3 breaks down the main components of the general conditions cost, the item cost percentage of the GC cost and comparison with the actual cost. The overall GC cost is 5.2% of the total project cost. The estimate is over the actual cost by approximately \$130,000. That's due to the use of multiple cost data sources and different duration for several field personal the performance Bond was estimated to be 1.4% of the overall project cost of \$19.4 million.

Table 3: General conditions cost breakdown

Item	Estimated Cost (\$)	Percentage (%)	Actual Cost (\$)
Field personal	659,600	64.9	511,450
Temporary Utilities	31,045.6	3	256,400
Field Offices and Sheds	49,460.38	4.9	90,510
Cleaning Up	4,786.368	0.5	28,500
Performance Bond	271,600	26.7	NA
Total	1,016,492.35	41.48	886,860

The field personal includes a project manager, field engineer and superintendent. It was assumed that they will all spend 16 months on the construction site. The temporary power costs were based on 12 hours per day use and the cost of that is about \$450 a week. The field offices cost includes two 20'x8' office trailers, two storage boxes (20'x8' & 40'x8') and air conditioning for the hot summer months. Additionally, it takes into account the cost of a 6' high fence and office equipment such as printers and other office's supply.

The pie chart below (figure3) provides a visual representation for the percentage of each major item of the general conditions cost. The biggest cost is field personal of \$659,600 followed by the performance bond of \$271,600.

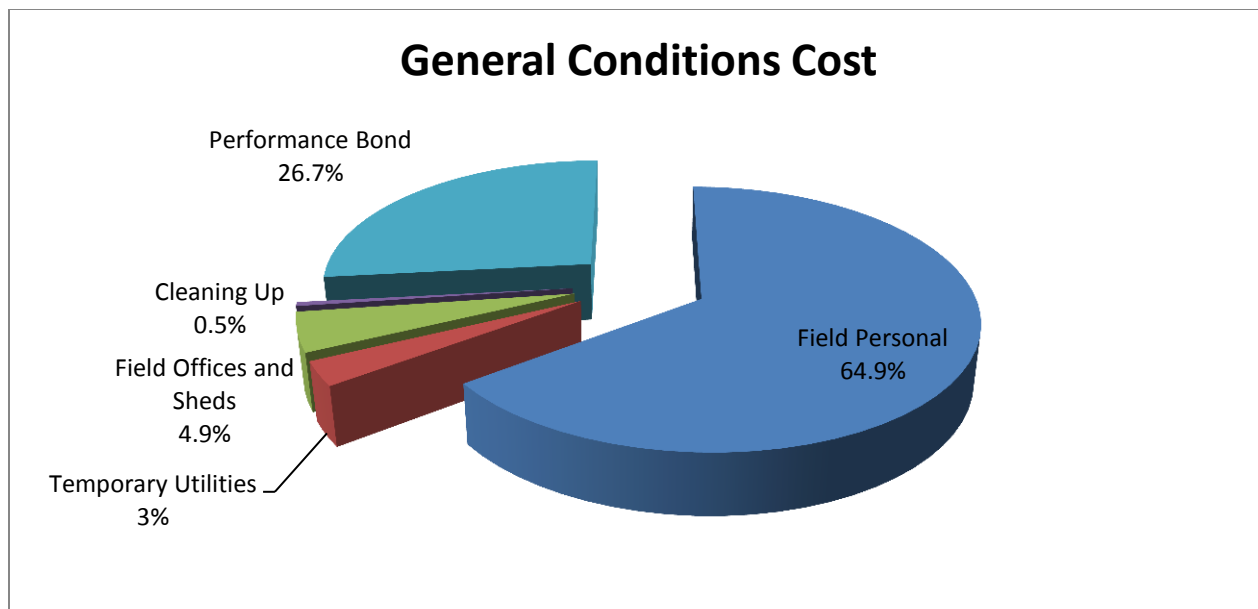


Figure 3: General Conditions cost estimate pie chart

See Appendix E for the General Conditions Estimate

Constructability Challenges

Utility Line on First Street broken:

During the 4th month of the construction work, around June 2013, the labors were working on the substructure and connecting the new building to the main utility line located on First Street. The project team excavated a little bit off where they were supposed to. Accidentally, one of the sanitary lines was damaged (Figure 1) and prevented other buildings on Penn State Harrisburg Campus from functioning well.

The team on the project acted fast and they were able to fix the line within 36 hours. Fortunately, it was summer and not too many people were on campus. The problem happened during June therefore courses were not in session which allowed them to easily fix the sanitary line without traffic throughout one of the campus's main streets.

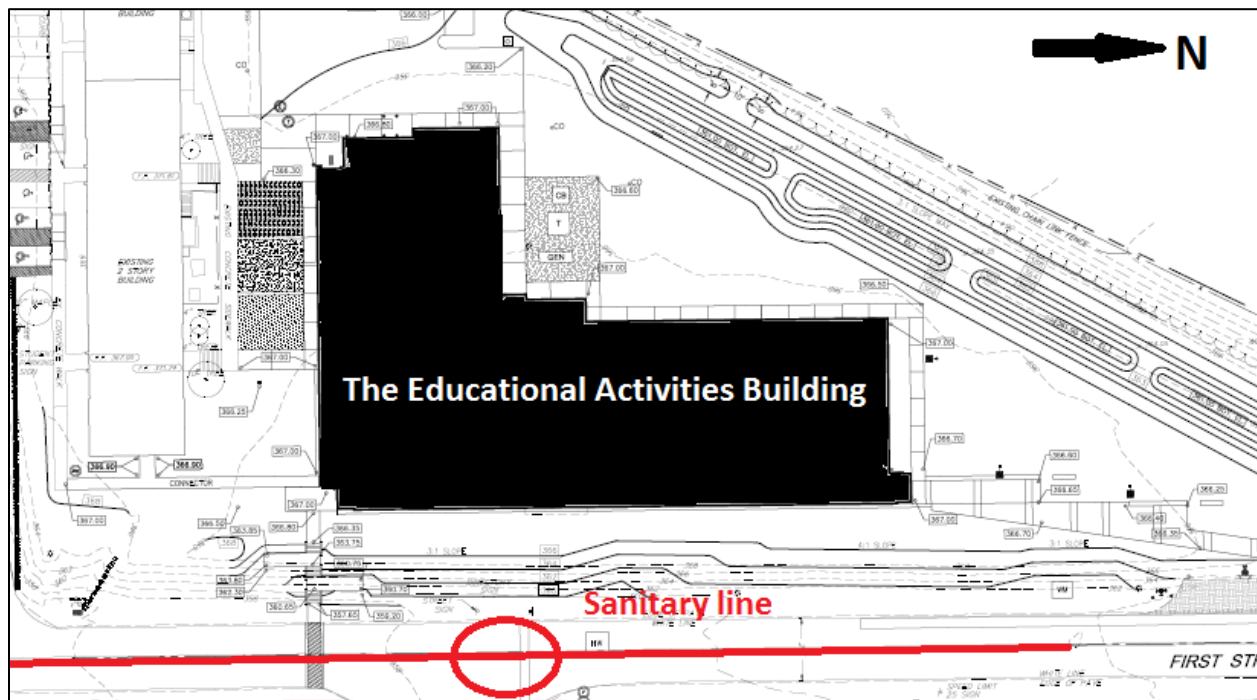


Figure 1: Sanitary line damage location

Adjacent Occupied Building (Occupants Safety)

The Educational Activities Building project is located right Next to an existing building that is occupied by students and faculty during construction. As a result, construction site safety is a big concern on this project.

The project team overcame this challenge by creating an efficient plan to ensure the safety of the occupants in the adjacent building. The construction site is enclosed with a 6 foot high fence (Figure 2) with temporary lighting. Additionally, the superstructure activities which involve the use of a crane are scheduled to start on May 1ST, 2013 and ends on July 17th, 2013

during the summer months. The reason for that is summer break, where the campus is less crowded and fewer occupants will be using the existing building.



Figure 2 The 6 foot high fence around the construction site

Weather Impact

As mentioned before the Educational Activities Building is located in Harrisburg, PA. This region is known for its long cold and snowy winters. Severe cold could delay the construction work for days which will impact the project overall schedule and eventually the cost. Moreover, in case of heavy snow fall, all deliveries and site work can also be stopped for few days. To solve this problem, the project team made a plan to compensate for any weather impact. This plan involves installing the curtain walls faster before the beginning of winter and work extended hours during weekdays or weekends.

Building Information Modeling Use Evaluation

Penn State University pays a lot of attention to BIM and requires BIM implementation on all projects located on its premises. The Educational Activities Building being one of these projects, BIM was used from the beginning and it plays a huge role in this particular project.

After a thorough analyzing of the Penn State BIM manual, the BIM use list and Level 1 Process map have been created to at least meet the university requirements (Appendix F). This project should utilize BIM for the following:

- Record Modeling
- 3D Coordination (Design)
- 3D Coordination (Construction)
- 4D Modeling
- Engineering Analysis
- Design Authoring

Each one of these uses was carefully chosen to deliver the project efficiently. The record modeling includes information relating to structural and MEP systems in addition to other systems. This use helps with future renovation plans or even regular maintenance of the different building systems. Additionally, it provides the owner with an accurate model of the project. The 3D Coordination is a very important element of BIM due to its benefits. It's basically clash detection for any of the building different systems. It uses a 3D model to coordinate between the different subcontractors. By doing so it eliminate any schedule delays due to conflicts between subcontractors, increases productivity and decreases construction cost and time.

The 4D model is a 3D model combined with the construction schedule. The main purpose of the 4D modeling is to provide the different project teams with a better understanding of the phases of the project and its sequencing. This also leads to increase productivity and decrease waste on site. The engineering analysis is a very efficient tool to provide analysis and solutions which improves the overall quality of this project.

