

October 27<sup>th</sup>, 2010

# TECHNICAL ASSIGNMENT TWO

PENN STATE SENIOR THESES



## UNIVERSITY SCIENCES BUILDING

NORTHEASTERN U.S.

PENNSTATE



**Turner**

**JUSTIN GREEN**

CONSTRUCTION MANAGEMENT  
ADVISOR: DR. RILEY



# University Sciences Building

Northeastern U.S.

## TECHNICAL ASSIGNMENT TWO

Justin Green - CM

### EXECUTIVE SUMMARY

**Technical Assignment Two** is intended to analyze the key features of the project that affect the project execution of the University Sciences Building. This project is a mixed use facility that will house both students and faculty of the university. It includes 39 research and teaching laboratories for bio-medical engineering, biology, chemistry, and fossil preparation. This 138,000 square foot building also houses 8 educational classrooms, a small auditorium seating 240 students, and a wing dedicated to both administrative and faculty support.

This report will contain a **detailed project schedule** that is more developed than the summary schedule developed in the first technical assignment. This schedule is comprised of two hundred line items that summarize the key construction tasks and their relationships on the project. Some of the larger challenges with construction will be discussed under the **site layout** portion of this technical report. Under this section, an in-depth analysis of site logistical planning during the building's superstructure phase will describe some of the reasoning behind where items were placed on the jobsite, and how they could possibly be re-arranged to allow for better efficiency in layout around the building perimeter.

Two estimates can be found in the later portion of the report. The first is a **detail structural estimate** that breaks down the costs of steel and concrete within the building. This estimate provided some difficulties because of the building's unique layout and the variety of structural systems implemented into the design. This building has a mix of precast filigree slabs, cast-in-place concrete, and structural steel. The second estimate is a **general conditions estimate**. This estimate breaks down the general conditions costs into four major categories: Supervision & Personnel, Construction Facilities & Equipment, Temporary Utilities, and other Miscellaneous Costs. The largest of which is the cost of supervision & personnel, and the most difficult to accurately predict was the temporary utilities costs during construction. All unit rates were obtained from RS Means Building Construction and all quantities were scaled from the supplied contract drawings.

Lastly, this report contains a summary of **critical industry issues** discussed during the PACE Roundtable Meeting. Items discussed include surprising facts learned, issues that might affect or be applied to this project, and key contacts obtained that can be used for future reference.

After analyzing the information within the report, site logistics is a critical feature and needs to be thoroughly thought out for any project with a limited amount of space for materials and equipment. Site logistics in a congested city has a direct impact on the phasing of exterior enclosures and other trades on site. These considerations can be shown on the detailed project schedule attached.



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## DETAILED PROJECT SCHEDULE

*\*See APPENDIX A for the Detailed Project Schedule*

### PRECONSTRUCTION / PROCUREMENT

The University Sciences Building was bid out in the traditional Design-Bid-Build fashion. This means that there was very little to no overlap between the design and construction phases of the project. It is because of this that Turner Construction is unaware of the specific details in the procurement and design of this facility. In comparison with other facilities of the same occupancy type and location, it was determined that the design phase of the project was in the vicinity of 1 year, or 260 work days.

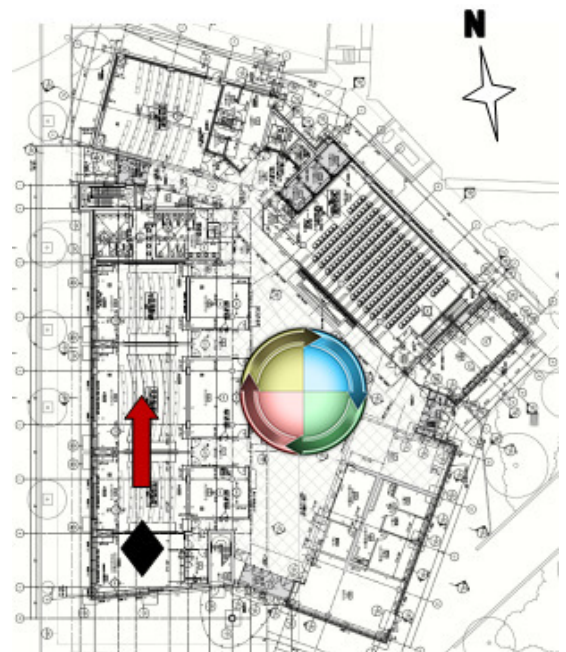
Members of the construction team are also unaware of the exact time frame of when the design was put out to bid and when the team was awarded the project. Most construction projects have a typical contractor selection period of about a month and a half, resulting in the duration of 35 work days for the bid and award of the CM @ Risk.

Lastly, a major time commitment of any project startup is the permits and approvals needed to begin construction. When researching typical permit request and approval durations in the area, it was found that construction permits can take anywhere from 15 to 90 days depending on what type of permit is being requested. This is what you see in the final line item of the preconstruction phase (*Reference Appendix A*).

### CONSTRUCTION

For this technical report, the preconstruction and project completion dates did not change from the initial overview schedule generated in the first technical report. For this report, construction was broken up into five major subdivisions. These divisions are general, foundation/superstructure, enclosure/façade, MEP systems, and finishes. Within these divisions are minor subdivisions that break the building up into its different areas.

The major sequence of work on this project is such that construction starts on the first floor and raises one floor at a time in a clockwise rotation until the penthouse is reached (*see Figure 1*). This however, is not the sequence pattern for every type of activity on the project.



*Figure 1: First Floor Layout Showing Sequence*



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## CONSTRUCTION ACTIVITY BREAKDOWN

### *Foundation / Superstructure*

The structure of the building is comprised of drilled caisson piers, pile caps, grade beams, shear walls, concrete/steel columns, and precast/cast-in-place concrete slabs. The masonry walls are under the enclosure/façade portion of the schedule because there are no load bearing walls in the University Sciences Building, making the CMU walls an architectural feature of the building instead of a means of support for the facility.

This grouping of activities is broken down by floor, starting at the basement level and proceeding to the roof of the penthouse floor.

One important thing to point out is that the slab on grade (SOG) was placed after the other building slabs because of the shoring required to support each floor above. You need four levels of shoring before you can start the SOG. Another reason that SOG's are typically skipped over and poured later on in the job is because of the time needed to wait for the ground floor to cure. This can hold up other activities within the building.

### *Enclosure / Façade*

The enclosure is unique in that the sequencing of masonry wall proceeds from floor to floor, while the rest of the façade focuses on one face of the building at a time. More time was allocated to the masonry work on the first floor when compare to the other floors that have a similar quantity of CMU block. This may be because of the learning curve with any new activity, and possibly the assembly of scaffolding around the facility.

Another surprising fact about the sequencing of the façade is that it typically proceeds in a clockwise direction like the other building activities, but often skips the south-eastern façade of the building (the side facing the laydown area) and returns after the other faces have been completed. Perhaps this is due to limited space on that side of the University Sciences Building at the time of erection.

### *MEP Systems*

The MEP systems consist of electrical, mechanical, plumbing, fire protection, and elevator work. Of these systems, the electrical, mechanical, and plumbing features of the building have been broken down into their core activities. These activities include rough-in, distribution, and final connections. The hardest of which to analyze was that of the mechanical systems within the building. This is because of the large air and ventilation requirements that are involved with the laboratory spaces, as well as the quantity of activities present in the current schedule.



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## ***Building Finishes***

The building finishes were broken down into framing of interior partitions, hanging/taping/painting drywall, installation of ceiling grid, hanging of lighting fixtures, dropping ceiling tile, and flooring installation. Other key finishes to point out lie within the auditorium and atrium spaces within the University Sciences Building.

The atrium is unique because of its living wall system and the large quantity of scaffolding that will fill every square foot of the open space. The four floor atrium spaced will be completely filled with scaffolding in order to streamline the finishing of walls and railings around the perimeter of the space. The less you move scaffolding or other forms of equipment, more time can be spent actually performing the work and performing the work safely.

## ***Summary of Key Milestones***

MILESTONES	KEY CONSTRUCTION DATES
Notice to Proceed	8/25/2009
Ground Breaking	10/21/2009
Steel Top Out	7/20/2010
Enclosure	1/27/2011
Substantial Completion	6/30/2011

*Figure 2: Summary of Key Project Milestones*



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## SITE LAYOUT PLANNING

**\*See APPENDIX B for a Site Plan of the Superstructure Logistics Plan**

The site for the University Sciences Building is located in the heart of the University's campus. This means that vehicular and pedestrian traffic will be a major concern during all phases of the project. Whether it means blocking of street lanes or installing overhead protection, site safety has to be taken into serious consideration.

Being in a city has its advantages and disadvantages. One perk of this building's location is the easy access to nearby utility lines and highly skilled trades in the area. Some of the major disadvantages include limited space for site storage and material deliveries. This means that more thought has to be put into scheduling and material staging. Less space outside of the building also typically equates to more congestion within the building.

### The Superstructure Phase Plan

The site logistics plan shown below (and in larger detail in Appendix B) of the superstructure phase of the project is very similar to all other phases of the project. Site access and laydown space along with trailer locations are identical throughout the entire duration of the project. The key feature shown in figure 3 is that of the positioning of the tower crane. This type of crane was used because of the limited space around the perimeter of the University Sciences Building, as well as the convenience of having a large open space within the building to help avoid crane interference with building trades.

### Contractor Layout Critique

This site is already extremely efficient, mostly because of the simplicity of its layout and the limited space to stage any materials or equipment outside of the building.

The positioning of the tower crane in the atrium makes sense because of its central location, the ease of access to all areas of the structure, and the limited disturbance to the work surrounding the tower (no holes left to patch after the floors are erected and crane is removed).

Two site entrances with two areas for material distribution help give the site flexibility and ease of access at all times.

The only space that could be rearranged or condensed is that of the northwestern corner of the site. It may have been better to arrange the concrete subcontractor's trailer next to the other trailers on site. Also, the mock-up panel has room to move either further backward or closer to the Turner job trailers. Moving these few items would allow for more space that could be used to store materials or equipment.

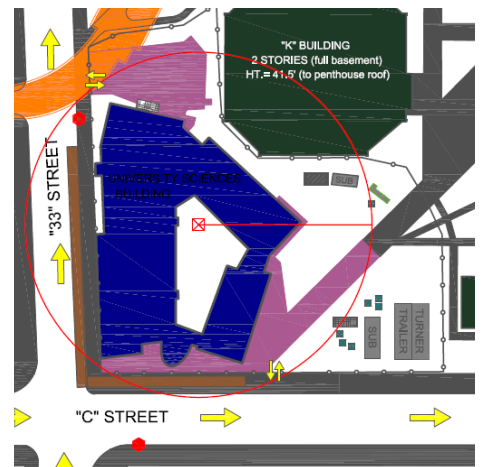


Figure 3: Superstructure Layout Plan



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## DETAILED STRUCTURAL SYSTEM ESTIMATE

***\*See APPENDIX C for the complete Structural System Estimate***

The superstructure for the University Sciences Building is composed of a variety of different steel and concrete systems. Steel for the building contains a variety of I-beams sizes, mainly located at the Penthouse levels, with some steel existing above the first floor auditorium. The University Sciences Building's concrete floor system is composed of a thin precast layer (filigree slab) that supports a voided cast-in-place concrete slab on top.

This detailed structural estimate (*located in Appendix C*) is a good representation of the actual system costs for concrete and steel within the building.

Some of the major factors that can affect cost are as follows:

- Quality
- Productivity
- Size of Project
- Location
- Overtime

The factor that most affects this estimate is productivity because of the use of precast panels on the project. These filigree slabs can drastically reduce the time of placing concrete and completing the structure. Filigree slabs replace the need for formwork, thereby reducing the time between concrete placements. This is why the estimated concrete values are a little higher than the actual cost of the system (*see figure 4 below*), because of the labor savings not accounted for by the RS Means values utilized in the estimate.

Steel costs were found to be almost exactly the same as the actual cost of construction. The accuracy of this estimate can be contributed to the detailed breakdown of each and every structural steel member within the building (with the exception of tube steel supporting the atrium skylights).

MAJOR STRUCTURAL SYSTEMS				
SYSTEM	ACTUAL COST	COST PER SF	ESTIMATED COST	COST PER SF
Concrete	\$ 5,800,000	\$ 42.03	\$ 6,927,426	\$ 50.20
Steel	\$ 800,000	\$ 5.80	\$ 797,602	\$ 5.78

*Figure 4: Structural Comparison  
Actual vs. Estimated*

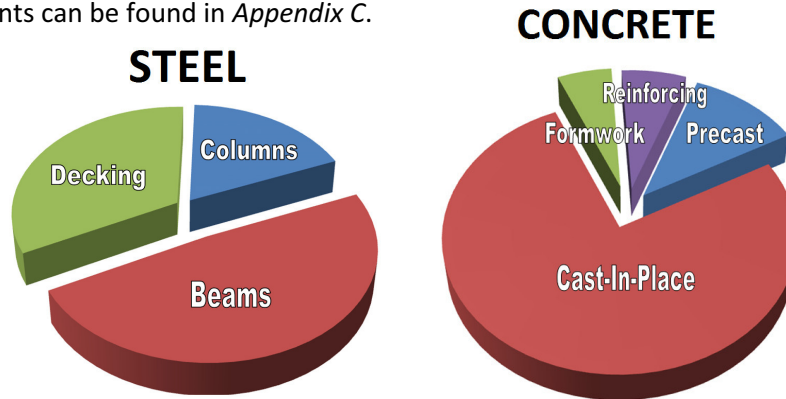




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These pie charts shown in *figure 5* represent the breakdown of costs for each type of structural system. Actual dollar amounts can be found in *Appendix C*.



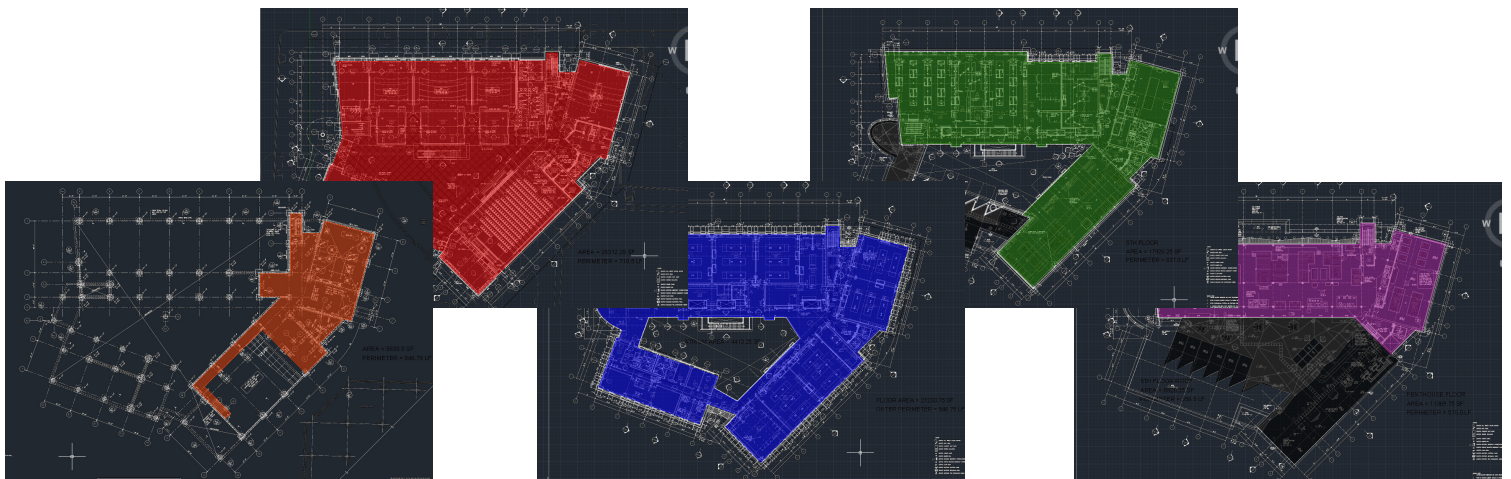
*Figure 5: Cost Percentage Breakdowns for Steel & Concrete Systems*

Items that the detailed estimate does not include are:

*Concrete finishing/curing, bulk heads, expansion/saw cut joints, block outs, masonry CMU, metal wall studs, miscellaneous steel, or percentages for material waste.*

All of the unit pricing in this detailed estimate came from RS Means Building Construction 2011. These values were used to determine all material, labor, and equipment costs for the structural system of the University Sciences Building. A location factor was applied at the end of the estimate to accurately adjust the average costs that RS Means supplies to better fit the city that this building is currently being constructed.

Other assumptions and findings can be found at the end of the estimate, located in *Appendix C*. Floor areas were determined using the scaled CAD drawings shown below in *figure 6*.



*Figure 6: Floor Areas Found in CAD for Quantity Take-offs*



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## GENERAL CONDITIONS ESTIMATE

*\*See APPENDIX D for the complete Structural System Estimate*

The estimate, summarized in *figures 7 and 8*, shows the cost breakdown for the general conditions of the University Sciences Building project. All values are an approximation based upon RS Means figures, and do not reflect the actual amounts incurred by Turner construction.

The estimate was broken down into four separate categories: Supervision and Personnel, Construction Facilities and Equipment, Temporary Utilities, and other Miscellaneous Costs. All figures are based on a project duration of 22 months, and a bulk construction period of 20 months.

**Supervision and Personnel** includes all staffing and project administration for the project. This cost was found to be the largest of the four categories considered, and will be the case for most projects constructed in the United States.

**Construction Facilities and Equipment** incorporates items such as field office trailer set-up & removal, construction fencing & pedestrian protection, storage, tools & equipment, personal protective equipment, etc.

**Temporary Utilities** are the most difficult of the four categories to accurately predict without knowing the exact extent and durations for the use of things such as temporary power, water, phone, toilets, etc. on the project.

**Miscellaneous Costs** account for items such as commissioning, document reproduction, permits, bonding, insurance, travel expenses, etc. These costs account for the second largest contribution to the general conditions estimate. This is true in large part because of the cost of commissioning, permits, bonding, and insurance on the job. Each of these categories is determined by RS Means as a percentage of the overall cost of the project. So the larger the project, the higher the miscellaneous costs incurred.

### GENERAL CONDITIONS SUMMARY

Description	Cost/Month	Cost
Supervision and Personnel	\$ 68,611	\$ 1,509,450
Construction Facilities and Equipment	\$ 7,325	\$ 161,150
Temporary Utilities	\$ 2,350	\$ 51,700
Miscellaneous Costs	\$ 56,578	\$ 1,244,720
<b>TOTAL</b>		<b>\$ 2,967,020</b>

Figure 7: General Conditions Breakdown by Category.

### General Conditions Summary

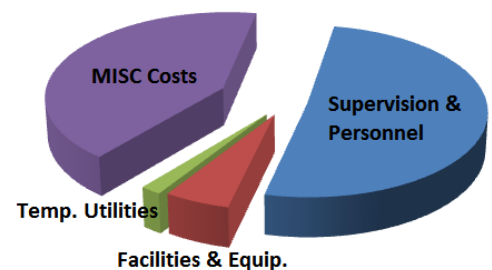


Figure 8: General Conditions by percentage.



