October 27, 2010

# Technical Assignment Two

Penn State AE Senior Thesis

**Office Building - G**

**Eastern USA**

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**Construction Management**

**Dr. Robert Leicht**

# EXECUTIVE SUMMARY

Technical Assignment Two is an analysis of the key features and parameters that went into the design and construction of the new Office Building-G in the eastern United States. This project includes a brand new 14 story, 380,100 SF office building along with a four level underground parking garage that totals around 269,000 SF. The building features a glass curtain wall along the southern elevation with the rest being made up of architectural precast concrete with punched out glazing. The largest challenge associated with the project is the adjacent metro station to the west of the project site. Special attention has to be taken into account with the metro station and well as the pedestrians that will pass the site daily to use the metro to commute to and from work.

Information contained in this report includes a detailed project schedule, site layout plan, detailed structural estimate, and general conditions estimate. The detailed project schedule includes phasing/turnover milestones of the construction along with the excavation, garage, superstructure, MEP/interior fitouts, and tenant fitouts as the main phases of construction. The site plan depicts the concrete/superstructure phase of construction. This is a critical phase since concrete is the primary material used for the structural support of the building. A detailed estimate was performed on the structural system of the building. The estimate produced 17,208.43 yd$^3$ of concrete and just over 8 tons of steel, and totaled to $14,314,136.96 for concrete and $40,442.68 for steel. The estimate was within 4% of the actual cost for the concrete but differed quite a bit in regards to the steel. The general conditions estimate shows estimated costs for four categories: Personnel, Facilities and Equipment, Temporary Utilities, and Miscellaneous Equipment. The overall general conditions cost of $ 4,202,800.00 is 6% of the entire project cost of $ 70,000,000.00

After analyzing the information in this report and the information obtained in Technical Assignment one, upcoming research will be directed towards any possible schedule acceleration techniques and also different coordination methods in regards to the adjacent metro station.

# TABLE OF CONTENTS

# A. DETAILED PROJECT SCHEDULE

## * Refer to Appendix A for Project Schedule Summary

The new Office Building-G project was scheduled to begin in November 2009. Originally, Turner was not awarded the project. After complications with the original bid winner, they were released from their contract and Turner was awarded the project in December 2009. Design immediately began in mid-December 2009 and lasted until July 2010 with revisions still being made as the project progresses. The Guaranteed Maximum Price (GMP) contracted was developed between Turner and the owner and finalized in June 2010.

Construction began on August 20, 2010 with piles being drilled on the west end of the project. Excavation and shoring is scheduled to last until December 2010 with construction of the underground parking garage to begin in November 2010, a month prior to the excavation completion date. Construction of the garage will last until the following Summer with a scheduled completion date of July 29, 2011. Immediately after, the core building structure will commence. Core construction will last through the Summer of 2011 along with the facade and roof construction as well. Interior fitouts will begin in August 2011 and last until the end of February 2012. Commissioning and inspections will follow along with the tenant fitout as well. Tenant occupancy is scheduled for June 12, 2012 with a project completion date of September 12, 2012. The entire schedule can be found in ***Appendix A***.

| Description | Start Date | End Date |
|---|---|---|
| Start of Project | 11/18/2009 | - |
| Design and Procurement | 12/14/2009 | 7/3/2010 |
| Excavation | 6/21/2010 | 12/10/2010 |
| Underground Garage | 10/29/2010 | 7/29/2011 |
| Core Building Structure | 5/4/2011 | 9/9/2011 |
| Façade and Roof | 6/30/2011 | 6/4/2012 |
| Interior Fitouts | 8/26/2011 | 2/24/2012 |
| Project Completion | - | 9/12/2012 |

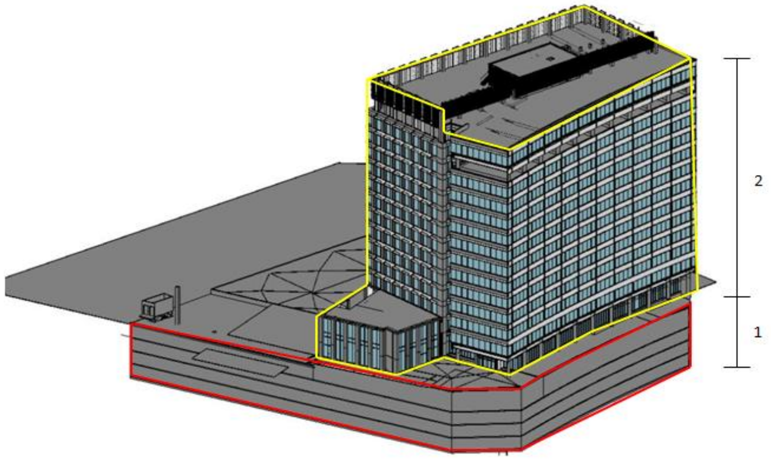


**Figure 1**

1. Four Level Underground Parking Garage (Outlined in RED)
2. 14 Story Office Building (Outlined in Yellow)

## B. SITE LAYOUT PLANNING

### * Refer to Appendix B for Project Site Layout

The new Office Building-G is located in the eastern United States. Due to owner restrictions, the exact location of the building cannot be disclosed. If you refer to ***Appendix B***, you will see the site layout plan for the new Office Building-G. The site will have two entrances, with the main entrance being to the north. The entrance that is behind the building footprint will be used for special deliveries and also for construction equipment to enter the project site. The office trailers for Turner Construction and the project subcontractors on site will be to the north of the building footprint. Along side of the trailers will be waste dumpsters and portable toilets. There will be limited parking near the trailers for Turner workers. Subcontractor employees will have to park in the parking lot that is located to the east of the site. The layout for the office trailers are shown in figure 2 below. The Turner trailers are in yellow, the subcontractor trailers are in purple, and the dumpsters and toilets are in red.

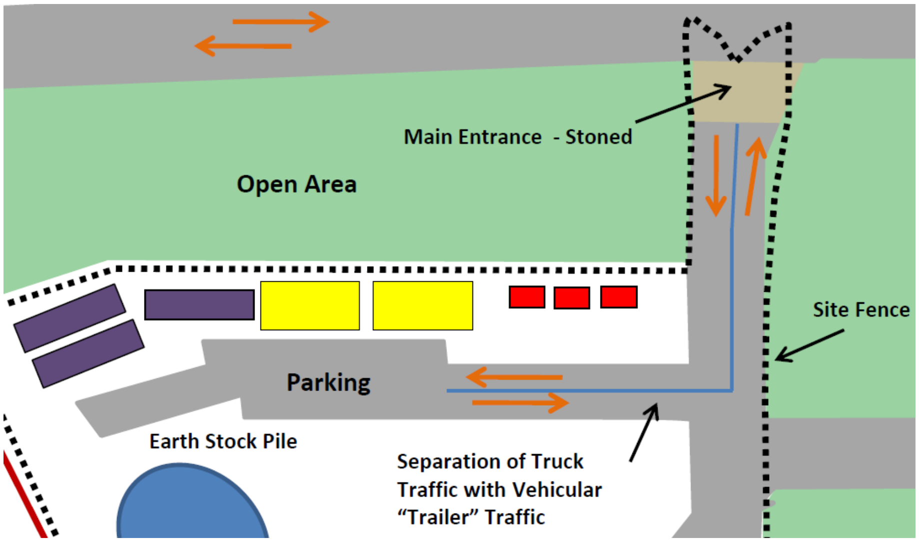


**Figure 2**

Along the western side of the building footprint, tiebacks will be utilized during excavation due to the adjacent metro station. In the geotechnical report, tiebacks were suggested because of the closeness of the metro line to the project. Also, because the metro station will stay open throughout the entire construction process, overhead protection will be installed over the sidewalk on the southern end of the site for pedestrian protection. The overhead protection will be installed on the southern end because pedestrians who use the metro daily park in a lot that is next to the designated subcontractor parking. Temporary utilities come from the northwest side of the building footprint and the temporary electricity will be routed through a power shed that is located to the west of the site.

### *Concrete Phase*

The major site layout Turner currently has is the **Concrete Phase** of the construction project. Turner will utilize on site batch plants along with two tower cranes and one mobile crane. Each tower crane has a boom of 100 feet and will be the major means moving material about the site. The exact size and location of the mobile crane to be used is not known. From figure 3 below, you can see the planned locations of the two tower cranes on the new Office Building-G site. The concrete phase is one of the most critical phases of the project because the building's structure is primarily concrete (cast-in-place). The concrete mixing stations are located where the green square is. It is critical to have the mixing locations close to the site because when dealing with concrete, time is crucial from the mixing to placing of the concrete.

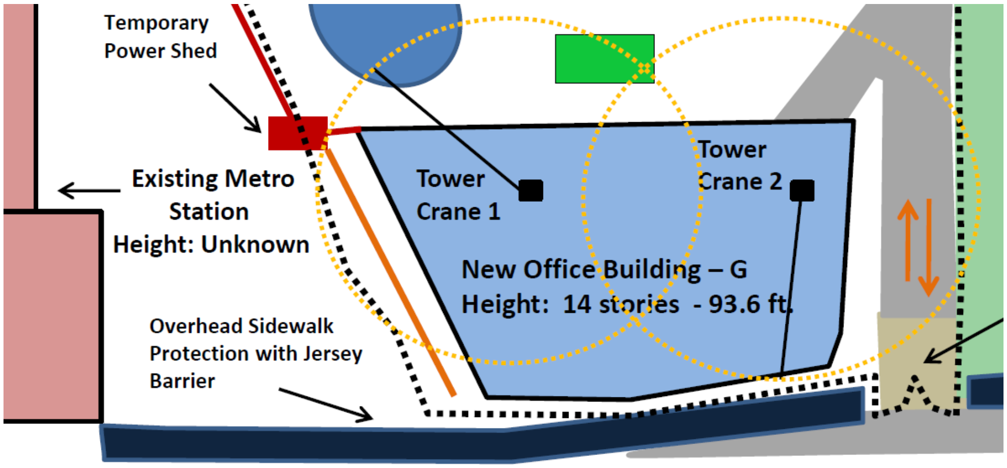


Figure 3

# C. DETAILED STRUCTURAL SYSTEMS ESTIMATE

## * Refer to Appendix C for Structural Systems Estimate

The superstructure of the new Office Building-G is primarily Cast-In-Place concrete with a portion of structural steel used for the elevators throughout the building. Table 1 shows the comparison between the total estimated costs versus the actual total costs and the estimated cost per square foot versus the actual cost per square foot for the cast-in-place concrete and the structural steel. Because of the detailed drawings and specifications, the estimated cost came within 4% of the actual cost of the concrete. The structural steel was off by a more substantial margin. I will list my thoughts on why these calculations differ later in this section.

| Structural Totals | | |
|---|---|---|
| **Description** | **Total** | **$/SF** |
| | | |
| **Cast-In-Place Concrete** | | |
| **Estimated** | **$14,314,136.96** | **$22.04** |
| **Actual** | **$14,909,500.00** | **$22.96** |
| | | |
| **Structural Steel** | | |
| **Estimated** | **$40,442.68** | **$0.06** |
| **Actual** | **$965,889.00** | **$1.49** |

**Table 1**

Table 2 below shows the cost breakdown of each system that made up the total estimate. As expected, the concrete slabs were the highest cost because of the amount of cubic yards of concrete needed to cover each floor of the building. Because of the minimal steel used, it was assumed prior to the estimate that the cost would not be substantial.

| Total System Costs | | |
|---|---|---|
| **Description** | **Quantity** | **Total** |
| | | |
| **Cast In Place Concrete** | | |
| **Columns (square)** | **1,719.40 yd$^3$** | **$2,384,463.92** |
| **Columns (round)** | **551.20 yd$^3$** | **$514,043.61** |
| **Beams and Girders** | **3312.59 yd$^3$** | **$3,752,733.83** |
| **Slabs** | **11,625.42 yd$^3$** | **$7,662,895.59** |
| | | |
| **Structural Steel** | | |
| **Columns** | **0.136 tons** | **$4837.39** |
| **Beams and Girders** | **7.883 tons** | **$35,605.29** |

**Table 2**

When using the ***RS Means Costworks*** software, several assumptions were made.  For the cast-in-place concrete, all of the formwork and rebar for the columns, beams, and slabs was taken into account in the estimate.  No takeoffs were needed.  Because of that, the total estimate for the cast-in-place concrete is higher than it should be.  Also, because the rebar was accounted for in the estimate with the concrete, that takes away from the total structural estimate, making that estimate much lower than the actual estimate.