This implementation requires transparency and cooperation from each party including but not limited to the architect, CM, owner, subcontractors, etc. This is beneficial for everyone and it could save them a lot of time and money. There should be weekly coordination meetings between the project teams to review the project progress and plan for any potential challenges. Each party is responsible to submit their own reports on the construction work to ensure that everyone is on time and falling behind.

Table 4 shows the BIM uses for each phase of the project. Based on this the BIM uses analysis (Appendix F) was then developed to decide the uses to implement on this project.

Table 4 BIM uses

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

The actual BIM uses implementation on this project is quite similar with the suggested uses with the key players being BCJ (Architect), Reynolds (CM) and Penn State (Owner). In my opinion the project team did a great job on implementing BIM uses that will be most beneficial for this specific project. They also are very efficient when it comes to weekly meetings and coordination. The models were transferred from design to construction through cooperation of the project team. The BIM is also used for turnover to the owner for the following uses:

- Record Model: to compare the design to the installed conditions.
- As-Built Model: to document the installed conditions during construction.

See Appendix F BIM Evaluation


































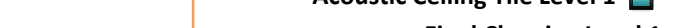






Appendix A: Detailed Project Schedule



















ID	Task Name	Duration	Start	Finish	2013												2014											
					Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				
1	Notice to Proceed	0 days	Mon 2/4/13	Mon 2/4/13	Notice to Proceed																							
2	Site Work	227 days	Mon 2/4/13	Tue 12/17/13	Site Work																							
3	Phase 1	35 days	Mon 2/4/13	Fri 3/22/13	Phase 1																							
4	Mobilization	5 days	Mon 2/4/13	Fri 2/8/13	Mobilization																							
5	Office Trailer Set Up	2 days	Thu 2/7/13	Fri 2/8/13	Office Trailer Set Up																							
6	Temporary Site Fencing	2 days	Mon 2/11/13	Tue 2/12/13	Temporary Site Fencing																							
7	Site Clearing	4 days	Tue 2/12/13	Fri 2/15/13	Site Clearing																							
8	Excavation and Fill	10 days	Mon 2/18/13	Fri 3/1/13	Excavation and Fill																							
9	Prepare Building Pad	5 days	Mon 2/25/13	Fri 3/1/13	Prepare Building Pad																							
10	Site Utilities	15 days	Mon 3/4/13	Fri 3/22/13	Site Utilities																							
11	Phase 2	32 days	Mon 11/4/13	Tue 12/17/13	Phase 2																							
12	Spread Topsoil	5 days	Mon 11/4/13	Fri 11/8/13	Spread Topsoil																							
13	Landscaping	6 days	Mon 11/11/13	Mon 11/18/13	Landscaping																							
14	Sidewalks	23 days	Fri 11/15/13	Tue 12/17/13	Sidewalks																							
15	Pavement	5 days	Mon 12/2/13	Fri 12/6/13	Pavement																							
16	Substructure	92 days	Wed 3/6/13	Thu 7/11/13	Substructure																							
17	South Wing	70 days	Wed 3/6/13	Tue 6/11/13	South Wing																							
18	Excavate Footings	6 days	Wed 3/6/13	Wed 3/13/13	Excavate Footings																							
19	Form and Rebar	4 days	Thu 3/14/13	Tue 3/19/13	Form and Rebar																							
20	Place Concrete	12 days	Wed 3/20/13	Thu 4/4/13	Place Concrete																							
21	Elevator Pit	10 days	Wed 3/20/13	Tue 4/2/13	Elevator Pit																							
22	CMU Foundation Walls	15 days	Wed 3/27/13	Tue 4/16/13	CMU Foundation Walls																							
23	Underground Plumbing and Electrical	35 days	Wed 4/3/13	Tue 5/21/13	Underground Plumbing and Electrical																							
24	Foundation Backfill	10 days	Wed 4/17/13	Tue 4/30/13	Foundation Backfill																							
25	Slab on Grade Stone	10 days	Wed 4/24/13	Tue 5/7/13	Slab on Grade Stone																							
26	Slab on Grade Form and Rebar	5 days	Wed 5/22/13	Tue 5/28/13	Slab on Grade Form and Rebar																							
27	Place Concrete	10 days	Wed 5/29/13	Tue 6/11/13	Place Concrete																							
28	North Wing	60 days	Wed 4/3/13	Tue 6/25/13	North Wing																							
29	Excavate Footings	6 days	Wed 4/3/13	Wed 4/10/13	Excavate Footings																							
30	Form and Rebar	4 days	Wed 4/10/13	Mon 4/15/13	Form and Rebar																							
31	Place Concrete	12 days	Tue 4/16/13	Wed 5/1/13	Place Concrete																							
32	CMU Foundation Walls	15 days	Wed 4/24/13	Tue 5/14/13	CMU Foundation Walls																							
33	Underground Plumbing and Electrical	36 days	Wed 5/1/13	Wed 6/19/13	Underground Plumbing and Electrical																							
34	Foundation Backfill	10 days	Wed 5/15/13	Tue 5/28/13	Foundation Backfill																							
35	Slab on Grade Stone	10 days	Wed 5/22/13	Tue 6/4/13	Slab on Grade Stone																							
36	Slab on Grade Form and Rebar	5 days	Wed 6/5/13	Tue 6/11/13	Slab on Grade Form and Rebar																							
37	Place Concrete	10 days	Wed 6/12/13	Tue 6/25/13	Place Concrete																							
38	SuperStructure	56 days	Wed 5/1/13	Wed 7/17/13	SuperStructure																							
39	South Wing	65 days	Wed 4/17/13	Tue 7/16/13	South Wing																							
40	Elevator Shaft	10 days	Wed 4/17/13	Tue 4/30/13	Elevator Shaft																							

Project: EAB.mpp Date: Fri 12/20/13	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	2013												2014											
					Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				
41	Steel Erection Phase 1	3 days	Wed 5/1/13	Fri 5/3/13	Steel Erection Phase 1																							
42	Steel Erection Phase 2	3 days	Mon 5/6/13	Wed 5/8/13	Steel Erection Phase 2																							
43	Steel Erection Phase 3	3 days	Thu 5/9/13	Mon 5/13/13	Steel Erection Phase 3																							
44	Steel Erection Phase 4	3 days	Tue 5/14/13	Thu 5/16/13	Steel Erection Phase 4																							
45	Steel Erection Phase 5	3 days	Fri 5/17/13	Tue 5/21/13	Steel Erection Phase 5																							
46	Metal Decking- Penthouse and Roof	6 days	Thu 6/6/13	Thu 6/13/13	Metal Decking- Penthouse and Roof																							
47	Metal Decking Level 2	4 days	Fri 6/14/13	Wed 6/19/13	Metal Decking Level 2																							
48	Slab on Deck- Penthouse and Roof	6 days	Tue 6/25/13	Tue 7/2/13	Slab on Deck- Penthouse and Roof																							
49	Slab on Deck Level 2	10 days	Wed 7/3/13	Tue 7/16/13	Slab on Deck Level 2																							
50	Superstructure Topout	0 days	Tue 7/16/13	Tue 7/16/13	Superstructure Topout 7/16																							
51	North Wing	27 days	Thu 5/30/13	Fri 7/5/13	North Wing																							
52	Steel Erection Phase 6	2 days	Thu 5/30/13	Fri 5/31/13	Steel Erection Phase 6																							
53	Steel Erection Phase 7	4 days	Mon 6/3/13	Thu 6/6/13	Steel Erection Phase 7																							
54	Steel Erection Phase 8	5 days	Fri 6/7/13	Thu 6/13/13	Steel Erection Phase 8																							
55	Metal Decking Roof	5 days	Mon 6/24/13	Fri 6/28/13	Metal Decking Roof																							
56	Slab on Deck Roof	5 days	Mon 7/1/13	Fri 7/5/13	Slab on Deck Roof																							
57	Superstructure Topout	0 days	Fri 7/5/13	Fri 7/5/13	Superstructure Topout 7/5																							
58	Building Systems	135 days	Fri 7/12/13	Thu 1/16/14	Building Systems																							
59	South Wing	132 days	Wed 7/17/13	Thu 1/16/14	South Wing																							
60	Mechanical Rough-In Penthouse	42 days	Wed 7/17/13	Thu 9/12/13	Mechanical Rough-In Penthouse																							
61	Electrical Rough-In Penthouse	20 days	Wed 9/4/13	Tue 10/1/13	Electrical Rough-In Penthouse																							
62	Plumbing Rough-In Penthouse	10 days	Wed 9/4/13	Tue 9/17/13	Plumbing Rough-In Penthouse																							
63	Fire System Rough-in Penthouse	5 days	Wed 9/4/13	Tue 9/10/13	Fire System Rough-in Penthouse																							
64	Mechanical Distribution Penthouse	28 days	Wed 8/14/13	Fri 9/20/13	Mechanical Distribution Penthouse																							
65	Electrical Distribution Penthouse	3 days	Fri 9/27/13	Tue 10/1/13	Electrical Distribution Penthouse																							
66	Plumbing Distribution Penthouse	20 days	Tue 9/17/13	Mon 10/14/13	Plumbing Distribution Penthouse																							
67	Fire System Distribution Penthouse	3 days	Fri 9/20/13	Tue 9/24/13	Fire System Distribution Penthouse																							
68	Mechanical Equipment Penthouse	10 days	Fri 9/13/13	Thu 9/26/13	Mechanical Equipment Penthouse																							
69	Mechanical Finishes Penthouse	10 days	Fri 9/13/13	Thu 9/26/13	Mechanical Finishes Penthouse																							
70	Electrical Finishes Penthouse	3 days	Fri 9/27/13	Tue 10/1/13	Electrical Finishes Penthouse																							
71	Plumbing Finishes Penthouse	5 days	Fri 10/11/13	Thu 10/17/13	Plumbing Finishes Penthouse																							
72	Fire System Finishes Penthouse	3 days	Fri 9/20/13	Tue 9/24/13	Fire System Finishes Penthouse																							
73	Mechanical Rough-In Level 2	30 days	Fri 9/13/13	Thu 10/24/13	Mechanical Rough-In Level 2																							
74	Electrical Rough-In Level 2	33 days	Fri 10/25/13	Tue 12/10/13	Electrical Rough-In Level 2																							
75	Plumbing Rough-In Level 2	15 days	Fri 10/11/13	Thu 10/31/13	Plumbing Rough-In Level 2																							
76	Fire System Rough-in Level 2	5 days	Fri 10/25/13	Thu 10/31/13	Fire System Rough-in Level 2																							
77	Mechanical Distribution Level 2	30 days	Mon 10/7/13	Fri 11/15/13	Mechanical Distribution Level 2																							
78	Electrical Distribution Level 2	9 days	Mon 12/2/13	Thu 12/12/13	Electrical Distribution Level 2																							
79	Plumbing Distribution Level 2	25 days	Thu 10/31/13	Wed 12/4/13	Plumbing Distribution Level 2																							
80	Fire System Distribution Level 2	10 days	Mon 11/4/13	Fri 11/15/13	Fire System Distribution Level 2																							

