Renovation of an Office Building in Washington D.C.

Washington, D.C.

Technical Report #2

Lynn Appel
Construction Management
Faculty Consultant: Dr. Riley
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Executive Summary

Technical Assignment 2 analyzes the key features of the project that affect project execution for the Office Building located in Washington, D.C. This project includes the complete renovation of a 550,000 SF office building. Important schedule attributes and the cost of the new structural system are determined.

A detailed project schedule was developed which reflects how the project was built beginning with the crucial phase of demolition and moving forward to the exterior construction and the interior construction. A site layout plan was developed for the Office Building to convey proposed locations of the key features of the site. A detailed estimate was performed for the structural system of the renovation. The estimate produced 4,943 CY of concrete and over 80 tons of steel for the project, and total costs of $899,589 for the cast-in-place concrete and $545,211 for the structural steel package. The estimates are 6% and 5% below the actual construction costs respectively. A general conditions estimate is included to show projected costs for project staff, construction facilities and equipment, temporary utilities and miscellaneous project costs. At an amount of $2.8 million, the general conditions accounts for approximately 4% of the total project cost. Finally, a summary of the issues discussed during the Integrated Project Delivery and Smart Grid sessions at the 2010 PACE Roundtable is included.

After analyzing the information contained within this report and the findings from Technical Assignment One, a major focus for upcoming thesis research will be directed towards schedule acceleration techniques and possibly rearranging the site layout to cut down on construction costs and increase productivity. From the discussions during the PACE Roundtable session, it would be a worthy research topic to investigate how the Smart Grid can be incorporated into the construction of the building all the way through the operation and maintenance of the building.

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Detailed Project Schedule

See Appendix A for the Detailed Project Schedule

The detailed project schedule is based on a Baseline schedule provided by the General Contractor. Notice to Proceed was received on March 2, 2010 and site mobilization began immediately following NTP. Due to the fact that this project is a renovation of an existing building, Demolition was a large portion of the schedule. Interior demolition began in the sub-basement, but then moved up to the penthouse and worked its way down through the building. Demolition of the typical floors included the removal of all doors/frames and MEP and then the removal of the concrete walls. The Exterior Demolition was broken into each elevation and then broken down even further into two quadrants. Overall, demolition will take about a year to complete.

Following Demolition, the schedule was broken into Exterior Construction, Interior Construction, and the construction of the Entry Pavilion/Atrium. Exterior Construction consisted of mainly installing new steel columns and beams followed by the Curtain Wall system. Interior Construction was broken down by floor and then further broken down into East Core Areas and West Core Areas. Construction began in the Penthouse and Roof and worked its way down to the first floor. Other sections of Interior Construction were the elevators and stairwells. The elevators were installed towards the beginning of the project, after demolition was complete, so they could be used during construction. The new stairwells were not constructed until the second half of 2011 because there were existing stairwells in the building that could be used during construction. The Entry Pavilion/Atrium part of the section was broken down into three sections; South Entrance Lobby, Entry Pavilion/Atrium, and Central Atrium.

Site Layout Planning

See Appendix B for the Site Layout Plan

Due to the fact that the Office Building is located in downtown D.C., the site is very restricted and therefore does not change throughout the construction of the building. The Construction Manager and General Contractor trailers are located along C Street, S.W. where a parking lot used to be. Besides the fact that this was the only location on site that the trailers could be placed, it was convenient that the area was already paved and flat. The CM and GC trailers remain in the same location throughout Demolition and Construction of the base building. The trailers sit on the future location of an extensive landscaped plaza. Once the landscaping is ready to begin, the CM and GC trailers will be moved and the staffs will be moved into the building. The subcontractors do not have any trailers and are located in the basement of the building and the underground parking garage.

There are two entrances to the main construction site and then one entrance to the loading dock and underground parking garage. There is one entrance on 2nd Street where the GC and subcontractors enter the site and another entrance on 3rd Street where the CM enters. There is a service road that connects these two entrances. This service road is used for the CM and GC staff and for deliveries. The entrance to the loading dock and underground parking garage is located on 2nd Street.

The electrical subcontractor is providing temporary power. They have provided temporary panels in various locations throughout the building. As far as temporary equipment goes, there will not be a tower crane used onsite. The subcontractors will bring out cranes when needed and they can be located around the perimeter of the building. However, due to weight, no crane can be located on the north side on top of the parking garage. All dumpsters are located in the loading dock in the underground parking garage and will be in that same location for the duration of the project.

Detailed Structural Systems Estimate

See Appendix C for complete Structural System Estimate

The renovation of the Office Building is primarily CIP concrete with a portion of structural steel components mainly to support the curtain wall system, entry pavilion atrium and central atrium. Table 1 shows the comparison between the actual costs vs. the estimated costs for the two systems analyzed. Despite the fact that the concrete from floor to floor was inconsistent and difficult to take-off, the CIP concrete estimate is within 6% of the actual cost. The structural steel estimate is within 5% of the actual value.

	Actual		Estimated		
System	Total	$/SF	Total	$/SF	% Difference
CIP Concrete	$ 961,000	$ 1.75	$ 899,590	$ 1.64	6%
Structural Steel	$ 574,000	$ 1.04	$ 545,211	$ 0.99	5%

Table 1 – Actual vs. Estimated Cost Comparison

The two main components of the CIP Concrete was the in-fill of slabs in existing openings and new concrete slabs on metal deck. It was difficult to take-off the quantity of concrete for the in-fill of slabs because the quantities were different for each floor so a typical bay could not be calculated. The depths of the existing openings that needed to be filled ranged from 4" to 12" so an average depth of 8" was used for each opening. The new concrete slabs on metal deck were consistent from floor to floor and therefore could be calculated for one floor and then repeated throughout the other floors.

The structural steel was also difficult to calculate because there was no column or beam schedule provided in the drawings. Therefore, everything had to be taken off by going through each drawing and counting every beam and column. The quantity take-offs were organized into columns, beams and then the structural steel that supports the Central Atrium and Entry Pavilion Atrium.

Several factors and assumptions were accounted for throughout the estimate to produce an accurate final cost of the CIP concrete and structural steel. *RS Means Costworks 2009* was used for all material, labor and equipment unit costs. The pricing information was released in quarter one of 2009, which is when the actual structural steel package was priced and released to the General Contractor. Therefore, no time modification was required for the estimate. Also, *Costworks* allowed for the location to be set as Washington, D.C. to provide an accurate location factor on the unit prices.

RS Means Costworks does not provide pricing data for the exact metal decking type specified for the Office Building project. Therefore, a comparable galvanized metal deck with the same gauge and rib sizing were used for unit costs. The majority of the structural steel member sizes had pricing available from *Costworks*. In the event that a particular size was not provided, the next available member size was used for unit pricing.

General Conditions Estimate

See Appendix D for complete General Conditions Estimate

The estimate summarized in Table 2 below shows a representation of the costs for the general condition line items on the Office Building project. These numbers are an approximation and do not reflect the actual amounts contracted by the General Contractor.

Line Item	Unit Rate	Unit	Quantity	Cost
Project Staff	$ 15,565	Week	131	$ 2,039,015
Construction Facilities & Equipment	$ 1,665	Week	131	$ 218,160
Temporary Utilities	$ 2,600	Week	131	$ 340,640
Miscellaneous Costs	$ 1,389	Week	131	$ 181,965
				$ 2,779,780

Table 2 – General Conditions Estimate Summary

The estimate was broken down into four categories: Project Staff, Construction Facilities and Equipment, Temporary Utilities and Miscellaneous Costs. Project staff includes the entire management and support staff for the project for the duration of the project. The Construction Facilities and Equipment category incorporates items such as Office Trailers, Office Equipment and supplies, personal protective equipment, dumpsters, etc. As far as temporary utilities goes, the Electrical Contractor is providing temporary electric power while the General Contractor is providing the rest. These include installation and service costs for field telephone lines, temporary water/sanitary supply, and temporary toilet facilities. Finally, the Miscellaneous Costs accounts for items permits, progress photographs and document reproduction, clean-up expenses, etc.

As shown below in Figure 1, the Project Staff costs account for over 70% of the general conditions estimate, which is fairly typical for construction projects. The overall general conditions estimate of $2.7 million is just over 4% of the total project cost of $72 million.

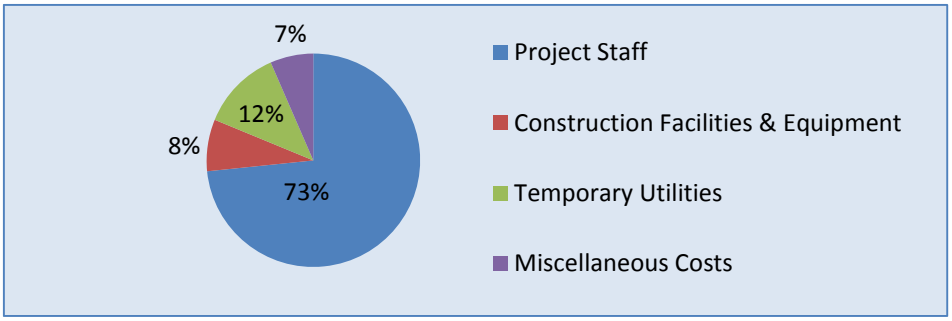


Figure 1 – General Conditions Percent Break-down

Critical Industry Issues

The 19th Annual PACE Roundtable was held at The Pennsylvania State University on October 27-28, 2010. The theme of the conference was "Building a Collaboration Culture," which attracted a large amount of industry leaders and AE students. Along with industry and student discussion panels, there were three main break-out sessions pertaining to the following issues:

- **Sustainability/Green Building** – Educating a future workforce for delivering high performance buildings and energy impacts in the building industry.
- **Technology Applications -** Innovations that will transform our industry and carrying BIM to the field.
- **Process Innovation –** Integrated project delivery and operations and maintenance process integration in new and retrofit projects.