Another factor that can account for the difference in the estimate is the quarter the estimate was produced in.  The RS Means cost estimate I used took data from quarter 3 of the 2010 year.  While I am not certain that the actual cost was calculated with data from a different quarter, that can account for some of the difference between the actual and estimated cost.  Also, the location used in the estimate was not the actual location of the project which would cause a difference in the estimate as well.

With respect to the structural members of the estimate, the some of the sizes could not be found in the costworks software so steel members that were closest in size were used.  This also is a factor as to why the structural estimate could differ from the actual structural estimate.

# D. GENERAL CONDITIONS ESTIMATE

## * Refer to Appendix D for Complete General Conditions Estimate

The estimate shown below in Table 3 summarizes the general condition line items for the new Office Building-G project. The data is an approximation and are not the actual estimates used by Turner Construction.

| **GENERAL CONDITIONS SUMMARY** | | | | |
|---|---|---|---|---|
| **Description** | **Unit Rate** | **Unit** | **Quantity** | **Cost** |
| Personnel | $ 24,929.00 | WEEK | 100 | $ 2,492,900.00 |
| Facilities and Equipment | $ 2,795.00 | WEEK | 100 | $ 279,500.00 |
| Temporary Utilities | $ 2,580.00 | WEEK | 100 | $ 258,000.00 |
| Miscellaneous Equipment | $ 11,724.00 | WEEK | 100 | $ 1,172,400.00 |
| | | | **TOTAL** | **$ 4,202,800.00** |

**Table 3**

The estimate was broken down into four sections: Personnel, Facilities and Equipment, Temporary Utilities, and Miscellaneous Equipment. The Personnel section includes the cost for the Vice President, Senior Project Manager, Project Manager, Senior Superintendents, Project Engineers, Safety Managers, Purchasing, Project Estimator, and Project Accountant. The Facilities section has items such as the office trailer rental, along with installation and removal. Also included is the technology fee, computer fee, office supplies and printer/copier costs. Temporary Utilities includes power installation, power and lighting, toilet installation and monthly cost, and potable water. Finally, miscellaneous items included in the general conditions report consist of any taxes and insurance, company travel expenses, mail service, documentation, and progress photos.

After collecting all of the general conditions data, it was clear that the majority of the costs were due to the project's personnel expenses. The overall general conditions cost of $ 4,202,800.00 is 6% of the entire project cost of $ 70,000,000.00

## E. CRITICAL INDUSTRY ISSUES

The 19th annual PACE conference was held on October 27th-28th, 2010 at the Penn Stater Hotel and Conference Center. The title of this year's conference was "Building a Collaboration Culture." The conference was headed by Professors David Riley, John Messner, and Robert Leicht. The conference began with opening remarks from all three professors and an update on what is going on in the Penn State AE community. An important piece of information noted was that Penn State received the largest grant ever from the Department of Energy for the Greater Philadelphia Innovation Cluster in energy efficient buildings. After the opening remarks, two breakout sessions followed to complete the morning of the conference. All six sessions are shown in the table below.

| A. Sustainability / Green Building | B. Technology Applications | C. Process Innovation |
|---|---|---|
| **Session 1A:** Educating a future workforce for delivering high performance buildings | **Session 1B:** Transformation: What are the innovations that will transform our industry | **Session 1C:** IPD: Exploring the drivers behind highly integrated delivery of projects |
| **Session 2A:** The SmartGrid: Energy impacts in the building industry | **Session 2B:** Carrying BIM to the field - new responsibilities, roles, and competencies | **Session 2C:** Operations and Maintenance process integration in new and retrofit projects |

### Breakout Session 1:
### IPD: Exploring the drivers behind highly integrated delivery of projects

I decided to attend the first session of Professor Leicht's discussion on IPD. I have been interested in learning more about how IPD can affect a project and wanted to gain more knowledge on just exactly what it is. Also, I felt that by learning more on IPD, I could possibly use it as a topic for my thesis research. The session began by everyone introducing themselves and their reasoning as to why they attended the session. Professor Leicht coordinated the discussion and began with barriers to IPD. The barriers discussed included case studies, insurance/legal precedents, assumed risk of companies, the traditional mindset, and the current economy. These, along with others, are some of the main reasons why it is difficult to implement IPD into the industry today. The discussion then shifted towards the main challenge of working with IPD. The main challenge discussed dealt with the behavior of the team and the struggle to change from old behaviors to new ones. From there, members began to talk about opportunities that IPD presented. Members talked about the usage of BIM to drive integration, the increase in innovation and collaboration, a team approach, and better decision making on the project. Then, the discussion moved to the philosophy of IPD that deals with hiring the CM and A/E at the same time and incentives that IPD can produce. We came to the conclusion that IPD seems to be owner driven and teamwork between all trades on the project needs to begin from day one. After attending this session, I feel that I could possibly incorporate IPD into my thesis project.

### Breakout Session 2:
### The SmartGrid: Energy impacts in the building industry

The second morning session I attended was with Professor Riley and the discussion on the SmartGrid. I wanted to attend this session because I had no idea what the SmartGrid is and wanted to learn about what it is and what it can do to help energy consumption in the United States. The discussion began with Professor Riley discussing Grid Star, which is an information source. He then began to discuss topics that included power generation/distribution, advanced metering, cyber security, distributed energy generation, and energy efficient controls. The discussion then turned back to advanced metering where he talked about what advanced metering is, how you can monitor energy time of use, direction of use, and the location of the energy use. By knowing this information, it can help save on energy usage if it is known exactly where and when energy is needed in a building system. We then started to discuss energy efficiency in buildings and what to do to reduce energy consumption in buildings. Professor Riley talked about phantom/vampire loads, and individual temperature control. Also, we said that in some situations, building operators need to be better trained when operating more sophisticated building systems. The last discussion included talks about energy-reducing building systems such as solar, wind, geothermal, photovoltaics, and wind turbines. During this discussion, I learned about photovoltaics being used in the exterior facades and glass of new buildings. I felt this could be a topic that I can look into more to use in my thesis project. After the session I felt I gained knowledge on the SmartGrid and was able to get some ideas to use in my thesis research.

### Team Collaboration Exercise

The afternoon session of the PACE conference began with a team exercise where everyone was broken down into groups. Within those groups, two teams, red and blue, were formed along with a designated score keeper. The exercise dealt with a game board, where each group had control of certain squares on the board with the objective of making as many lines from each groups side of the board to the other. You can use only your designated squares to do this, but can negotiate with the other group to use their squares as well. Points were awarded for each complete line and the number of squares used to complete that line. At the end, the team with the highest score won. While working on the exercise, it became apparent that in order to have the most points, we would have to collaborate with our opposing group. We decided to work together to form the most lines and gain the most points possible. We would then split the winnings evenly to each competitor. In the end, however, we did not work together from the beginning and did not have enough time to find the way to form lines that produced the maximum amount of points. From the exercise I learned that group interaction and discussion is very important and is an essential skill to have in the industry today.

### Student Panel – How the economy is impacting the industry

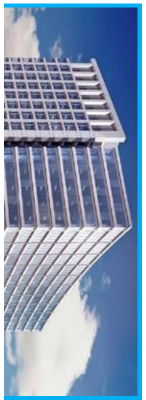
The final session of the conference was a discussion on the economy and how it is impacting the industry and the job market. A student panel was formed to speak on behalf of the students as a whole and give their thoughts on how the economy is effecting our search for jobs. From the discussion with the student panel and the industry leaders, I learned that the industry is starting to rebound from where it fell to a few years ago because of the economy. But, even though the economy and industry is turning

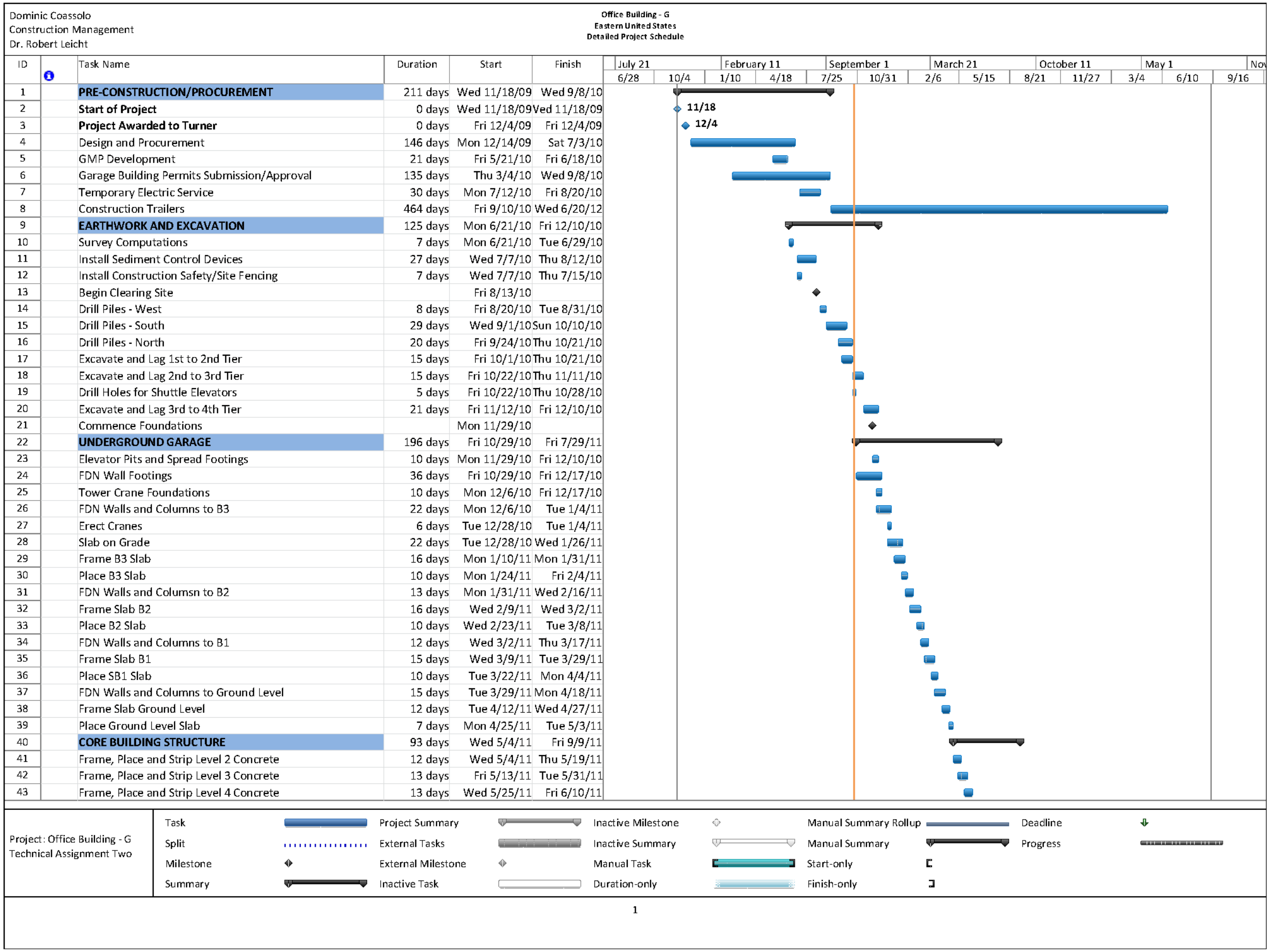
around, the job market is not the same as it once was. There are jobs out there and the advice that I learned from the industry leaders is to just be persistent and work hard to find that job that you are looking for. There are opportunities out there and you just have to work hard to find them.

