October 27, 2010

Technical Assignment Two

Penn State AE Senior Thesis

UMBC
Performing Arts &
Humanities Facility
Baltimore, MD

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Executive Summary

Technical Assignment Two is intended to analyze the key features and factors that influence the project execution of the UMBC Performing Arts & Humanities Facility. This project includes a new 90,000 SF addition to the University of Maryland, Baltimore County campus. The largest challenge associated with this project is the complicated relationship between the site excavations, structural excavation, foundations and structural elements since there are certain areas that are isolated structurally causing a delay in the progress of adjacent work. Although this is a major barrier, the project must stay on time and must satisfy the owner's needs to produce a very high quality building.

The areas of investigation during this report include a detailed project schedule, site layout planning, an estimated structural systems estimate, and a general conditions estimate. Information concerning the phasing of the new construction is found within the detailed schedule which depicts the sequencing of trades throughout different areas of the building. Site layout plans are included to convey some of the proposed locations of major items on the site, and then compared to the actual layout given by the contractor. The detailed estimate cost performed on the steel structure is $1,663,091.98, which is approximately 3% of the overall project cost. This estimate considers the costs of material, labor, and equipment required to construct the superstructure. The resulting estimate, which includes some assumptions, is just a detail of one of the three structures used on this building and the cost is about 54% below the actual construction costs. A general conditions estimate is also included to show the projected costs for the staff, non-personnel expenses and the GMP contingency. At an amount of a little over $6 million, the general conditions accounts for approximately 9% of the total project cost. Finally a brief summary of the issues discussed during the 2010 PACE Roundtable is included referring to the "Critical Industry Issues".

After evaluating the information contained within this report and the last report, a few major topics will be considered for future thesis research. One topic will be directed towards a more sufficient structural system with not as many different structural members to possibly cut down the costs. Also, another topic which was discussed during the PACE Roundtable session that would be worthy of researching would be the different ways to utilize BIM on a project and make the project more efficient and again have better cost savings for the owner.

Detailed Project Schedule

**** SEE APPENDIX – A FOR THE DETAILED PROJECT SCHEDULE**

The Whiting-Turner Contracting Company was awarded the General Contracting responsibilities for the UMBC Performing Arts & Humanities Facility. The funding was approved in May 2010 followed by the Notice to Proceed in June 2010. These milestones are the beginning of the attached detailed project schedule in Appendix A.

UMBC Performing Arts & Humanities Facility Milestones	
Milestone	Date
Notice to Proceed	6/2/2010
Mobilization Approval	6/4/2010
Start Construction	7/2/2010
Proscenium Water Tight	5/4/2011
Black Box/BOH Water Tight	8/3/2011
Humanities Water Tight	8/17/2011
Mech Start up for finishes Humanities	8/19/2011
Mech Start up for finishes BB/Proscenium	10/1/2011
Project Completion	7/17/2012

Table 1: Project Milestones

In order to develop a detailed project schedule for the PAHF, it was important to establish some important dates and activities that needed to take place in order for the project to be completed. The projected completion date is July 17, 2012 and staying on schedule is important being that this is a campus and the traffic flow is a critical factor. Refer to Table 1 for a list of the important milestone dates found within the schedule.

Upon mobilization, construction activities began with installing temporary utilities, the excavation of the site including the demolition of the parking lots, and installing the excavation support systems. Following the excavation activities, the foundation activities will fall directly in line with the critical path. These activities include forming, reinforcing, and pouring all concrete walls and slabs within the basement of the building and also the tunnel that will tie into the new PAHF. The structure-to-grade is scheduled to start around December 2010. There is a complicated relationship between the site excavations, structural excavation, foundations and structural elements. There are multiple structural systems being used on this project. The different systems incorporated into this building are concrete structures, masonry bearing structures, structural steel, and some areas have a combination of all three. Certain areas are isolated structurally from adjacent areas and since there are varying depths of excavation and areas of structural foundation, this will cause a hold up in the progression of the adjacent foundation work. This process needs to be carefully organized to ensure that all trades are

performing the proper work at the right time. While work is taking place on the structure above grade, interior work below grade will be starting to take place such as MEP rough-ins and equipment installation. Shown below in Figure 1 is the building footprint which indicates the theater and some of the rooms that are located on the first level.

Figure 1: Building Footprint

The Proscenium Theatre shown on the right will be enclosed with aluminum composite metal panels and the Humanities area of the building, which includes classrooms, offices, etc., will be surrounded by brick veneer façade. The curtain wall installation will be following closely behind in the proper sequence of events. These enclosures will provide the entire facility with a water tight status in May of 2011 August of 2011, respectively. At the time the work is taking place outside to enclose the building, work inside will be progressing through the MEP rough-in stages. Once the structures have the water tight status, the finish work can begin, eventually leading to substantial completion of the project.