All three break-out sessions dealt with very relevant issues among the construction industry, but I felt that the topics of Integrated Project Delivery and the Smart Grid related the most to the Office Building. There were a good number of industry professionals in each of the discussion topics. They provided great insight into these topics from a different perspective.

The discussion of Integrated Project Delivery (IPD) was broken into three topics: barriers, opportunities and research topics for our thesis buildings. An overwhelming barrier to IPD was people's significant level of fear of changing the industry and not thinking past the traditional design-bid-build mindset. Owners have accepted the Design-Build approach, but have not fully accepted IPD. They endorse the principle of IPD, but do not want to sign a tri-party contract. Another barrier are insurance companies. Insurance agents do not fully understand IPD and are therefore hesitant to take on the risk. Similar to the owner, they endorse the principle of IPD, but do not want the owner to sign the tri-party agreement. It would be beneficial for the insurance companies to go through training on IPD so they understand what IPD has to offer. Finally, the current economy is a speed bump to IPD. Nick Umosella of Barton Malow brought up the University of Michigan stadium expansion as an example. The University of Michigan wanted to receive the lowest possible price so they ended up breaking up the work into 72 different contracts and bid them out competitively. It is tough to get owners to buy into IPD when, at the end of the day, the only thing they are concerned about is cost.

Although there seems to be a lot of barriers to IPD, there are also a lot of opportunities. With IPD, there is increased innovation and collaboration and everyone ends the project as friends. One of the greatest opportunities IPD offers is that the decision making is what is best for the project, not what is best for the individual contractor. There is also better decision-making and

a more timely decision making process. That is why it is very surprising that more owners do not embrace a true IPD. They have yet to understand the value of an IPD and how the quality of their building can benefit so greatly from having the different teams work together.

Towards the end of the breakout session, the discussion was moved to possible research topics. One topic that caught my attention was IPD's effect on schedule and when production can begin on certain elements of construction. Many elements of construction can be pre-fabricated and installed quickly. IPD completely eliminates the shop drawings phase, which can reduce the schedule to up to six months. Although it may take a while for IPD to be fully accepted in the construction industry, it is definitely where the industry is headed and the more that people buy into it, the better the success it will have.

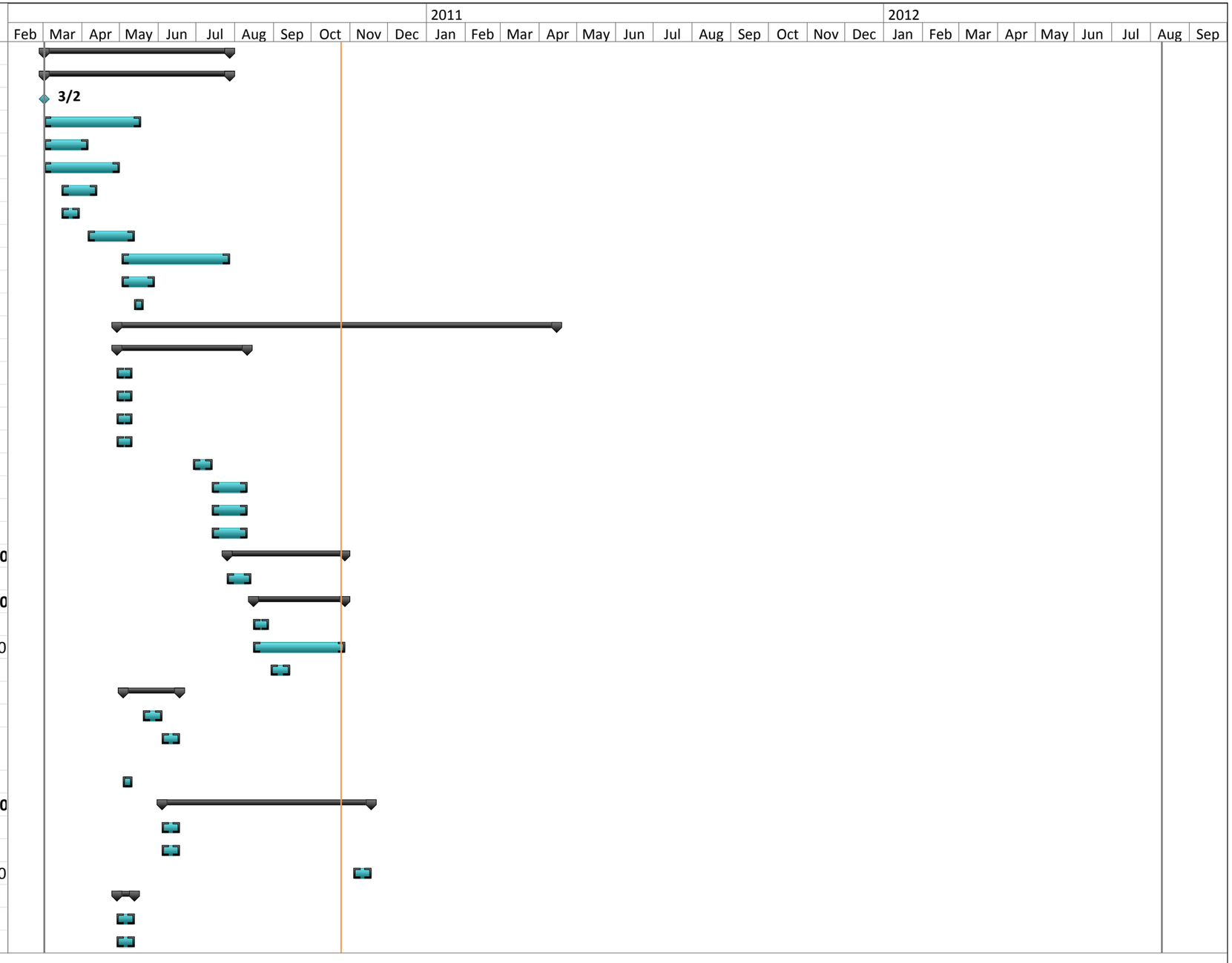
Due to the increased focus and attention on energy and the building industry, I felt that the discussion of the Smart Grid would be the most relevant concerning the Office Building. The industry professionals and students identified several key areas about the Smart Grid. These areas included Power Generation and Distribution, Advanced Metering, Cyber Security, Distributed Energy Generation and Energy Efficiency and Controls. Everyone agreed that Advanced Metering and Energy Efficiency were two of the largest smart grid topics. Advanced Metering is a meter that tracks how much energy is being used and at what times. Owners are getting more and more into how they are using power throughout their buildings. The more feedback they receive about their energy use, the more responsive they are to making changes. Energy Efficiency was the next topic of discussion. There are many building systems that can be made more efficient. One idea that caught my attention and related to the Office Building was integrating solar and photovoltaics into the curtain wall design. Weaving renewable energy into the architecture of the building can really show in energy savings.

All of the industry members were eager to provide insight on many issues pertaining to the construction industry and the direction it is headed. Particular attendees that were part of the break-out session discussions include Shawn Cingle of Southland Industries, Bob Grottenthaler of Barton Malow, Trey Hooper of DPR Construction, Dan Kerr of the McClure Company, Jason Reece of Balfour Beatty, Charles Tomasco of Truland Systems Corporation and Nick Umosella of Barton Malow. There are numerous contacts from the roundtable that would provide helpful information as I pursue my thesis topics.