## Reflection

The PACE conference was a very informative day and I gained a lot of information from it. During the first session, I learned about IPD and the advantages and disadvantages it can bring to a project. During the second session, I found out about the SmartGrid and how it can help reduce energy usage in building systems. During this session I also learned about photovoltaics being used in exterior glass and facades of buildings. I feel that can be something to look into to be used on my thesis building along with IPD. Something that I learned during the student panel discussion was about the industry, that some industry members are having doubt as to whether the industry will ever get back to where it once was. Hopefully it will. During the conference I met many industry leaders that would be of great help for my thesis project. Bill Moyer, from Davis Construction, is one contact that I feel will be of great help to discuss topics for thesis research.

# APPENDIX A – PROJECT SCHEDULE



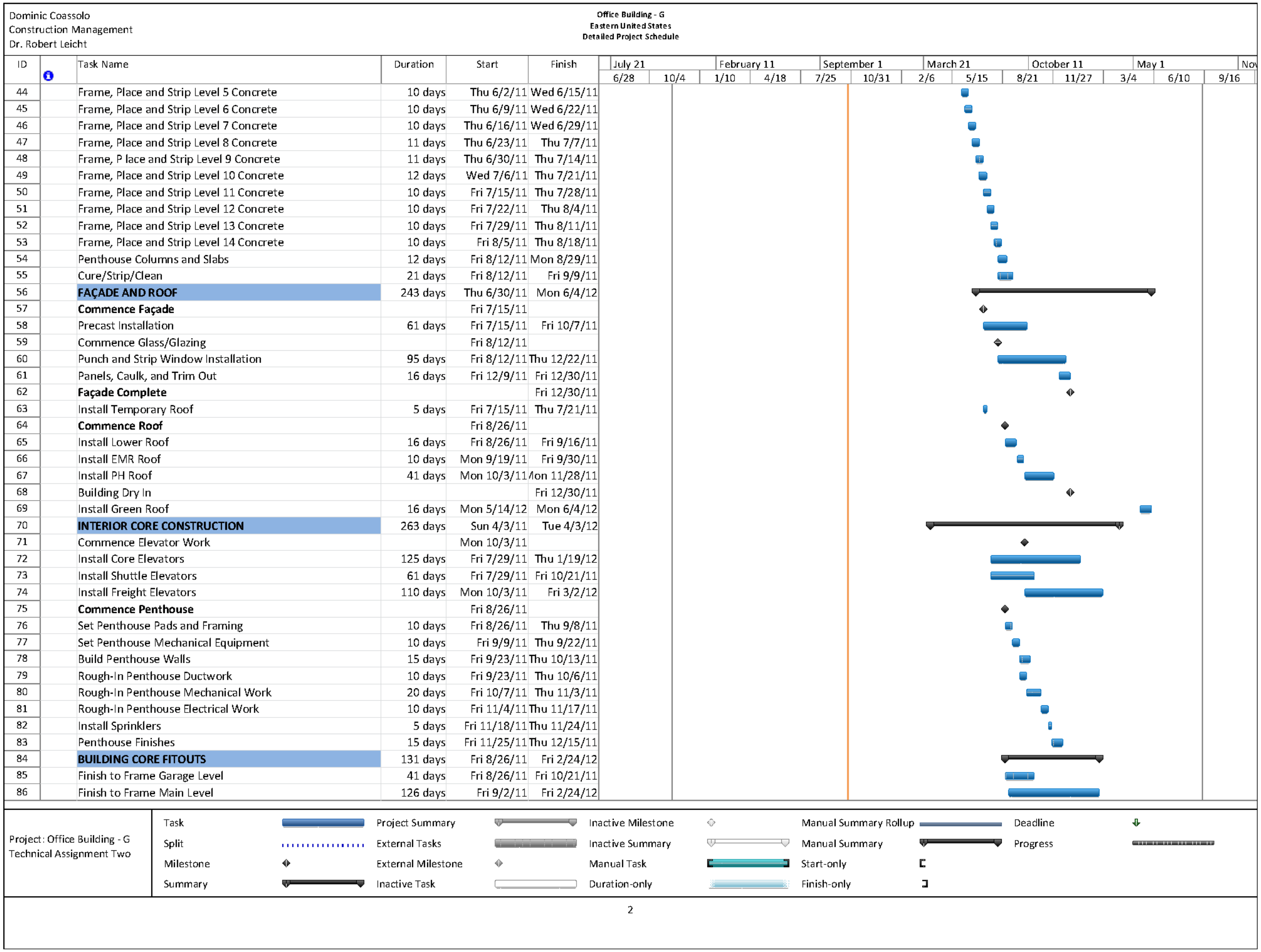


Dominic Coassolo
Construction Management
Dr. Robert Leicht

Office Building - G
Eastern United States
Detailed Project Schedule

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 1 | **PRE-CONSTRUCTION/PROCUREMENT** | 211 days | Wed 11/18/09 | Wed 9/8/10 |
| 2 | **Start of Project** | 0 days | Wed 11/18/09 | Ved 11/18/09 |
| 3 | **Project Awarded to Turner** | 0 days | Fri 12/4/09 | Fri 12/4/09 |
| 4 | Design and Procurement | 146 days | Mon 12/14/09 | Sat 7/3/10 |
| 5 | GMP Development | 21 days | Fri 5/21/10 | Fri 6/18/10 |
| 6 | Garage Building Permits Submission/Approval | 135 days | Thu 3/4/10 | Wed 9/8/10 |
| 7 | Temporary Electric Service | 30 days | Mon 7/12/10 | Fri 8/20/10 |
| 8 | Construction Trailers | 464 days | Fri 9/10/10 | Wed 6/20/12 |
| 9 | **EARTHWORK AND EXCAVATION** | 125 days | Mon 6/21/10 | Fri 12/10/10 |
| 10 | Survey Computations | 7 days | Mon 6/21/10 | Tue 6/29/10 |
| 11 | Install Sediment Control Devices | 27 days | Wed 7/7/10 | Thu 8/12/10 |
| 12 | Install Construction Safety/Site Fencing | 7 days | Wed 7/7/10 | Thu 7/15/10 |
| 13 | Begin Clearing Site |  | Fri 8/13/10 |  |
| 14 | Drill Piles - West | 8 days | Fri 8/20/10 | Tue 8/31/10 |
| 15 | Drill Piles - South | 29 days | Wed 9/1/10 | Sun 10/10/10 |
| 16 | Drill Piles - North | 20 days | Fri 9/24/10 | Thu 10/21/10 |
| 17 | Excavate and Lag 1st to 2nd Tier | 15 days | Fri 10/1/10 | Thu 10/21/10 |
| 18 | Excavate and Lag 2nd to 3rd Tier | 15 days | Fri 10/22/10 | Thu 11/11/10 |
| 19 | Drill Holes for Shuttle Elevators | 5 days | Fri 10/22/10 | Thu 10/28/10 |
| 20 | Excavate and Lag 3rd to 4th Tier | 21 days | Fri 11/12/10 | Fri 12/10/10 |
| 21 | Commence Foundations |  | Mon 11/29/10 |  |
| 22 | **UNDERGROUND GARAGE** | 196 days | Fri 10/29/10 | Fri 7/29/11 |
| 23 | Elevator Pits and Spread Footings | 10 days | Mon 11/29/10 | Fri 12/10/10 |
| 24 | FDN Wall Footings | 36 days | Fri 10/29/10 | Fri 12/17/10 |
| 25 | Tower Crane Foundations | 10 days | Mon 12/6/10 | Fri 12/17/10 |
| 26 | FDN Walls and Columns to B3 | 22 days | Mon 12/6/10 | Tue 1/4/11 |
| 27 | Erect Cranes | 6 days | Tue 12/28/10 | Tue 1/4/11 |
| 28 | Slab on Grade | 22 days | Tue 12/28/10 | Wed 1/26/11 |
| 29 | Frame B3 Slab | 16 days | Mon 1/10/11 | Mon 1/31/11 |
| 30 | Place B3 Slab | 10 days | Mon 1/24/11 | Fri 2/4/11 |
| 31 | FDN Walls and Columsn to B2 | 13 days | Mon 1/31/11 | Wed 2/16/11 |
| 32 | Frame Slab B2 | 16 days | Wed 2/9/11 | Wed 3/2/11 |
| 33 | Place B2 Slab | 10 days | Wed 2/23/11 | Tue 3/8/11 |
| 34 | FDN Walls and Columns to B1 | 12 days | Wed 3/2/11 | Thu 3/17/11 |
| 35 | Frame Slab B1 | 15 days | Wed 3/9/11 | Tue 3/29/11 |
| 36 | Place SB1 Slab | 10 days | Tue 3/22/11 | Mon 4/4/11 |
| 37 | FDN Walls and Columns to Ground Level | 15 days | Tue 3/29/11 | Mon 4/18/11 |
| 38 | Frame Slab Ground Level | 12 days | Tue 4/12/11 | Wed 4/27/11 |
| 39 | Place Ground Level Slab | 7 days | Mon 4/25/11 | Tue 5/3/11 |
| 40 | **CORE BUILDING STRUCTURE** | 93 days | Wed 5/4/11 | Fri 9/9/11 |
| 41 | Frame, Place and Strip Level 2 Concrete | 12 days | Wed 5/4/11 | Thu 5/19/11 |
| 42 | Frame, Place and Strip Level 3 Concrete | 13 days | Fri 5/13/11 | Tue 5/31/11 |
| 43 | Frame, Place and Strip Level 4 Concrete | 13 days | Wed 5/25/11 | Fri 6/10/11 |

Project: Office Building - G
Technical Assignment Two



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Construction Management
Dr. Robert Leicht