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## CRITICAL INDUSTRY ISSUES – PACE ROUNDTABLE SUMMARY

*Summary of events to follow shortly...*



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## APPENDIX A - Detailed Project Schedule

ID	Task Name	Start	Finish	Duration	Phase
1	PRECONSTRUCTION / PROCUREMENT	Thu 3/20/08	Wed 9/9/09	385 days	PRECONSTRUCTION / PROCUREMENT
2	GENERAL	Thu 3/20/08	Wed 9/9/09	385 days	GENERAL
3	Design Phase	Thu 3/20/08	Wed 3/18/09	260 days	GENERAL
4	Bid & Award CM @ Risk	Thu 3/19/09	Wed 5/6/09	35 days	GENERAL
5	Permits & Approvals	Thu 5/7/09	Wed 9/9/09	90 days	GENERAL
6	CONSTRUCTION	Tue 8/25/09	Thu 6/16/11	473 days?	CONSTRUCTION
7	GENERAL	Tue 8/25/09	Thu 10/22/09	43 days	GENERAL
8	Notice to Proceed	Tue 8/25/09	Tue 8/25/09	0 days	GENERAL
9	Mobilization	Tue 8/25/09	Mon 9/21/09	20 days	GENERAL
10	Survey & Layout	Thu 10/15/09	Thu 10/22/09	6 days	GENERAL
11	FOUNDATION / SUPERSTRUCTURE	Wed 10/21/09	Fri 8/27/10	223 days	FOUNDATION / SUPERSTRUCTURE
12	BASEMENT	Wed 10/21/09	Wed 3/31/10	116 days	BASEMENT
13	Drill/Place Caisson Piles	Wed 10/21/09	Fri 10/30/09	8 days	BASEMENT
14	Install Steel Soldier Beams	Wed 11/4/09	Mon 11/9/09	4 days	BASEMENT
15	Bulk Excavation	Mon 11/16/09	Fri 12/18/09	25 days	BASEMENT
16	Install Wood Lagging, Rakers, & Heel Blocks	Mon 12/7/09	Fri 12/18/09	10 days	BASEMENT
17	Excavate for Grade Beams/Pile Caps	Wed 1/6/10	Fri 1/15/10	8 days	BASEMENT
18	F/R/P Grade Beams	Wed 1/6/10	Fri 1/15/10	8 days	BASEMENT
19	F/R/P Columns/Shearwalls	Mon 1/18/10	Thu 1/28/10	9 days	BASEMENT
20	MEP Underground	Mon 2/1/10	Wed 2/24/10	18 days	BASEMENT
21	Vapor Barrier	Wed 2/24/10	Mon 3/8/10	9 days	BASEMENT
22	F/R/P Basement Slab on Grade	Wed 2/24/10	Tue 3/9/10	10 days	BASEMENT
23	Perimeter Drainage	Mon 3/15/10	Tue 3/20/10	12 days	BASEMENT
24	Backfill Foundations	Mon 3/15/10	Wed 3/31/10	13 days	BASEMENT
25	GROUND FLOOR	Thu 12/10/09	Fri 8/27/10	187 days	GROUND FLOOR
26	Install New Fill	Thu 12/10/09	Tue 12/15/09	4 days	GROUND FLOOR
27	F/P Pile Caps	Mon 2/1/10	Thu 3/25/10	39 days	GROUND FLOOR
28	F/R/P Grade Beams	Wed 2/3/10	Thu 3/25/10	37 days	GROUND FLOOR
29	F/R/P Columns/Shearwalls (1st to 2nd)	Fri 2/19/10	Mon 4/12/10	37 days	GROUND FLOOR
30	Structural Steel (Auditorium)	Wed 3/24/10	Fri 3/26/10	3 days	GROUND FLOOR
31	MEP Underground	Mon 6/14/10	Fri 7/23/10	30 days	GROUND FLOOR
32	Grade Stone For SOG	Mon 7/19/10	Fri 7/23/10	5 days	GROUND FLOOR
33	Vapor Barrier	Mon 7/26/10	Fri 7/30/10	5 days	GROUND FLOOR
34	F/R/P Slab on Grade	Mon 8/2/10	Fri 8/13/10	10 days	GROUND FLOOR
35	F/P Steps in Classrooms	Mon 8/16/10	Fri 8/27/10	10 days	GROUND FLOOR
36	2ND FLOOR	Mon 3/22/10	Mon 6/7/10	56 days	2ND FLOOR

Project: Detailed Project Schedule  
Date: 10/27/2010

Summary  
Project Summary  
External Tasks

Task  
Split  
Milestone

External Milestone  
Inactive Task  
Inactive Milestone

Inactive Summary  
Manual Task  
Duration-only

Manual Summary Rollup  
Start-only  
Finish-only

Deadline  
Progress

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ID	Task Name	Start	Finish	Duration	Task Description
37	Shore and Set Filigree	Mon 3/22/10	Tue 4/13/10	17 days	Shore and Set Filigree
38	F/R/P Concrete Slab	Thu 3/25/10	Fri 4/16/10	17 days	F/R/P Concrete Slab
39	F/R/P Columns/Shearwalls (2nd to 3rd)	Wed 4/7/10	Mon 4/26/10	14 days	F/R/P Columns/Shearwalls (2nd to 3rd)
40	Strip and Move Shoring	Tue 6/1/10	Mon 6/7/10	5 days	Strip and Move Shoring
41	<b>3RD FLOOR</b>	<b>Tue 4/13/10</b>	<b>Fri 6/4/10</b>	<b>39 days</b>	<b>Strip and Move Shoring</b>
42	Shore and Set Filigree	Tue 4/13/10	Tue 4/27/10	11 days	Shore and Set Filigree
43	F/R/P Concrete Slab	Tue 4/20/10	Fri 4/30/10	9 days	F/R/P Concrete Slab
44	F/R/P Columns/Shearwalls (3rd to 4th)	Mon 4/26/10	Tue 5/11/10	12 days	F/R/P Columns/Shearwalls (3rd to 4th)
45	Strip and Move Shoring	Thu 6/3/10	Fri 6/4/10	2 days	Strip and Move Shoring
46	<b>4TH FLOOR</b>	<b>Sat 4/17/10</b>	<b>Thu 6/10/10</b>	<b>39 days</b>	<b>Strip and Move Shoring</b>
47	Shore and Set Filigree	Thu 4/29/10	Thu 5/13/10	11 days	Shore and Set Filigree
48	F/R/P Concrete Slab	Sat 4/17/10	Sat 4/17/10	1 day	F/R/P Concrete Slab
49	F/R/P Columns/Shearwalls (4th to 5th)	Mon 5/17/10	Wed 5/26/10	8 days	F/R/P Columns/Shearwalls (4th to 5th)
50	Strip and Move Shoring	Thu 6/10/10	Thu 6/10/10	1 day	Strip and Move Shoring
51	<b>5TH FLOOR</b>	<b>Wed 5/19/10</b>	<b>Mon 6/14/10</b>	<b>19 days</b>	<b>Strip and Move Shoring</b>
52	Shore and Set Filigree	Wed 5/19/10	Tue 6/1/10	10 days	Shore and Set Filigree
53	F/R/P Concrete Slab	Thu 5/20/10	Mon 6/7/10	13 days	F/R/P Concrete Slab
54	F/R/P Columns/Shearwalls (5th to Pent)	Thu 5/27/10	Tue 6/1/10	4 days	F/R/P Columns/Shearwalls (5th to Pent)
55	Strip and Move Shoring	Mon 6/14/10	Mon 6/14/10	1 day	Strip and Move Shoring
56	<b>PENTHOUSE / LOWER ROOF</b>	<b>Fri 5/28/10</b>	<b>Wed 7/28/10</b>	<b>44 days</b>	<b>Strip and Move Shoring</b>
57	Shore and Set Filigree	Fri 5/28/10	Tue 6/8/10	8 days	Shore and Set Filigree
58	F/R/P Concrete Slab	Thu 6/3/10	Thu 6/10/10	6 days	F/R/P Concrete Slab
59	Strip and Move Shoring	Tue 6/15/10	Tue 6/15/10	1 day	Strip and Move Shoring
60	Erect Structural Steel	Tue 7/6/10	Mon 7/12/10	5 days	Erect Structural Steel
61	Metal Decking	Thu 7/22/10	Wed 7/28/10	5 days	Metal Decking
62	<b>PENTHOUSE ROOF</b>	<b>Wed 7/14/10</b>	<b>Mon 8/16/10</b>	<b>24 days</b>	<b>Erect Structural Steel</b>
63	Erect Structural Steel	Wed 7/14/10	Tue 7/20/10	5 days	Erect Structural Steel
64	Metal Decking	Thu 7/29/10	Wed 8/4/10	5 days	Metal Decking
65	F/R/P Concrete	Tue 8/10/10	Mon 8/16/10	5 days	F/R/P Concrete
66	<b>ENCLOSURE / FAÇADE</b>	<b>Fri 5/21/10</b>	<b>Thu 1/27/11</b>	<b>180 days</b>	<b>ENCLOSURE / FAÇADE</b>
67	On-Site Mockup	Fri 5/21/10	Tue 7/20/10	43 days	On-Site Mockup
68	<b>MASONRY &amp; VAPOR BARRIER</b>	<b>Thu 6/10/10</b>	<b>Fri 9/24/10</b>	<b>77 days</b>	<b>MASONRY &amp; VAPOR BARRIER</b>
69	Masonry 1st Floor	Thu 7/8/10	Wed 8/4/10	20 days	Masonry 1st Floor
70	Masonry 2nd Floor	Thu 6/10/10	Wed 6/23/10	10 days	Masonry 2nd Floor
71	Masonry 3rd Floor	Mon 6/21/10	Fri 7/2/10	10 days	Masonry 3rd Floor
72	Masonry 4th Floor	Fri 6/25/10	Mon 7/12/10	12 days	Masonry 4th Floor

Project: Detailed Project Schedule Date: 10/27/2010

Task Split Milestone

Summary Project Summary External Tasks

External Milestone Inactive Task Inactive Milestone

Inactive Summary Manual Task Duration-only

Manual Summary Rollup Start-only Finish-only

Deadline Progress

Page 2

ID	Task Name	Start	Finish	Duration	Task	Summary	Project Summary	External Tasks	Summary	Task	Split	Milestone
73	Masonry 5th Floor	Thu 7/1/10	Fri 7/16/10	12 days								
74	Vapor Barrier Facing "33" Street	Mon 7/19/10	Fri 7/30/10	10 days								
75	Vapor Barrier Facing "K" Building	Mon 8/9/10	Fri 8/20/10	10 days								
76	Vapor Barrier Facing "C" Street	Mon 8/30/10	Fri 9/10/10	10 days								
77	Vapor Barrier Facing "S" Building	Mon 9/13/10	Fri 9/24/10	10 days								
78	<b>CURTAINWALL &amp; WINDOWS</b>	<b>Mon 7/12/10</b>	<b>Thu 12/16/10</b>	<b>114 days</b>								
79	Unitized - Fin - Facing "C" Street	Mon 7/12/10	Tue 8/3/10	17 days								
80	Unitized - Fin - Facing "33" Street	Wed 7/14/10	Fri 8/6/10	18 days								
81	Unitized - Fin - Facing "K" Building	Wed 7/21/10	Tue 7/27/10	5 days								
82	Unitized - Fin - Facing "S" Building	Wed 8/4/10	Fri 8/6/10	3 days								
83	Stick - Louvers - Facing "33" Street	Tue 7/27/10	Fri 8/13/10	14 days								
84	Stick - Louvers - Facing "C" Street	Tue 9/14/10	Thu 10/21/10	28 days								
85	Misc. - Louvers	Mon 8/30/10	Fri 9/10/10	10 days								
86	Misc. - Panel Frames	Mon 9/13/10	Fri 9/17/10	5 days								
87	Unitized - Panels/Windows - "33" Street	Wed 8/11/10	Fri 8/20/10	8 days								
88	Unitized - Panels/Windows - "K" Building	Fri 8/13/10	Tue 8/24/10	8 days								
89	Unitized - Panels/Windows - "C" Street	Mon 8/16/10	Wed 8/18/10	3 days								
90	Unitized - Panels/Windows - "S" Building	Wed 8/18/10	Tue 8/24/10	5 days								
91	Stick - Facing "33" Street	Wed 8/4/10	Mon 9/13/10	29 days								
92	Stick - Facing "S" Building	Thu 9/16/10	Tue 9/28/10	9 days								
93	Stick - Facing "C" Street	Wed 9/22/10	Wed 10/6/10	11 days								
94	Stick - Rotunda	Thu 11/18/10	Thu 12/16/10	21 days								
95	Stick - Atrium Skylight	Fri 10/1/10	Tue 11/23/10	38 days								
96	Skylight	Mon 9/20/10	Wed 9/22/10	3 days								
97	<b>STONE &amp; METAL EXTERIOR PANELS</b>	<b>Mon 8/2/10</b>	<b>Thu 1/27/11</b>	<b>129 days</b>								
98	Framing and Girts - Facing "33" Street	Mon 8/23/10	Fri 9/17/10	20 days								
99	Framing and Girts - Facing "C" Street	Mon 9/13/10	Fri 10/1/10	15 days								
100	Framing and Girts - Facing "K" Building	Mon 9/20/10	Thu 10/14/10	19 days								
101	Framing and Girts - Facing "S" Building	Mon 9/27/10	Tue 10/26/10	22 days								
102	Exterior Insulation - Facing "33" Street	Mon 9/6/10	Tue 9/28/10	17 days								
103	Exterior Insulation - Facing "K" Building	Mon 10/4/10	Mon 10/25/10	16 days								
104	Exterior Insulation - Facing "C" Street	Tue 10/26/10	Wed 11/10/10	12 days								
105	Exterior Insulation - Facing "S" Building	Thu 11/11/10	Tue 12/7/10	19 days								
106	Stone Panels - Facing "33" Street	Tue 10/26/10	Wed 11/17/10	17 days								
107	Stone Panels - Facing "K" Building	Thu 11/18/10	Thu 12/9/10	16 days								
108	Stone Panels - Facing "C" Street	Fri 12/10/10	Thu 12/30/10	15 days								

Project: Detailed Project Schedule Date: 10/27/2010

Task Summary: Summary, Project Summary, External Tasks

Task Split: Milestone

External Milestone: Inactive Milestone, Inactive Task, Inactive Milestone

Inactive Summary: Inactive Summary, Manual Task, Duration-only

Manual Summary Rollup: Manual Summary Rollup, Start-only, Finish-only

Deadline: Progress

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ID	Task Name	Duration	Start	Finish	Task Details
109	Stone Panels - Facing "S" Building	20 days	Fri 12/31/10	Thu 1/27/11	Stone Panels - Facing "S" Building
110	Profile Corrugated Panels	46 days	Mon 8/2/10	Mon 10/4/10	Profile Corrugated Panels
111	Standing Seam Panels	45 days	Tue 8/31/10	Mon 11/1/10	Standing Seam Panels
112	Composite Panels	22 days	Thu 11/11/10	Fri 12/10/10	Composite Panels
113	ROOFING (Insulation & EPDM)	78 days	Wed 7/7/10	Fri 10/22/10	ROOFING (Insulation & EPDM)
114	5TH FLOOR	78 days	Wed 7/7/10	Fri 10/22/10	5TH FLOOR
115	LOWER ROOF (6TH Floor)	14 days	Wed 7/28/10	Sun 8/15/10	LOWER ROOF (6TH Floor)
116	MECHANICAL PENTHOUSE (7th Floor)	19 days	Thu 7/29/10	Tue 8/24/10	MECHANICAL PENTHOUSE (7th Floor)
117	MEP SYSTEMS	231 days	Tue 6/1/10	Tue 4/19/11	MEP SYSTEMS
118	ELECTRICAL	211 days	Tue 6/1/10	Tue 3/22/11	ELECTRICAL
119	Panel Installation/Main Conduits	116 days	Tue 6/1/10	Tue 11/9/10	Panel Installation/Main Conduits
120	Wall Rough-In & Branches	71 days	Tue 9/14/10	Tue 12/21/10	Wall Rough-In & Branches
121	Install Main Transformer	20 days	Thu 10/14/10	Wed 11/10/10	Install Main Transformer
122	Ready for Permanent Power	1 day	Tue 10/26/10	Tue 10/26/10	Ready for Permanent Power
123	Switchboard / Distribution Panels	60 days	Thu 11/11/10	Wed 2/2/11	Switchboard / Distribution Panels
124	Final Connections	39 days	Thu 1/27/11	Tue 3/22/11	Final Connections
125	MECHANICAL	212 days	Mon 6/28/10	Tue 4/19/11	MECHANICAL
126	Mechanical Piping Mains	98 days	Mon 6/28/10	Wed 11/10/10	Mechanical Piping Mains
127	Distribution (Risers & Branches)	84 days	Thu 11/11/10	Tue 3/8/11	Distribution (Risers & Branches)
128	Connections & Terminations	30 days	Wed 3/9/11	Tue 4/19/11	Connections & Terminations
129	Chiller Delivery / Set	1 day	Mon 7/26/10	Mon 7/26/10	Chiller Delivery / Set
130	Generator Delivery / Set	10 days	Fri 9/24/10	Thu 10/7/10	Generator Delivery / Set
131	AHU Delivery / Set	10 days	Thu 9/30/10	Wed 10/13/10	AHU Delivery / Set
132	Cooling Tower Delivery / Set	10 days	Fri 10/8/10	Thu 10/21/10	Cooling Tower Delivery / Set
133	Electrical Connections to Mech. Equip.	15 days	Mon 10/11/10	Fri 10/29/10	Electrical Connections to Mech. Equip.
134	Equipment Start-Up	10 days	Thu 3/17/11	Wed 3/30/11	Equipment Start-Up
135	PLUMBING	187 days	Mon 6/28/10	Tue 3/15/11	PLUMBING
136	Plumbing Piping Mains	87 days	Mon 6/28/10	Tue 10/26/10	Plumbing Piping Mains
137	Distribution (Drops & Branches)	42 days	Mon 9/20/10	Tue 11/16/10	Distribution (Drops & Branches)
138	Connections & Terminations	34 days	Thu 1/27/11	Tue 3/15/11	Connections & Terminations
139	FIRE PROTECTION	197 days	Mon 7/12/10	Tue 4/12/11	FIRE PROTECTION
140	Fire Pump & Piping	11 days	Mon 7/12/10	Mon 7/26/10	Fire Pump & Piping
141	Fire Protection Standpipes	5 days	Tue 7/27/10	Mon 8/2/10	Fire Protection Standpipes
142	Fire Protection Mains	24 days	Thu 9/16/10	Tue 10/19/10	Fire Protection Mains
143	Distribution (Branches)	50 days	Thu 9/23/10	Wed 12/1/10	Distribution (Branches)
144	Sprinkler Heads	29 days	Thu 3/3/11	Tue 4/12/11	Sprinkler Heads