Appendix A

Detailed Project Schedule

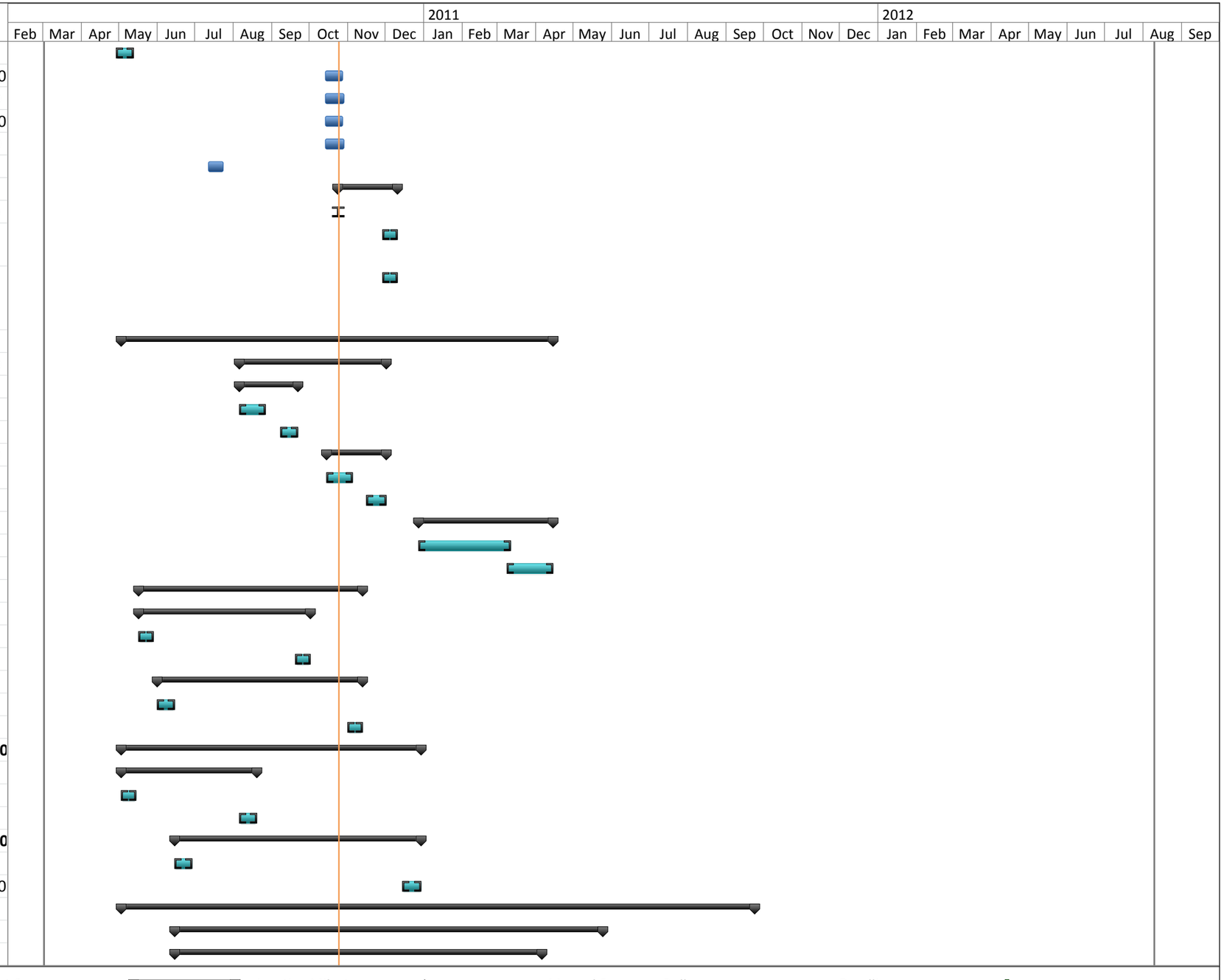
ID	Task Name	Start	Finish
1	**Project Start-up**	**Tue 3/2/10**	**Tue 7/27/10**
2	**Mobilization**	**Tue 3/2/10**	**Tue 7/27/10**
3	Notice to Proceed	Tue 3/2/10	Tue 3/2/10
4	Mobilize	Tue 3/2/10	Mon 5/17/10
5	Electrical Sub Mobilize	Tue 3/2/10	Mon 4/5/10
6	Procure/Buyout Major Subs	Tue 3/2/10	Fri 4/30/10
7	Install Temp. Lighting	Tue 3/16/10	Mon 4/12/10
8	Demo. Sub Mobilize	Tue 3/16/10	Mon 3/29/10
9	Obtain Public Space Permit	Tue 4/6/10	Wed 5/12/10
10	Procure/Buyout Interior Finish Subs	Mon 5/3/10	Tue 7/27/10
11	Plan/Coordinate MEP Equipment	Mon 5/3/10	Fri 5/28/10
12	Site Fencing	Thu 5/13/10	Wed 5/19/10
13	**Demolition**	**Thu 4/29/10**	**Thu 4/14/11**
14	**Sub-Basement**	**Thu 4/29/10**	**Tue 8/10/10**
15	Demo SB Concrete and CMU Walls	Thu 4/29/10	Mon 5/10/10
16	Cut CMU/Conc. Wall Openings	Thu 4/29/10	Mon 5/10/10
17	Demo Doors/Frames/CMU	Thu 4/29/10	Mon 5/10/10
18	Demo all Lighting Fixtures and Recpt.	Thu 4/29/10	Mon 5/10/10
19	Cut/Cap Mechanical	Tue 6/29/10	Tue 7/13/10
20	Demo Electrical	Wed 7/14/10	Tue 8/10/10
21	Demo (abandoned) Chillers 1 and 2	Wed 7/14/10	Tue 8/10/10
22	Demo Non-Essential Mech/Elec.	Wed 7/14/10	Tue 8/10/10
23	**Basement**	**Mon 7/26/10**	**Wed 10/27/10**
24	Demo Basement	Mon 7/26/10	Fri 8/13/10
25	**Parking Garage/Ramp**	**Mon 8/16/10**	**Wed 10/27/10**
26	Demo Doors, Fixtures, & CMU	Mon 8/16/10	Fri 8/27/10
27	Remove MEP	Mon 8/16/10	Wed 10/27/10
28	Demo Topping and Concrete	Mon 8/30/10	Mon 9/13/10
29	**Penthouse**	**Tue 5/4/10**	**Thu 6/17/10**
30	Demo Mech/Elec.	Thu 5/20/10	Thu 6/3/10
31	Demo Existing Phase 1 Cooling Towers	Fri 6/4/10	Thu 6/17/10
32	Demo Existing Phase 2 Cooling	Tue 5/4/10	Mon 5/10/10
33	**Roof (Main Roof & Penthouse Roof)**	**Fri 6/4/10**	**Wed 11/17/10**
34	Demo Rooftop Equip./Assemblies	Fri 6/4/10	Thu 6/17/10
35	Demo Conc. Slab	Fri 6/4/10	Thu 6/17/10
36	Cut opening for Atrium Skylight	Thu 11/4/10	Wed 11/17/10
37	**Sixth Floor**	**Thu 4/29/10**	**Wed 5/12/10**
38	Demo Doors/Frames, MEP	Thu 4/29/10	Wed 5/12/10
39	Demo Concrete Walls	Thu 4/29/10	Wed 5/12/10



Project: Office Building - Detailed
Date: Mon 10/25/10

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

ID	Task Name	Start	Finish
40	Remove Topping	Thu 4/29/10	Wed 5/12/10
41	Fifth Floor	Thu 10/14/10	Wed 10/27/10
42	Fourth Floor	Thu 10/14/10	Thu 10/28/10
43	Third Floor	Thu 10/14/10	Wed 10/27/10
44	Second Floor	Thu 10/14/10	Thu 10/28/10
45	First Floor	Mon 7/12/10	Fri 7/23/10
46	**Elevators**	**Sun 10/24/10**	**Fri 12/10/10**
47	Mobilize Elevators (1,2,3)	Sun 10/24/10	Sun 10/24/10
48	Remove existing elev. Cabs, doors, sills, trim & block	Mon 11/29/10	Fri 12/10/10
49	Remove Cmu walls and handrail/guardrails in the Mach. Room	Mon 11/29/10	Fri 12/10/10
50	**Exterior Demolition**	**Mon 5/3/10**	**Thu 4/14/11**
51	**West Elevation**	**Fri 8/6/10**	**Wed 12/1/10**
52	**Southwest Quadrant**	**Fri 8/6/10**	**Tue 9/21/10**
53	Demo Stone Veneer/Conc. Wall	Fri 8/6/10	Thu 8/26/10
54	Demo Existing Conc. Column	Wed 9/8/10	Tue 9/21/10
55	**Northwest Elevation**	**Fri 10/15/10**	**Wed 12/1/10**
56	Demo Stone Veneer/Conc. Wall	Fri 10/15/10	Thu 11/4/10
57	Demo Existing Conc. Column	Tue 11/16/10	Wed 12/1/10
58	**East Elevation**	**Tue 12/28/10**	**Thu 4/14/11**
59	NE Quadrant	Tue 12/28/10	Fri 3/11/11
60	SE Quadrant	Wed 3/9/11	Thu 4/14/11
61	**North Elevation**	**Mon 5/17/10**	**Fri 11/12/10**
62	**NW Quadrant**	**Mon 5/17/10**	**Fri 10/1/10**
63	Demo Existing Stone Band	Mon 5/17/10	Fri 5/28/10
64	Demo Windows, Panels	Mon 9/20/10	Fri 10/1/10
65	**NE Quadrant**	**Tue 6/1/10**	**Fri 11/12/10**
66	Demo Existing Stone Band	Tue 6/1/10	Mon 6/14/10
67	Demo Windows, Panels	Mon 11/1/10	Fri 11/12/10
68	**South Elevation**	**Mon 5/3/10**	**Wed 12/29/10**
69	**SW Quadrant**	**Mon 5/3/10**	**Thu 8/19/10**
70	Demo Existing Stone Band	Mon 5/3/10	Fri 5/14/10
71	Demo Windows, Panels	Fri 8/6/10	Thu 8/19/10
72	**SE Quadrant**	**Tue 6/15/10**	**Wed 12/29/10**
73	Demo Existing Stone Band	Tue 6/15/10	Mon 6/28/10
74	Demo Windows, Panels	Wed 12/15/10	Wed 12/29/10
75	**Exterior Construction**	**Mon 5/3/10**	**Fri 9/23/11**
76	**West Elevation**	**Tue 6/15/10**	**Tue 5/24/11**
77	**Southwest Quadrant**	**Tue 6/15/10**	**Tue 4/5/11**