Site Layout Planning

**** SEE APPENDIX – B FOR THE SITE LAYOUT PLANS**

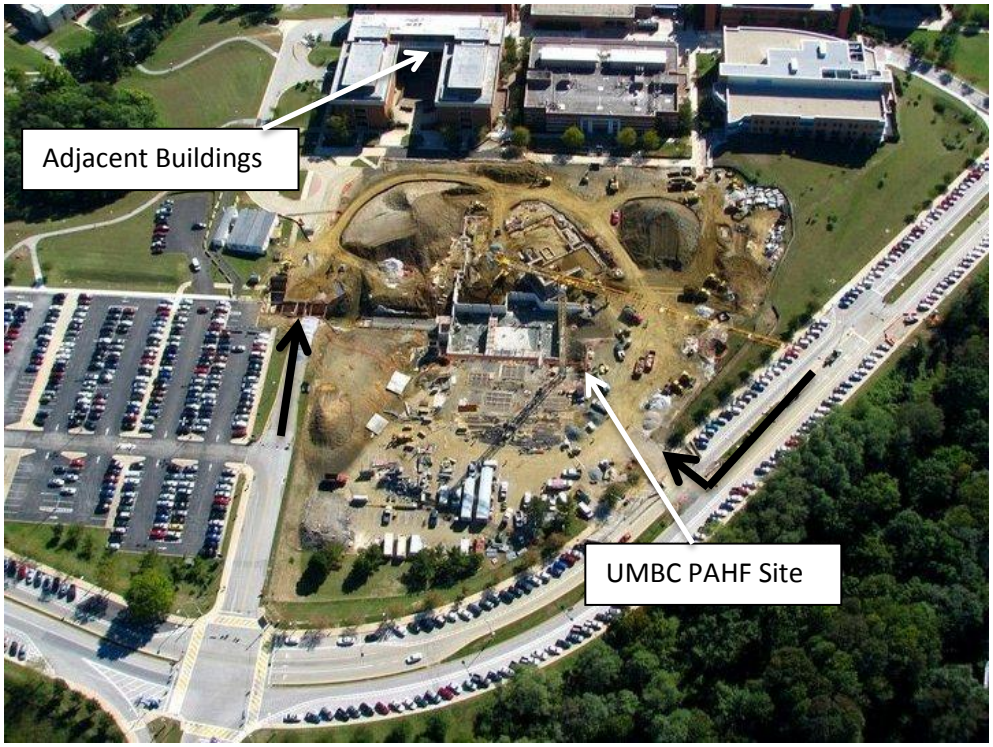


Figure 2: Aerial View of UMBC PAHF Construction Site

The site for the new Performing Arts & Humanities Facility is located on the campus of the University of Maryland, Baltimore County (UMBC). There is limited on-site parking for construction personnel and everyone else is required park of campus and then shuttle to the site. Based on the detailed schedule, the project consists of two major phases: Excavation and Superstructure.

Excavation

The excavation phase of UMBC's Performing Arts & Humanities Facility primarily consists of demolishing the existing parking lot, curbs, utilities, site lighting, railings, etc. before excavation can even begin. The soil that will be excavated for the foundation of the building will be kept in soil piles on site before it is hauled off to other locations, which can be found on the excavation site utilization plan in Appendix B. The project sits near the perimeter of the Hilltop Circle road and there are three adjacent buildings near the site.

A beam and lagging system is used for the structural excavation support of the basement and tunnel areas as well as for the installation of the underground rain water harvest tank. Other areas of excavation are standard cut and fill operations.

Superstructure

During the superstructure phase of the project, the site is more congested than any other point during construction. The concrete, steel, masonry, mechanical and electrical subcontractors are all present on site with field trailers and storage facilities. A 140' boom tower crane is stationed within the perimeter of the building footprint and will be utilized to construct the structure of the building and unload materials and equipment associated with the structure. There will also be specified crane paths for the crawler cranes on site shown in Appendix B.

Contractor Layout Critique

The layouts shown in Appendix B are similar to the actual layout/techniques utilized by the contractor. One of the main issues with the contractor layout plan, shown below in Figure 3, is that there is only one subcontractor trailer shown and not a lot of detail as to where anything else is located. This will lead to confusion and frustration when the site becomes increasingly messy with several different trades and not assigned a designation. Another criticism is that the contractor only created one general layout plan for the entire project duration. With all of the different phases and sequencing challenges associated with this schedule, relying on one site layout plan for the entire project presents a challenging and disorganized situation. Each of the site layout plans provided in Appendix B attempt to rectify some of these issues.