Project: Detailed Project Schedule Date: 10/27/2010

Summary: Summary, Project Summary, External Tasks

Task: Task, Split, Milestone

External Milestone: External Milestone, Inactive Task, Inactive Milestone

Inactive Summary: Inactive Summary, Manual Task, Duration-only

Manual Summary Rollup: Manual Summary Rollup, Start-only, Finish-only

Deadline: Deadline, Progress

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ID	Task Name	Duration	Start	Finish
145	ELEVATORS	98 days	Wed 10/20/10	Fri 3/4/11
146	Installation and Testing	98 days	Wed 10/20/10	Fri 3/4/11
147	FINISHES	226 days?	Thu 8/5/10	Thu 6/16/11
148	GROUND FLOOR			
149	Frame Interior Partitions	10 days	Wed 10/27/10	Tue 11/9/10
150	Drywall - Hang, Tape, Paint (1st Coat)	20 days	Wed 11/24/10	Tue 12/21/10
151	Install Ceiling Grid	10 days	Wed 12/22/10	Tue 1/4/11
152	Lighting Fixtures	10 days	Wed 1/19/11	Tue 2/1/11
153	Drop Ceiling Tile	20 days	Wed 2/2/11	Tue 3/1/11
154	Painting - Final Coat	5 days	Wed 3/2/11	Tue 3/8/11
155	Classroom Seating	10 days	Wed 4/6/11	Tue 4/19/11
156	Flooring Installation	10 days	Wed 4/20/11	Tue 5/3/11
157	2ND FLOOR			
158	Frame Interior Partitions	45 days	Thu 8/5/10	Wed 10/6/10
159	Drywall - Hang, Tape, Paint (1st Coat)	52 days	Wed 10/20/10	Thu 12/30/10
160	Install Ceiling Grid	84 days	Mon 11/8/10	Thu 3/3/11
161	Lighting Fixtures	84 days	Mon 11/15/10	Thu 3/10/11
162	Drop Ceiling Tile	114 days	Mon 11/29/10	Thu 5/5/11
163	Flooring Installation	91 days	Thu 12/2/10	Thu 4/7/11
164	Painting - Final Coat	106 days	Mon 12/20/10	Mon 5/16/11
165	3RD FLOOR			
166	Frame Interior Partitions	65 days	Thu 8/5/10	Wed 11/3/10
167	Drywall - Hang, Tape, Paint (1st Coat)	77 days	Thu 9/16/10	Fri 12/31/10
168	Install Ceiling Grid	109 days	Tue 10/5/10	Fri 3/4/11
169	Lighting Fixtures	109 days	Tue 10/12/10	Fri 3/11/11
170	Drop Ceiling Tile	144 days	Tue 10/19/10	Fri 5/6/11
171	Flooring Installation	84 days	Tue 12/14/10	Fri 4/8/11
172	Painting - Final Coat	113 days	Fri 12/10/10	Tue 5/17/11
173	4TH FLOOR			
174	Frame Interior Partitions	75 days	Thu 8/5/10	Wed 11/17/10
175	Drywall - Hang, Tape, Paint (1st Coat)	61 days	Wed 10/20/10	Wed 1/12/11
176	Install Ceiling Grid	93 days	Mon 11/8/10	Wed 3/16/11
177	Lighting Fixtures	93 days	Mon 11/15/10	Wed 3/23/11
178	Drop Ceiling Tile	128 days	Mon 11/22/10	Wed 5/18/11
179	Flooring Installation	75 days	Thu 1/6/11	Wed 4/20/11
180	Painting - Final Coat	125 days	Mon 12/6/10	Fri 5/27/11

Project: Detailed Project Schedule Date: 10/27/2010

Task Split Milestone

Summary Project Summary External Tasks

External Milestone Inactive Task Inactive Milestone

Inactive Summary Manual Task Duration-only

Manual Summary Rollup Start-only Finish-only

Deadline Progress

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University Sciences Building

Tech Assignment #2

ID	Task Name	Start	Finish	Duration	Task	Summary	Project Summary	External Tasks	Summary	Task	Split	Milestone
181	<b>5TH FLOOR</b>											
182	Frame Interior Partitions	Wed 10/13/10	Wed 12/1/10	36 days								
183	Drywall - Hang, Tape, Paint (1st Coat)	Wed 12/22/10	Tue 2/1/11	30 days								
184	Install Ceiling Grid	Wed 1/19/11	Tue 4/5/11	55 days								
185	Lighting Fixtures	Fri 1/21/11	Tue 4/12/11	58 days								
186	Drop Ceiling Tile	Wed 5/25/11	Tue 6/7/11	10 days								
187	Flooring Installation	Wed 2/9/11	Tue 5/10/11	65 days								
188	Painting - Final Coat	Wed 6/8/11	Thu 6/16/11	7 days								
189	<b>AUDITORIUM</b>											
190	Frame Interior Partitions	Tue 9/28/10	Mon 10/11/10	10 days								
191	Drywall - Hang, Tape, Paint (1st Coat)	Tue 10/26/10	Mon 11/15/10	15 days								
192	Install Ceiling Grid	Tue 11/16/10	Mon 11/29/10	10 days								
193	Lighting Fixtures	Tue 12/7/10	Mon 12/13/10	5 days								
194	Drop Ceiling Tile	Tue 12/21/10	Mon 1/10/11	15 days								
195	Painting - Final Coat	Tue 1/11/11	Mon 1/17/11	5 days								
196	Flooring Installation	Tue 2/8/11	Mon 2/21/11	10 days								
197	Auditorium Seating	Tue 2/22/11	Mon 3/7/11	10 days								
198	<b>ATRIUM</b>											
199	Erect Scaffolding	Thu 8/19/10	Wed 9/8/10	15 days								
200	Living Wall System Installation	Thu 9/9/10	Wed 11/3/10	40 days								
201	Frame Interior Partitions	Thu 9/23/10	Wed 11/24/10	45 days								
202	Erect Spiral Staircase	Mon 10/4/10	Fri 12/24/10	60 days								
203	GWB Board - Ceiling	Tue 11/23/10	Tue 12/7/10	11 days								
204	Lighting Fixtures	Thu 11/25/10	Wed 12/8/10	10 days								
205	GWB Finishing - Ceiling	Tue 12/7/10	Tue 12/21/10	11 days								
206	Drywall - Hang, Tape, Paint (1st Coat)	Fri 1/14/11	Thu 2/24/11	30 days								
207	Painting - Final Coat	Fri 2/25/11	Thu 3/17/11	15 days								
208	Remove Scaffolding	Fri 4/29/11	Thu 5/5/11	5 days								
209	Terrazzo Flooring Installation	Fri 5/13/11	Thu 6/16/11	25 days								
210	<b>PROJECT COMPLETION</b>	<b>Fri 7/1/11</b>	<b>Fri 7/1/11</b>	<b>0 days</b>								
211	Punch list	Fri 5/20/11	Thu 6/30/11	30 days								
212	Local Building Inspections	Fri 6/24/11	Thu 6/30/11	5 days								
213	Substantial Completion	Thu 6/30/11	Thu 6/30/11	0 days								
214	Occupancy & Commissioning	Fri 7/1/11	Fri 9/2/11	46 days								

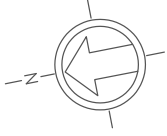
External Milestone  Inactive Milestone  Inactive Task  Inactive Milestone  
 Manual Summary Rollup  Manual Task  Duration-only  Start-only  Finish-only  
 Deadline  Progress  
 Summary  Project Summary  External Tasks  
 Project: Detailed Project Schedule  
 Date: 10/27/2010



# University Sciences Building

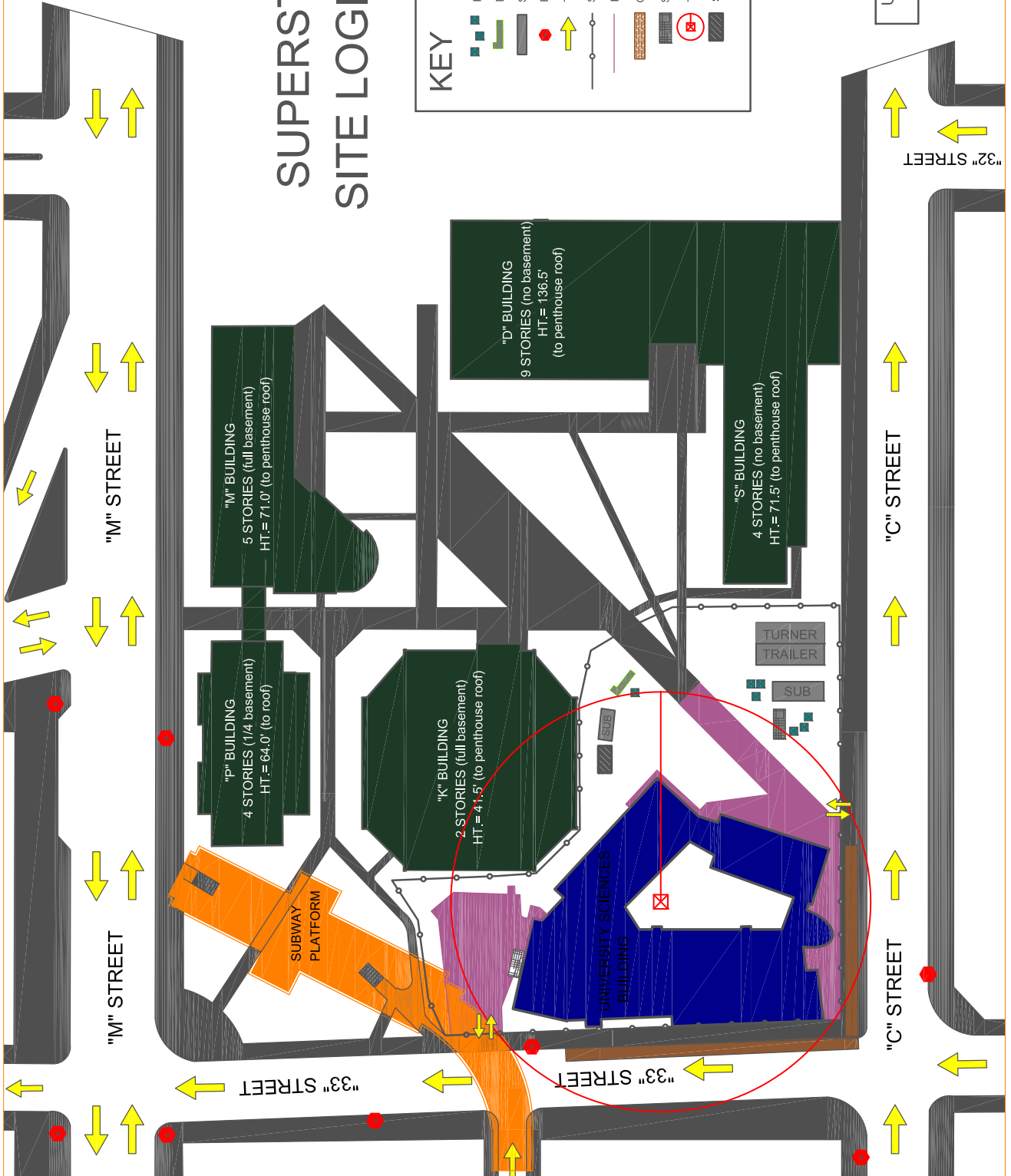
Northeastern U.S.

## APPENDIX B - Site Logistics Plan of Superstructure



# SUPERSTRUCTURE SITE LOGISTICS PLAN

KEY	
	PORTABLE TOILET
	EXT. MOCK-UP
	SITE TRAILERS
	FIRE HYDRANTS
	TRAFFIC FLOW
	SITE FENCE
	NEW SIDEWALK
	OVERHEAD PROTECTION
	SITE TRASH
	TOWER CRANE
	STORAGE CONTAINER



UNIVERSITY SCIENCES BUILDING  
JUSTIN GREEN  
10 / 27 / 2010



# University Sciences Building

Northeastern U.S.

## APPENDIX C - Detailed Structural Takeoff with RS Means Data

**DETAILED STRUCTURAL SYSTEMS ESTIMATE SUMMARY**

TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
<b>Structural Steel</b>										
Steel Column (28)	W8x40 - 22'6"	630.000	LF	59.50	\$ 37,485.00	4.82	\$ 3,036.60	2.95	\$ 1,858.50	\$ 42,380.10
Steel Column (17)	W8x48 - 22'6"	382.500	LF	59.50	\$ 22,758.75	4.82	\$ 1,843.65	2.95	\$ 1,128.38	\$ 25,730.78
Steel Column (7)	W8x48 - 29'9"	208.250	LF	59.50	\$ 12,390.88	4.82	\$ 1,003.77	2.95	\$ 614.34	\$ 14,008.98
Steel Column (1)	W8x67 - 29'9"	29.750	LF	59.50	\$ 1,770.13	4.82	\$ 143.40	2.95	\$ 87.76	\$ 2,001.28
Steel Column (1)	W12x65 - 22'6"	22.500	LF	59.50	\$ 1,338.75	4.82	\$ 108.45	2.95	\$ 66.38	\$ 1,513.58
Steel Beam (8)	Auditorium - W10x26 - 15'0"	120.000	LF	32.00	\$ 3,840.00	4.42	\$ 530.40	2.70	\$ 324.00	\$ 4,694.40
Steel Beam (2)	Auditorium - W12x26 - 40'0"	320.000	LF	32.00	\$ 10,240.00	3.01	\$ 963.20	1.84	\$ 588.80	\$ 11,792.00
Steel Beam (2)	Auditorium - W24x103 - 44'0"	88.000	LF	129.00	\$ 11,352.00	3.65	\$ 321.20	1.65	\$ 145.20	\$ 11,818.40
Steel Beam (7)	5th FL - W18x35 - 21'0"	147.000	LF	43.50	\$ 6,394.50	3.99	\$ 586.53	1.80	\$ 264.60	\$ 7,245.63
Steel Beam (3)	5th FL - W18x40 - 21'0"	63.000	LF	49.50	\$ 3,118.50	3.99	\$ 251.37	1.80	\$ 113.40	\$ 3,483.27
Steel Beam (7)	5th FL - W21x44 - 36'6"	255.500	LF	54.50	\$ 13,924.75	3.60	\$ 919.80	1.63	\$ 416.47	\$ 15,261.02
Steel Beam (1)	5th FL - W21x48 - 21'0"	21.000	LF	62.00	\$ 1,302.00	3.60	\$ 75.60	1.63	\$ 34.23	\$ 1,411.83
Steel Beam (1)	5th FL - W21x50 - 36'6"	36.500	LF	62.00	\$ 2,263.00	3.60	\$ 131.40	1.63	\$ 59.50	\$ 2,453.90
Steel Beam (1)	5th FL - W21x62 - 36'6"	36.500	LF	76.50	\$ 2,792.25	3.70	\$ 135.05	1.67	\$ 60.96	\$ 2,988.26
Steel Beam (1)	5th FL - W21x68 - 36'6"	36.500	LF	84.00	\$ 3,066.00	3.70	\$ 135.05	1.67	\$ 60.96	\$ 3,262.01
Steel Beam	Atrium - W8x10 - 32'	322	LF	12.40	\$ 3,992.80	4.42	\$ 1,423.24	2.70	\$ 869.40	\$ 6,285.44
Steel Beam	Atrium - W8x15 - 9'	9	LF	18.55	\$ 166.95	4.42	\$ 39.78	2.70	\$ 24.30	\$ 231.03
Steel Beam	Atrium - W8x35 - 59'	59	LF	43.50	\$ 2,566.50	4.82	\$ 284.38	2.95	\$ 174.05	\$ 3,024.93
Steel Beam	Atrium - W10x12 - 21'	12	LF	14.85	\$ 178.20	4.42	\$ 53.04	2.70	\$ 32.40	\$ 263.64
Steel Beam	Atrium - W12x14 - 47'	47	LF	19.80	\$ 930.60	3.01	\$ 141.47	1.84	\$ 86.48	\$ 1,158.55
Steel Beam	Atrium - W12x152 - 11'	11	LF	108.00	\$ 1,188.00	4.14	\$ 45.54	2.53	\$ 27.83	\$ 1,261.37
Steel Beam	Atrium - W14x22 - 117'	117	LF	32.00	\$ 3,744.00	2.68	\$ 313.56	1.64	\$ 191.88	\$ 4,249.44
Steel Beam	Atrium - W18x35 - 47'	47	LF	43.50	\$ 2,044.50	3.99	\$ 187.53	1.80	\$ 84.60	\$ 2,316.63
Steel Beam	Atrium - W18x40 - 31'	31	LF	49.50	\$ 1,534.50	3.99	\$ 123.69	1.80	\$ 55.80	\$ 1,713.99
Steel Beam	Atrium - W18x65 - 40'	40	LF	80.50	\$ 3,220.00	4.26	\$ 170.40	1.92	\$ 76.80	\$ 3,467.20
Steel Beam	Atrium - W21x44 - 23'	23	LF	54.50	\$ 1,253.50	3.60	\$ 82.80	1.63	\$ 37.49	\$ 1,373.79
Steel Beam	Atrium - W21x48 - 17'	17	LF	62.00	\$ 1,054.00	3.60	\$ 61.20	1.63	\$ 27.71	\$ 1,142.91
Steel Beam	Atrium - W21x93 - 43'	43	LF	115.00	\$ 4,945.00	3.83	\$ 164.69	1.73	\$ 74.39	\$ 5,184.08
Steel Beam	Atrium - W21x101 - 110'	110	LF	125.00	\$ 13,750.00	3.83	\$ 421.30	1.73	\$ 190.30	\$ 14,361.60
Steel Beam	Atrium - W21x111 - 20'	20	LF	151.00	\$ 3,020.00	3.83	\$ 76.60	1.73	\$ 34.60	\$ 3,131.20
Steel Beam	Atrium - W21x166 - 150'	150	LF	151.00	\$ 22,650.00	3.83	\$ 574.50	1.73	\$ 259.50	\$ 23,484.00
Steel Beam	Pent - W8x10 - 253'	253	LF	12.40	\$ 3,137.20	4.42	\$ 1,118.26	2.70	\$ 683.10	\$ 4,938.56
Steel Beam	Pent - W8x15 - 84'	84	LF	18.55	\$ 1,558.20	4.42	\$ 371.28	2.70	\$ 226.80	\$ 2,156.28
Steel Beam	Pent - W8x24 - 165'	165	LF	29.50	\$ 4,867.50	4.82	\$ 795.30	2.95	\$ 486.75	\$ 6,149.55
Steel Beam	Pent - W10x12 - 12'	12	LF	14.85	\$ 178.20	4.42	\$ 53.04	2.70	\$ 32.40	\$ 263.64
Steel Beam	Pent - W10x15 - 96'	96	LF	18.55	\$ 1,780.80	4.42	\$ 424.32	2.70	\$ 259.20	\$ 2,464.32
Steel Beam	Pent - W12x14 - 68'	68	LF	19.80	\$ 1,346.40	3.01	\$ 204.68	1.84	\$ 125.12	\$ 1,676.20
Steel Beam	Pent - W12x16 - 24'	24	LF	19.80	\$ 475.20	3.01	\$ 72.24	1.84	\$ 44.16	\$ 591.60
Steel Beam	Pent - W14x22 - 252'	252	LF	32.00	\$ 8,064.00	2.68	\$ 675.36	1.64	\$ 413.28	\$ 9,152.64
Steel Beam	Pent - W14x30 - 38'	38	LF	37.00	\$ 1,406.00	2.95	\$ 112.10	1.80	\$ 68.40	\$ 1,586.50
Steel Beam	Pent - W14x38 - 14'	14	LF	42.00	\$ 588.00	3.27	\$ 45.78	2.00	\$ 28.00	\$ 661.78
Steel Beam	Pent - W16x26 - 115'	115	LF	32.00	\$ 3,680.00	2.65	\$ 304.75	1.62	\$ 186.30	\$ 4,171.05
Steel Beam	Pent - W16x31 - 293'	293	LF	38.50	\$ 11,280.50	2.95	\$ 864.35	1.80	\$ 527.40	\$ 12,672.25
Steel Beam	Pent - W18x35 - 226'	226	LF	49.50	\$ 9,831.00	3.99	\$ 901.74	1.80	\$ 406.80	\$ 11,139.54
Steel Beam	Pent - W18x40 - 195'	195	LF	49.50	\$ 9,652.50	3.99	\$ 778.05	1.80	\$ 351.00	\$ 10,781.55
Steel Beam	Pent - W18x46 - 148'	148	LF	57.00	\$ 8,436.00	3.99	\$ 590.52	1.80	\$ 266.40	\$ 9,292.92

TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
Steel Beam	Pent - W18x50 - 21'	21	LF	62.00	1,302.00	4.20	88.20	1.90	39.90	1,430.10
Steel Beam	Pent - W18x55 - 42'	42	LF	68.00	2,856.00	4.20	176.40	1.90	79.80	3,112.20
Steel Beam	Pent - W21x44 - 17'	17	LF	54.50	926.50	3.60	61.20	1.63	27.71	1,015.41
Steel Beam	Pent - W24x84 - 19'	19	LF	103.00	1,957.00	3.83	72.77	1.73	32.87	2,062.64
Steel Beam	Pent Roof - W10x30 - 120'	120	LF	41.00	4,920.00	4.82	578.40	2.95	354.00	5,852.40
Steel Beam	Pent Roof - W10x33 - 54'	54	LF	41.00	2,214.00	4.82	260.28	2.95	159.30	2,633.58
* Doesn't include Steel at Skylights										
<b>Totals:</b> \$ 280,732 \$ 22,898 \$ 12,870 \$ 316,500										

Precast Filigree Slabs										
TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
Precast	2nd FL - 2.25" typ. Filigree Slab	21230.75	SF	7.25	153,922.94	1.30	27,599.98	0.42	8,916.92	190,439.83
Precast	3rd FL - 2.25" typ. Filigree Slab	21230.75	SF	7.25	153,922.94	1.30	27,599.98	0.42	8,916.92	190,439.83
Precast	4th FL - 2.25" typ. Filigree Slab	21230.75	SF	7.25	153,922.94	1.30	27,599.98	0.42	8,916.92	190,439.83
Precast	5th FL - 2.25" typ. Filigree Slab	17926.25	SF	7.25	129,965.31	1.30	23,304.13	0.42	7,529.03	160,798.46
Precast	Pent. - 2.25" typ. Filigree Slab	11369.75	SF	7.25	82,430.69	1.30	14,780.68	0.42	4,775.30	101,986.66
<b>Totals:</b> \$ 674,165 \$ 120,885 \$ 39,055 \$ 834,105										

Cast-In-Place Concrete										
TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
Caisson (20)	36" (3'-0") diameter cassion	70.7	CY	111.00	7,842.15	12.25	865.46	0.33	23.31	8,730.93
Caisson (21)	42" (3'-6") diameter cassion	101.0	CY	111.00	11,207.74	12.25	1,236.89	0.33	33.32	12,477.95
Caisson (22)	48" (4'-0") diameter cassion	138.2	CY	111.00	15,335.76	12.25	1,692.46	0.33	45.59	17,073.81
Caisson (15)	54" (4'-6") diameter cassion	119.2	CY	111.00	13,233.63	12.25	1,460.47	0.33	39.34	14,733.44
Caisson (5)	60" (5'-0") diameter cassion	49.1	CY	111.00	5,445.94	12.25	601.02	0.33	16.19	6,063.14
Pile Cap (13)	42"x 42"x 40" pile cap	19.7	CY	111.00	2,182.29	19.10	375.51	0.52	10.22	2,568.03
Pile Cap (17)	48"x 48"x 40" pile cap	33.6	CY	111.00	3,727.37	19.10	641.38	0.52	17.46	4,386.21
Pile Cap (19)	54"x 54"x 40" pile cap	47.5	CY	111.00	5,272.45	19.10	907.24	0.52	24.70	6,204.39
Pile Cap (3)	56"x 56"x 40" pile cap	8.1	CY	111.00	895.43	19.10	154.08	0.52	4.19	1,053.70
Pile Cap (15)	58"x 58"x 40" pile cap	43.3	CY	111.00	4,801.30	19.10	826.17	0.52	22.49	5,649.96
Pile Cap (5)	60"x 60"x 40" pile cap	15.4	CY	111.00	1,712.95	19.10	294.75	0.52	8.02	2,015.72
Pile Cap (2)	66"x 66"x 40" pile cap	7.5	CY	111.00	829.07	19.10	142.66	0.52	3.88	975.61
Pile Cap (9)	82"x 42"x 40" pile cap	26.6	CY	111.00	2,949.68	19.10	507.56	0.52	13.82	3,471.05
Grade Beam	Grade Beams (~1,450 LF)	214.8	CY	111.00	23,838.48	11.45	2,459.01	0.31	66.58	26,364.07
Foundation Wall (379 LF)	Concrete Wall - 11'8" x 1'0" section	163.8	CY	106.00	17,359.14	29.50	4,831.08	14.20	2,325.47	24,515.69
Column (5)	Base to Ground - 10"x 24"	3.6	CY	111.00	399.69	67.00	241.26	32.00	115.23	756.18
Column (2)	Base to Ground - 16"x 34"	3.3	CY	111.00	362.39	48.50	158.34	48.50	158.34	679.07
Column (6)	Base to Ground - 16"x 36"	10.4	CY	111.00	1,151.11	38.00	394.08	18.50	191.85	1,737.04
Column (2)	Base to Ground - 24"x 24"	2.1	CY	111.00	238.44	39.00	83.78	19.50	41.89	364.11
Column (1)	Base to Ground - 24" diameter	1.4	CY	111.00	150.60	38.00	51.56	18.25	24.76	226.92
Column (1)	Base to Ground - 28" diameter	1.8	CY	111.00	204.99	27.00	49.86	12.75	23.55	278.40
Column (4)	Base to 2nd - 28"x 40"	30.9	CY	111.00	3,432.01	38.00	1,176.00	12.75	394.22	4,661.04
Column (15)	1st to 2nd - 24" diameter	26.5	CY	111.00	2,936.77	38.00	1,005.38	18.25	482.85	4,425.00
Column (3)	1st to 2nd - 28" diameter	7.2	CY	111.00	799.46	27.00	194.46	12.75	91.83	1,085.75

TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
Column (2)	1st to 5th - 16"x 36"	16.9	CY	111.00	1,880.15	38.00	643.65	18.50	313.36	2,837.16
Column (1)	1st to 5th - 24" diameter	6.6	CY	111.00	737.96	38.00	252.63	18.25	121.33	1,111.92
Column (8)	1st to Penthouse - 16"x 34"	80.3	CY	111.00	8,914.72	48.50	3,895.17	48.50	3,895.17	16,705.05
Column (10)	1st to Penthouse - 16"x 36"	106.3	CY	111.00	11,798.89	38.00	4,039.26	18.50	1,966.48	17,804.63
Column (5)	1st to Penthouse - 24" diameter	41.7	CY	111.00	4,631.06	38.00	1,585.41	18.25	761.41	6,977.89
Column (1)	2nd to 3rd - 30"x 36"	3.9	CY	111.00	431.67	27.00	105.00	12.75	49.58	586.25
Column (9)	2nd to 5th - 16"x 34"	52.9	CY	111.00	5,870.67	48.50	2,565.11	48.50	2,565.11	11,000.89
Column (10)	2nd to 5th - 16"x 36"	62.2	CY	111.00	6,906.67	38.00	2,364.44	18.50	1,151.11	10,422.22
Column (1)	2nd to Penthouse - 16"x 36"	8.4	CY	111.00	930.48	39.00	326.93	19.50	163.46	1,420.87
Column (1)	3rd to Penthouse - 16"x 34"	6.0	CY	111.00	661.56	48.50	288.97	48.50	288.97	1,239.30
Shear Wall (97 LF)	From 1st to 5th - 57' 2" High	5545.2	CY	106.00	587,787.70	29.50	163,582.43	14.20	78,741.37	830,111.50
Shear Wall (87 LF)	From 1st to Pent. Roof - 94' 3"	8199.8	CY	106.00	869,173.50	29.50	241,892.63	14.20	116,436.45	1,227,502.58
Shear Wall (66 LF)	From Base to Pent. - 83' 5"	5505.5	CY	106.00	583,583.02	29.50	162,412.26	14.20	78,178.10	824,173.38
Shear Wall (139 LF)	From Base to Pent. Roof - 105' 11"	14722.4	CY	106.00	1,560,576.66	29.50	434,311.43	14.20	209,058.38	2,203,946.47
Beam (770 LF)	2nd FL Slab (Cross Sect. = 2.25 SF)	64.2	CY	106.00	6,801.67	41.00	2,630.83	19.65	1,260.88	10,693.38
Beam (770 LF)	3rd FL Slab (Cross Sect. = 2.25 SF)	64.2	CY	106.00	6,801.67	41.00	2,630.83	19.65	1,260.88	10,693.38
Beam (770 LF)	4th FL Slab (Cross Sect. = 2.25 SF)	64.2	CY	106.00	6,801.67	41.00	2,630.83	19.65	1,260.88	10,693.38
Beam (785 LF)	5th FL Slab (Cross Sect. = 4.92 SF)	143.0	CY	106.00	15,162.71	41.00	5,864.82	19.65	2,810.82	23,838.36
Beam (585 LF)	Pent FL Slab (Cross Sect. = 5.58 SF)	120.9	CY	106.00	12,815.40	41.00	4,956.90	19.65	2,375.69	20,147.99
Slab (5634 SF)	Base Floor Slab	86.9	CY	106.00	9,216.11	15.60	1,356.33	0.42	36.52	10,608.96
Slab (20899 SF)	1st Floor Slab	322.5	CY	106.00	34,186.64	15.60	5,031.24	0.42	135.46	39,353.33
Slab (4413.25 SF)	1st Floor Atrium	81.7	CY	106.00	8,663.05	24.50	2,002.31	11.60	948.03	11,613.39
Slab (21231 SF)	2nd Floor Slab	276.4	CY	106.00	29,301.33	24.50	6,772.48	11.60	3,206.56	39,280.36
Slab (21231 SF)	3rd Floor Slab	276.4	CY	106.00	29,301.33	24.50	6,772.48	11.60	3,206.56	39,280.36
Slab (21231 SF)	4th Floor Slab	276.4	CY	106.00	29,301.33	24.50	6,772.48	11.60	3,206.56	39,280.36
Slab (17926 SF)	5th Floor Slab	233.4	CY	106.00	24,740.03	24.50	5,718.21	11.60	2,707.40	33,165.65
Slab (11369 SF)	Pent Floor Slab	148.0	CY	106.00	15,690.58	24.50	3,626.60	11.60	1,717.08	21,034.26
<b>Totals:</b>										
					<b>\$ 3,998,977</b>	<b>\$ 1,095,041</b>		<b>\$ 522,003</b>		<b>\$ 5,616,020</b>

TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
<b>Reinforcing Steel</b>										
Caisson (20)	36" (3'-0") diameter cassion	0.3742	Tons	810.00	303.07	430.00	160.89	0.00	-	463.95
Caisson (21)	42" (3'-6") diameter cassion	0.3824	Tons	810.00	309.78	430.00	164.45	0.00	-	474.24
Caisson (22)	48" (4'-0") diameter cassion	0.4989	Tons	810.00	404.09	430.00	214.52	0.00	-	618.61
Caisson (15)	54" (4'-6") diameter cassion	0.5072	Tons	810.00	410.81	430.00	218.08	0.00	-	628.89
Caisson (5)	60" (5'-0") diameter cassion	0.6236	Tons	810.00	505.11	430.00	268.15	0.00	-	773.26
Pile Cap (13)	42"x 42" x 40" pile cap rebar	0.7831	Tons	810.00	634.35	430.00	336.75	0.00	-	971.10
Pile Cap (17)	48"x 48" x 40" pile cap rebar	1.1704	Tons	810.00	948.04	430.00	503.28	0.00	-	1,451.32
Pile Cap (19)	54"x 54" x 40" pile cap rebar	1.4716	Tons	810.00	1,192.02	430.00	632.80	0.00	-	1,824.82
Pile Cap (3)	56" x 56" x 40" pile cap rebar	0.2410	Tons	810.00	195.18	430.00	103.62	0.00	-	298.80
Pile Cap (15)	58" x 58" x 40" pile cap rebar	1.2479	Tons	810.00	1,010.77	430.00	536.58	0.00	-	1,547.36
Pile Cap (5)	60" x 60" x 40" pile cap rebar	0.4303	Tons	810.00	348.54	430.00	185.03	0.00	-	533.57
Pile Cap (2)	66" x 66" x 40" pile cap rebar	0.1893	Tons	810.00	153.36	430.00	81.41	0.00	-	234.77
Pile Cap (9)	82" x 42" x 40" pile cap rebar	0.8004	Tons	810.00	648.29	430.00	344.15	0.00	-	992.44
Grade Beam	Grade Beams - Epoxy Coated	16.4252	Tons	900.00	14,782.70	970.00	15,932.47	0.00	-	30,715.17
Grade Beam	Additional cost for Epoxy Coating	16.4252	Tons	350.00	5,748.83	0.00	-	0.00	-	5,748.83



TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
Foundation Wall (379 LF)	Vertical (Inside Face) Rebar	7.0431	Tons	855.00	6,021.85	385.00	2,711.59	0.00	\$	8,733.44
Foundation Wall (379 LF)	Vertical (Outside Face) Rebar	1.5285	Tons	855.00	1,306.87	515.00	787.18	0.00	\$	2,094.05
Foundation Wall (379 LF)	Horizontal Rebar	3.0570	Tons	855.00	2,613.74	515.00	1,574.36	0.00	\$	4,188.09
Column	Column - 10"x24"	0.4217	Tons	900.00	379.50	700.00	295.17	0.00	\$	674.66
Column	Column - 16"x34"	21.8577	Tons	900.00	19,671.94	700.00	15,300.39	0.00	\$	34,972.33
Column	Column - 16"x36"	26.0720	Tons	900.00	23,464.78	700.00	18,250.38	0.00	\$	41,715.16
Column	Column - 24"x24"	0.3872	Tons	900.00	348.49	700.00	271.05	0.00	\$	619.53
Column	Column - 28"x40"	3.2711	Tons	900.00	2,943.97	700.00	2,289.75	0.00	\$	5,233.72
Column	Column - 30"x36"	0.3131	Tons	900.00	281.79	700.00	219.17	0.00	\$	500.95
Column	Column - 24" diameter	8.3706	Tons	900.00	7,533.50	700.00	5,859.39	0.00	\$	13,392.89
Column	Column - 28" diameter	0.7509	Tons	900.00	675.78	700.00	525.61	0.00	\$	1,201.39
Shear Wall (97 LF)	1st to 5th - 57' 2" High	7.7115	Tons	855.00	6,593.31	515.00	3,971.41	0.00	\$	10,564.73
Shear Wall (87 LF)	1st to Pent. Roof - 94' 3"	11.4031	Tons	855.00	9,749.67	515.00	5,872.61	0.00	\$	15,622.27
Shear Wall (66 LF)	Base to Pent. - 83' 5"	7.6563	Tons	855.00	6,546.15	515.00	3,943.00	0.00	\$	10,489.15
Shear Wall (139 LF)	Base to Pent. Roof - 105' 11"	20.4740	Tons	855.00	17,505.25	515.00	10,544.10	0.00	\$	28,049.35
Beam - Rebar	Concrete Beam - Horiz	1.9191	Tons	900.00	1,727.19	970.00	1,861.53	0.00	\$	3,588.72
Beam - Rebar	Concrete Beam - Long (top)	43.792	Tons	900.00	39,412.80	575.00	25,180.40	0.00	\$	64,593.20
Beam - Rebar	Concrete Beam - Long (bot)	13.8184	Tons	900.00	12,436.56	970.00	13,403.85	0.00	\$	25,840.41
Slab - Rebar	Concrete Slabs - SOG's	16.1665	Tons	855.00	13,822.36	675.00	10,912.39	0.00	\$	24,734.75
Slab - WWF (31,000 SF)	6x6 W4.0 x W4.0 WWF - SOG only	310	CSF	29.50	9,145.00	28.50	8,835.00	0.00	\$	17,980.00
Slab - WWF (93,000 SF)	6x6 W2.0 x W2.0 WWF - Elev. Slabs	930	CSF	18.90	17,577.00	25.00	23,250.00	0.00	\$	40,827.00
<b>Totals: \$ 227,352 \$ 175,540 \$ 402,893</b>										

Concrete Formwork										
TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
Pile Cap (13)	42" x 42" x 40" pile cap rebar	606.7	SF	0.76	461.07	3.42	2,074.80	0.00	\$	2,535.87
Pile Cap (17)	48" x 48" x 40" pile cap rebar	906.7	SF	0.76	689.07	3.42	3,100.80	0.00	\$	3,789.87
Pile Cap (19)	54" x 54" x 40" pile cap rebar	1140.0	SF	0.76	866.40	3.42	3,898.80	0.00	\$	4,765.20
Pile Cap (3)	56" x 56" x 40" pile cap rebar	186.7	SF	0.76	141.87	3.42	638.40	0.00	\$	780.27
Pile Cap (15)	58" x 58" x 40" pile cap rebar	966.7	SF	0.76	734.67	3.42	3,306.00	0.00	\$	4,040.67
Pile Cap (5)	60" x 60" x 40" pile cap rebar	333.3	SF	0.76	253.33	3.42	1,140.00	0.00	\$	1,393.33
Pile Cap (2)	66" x 66" x 40" pile cap rebar	146.7	SF	0.76	111.47	3.42	501.60	0.00	\$	613.07
Pile Cap (9)	82" x 42" x 40" pile cap rebar	620.0	SF	0.76	471.20	3.42	2,120.40	0.00	\$	2,591.60
Grade Beam (1,450 LF)	Grade Beam	8700.0	SF	1.30	11,310.00	3.47	30,189.00	0.00	\$	41,499.00
Foundation Wall (379 LF)	Concrete Wall - 11'8" x 1'0" section	8843.3	SF	0.63	5,571.30	5.10	45,101.01	0.00	\$	50,672.31
Column	Column - 10" x 24"	330.4	SF	0.71	234.56	5.80	1,916.13	0.00	\$	2,150.69
Column	Column - 16" x 34"	8482.5	SF	0.71	6,022.58	5.55	47,077.88	0.00	\$	53,100.45
Column	Column - 16" x 36"	11946.1	SF	0.71	8,481.75	5.55	66,301.04	0.00	\$	74,782.79
Column	Column - 24" x 24"	232.0	SF	0.79	183.28	5.50	1,276.00	0.00	\$	1,459.28
Column	Column - 28" x 40"	1216.1	SF	1.01	1,228.23	5.70	6,931.58	0.00	\$	8,159.81
Column	Column - 30" x 36"	154.0	SF	1.01	155.54	5.70	877.80	0.00	\$	1,033.34
Column	Column - 24" diameter	655.1	LF	8.40	5,502.84	10.05	6,583.76	0.00	\$	12,086.60