Project: EAB.mpp Date: Fri 12/20/13	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	2013												2014											
					Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun				
121	North Wing	63 days	Fri 8/2/13	Tue 10/29/13	<p style="text-align: center;">North Wing </p> <p>CMU Backup Masonry </p> <p>Roof Insulation </p> <p>Air and Vapor Barrier </p> <p>Masonry Veneer </p> <p>Curtain Wall </p> <p>Metal Wall Panels </p> <p>Interior Finishes </p> <p>South Wing </p> <p>Painting First Coat Penthouse </p> <p>Interior Doors and Hardware Penthouse </p> <p>Painting Finish Coat Penthouse </p> <p>Ceiling Light Fixtures Penthouse </p> <p>Final Cleaning Penthouse </p> <p>Painting First Coat Level 2 </p> <p>Acoustic Ceiling Grid Level 2 </p> <p>Ceiling Light Fixtures Level 2 </p> <p>Painting Finish Coat Level 2 </p> <p>Ceramic Wall and Floor Tile Level 2 </p> <p>Polish Concrete Floor Level 2 </p> <p>Interior Doors and Hardware Level 2 </p> <p>Toilets Level 2 </p> <p>Acoustic Ceiling Tile Level 2 </p> <p>Final Cleaning Level 2 </p> <p>Painting First Coat Level 1 </p> <p>Acoustic Ceiling Grid Level 1 </p> <p>Ceiling Light Fixtures Level 1 </p> <p>Painting Finish Coat Level 1 </p> <p>Ceramic Wall and Floor Tile Level 1 </p> <p>Polish Concrete Floor Level 1 </p> <p>Interior Doors and Hardware Level 1 </p> <p>Toilets Level 1 </p> <p>Acoustic Ceiling Tile Level 1 </p> <p>Final Cleaning Level 1 </p> <p style="text-align: center;">North Wing </p> <p>Painting First Coat Level 1 </p> <p>Acoustic Ceiling Grid Level 1 </p> <p>Ceiling Light Fixtures Level 1 </p> <p>Painting Finish Coat Level 1 </p> <p>Polish Concrete Floor Level 1 </p>																							
122	CMU Backup Masonry	5 days	Fri 8/2/13	Thu 8/8/13																								
123	Roof Insulation	15 days	Fri 8/2/13	Thu 8/22/13																								
124	Air and Vapor Barrier	10 days	Thu 8/22/13	Wed 9/4/13																								
125	Masonry Veneer	20 days	Wed 9/4/13	Tue 10/1/13																								
126	Curtain Wall	20 days	Wed 10/2/13	Tue 10/29/13																								
127	Metal Wall Panels	5 days	Wed 10/2/13	Tue 10/8/13																								
128	Interior Finishes	175 days	Fri 9/20/13	Thu 5/22/14																								
129	South Wing	175 days	Fri 9/20/13	Thu 5/22/14																								
130	Painting First Coat Penthouse	5 days	Fri 9/20/13	Thu 9/26/13																								
131	Interior Doors and Hardware Penthouse	2 days	Fri 9/27/13	Mon 9/30/13																								
132	Painting Finish Coat Penthouse	5 days	Fri 9/27/13	Thu 10/3/13																								
133	Ceiling Light Fixtures Penthouse	5 days	Wed 10/2/13	Tue 10/8/13																								
134	Final Cleaning Penthouse	3 days	Fri 10/18/13	Tue 10/22/13																								
135	Painting First Coat Level 2	15 days	Fri 1/24/14	Thu 2/13/14																								
136	Acoustic Ceiling Grid Level 2	10 days	Fri 2/7/14	Thu 2/20/14																								
137	Ceiling Light Fixtures Level 2	10 days	Fri 2/14/14	Thu 2/27/14																								
138	Painting Finish Coat Level 2	5 days	Fri 2/21/14	Thu 2/27/14																								
139	Ceramic Wall and Floor Tile Level 2	7 days	Fri 2/21/14	Mon 3/3/14																								
140	Polish Concrete Floor Level 2	10 days	Fri 2/21/14	Thu 3/6/14																								
141	Interior Doors and Hardware Level 2	10 days	Fri 3/7/14	Thu 3/20/14																								
142	Toilets Level 2	10 days	Tue 3/18/14	Mon 3/31/14																								
143	Acoustic Ceiling Tile Level 2	5 days	Fri 3/21/14	Thu 3/27/14																								
144	Final Cleaning Level 2	5 days	Tue 4/1/14	Mon 4/7/14																								
145	Painting First Coat Level 1	15 days	Fri 3/7/14	Thu 3/27/14																								
146	Acoustic Ceiling Grid Level 1	10 days	Fri 3/21/14	Thu 4/3/14																								
147	Ceiling Light Fixtures Level 1	10 days	Fri 3/28/14	Thu 4/10/14																								
148	Painting Finish Coat Level 1	5 days	Fri 4/4/14	Thu 4/10/14																								
149	Ceramic Wall and Floor Tile Level 1	7 days	Fri 4/4/14	Mon 4/14/14																								
150	Polish Concrete Floor Level 1	10 days	Fri 4/4/14	Thu 4/17/14																								
151	Interior Doors and Hardware Level 1	10 days	Fri 4/18/14	Thu 5/1/14																								
152	Toilets Level 1	10 days	Wed 5/7/14	Tue 5/20/14																								
153	Acoustic Ceiling Tile Level 1	5 days	Fri 5/2/14	Thu 5/8/14																								
154	Final Cleaning Level 1	5 days	Fri 5/16/14	Thu 5/22/14																								
155	North Wing	61 days	Mon 11/18/13	Mon 2/10/14																								
156	Painting First Coat Level 1	15 days	Mon 11/18/13	Fri 12/6/13																								
157	Acoustic Ceiling Grid Level 1	10 days	Thu 12/5/13	Wed 12/18/13																								
158	Ceiling Light Fixtures Level 1	10 days	Thu 12/12/13	Wed 12/25/13																								
159	Painting Finish Coat Level 1	5 days	Fri 12/27/13	Thu 1/2/14																								
160	Polish Concrete Floor Level 1	5 days	Thu 12/19/13	Wed 12/25/13																								

Project: EAB.mpp Date: Fri 12/20/13	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 & MEP Assembly Estimates