Office Building - G
Eastern United States
Detailed Project Schedule

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 44 | Frame, Place and Strip Level 5 Concrete | 10 days | Thu 6/2/11 | Wed 6/15/11 |
| 45 | Frame, Place and Strip Level 6 Concrete | 10 days | Thu 6/9/11 | Wed 6/22/11 |
| 46 | Frame, Place and Strip Level 7 Concrete | 10 days | Thu 6/16/11 | Wed 6/29/11 |
| 47 | Frame, Place and Strip Level 8 Concrete | 11 days | Thu 6/23/11 | Thu 7/7/11 |
| 48 | Frame, P lace and Strip Level 9 Concrete | 11 days | Thu 6/30/11 | Thu 7/14/11 |
| 49 | Frame, Place and Strip Level 10 Concrete | 12 days | Wed 7/6/11 | Thu 7/21/11 |
| 50 | Frame, Place and Strip Level 11 Concrete | 10 days | Fri 7/15/11 | Thu 7/28/11 |
| 51 | Frame, Place and Strip Level 12 Concrete | 10 days | Fri 7/22/11 | Thu 8/4/11 |
| 52 | Frame, Place and Strip Level 13 Concrete | 10 days | Fri 7/29/11 | Thu 8/11/11 |
| 53 | Frame, Place and Strip Level 14 Concrete | 10 days | Fri 8/5/11 | Thu 8/18/11 |
| 54 | Penthouse Columns and Slabs | 12 days | Fri 8/12/11 | Mon 8/29/11 |
| 55 | Cure/Strip/Clean | 21 days | Fri 8/12/11 | Fri 9/9/11 |
| 56 | **FAÇADE AND ROOF** | 243 days | Thu 6/30/11 | Mon 6/4/12 |
| 57 | **Commence Façade** |  | Fri 7/15/11 |  |
| 58 | Precast Installation | 61 days | Fri 7/15/11 | Fri 10/7/11 |
| 59 | Commence Glass/Glazing |  | Fri 8/12/11 |  |
| 60 | Punch and Strip Window Installation | 95 days | Fri 8/12/11 | Thu 12/22/11 |
| 61 | Panels, Caulk, and Trim Out | 16 days | Fri 12/9/11 | Fri 12/30/11 |
| 62 | **Façade Complete** |  |  | Fri 12/30/11 |
| 63 | Install Temporary Roof | 5 days | Fri 7/15/11 | Thu 7/21/11 |
| 64 | **Commence Roof** |  | Fri 8/26/11 |  |
| 65 | Install Lower Roof | 16 days | Fri 8/26/11 | Fri 9/16/11 |
| 66 | Install EMR Roof | 10 days | Mon 9/19/11 | Fri 9/30/11 |
| 67 | Install PH Roof | 41 days | Mon 10/3/11 | Mon 11/28/11 |
| 68 | Building Dry In |  |  | Fri 12/30/11 |
| 69 | Install Green Roof | 16 days | Mon 5/14/12 | Mon 6/4/12 |
| 70 | **INTERIOR CORE CONSTRUCTION** | 263 days | Sun 4/3/11 | Tue 4/3/12 |
| 71 | Commence Elevator Work |  | Mon 10/3/11 |  |
| 72 | Install Core Elevators | 125 days | Fri 7/29/11 | Thu 1/19/12 |
| 73 | Install Shuttle Elevators | 61 days | Fri 7/29/11 | Fri 10/21/11 |
| 74 | Install Freight Elevators | 110 days | Mon 10/3/11 | Fri 3/2/12 |
| 75 | **Commence Penthouse** |  | Fri 8/26/11 |  |
| 76 | Set Penthouse Pads and Framing | 10 days | Fri 8/26/11 | Thu 9/8/11 |
| 77 | Set Penthouse Mechanical Equipment | 10 days | Fri 9/9/11 | Thu 9/22/11 |
| 78 | Build Penthouse Walls | 15 days | Fri 9/23/11 | Thu 10/13/11 |
| 79 | Rough-In Penthouse Ductwork | 10 days | Fri 9/23/11 | Thu 10/6/11 |
| 80 | Rough-In Penthouse Mechanical Work | 20 days | Fri 10/7/11 | Thu 11/3/11 |
| 81 | Rough-In Penthouse Electrical Work | 10 days | Fri 11/4/11 | Thu 11/17/11 |
| 82 | Install Sprinklers | 5 days | Fri 11/18/11 | Thu 11/24/11 |
| 83 | Penthouse Finishes | 15 days | Fri 11/25/11 | Thu 12/15/11 |
| 84 | **BUILDING CORE FITOUTS** | 131 days | Fri 8/26/11 | Fri 2/24/12 |
| 85 | Finish to Frame Garage Level | 41 days | Fri 8/26/11 | Fri 10/21/11 |
| 86 | Finish to Frame Main Level | 126 days | Fri 9/2/11 | Fri 2/24/12 |

Project: Office Building - G
Technical Assignment Two

|  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
| 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 | ] |  |  |

2

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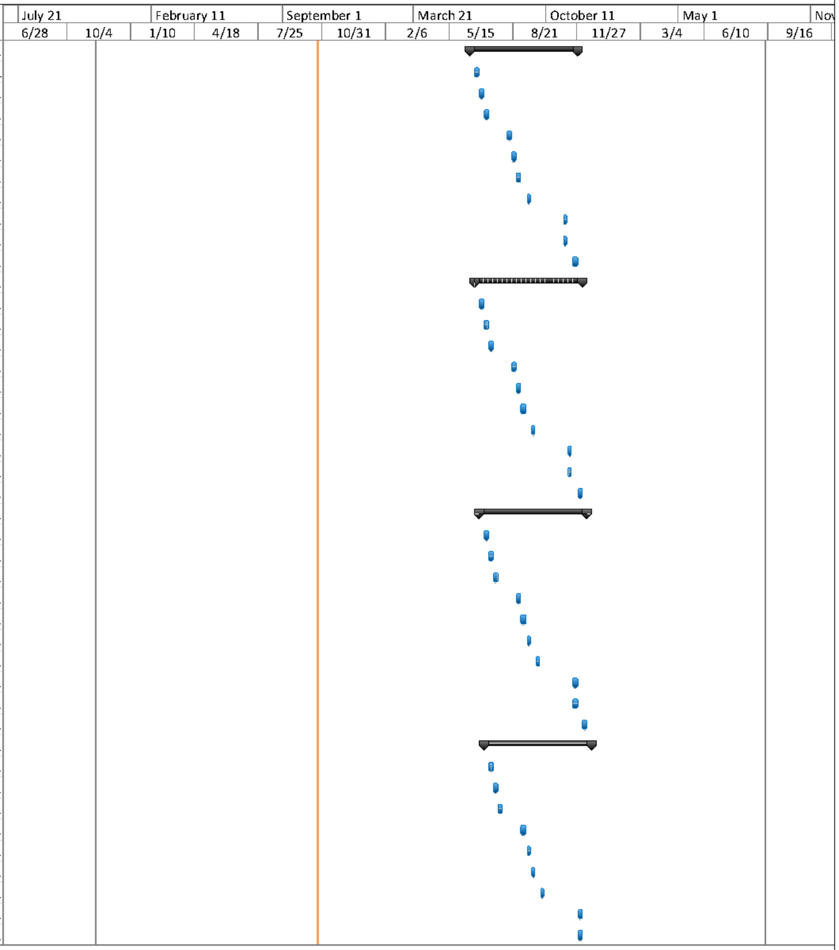
Construction Management
Dr. Robert Leicht