Column	57.2	LF	11.40	\$	652.08	10.45	\$	597.74	0.00	\$	-	\$	1,249.82
Column - 28" diameter													
Shear Wall (97 LF)	5545.2	SF	0.63	\$	3,493.46	5.10	\$	28,280.35	0.00	\$	-	\$	31,773.81
Shear Wall (87 LF)	8199.8	SF	0.63	\$	5,165.84	5.10	\$	41,818.73	0.00	\$	-	\$	46,984.57
Shear Wall (66 LF)	5505.5	SF	0.63	\$	3,468.47	5.10	\$	28,078.05	0.00	\$	-	\$	31,546.52
Shear Wall (139 LF)	14722.4	SF	0.63	\$	9,275.12	5.10	\$	75,084.33	0.00	\$	-	\$	84,359.45
Slab	546.8	LF	0.27	\$	147.62	2.18	\$	1,191.92	0.00	\$	-	\$	1,339.54
Slab	710.5	LF	0.27	\$	191.84	2.18	\$	1,548.89	0.00	\$	-	\$	1,740.73
Slab	1066.5	LF	0.17	\$	181.31	2.62	\$	2,794.23	0.00	\$	-	\$	2,975.54
Slab	1066.5	LF	0.17	\$	181.31	2.62	\$	2,794.23	0.00	\$	-	\$	2,975.54
Slab	1066.5	LF	0.17	\$	181.31	2.62	\$	2,794.23	0.00	\$	-	\$	2,975.54
Slab	837.0	LF	0.17	\$	142.29	2.62	\$	2,192.94	0.00	\$	-	\$	2,335.23
Slab	570.0	LF	0.17	\$	96.90	2.62	\$	1,493.40	0.00	\$	-	\$	1,590.30
* Doesn't include Polystyrene Void Block Outs													
<b>Totals: \$ 65,597 \$ 411,704 \$ - \$ 477,901</b>													

TYPE	DESCRIPTION	QUANTITY	UNIT	MATERIAL UNIT RATE	MATERIAL COST	LABOR UNIT RATE	LABOR COST	EQUIPMENT UNIT RATE	EQUIPMENT COST	TOTAL COST
<b>Metal Decking</b>										
1.5" Steel Deck	Auditorium (WD=60 & WL=100)	3375	SF	1.92	\$ 6,480.00	0.43	\$ 1,451.25	0.03	\$ 101.25	\$ 8,032.50
3" Steel Deck	Atrium (WD=30 psf & WL=25 psf)	4413	SF	2.35	\$ 10,370.55	0.46	\$ 2,029.98	0.03	\$ 132.39	\$ 12,532.92
3" Steel Deck	Roof (WD=70 psf & WL=25 psf)	8928	SF	2.35	\$ 20,980.80	0.46	\$ 4,106.88	0.03	\$ 267.84	\$ 25,355.52
3" Steel Deck	Penthouse Roof (WD=70-165 psf & WL=35-125 psf)	11369	SF	2.35	\$ 26,717.15	0.46	\$ 5,229.74	0.03	\$ 341.07	\$ 32,287.96
<b>Totals: \$ 64,549 \$ 12,818 \$ 843 \$ 78,209</b>										

<b>SUBTOTAL</b>	\$5,311,371	\$1,838,886	\$574,770	\$7,725,028
<b>LOCATION MULTIPLIERS</b>	0.997	1.322	1.143	

**STRUCTURAL SYSTEMS GRAND TOTAL \$8,383,407**

TOTAL MATERIAL BREAKDOWN =	\$5,295,437
TOTAL LABOR BREAKDOWN =	\$2,431,008
TOTAL EQUIPMENT BREAKDOWN =	\$656,962
TOTAL CONCRETE (w/out Location Mult.) =	\$6,927,426
TOTAL STEEL (w/out Location Mult.) =	\$797,602

## **ASSUMPTIONS / FINDINGS**

Estimated  $\pi$  to be 3.14.

### **CAISSONS**

Caissons have a minimum length of 13'6", and that's what I used for length.

### **GRADE BEAMS**

Determined average width and depths of grade beams to be 16" x 36" based on the range of values found in the beam schedule.

Determined average stirrup spacing w/in grade beams to be 15" and an average length of 8.667 LF based on the range of values found in the beam schedule.

Determined average horizontal spacing of rebar in grade beams to be 6" totaling 7 bars on each face of the grade beam based on the range of values found in the beam schedule.

Determined average size of horizontal rebar to be #6 size rebar (most were either #5 or #7) based on the range of values found in the beam schedule.

### **FOUNDATION WALLS**

Typical vertical (Inside Face) reinforcing is #8@10".

Typical vertical (Outside Face) reinforcing is #5@18".

Typical horizontal reinforcing is #5@18".

### **CONCRETE COLUMNS**

Typical horizontal reinforcement is #4 rebar @ 12" spacing (found in the caisson and column schedule).

Typical average vertical reinforcement is #8 rebar (very few cases have # 10 rebar, so assumed #8 for all cases).

### **SHEAR WALLS**

All shear walls are 12" thick according to the framing plans given.

### **CONCRETE BEAMS**

Typical concrete beams are 96" x 18" (includes slab thickness) on Floors 2-4.

Typical concrete beams are 96" x 26" (includes slab thickness) on the 5th Floor.

Typical concrete beams are 96" x 28" (includes slab thickness) on the Penthouse Floor.

Determined the cross-sectional area of the typical 96" x 18" voided concrete beam with precast to contain 2.25 SF of concrete (this excludes concrete considered in slab quantity).

Determined the cross-sectional area of the typical 96" x 26" voided concrete beam with precast to contain 4.92 SF of concrete (this excludes concrete considered in slab quantity).

Determined the cross-sectional area of the typical 96" x 28" voided concrete beam with precast to contain 5.58 SF of concrete (this excludes concrete considered in slab quantity).

### **PRECAST SLABS**

SF of Filigree Slab is roughly the same as the total SF of slab area for each floor.

Precast slabs include rebar in their material cost.

### **SLABS**

The majority of slabs (excluding SOG's) are 8" and 10" voided slabs with a 12" thickened edge at the perimeter of the building (36" from the edge of slab).

Assumed a 9" voided slab everywhere to simplify calculations and to account for the extra concrete at thickened slab locations.

SOG thickness for the Auditorium, Offices, and Classrooms is 5" thick.

SOG thickness for the Atrium is 6" thick.

Determined the ratio of CY of concrete to SF of slab surface area to be 0.01302 CY/SF for a typical 9" Voided Slab

*Basement Area = 5,633.5 SF*

*1st Floor Area = 25,312.25 SF (Includes Atrium Area)*

*2nd Floor Area = 21,230.75 SF*

*3rd Floor Area = 21,230.75 SF*

*4th Floor Area = 21,230.75 SF*

*5th Floor Area = 17,926.25 SF*

*Penthouse Floor Area = 11,369.75 SF*

*Atrium Floor Area = 4,413.25 SF*

### **CONCRETE FORMWORK**

Assumed multiple uses of various types of formwork.

### **STEEL REINFORCING**

6x6 - W2.0 x W2.0 WWF throughout all elevated slabs (totaling 93,000 SF).

6x6 - W4.0 x W4.0 WWF throughout all Slab On Grade concrete (totaling 31,000 SF).

SOG's have a typical reinforcing of #5 rebar spaced @12" o.c. (one way).

Concrete beams have typical longitudinal rebar with #9 bar on top and #6 bar on the bottom.

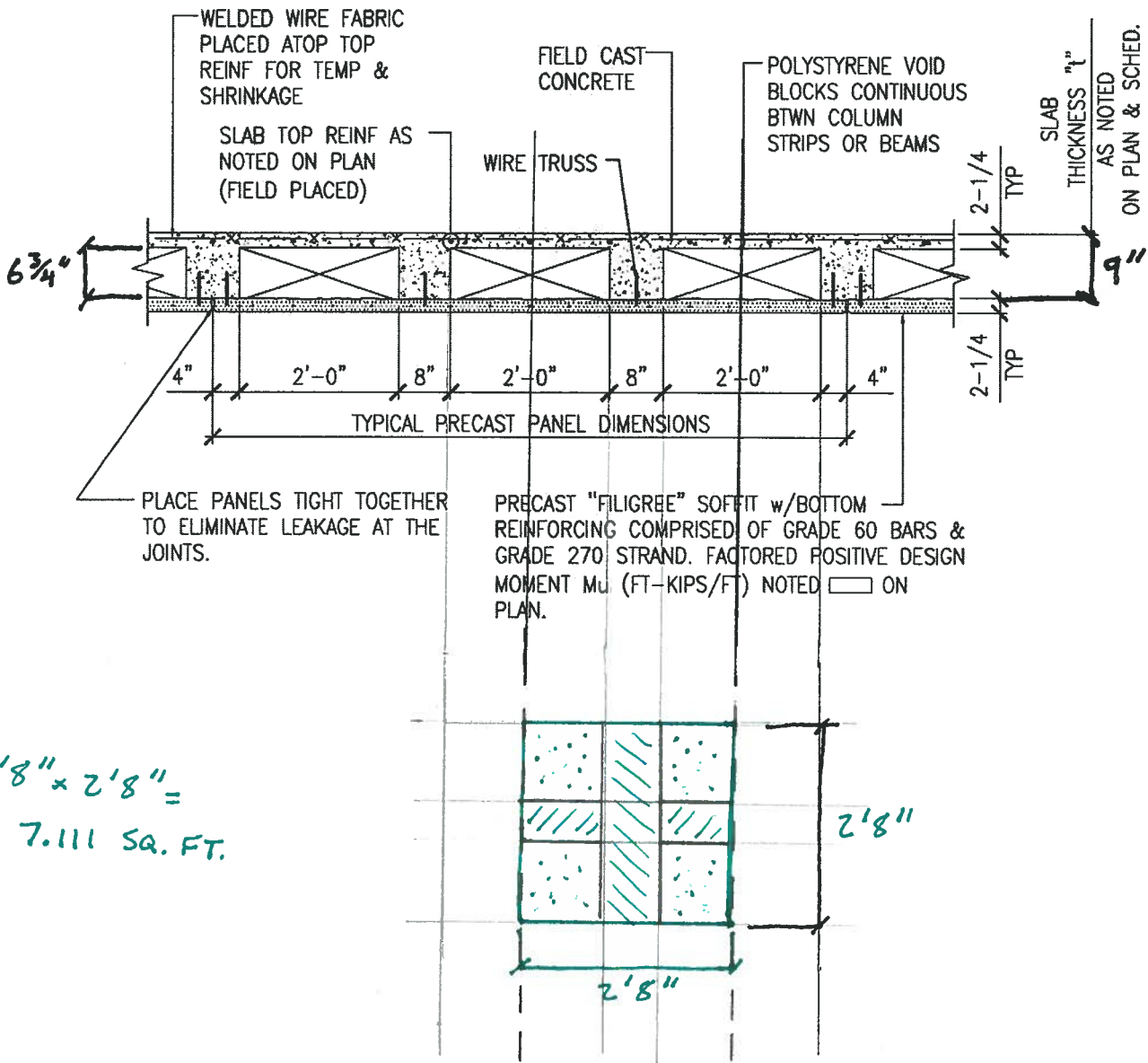
Concrete beams have typical horizontal rebar of #5@12" spanning an average of 16'0".

**REINFORCING STEEL CALCULATIONS:**

Size	Wt. in Lbs./Ft.
#4	0.67
#5	1.04
#6	1.50
#8	2.67
#9	3.40
#10	4.30

36" Caisson	Vertical Reinforcement	18 #8 x 13.5' =	243.0	LF	0.3244	Tons
	Stirrups	#5 @ 16" =	95.4	LF	0.0498	Tons
42" Caisson	Vertical Reinforcement	18 #8 x 13.5' =	243.0	LF	0.3244	Tons
	Stirrups	#5 @ 16" =	111.3	LF	0.0580	Tons
48" Caisson	Vertical Reinforcement	24 #8 x 13.5' =	324.0	LF	0.4325	Tons
	Stirrups	#5 @ 16" =	127.2	LF	0.0663	Tons
54" Caisson	Vertical Reinforcement	24 #8 x 13.5' =	324.0	LF	0.4325	Tons
	Stirrups	#5 @ 16" =	143.1	LF	0.0746	Tons
60" Caisson	Vertical Reinforcement	30 #8 x 13.5' =	405.0	LF	0.5407	Tons
	Stirrups	#5 @ 16" =	159.0	LF	0.0829	Tons
42"x 42" x 40" pile cap (13)	NS-EW Reinforcement	2 x 4 #10 =	364.0	LF	0.7831	Tons
48"x 48" x 40" pile cap (17)	NS-EW Reinforcement	2 x 4 #10 =	544.0	LF	1.1704	Tons
54"x 54" x 40" pile cap (19)	NS-EW Reinforcement	2 x 4 #10 =	684.0	LF	1.4716	Tons
56"x 56" x 40" pile cap (3)	NS-EW Reinforcement	2 x 4 #10 =	112.0	LF	0.2410	Tons
58"x 58" x 40" pile cap (15)	NS-EW Reinforcement	2 x 4 #10 =	580.0	LF	1.2479	Tons
60"x 60" x 40" pile cap (5)	NS-EW Reinforcement	2 x 4 #10 =	200.0	LF	0.4303	Tons
66"x 66" x 40" pile cap (2)	NS-EW Reinforcement	2 x 4 #10 =	88.0	LF	0.1893	Tons
82"x 42" x 40" pile cap (9)	NS-EW Reinforcement	2 x 4 #10 =	372.0	LF	0.8004	Tons
<b>Grade Beams (1,450 LF)</b>	<b>Stirrups</b>	<b>#4 @ 1.25' =</b>	<b>10053.4</b>	<b>LF</b>	<b>3.3578</b>	<b>Tons</b>
	<b>Horizontal Reinforcement</b>	<b>#6 @ 0.5' =</b>	<b>17400.0</b>	<b>LF</b>	<b>13.0674</b>	<b>Tons</b>
Foundation Wall (379 LF)	Vertical (Inside Face) Rebar	#8@10" =	5275.7	LF	7.0431	Tons
Foundation Wall (379 LF)	Vertical (Outside Face) Rebar	#5@18" =	2930.9	LF	1.5285	Tons
Foundation Wall (379 LF)	Horizontal Rebar	#5@18" =	5861.9	LF	3.0570	Tons
Column - 10"x 24"	58.3 LF	Vertical Reinforcement	4 - #8	LF	233.2	0.3113 Tons
		Stirrups	#4 @ 12"	LF	330.4	0.1103 Tons
Column - 16"x 34"	1017.9 LF	Vertical Reinforcement	14 - #8	LF	14250.6	19.0246 Tons
		Stirrups	#4 @ 12"	LF	8482.5	2.8332 Tons
Column - 16"x 36"	1378.4 LF	Vertical Reinforcement	12 - #8	LF	16540.8	22.0820 Tons
		Stirrups	#4 @ 12"	LF	11946.1	3.9900 Tons
Column - 24"x 40"	29.0 LF	Vertical Reinforcement	8 - #8	LF	232.0	0.3097 Tons
		Stirrups	#4 @ 12"	LF	232.0	0.0775 Tons
Column - 28"x 40"	107.3 LF	Vertical Reinforcement	20 - #8	LF	2146.0	2.8649 Tons
		Stirrups	#4 @ 12"	LF	1216.1	0.4062 Tons
Column - 30"x 36"	14.0 LF	Vertical Reinforcement	14 - #8	LF	196.0	0.2617 Tons
		Stirrups	#4 @ 12"	LF	154.0	0.0514 Tons
Column - 24" diameter	655.1 LF	Vertical Reinforcement	8 - #8	LF	5240.8	6.9965 Tons
		Stirrups	#4 @ 12"	LF	4114.0	1.3741 Tons
Column - 28" diameter	57.2 LF	Vertical Reinforcement	8 - #8	LF	457.6	0.6109 Tons
		Stirrups	#4 @ 12"	LF	419.1	0.1400 Tons
Shear Wall (97 LF)	1st to 5th - 57" 2" High	Vertical / Horizontal Reinforcement	2 x #5 @ 18"	LF	14787.1	7.7115 Tons
Shear Wall (87 LF)	1st to Pent. Roof - 94' 3"	Vertical / Horizontal Reinforcement	2 x #5 @ 18"	LF	21866.0	11.4031 Tons
Shear Wall (66 LF)	Base to Pent. - 83' 5"	Vertical / Horizontal Reinforcement	2 x #5 @ 18"	LF	14681.3	7.6563 Tons
Shear Wall (139 LF)	Base to Pent. Roof - 105' 11"	Vertical / Horizontal Reinforcement	2 x #5 @ 18"	LF	39259.8	20.4740 Tons
Concrete Slabs - SOG's	31,000 SF	#5@12"	31000.0	LF	16.1665	Tons
Concrete Beam - Horiz	3680 LF	#5@12"	3680.0	LF	1.9191	Tons
Concrete Beam - Long	3680 LF	T - 7#9	25760.0	LF	43.7920	Tons
Concrete Beam - Long	3680 LF	B - 5#6	18400.0	LF	13.8184	Tons

# TYPICAL VOIDED SLAB SECTION



2'8" x 2'8" =  
7.111 SQ. FT.