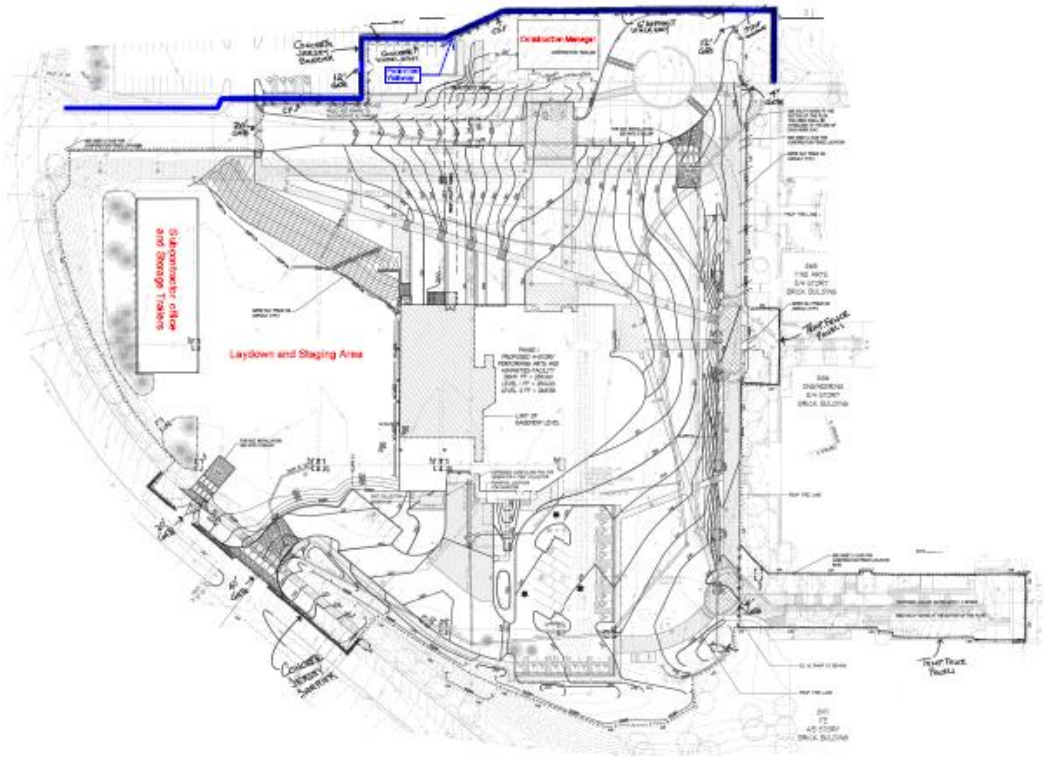


Figure 3: Contractor Site Layout Plan provided by Whiting Turner

Detailed Structural System Estimate

**** SEE APPENDIX – C FOR THE COMPLETE STRUCTURAL SYSTEM ESTIMATE**

The entire superstructure, supporting foundation, and lateral system for the Performing Arts & Humanities Facility consists of structural steel, cast-in-place concrete, and CMU masonry walls. This system is the largest item within the project and provides an area to investigate for potential cost savings. To start off this process, a detailed structural system estimate was performed on the structural steel based off of the structural drawings. The other systems mentioned are not estimated in detail but are available to view in Appendix C along with the detailed estimate.

The estimate includes columns, beams, and metal decking that is provided to make up the structural steel system. The overall tonnage of steel beam members is approximately 600 tons. When the estimate was completed, only certain beams were used because of the extensive amount of pages that would have been attached if all total beams were included. The estimated total cost of the columns, beams, and decking was $1,663,091.98 and the actual structural cost of everything is $3,055,000.00 which includes catwalks, bracing, supports, etc. that the detailed estimate did not include within it. So that resulted in about 54% of the structural steel cost is just columns, beams, and decking. Assumptions were made during the estimate because RS Means/Cost Works did not provide all the costs per specific beam/column so the higher value was chosen to accommodate for any error (i.e. pricing for a 12x18 member was used for a 12x16 member if pricing was not available for the 12x16). Being that estimating rebar within CIP concrete is rather difficult, a 10% factor was applied to the metal decking to incorporate all rebar ties and anchors not clearly shown on the drawings.