Structural Steel													
CSI Division	Item	Unit Costs						Quantity	Total Costs				
		Unit	Material	Labor	Equipment	Total	Total O&P		Material	Labor	Equipment	Total	Total O&P
051223750320	W8x15, bolted connections	L.F.	21.74	5.55	2.88	30.17	36.44	104	2260.96	577.20	299.52	3137.68	3789.76
051223750360	W8x24, bolted connections	L.F.	34.88	6.04	3.14	44.06	52.22	278	9696.64	1679.12	872.92	12248.68	14517.16
051223750500	W8x31, bolted connections	L.F.	44.99	6.04	3.14	54.17	63.34	13	584.87	78.52	40.82	704.21	823.42
051223750600	W10x12, bolted connections	L.F.	17.34	5.55	2.88	25.77	31.79	871	15103.14	4834.05	2508.48	22445.67	27689.09
051223750700	W10x19, bolted connections	L.F.	31.85	5.55	2.88	40.28	47.56	33	1051.05	183.15	95.04	1329.24	1569.48
051223751100	W12x14, bolted connections	L.F.	23.25	3.78	1.96	28.99	33.92	61	1418.25	230.58	119.56	1768.39	2069.12
051223751100	W12x16, bolted connections	L.F.	23.25	3.78	1.96	28.99	33.92	97	2255.25	366.66	190.12	2812.03	3290.24
051223751300	W12x19, bolted connections	L.F.	31.85	3.78	1.96	37.59	43.52	38	1210.30	143.64	74.48	1428.42	1653.76
051223751300	W12x22, bolted connections	L.F.	31.85	3.78	1.96	37.59	43.52	67	2133.95	253.26	131.32	2518.53	2915.84
051223751900	W14x22, bolted connections	L.F.	37.41	3.35	1.74	42.5	49.11	222	8305.02	743.70	386.28	9435.00	10902.42
051223751900	W14x26, bolted connections	L.F.	37.41	3.35	1.74	42.5	49.11	18	673.38	60.30	31.32	765.00	883.98
051223752100	W14x30, bolted connections	L.F.	43.47	3.69	1.91	49.07	55.93	46	1999.62	169.74	87.86	2257.22	2572.78
051223752700	W16x26, bolted connections	L.F.	37.41	3.33	1.72	42.46	49.04	65	2431.65	216.45	111.80	2759.90	3187.60
051223752900	W16x31, bolted connections	L.F.	44.99	3.69	1.91	50.59	57.95	130	5848.70	479.70	248.30	6576.70	7533.50
051223753100	W16x40, bolted connections	L.F.	57.63	4.15	2.16	63.94	73.21	76	4379.88	315.40	164.16	4859.44	5563.96
051223753140	W16x67, bolted connections	L.F.	97.06	4.37	2.28	103.71	116.17	18	1747.08	78.66	41.04	1866.78	2091.06
051223753140	W16x100, bolted connections	L.F.	97.06	4.37	2.28	103.71	116.17	87	8444.22	380.19	198.36	9022.77	10106.79
051223753300	W18x35, bolted connections	L.F.	50.55	5	1.97	57.52	66.43	411	20776.05	2055.00	809.67	23640.72	27302.73
051223753500	W18x40, bolted connections	L.F.	57.63	5	1.97	64.6	74.51	181	10431.03	905.00	356.57	11692.60	13486.31
051223753700	W18x50, bolted connections	L.F.	72.29	5.27	2.07	79.63	90.78	34	2457.86	179.18	70.38	2707.42	3086.52
051223753920	W18x60, bolted connections	L.F.	94.02	5.33	2.09	101.44	114.69	142	13350.84	756.86	296.78	14404.48	16285.98
051223753960	W18x86, bolted connections	L.F.	124.35	5.33	2.09	131.77	148.06	50	6217.50	266.50	104.50	6588.50	7403.00
051223753980	W18x97, bolted connections	L.F.	153.67	5.33	2.09	161.09	180.41	39	5993.13	207.87	81.51	6282.51	7035.99
051223753980	W18x119, bolted connections	L.F.	153.67	5.33	2.09	161.09	180.41	129	19823.43	687.57	269.61	20780.61	23272.89
051223753980	W18x158, bolted connections	L.F.	153.67	5.33	2.09	161.09	180.41	52	7990.84	277.16	108.68	8376.68	9381.32
051223754100	W21x44, bolted connections	L.F.	63.69	4.52	1.78	69.99	79.53	1027	65409.63	4642.04	1828.06	71879.73	81677.31
051223754300	W21x50, bolted connections	L.F.	72.29	4.52	1.78	78.59	89.13	493	35638.97	2228.36	877.54	38744.87	43941.09
051223754500	W21x62, bolted connections	L.F.	89.47	4.64	1.82	95.93	108.62	711	63613.17	3299.04	1294.02	68206.23	77228.82
051223754700	W21x68, bolted connections	L.F.	98.07	4.64	1.82	104.53	118.23	306	30009.42	1419.84	556.92	31986.18	36178.38
051223754720	W21x83, bolted connections	L.F.	120.31	4.8	1.89	127	142.82	71	8542.01	340.80	134.19	9017.00	10140.22
051223754740	W21x93, bolted connections	L.F.	134.46	4.8	1.89	141.15	157.99	124	16673.04	595.20	234.36	17502.60	19590.76
051223754760	W21x101, bolted connections	L.F.	145.58	4.8	1.89	152.27	171.13	115	16741.70	552.00	217.35	17511.05	19679.95
051223754780	W21x132, bolted connections	L.F.	175.91	4.8	1.89	182.6	204.49	141	24803.31	676.80	266.49	25746.60	28833.09
051223754780	W21x182, bolted connections	L.F.	175.91	4.8	1.89	182.6	204.49	32	5629.12	153.60	60.48	5843.20	6543.68
051223754900	W24x55, bolted connections	L.F.	79.36	4.32	1.7	85.38	96.83	2213	175623.68	9560.16	3762.10	188945.94	214284.79
051223755100	W24x62, bolted connections	L.F.	89.47	4.32	1.7	95.49	107.95	450	40261.50	1944.00	765.00	42970.50	48577.50

05122375 5300	W24x68, bolted connections	L.F.	98.07	4.32	1.7	104.0 9	117.56	223	21869.6 1	963.36	379.10	23212.0 7	26215.8 8
05122375 5500	W24x76, bolted connections	L.F.	110.2	4.32	1.7	116.2 2	130.7	178	19615.6 0	768.96	302.60	20687.1 6	23264.6 0
05122375 5700	W24x84, bolted connections	L.F.	121.3 2	4.44	1.75	127.5 1	143.06	317	38458.4 4	1407.4 8	554.75	40420.6 7	45350.0 2
05122375 5720	W24x94, bolted connections	L.F.	135.4 7	4.44	1.75	141.6 6	159.24	89	12056.8 3	395.16	155.75	12607.7 4	14172.3 6
05122375 5740	W24x103, bolted connections	L.F.	150.6 4	4.58	1.8	157.0 2	175.71	114	17172.9 6	522.12	205.20	17900.2 8	20030.9 4
05122375 5740	W24x104, bolted connections	L.F.	150.6 4	4.58	1.8	157.0 2	175.71	223	33592.7 2	1021.3 4	401.40	35015.4 6	39183.3 3
05122375 5760	W24x117, bolted connections	L.F.	168.8 4	4.58	1.8	175.2 2	195.93	125	21105.0 0	572.50	225.00	21902.5 0	24491.2 5
05122375 5780	W24x131, bolted connections	L.F.	211.3	4.58	1.8	217.6 8	242.44	159	33596.7 0	728.22	286.20	34611.1 2	38547.9 6
05122375 5780	W24x146, bolted connections	L.F.	211.3	4.58	1.8	217.6 8	242.44	160	33808.0 0	732.80	288.00	34828.8 0	38790.4 0
05122375 5780	W24x162, bolted connections	L.F.	211.3	4.58	1.8	217.6 8	242.44	207	43739.1 0	948.06	372.60	45059.7 6	50185.0 8
05122375 5780	W24x229, bolted connections	L.F.	211.3	4.58	1.8	217.6 8	242.44	45	9508.50	206.10	81.00	9795.60	10909.8 0
05122375 5780	W24x250, bolted connections	L.F.	211.3	4.58	1.8	217.6 8	242.44	38	8029.40	174.04	68.40	8271.84	9212.72
05122375 5780	W24x279, bolted connections	L.F.	211.3	4.58	1.8	217.6 8	242.44	38	8029.40	174.04	68.40	8271.84	9212.72
05122375 6100	W30x90, bolted connections	L.F.	143.5 6	4	1.57	149.1 3	166.41	11	1579.16	44.00	17.27	1640.43	1830.51
05122375 0010	HSS6x4x3/16	Ea.	730	54	30	814	935	1	730.00	54.00	30.00	814.00	935.00
05122375 0010	HSS6x4x3/8	Ea.	730	54	30	814	935	4	2920.00	216.00	120.00	3256.00	3740.00
05122375 0010	HSS6x4x1/2	Ea.	730	54	30	814	935	16	11680.0 0	864.00	480.00	13024.0 0	14960.0 0
05122375 0010	HSS8x6x1/2	Ea.	730	54	30	814	935	3	2190.00	162.00	90.00	2442.00	2805.00
05122375 0010	HSS10x6x1/2	Ea.	730	54	30	814	935	6	4380.00	324.00	180.00	4884.00	5610.00
05122375 0010	C15x50	Ea.	730	54	30	814	935	2	1460.00	108.00	60.00	1628.00	1870.00
Structural Steel Total									965051. 61	51923. 48	22061. 26	103903 6.35	117640 7.86

Columns

CSI Division	Item	Unit Costs						Quantity	Total Costs				
		Unit	Material	Labor	Equipment	Total	Total O&P		Material	Labor	Equipment	Total	Total O&P
05122317 6800	W8x21, splice plates, bolts	L.F.	34.88	3.08	1.6	39.56	45.44	165	5755.20	508.20	264.00	6527.40	7497.60
05122317 7000	W10x33, splice plates, bolts	L.F.	65.21	3.22	1.68	70.11	79.15	291	18976.1 1	937.02	488.88	20402.0 1	23032.6 5
05122317 7000	W10x39, splice plates, bolts	L.F.	65.21	3.22	1.68	70.11	79.15	122	7955.62	392.84	204.96	8553.42	9656.30
05122317 7000	W10x45, splice plates, bolts	L.F.	65.21	3.22	1.68	70.11	79.15	362	23606.0 2	1165.6 4	608.16	25379.8 2	28652.3 0
05122317 7050	W10x49, splice plates, bolts	L.F.	98.07	3.38	1.75	103.2	115.91	286	28048.0 2	966.68	500.50	29515.2 0	33150.2 6
05122317 7050	W10x54, splice plates, bolts	L.F.	98.07	3.38	1.75	103.2	115.91	182	17848.7 4	615.16	318.50	18782.4 0	21095.6 2
05122317 7050	W10x60, splice plates, bolts	L.F.	98.07	3.38	1.75	103.2	115.91	233	22850.3 1	787.54	407.75	24045.6 0	27007.0 3
05122317 7050	W10x68, splice plates, bolts	L.F.	98.07	3.38	1.75	103.2	115.91	60	5884.20	202.80	105.00	6192.00	6954.60
05122317 7100	W10x88, splice plates, bolts	L.F.	161.7 6	3.46	1.8	167.0 2	185.85	101	16337.7 6	349.46	181.80	16869.0 2	18770.8 5
05122317 7100	W10x100, splice plates, bolts	L.F.	161.7 6	3.46	1.8	167.0 2	185.85	60	9705.60	207.60	108.00	10021.2 0	11151.0 0
05122375 0010	HSS4x3x1/4	Ea.	730	54	30	814	935	9	6570.00	486.00	270.00	7326.00	8415.00
05122375 0010	HSS4x4x3/8	Ea.	730	54	30	814	935	2	1460.00	108.00	60.00	1628.00	1870.00
Columns Total									164997. 58	6726.9 4	3517.5 5	17524.2 07	197253. 21