≡ Middle = 2'8" x 8" x 6 3/4" = 0.037037  
CY

≡ Middle = 2' x 8" x 6 3/4" = 0.027778  
CY

∴ Top of Voids = 4 x 1' x 1' x 2 1/4" = 0.027778  
CY

Ratio:

$$\frac{0.092593 \text{ CY}}{7.111 \text{ SF}} = \boxed{0.01302 \text{ CY/SF of Slab}}$$

Σ = 0.092593 CY

# 03 11 Concrete Forming

## 03 11 13 - Structural Cast-In-Place Concrete Forming

ProFit = 10%

Total  
Incl O&P  
13.75  
13.85  
27.50  
27.50  
25.50  
27.50  
10.50  
4.40  
5.50  
595  
790  
400  
705  
6.50  
8.50  
16.45  
12.70  
11.55  
10.85  
14.75  
12.40  
11.05  
10.40  
13.85  
11.90  
10.70  
10.20  
13.65  
10.70  
9.85  
9.30  
11.90  
9.70  
8.90  
8.50  
12.15  
9.35  
8.50

### 03 11 13.20 Forms In Place, Beams and Girders

Code	Description	Crew	Daily Output	Labor Hours	Unit	Material	2011 Bare Costs			Total Incl O&P
							Labor	Equipment	Total	
3150	4 use	C-2	430	.112	SFCA	.79	4.68		5.47	8.05
3500	Bottoms only, to 30" wide, job-built plywood, 1 use		230	.209		3.42	8.75		12.17	17.20
3550	2 use		265	.181		1.91	7.60		9.51	13.75
3600	3 use		280	.171		1.37	7.20		8.57	12.55
3650	4 use		290	.166		1.11	6.95		8.06	11.85
4000	Sides only, vertical, 36" high, job-built plywood, 1 use		335	.143		3.46	6		9.46	13
4050	2 use		405	.119		1.91	4.97		6.88	9.70
4100	3 use		430	.112		1.39	4.68		6.07	8.70
4150	4 use		445	.108		1.13	4.52		5.65	8.20
4500	Sloped sides, 36" high, 1 use		305	.157		3.41	6.60		10.01	13.85
4550	2 use		370	.130		1.90	5.45		7.35	10.45
4600	3 use		405	.119		1.36	4.97		6.33	9.10
4650	4 use		425	.113		1.11	4.74		5.85	8.45
5000	Upstanding beams, 36" high, 1 use		225	.213		4.14	8.95		13.09	18.25
5050	2 use		255	.188		2.30	7.90		10.20	14.65
5100	3 use		275	.175		1.67	7.30		8.97	13.10
5150	4 use		280	.171		1.36	7.20		8.56	12.55

### 03 11 13.25 Forms In Place, Columns

Code	Description	Code	Crew	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P
0010	<b>FORMS IN PLACE, COLUMNS</b>	R031113-40									
0500	Round fiberglass, 4 use per mo., rent, 12" diameter		C-1	160	.200	L.F.	8.15	8.20		16.35	21.50
0550	16" diameter	R031113-60		150	.213		9.70	8.70		18.40	24
0600	18" diameter			140	.229		10.85	9.35		20.20	26.50
0650	24" diameter			135	.237		13.50	9.70		23.20	29.50
0700	28" diameter			130	.246		15.10	10.05		25.15	32
0800	30" diameter			125	.256		15.75	10.45		26.20	33.50
0850	36" diameter			120	.267		21	10.90		31.90	39.50
1500	Round fiber tube, recycled paper, 1 use, 8" diameter	G		155	.206		1.42	8.45		9.87	14.50
1550	10" diameter	G		155	.206		1.97	8.45		10.42	15.10
1600	12" diameter	G		150	.213		2.30	8.70		11	15.95
1650	14" diameter	G		145	.221		3.33	9		12.33	17.50
1700	16" diameter	G		140	.229		4.06	9.35		13.41	18.80
1720	18" diameter	G		140	.229		4.75	9.35		14.10	19.60
1750	20" diameter	G		135	.237		6.55	9.70		16.25	22
1800	24" diameter	G		130	.246		8.40	10.05		18.45	24.50
1850	30" diameter	G		125	.256		11.40	10.45		21.85	28.50
1900	36" diameter	G		115	.278		15.05	11.40		26.45	34
1950	42" diameter	G		100	.320		38	13.10		51.10	61.50
2000	48" diameter	G		85	.376		44	15.40		59.40	72
2200	For seamless type, add						15%				
3000	Round, steel, 4 use per mo., rent, regular duty, 14" diameter	G	C-1	145	.221	L.F.	15.15	9		24.15	30.50
3050	16" diameter	G		125	.256		15.50	10.45		25.95	33
3100	Heavy duty, 20" diameter	G		105	.305		17	12.45		29.45	38
3150	24" diameter	G		85	.376		18.65	15.40		34.05	44
3200	30" diameter	G		70	.457		21.50	18.70		40.20	52
3250	36" diameter	G		60	.533		23	22		45	59
3300	48" diameter	G		50	.640		68	26		94	115
3350	60" diameter	G		45	.711		42	29		71	90.50
4500	For second and succeeding months, deduct						50%				
5000	Job-built plywood, 8" x 8" columns, 1 use		C-1	165	.194	SFCA	2.31	7.95		10.26	14.70
5050	2 use			195	.164		1.32	6.70		8.02	11.75
5100	3 use			210	.152		.92	6.25		7.17	10.55
5150	4 use			215	.149		.76	6.10		6.86	10.20

655 LF  
57 LF

# 03 11 Concrete Forming

## 03 11 13 - Structural Cast-In-Place Concrete Forming

03 11 13.25 Forms In Place, Columns		Crew	Daily Output	Labor-Hours	Unit	Material	2011 Labor	Bare Costs Equipment	Total	Total Incl O&P
5500	12" x 12" columns, 1 use	C-1	180	.178	SFCA	2.19	7.25		9.44	13.55
5550	2 use		210	.152		1.20	6.25		7.45	10.85
5600	3 use		220	.145		.87	5.95		6.82	10.05
5650	4 use		225	.142		.71	5.80		6.51	9.70
6000	16" x 16" columns, 1 use		185	.173		2.17	7.05		9.22	13.25
6050	2 use		215	.149		1.16	6.10		7.26	10.65
6100	3 use		230	.139		.87	5.70		6.57	9.65
6150	4 use		235	.136		.71	5.55		6.26	9.35
6500	24" x 24" columns, 1 use		190	.168		2.43	6.90		9.33	13.20
6550	2 use		216	.148		1.33	6.05		7.38	10.75
6600	3 use		230	.139		.97	5.70		6.67	9.75
6650	4 use		238	.134		.79	5.50		6.29	9.30
7000	36" x 36" columns, 1 use		200	.160		1.77	6.55		8.32	12
7050	2 use		230	.139		1.01	5.70		6.71	9.80
7100	3 use		245	.131		.71	5.35		6.06	9
7150	4 use		250	.128		.58	5.25		5.83	8.70
7400	Steel framed plywood, based on 50 uses of purchased forms, and 4 uses of bracing lumber									
7420										
7500	8" x 8" column	C-1	340	.094	SFCA	1.81	3.85		5.66	7.90
7550	10" x 10"		350	.091		1.58	3.74		5.32	7.50
7600	12" x 12"		370	.086		1.35	3.54		4.89	6.90
7650	16" x 16"		400	.080		1.05	3.27		4.32	6.15
7700	20" x 20"		420	.076		.93	3.11		4.04	5.80
7750	24" x 24"		440	.073		.67	2.97		3.64	5.30
7755	30" x 30"		440	.073		.86	2.97		3.83	5.50
7760	36" x 36"		460	.070		.75	2.84		3.59	5.20
<b>03 11 13.30 Forms In Place, Culvert</b>										
0010	<b>FORMS IN PLACE, CULVERT</b>	R031113-40								
0015	5' to 8' square or rectangular, 1 use		C-1	170	.188	SFCA	3.10	7.70	10.80	15.20
0050	2 use	R031113-60		180	.178		1.83	7.25	9.08	13.15
0100	3 use			190	.168		1.40	6.90	8.30	12.10
0150	4 use			200	.160		1.19	6.55	7.74	11.35
<b>03 11 13.35 Forms In Place, Elevated Slabs</b>										
0010	<b>FORMS IN PLACE, ELEVATED SLABS</b>	R031113-40								
1000	Flat plate, job-built plywood, to 15' high, 1 use	R031113-60	C-2	470	.102	S.F.	3.16	4.28	7.44	10.05
1050	2 use			520	.092		1.74	3.87	5.61	7.85
1100	3 use			545	.088		1.26	3.69	4.95	7.05
1150	4 use			560	.086		1.03	3.59	4.62	6.65
1500	15' to 20' high ceilings, 4 use			495	.097		1.03	4.07	5.10	7.40
1600	21' to 35' high ceilings, 4 use			450	.107		1.29	4.47	5.76	8.25
2000	Flat slab, drop panels, job-built plywood, to 15' high, 1 use			449	.107		3.59	4.48	8.07	10.85
2050	2 use			509	.094		1.97	3.95	5.92	8.20
2100	3 use			532	.090		1.43	3.78	5.21	7.40
2150	4 use			544	.088		1.17	3.70	4.87	7
2250	15' to 20' high ceilings, 4 use			480	.100		2.08	4.19	6.27	8.75
2350	20' to 35' high ceilings, 4 use			435	.110		2.34	4.63	6.97	9.70
3000	Floor slab hung from steel beams, 1 use			485	.099		1.99	4.15	6.14	8.55
3050	2 use			535	.090		1.54	3.76	5.30	7.45
3100	3 use			550	.087		1.40	3.66	5.06	7.15
3150	4 use			565	.085		1.32	3.56	4.88	6.90
3500	Floor slab, with 1-way joist pans, 1 use			415	.116		5.35	4.85	10.20	13.35
3550	2 use			445	.108		3.73	4.52	8.25	11.05

# 03 11 Concrete Forming

## 03 11 13 - Structural Cast-In-Place Concrete Forming

### 03 11 13.35 Forms In Place, Elevated Slabs

Code	Description	Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs		Total	Total Incl O&P
							Labor	Equipment		
3600	3 use	C-2	475	.101	S.F.	3.19	4.24		7.43	10
3650	4 use		500	.096		2.92	4.03		6.95	9.40
4500	With 2-way waffle domes, 1 use		405	.119		5.50	4.97		10.47	13.65
4520	2 use		450	.107		3.86	4.47		8.33	11.10
4530	3 use		460	.104		3.32	4.38		7.70	10.35
4550	4 use		470	.102		3.05	4.28		7.33	9.90
5000	Box out for slab openings, over 16" deep, 1 use		190	.253	SFCA	3.51	10.60		14.11	20
5050	2 use		240	.200	"	1.93	8.40		10.33	14.95
5500	Shallow slab box outs, to 10 S.F.		42	1.143	Eq.	9.65	48		57.65	84
5550	Over 10 S.F. (use perimeter)		600	.080	L.F.	1.29	3.35		4.64	6.55
6000	Bulkhead forms for slab, with keyway, 1 use, 2 piece		500	.096		1.67	4.03		5.70	8.05
6100	3 piece (see also edge forms)		460	.104		1.80	4.38		6.18	8.70
6200	Slab bulkhead form, 4-1/2" high, exp metal, w/keyway & stakes	G	1200	.027		1.64	1.09		2.73	3.47
6210	5-1/2" high	G	1100	.029		1.90	1.19		3.09	3.91
6215	7-1/2" high	G	960	.033		2.31	1.36		3.67	4.63
6220	9-1/2" high	G	840	.038		2.40	1.56		3.96	5.05
6500	Curb forms, wood, 6" to 12" high, on elevated slabs, 1 use		180	.178	SFCA	1.34	7.25		8.59	12.65
6550	2 use		205	.156		.74	6.40		7.14	10.60
6600	3 use		220	.145		.54	5.95		6.49	9.70
6650	4 use		225	.142		.44	5.80		6.24	9.40
7000	Edge forms to 6" high, on elevated slab, 4 use		500	.064	L.F.	.17	2.62		2.79	4.20
7500	Depressed area forms to 12" high, 4 use		300	.107		.78	4.36		5.14	7.55
7550	12" to 24" high, 4 use		175	.183		1.06	7.50		8.56	12.60
8000	Perimeter deck and rail for elevated slabs, straight		90	.356		9.70	14.55		24.25	33
8050	Curved		65	.492		13.35	20		33.35	45.50
8500	Void forms, round fiber, 3" diameter	G	450	.071		.99	2.91		3.90	5.55
8550	4" diameter	G	425	.075		1.46	3.08		4.54	6.35
8600	6" diameter	G	400	.080		2.28	3.27		5.55	7.50
8650	8" diameter	G	375	.085		3.90	3.49		7.39	9.65
8700	10" diameter	G	350	.091		2.52	3.74		6.26	8.50
8750	12" diameter	G	300	.107		3.20	4.36		7.56	10.20

### 03 11 13.40 Forms In Place, Equipment Foundations

Code	Description	Code	Crew	Daily Output	Labor-Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P
0010	<b>FORMS IN PLACE, EQUIPMENT FOUNDATIONS</b>	R031113-40									
0020	1 use		C-2	160	.300	SFCA	2.66	12.60		15.26	22
0050	2 use	R031113-60		190	.253		1.47	10.60		12.07	17.85
0100	3 use			200	.240		1.07	10.05		11.12	16.60
0150	4 use			205	.234		.87	9.80		10.67	16

### 03 11 13.45 Forms In Place, Footings

Code	Description	Code	Crew	Daily Output	Labor-Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P
0010	<b>FORMS IN PLACE, FOOTINGS</b>	R031113-40									
0020	Continuous wall, plywood, 1 use		C-1	375	.085	SFCA	5	3.49		8.49	10.85
0050	2 use	R031113-60		440	.073		2.76	2.97		5.73	7.60
0100	3 use			470	.068		2	2.78		4.78	6.45
0150	4 use			485	.066		1.63	2.70		4.33	5.95
0500	Dowel supports for footings or beams, 1 use			500	.064	L.F.	.74	2.62		3.36	4.83
1000	Integral starter wall, to 4" high, 1 use			400	.080		.79	3.27		4.06	5.85
1500	Keyway, 4 use, tapered wood, 2" x 4"		1 Carp	530	.015		.18	.65		.83	1.20
1550	2" x 6"			500	.016		.26	.69		.95	1.35
2000	Tapered plastic			530	.015		.45	.65		1.10	1.50
2250	For keyway hung from supports, add			150	.053		.74	2.30		3.04	4.34
3000	Pile cap, square or rectangular, job-built plywood, 1 use		C-1	290	.110	SFCA	2.33	4.51		6.84	9.45
3050	2 use			346	.092		1.28	3.78		5.06	7.20
3100	3 use			371	.086		.93	3.53		4.46	6.40



# 03 11 Concrete Forming

## 03 11 13 - Structural Cast-In-Place Concrete Forming

### 03 11 13.45 Forms In Place, Footings

	Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs		Total	Total Incl O&P
						Labor	Equipment		
3150	C-1	383	.084	SFCA	.76	3.42		4.18	6.10
4000		225	.142		2.72	5.80		8.52	11.90
4050		280	.114		1.50	4.67		6.17	8.80
4100		305	.105		1.09	4.29		5.38	7.80
4150		315	.102		.88	4.15		5.03	7.30
5000		305	.105		1.79	4.29		6.08	8.55
5050		371	.086		1	3.53		4.53	6.50
5100		401	.080		.72	3.26		3.98	5.80
5150		414	.077		.58	3.16		3.74	5.50
6000		25	1.280	Ea.	4.92	52.50		57.42	86
6050		22	1.455		9.85	59.50		69.35	102
6100		20	1.600		19.70	65.50		85.20	122
6150		17	1.882		24	77		101	144
7000		250	.128	SFCA	2.49	5.25		7.74	10.80
7100		270	.119	"	.82	4.85		5.67	8.35

### 03 11 13.47 Forms In Place, Gas Station Forms

FORMS IN PLACE, GAS STATION FORMS										
0010										
0050	Curb fascia, with template, 12 ga. steel, left in place, 9" high	G	1 Carp	50	.160	L.F.	11.80	6.90	18.70	23.50
1000	Sign or light bases, 18" diameter, 9" high	G		9	.889	Ea.	74.50	38.50	113	140
1050	30" diameter, 13" high	G		8	1		118	43	161	196
2000	Island forms, 10' long, 9" high, 3'-6" wide	G	C-1	10	3.200		330	131	461	565
2050	4' wide	G		9	3.556		340	145	485	600
2500	20' long, 9" high, 4' wide	G		6	5.333		545	218	763	935
2550	5' wide	G		5	6.400		570	262	832	1,025

### 03 11 13.50 Forms In Place, Grade Beam

FORMS IN PLACE, GRADE BEAM											
0010											
0020	Job-built plywood, 1 use		R031113-40	C-2	530	.091	SFCA	2.37	3.80	6.17	8.45
0050	2 use		R031113-60		580	.083		1.30	3.47	4.77	6.75
0100	3 use				600	.080		.95	3.35	4.30	6.20
0150	4 use				605	.079		.77	3.33	4.10	5.95

### 03 11 13.55 Forms In Place, Mat Foundation

FORMS IN PLACE, MAT FOUNDATION											
0010											
0020	Job-built plywood, 1 use		R031113-40	C-2	290	.166	SFCA	2.44	6.95	9.39	13.35
0050	2 use		R031113-60		310	.155		.99	6.50	7.49	11.05
0100	3 use				330	.145		.65	6.10	6.75	10.05
0120	4 use				350	.137		.58	5.75	6.33	9.45

### 03 11 13.65 Forms In Place, Slab On Grade

FORMS IN PLACE, SLAB ON GRADE											
0010											
1000	Bulkhead forms w/keyway, wood, 6" high, 1 use		R031113-40	C-1	510	.063	L.F.	.86	2.57	3.43	4.88
1050	2 uses		R031113-60		400	.080		.47	3.27	3.74	5.50
1100	4 uses				350	.091		.28	3.74	4.02	6.05
1400	Bulkhead form for slab, 4-1/2" high, exp metal, incl keyway & stakes	G			1200	.027		1.64	1.09	2.73	3.47
1410	5-1/2" high	G			1100	.029		1.90	1.19	3.09	3.91
1420	7-1/2" high	G			960	.033		2.31	1.36	3.67	4.63
1430	9-1/2" high	G			840	.038		2.40	1.56	3.96	5.05
2000	Curb forms, wood, 6" to 12" high, on grade, 1 use				215	.149	SFCA	1.80	6.10	7.90	11.35
2050	2 use				250	.128		1	5.25	6.25	9.15
2100	3 use				265	.121		.72	4.94	5.66	8.35
2150	4 use				275	.116		.58	4.76	5.34	7.95
3000	Edge forms, wood, 4 use, on grade, to 6" high				600	.053	L.F.	.27	2.18	2.45	3.64
3050	7" to 12" high				435	.074	SFCA	.59	3.01	3.60	5.25
3500	For depressed slabs, 4 use, to 12" high				300	.107	L.F.	.60	4.36	4.96	7.35

# 03 11 Concrete Forming

## 03 11 13 - Structural Cast-In-Place Concrete Forming

### 03 11 13.65 Forms In Place, Slab On Grade

	Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs		Total	Total Incl O&P
						Labor	Equipment		
3550 To 24" high	C-1	175	.183	L.F.	.79	7.50		8.29	12.30
4000 For slab blockouts, to 12" high, 1 use		200	.160		.63	6.55		7.18	10.75
4050 To 24" high, 1 use		120	.267		.80	10.90		11.70	17.60
4100 Plastic (extruded), to 6" high, multiple use, on grade		800	.040		7.90	1.64		9.54	11.20
5000 Screed, 24 ga. metal key joint, see Section 03 15 05.25									
5020 Wood, incl. wood stakes, 1" x 3"	C-1	900	.036	L.F.	.68	1.45		2.13	2.98
5050 2" x 4"		900	.036	"	.67	1.45		2.12	2.97
6000 Trench forms in floor, wood, 1 use		160	.200	SFCA	1.55	8.20		9.75	14.25
6050 2 use		175	.183		.85	7.50		8.35	12.40
6100 3 use		180	.178		.62	7.25		7.87	11.85
6150 4 use		185	.173		.50	7.05		7.55	11.40
8760 Void form, corrugated fiberboard, 4" x 12", 4' long	G	3000	.011	S.F.	2.39	.44		2.83	3.29
8770 6" x 12", 4' long		3000	.011		2.81	.44		3.25	3.76
8780 1/4" thick hardboard protective cover for void form	2 Carp	1500	.011		.57	.46		1.03	1.33

### 03 11 13.85 Forms In Place, Walls

0010 FORMS IN PLACE, WALLS	R031113-10								
0100 Box out for wall openings, to 16" thick, to 10 S.F.	C-2	24	2	Eq.	23	84		107	154
0150 Over 10 S.F. (use perimeter)	R031113-40	"	280	L.F.	1.94	7.20		9.14	13.20
0250 Brick shelf, 4" w, add to wall forms, use wall area obv shelf									
0260 1 use	R031113-60	C-2	240	.200	SFCA	2.06	8.40	10.46	15.10
0300 2 use			275	.175		1.13	7.30	8.43	12.50
0350 4 use			300	.160		.82	6.70	7.52	11.20
0500 Bulkhead, wood with keyway, 1 use, 2 piece			265	.181	L.F.	1.69	7.60	9.29	13.50
0600 Bulkhead forms with keyway, 1 piece expanded metal, 8" wall	G	C-1	1000	.032		2.31	1.31	3.62	4.55
0610 10" wall	G		800	.040		2.40	1.64	4.04	5.15
0620 12" wall	G		525	.061		2.88	2.49	5.37	7
0700 Buttress, to 8' high, 1 use		C-2	350	.137	SFCA	2.89	5.75	8.64	12
0750 2 use			430	.112		1.59	4.68	6.27	8.95
0800 3 use			460	.104		1.16	4.38	5.54	8
0850 4 use			480	.100		.96	4.19	5.15	7.50
1000 Corbel or haunch, to 12" wide, add to wall forms, 1 use			150	.320	L.F.	1.91	13.40	15.31	22.50
1050 2 use			170	.282		1.05	11.85	12.90	19.30
1100 3 use			175	.274		.76	11.50	12.26	18.50
1150 4 use			180	.267		.62	11.20	11.82	17.85
2000 Wall, job-built plywood, to 8' high, 1 use			370	.130	SFCA	2.17	5.45	7.62	10.75
2050 2 use			435	.110		1.38	4.63	6.01	8.60
2100 3 use			495	.097		1.01	4.07	5.08	7.35
2150 4 use			505	.095		.82	3.99	4.81	7
2400 Over 8' to 16' high, 1 use			280	.171		2.38	7.20	9.58	13.65
2450 2 use			345	.139		1.08	5.85	6.93	10.15
2500 3 use			375	.128		.77	5.35	6.12	9.10
2550 4 use			395	.122		.63	5.10	5.73	8.50
2700 Over 16' high, 1 use			235	.204		2.18	8.55	10.73	15.55
2750 2 use			290	.166		1.20	6.95	8.15	11.95
2800 3 use			315	.152		.87	6.40	7.27	10.75
2850 4 use			330	.145		.71	6.10	6.81	10.15
4000 Radial, smooth curved, job-built plywood, 1 use			245	.196		2.16	8.20	10.36	15
4050 2 use			300	.160		1.19	6.70	7.89	11.60
4100 3 use			325	.148		.86	6.20	7.06	10.45
4150 4 use			335	.143		.70	6	6.70	9.95
4200 Below grade, job-built plywood, 1 use			225	.213		2.25	8.95	11.20	16.20
4210 2 use			225	.213		1.24	8.95	10.19	15.05