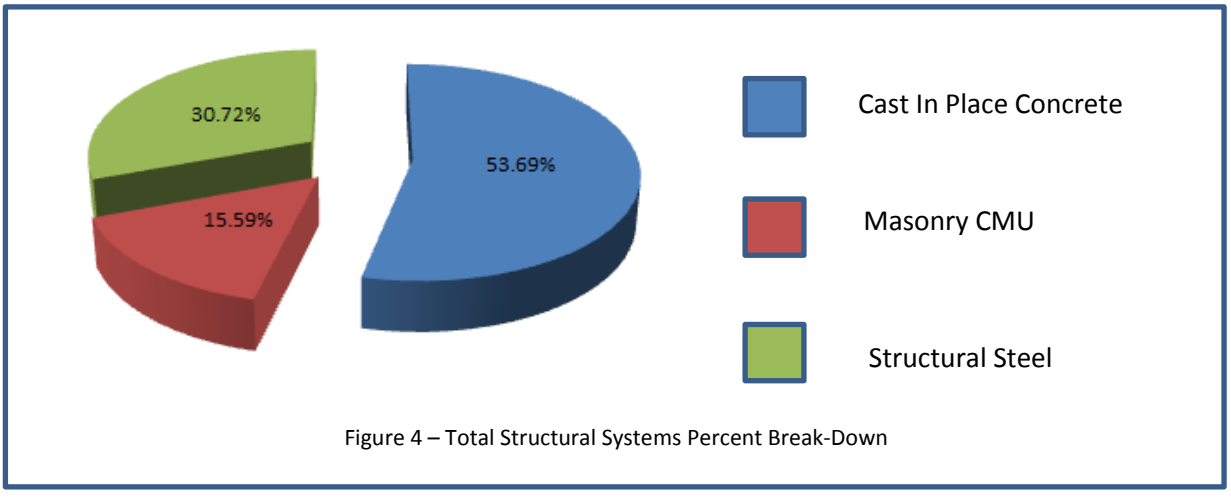


Figure 4 – Total Structural Systems Percent Break-Down

General Conditions Estimate

****SEE APPENDIX D FOR THE 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 UMBC Performing Arts & Humanities Facility. These numbers are an approximation between the cost data and the industry standards provided by The Whiting-Turner Contracting Company.

General Conditions Summary

Line Item	Quantity	Unit	Unit Cost	Cost
Staff Reimbursable	$20,928.92	Week	104	$2,176,608
Total Construction Phase Non-Personnel	$30,308.65	Week	104	$3,152,100
CM-GMP Contingency	$9,615.38	Week	104	$1,000,000
TOTAL CM REIMBURSABLE COSTS	$60,852.95	Week	104	$6,328,708

Table 2 – General Conditions Estimate Summary

The estimate was broken down into three categories: Staff Reimbursable, Non-Personnel, and CM-GMP Contingency. Staff Reimbursable includes the management and support staff for the project, such as the Project Managers, Superintendents, and Project Engineers. The Total Construction Phase Non-Personnel category incorporates items such as mobilization, temporary facilities, tools/equipment, safety, etc. Finally, the CM-GMP Contingency accounts for the GMP Contingency.

As shown below in Figure 5, the Non-Personnel costs account for nearly 50% of the general conditions estimate, which is evident given the amount of items listed under this line item. If these items were broken up into more categories, the Staff costs would be the largest. The overall general conditions amount of $6,328,708 is just over 9% of the total project cost of $67 million. Additionally, the 9% falls just below the industry average of 10% for general conditions.

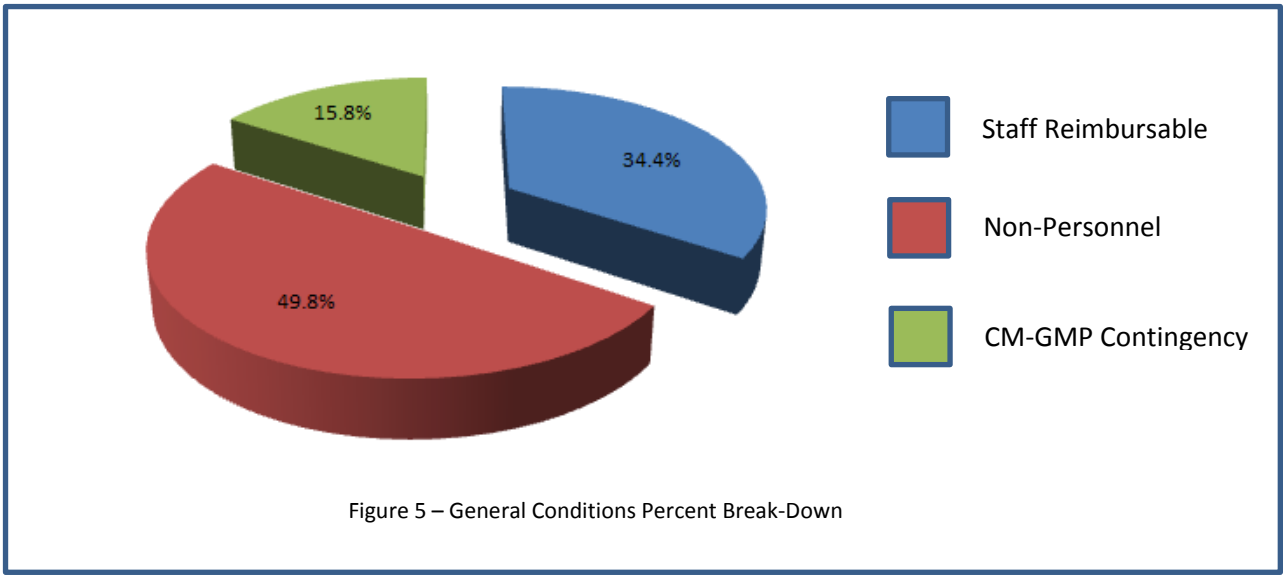


Figure 5 – General Conditions Percent Break-Down

Critical Industry Issues

The 19th Annual PACE Roundtable was held at The Pennsylvania State University at the Penn Stater Conference Hotel on October 27-28, 2010 with an overall theme of "Building a Collaboration Culture", attracting a large amount of students and industry professionals. Along with the discussions held by the students and industry, there were also break-out sessions that were attended:

- Industry Transformations: What are the innovations that will transform our industry?
- The Smart Grid: Energy impacts in the building industry.