Office Building - G
Eastern United States
Detailed Project Schedule

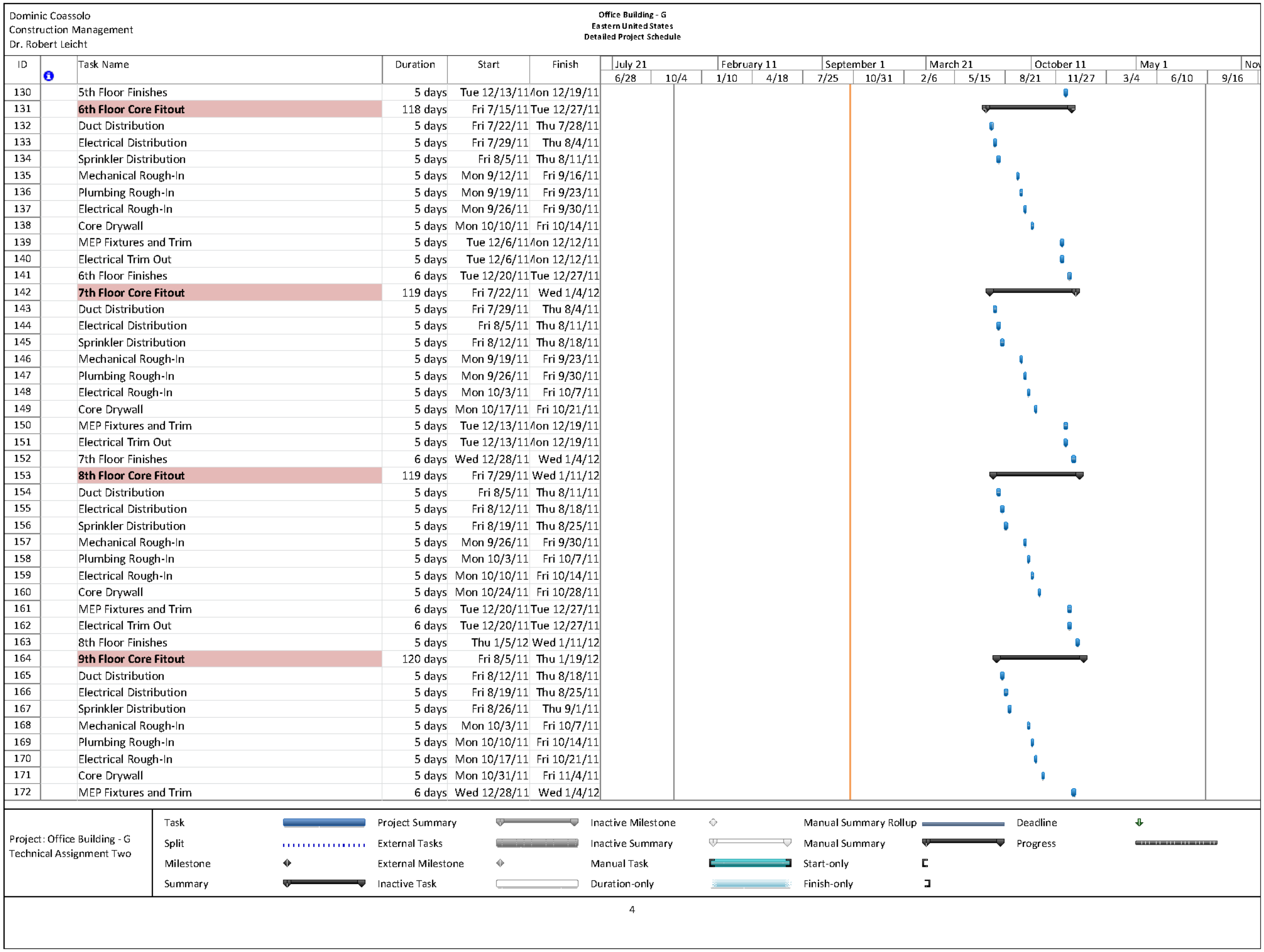
| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 87 | **2nd Floor Core Fitout** | 118 days | Thu 6/16/11 | Mon 11/28/11 |
| 88 | Duct Distribution | 5 days | Thu 6/23/11 | Wed 6/29/11 |
| 89 | Electrical Distribution | 6 days | Thu 6/30/11 | Thu 7/7/11 |
| 90 | Sprinkler Distribution | 5 days | Fri 7/8/11 | Thu 7/14/11 |
| 91 | Mechanical Rough-In | 5 days | Fri 8/12/11 | Thu 8/18/11 |
| 92 | Plumbing Rough-In | 5 days | Fri 8/19/11 | Thu 8/25/11 |
| 93 | Electrical Rough-In | 5 days | Fri 8/26/11 | Thu 9/1/11 |
| 94 | Core Drywall | 5 days | Mon 9/12/11 | Fri 9/16/11 |
| 95 | MEP Fixtures and Trim | 5 days | Mon 11/7/11 | Fri 11/11/11 |
| 96 | Electrical Trim Out | 5 days | Mon 11/7/11 | Fri 11/11/11 |
| 97 | 2nd Floor Finishes | 6 days | Mon 11/21/11 | Mon 11/28/11 |
| 98 | **3rd Floor Core Fitout** | 118 days | Thu 6/23/11 | Mon 12/5/11 |
| 99 | Duct Distribution | 6 days | Thu 6/30/11 | Thu 7/7/11 |
| 100 | Electrical Distribution | 5 days | Fri 7/8/11 | Thu 7/14/11 |
| 101 | Sprinkler Distribution | 5 days | Fri 7/15/11 | Thu 7/21/11 |
| 102 | Mechanical Rough-In | 5 days | Fri 8/19/11 | Thu 8/25/11 |
| 103 | Plumbing Rough-In | 5 days | Fri 8/26/11 | Thu 9/1/11 |
| 104 | Electrical Rough-In | 6 days | Fri 9/2/11 | Fri 9/9/11 |
| 105 | Core Drywall | 5 days | Mon 9/19/11 | Fri 9/23/11 |
| 106 | MEP Fixtures and Trim | 5 days | Mon 11/14/11 | Fri 11/18/11 |
| 107 | Electrical Trim Out | 5 days | Mon 11/14/11 | Fri 11/18/11 |
| 108 | 3rd Floor Finishes | 5 days | Tue 11/29/11 | Mon 12/5/11 |
| 109 | **4th Floor Core Fitout** | 118 days | Thu 6/30/11 | Mon 12/12/11 |
| 110 | Duct Distribution | 5 days | Fri 7/8/11 | Thu 7/14/11 |
| 111 | Electrical Distribution | 5 days | Fri 7/15/11 | Thu 7/21/11 |
| 112 | Sprinkler Distribution | 5 days | Fri 7/22/11 | Thu 7/28/11 |
| 113 | Mechanical Rough-In | 5 days | Fri 8/26/11 | Thu 9/1/11 |
| 114 | Plumbing Rough-In | 6 days | Fri 9/2/11 | Fri 9/9/11 |
| 115 | Electrical Rough-In | 5 days | Mon 9/12/11 | Fri 9/16/11 |
| 116 | Core Drywall | 5 days | Mon 9/26/11 | Fri 9/30/11 |
| 117 | MEP Fixtures and Trim | 6 days | Mon 11/21/11 | Mon 11/28/11 |
| 118 | Electrical Trim Out | 6 days | Mon 11/21/11 | Mon 11/28/11 |
| 119 | 4th Floor Finishes | 5 days | Tue 12/6/11 | Mon 12/12/11 |
| 120 | **5th Floor Core Fitout** | 117 days | Fri 7/8/11 | Mon 12/19/11 |
| 121 | Duct Distribution | 5 days | Fri 7/15/11 | Thu 7/21/11 |
| 122 | Electrical Distribution | 5 days | Fri 7/22/11 | Thu 7/28/11 |
| 123 | Sprinkler Distribution | 5 days | Fri 7/29/11 | Thu 8/4/11 |
| 124 | Mechanical Rough-In | 6 days | Fri 9/2/11 | Fri 9/9/11 |
| 125 | Plumbing Rough-In | 5 days | Mon 9/12/11 | Fri 9/16/11 |
| 126 | Electrical Rough-In | 5 days | Mon 9/19/11 | Fri 9/23/11 |
| 127 | Core Drywall | 5 days | Mon 10/3/11 | Fri 10/7/11 |
| 128 | MEP Fixtures and Trim | 5 days | Tue 11/29/11 | Mon 12/5/11 |
| 129 | Electrical Trim Out | 5 days | Tue 11/29/11 | Mon 12/5/11 |



Project: Office Building - G
Technical Assignment Two

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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 | ] | | |

3



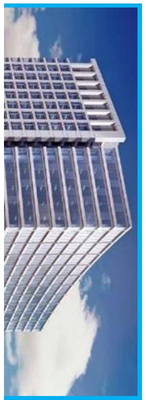
Dominic Coassolo
Construction Management
Dr. Robert Leicht

**Office Building - G**
**Eastern United States**
**Detailed Project Schedule**

| ID | Task Name | Duration | Start | Finish |
|---|---|---|---|---|
| 130 | 5th Floor Finishes | 5 days | Tue 12/13/11 | on 12/19/11 |
| 131 | **6th Floor Core Fitout** | 118 days | Fri 7/15/11 | Tue 12/27/11 |
| 132 | Duct Distribution | 5 days | Fri 7/22/11 | Thu 7/28/11 |
| 133 | Electrical Distribution | 5 days | Fri 7/29/11 | Thu 8/4/11 |
| 134 | Sprinkler Distribution | 5 days | Fri 8/5/11 | Thu 8/11/11 |
| 135 | Mechanical Rough-In | 5 days | Mon 9/12/11 | Fri 9/16/11 |
| 136 | Plumbing Rough-In | 5 days | Mon 9/19/11 | Fri 9/23/11 |
| 137 | Electrical Rough-In | 5 days | Mon 9/26/11 | Fri 9/30/11 |
| 138 | Core Drywall | 5 days | Mon 10/10/11 | Fri 10/14/11 |
| 139 | MEP Fixtures and Trim | 5 days | Tue 12/6/11 | on 12/12/11 |
| 140 | Electrical Trim Out | 5 days | Tue 12/6/11 | on 12/12/11 |
| 141 | 6th Floor Finishes | 6 days | Tue 12/20/11 | Tue 12/27/11 |
| 142 | **7th Floor Core Fitout** | 119 days | Fri 7/22/11 | Wed 1/4/12 |
| 143 | Duct Distribution | 5 days | Fri 7/29/11 | Thu 8/4/11 |
| 144 | Electrical Distribution | 5 days | Fri 8/5/11 | Thu 8/11/11 |
| 145 | Sprinkler Distribution | 5 days | Fri 8/12/11 | Thu 8/18/11 |
| 146 | Mechanical Rough-In | 5 days | Mon 9/19/11 | Fri 9/23/11 |
| 147 | Plumbing Rough-In | 5 days | Mon 9/26/11 | Fri 9/30/11 |
| 148 | Electrical Rough-In | 5 days | Mon 10/3/11 | Fri 10/7/11 |
| 149 | Core Drywall | 5 days | Mon 10/17/11 | Fri 10/21/11 |
| 150 | MEP Fixtures and Trim | 5 days | Tue 12/13/11 | on 12/19/11 |
| 151 | Electrical Trim Out | 5 days | Tue 12/13/11 | on 12/19/11 |
| 152 | 7th Floor Finishes | 6 days | Wed 12/28/11 | Wed 1/4/12 |
| 153 | **8th Floor Core Fitout** | 119 days | Fri 7/29/11 | Wed 1/11/12 |
| 154 | Duct Distribution | 5 days | Fri 8/5/11 | Thu 8/11/11 |
| 155 | Electrical Distribution | 5 days | Fri 8/12/11 | Thu 8/18/11 |
| 156 | Sprinkler Distribution | 5 days | Fri 8/19/11 | Thu 8/25/11 |
| 157 | Mechanical Rough-In | 5 days | Mon 9/26/11 | Fri 9/30/11 |
| 158 | Plumbing Rough-In | 5 days | Mon 10/3/11 | Fri 10/7/11 |
| 159 | Electrical Rough-In | 5 days | Mon 10/10/11 | Fri 10/14/11 |
| 160 | Core Drywall | 5 days | Mon 10/24/11 | Fri 10/28/11 |
| 161 | MEP Fixtures and Trim | 6 days | Tue 12/20/11 | Tue 12/27/11 |
| 162 | Electrical Trim Out | 6 days | Tue 12/20/11 | Tue 12/27/11 |
| 163 | 8th Floor Finishes | 5 days | Thu 1/5/12 | Wed 1/11/12 |
| 164 | **9th Floor Core Fitout** | 120 days | Fri 8/5/11 | Thu 1/19/12 |
| 165 | Duct Distribution | 5 days | Fri 8/12/11 | Thu 8/18/11 |
| 166 | Electrical Distribution | 5 days | Fri 8/19/11 | Thu 8/25/11 |
| 167 | Sprinkler Distribution | 5 days | Fri 8/26/11 | Thu 9/1/11 |
| 168 | Mechanical Rough-In | 5 days | Mon 10/3/11 | Fri 10/7/11 |
| 169 | Plumbing Rough-In | 5 days | Mon 10/10/11 | Fri 10/14/11 |
| 170 | Electrical Rough-In | 5 days | Mon 10/17/11 | Fri 10/21/11 |
| 171 | Core Drywall | 5 days | Mon 10/31/11 | Fri 11/4/11 |
| 172 | MEP Fixtures and Trim | 6 days | Wed 12/28/11 | Wed 1/4/12 |

Project: Office Building - G
Technical Assignment Two

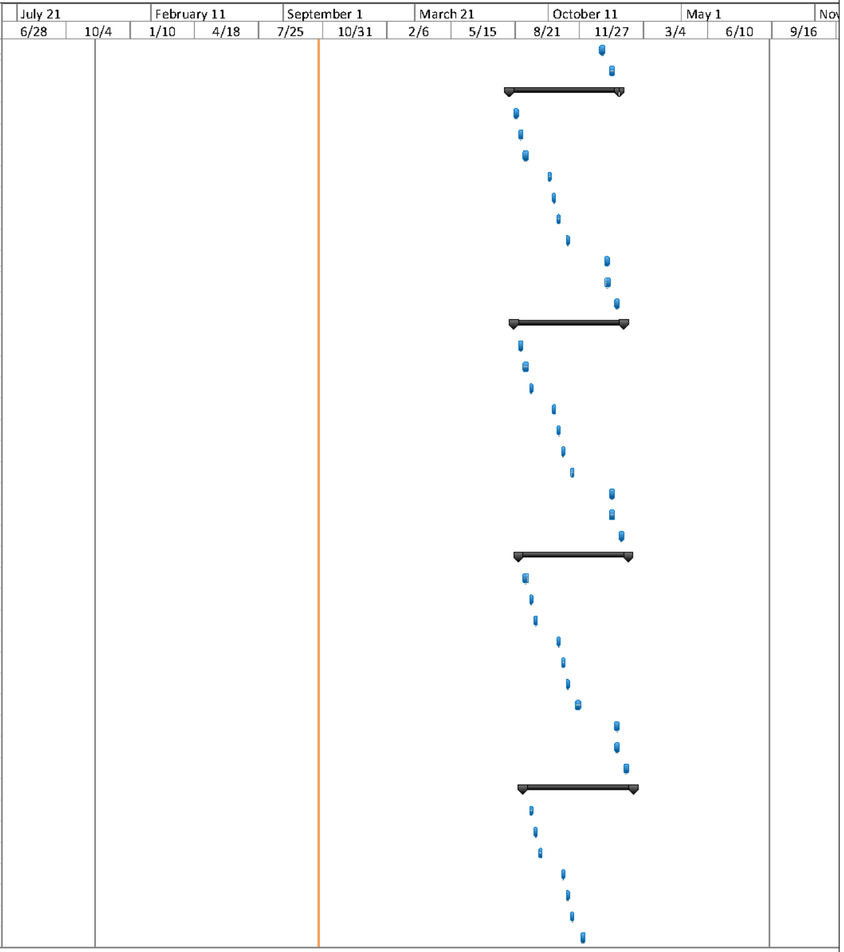
4



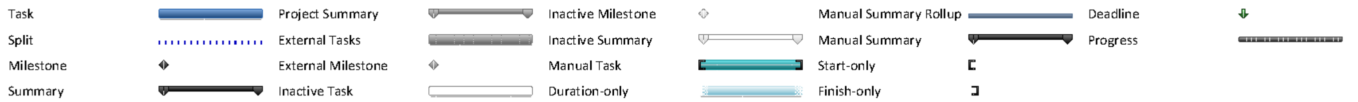
Dominic Coassolo
Construction Management
Dr. Robert Leicht