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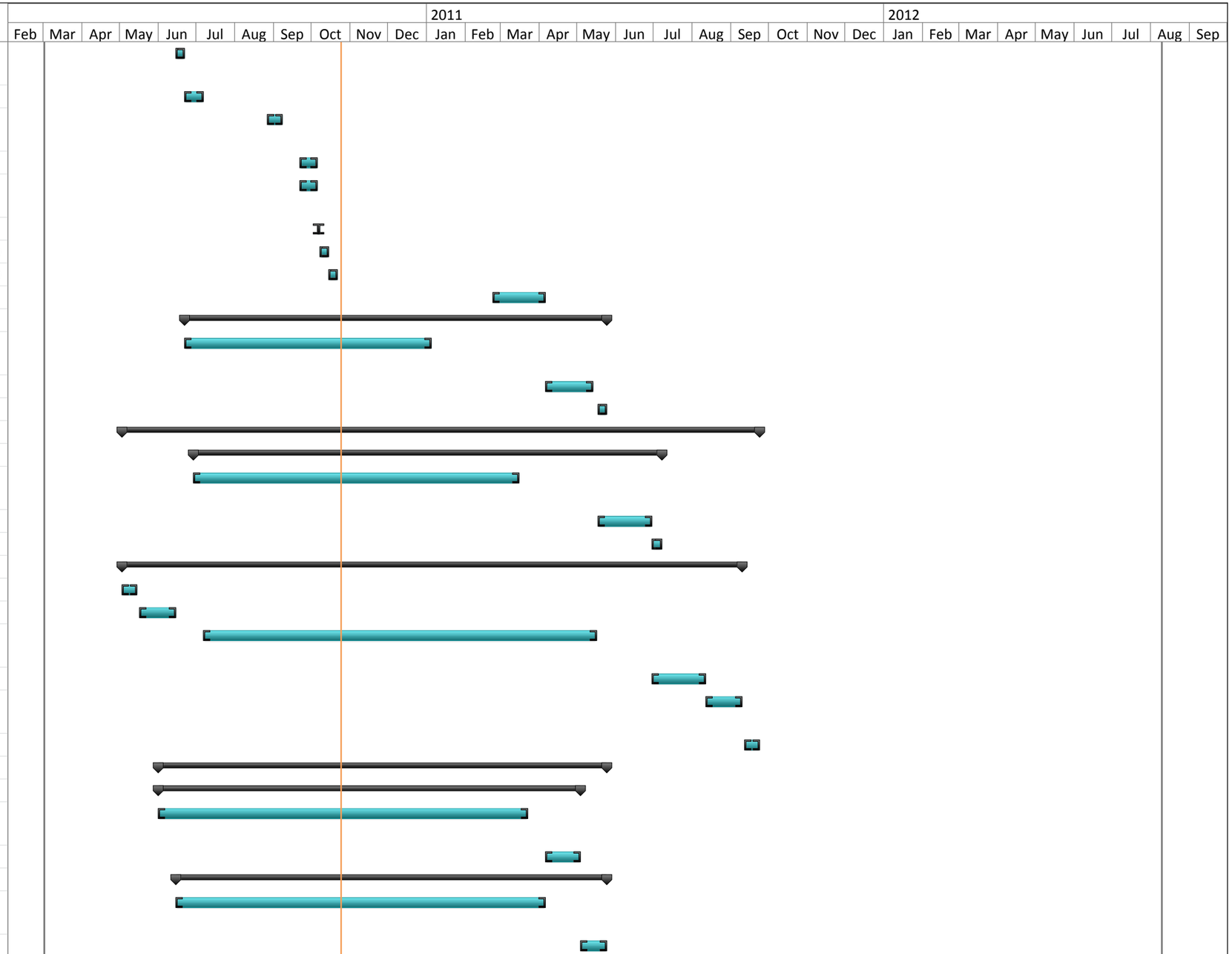
Split	External Tasks	Inactive Summary	Manual Summary	Progress
Milestone	External Milestone	Manual Task	Start-only	
Summary	Inactive Task	Duration-only	Finish-only	

ID	Task Name	Start	Finish
78	Excavate Foundation at Curtain Wall	Tue 6/15/10	Mon 6/21/10
79	FRP Foundation Wall @ 1st Floor	Tue 6/22/10	Tue 7/6/10
80	Install Steel Columns/Beams/Drypack	Fri 8/27/10	Tue 9/7/10
81	Install Steel Moment Connections	Wed 9/22/10	Tue 10/5/10
82	Install Cantilevered Beams/Metal Deck	Wed 9/22/10	Tue 10/5/10
83	Imbeds for Curtainwall	Wed 10/6/10	Thu 10/7/10
84	FRP Concrete Infill Slab	Fri 10/8/10	Thu 10/14/10
85	Washdown Exterior	Fri 10/15/10	Thu 10/21/10
86	Install Curtain Wall System	Wed 2/23/11	Tue 4/5/11
87	**Northwest Elevation**	**Tue 6/22/10**	**Tue 5/24/11**
88	Prepare NW Quadrant for Curtain Wall	Tue 6/22/10	Tue 1/4/11
89	Install Curtain Wall System	Wed 4/6/11	Fri 5/13/11
90	Install Glass/Metal Canopy @ West	Wed 5/18/11	Tue 5/24/11
91	**East Elevation**	**Mon 5/3/10**	**Fri 9/23/11**
92	**Northeast Quadrant**	**Tue 6/29/10**	**Thu 7/7/11**
93	Prepare NE Quadrant for Curtain Wall	Tue 6/29/10	Tue 3/15/11
94	Install Curtain Wall System	Wed 5/18/11	Wed 6/29/11
95	Install Glass/Metal Canopy @ East	Thu 6/30/11	Thu 7/7/11
96	**Southeast Quadrant**	**Mon 5/3/10**	**Fri 9/9/11**
97	Erect Scaffolding	Mon 5/3/10	Fri 5/14/10
98	Salvage Stone	Mon 5/17/10	Mon 6/14/10
99	Prepare SE Quadrant for Curtain Wall	Wed 7/7/10	Mon 5/16/11
100	Install Curtain Wall System	Thu 6/30/11	Thu 8/11/11
101	Areaway Steel Supports and Grating	Fri 8/12/11	Fri 9/9/11
102	Exterior Punchout	Mon 9/12/11	Fri 9/23/11
103	**North Elevation**	**Tue 6/1/10**	**Tue 5/24/11**
104	**Northwest Quadrant**	**Tue 6/1/10**	**Tue 5/3/11**
105	Prepare NW Quadrant for Curtain Wall	Tue 6/1/10	Tue 3/22/11
106	Curtain Wall Framing/Glazing	Wed 4/6/11	Tue 5/3/11
107	**NE Quadrant**	**Tue 6/15/10**	**Tue 5/24/11**
108	Prepare NE Quadrant for Curtain Wall	Tue 6/15/10	Tue 4/5/11
109	Curtain Wall Framing/Glazing	Wed 5/4/11	Tue 5/24/11



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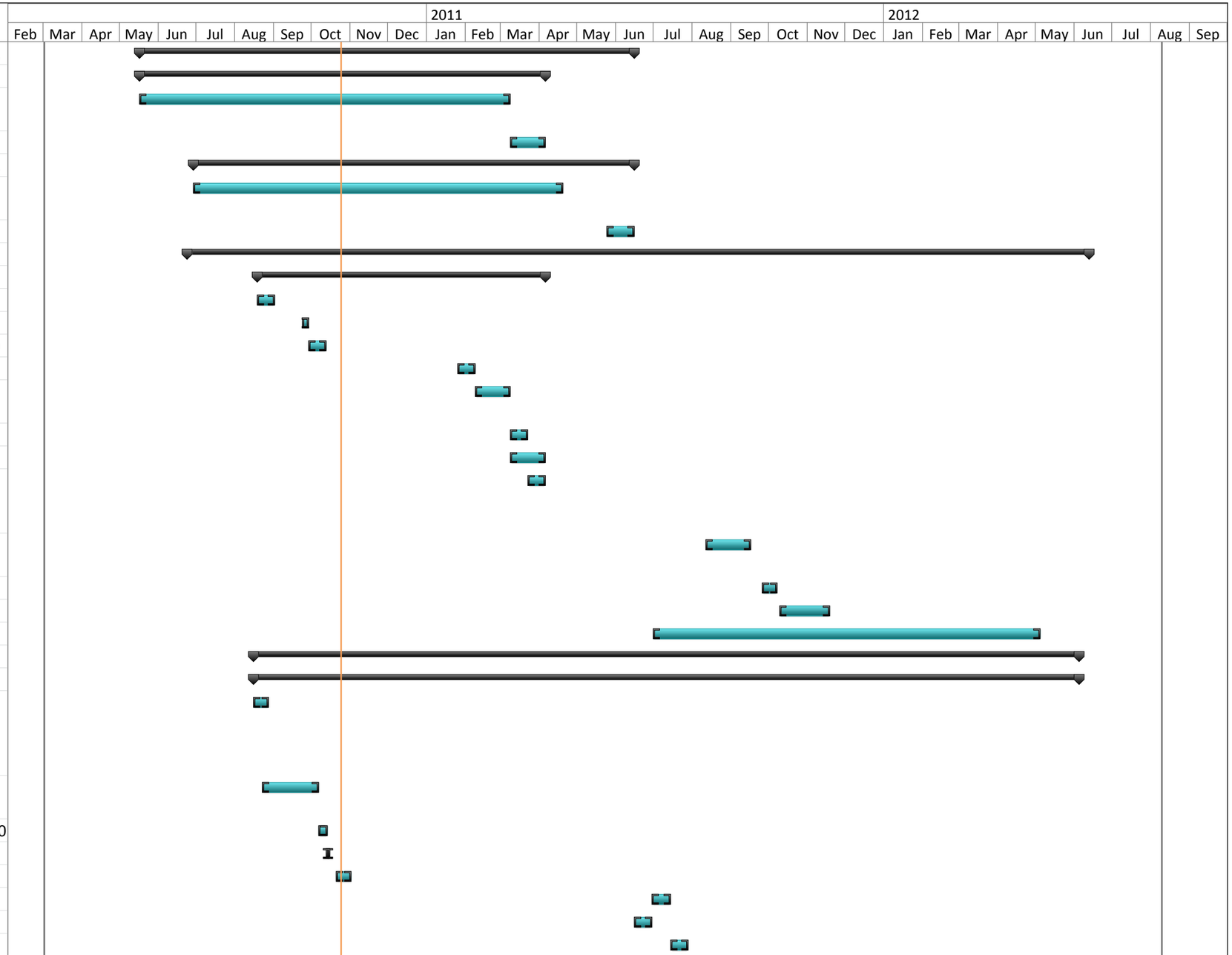
Split	External Tasks	Inactive Summary	Manual Summary	Progress	
Milestone	External Milestone	Manual Task	Start-only		
Summary	Inactive Task	Duration-only	Finish-only		