During break-out session 1, the topic of discussion was *Transformations.* This session focused on technology and product innovation, process innovation, and from ideas to implementation. Some of the main topics discussed upon between industry leaders and students were BIM (Building Information Modeling), Prefabrication, Wireless Technology and LEED. BIM was a major topic of debate in this session which raised a lot of questions and comments about the overall use. Some questions were what are the benefits of BIM for the clients/owners and who benefits the most? How do we take a complex BIM model and simplify it for the owner/user? What training techniques should be implemented and who should be trained? Another big topic of discussion was going wireless in the field and in the office and how will people become accustomed to the new technology. A lot of people in the industry are used to paper copies of everything and doing everything by hand, but in today's construction business everything is 'Go Green' or 'wireless'. Technology everywhere is changing and new ideas are being brought up such as robots in the field that do layouts and using tablets for closeout and punchlist procedures. One thing that interested myself was the use of laser scans out in the field that can visually layout the room and show what it will look like in the future when the building is complete. It is like putting yourself in the BIM model so you can picture what the final product will be, such like a simulation model. BIM is definitely growing with all the new technology and methods being invented and is helping in the construction process by eliminating some time and risks that comes with difficult projects, even though some people don't seem to think so.

In the second break-out session, the topic of discussion was *Smart Grid Technology.* Since everything in the world is evolving and technology is growing, the use of energy and power and the knowledge of the subject matter is also increasing. Some of the topics discussed in this session were Power Generation, Advanced Metering, Cyber Security, Distributed Energy Generation, and Energy Efficiency and Controls. The most important topics relating to buildings are the power generation and the energy generation and efficiency. Innovative solar panels and wind turbines were discussed between the students and leaders as being able to help save money for the owner and anyone else involved. Solar, wind, and geothermal systems are just a few of the natural resources of energy that can be utilized to power parts of a building. Some of the ways to becoming more energy efficient in buildings is choosing when to use the energy and knowing how to control the different loads. Money can be saved by having control over the temperature in certain spaces and the lighting provided to each space. Also one should avoid phantom/vampire loads such as cell phone chargers and computers because they still draw power even

though they are completely turned off. In order to control when to use the energy, avoid using energy during peak load hours. For example, do laundry during the evening when it isn't during peak hours so it will be cheaper. One topic that caught my attention was the cyber security. We were told that if someone hacks into the smart grid system, they will know when someone is home or not just by looking at their energy levels. They will also be able to shut down the security system to a certain building/home by getting access to the system. All of this 'smart' energy is beneficial to the society and nature but if the access gets into the wrong hands then having all of this technology will not have such a great impact.

The main reason for the building of the UMBC Performing Arts & Humanities Facility was to provide students with more suitable room for their performing arts. While researching some of the topics discussed such as BIM, prefabrication and energy efficiency the overall project may benefit in cost, quality, and production. A form of BIM was implemented on this project but if possibly a simulation model was used or a laser scan, then some of the challenges on this project may be avoided. If the use of prefabrication was utilized, one major benefit is the decrease in labor time and the increase in production. This would result in an acceleration to the schedule time and an early finish on the project. The PAHF has a goal of achieving a LEED Silver Rating on this project which means that when designing this building, energy efficiency played a large role.