**Office Building - G**
**Eastern United States**
**Detailed Project Schedule**

| ID | ℹ | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|
| 173 | | Electrical Trim Out | 6 days | Wed 12/28/11 | Wed 1/4/12 |
| 174 | | 9th Floor Finishes | 6 days | Thu 1/12/12 | Thu 1/19/12 |
| 175 | | **10th Floor Core Fitout** | 120 days | Fri 8/12/11 | Thu 1/26/12 |
| 176 | | Duct Distribution | 5 days | Fri 8/19/11 | Thu 8/25/11 |
| 177 | | Electrical Distribution | 5 days | Fri 8/26/11 | Thu 9/1/11 |
| 178 | | Sprinkler Distribution | 6 days | Fri 9/2/11 | Fri 9/9/11 |
| 179 | | Mechanical Rough-In | 5 days | Mon 10/10/11 | Fri 10/14/11 |
| 180 | | Plumbing Rough-In | 5 days | Mon 10/17/11 | Fri 10/21/11 |
| 181 | | Electrical Rough-In | 5 days | Mon 10/24/11 | Fri 10/28/11 |
| 182 | | Core Drywall | 5 days | Mon 11/7/11 | Fri 11/11/11 |
| 183 | | MEP Fixtures and Trim | 5 days | Thu 1/5/12 | Wed 1/11/12 |
| 184 | | Electrical Trim Out | 6 days | Thu 1/5/12 | Thu 1/12/12 |
| 185 | | 10th Floor Finishes | 5 days | Fri 1/20/12 | Thu 1/26/12 |
| 186 | | **11th Floor Core Fitout** | 120 days | Fri 8/19/11 | Thu 2/2/12 |
| 187 | | Duct Distribution | 5 days | Fri 8/26/11 | Thu 9/1/11 |
| 188 | | Electrical Distribution | 6 days | Fri 9/2/11 | Fri 9/9/11 |
| 189 | | Sprinkler Distribution | 5 days | Mon 9/12/11 | Fri 9/16/11 |
| 190 | | Mechanical Rough-In | 5 days | Mon 10/17/11 | Fri 10/21/11 |
| 191 | | Plumbing Rough-In | 5 days | Mon 10/24/11 | Fri 10/28/11 |
| 192 | | Electrical Rough-In | 5 days | Mon 10/31/11 | Fri 11/4/11 |
| 193 | | Core Drywall | 5 days | Mon 11/14/11 | Fri 11/18/11 |
| 194 | | MEP Fixtures and Trim | 6 days | Thu 1/12/12 | Thu 1/19/12 |
| 195 | | Electrical Trim Out | 6 days | Thu 1/12/12 | Thu 1/19/12 |
| 196 | | 11th Floor Finishes | 5 days | Fri 1/27/12 | Thu 2/2/12 |
| 197 | | **12th Floor Core Fitout** | 120 days | Fri 8/26/11 | Thu 2/9/12 |
| 198 | | Duct Distribution | 6 days | Fri 9/2/11 | Fri 9/9/11 |
| 199 | | Electrical Distribution | 5 days | Mon 9/12/11 | Fri 9/16/11 |
| 200 | | Sprinkler Distribution | 5 days | Mon 9/19/11 | Fri 9/23/11 |
| 201 | | Mechanical Rough-In | 5 days | Mon 10/24/11 | Fri 10/28/11 |
| 202 | | Plumbing Rough-In | 5 days | Mon 10/31/11 | Fri 11/4/11 |
| 203 | | Electrical Rough-In | 5 days | Mon 11/7/11 | Fri 11/11/11 |
| 204 | | Core Drywall | 6 days | Mon 11/21/11 | Mon 11/28/11 |
| 205 | | MEP Fixtures and Trim | 5 days | Fri 1/20/12 | Thu 1/26/12 |
| 206 | | Electrical Trim Out | 5 days | Fri 1/20/12 | Thu 1/26/12 |
| 207 | | 12th Floor Finishes | 5 days | Fri 2/3/12 | Thu 2/9/12 |
| 208 | | **13th Floor Core Fitout** | 121 days | Fri 9/2/11 | Fri 2/17/12 |
| 209 | | Duct Distribution | 5 days | Mon 9/12/11 | Fri 9/16/11 |
| 210 | | Electrical Distribution | 5 days | Mon 9/19/11 | Fri 9/23/11 |
| 211 | | Sprinkler Distribution | 5 days | Mon 9/26/11 | Fri 9/30/11 |
| 212 | | Mechanical Rough-In | 5 days | Mon 10/31/11 | Fri 11/4/11 |
| 213 | | Plumbing Rough-In | 5 days | Mon 11/7/11 | Fri 11/11/11 |
| 214 | | Electrical Rough-In | 5 days | Mon 11/14/11 | Fri 11/18/11 |
| 215 | | Core Drywall | 5 days | Tue 11/29/11 | Mon 12/5/11 |



Project: Office Building - G
Technical Assignment Two



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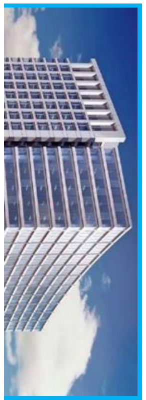

Dominic Coassolo
Construction Management
Dr. Robert Leicht

**Office Building - G**
**Eastern United States**
**Detailed Project Schedule**

| ID | ℹ | Task Name | Duration | Start | Finish |
|---|---|---|---|---|---|
| 216 | | MEP Fixtures and Trim | 5 days | Fri 1/27/12 | Thu 2/2/12 |
| 217 | | Electrical Trim Out | 5 days | Fri 1/27/12 | Thu 2/2/12 |
| 218 | | 13th Floor Finishes | 6 days | Fri 2/10/12 | Fri 2/17/12 |
| 219 | | **14th Floor Core Fitout** | 120 days | Mon 9/12/11 | Fri 2/24/12 |
| 220 | | Duct Distribution | 5 days | Mon 9/19/11 | Fri 9/23/11 |
| 221 | | Electrical Distribution | 5 days | Mon 9/26/11 | Fri 9/30/11 |
| 222 | | Sprinkler Distribution | 5 days | Mon 10/3/11 | Fri 10/7/11 |
| 223 | | Mechanical Rough-In | 5 days | Mon 11/7/11 | Fri 11/11/11 |
| 224 | | Plumbing Rough-In | 5 days | Mon 11/14/11 | Fri 11/18/11 |
| 225 | | Electrical Rough-In | 5 days | Mon 11/21/11 | Fri 11/25/11 |
| 226 | | Core Drywall | 5 days | Tue 12/6/11 | Mon 12/12/11 |
| 227 | | MEP Fixtures and Trim | 5 days | Fri 2/3/12 | Thu 2/9/12 |
| 228 | | Electrical Trim Out | 5 days | Fri 2/3/12 | Thu 2/9/12 |
| 229 | | 14th Floor Finishes | 5 days | Mon 2/20/12 | Fri 2/24/12 |
| 230 | | **Commissioning & Final Inspections** | 113 days | Mon 1/9/12 | Wed 6/13/12 |
| 231 | | **Tenant Fitout** | 193 days | Thu 10/27/11 | Mon 7/23/12 |
| 232 | | **Tenant Occupancy** | 0 days | Tue 6/12/12 | Tue 6/12/12 |
| 233 | | **Project Completion (Tenative Date)** | 0 days | Wed 9/12/12 | Wed 9/12/12 |
| 234 | | | | | |
| 235 | | | | | |
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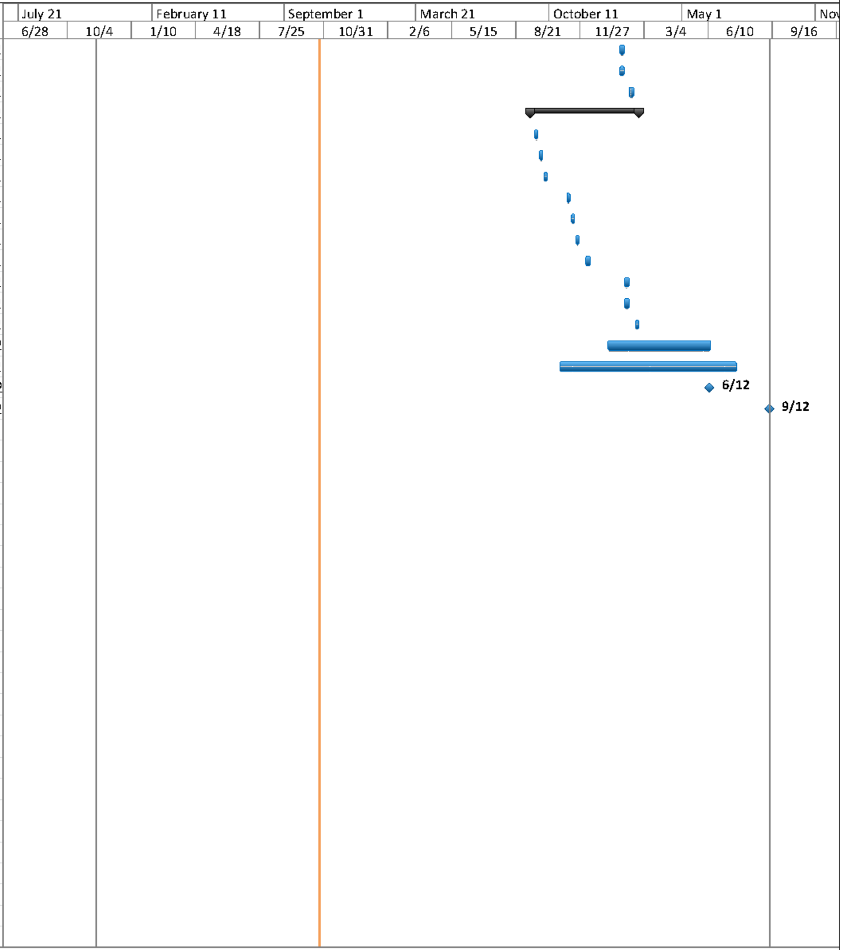
| 257 | | | | | |
| 258 | | | | | |