ID	Task Name	Start	Finish
110	**South Elevation**	**Mon 5/17/10**	**Wed 6/15/11**
111	**SW Quadrant**	**Mon 5/17/10**	**Tue 4/5/11**
112	Prepare SW Quadrant for Curtain Wall	Mon 5/17/10	Tue 3/8/11
113	Curtain Wall Framing/Glazing	Wed 3/9/11	Tue 4/5/11
114	**SE Quadrant**	**Tue 6/29/10**	**Wed 6/15/11**
115	Prepare SE Quadrant for Curtain Wall	Tue 6/29/10	Tue 4/19/11
116	Curtain Wall Framing/Glazing	Wed 5/25/11	Wed 6/15/11
117	**Interior Construction**	**Thu 6/24/10**	**Tue 6/12/12**
118	**Sub-Basement**	**Thu 8/19/10**	**Tue 4/5/11**
119	Repair Control Jt./Floor Topping	Thu 8/19/10	Wed 9/1/10
120	MEP Pre Hangers	Fri 9/24/10	Tue 9/28/10
121	Install MEP Risers	Wed 9/29/10	Tue 10/12/10
122	Set AHU	Wed 1/26/11	Tue 2/8/11
123	MEP Rough-In/Set new MEP Equipment	Wed 2/9/11	Tue 3/8/11
124	Elec./Fire Alarm/Telecom Rough-in	Wed 3/9/11	Tue 3/22/11
125	Connect Mech. Equipment	Wed 3/9/11	Tue 4/5/11
126	Pull Power/Lighting/FA/Comm/Data/Security Wires	Wed 3/23/11	Tue 4/5/11
127	Insulate Int./Ext. Walls, Drywall, Tape & Finish, Prime & Paint	Fri 8/12/11	Fri 9/16/11
128	Install Plumbing Fixtures	Mon 9/26/11	Fri 10/7/11
129	Miscellaneous Finishes	Mon 10/10/11	Fri 11/18/11
130	Phase 2 of Sub-Basement	Fri 7/1/11	Fri 5/4/12
131	**Basement**	**Mon 8/16/10**	**Mon 6/4/12**
132	**East Core Areas**	**Mon 8/16/10**	**Mon 6/4/12**
133	Install Metal Decking/Prep Slab and Walls/Install New Beams/Steel Framing for Central Atrium Opening	Mon 8/16/10	Fri 8/27/10
134	Repair Concrete Floor & Fill Openings in Slab	Mon 8/23/10	Wed 10/6/10
135	Misc. CMU/Fireproof Steel	Thu 10/7/10	Wed 10/13/10
136	MEP Risers	Wed 10/13/10	Fri 10/15/10
137	Layout Track/Mech. Pre Hangers	Thu 10/21/10	Mon 11/1/10
138	MEP Rough-In	Thu 6/30/11	Thu 7/14/11
139	Set AHU	Thu 6/16/11	Wed 6/29/11
140	Elec./Fire Alarm/Telecom In-Wall	Fri 7/15/11	Thu 7/28/11



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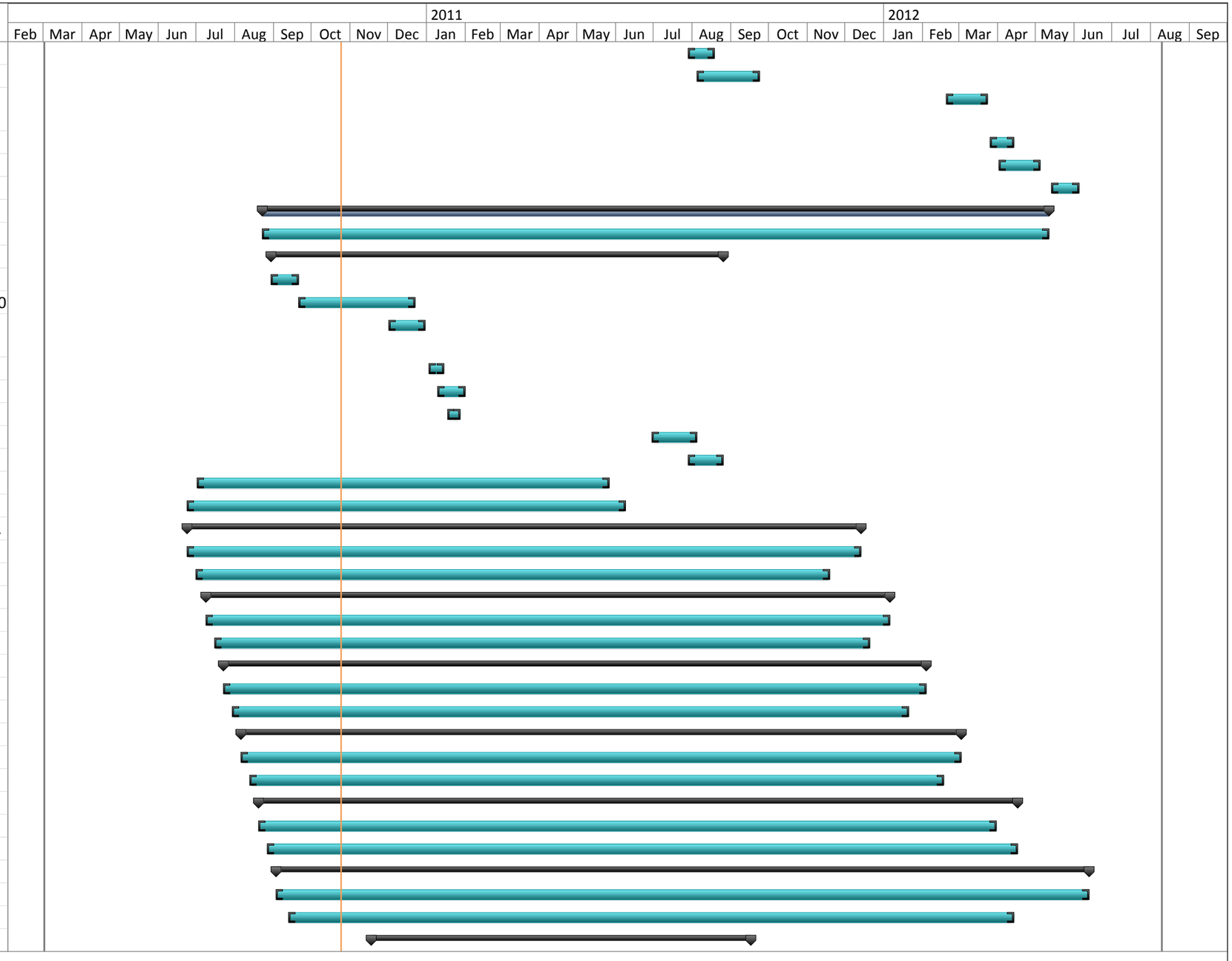
Split	External Tasks	Inactive Summary	Manual Summary	Progress			
Milestone	External Milestone	Manual Task	Start-only				
Summary	Inactive Task	Duration-only	Finish-only				