Slab on Grade

CSI Division	Item	Unit Costs						Quantity	Total Costs				
		Unit	Material	Labor	Equipment	Total	Total O&P		Material	Labor	Equipment	Total	Total O&P
03310535 0200	Concrete, Slab on Grade	C.Y.	97.12	0	0	97.12	106.93	462	44869.4 4	0.00	0.00	44869.4 4	49401.6 6

03111345 0150	Forming	SFC A	0.85	4.53	0	5.38	7.91	565	480.25	2559.4 5	0.00	3039.70	4469.15
03310570 4300	Concrete Placement	C.Y.	0	16.0 5	0.68	16.73	25.1	462	0.00	7415.1 0	314.16	7729.26	11596.2 0
03220550 0300	Reinforcement, 6x6—W2.9xW2.9	C.S. F.	22.32	29.8 4	0	52.16	72	288	6422.58	8586.4 6	0.00	15009.0 4	20718.0 0
Slab on Grade Total									51772.2 7	18561. 01	314.16	70647.4 4	86185.0 1
Footings													
CSI Division	Item	Unit Costs						Quan tity	Total Costs				
		Uni t	Mate rial	Lab or	Equipm ent	Total	Total O&P		Material	Labor	Equipm ent	Total	Total O&P
03310535 0350	Concrete, 4500 psi	C.Y.	103.0 1	0	0	103.0 1	112.82	300	30903.0 0	0.00	0.00	30903.0 0	33846.0 0
03111345 0150	Forming	SFC A	2.09	2.57	0	4.66	6.26	2913	6088.17	7486.4 1	0.00	13574.5 8	18235.3 8
03310570 2450	Concrete Placement	C.Y.	0	37.2 8	13.64	50.92	72.16	300	0.00	11184. 00	4092.0 0	15276.0 0	21648.0 0
03211060 0700	Reinforcing Steel, #3 to #7	Ton	992	575. 05	0	1567. 05	2002.6	7	7027.35	4073.6 7	0.00	11101.0 1	14186.4 6
03211060 0750	Reinforcing Steel, #8 to #18	Ton	992	434	0	1426	1774.7 5	6	6037.77	2641.5 2	0.00	8679.29	10801.9 4
Footings Total									50056.2 9	25385. 60	4092.0 0	79533.8 9	98717.7 8
Metal Deck													
CSI Division	Item	Unit Costs						Quan tity	Total Costs				
		Uni t	Mate rial	Lab or	Equipm ent	Total	Total O&P		Material	Labor	Equipm ent	Total	Total O&P
05311350 5300	Level 2, 2" 20 gauge Galvanized Metal Deck	S.F.	2.36	0.56	0.05	2.97	3.64	16590	39152.4	9290.4 0	829.50	49272.3 0	60387.6 0
05311350 5300	Penthouse, 2" 20 gauge Galvanized Metal Deck	S.F.	2.36	0.56	0.05	2.97	3.64	5400	12744	3024.0 0	270.00	16038.0 0	19656.0 0
05312350 2600	Roof, 1 1/2" 20 gauge Galvanized Metal Deck	S.F.	2.65	0.52	0.05	3.22	3.9	28775	76253.7 5	14963. 00	1438.7 5	92655.5 0	112222. 50
03310535 0200	Level 2, Penthouse and Roof, 3.25" Slab on Metal Deck	C.Y.	97.12	0	0	97.12	106.93	138	13401.5 888	0.00	0.00	13401.5 9	14755.2 7
03111335 1150	Forming	S.F.	1.21	3.43	0	4.64	6.59	50765	61425.6 5	17412 3.95	0.00	235549. 60	334541. 35
03310570 1400	Concrete Placement	C.Y.	0	17.3 5	6.34	23.69	33.3	138	0	2394.3 0	874.92	3269.22	4595.40
03220550 0100	Level 2, Penthouse and Roof, Reinforcing, 6x6—W1.4xW1.4	C.S. F.	14.48	24.9 6	0	39.44	54.98	507.6 5	7350.77 2	12670. 94	0.00	20021.7 2	27910.6 0
Metal Deck Total									210328. 1608	21646 6.59	3413.1 7	430207. 92	574068. 72
Total Structural Costs											179466 7.67	213263 2.58	

MEP Assembly Estimate							
CSI Division	Description	Unit	Material	Installation	Quantity	Total O&P	Ext. Total O&P
D2090810 1560	Copper tubing, hard temper, solder, type L, 1/2" diameter	L.F.	4.98	6.28	989	11.26	11136.14
D2090810 1600	Copper tubing, hard temper, solder, type L, 3/4" diameter	L.F.	7.69	6.7	450	14.39	6475.5
D2090810 1620	Copper tubing, hard temper, solder, type L, 1" diameter	L.F.	11.27	7.5	550	18.77	10323.5
D2090810 1640	Copper tubing, hard temper, solder, type L, 1-1/4" diameter	L.F.	16.07	8.81	128	24.88	3184.64
D2090810 1660	Copper tubing, hard temper, solder, type L, 1-1/2" diameter	L.F.	20.61	9.79	133	30.4	4043.2
D2090810 1680	Copper tubing, hard temper, solder, type L, 2" diameter	L.F.	32.57	12.13	77	44.7	3441.9
D2090810 1700	Copper tubing, hard temper, solder, type L, 2-1/2" diameter	L.F.	50.2	14.8	150	65	9750
D2090820 2500	Copper, wrought, solder joints, 90< elbow, 1/2" diameter	Ea.	3.32	25.3	159	28.62	4550.58
D2090820 2510	Copper, wrought, solder joints, 90< elbow, 3/4" diameter	Ea.	7.48	26.7	103	34.18	3520.54
D2090820 2520	Copper, wrought, solder joints, 90< elbow, 1" diameter	Ea.	18.37	31.86	119	50.23	5977.37
D2090820 2530	Copper, wrought, solder joints, 90< elbow, 1-1/4" diameter	Ea.	27.77	34.2	23	61.97	1425.31
D2090820 2540	Copper, wrought, solder joints, 90< elbow, 1-1/2" diameter	Ea.	43.25	39.35	10	82.6	826
D2090820 2550	Copper, wrought, solder joints, 90< elbow, 2" diameter	Ea.	79.03	46.38	37	125.41	4640.17
D2090820 2700	Copper, wrought, solder joints, tee, 1/2" diameter	Ea.	5.66	39.35	2	45.01	90.02
D2090820 2710	Copper, wrought, solder joints, tee, 3/4" diameter	Ea.	13.72	42.63	13	56.35	732.55
D2090820 2730	Copper, wrought, solder joints, tee, 1-1/4" diameter	Ea.	58.21	56.69	35	114.9	4021.5
D2090820 2740	Copper, wrought, solder joints, tee, 1-1/2" diameter	Ea.	89.18	63.72	16	152.9	2446.4
D2090820 2750	Copper, wrought, solder joints, tee, 2" diameter	Ea.	138.84	72.62	22	211.46	4652.12
D2090820 2880	Copper, wrought, solder joints, coupling, 1/2" diameter	Ea.	2.51	22.96	70	25.47	1782.9
D2090820 2890	Copper, wrought, solder joints, coupling, 3/4" diameter	Ea.	5.07	24.36	35	29.43	1030.05
D2090820 2900	Copper, wrought, solder joints, coupling, 1" diameter	Ea.	10.09	28.11	90	38.2	3438
D2090820 2920	Copper, wrought, solder joints, coupling, 1-1/2" diameter	Ea.	23.5	34.2	7	57.7	403.9
D2090820 2930	Copper, wrought, solder joints, coupling, 2" diameter	Ea.	39.52	39.35	6	78.87	473.22
D2090820 2940	Copper, wrought, solder joints, coupling, 2-1/2" diameter	Ea.	84.37	61.37	17	145.74	2477.58
D2090810 0860	Pipe cast iron, soil, B & S, service weight, 3" diameter	L.F.	15.01	15.27	155	30.28	4693.4
D2090810 0880	Pipe cast iron, soil, B & S, service weight, 4" diameter	L.F.	19.86	16.68	280	36.54	10231.2
D2090820 0820	Cast iron, soil, no hub, 1/8 bend, 2" diameter	Ea.	10.31	0	3	10.31	30.93
D2090820 0830	Cast iron, soil, no hub, 1/8 bend, 3" diameter	Ea.	13.83	0	30	13.83	414.9
D2090820 0970	Cast iron, soil, no hub, 1/4 bend, 2" diameter	Ea.	11.91	0	1	11.91	11.91
D2090820 0960	Cast iron, soil, no hub, 1/4 bend, 1-1/2" diameter	Ea.	11	0	17	11	187
D2090820 0980	Cast iron, soil, no hub, 1/4 bend, 3" diameter	Ea.	16.71	0	8	16.71	133.68
D2090820 5580	Plastic, PVC, high impact/pressure sch 40, tee, 6" diameter	Ea.	105.2	123.68	69	228.88	15792.72
D3020106 0720	Boiler, electric, steel, hot water, 720 KW, 2,452 MBH	Ea.	30972	5036.38	1	36008.38	36008.38
D3050155 4440	Rooftop, multizone, air conditioner, schools and colleges, 25,000 SF, 95.83 ton	S.F.	11	7.45	50410	18.45	930064.5
D3030110 3960	Packaged chiller, air cooled, with fan coil unit, schools and colleges,, 20,000 SF,76.66 ton	S.F.	8.92	3.61	50410	12.53	631637.3
D5010130 1100	Underground service installation, includes excavation, backfill, and compaction, 100' length, 4' depth, 3 phase, 4 wire, 277/480 volts, 1600 A	Ea.	34537.6	12755	1	47292.6	47292.6
D5010120 0520	Service installation, includes breakers, metering, 20' conduit & wire, 3 phase, 4 wire, 120/208 V, 1600 A	Ea.	17971.6	8145	1	26116.6	26116.6
D5010240 0600	Switchgear installation, incl switchboard, panels & circuit breaker, 277/480 V, 1600 A	Ea.	34939.2	6705	1	41644.2	41644.2
D5020115 0280	Receptacle systems, underfloor duct, 7' on center, low density	S.F.	5.57	2.08	50410	7.65	385636.5