# 03 21 Reinforcing Steel

## 03 21 05 - Reinforcing Steel Accessories

### 03 21 05.75 Splicing Reinforcing Bars

	Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs			Total	Total Incl Over
						Labor	Equipment			
0810 #10 bars	G	C-5	40	1.400	Eq.	41	66	18.70	125.70	170
0900 #11 bars	G		32	1.750		49	82.50	23.50	155	210
0920 #14 bars	G		24	2.333		79.50	110	31	220.50	295
1000 Sleeve type w/ferrous filler, for critical structures, #6 bars	G	C-25	72	.444		41	16.80		57.80	72.50
1210 #7 bars	G		64	.500		42	18.90		60.90	76.50
1220 #8 bars	G		56	.571		44	21.50		65.50	83.50
1230 #9 bars	G	C-5	48	1.167		45	55	15.60	115.60	154
1240 #10 bars	G		40	1.400		48	66	18.70	132.70	178
1250 #11 bars	G		32	1.750		58	82.50	23.50	164	220
1260 #14 bars	G		24	2.333		73	110	31	214	288
1270 #18 bars	G		16	3.500		106	165	47	318	430
2000 Weldable half coupler, taper threaded, #4 bars	G	E-16	120	.133		7.10	6.60	.91	14.61	20.50
2100 #5 bars	G		112	.143		8.40	7.10	.97	16.47	23
2200 #6 bars	G		104	.154		13.35	7.60	1.05	22	29.50
2300 #7 bars	G		96	.167		15.50	8.25	1.14	24.89	33
2400 #8 bars	G		88	.182		16.15	9	1.24	26.39	35
2500 #9 bars	G		80	.200		17.80	9.90	1.36	29.06	38.50
2600 #10 bars	G		72	.222		18.20	11	1.51	30.71	41
2700 #11 bars	G		64	.250		19.45	12.40	1.70	33.55	45.50
2800 #14 bars	G		56	.286		22.50	14.15	1.95	38.60	51.50
2900 #18 bars	G		48	.333		36.50	16.50	2.27	55.27	71.50

### 03 21 10 - Uncoated Reinforcing Steel

#### 03 21 10.60 Reinforcing In Place

0015 REINFORCING IN PLACE, 50-60 ton lots, A615 Grade 60	R032110-10									
0020 Includes labor, but not material cost, to install accessories										
0030 Made from recycled materials	G									
0100 Beams & Girders, #3 to #7	G	4 Rodm	1.60	20	Ton	900	970		1,870	2,550
0150 #8 to #18	R032110-20	G	2.70	11.852		900	575		1,475	1,900
0200 Columns, #3 to #7	G		1.50	21.333		900	1,025		1,925	2,650
0250 #8 to #18	G		2.30	13.913		900	675		1,575	2,075
0300 Spirals, hot rolled, 8" to 15" diameter	G		2.20	14.545		1,400	705		2,105	2,675
0320 15" to 24" diameter	R032110-40	G	2.20	14.545		1,350	705		2,055	2,600
0330 24" to 36" diameter	G		2.30	13.913		1,275	675		1,950	2,475
0340 36" to 48" diameter	R032110-50	G	2.40	13.333		1,225	645		1,870	2,350
0360 48" to 64" diameter	G		2.50	12.800		1,350	620		1,970	2,475
0380 64" to 84" diameter	R032110-70	G	2.60	12.308		1,400	595		1,995	2,500
0390 84" to 96" diameter	G		2.70	11.852		1,475	575		2,050	2,550
0400 Elevated slabs, #4 to #7	R032110-80	G	2.90	11.034		955	535		1,490	1,900
0500 Footings, #4 to #7	G		2.10	15.238		855	740		1,595	2,125
0550 #8 to #18 <i>Pile Caps, Caissons</i>	G		3.60	8.889		810	430		1,240	1,575
0600 Slab on grade, #3 to #7	G		2.30	13.913		855	675		1,530	2,025
0700 Walls, #3 to #7	G		3	10.667		855	515		1,370	1,775
0750 #8 to #18	G		4	8		855	385		1,240	1,550
0900 For other than 50 - 60 ton lots										
1000 Under 10 ton job, #3 to #7, add					Ton	25%	10%			
1010 #8 to #18, add						20%	10%			
1050 10 - 50 ton job, #3 to #7, add						10%				
1060 #8 to #18, add						5%				
1100 60 - 100 ton job, #3 to #7, deduct						5%				
1110 #8 to #18, deduct						10%				
1150 Over 100 ton job, #3 to #7, deduct						10%				
1160 #8 to #18, deduct						15%				

# 03 22 Welded Wire Fabric Reinforcing

## 03 22 05 - Uncoated Welded Wire Fabric

03 22 05.50 Welded Wire Fabric			Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs Labor	Equipment	Total	Total Incl O&P
0010	<b>WELDED WIRE FABRIC ASTM A185</b>	R032205-30									
0030	Made from recycled materials	G									
0050	Sheets										
0100	6 x 6 - W1.4 x W1.4 (10 x 10) 21 lb. per C.S.F.	G	2 Rodm	35	.457	C.S.F.	12.50	22		34.50	49.50
0200	6 x 6 - W2.1 x W2.1 (8 x 8) 30 lb. per C.S.F.	G		31	.516		18.90	25		43.90	61
0300	6 x 6 - W2.9 x W2.9 (6 x 6) 42 lb. per C.S.F.	G		29	.552		21.50	26.50		48	66
0400	6 x 6 - W4 x W4 (4 x 4) 58 lb. per C.S.F.	G		27	.593		29.50	28.50		58	78.50
0500	4 x 4 - W1.4 x W1.4 (10 x 10) 31 lb. per C.S.F.	G		31	.516		17.90	25		42.90	59.50
0600	4 x 4 - W2.1 x W2.1 (8 x 8) 44 lb. per C.S.F.	G		29	.552		22.50	26.50		49	67
0650	4 x 4 - W2.9 x W2.9 (6 x 6) 61 lb. per C.S.F.	G		27	.593		36	28.50		64.50	85.50
0700	4 x 4 - W4 x W4 (4 x 4) 85 lb. per C.S.F.	G		25	.640		45	31		76	99
0750	Rolls										
0800	2 x 2 - #14 galv., 21 lb./C.S.F. beam & column wrap	G	2 Rodm	6.50	2.462	C.S.F.	44	119		163	239
0900	2 x 2 - #12 galv. for gunite reinforcing	G	"	6.50	2.462	"	65	119		184	262

# 03 23 Stressing Tendons

## 03 23 05 - Prestressing Tendons

### 03 23 05.50 Prestressing Steel

03 23 05.50 Prestressing Steel			Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs Labor	Equipment	Total	Total Incl O&P
0010	<b>PRESTRESSING STEEL</b>	R034136-90									
0100	Grouted strand, post-tensioned in field, 50' span, 100 kip	G	C-3	1200	.053	Lb.	2.28	2.38	.09	4.75	6.35
0150	300 kip	G		2700	.024		1.04	1.06	.04	2.14	2.85
0300	100' span, 100 kip	G		1700	.038		2.29	1.68	.06	4.03	5.20
0350	300 kip	G		3200	.020		1.98	.89	.03	2.90	3.62
0500	200' span, 100 kip	G		2700	.024		2.28	1.06	.04	3.38	4.21
0550	300 kip	G		3500	.018		1.98	.81	.03	2.82	3.48
0800	Grouted bars, 50' span, 42 kip	G		2600	.025		.91	1.10	.04	2.05	2.77
0850	143 kip	G		3200	.020		.88	.89	.03	1.80	2.40
1000	75' span, 42 kip	G		3200	.020		.93	.89	.03	1.85	2.46
1050	143 kip	G		4200	.015		.78	.68	.03	1.49	1.96
1200	UngROUTED strand, 50' span, 100 kip	G	C-4	1275	.025		.62	1.23	.02	1.87	2.67
1250	300 kip	G		1475	.022		.62	1.06	.02	1.70	2.40
1400	100' span, 100 kip	G		1500	.021		.62	1.04	.02	1.68	2.37
1450	300 kip	G		1650	.019		.62	.95	.02	1.59	2.22
1600	200' span, 100 kip	G		1500	.021		.62	1.04	.02	1.68	2.37
1650	300 kip	G		1700	.019		.62	.92	.02	1.56	2.17
1800	UngROUTED bars, 50' span, 42 kip	G		1400	.023		.45	1.12	.02	1.59	2.31
1850	143 kip	G		1700	.019		.45	.92	.02	1.39	1.99
2000	75' span, 42 kip	G		1800	.018		.45	.87	.02	1.34	1.91
2050	143 kip	G		2200	.015		.45	.71	.01	1.17	1.65
2220	UngROUTED single strand, 100' slab, 25 kip	G		1200	.027		.62	1.30	.02	1.94	2.79
2250	35 kip	G		1475	.022		.62	1.06	.02	1.70	2.40
3000	Slabs on grade, 0.5-inch diam. non-bonded strands, HDPE sheathed,										
3050	attached dead-end anchors, loose stressing-end anchors										
3100	25' x 30' slab, strands @ 36" O.C., placing		2 Rodm	2940	.005	S.F.	.59	.26		.85	1.07
3105	Stressing		C-4A	3750	.004			.21	.01	.22	.34
3110	42" O.C., placing		2 Rodm	3200	.005		.52	.24		.76	.96
3115	Stressing		C-4A	4040	.004			.19	.01	.20	.32
3120	48" O.C., placing		2 Rodm	3510	.005		.46	.22		.68	.85
3125	Stressing		C-4A	4390	.004			.18	.01	.19	.29
3150	25' x 40' slab, strands @ 36" O.C., placing		2 Rodm	3370	.005		.57	.23		.80	1
3155	Stressing		C-4A	4360	.004			.18	.01	.19	.29

# 03 30 Cast-In-Place Concrete

## 03 30 53 - Miscellaneous Cast-In-Place Concrete

03 30 53.40 Concrete In Place		Daily Crew	Output	Labor-Hours	Unit	Material	2011 Bare Costs			Total
							Labor	Equipment		Incl O&P
5500	Lightweight, ready mix, including screed finish only,									
5510	not including forms or reinforcing									
5550	1:4 (2500 psi) for structural roof decks	C-14B	260	.800	C.Y.	136	34.50	2.94	173.44	205
5600	1:6 (3000 psi) for ground slab with radiant heat	C-14F	92	.783		133	30.50	.25	163.75	192
5650	1:3:2 (2000 psi) with sand aggregate, roof deck	C-14B	260	.800		133	34.50	2.94	170.44	202
5700	Ground slab (2000 psi)	C-14F	107	.673		133	26	.22	159.22	185
5900	Pile caps (3000 psi), incl. forms and reinf., sq. or rect., under 10 C.Y.	C-14C	54.14	2.069		154	85.50	.43	239.93	300
5950	Over 10 C.Y.		75	1.493		147	61.50	.31	208.81	256
6000	Triangular or hexagonal, under 10 C.Y.		53	2.113		118	87.50	.44	205.94	264
6050	Over 10 C.Y.		85	1.318		132	54.50	.28	186.78	229
6200	Retaining walls (3000 psi), gravity, 4' high see Section 32 32	C-14D	66.20	3.021		136	130	11.55	277.55	360
6250	10' high		125	1.600		129	68.50	6.10	203.60	254
6300	Cantilever, level backfill loading, 8' high		70	2.857		148	122	10.90	280.90	365
6350	16' high		91	2.198		141	94	8.40	243.40	310
6800	Stairs (3500 psi), not including safety treads, free standing, 3'-6" wide	C-14H	83	.578	LF Nose	5	24.50	.28	29.78	43.50
6850	Cast on ground		125	.384	"	4.28	16.30	.18	20.76	30
7000	Stair landings, free standing		200	.240	S.F.	4.03	10.20	.12	14.35	20
7050	Cast on ground		475	.101	"	3.29	4.29	.05	7.63	10.25

# 03 31 Structural Concrete

## 03 31 05 - Normal Weight Structural Concrete

### 03 31 05.30 Concrete, Field Mix

0010	CONCRETE, FIELD MIX	R033105-65								
0015	FOB forms 2250 psi				C.Y.	85			85	93.50
0020	3000 psi				"	92			92	101

### 03 31 05.35 Normal Weight Concrete, Ready Mix

0010	NORMAL WEIGHT CONCRETE, READY MIX, delivered	R033105-10								
0012	Includes local aggregate, sand, Portland cement, and water									
0015	Excludes all additives and treatments	R033105-20								
0020	2000 psi				C.Y.	91.50			91.50	101
0100	2500 psi	R033105-30				94			94	103
0150	3000 psi					99			99	109
0200	3500 psi	R033105-40				99.50			99.50	110
0300	4000 psi					103			103	113
0350	4500 psi	R033105-50				106			106	116
0400	5000 psi					111			111	122
0411	6000 psi					127			127	139
0412	8000 psi					206			206	227
0413	10,000 psi					293			293	320
0414	12,000 psi					355			355	390
1000	For high early strength cement, add					10%				
1010	For structural lightweight with regular sand, add					25%				
1300	For winter concrete (hot water), add					4.25			4.25	4.68
1400	For hot weather concrete (ice), add					9.35			9.35	10.25
1410	For mid-range water reducer, add					4.13			4.13	4.54
1420	For high-range water reducer/superplasticizer, add					6.35			6.35	6.95
1430	For retarder, add					2.71			2.71	2.98
1440	For non-Chloride accelerator, add					4.83			4.83	5.30
1450	For Chloride accelerator, per 1%, add					3.28			3.28	3.61
1460	For fiber reinforcing, synthetic (1 lb./C.Y.), add					6.65			6.65	7.30
1500	For Saturday delivery, add					8.85			8.85	9.70

# 03 31 Structural Concrete

## 03 31 05 - Normal Weight Structural Concrete

03 31 05.35 Normal Weight Concrete, Ready Mix		Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs		Total	Total Incl O&P
							Labor	Equipment		
1510	For truck holding/waiting time past 1st hour per load, add				Hr.	87.50			87.50	96.50
1520	For short load (less than 4 C.Y.), add per load				Ea.	112			112	124
2000	For all lightweight aggregate, add				C.Y.	45%				

### 03 31 05.70 Placing Concrete

03 31 05.70 PLACING CONCRETE		R033105-70								
0010	PLACING CONCRETE									
0020	Includes labor and equipment to place, strike off and consolidate									
0050	Beams, elevated, small beams, pumped	C-20	60	1.067	C.Y.		39	13.10	52.10	74
0100	With crane and bucket	C-7	45	1.600			59.50	28.50	88	121
0200	Large beams, pumped	C-20	90	.711			26	8.75	34.75	49
0250	With crane and bucket	C-7	65	1.108			41	19.65	60.65	84
0400	Columns, square or round, 12" thick, pumped	C-20	60	1.067			39	13.10	52.10	74
0450	With crane and bucket	C-7	40	1.800		12"	67	32	99	136
0600	18" thick, pumped	C-20	90	.711			26	8.75	34.75	49
0650	With crane and bucket	C-7	55	1.309		18"	48.50	23	71.50	99
0800	24" thick, pumped	C-20	92	.696			25.50	8.55	34.05	48.50
0850	With crane and bucket	C-7	70	1.029		24"	38	18.25	56.25	78
1000	36" thick, pumped	C-20	140	.457			16.80	5.60	22.40	31.50
1050	With crane and bucket	C-7	100	.720		36"	27	12.75	39.75	54.50
1400	Elevated slabs, less than 6" thick, pumped	C-20	140	.457			16.80	5.60	22.40	31.50
1450	With crane and bucket	C-7	95	.758			28	13.45	41.45	57.50
1500	6" to 10" thick, pumped	C-20	160	.400			14.70	4.92	19.62	28
1550	With crane and bucket	C-7	110	.655			24.50	11.60	36.10	50
1600	Slabs over 10" thick, pumped	C-20	180	.356			13.10	4.37	17.47	24.50
1650	With crane and bucket	C-7	130	.554			20.50	9.85	30.35	42
1900	Footings, continuous, shallow, direct chute	C-6	120	.400			14.30	.39	14.69	22
1950	Pumped	C-20	150	.427			15.70	5.25	20.95	30
2000	With crane and bucket	C-7	90	.800			29.50	14.20	43.70	60.50
2100	Footings, continuous, deep, direct chute <i>Caissons</i>	C-6	140	.343			12.25	.33	12.58	19
2150	Pumped	C-20	160	.400			14.70	4.92	19.62	28
2200	With crane and bucket	C-7	110	.655			24.50	11.60	36.10	50
2400	Footings, spread, under 1 C.Y., direct chute	C-6	55	.873			31	.85	31.85	48.50
2450	Pumped	C-20	65	.985			36	12.10	48.10	68.50
2500	With crane and bucket	C-7	45	1.600			59.50	28.50	88	121
2600	Over 5 C.Y., direct chute	C-6	120	.400			14.30	.39	14.69	22
2650	Pumped	C-20	150	.427			15.70	5.25	20.95	30
2700	With crane and bucket	C-7	100	.720			27	12.75	39.75	54.50
2900	Foundation mats, over 20 C.Y., direct chute	C-6	350	.137			4.91	.13	5.04	7.60
2950	Pumped	C-20	400	.160			5.90	1.97	7.87	11.10
3000	With crane and bucket	C-7	300	.240			8.90	4.26	13.16	18.20
3200	Grade beams, direct chute	C-6	150	.320			11.45	.31	11.76	17.75
3250	Pumped	C-20	180	.356			13.10	4.37	17.47	24.50
3300	With crane and bucket	C-7	120	.600			22.50	10.65	33.15	45.50
3500	High rise, for more than 5 stories, pumped, add per story	C-20	2100	.030			1.12	.37	1.49	2.11
3510	With crane and bucket, add per story	C-7	2100	.034			1.27	.61	1.88	2.60
3700	Pile caps, under 5 C.Y., direct chute	C-6	90	.533			19.10	.52	19.62	29.50
3750	Pumped	C-20	110	.582			21.50	7.15	28.65	40.50
3800	With crane and bucket	C-7	80	.900			33.50	15.95	49.45	68
3850	Pile cap, 5 C.Y. to 10 C.Y., direct chute	C-6	175	.274			9.80	.27	10.07	15.20
3900	Pumped	C-20	200	.320			11.75	3.94	15.69	22
3950	With crane and bucket	C-7	150	.480			17.85	8.50	26.35	36.50
4000	Over 10 C.Y., direct chute	C-6	215	.223			8	.22	8.22	12.40
4050	Pumped	C-20	240	.267			9.80	3.28	13.08	18.50