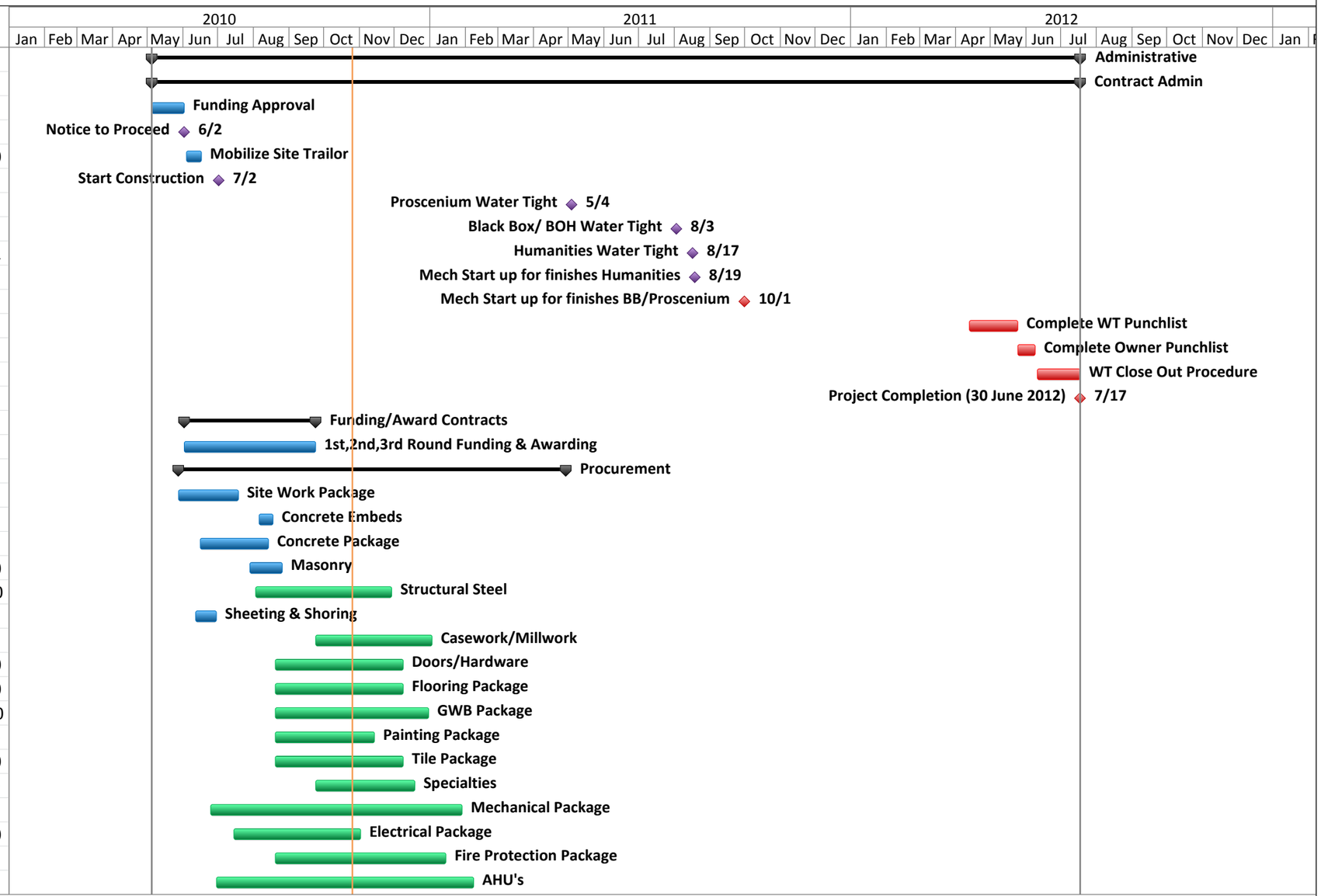
All of the industry professionals that attended the roundtable were very eager to provide insight on any of the issues pertaining to the current construction industry. Some of the attendees that were participating in the break-out sessions were John Bechtel with OPP, Chris Magent with Alexander Building Construction, Jason Reece with Balfour Beatty Construction, and many others. There are a variety of key contacts that were present at this roundtable from a lot of different companies that would provide useful information to all of us in pursuing research on the topics reviewed above.