D5020130 0360	Wall switches, 5.0 per 1000 SF	S.F.	0.26	0.77	50410	1.03	51922.3
D5030310 0240	Telephone systems, underfloor duct, 5' on center, high density	S.F.	10.49	2.75	50410	13.24	667428.4
D5030910 0240	Communication and alarm systems, includes outlets, boxes, conduit and wire, sound systems, 30 outlets	Ea.	14859 .2	18900	1	33759. 2	33759.2
D5030910 0400	Communication and alarm systems, fire detection, non-addressable, 50 detectors, includes outlets, boxes, conduit and wire	Ea.	11445 .6	17370	1	28815. 6	28815.6
D5030920 0104	Internet wiring, 4 data/voice outlets per 1000 S.F.	M.S. F.	341.3 6	720	50.41	1061.3 6	53503.16
D5090210 0600	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 50 kW	kW	507.0 2	65.25	40	572.27	22890.8
Total							3079058.3 7

Appendix C: Quantity Take-Off

Slab on Grade Take-Off:

Slab on Grade					
Type	Floor Area (SF)	Depth (ft)	Volume Total (CY)	Edge Length (ft)	Form (SF)
5" Slab on Grade	23922	0.42	372.12	867	364
6" Slab on Grade	4853	0.5	89.87	401	201
		Total	462	Total	565

Slab on Grade Reinforcing			
Reinforcement	Floor Area (SF)	Weight (lb/100SF)	Total Weight (lb)
6x6—W2.9xW2.9	28775	42	12086

Footings Take-Off:

Footings								
4500psi	Size (ft)			Volume (CY)	Quantity	Volume Total (CY)	Form (SF)	Form Total (SF)
	W	L	D					
F30	3	3	1.3	0.44	1	0.4	16	16
F40	4	4	1.5	0.89	9	8.0	24	216
F50	5	5	1.5	1.39	5	6.9	30	150
F60	6	6	1.5	2.00	12	24.0	36	432
F70	7	7	1.5	2.72	2	5.4	42	84
F80	8	8	1.5	3.56	5	17.8	48	240
F90	9	9	2	6.00	4	24.0	72	288
F100	10	10	2	7.41	1	7.4	80	80
F120T	12	12	2	10.67	3	32.0	96	288
F1280	12	8	1.5	5.33	1	5.3	60	60
F1812T	18	12	3	24.00	2	48.0	180	360
F3211T	11	33	2.5	33.61	1	33.6	220	220
F4114T	14	42	2	43.56	1	43.6	224	224

F3912T	12	39	2.5	43.33	1	43.3	255	255
					Total	300	Total	2913

Footing Reinforcing						
Type	Quantity	Reinforcement	Reinforcing (LF)	Reinforcing (lb/LF)	Reinforcing (lb/Footing)	Reinforcing Total (lb)
F30	1	(3)-#6 EA. WAY, BOTTOM	18	1.502	27.036	27.036
F40	9	(4)-#6 EA. WAY, BOTTOM	32	1.502	48.064	432.576
F50	5	(5)-#6 EA. WAY, BOTTOM	50	1.502	75.1	375.5
F60	12	(6)-#6 EA. WAY, BOTTOM	72	1.502	108.144	1297.728
F70	2	(7)-#6 EA. WAY, BOTTOM	98	1.502	147.196	294.392
F80	5	(7)-#7 EA. WAY, BOTTOM	112	2.044	228.928	1144.64
F90	4	(8)-#7 EA. WAY, BOTTOM	144	2.044	294.336	1177.344
F100	1	(10)-#7 EA. WAY, BOTTOM	200	2.044	408.8	408.8
F120T	3	(11)-#9 EA. WAY BOTTOM	264	3.4	897.6	2692.8
		(11)-#7 EA. WAY TOP	264	2.044	539.616	1618.848
F1280	1	#7@12" EA. WAY BOTTOM	152	2.044	310.688	310.688
		#5@12" EA. WAY TOP	152	1.043	158.536	158.536
F1812T	2	#7@9" EA. WAY BOTTOM	516	2.044	1054.704	2109.408
		#5@18" EA. WAY TOP	258	1.043	269.094	538.188
F3211T	1	#9@9" EA. WAY BOTTOM	891	3.4	3029.4	3029.4
		#7@16" EA. WAY TOP	495	2.044	1011.78	1011.78
F4114T	1	#8@12" EA. WAY BOTTOM	1120	2.67	2990.4	2990.4
		#7@12" EA. WAY TOP	1120	2.044	2289.28	2289.28
F3912T	1	#8@8" EA. WAY BOTTOM	1296	2.67	3460.32	3460.32
		#6@16" EA. WAY TOP	648	1.502	973.296	973.296
Total						26341

Metal Deck Take-Off:

Metal Deck		
Level	Type	Floor Area (SF)
Level 2	2" 20 gauge Galvanized	16590
Penthouse	2" 20 gauge Galvanized	5400
Roof	1 1/2" 20 gauge Galvanized	28775
Total		50765

Slab on Deck				
Level	Type	Thickness (ft)	Floor Area (SF)	Volume Total (CY)
Level 2	3.25" LW Concrete	0.271	16590	166.51
Penthouse	3.25" LW Concrete	0.271	5400	54.20
Roof	3.25" LW Concrete	0.271	28775	288.82
Total			50765	509.53

Slab on Deck Reinforcing				
Level	Reinforcement	Floor Area (SF)	Weight (lb/100SF)	Total Weight (lb)
Level 2	6x6—W1.4xW1.4	16590	21	3483.9
Penthouse	6x6—W1.4xW1.4	5400	21	1134
Roof	6x6—W1.4xW1.4	28775	21	6042.75
Total				10660.65

Beams Take-Off:

Steel Beams				
Type	Quantity	Total LF	Weight (lb/LF)	Total Weight (lb)
W8x15	7	104	15	1560
W8x24	10	278	24	6672
W8x31	1	13	31	403
W10x12	111	871	12	10452
W10x19	5	33	19	627
W12x14	6	61	14	854
W12x16	8	97	16	1552
W12x19	2	38	19	722
W12x22	9	67	22	1474
W14x22	19	222	22	4884
W14x26	1	18	26	468
W14x30	2	46	30	1380
W16x26	5	65	26	1690
W16x31	3	130	31	4030