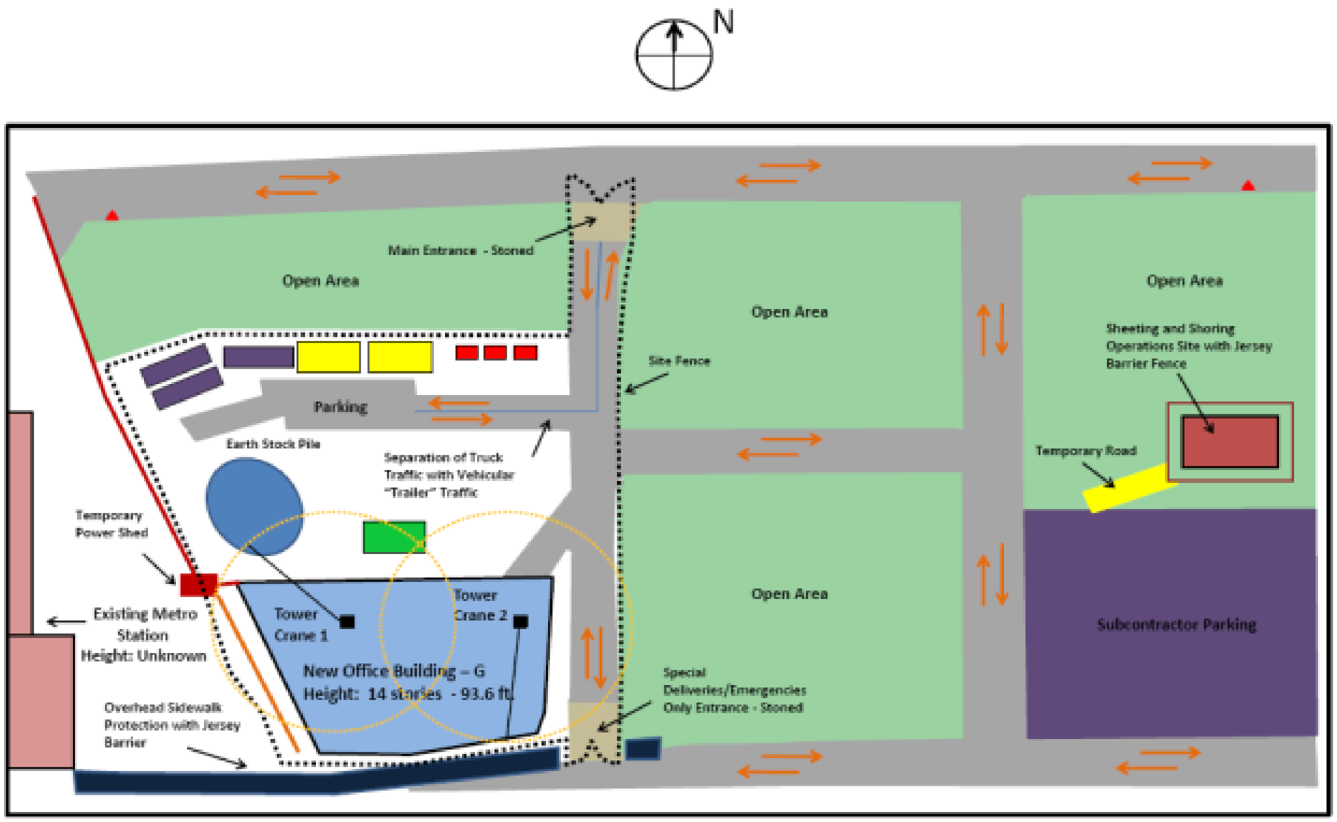


Project: Office Building - G
Technical Assignment Two

| | | | | |
|---|---|---|---|---|
| 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 | |

6

# APPENDIX B – SITE LAYOUT



**Scale**: 1" = 20'

NOTE:
Overhead Sidewalk
Protection for Pedestrian
Traffic

**LEGEND:**

🔺 Fire Hydrant
🟨 Turner Office Trailers
🟪 Subcontractor Office Trailers
⇄ Indicates 2-Way Traffic
— Main Utility Lines into Power Shed
— Tie Backs used for Excavation near Metro
🟥 Dumpsters & Toilets
🟩 Concrete Mixing Location

Office Building–G
Eastern USA

Site Layout Plan
Concrete Phase

Dominic Coassolo
Construction
Management

# APPENDIX C – STRUCTURAL SYSTEMS ESTIMATE

# Cast-In-Place Concrete

| **Columns** | | | | | |
|---|---|---|---|---|---|
| **Description** | **Description and Type** | **Type** | **Quantity** | **Total Length (feet)** | **Total Volume ($yd^3$)** |
| Concrete-Rectangular-Column | Concrete-Rectangular-Column: 10 x 24 | 10 x 24 | 4 | 36 | 2.24 |
| Concrete-Rectangular-Column | Concrete-Rectangular-Column: 12 x 24 | 12 x 24 | 27 | 778 | 57.43 |
| Concrete-Rectangular-Column | Concrete-Rectangular-Column: 18 x 24 | 18 x 24 | 1 | 33 | 3.7 |
| Concrete-Rectangular-Column | Concrete-Rectangular-Column: 18 x 30 | 18 x 30 | 17 | 511 | 71.29 |
| Concrete-Rectangular-Column | Concrete-Rectangular-Column: 24 x 30 | 24 x 30 | 1 | 159 | 29.38 |
| Concrete-Rectangular-Column | Concrete-Rectangular-Column: 24 x 32 | 24 x 32 | 26 | 2246 | 443.32 |
| Concrete-Round-Column | Concrete-Round-Column: 30" | 30 | 19 | 3032 | 551.2 |
| Concrete-Square-Column | Concrete-Square-Column: 12 x 12 | 12 x 12 | 4 | 0 | 0.04 |
| Concrete-Square-Column | Concrete-Square-Column: 18 x 18 | 18 x 18 | 8 | 24 | 2.04 |
| Concrete-Square-Column | Concrete-Square-Column: 24 x 24 | 24 x 24 | 135 | 7506 | 1109.78 |
| | | | | **Total Volume ($yd^3$)** | **2270.42** |

| **Beams and Girders** | | | | | |
|---|---|---|---|---|---|
| **Description** | **Description and Type** | **Type** | **Quantity** | **Total Length (feet)** | **Total Volume ($yd^3$)** |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 12 x 18 | 12 x 18 | 41 | 533 | 0.41 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 12 x 24 | 12 x 24 | 4 | 253 | 17.29 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 24 x 19 | 24 x 19 | 27 | 593 | 56.8 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 24 x 24 | 24 x 24 | 15 | 196 | 24.88 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 24 x 30 | 24 x 30 | 1 | 59 | 10 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 24 x 51 | 24 x 51 | 2 | 59 | 17 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 24 x 54 | 24 x 54 | 2 | 45 | 13.84 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 24 x 63 | 24 x 63 | 2 | 128 | 45.87 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 24 x 72 | 24 x 72 | 3 | 69 | 27.43 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 30 x 19 | 30 x 19 | 128 | 3771 | 274.74 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 30 x 30 | 30 x 30 | 37 | 652 | 106.65 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 36 x 30 | 36 x 30 | 9 | 181 | 46.75 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 48 x 18 | 48 x 18 | 339 | 13543 | 2665.84 |
| Concrete-Rectangular Beam | Concrete-Rectangular Beam: 8 x 18 | 8 x 18 | 13 | 147 | 5.09 |
| | | | | **Total Volume ($yd^3$)** | **3312.59** |

## Concrete Slabs

### Building

| Floor | Area (ft$^2$) | Slab Thickness (feet) | Volume (yd$^3$) |
|---|---|---|---|
| 1 | 26,733 | 12" = 1' | 990.11 |
| 2 | 26,733 | 7" = 0.5833' | 577.53 |
| 3 | 25,376 | 7" = 0.5833' | 548.22 |
| 4 | 25,376 | 7" = 0.5833' | 548.22 |
| 5 | 25,376 | 7" = 0.5833' | 548.22 |
| 6 | 25,376 | 7" = 0.5833' | 548.22 |
| 7 | 25,376 | 7" = 0.5833' | 548.22 |
| 8 | 25,376 | 7" = 0.5833' | 548.22 |
| 9 | 25,376 | 7" = 0.5833' | 548.22 |
| 10 | 25,376 | 7" = 0.5833' | 548.22 |
| 11 | 25,376 | 7" = 0.5833' | 548.22 |
| 12 | 25,376 | 7" = 0.5833' | 548.22 |
| 13 | 25,376 | 7" = 0.5833' | 548.22 |
| 14 | 24,828 | 7" = 0.5833' | 536.38 |
| | | **Total Volume (yd$^3$)** | **8134.44** |

### Garage

| Floor | Area (ft$^2$) | Slab Thickness (feet) | Volume (yd$^3$) |
|---|---|---|---|
| B1 | 36,137 | 8" = 0.6667' | 892.32 |
| B2 | 35,080 | 8" = 0.6667' | 866.22 |
| B3 | 35,080 | 8" = 0.6667' | 866.22 |
| B4 | 35,080 | 8" = 0.6667' | 866.22 |
| | | **Total Volume (yd$^3$)** | **3490.98** |

# Structural Steel

| **Columns** | | | | | |
|---|---|---|---|---|---|
| **Description** | **Description and Type** | **Type** | **Quantity** | **Total Length (feet)** | **Total (tons)** |
| HSS-Hollow Structural Section-Column | HSS-Hollow Structural Section-Column: HSS2X2X.500 | HSS2X2X.500 | 4 | 28 | 0.028 |
| HSS-Hollow Structural Section-Column | HSS-Hollow Structural Section-Column: HSS9X5X.625 | HSS9X5X.625 | 6 | 54 | 0.135 |
| | | | | **Total (tons)** | **0.163** |