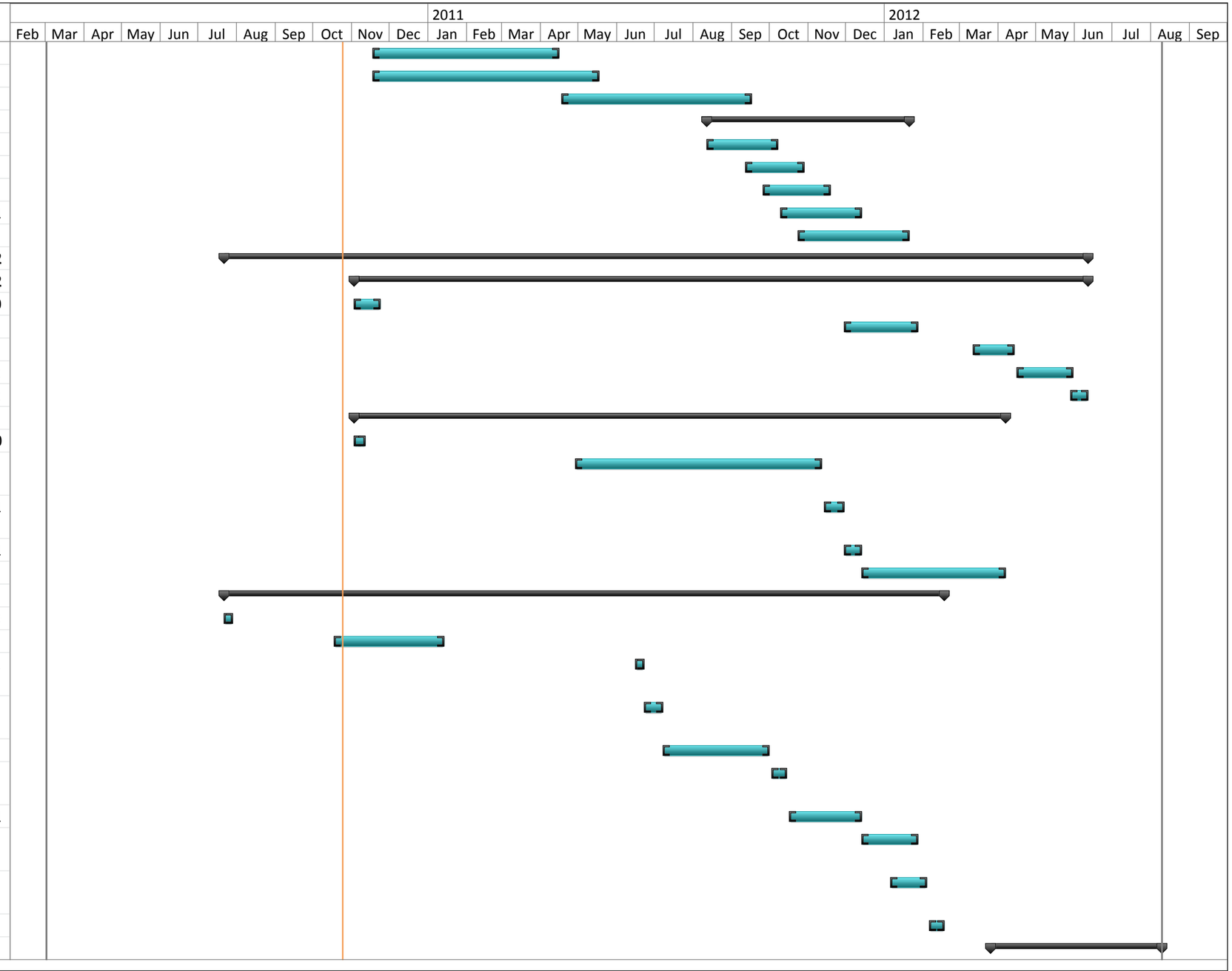
ID	Task Name	Start	Finish
141	Pull Telecom/Security Wires	Fri 7/29/11	Thu 8/18/11
142	Install Electrical Equipment	Fri 8/5/11	Fri 9/23/11
143	Insulate Int./Ext. Walls, Drywall, Tape & Finish, Prime & Paint	Mon 2/20/12	Fri 3/23/12
144	Ceiling Grid	Mon 3/26/12	Fri 4/13/12
145	Install Plumbing Fixtures	Mon 4/2/12	Fri 5/4/12
146	Miscellaneous Finishes	Mon 5/14/12	Mon 6/4/12
147	**West Core Areas**	**Mon 8/23/10**	**Fri 5/11/12**
148	Same as East Core Areas	Mon 8/23/10	Fri 5/11/12
149	**Parking Garage/Ramp**	**Mon 8/30/10**	**Thu 8/25/11**
150	Steel Jacket Reinforcement	Mon 8/30/10	Mon 9/20/10
151	FRP Parking Garage Concrete	Tue 9/21/10	Wed 12/22/10
152	Waterproof Swm Vault/Install Filter Media/Conc. Curb	Thu 12/2/10	Thu 12/30/10
153	Install Doors and Lifts	Mon 1/3/11	Fri 1/14/11
154	Rough-In Overhead Door Controls	Mon 1/10/11	Mon 1/31/11
155	HC Lift/Dock Bumpers	Tue 1/18/11	Thu 1/27/11
156	MEP Rough-In	Thu 6/30/11	Thu 8/4/11
157	Miscellaneous Finishes	Fri 7/29/11	Thu 8/25/11
158	Roof (Main Roof & Penthouse Roof)	Fri 7/2/10	Thu 5/26/11
159	Penthouse	Thu 6/24/10	Wed 6/8/11
160	**Sixth Floor**	**Thu 6/24/10**	**Tue 12/13/11**
161	East Core Areas	Thu 6/24/10	Tue 12/13/11
162	West Core Areas	Thu 7/1/10	Fri 11/18/11
163	**Fifth Floor**	**Fri 7/9/10**	**Thu 1/5/12**
164	East Core Areas	Fri 7/9/10	Thu 1/5/12
165	West Core Areas	Fri 7/16/10	Tue 12/20/11
166	**Fourth Floor**	**Fri 7/23/10**	**Fri 2/3/12**
167	East Core Areas	Fri 7/23/10	Fri 2/3/12
168	West Core Areas	Fri 7/30/10	Fri 1/20/12
169	**Third Floor**	**Fri 8/6/10**	**Fri 3/2/12**
170	East Core Areas	Fri 8/6/10	Fri 3/2/12
171	West Core Areas	Fri 8/13/10	Fri 2/17/12
172	**Second Floor**	**Fri 8/20/10**	**Mon 4/16/12**
173	East Core Areas	Fri 8/20/10	Fri 3/30/12
174	West Core Areas	Fri 8/27/10	Mon 4/16/12
175	**First Floor**	**Fri 9/3/10**	**Tue 6/12/12**
176	East Core Areas	Fri 9/3/10	Tue 6/12/12
177	West Core Areas	Mon 9/13/10	Fri 4/13/12
178	**Elevators**	**Thu 11/18/10**	**Fri 9/16/11**



Project: Office Building - Detailed
Date: Mon 10/25/10

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

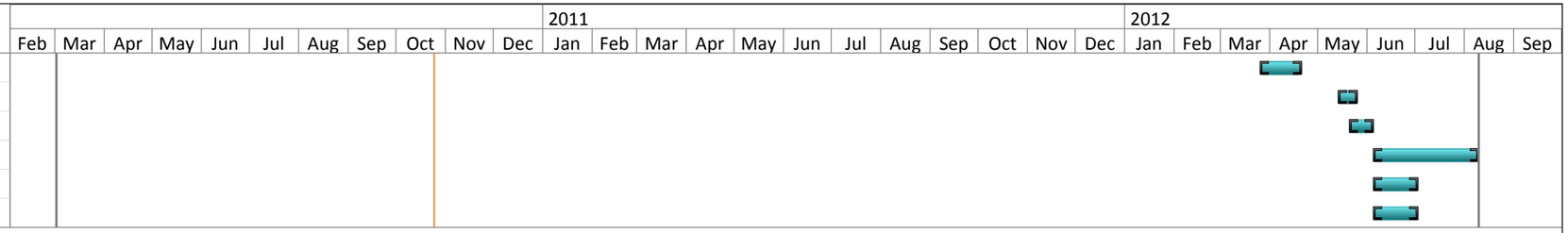
ID	Task Name	Start	Finish
179	Elevators 1, 2, 3	Thu 11/18/10	Fri 4/15/11
180	Elevators 7 and 8	Thu 11/18/10	Tue 5/17/11
181	Elevators 4, 5, 6	Mon 4/18/11	Fri 9/16/11
182	**Stairs**	**Fri 8/12/11**	**Fri 1/20/12**
183	Sub-Basement & Basement Stairs	Fri 8/12/11	Fri 10/7/11
184	Stairwell #1	Mon 9/12/11	Fri 10/28/11
185	Stairwell #2	Mon 9/26/11	Fri 11/18/11
186	Stairwell #3	Mon 10/10/11	Tue 12/13/11
187	Stairwell #4	Mon 10/24/11	Fri 1/20/12
188	**Entry Pavilion/Atrium**	**Thu 7/22/10**	**Mon 6/11/12**
189	**South Entrance Lobby**	**Wed 11/3/10**	**Mon 6/11/12**
190	Place New Slab & CMU Blast Walls	Wed 11/3/10	Tue 11/23/10
191	Install Canopy	Wed 11/30/11	Fri 1/27/12
192	Drywall & Limestone Walls	Mon 3/12/12	Fri 4/13/12
193	Install Floor & Doors	Mon 4/16/12	Wed 5/30/12
194	Final Paint/Touch-up	Tue 5/29/12	Mon 6/11/12
195	**Entry Pavilion/Atrium**	**Wed 11/3/10**	**Fri 4/6/12**
196	New Conc. Slab/Slab Openings	Wed 11/3/10	Thu 11/11/10
197	Install Steel Framing/Curtain Wall Anchors	Fri 4/29/11	Fri 11/11/11
198	Install Rainwater Collection, Ext. Lighting, Hot Water Supply Risers	Mon 11/14/11	Tue 11/29/11
199	Install Diffusers and Interior Lights	Wed 11/30/11	Tue 12/13/11
200	Install Granite Floor & Walls	Wed 12/14/11	Fri 4/6/12
201	**Central Atrium**	**Thu 7/22/10**	**Fri 2/17/12**
202	FRP 6" Curb BSM for Stairs	Thu 7/22/10	Wed 7/28/10
203	Install Central Atrium Stairs	Mon 10/18/10	Thu 1/13/11
204	Install Clips for Curtain Wall & Anchors for Window Washing System	Thu 6/16/11	Wed 6/22/11
205	Install Glazed Storefront and Steel Channel Support	Thu 6/23/11	Thu 7/7/11
206	Install Glazed Curtain Wall - Atrium	Fri 7/8/11	Fri 9/30/11
207	Install Metal Panels @ 1st Floor Ceiling	Mon 10/3/11	Fri 10/14/11
208	Install Glass/Mtl Railings @ Stairs	Mon 10/17/11	Tue 12/13/11
209	Place Stone at Atrium Columns and Install Doors	Wed 12/14/11	Fri 1/27/12
210	Marble/Granite Floor Central Atrium Lobby	Fri 1/6/12	Fri 2/3/12
211	Install Window Washing System	Mon 2/6/12	Fri 2/17/12
212	**Project Close-out**	**Mon 3/26/12**	**Thu 8/9/12**