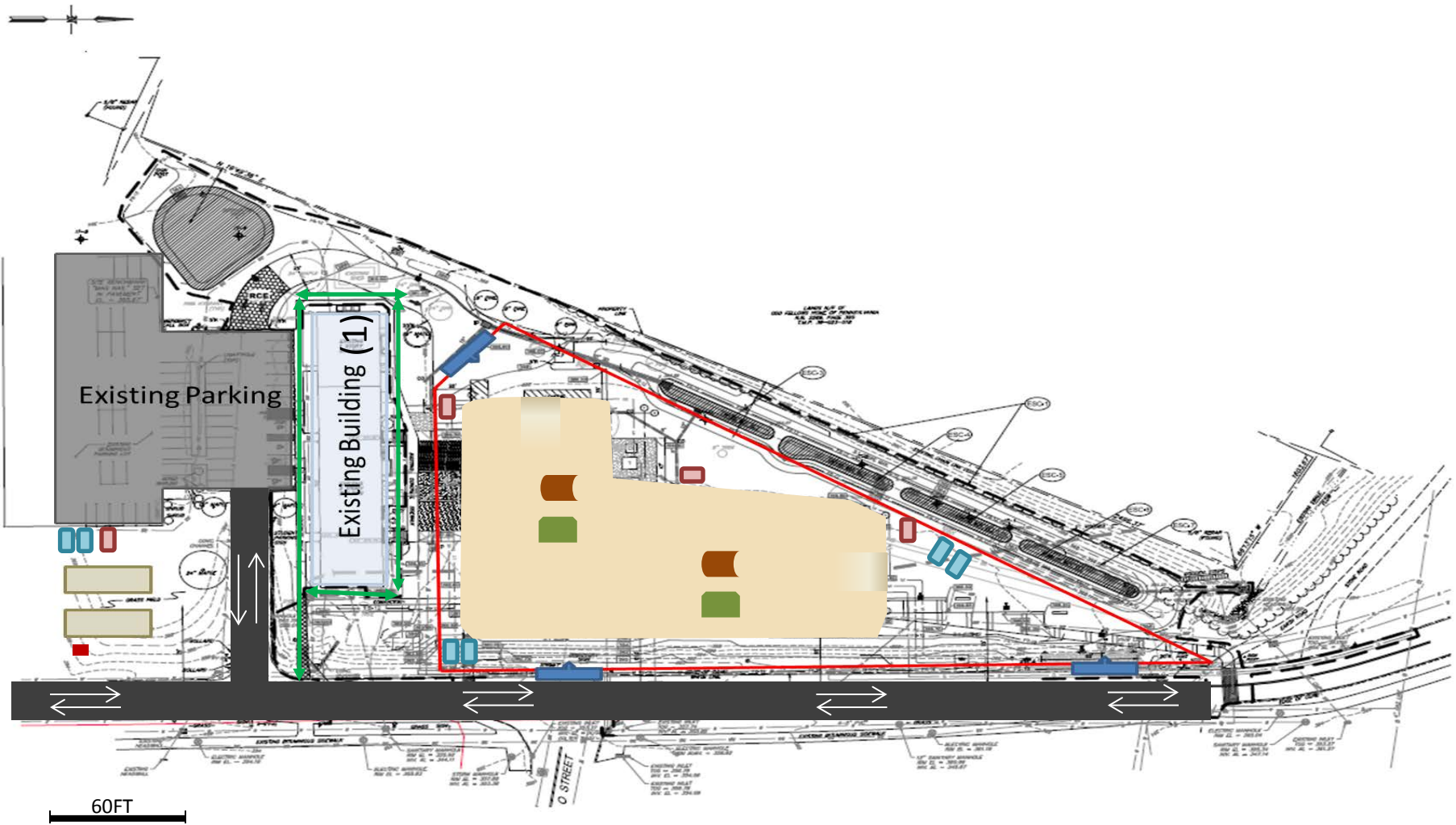
W16x40	3	76	40	3040
W16x67	1	18	67	1206
W16x100	2	87	100	8700
W18x35	14	411	35	14385
W18x40	6	181	40	7240
W18x50	2	34	50	1700
W18x60	4	142	60	8520
W18x86	2	50	86	4300
W18x97	1	39	97	3783
W18x119	3	129	119	15351
W18x158	2	52	158	8216
W21x44	31	1027	44	45188
W21x50	14	493	50	24650
W21x62	23	711	62	44082
W21x68	14	306	68	20808
W21x83	2	71	83	5893
W21x93	3	124	93	11532
W21x101	4	115	101	11615
W21x132	4	141	132	18612
W21x182	1	32	182	5824
W24x55	72	2213	55	121715
W24x62	10	450	62	27900
W24x68	6	223	68	15164
W24x76	4	178	76	13528
W24x84	11	317	84	26628
W24x94	3	89	94	8366
W24x103	3	114	103	11742
W24x104	8	223	104	23192
W24x117	3	125	117	14625
W24x131	4	159	131	20829
W24x146	4	160	146	23360
W24x162	5	207	162	33534
W24x229	1	45	229	10305
W24x250	1	38	250	9500
W24x279	1	38	279	10602
W30x90	1	11	90	990
HSS6x4x3/16	1	11	11.97	131.67
HSS6x4x3/8	4	141	22.37	3154.17
HSS6x4x1/2	16	104	28.43	2956.72
HSS8x6x1/2	3	30	11.6	348
HSS10x6x1/2	6	133	13.5	1795.5

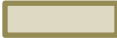











C15x50	2	46	50	2300
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Columns Take-Off:

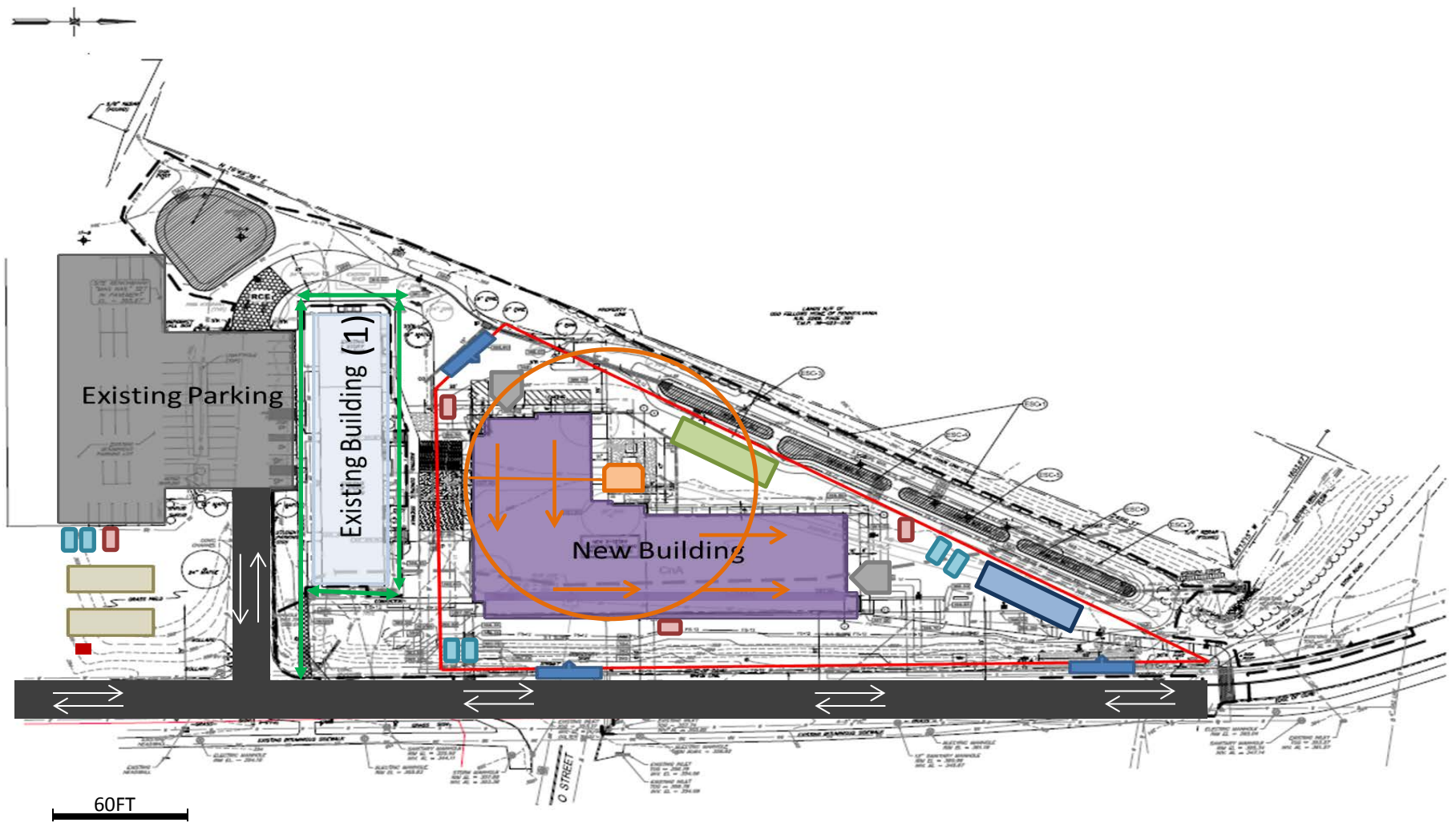
Steel Columns				
Type	Quantity	Length (ft)	Total Length (ft)	Total Length per type (ft)
W8x21	11	15	165	165
W10x33	3	7	21	291
W10x33	4	15	60	
W10x33	7	30	210	
W10x39	1	15	15	122
W10x39	2	30	60	
W10x39	1	47	47	
W10x45	1	15	15	362
W10x45	10	30	300	
W10x45	1	47	47	
W10x49	2	7	14	286
W10x49	1	15	15	
W10x49	7	30	210	
W10x49	1	47	47	
W10x54	3	15	45	182
W10x54	3	30	90	
W10x54	1	47	47	
W10x60	1	15	15	233
W10x60	1	30	30	
W10x60	4	47	188	
W10x68	2	30	60	60
W10x88	1	7	7	101
W10x88	2	47	94	
W10x100	2	30	60	60
HSS4x3x1/4	9	15	135	135
HSS4x4x3/8	2	7	14	14