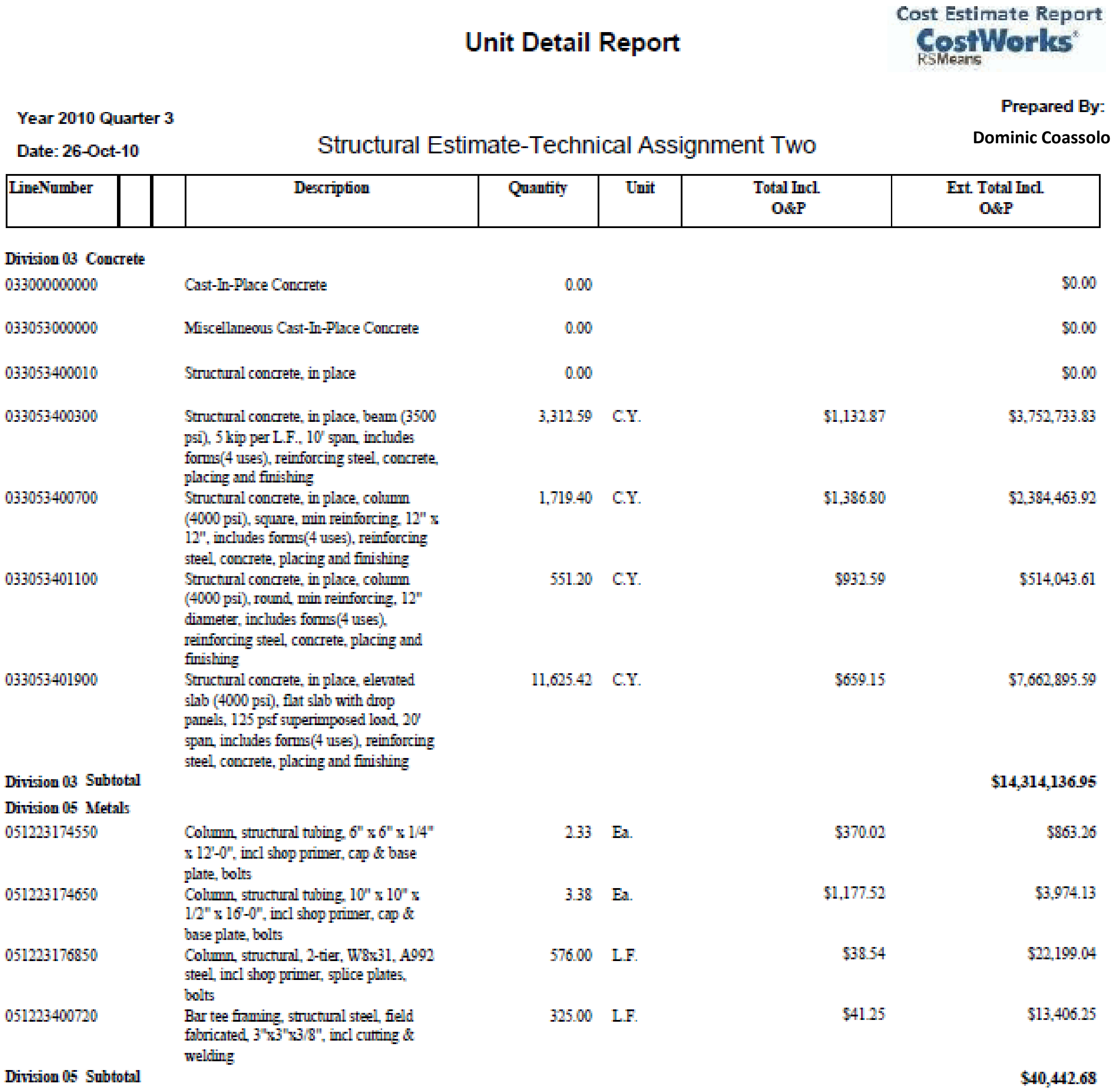
| **Beams** | | | | | |
|---|---|---|---|---|---|
| **Description** | **Description and Type** | **Type** | **Quantity** | **Total Length (feet)** | **Total (tons)** |
| S-American Standard | S-American Standard: S8x18.4 | S8x18.4 | 71 | 576 | 5.2992 |
| ST-Structural Tee | ST-Structural Tee: ST6X15.9 | ST6X15.9 | 25 | 325 | 2.5838 |
| | | | | **Total (tons)** | **7.883** |

# Total Take-Offs

| **Take Off Totals** | | |
|---|---|---|
| **Description** | **Quantity** | **Total** |
| | | |
| **Cast In Place Concrete** | | |
| Columns | 242 | 2270.42 yd$^3$ |
| Beams and Girders | 582 | 3312.59 yd$^3$ |
| Slabs | per floor | 11,625.42 yd$^3$ |
| | | |
| **Structural Steel** | | |
| Columns | 10 | 0.136 tons |
| Beams and Girders | 96 | 7.883 tons |

| **Totals:** | |
|---|---|
| Concrete | 17,208.43 yd$^3$ |
| Steel | 8.019 tons |

# RS Means Estimate



## Unit Detail Report

Cost Estimate Report CostWorks RSMeans

Year 2010 Quarter 3

Date: 26-Oct-10

Structural Estimate-Technical Assignment Two

Prepared By:
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| LineNumber | | | Description | Quantity | Unit | Total Incl. O&P | Ext. Total Incl. O&P |
|---|---|---|---|---|---|---|---|
| **Division 03 Concrete** | | | | | | | |
| 033000000000 | | | Cast-In-Place Concrete | 0.00 | | | $0.00 |
| 033053000000 | | | Miscellaneous Cast-In-Place Concrete | 0.00 | | | $0.00 |
| 033053400010 | | | Structural concrete, in place | 0.00 | | | $0.00 |
| 033053400300 | | | Structural concrete, in place, beam (3500 psi), 5 kip per L.F., 10' span, includes forms(4 uses), reinforcing steel, concrete, placing and finishing | 3,312.59 | C.Y. | $1,132.87 | $3,752,733.83 |
| 033053400700 | | | Structural concrete, in place, column (4000 psi), square, min reinforcing, 12" x 12", includes forms(4 uses), reinforcing steel, concrete, placing and finishing | 1,719.40 | C.Y. | $1,386.80 | $2,384,463.92 |
| 033053401100 | | | Structural concrete, in place, column (4000 psi), round, min reinforcing, 12" diameter, includes forms(4 uses), reinforcing steel, concrete, placing and finishing | 551.20 | C.Y. | $932.59 | $514,043.61 |
| 033053401900 | | | Structural concrete, in place, elevated slab (4000 psi), flat slab with drop panels, 125 psf superimposed load, 20' span, includes forms(4 uses), reinforcing steel, concrete, placing and finishing | 11,625.42 | C.Y. | $659.15 | $7,662,895.59 |
| **Division 03 Subtotal** | | | | | | | **$14,314,136.95** |
| **Division 05 Metals** | | | | | | | |
| 051223174550 | | | Column, structural tubing, 6" x 6" x 1/4" x 12'-0", incl shop primer, cap & base plate, bolts | 2.33 | Ea. | $370.02 | $863.26 |
| 051223174650 | | | Column, structural tubing, 10" x 10" x 1/2" x 16'-0", incl shop primer, cap & base plate, bolts | 3.38 | Ea. | $1,177.52 | $3,974.13 |
| 051223176850 | | | Column, structural, 2-tier, W8x31, A992 steel, incl shop primer, splice plates, bolts | 576.00 | L.F. | $38.54 | $22,199.04 |
| 051223400720 | | | Bar tee framing, structural steel, field fabricated, 3"x3"x3/8", incl cutting & welding | 325.00 | L.F. | $41.25 | $13,406.25 |
| **Division 05 Subtotal** | | | | | | | **$40,442.68** |

| **Estimate Totals:** | |
|---|---|
| **Concrete** | **$14,314,136.96** |
| **Steel** | **$40,442.68** |
| **Total** | **$14,354,579.64** |

# APPENDIX D – GENERAL CONDITIONS ESTIMATE

| PERSONNEL | | | | |
|---|---|---|---|---|
| **Description** | **Unit Rate** | **Unit** | **Quantity** | **Cost** |
| Project Manager | $ 2,000.00 | WEEK | 100 | $ 200,000.00 |
| Senior Superintendents | $ 7,550.00 | WEEK | 100 | $ 755,000.00 |
| Project Engineers | $ 10,000.00 | WEEK | 100 | $ 1,000,000.00 |
| Safety Managers | $ 2,171.25 | WEEK | 80 | $ 173,700.00 |
| Purchasing | $ 5,600.00 | WEEK | 20 | $ 112,000.00 |
| Project Estimator | $ 1,666.67 | WEEK | 30 | $ 50,000.00 |
| Project Accountant | $ 8,385.00 | WEEK | 20 | $ 167,700.00 |
| Project Management (VP and Senior Project Manager) | $ 1,380.00 | WEEK | 25 | $ 34,500.00 |
| | | | **TOTAL** | **$ 2,492,900.00** |

| FACILITIES AND EQUIPMENT | | | | |
|---|---|---|---|---|
| **Description** | **Unit Rate** | **Unit** | **Quantity** | **Cost** |
| Office Trailer Installation | $ 7,500.00 | LS | 1 | $ 7,500.00 |
| Office Trailer Rental | $ 1,740.00 | MONTH | 25 | $ 43,500.00 |
| Office Trailer Removal | $ 7,500.00 | LS | 1 | $ 7,500.00 |
| Telephone/Fax Service | $ 20.00 | LS | 3500 | $ 70,000.00 |
| Technology Fee | $ 20.00 | LS | 1550 | $ 31,000.00 |
| Computer Fee | $ 2,400.00 | MONTH | 25 | $ 60,000.00 |
| Office Supplies | $ 800.00 | MONTH | 25 | $ 20,000.00 |
| Office Printer/Copier | $ 1,600.00 | MONTH | 25 | $ 40,000.00 |
| | | | **TOTAL** | **$ 279,500.00** |

| TEMPORARY UTILITIES | | | | |
|---|---|---|---|---|
| **Description** | **Unit Rate** | **Unit** | **Quantity** | **Cost** |
| Temporary Power Installation | $ 1,000.00 | LS | 1 | $ 1,000.00 |
| Temporary Lighting and Power | $ 7,800.00 | MONTH | 25 | $ 195,000.00 |
| Toilet Installation/Removal | $ 10,000.00 | LS | 1 | $ 10,000.00 |
| Temporary Plumbing | $ 2,000.00 | LS | 17.5 | $ 35,000.00 |
| Temporary Toilets | $ 228.00 | MONTH | 22 | $ 5,000.00 |
| Potable Water | $ 500.00 | MONTH | 24 | $ 12,000.00 |
| | | | **TOTAL** | **$ 258,000.00** |

| **MISCELLANEOUS COSTS** | | | | |
|---|---|---|---|---|
| **Description** | **Unit Rate** | **Unit** | **Quantity** | **Cost** |
| Taxes/Insurance | $ 1,000,000.00 | LS | 1 | $ 1,000,000.00 |
| Travel Expenses | $ 4,000.00 | MONTH | 5.25 | $ 21,000.00 |
| Misc. General Expenses | $ 1,000.00 | MONTH | 24 | $ 24,000.00 |
| Postage/Mail Service | $ 456.00 | MONTH | 25 | $ 11,400.00 |
| Progress Photos | $ 400.00 | MONTH | 25 | $ 10,000.00 |
| Record Retention | $ 14,000.00 | LS | 1 | $ 14,000.00 |
| Office Cleaning | $ 500.00 | WEEK | 80 | $ 40,000.00 |
| Tools and Supplies | $ 880.00 | MONTH | 25 | $ 22,000.00 |
| Documents/Blueprints | $ 30,000.00 | LS | 1 | $ 30,000.00 |
| | | | **TOTAL** | **$ 1,172,400.00** |

| **GENERAL CONDITIONS SUMMARY** | | | | |
|---|---|---|---|---|
| **Description** | **Unit Rate** | **Unit** | **Quantity** | **Cost** |
| Personnel | $ 24,929.00 | WEEK | 100 | $ 2,492,900.00 |
| Facilities and Equipment | $ 2,795.00 | WEEK | 100 | $ 279,500.00 |
| Temporary Utilities | $ 2,580.00 | WEEK | 100 | $ 258,000.00 |
| Miscellaneous Equipment | $ 11,724.00 | WEEK | 100 | $ 1,172,400.00 |
| | | | **TOTAL** | **$ 4,202,800.00** |