Project: Office Building - Detailed
Date: Mon 10/25/10

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

ID	Task Name	Start	Finish
213	GC Submit O&M's	Mon 3/26/12	Fri 4/20/12
214	Test and Balance	Mon 5/14/12	Fri 5/25/12
215	Fire Alarm Testing	Mon 5/21/12	Mon 6/4/12
216	MEP Commissioning	Tue 6/5/12	Thu 8/9/12
217	Owner Training	Tue 6/5/12	Mon 7/2/12
218	Submit Record Drawings	Tue 6/5/12	Mon 7/2/12

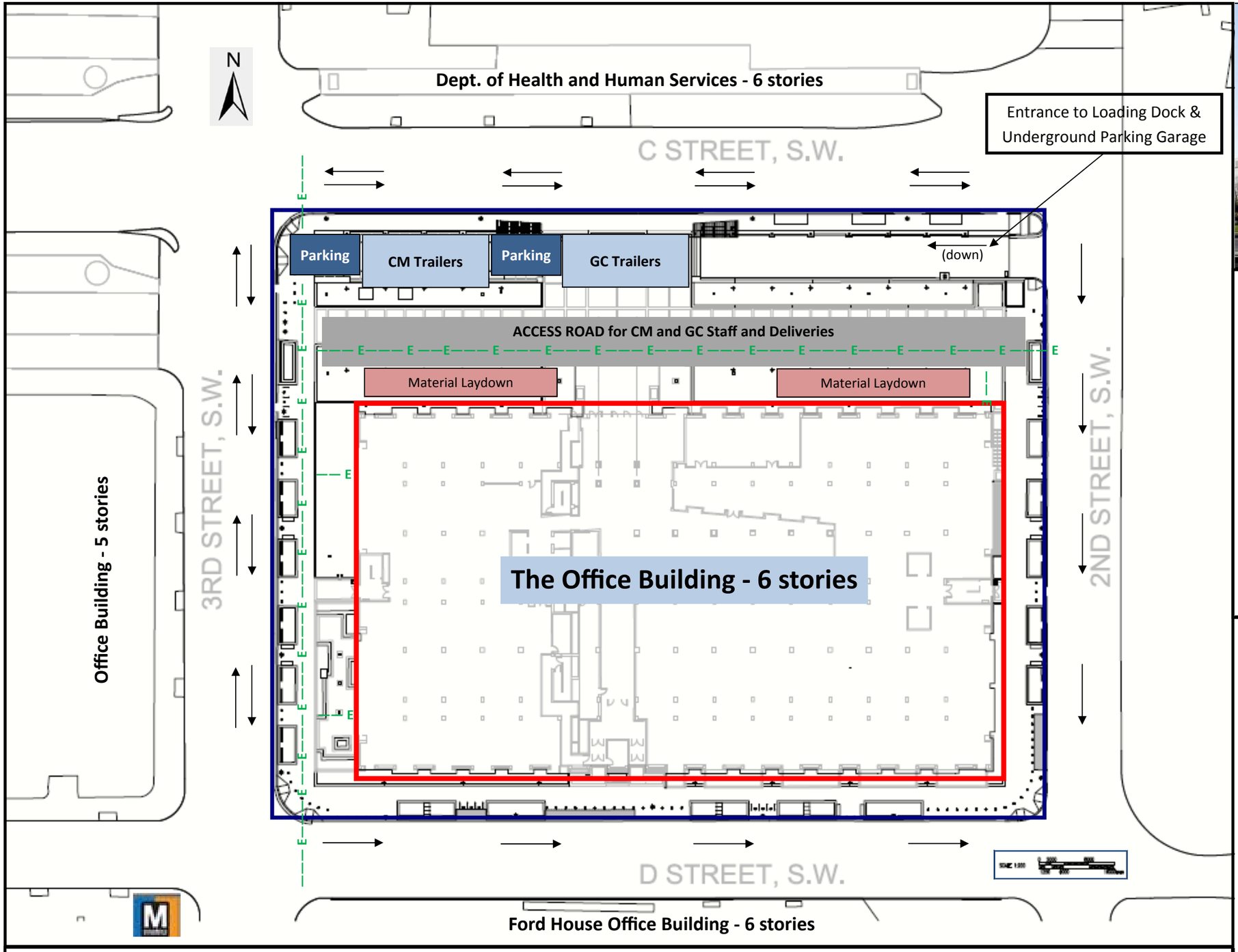


Project: Office Building - Detailed
Date: Mon 10/25/10

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

Appendix B

Site Layout Plan



Lynn Appel

Technical Assignment #2

Site Layout Plan

Demolition & Construction Phases

Appendix C

Detailed Structural Systems Estimate

Cast-In-Place Concrete Estimate Take-Off Charts				
In-Fill Slabs on Existing Openings				
Floor	**Area (SF)**	**Thickness (FT)**	**Quantity**	**Concrete (CY)**
SB	54	0.667	4	5.34
SB	1776.33	0.667	4	175.53
SB	65	0.667	4	6.42
SB	30	0.667	4	2.96
SB	136	0.667	4	13.44
SB	120	0.667	4	11.86
BT	514.17	0.667	3.5	44.46
BT	145.42	0.667	3	10.78
BT	536.25	0.667	17	225.21
BT	518.33	0.667	9.5	121.64
BT	171.67	0.667	3.5	14.84
1	536.25	0.667	12	158.97
1	518.33	0.667	11	140.85
1	171.67	0.667	3	12.72
1	514.17	0.667	2	25.40
2	536.25	0.667	18	238.45
2	518.33	0.667	9	115.24
2	171.67	0.667	9	38.17
3	357.5	0.667	9	79.48
3	518.33	0.667	12.5	160.06
3	171.67	0.667	9	38.17
3	536.25	0.667	6	79.48
4	268.125	0.667	4	26.49
4	518.33	0.667	4	51.22
4	357.5	0.667	4	35.33
5	536.25	0.667	18	238.45
5	518.33	0.667	13	166.46
5	171.67	0.667	10	42.41
6	536.25	0.667	16	211.96
6	518.33	0.667	13	166.46
6	171.67	0.667	9	38.17
				2,696.43

Cast-in-Place New Concrete Slabs					
Floor	Area/ Department	Area (SF)	Thickness (FT)	Quantity	Concrete (CY)
1	NE	200	0.417	13	40.16
1	SE	200	0.417	13	40.16
1	SWQ	400	0.417	4	24.71
1	NWQ	400	0.417	4	24.71
1	NEQ	400	0.417	4	24.71
1	SEQ	400	0.417	4	24.71
1		40	0.417	91	56.22
1		40	0.417	82	50.66
1		32	0.417	168	83.03
2	NE	200	0.417	13	40.16
2	SE	200	0.417	13	40.16
2	SWQ	400	0.417	4	24.71
2	NWQ	40	0.417	4	2.47
2	NEQ	400	0.417	4	24.71
2	SEQ	400	0.417	4	24.71
2		40	0.417	91	56.22
2		40	0.417	82	50.66
2		32	0.417	168	83.03
3	NE	200	0.417	13	40.16
3	SE	200	0.417	13	40.16
3	SWQ	400	0.417	4	24.71
3	NWQ	400	0.417	4	24.71
3	NEQ	400	0.417	4	24.71
3	SEQ	400	0.417	4	24.71
3		40	0.417	91	56.22
3		40	0.417	82	50.66
3		32	0.417	168	83.03
4	NE	200	0.417	13	40.16
4	SE	200	0.417	13	40.16
4	SWQ	400	0.417	4	24.71
4	NWQ	400	0.417	4	24.71
4	NEQ	400	0.417	4	24.71
4	SEQ	400	0.417	4	24.71
4		40	0.417	100	61.78

4		40	0.417	100	61.78
4		32	0.417	168	83.03
5	NE	200	0.417	13	40.16
5	SE	200	0.417	13	40.16
5	SWQ	400	0.417	4	24.71
5	NWQ	400	0.417	4	24.71
5	NEQ	400	0.417	4	24.71
5	SEQ	400	0.417	4	24.71
5		40	0.417	91	56.22
5		40	0.417	82	50.66
5		32	0.417	168	83.03
6	NE	200	0.417	13	40.16
6	SE	200	0.417	13	40.16
6	SWQ	400	0.417	4	24.71
6	NWQ	400	0.417	4	24.71
6	NEQ	400	0.417	4	24.71
6	SEQ	400	0.417	4	24.71
6		40	0.417	91	56.22
6		40	0.417	82	50.66
6		32	0.417	168	83.03
PH/R		104.5	0.417	10	16.14
1	PVLN	1294.8	0.417	2	39.99
					2,264.94