Appendix D: Site Plans



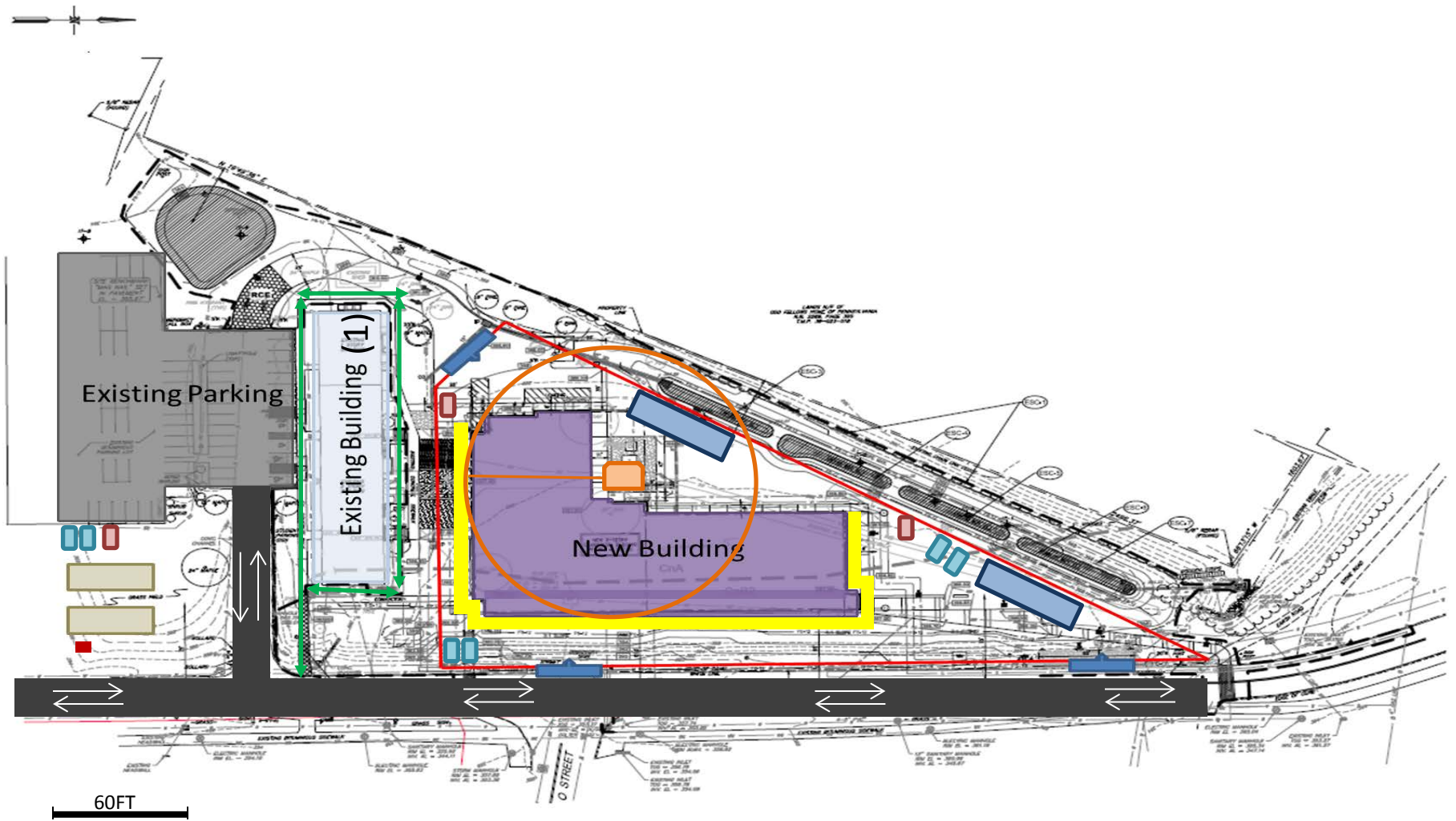
	Office Trailers		Dumpster		Soil
	Fence		Traffic Flow		Ramps
	Site Access		Pedestrian Flow		Excavator
	Portable Toilet		Temporary Power		Dump Truck












Penn State Harrisburg	Meshal Alenezi
Educational Activities Building	10/16/2013
Harrisburg, PA	Excavation Site Plan



	Office Trailers		Dumpster		Concrete Truck
	Fence		Traffic Flow		Steel Laydown
	Site Access		Pedestrian Flow		Material Laydown
	Portable Toilet		Temporary Power		Mobile Crane

Penn State Harrisburg	Meshal Alenezi
Educational Activities Building	10/16/2013
Harrisburg, PA	Superstructure Site Plan



	Office Trailers		Dumpster		Mobile Crane
	Fence		Traffic Flow		Scaffolding
	Site Access		Pedestrian Flow		Material Laydown
	Portable Toilet		Temporary Power		

Penn State Harrisburg	Meshal Alenezi
Educational Activities Building	10/16/2013
Harrisburg, PA	Enclosure Site Plan

Appendix E: General Conditions Estimate

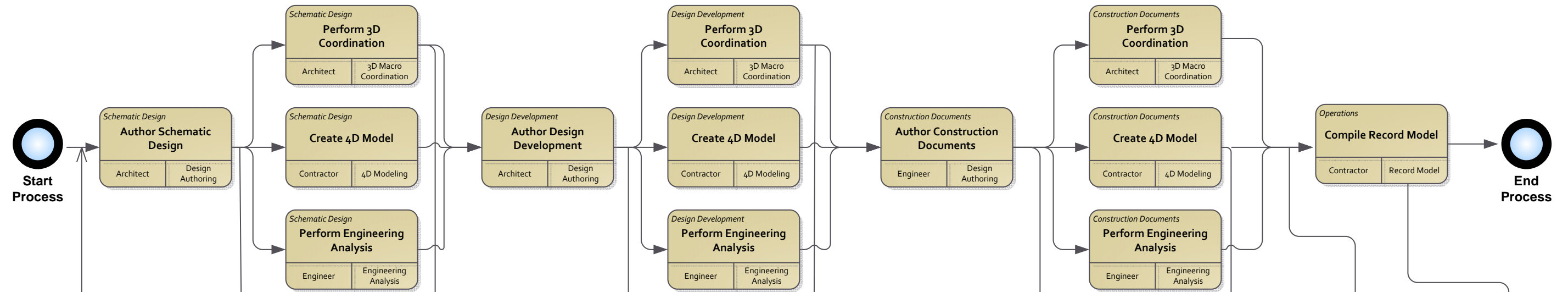
General Conditions													
CSI Division	Description	Unit Costs							Total Costs				
		Quantity	Unit	Material	Labor	Equipment	Total	Total O&P	Material	Labor	Equipment	Total	Total O&P
01311320 0010	Field personnel												
01311320 0140	Field personnel, field engineer, maximum	68	Week	0.00	1500.00	0.00	1500.00	2325.00	0	10200.00	0	10200.00	15810.00
01311320 0220	Field personnel, project manager, maximum	68	Week	0.00	2475.00	0.00	2475.00	3825.00	0	16830.00	0	16830.00	26010.00
01311320 0280	Field personnel, superintendent, maximum	68	Week	0.00	2300.00	0.00	2300.00	3550.00	0	15640.00	0	15640.00	24140.00
01510000 0000	Temporary Utilities												
01511380 0100	Temporary Heat, per week, 12 hours per day, incl. fuel and operation	514	CSF Flr	28.57	3.63	0.00	32.20	37.28	14684.98	1865.82	0	16550.80	19161.92
01511380 0350	Temporary Power, lighting, incl. service lamps, wiring and outlets, min	514	CSF Flr	2.91	12.10	0.00	15.01	21.28	1495.74	6219.4	0	7715.14	10937.92
01511380 0430	Temporary Power, for temp lighting only, 11.8 KWH/month	514	CSF Flr	0.00	0.00	0.00	1.67	1.84	0	0	0	858.38	945.76
01521300 0000	Field offices and sheds												
01521320 0020	Office Trailer, furnished, buy, 20' x 8', excl. hookups	2	Ea.	8883.45	725.20	0.00	9608.65	10893.60	17766.9	1450.4	0	19217.3	21787.2
01521320 0700	Office Trailer, excl. hookups, air conditioning, rent per month, add	64	Ea.	47.79	0.00	0.00	47.79	52.47	3058.56	0	0	3058.56	3358.08
01521320 1200	Storage Boxes, buy, 20' x 8'	1	Ea.	3142.98	401.80	0.00	3544.78	4076.98	3142.98	401.8	0	3544.78	4076.98
01521320 1300	Storage Boxes, buy, 40' x 8'	1	Ea.	4130.03	519.40	0.00	4649.43	5344.33	4130.03	519.4	0	4649.43	5344.33
01521340 0010	FIELD OFFICE EXPENSE												
01521340 0100	Field Office Expense, office equipment rental, average	16	Month	207.80	0.00	0.00	207.80	228.58	3324.8	0	0	3324.8	3657.28
01543340 6430	Rent toilet, fresh water flush, garden hose, Excl. Hourly Oper. Cost.	16	Month	0.19	32.83	295.45	328.47	325.00	3.04	525.28	4727.2	5255.52	5199.92
01562650 0100	Temporary Fencing, chain link, 6' high, 11 ga	1039	L.F.	2.69	1.85	0.00	4.54	5.81	2794.91	1922.15	0	4717.06	6036.59
01741320 0100	Cleaning up	51.4	M.S.F.	1.94	54.39	6.57	62.90	93.12	99.716	2795.646	337.698	3233.06	4786.368
01311390 0010	Performance bond	Job	%				2.50	2.50				27160.00	27160.00
Total											770,424.8	1,016,492	

Appendix F: BIM Evaluation

BIM Use*	Value to Project	Responsible Party	Value to Resp Party	Capability Rating			Additional Resources / Competencies Required to Implement	Notes	Proceed with Use
				Resources	Competency	Experience			
	High / Med / Low		High / Med / Low	Scale 1-3 (1 = Low)					YES / NO / MAYBE
Building Systems Analysis	Med	MEP Engineer	High	3	3	2			Maybe
Record Modeling	High	Contractor	Med	3	3	3			Yes
		Facility Manager	High	3	2	3			
		Architect	High	3	3	3			
Cost Estimation	Med	Contractor	High	3	2	1			No
4D Modeling	High	Contractor	High	3	2	2			Yes
		Subcontractors	Med	3	3	3			
3D Coordination (Construction)	High	Contractor	High	3	2	2			Yes
		Subcontractors	High	2	2	2			
Engineering Analysis	High	MEP Engineer	High	3	2	2			Yes
		Architect	Med	3	3	3			
3D Coordination (Design)	High	Architect	High	3	3	3			Yes
		MEP Engineer	High	2	2	2			
		Structural Engineer	High	2	2	2			
Existing Conditions Modeling	Low	Contractor	Med	3	2	2			No

Design Authoring	High	Architect	High	3	3	3			Yes
		MEP Engineer	High	3	3	2			
		Structural Engineer	Med	2	2	2			
* Additional BIM Uses as well as information on each Use can be found at http://www.engr.psu.edu/ae/cic/bimex/									

BIM USES



INFO. EXCHANGE