# 03 31 Structural Concrete

## 03 31 05 - Normal Weight Structural Concrete

03 31 05.70 Placing Concrete		Crew	Daily Output	Labor-Hours	Unit	Material	2011 Base Costs		Total	Total Incl O&P
							Labor	Equipment		
4100	With crane and bucket	C-7	185	.389	C.Y.		14.45	6.90	21.35	29.50
4300	Slab on grade, up to 6" thick, direct chute	C-6	110	.436			15.60	.42	16.02	24
4350	Pumped	C-20	130	.492			18.10	6.05	24.15	34
4400	With crane and bucket	C-7	110	.655			24.50	11.60	36.10	50
4600	Over 6" thick, direct chute	C-6	165	.291			10.40	.28	10.68	16.10
4650	Pumped	C-20	185	.346			12.75	4.26	17.01	24
4700	With crane and bucket	C-7	145	.497			18.45	8.80	27.25	37.50
4900	Walls, 8" thick, direct chute	C-6	90	.533			19.10	.52	19.62	29.50
4950	Pumped	C-20	100	.640			23.50	7.85	31.35	44
5000	With crane and bucket	C-7	80	.900			33.50	15.95	49.45	68
5050	12" thick, direct chute	C-6	100	.480			17.15	.47	17.62	26.50
5100	Pumped	C-20	110	.582			21.50	7.15	28.65	40.50
5200	With crane and bucket	C-7	90	.800			29.50	14.20	43.70	60.50
5300	15" thick, direct chute	C-6	105	.457			16.35	.44	16.79	25.50
5350	Pumped	C-20	120	.533			19.60	6.55	26.15	37
5400	With crane and bucket	C-7	95	.758			28	13.45	41.45	57.50
5600	Wheeled concrete dumping, add to placing costs above									
5610	Walking cart, 50' haul, add	C-18	32	.281	C.Y.		9.70	1.72	11.42	16.80
5620	150' haul, add		24	.375			12.95	2.29	15.24	22.50
5700	250' haul, add		18	.500			17.30	3.06	20.36	30
5800	Riding cart, 50' haul, add	C-19	80	.113			3.89	1.15	5.04	7.20
5810	150' haul, add		60	.150			5.20	1.53	6.73	9.65
5900	250' haul, add		45	.200			6.90	2.04	8.94	12.85

# 03 35 Concrete Finishing

## 03 35 29 - Tooled Concrete Finishing

### 03 35 29.30 Finishing Floors

0010	<b>FINISHING FLOORS</b>									
0012	Finishing requires that concrete first be placed, struck off & consolidated									
0015	Basic finishing for various unspecified flatwork									
0100	Bull float only	C-10	4000	.006	S.F.		.23		.23	.34
0125	Bull float & manual float		2000	.012			.46		.46	.69
0150	Bull float, manual float, & broom finish, w/edging & joints		1850	.013			.50		.50	.74
0200	Bull float, manual float & manual steel trowel		1265	.019			.73		.73	1.09
0210	For specified Random Access Floors in ACI Classes 1, 2, 3 and 4 to achieve									
0215	Composite Overall Floor Flatness and Levelness values up to F35/F25									
0250	Bull float, machine float & machine trowel (walk-behind)	C-10C	1715	.014	S.F.		.54	.02	.56	.82
0300	Power screed, bull float, machine float & trowel (walk-behind)	C-10D	2400	.010			.39	.04	.43	.62
0350	* Power screed, bull float, machine float & trowel (ride-on)	C-10E	4000	.006			.23	.06	.29	.40
0352	For specified Random Access Floors in ACI Classes 5, 6, 7 and 8 to achieve									
0354	Composite Overall Floor Flatness and Levelness values up to F50/F50									
0356	Add for two-dimensional restraightening after power float	C-10	6000	.004	S.F.		.15		.15	.23
0358	For specified Random or Defined Access Floors in ACI Class 9 to achieve									
0360	Composite Overall Floor Flatness and Levelness values up to F100/F100									
0362	Add for two-dimensional restraightening after bull float & power float	C-10	3000	.008	S.F.		.31		.31	.46
0364	For specified Superflat Defined Access Floors in ACI Class 9 to achieve									
0366	Minimum Floor Flatness and Levelness values of F100/F100									
0368	Add for 2-dim'l restraightening after bull float, power float, power trowel	C-10	2000	.012	S.F.		.46		.46	.69
0400	Integral topping and finish, using 1:1:2 mix, 3/16" thick	C-10B	1000	.040		.10	1.48	.23	1.81	2.58
0450	1/2" thick		950	.042		.27	1.56	.24	2.07	2.89
0500	3/4" thick		850	.047		.41	1.74	.27	2.42	3.36

# 05 12 Structural Steel Framing

## 05 12 23 - Structural Steel for Buildings

### 05 12 23.75 Structural Steel Members

			Crew	Daily Output	Labor-Hours	Unit	Material	2011 Bare Costs		Total	Total Incl O&P
								Labor	Equipment		
0020	Shop fab'd for 100-ton, 1-2 story project, bolted connections										
0100	W 6 x 9	G	E-2	600	.093	L.F.	11.15	4.42	2.70	18.27	22.50
0120	x 15	G		600	.093		18.55	4.42	2.70	25.67	31
0140	x 20	G		600	.093		25	4.42	2.70	32.12	37.50
0300	W 8 x 10	G		600	.093		12.40	4.42	2.70	19.52	24
0320	x 15	G		600	.093		18.55	4.42	2.70	25.67	31
0350	x 21	G		600	.093		26	4.42	2.70	33.12	39
0360	x 24	G		550	.102		29.50	4.82	2.95	37.27	44
0370	x 28	G		550	.102		34.50	4.82	2.95	42.27	49.50
0500	x 31	G		550	.102		38.50	4.82	2.95	46.27	53.50
0520	x 35	G		550	.102		43.50	4.82	2.95	51.27	59
0540	x 48	G		550	.102		59.50	4.82	2.95	67.27	77
0600	W 10 x 12	G		600	.093		14.85	4.42	2.70	21.97	27
0620	x 15	G		600	.093		18.55	4.42	2.70	25.67	31
0700	x 22	G		600	.093		27	4.42	2.70	34.12	40.50
0720	x 26	G		600	.093		32	4.42	2.70	39.12	46
0740	x 33	G		550	.102		41	4.82	2.95	48.77	56.50
0900	x 49	G		550	.102		60.50	4.82	2.95	68.27	78
1100	W 12 x 16	G		880	.064		19.80	3.01	1.84	24.65	29
1300	x 22	G		880	.064		27	3.01	1.84	31.85	37
1500	x 26	G		880	.064		32	3.01	1.84	36.85	42.50
1520	x 35	G		810	.069		43.50	3.27	2	48.77	55.50
1560	x 50	G		750	.075		62	3.54	2.16	67.70	76.50
1580	x 58	G		750	.075		72	3.54	2.16	77.70	87.50
1700	x 72	G		640	.088		89	4.14	2.53	95.67	108
1740	x 87	G		640	.088		108	4.14	2.53	114.67	128
1900	W 14 x 26	G		990	.057		32	2.68	1.64	36.32	42
2100	x 30	G		900	.062		37	2.95	1.80	41.75	48
2300	x 34	G		810	.069		42	3.27	2	47.27	54.50
2320	x 43	G		810	.069		53	3.27	2	58.27	66.50
2340	x 53	G		800	.070		65.50	3.32	2.03	70.85	80
2360	x 74	G		760	.074		91.50	3.49	2.13	97.12	109
2380	x 90	G		740	.076		111	3.58	2.19	116.77	131
2500	x 120	G		720	.078		149	3.68	2.25	154.93	172
2700	W 16 x 26	G		1000	.056		32	2.65	1.62	36.27	42
2900	x 31	G		900	.062		38.50	2.95	1.80	43.25	49
3100	x 40	G		800	.070		49.50	3.32	2.03	54.85	62.50
3120	x 50	G		800	.070		62	3.32	2.03	67.35	76
3140	x 67	G		760	.074		83	3.49	2.13	88.62	99.50
3300	W 18 x 35	G	E-5	960	.083		43.50	3.99	1.80	49.29	56.50
3500	x 40	G		960	.083		49.50	3.99	1.80	55.29	63.50
3520	x 46	G		960	.083		57	3.99	1.80	62.79	71.50
3700	x 50	G		912	.088		62	4.20	1.90	68.10	77.50
3900	x 55	G		912	.088		68	4.20	1.90	74.10	84.50
3920	x 65	G		900	.089		80.50	4.26	1.92	86.68	98
3940	x 76	G		900	.089		94	4.26	1.92	100.18	112
3960	x 86	G		900	.089		106	4.26	1.92	112.18	126
3980	x 106	G		900	.089		131	4.26	1.92	137.18	153
4100	W 21 x 44	G		1064	.075		54.50	3.60	1.63	59.73	68
4300	x 50	G		1064	.075		62	3.60	1.63	67.23	76
4500	x 62	G		1036	.077		76.50	3.70	1.67	81.87	92.50
4700	x 68	G		1036	.077		84	3.70	1.67	89.37	101
4720	x 83	G		1000	.080		103	3.83	1.73	108.56	122



# 05 12 Structural Steel Framing

## 05 12 23 - Structural Steel for Buildings

### 05 12 23.75 Structural Steel Members

Total Cost	Quantity	Description	Unit	Crew	Daily Output	Labor- Hours	Unit	Material	2011 Bare Costs			Total	Total Incl O&P
									Labor	Equipment	Total		
4740	x 93	G	E-5	1000	.080	L.F.		115	3.83	1.73	120.56	136	
22.50	4760	x 101	G		1000	.080		125	3.83	1.73	130.56	146	
31	4780	x 122	G		1000	.080		151	3.83	1.73	156.56	175	
37.50	4900	W 24 x 55	G		1110	.072		68	3.45	1.56	73.01	82.50	
24	5100	x 62	G		1110	.072		76.50	3.45	1.56	81.51	92	
31	5300	x 68	G		1110	.072		84	3.45	1.56	89.01	100	
39	5500	x 76	G		1110	.072		94	3.45	1.56	99.01	111	
44	5700	x 84	G		1080	.074		104	3.55	1.60	109.15	122	
49.50	5720	x 94	G		1080	.074		116	3.55	1.60	121.15	136	
53.50	5740	x 104	G		1050	.076		129	3.65	1.65	134.30	150	
59	5760	x 117	G		1050	.076		145	3.65	1.65	150.30	167	
77	5780	x 146	G		1050	.076		181	3.65	1.65	186.30	207	
27	5800	W 27 x 84	G		1190	.067		104	3.22	1.45	108.67	121	
31	5900	x 94	G		1190	.067		116	3.22	1.45	120.67	135	
40.50	5920	x 114	G		1150	.070		141	3.33	1.51	145.84	162	
46	5940	x 146	G		1150	.070		181	3.33	1.51	185.84	206	
56.50	5960	x 161	G		1150	.070		199	3.33	1.51	203.84	226	
78	6100	W 30 x 99	G		1200	.067		123	3.19	1.44	127.63	142	
29	6300	x 108	G		1200	.067		134	3.19	1.44	138.63	154	
37	6500	x 116	G		1160	.069		144	3.31	1.49	148.80	165	
42.50	6520	x 132	G		1160	.069		163	3.31	1.49	167.80	187	
55.50	6540	x 148	G		1160	.069		183	3.31	1.49	187.80	208	
76.50	6560	x 173	G		1120	.071		214	3.42	1.55	218.97	244	
87.50	6580	x 191	G		1120	.071		236	3.42	1.55	240.97	268	
38	6700	W 33 x 118	G		1176	.068		146	3.26	1.47	150.73	168	
28	6900	x 130	G		1134	.071		161	3.38	1.53	165.91	184	
42	7100	x 141	G		1134	.071		174	3.38	1.53	178.91	199	
18	7120	x 169	G		1100	.073		209	3.49	1.57	214.06	238	
54.50	7140	x 201	G		1100	.073		249	3.49	1.57	254.06	282	
66.50	7300	W 36 x 135	G		1170	.068		167	3.28	1.48	171.76	191	
10	7500	x 150	G		1170	.068		186	3.28	1.48	190.76	211	
19	7600	x 170	G		1150	.070		210	3.33	1.51	214.84	238	
11	7700	x 194	G		1125	.071		240	3.41	1.54	244.95	272	
2	7900	x 231	G		1125	.071		286	3.41	1.54	290.95	325	
2	7920	x 262	G		1035	.077		325	3.70	1.67	330.37	365	
9	8100	x 302	G		1035	.077		375	3.70	1.67	380.37	420	
2.50	8490	For projects 75 to 99 tons, add						10%					
6	8492	50 to 74 tons, add						20%					
9.50	8494	25 to 49 tons, add						30%	10%				
6.50	8496	10 to 24 tons, add						50%	25%				
3.50	8498	2 to 9 tons, add						75%	50%				
1.50	8499	Less than 2 tons, add						100%	100%				

### 05 12 23.77 Structural Steel Projects

Code	Description	Unit	Crew	Daily Output	Labor- Hours	Unit	Material	Labor	Equipment	Total	Total Incl O&P	
0010	<b>STRUCTURAL STEEL PROJECTS</b>											
0015	Made from recycled materials											
0020	Shop fab'd for 100-ton, 1-2 story project, bolted connections											
0200	Apartments, nursing homes, etc., 1 to 2 stories	R050523-10	G	E-5	10.30	7.767	Ton	2,250	370	168	2,788	3,300
0300	3 to 6 stories		G	"	10.10	7.921		2,300	380	171	2,851	3,375
0400	7 to 15 stories	R051223-10	G	E-6	14.20	9.014		2,350	430	133	2,913	3,475
0500	Over 15 stories		G	"	13.90	9.209		2,425	440	136	3,001	3,575
0700	Offices, hospitals, etc., steel bearing, 1 to 2 stories	R051223-20	G	E-5	10.30	7.767		2,250	370	168	2,788	3,300
0800	3 to 6 stories		G	E-6	14.40	8.889		2,300	425	131	2,856	3,400



# University Sciences Building

Northeastern U.S.

## APPENDIX D - General Conditions Estimate Breakdown

**GENERAL CONDITIONS**  
**ESTIMATE**

All figures were obtained from RS Means Building Construction  
Data 2011

Project Duration = 22 Months  
Bulk Construction = 20 Months

**SUPERVISION AND PERSONNEL**

Description	Quantity	Unit	Unit Rate	Cost
Vice President	95	WEEK	\$ 2,500	\$ 237,500
Project Executive	95	WEEK	\$ 2,200	\$ 209,000
Project Superintendent	95	WEEK	\$ 1,925	\$ 182,875
Assistant Superintendent	95	WEEK	\$ 1,800	\$ 171,000
Field Engineer	95	WEEK	\$ 1,265	\$ 120,175
Project Manager	95	WEEK	\$ 2,075	\$ 197,125
Project Engineer	95	WEEK	\$ 1,800	\$ 171,000
Office Engineer	95	WEEK	\$ 1,265	\$ 120,175
Project Administrator	22	MONTH	\$ 800	\$ 17,600
Safety Coordinator	95	WEEK	\$ 175	\$ 16,625
Project Scheduler	95	WEEK	\$ 225	\$ 21,375
Estimating Expenses	1	LS	\$ 45,000	\$ 45,000
<b>TOTAL</b>				<b>\$ 1,509,450</b>

**CONSTRUCTION FACILITIES AND EQUIPMENT**

Description	Quantity	Unit	Unit Rate	Cost
Field Office Trailer Set-up	1	LS	\$ 2,000	\$ 2,000
Field Office Trailer Rental	22	MONTH	\$ 425	\$ 9,350
Field Office Trailer Removal	1	LS	\$ 2,500	\$ 2,500
Construction Site Fence	20	MONTH	\$ 600	\$ 12,000
Sidewalk Overhead Protection	1	LS	\$ 1,250	\$ 1,250
Storage Trailer	15	MONTH	\$ 140	\$ 2,100
Gang Box	20	MONTH	\$ 55	\$ 1,100
Tools/Equipment	20	MONTH	\$ 650	\$ 13,000
Fire Extinguishers	20	MONTH	\$ 275	\$ 5,500
Copier/Fax/Printer	22	MONTH	\$ 400	\$ 8,800
Computer/LAN Equipment	22	MONTH	\$ 2,400	\$ 52,800
Mobile Phones	22	MONTH	\$ 325	\$ 7,150
Personal Protective Equipment	20	MONTH	\$ 250	\$ 5,000
Signage	1	LS	\$ 2,600	\$ 2,600
Dumpsters	20	MONTH	\$ 1,800	\$ 36,000
<b>TOTAL</b>				<b>\$ 161,150</b>

**TEMPORARY UTILITIES**

Description	Quantity	Unit	Unit Rate	Cost
Field IT/Network Set-up	1	LS	\$ 4,250	\$ 4,250
Temporary Power Installation	1	LS	\$ 15,000	\$ 15,000
Temporary Power Consumption	20	MONTH	\$ 750	\$ 15,000
Temporary Water/Sanitary Supply	1	LS	\$ 1,500	\$ 1,500
Temporary Toilets	22	MONTH	\$ 550	\$ 12,100
Potable Water	22	MONTH	\$ 175	\$ 3,850
<b>TOTAL</b>				<b>\$ 51,700</b>

**MISCELLANEOUS COSTS**

<b>Description</b>	<b>Quantity</b>	<b>Unit</b>	<b>Unit Rate</b>	<b>Cost</b>
Progress Photographs	20	MONTH	\$ 350	\$ 7,000
Document Reproduction	1	LS	\$ 25,000	\$ 25,000
Travel Expenses (Staff Vehicles)	20	MONTH	\$ 3,500	\$ 70,000
Delivery/Shipping Expenses	20	MONTH	\$ 300	\$ 6,000
Clean-up Expenses	20	MONTH	\$ 2,000	\$ 40,000
Misc. Field Expenses	20	MONTH	\$ 1,000	\$ 20,000
Office Supplies	20	MONTH	\$ 86	\$ 1,720
QC and Commissioning (0.5%)	1	LS	\$ 250,000	\$ 250,000
Permits (0.75%)	1	LS	\$ 375,000	\$ 375,000
Insurance (0.3%)	1	LS	\$ 150,000	\$ 150,000
Bonds (0.6%)	1	LS	\$ 300,000	\$ 300,000
<b>TOTAL</b>				<b>\$ 1,244,720</b>

**GENERAL CONDITIONS SUMMARY**

<b>Description</b>	<b>Cost/Month</b>	<b>Cost</b>
Supervision and Personnel	\$ 68,611	\$ 1,509,450
Construction Facilities and Equipment	\$ 7,325	\$ 161,150
Temporary Utilities	\$ 2,350	\$ 51,700
Miscellaneous Costs	\$ 56,578	\$ 1,244,720
<b>TOTAL</b>		<b>\$ 2,967,020</b>