Cast-in-Place Concrete Estimate Pricing

Description	Quantity	Unit	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P	Total Cost
In-Fill Slabs on Existing Openings (3000 psi)	2,696.4	CY	$ 106.00	$ 22.50	$ 10.90	$ 139.40	$ 182.00	$ 490,744.80
CIP New Concrete Slabs	2,246.4	CY	$ 106.00	$ 22.50	$ 10.90	$ 139.40	$ 182.00	$ 408,844.80
							TOTAL:	$ 899,589.60

Structural Steel Estimate Take-Off Charts

Columns

Type		Length (ft)	# of 12' Section	Quantity	Total Section
SE Elevation	W10x77	77	6	1	6
	W10x68	96	8	1	8
	W8x67	125	10	1	10
	W8x48	48	4	1	4
NE Elevation	W10x77	77	6	1	6
	W10x68	96	8	1	8
	W8x67	125	10	1	10
	W8x48	48	4	1	4
SW Elevation	W10x77	77	6	1	6
	W10x68	67	6	1	6
	W8x67	125	10	1	10
	W8x48	48	4	1	4
NW Elevation	W10x77	77	6	1	6
	W10x68	67	6	1	6
	W8x67	125	10	1	10
	W8x48	48	4	1	4

Beams

Type	Unit	Length	Quantity	Total
W21x50	LF	12	24	288
W21x50	LF	10	48	480
W21x50	LF	18.667	24	448
W21x50	LF	11	24	264
W21x57	LF	648	1	648
W12x87	LF	150	1	150
W18x40	LF	20	1	20

Central Atrium

Type	Length (ft)	# of 14' Sections	Quantity	Total Sections
HSS 10x8x5/8	311	22	1	22
HSS 10x8x5/8	200	14	7	100
HSS 10x8x5/8	51.833	4	6	22

Entry Atrium

Type	Length (ft)	# of 14' Sections	Quantity	Total Sections
2 - HSS 10x8x1/2	50.000	4	2	7
2 - HSS 8x8x3/8	11.396	1	2	2

2 - HSS 8x8x3/8	2.333	1	6	6
2 - HSS 8x8x3/8	40.000	3	2	6
3 - HSS 10x8x1/2	50.000	4	2	7
3 - HSS 8x8x5/8	40.000	3	2	6
3 - HSS 8x8x3/8	2.333	1	2	2
3 - HSS 8x8x1/2	12.500	1	2	2
4 - HSS 10x8x1/2	50.000	4	2	7
4 - HSS 8x8x3/8	11.396	1	2	2
4 - HSS 8x8x3/8	2.333	1	6	6
4 - HSS 8x8x3/8	40.000	3	2	6
5 - HSS 10x8x1/2	50.000	4	2	7
5 - HSS 8x8x5/8	40.000	3	1	3
5 - HSS 8x8x5/8	5.000	1	9	9
6 - HSS 10x8x1/2	50.000	4	2	7
6 - HSS 8x8x3/8	11.396	1	2	2
6 - HSS 8x8x3/8	2.333	1	6	6
6 - HSS 8x8x3/8	40.000	3	2	6
PH/R - HSS 8x8x5/8	4.000	1	3	3
PH/R - HSS 8x8x5/8	90.000	1	1	1
PH/R - HSS 8x8x5/8	10.000	1	6	4
PH/R - HSS 8x8x5/8	8.000	1	7	4
Roof - HSS 8x8x5/8	20.000	1	8	11
Roof - HSS 8x8x5/8	5.750	1	5	5

Steel Decking

Type	Unit	Area	Quantity	Total
2" Galvanized, Composite Steel Decking	SF	50	156	7800
2" Galvanized, Composite Steel Decking	SF	385.7	24	9256.8

Detailed Structural Steel Estimate Pricing

Columns

Description	Quantity	Unit	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P	Total Cost
W 10x77	308	LF	$ 128.79	$ 2.85	$ 1.74	$ 133.38	$ 147.85	$ 45,537.80
W10x68	326	LF	$ 78.13	$ 2.79	$ 1.70	$ 82.62	$ 92.29	$ 30,086.54
W8x67	500	LF	$ 76.71	$ 2.79	$ 1.70	$ 81.20	$ 90.87	$ 45,435.00
W8x48	192	LF	$ 54.93	$ 2.65	$ 1.63	$ 59.21	$ 66.89	$ 12,842.88
							TOTAL	$ 133,902.22

Beams

Description	Quantity	Unit	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P	Total Cost
W21x50	1480	LF	$ 57.29	$ 3.72	$ 1.72	$ 62.73	$ 71.25	$ 105,450.00
W21x57	648	LF	$ 75.00	$ 3.27	$ 1.64	$ 79.91	$ 90.05	$ 58,352.40
W12x87	150	LF	$ 105.00	$ 2.38	$ 1.59	$ 108.97	$ 121.86	$ 18,279.00
W18x40	20	LF	$ 48.50	$ 3.53	$ 1.77	$ 53.80	$ 61.15	$ 1,223.00
							TOTAL	$ 183,304.40

Steel Decking

Description	Quantity	Unit	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P	Total Cost
2" Galvanized, Composite Steel Decking	17056.8	SF	$ 1.50	$ 0.46	$ 0.04	$ 2.00	$ 6,822.40	$ 40,936.00
							TOTAL	$ 40,936.00

Structural Steel Tubing

Description	Quantity	Unit	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O&P	Total Cost
HSS 10x8x3/8 (14' sections)	40	Ea.	$ 1,200.00	$ 49.00	$ 32.50	$ 1,281.50	$ 1,445.50	$ 57,820.00
HSS 10x8x1/2 (14' sections)	26	Ea.	$ 1,200.00	$ 49.00	$ 32.50	$ 1,281.50	$ 1,445.50	$ 37,583.00
HSS 8x8x3/8 (14' sections)	16	Ea.	$ 645.00	$ 47.00	$ 31.50	$ 723.50	$ 825.50	$ 13,208.00
HSS 8x8x5/8 (14' sections)	25	Ea.	$ 645.00	$ 47.00	$ 31.50	$ 723.50	$ 825.50	$ 20,637.50
							TOTAL	$ 129,248.50
							TOTAL ESTIMATE:	$ 545,211.12

Appendix D

General Conditions Estimate

Project Staff

Line Item	Unit Rate	Unit	Quantity	Cost
Operations Manager	$ 2,100	Wks	131	$ 275,100
Project Executive	$ 2,100	Wks	65.5	$ 137,550
Accountant	$ 1,600	Wks	131	$ 209,600
Cost Engineer	$ 1,125	Wks	131	$ 147,375
Project Manager	$ 1,850	Wks	131	$ 242,350
Project Engineer	$ 1,300	Wks	131	$ 170,300
Field Engineer	$ 1,125	Wks	131	$ 147,375
Adminstration	$ 365	Wks	131	$ 47,815
General Superintendent	$ 1,950	Wks	131	$ 255,450
Superintendent	$ 1,700	Wks	131	$ 222,700
Safety Manager	$ 1,400	Wks	131	$ 183,400
$				2,039,015

Construction Facilities and Equipment

Line Item	Unit Rate	Unit	Quantity	Cost
Trailers (2) 50'x10'	$ 330	Mos.	26	$ 8,580
Office Equipment	$ 150	Mos.	29	$ 4,350
Office Supplies	$ 95	Mos.	29	$ 2,755
Office Furniture	$ 1,000	Ea.	5	$ 5,000
Construction Site Fence	$ 600	Mos.	29	$ 17,400
Copiers	$ 2,000	Mos.	29	$ 58,000
Scanners/Color Printer	$ 5,000	Ea.	2	$ 10,000
Network Equipment	$ 50	Mos.	29	$ 1,450
Mobile Phones	$ 325	Mos.	29	$ 9,425
Personal Protective Equipment	$ 100	Mos.	29	$ 2,900
Signage	$ 2,600	Ls.	1	$ 2,600
Dumpsters (6)	$ 550	Mos.	29	$ 95,700
$				218,160

Temporary Utilities

Line Item	Unit Rate	Unit	Quantity	Cost
Field IT/Network Set-up	$ 15,000	LS	1	$ 15,000
Field Telephone Hook-up	$ 1,500	LS	1	$ 1,500
Field Telephone Service	$ 100	Mos.	13	$ 1,300
High Speed Internet	$ 1,250	Mos.	29	$ 36,250
Temporary Water/Sanitary Supply	$ 2,100	LS	1	$ 2,100
Temporary Toilets (10)	$ 975	Mos.	29	$ 282,750
Potable Water	$ 60	Mos.	29	$ 1,740
$				340,640

Miscellaneous Costs

Line Item	Unit Rate	Unit	Quantity	Cost
Public Space Permit	$ 1,000	Ls.	1	$ 1,000
Progress Photographs	$ 475	Mos.	29	$ 13,775
Document Reproduction	$ 35,000	Ls.	1	$ 35,000
Clean-up Expenses	$ 490	Wks.	131	$ 64,190
Misc. Field Expenses	$ 1,000	Mos.	65.5	$ 65,500
Construction Sign	$ 2,500	Ls	1	$ 2,500
$				181,965

General Conditions Summary

Line Item	Unit Rate	Unit	Quantity	Cost
Project Staff	$ 15,565	Week	131	$ 2,039,015
Construction Facilities & Equipment	$ 1,665	Week	131	$ 218,160
Temporary Utilities	$ 2,600	Week	131	$ 340,640
Miscellaneous Costs	$ 1,389	Week	131	$ 181,965
$				2,779,780