APPENDIX A – Detailed Project Schedule

Courtney Glaub
Construction Management

Detailed Project Schedule - Tech 2
October 27, 2010

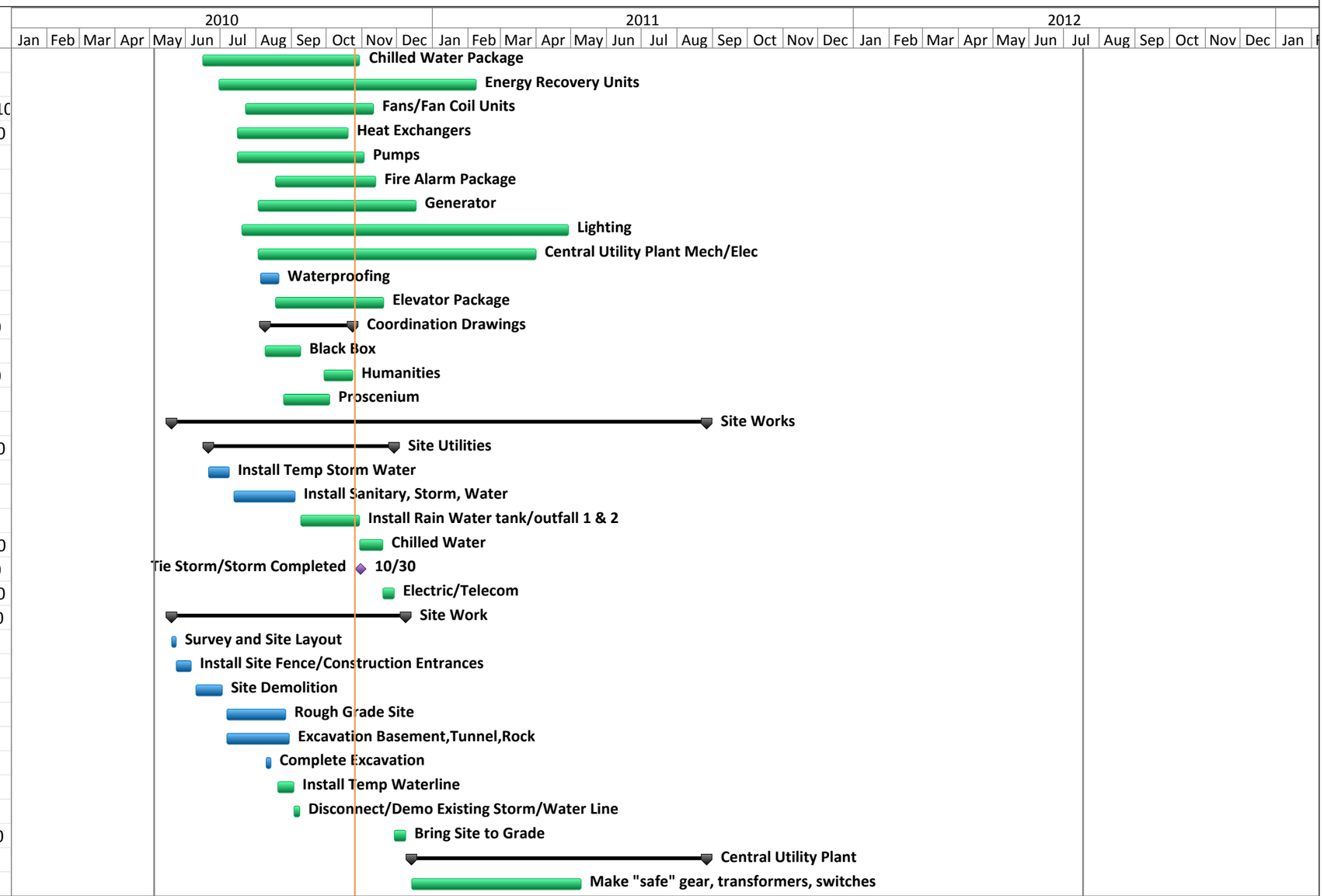
Task Name	Duration	Start	Finish
Administrative	575 days	Wed 5/5/10	Tue 7/17/12
Contract Admin	575 days	Wed 5/5/10	Tue 7/17/12
Funding Approval	20 days	Wed 5/5/10	Tue 6/1/10
Notice to Proceed	0 days	Wed 6/2/10	Wed 6/2/10
Mobilize Site Trailor	9 days	Fri 6/4/10	Wed 6/16/10
Start Construction	0 days	Fri 7/2/10	Fri 7/2/10
Proscenium Water Tight	0 days	Wed 5/4/11	Wed 5/4/11
Black Box/ BOH Water Tight	0 days	Wed 8/3/11	Wed 8/3/11
Humanities Water Tight	0 days	Wed 8/17/11	Wed 8/17/11
Mech Start up for finishes Humanities	0 days	Fri 8/19/11	Fri 8/19/11
Mech Start up for finishes BB/Proscenium	0 days	Sat 10/1/11	Sat 10/1/11
Complete WT Punchlist	30 days	Fri 4/13/12	Thu 5/24/12
Complete Owner Punchlist	11 days	Fri 5/25/12	Fri 6/8/12
WT Close Out Procedure	27 days	Mon 6/11/12	Tue 7/17/12
Project Completion (30 June 2012)	0 days	Tue 7/17/12	Tue 7/17/12
Funding/Award Contracts	82 days	Wed 6/2/10	Thu 9/23/10
1st,2nd,3rd Round Funding & Awarding	82 days	Wed 6/2/10	Thu 9/23/10
Procurement	240 days	Fri 5/28/10	Thu 4/28/11
Site Work Package	37 days	Fri 5/28/10	Sun 7/18/10
Concrete Embeds	8 days	Fri 8/6/10	Tue 8/17/10
Concrete Package	43 days	Wed 6/16/10	Fri 8/13/10
Masonry	20 days	Thu 7/29/10	Wed 8/25/10
Structural Steel	85 days	Tue 8/3/10	Sun 11/28/10
Sheeting & Shoring	13 days	Sat 6/12/10	Tue 6/29/10
Casework/Millwork	72 days	Fri 9/24/10	Sun 1/2/11
Doors/Hardware	79 days	Fri 8/20/10	Wed 12/8/10
Flooring Package	79 days	Fri 8/20/10	Wed 12/8/10
GWB Package	95 days	Fri 8/20/10	Thu 12/30/10
Painting Package	62 days	Fri 8/20/10	Sat 11/13/10
Tile Package	79 days	Fri 8/20/10	Wed 12/8/10
Specialties	62 days	Fri 9/24/10	Sat 12/18/10
Mechanical Package	156 days	Fri 6/25/10	Fri 1/28/11
Electrical Package	78 days	Thu 7/15/10	Mon 11/1/10
Fire Protection Package	106 days	Fri 8/20/10	Fri 1/14/11
AHU's	159 days	Wed 6/30/10	Mon 2/7/11



Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

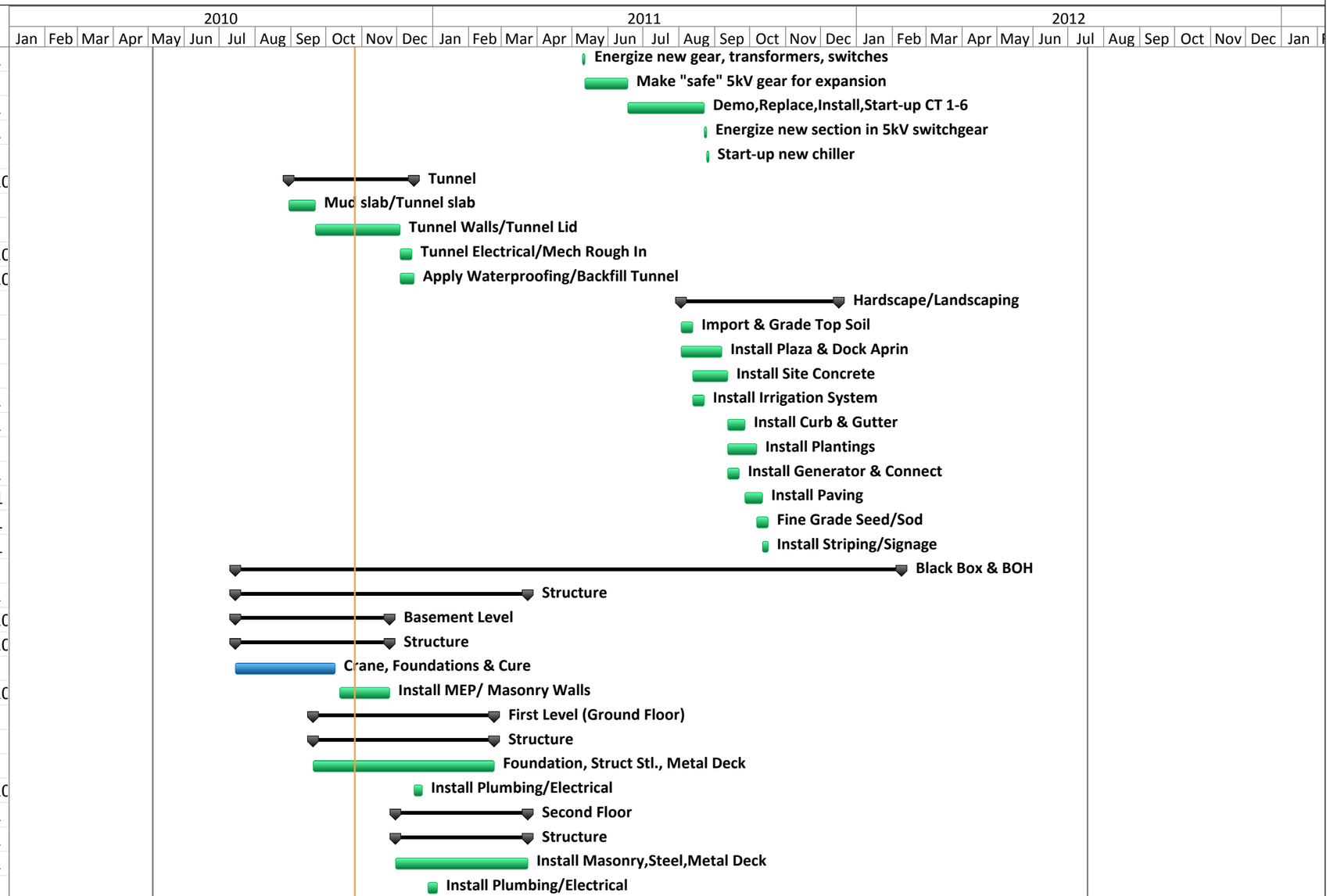
Task Name	Duration	Start	Finish
Chilled Water Package	98 days	Wed 6/16/10	Fri 10/29/10
Energy Recovery Units	159 days	Wed 6/30/10	Mon 2/7/11
Fans/Fan Coil Units	79 days	Fri 7/23/10	Wed 11/10/10
Heat Exchangers	68 days	Fri 7/16/10	Tue 10/19/10
Pumps	78 days	Fri 7/16/10	Tue 11/2/10
Fire Alarm Package	63 days	Wed 8/18/10	Fri 11/12/10
Generator	99 days	Tue 8/3/10	Fri 12/17/10
Lighting	203 days	Tue 7/20/10	Thu 4/28/11
Central Utility Plant Mech/Elec	173 days	Tue 8/3/10	Thu 3/31/11
Waterproofing	12 days	Thu 8/5/10	Fri 8/20/10
Elevator Package	68 days	Wed 8/18/10	Fri 11/19/10
Coordination Drawings	56 days	Mon 8/9/10	Sat 10/23/10
Black Box	23 days	Mon 8/9/10	Wed 9/8/10
Humanities	19 days	Wed 9/29/10	Sat 10/23/10
Proscenium	29 days	Wed 8/25/10	Sun 10/3/10
Site Works	332 days	Thu 5/20/10	Fri 8/26/11
Site Utilities	116 days	Mon 6/21/10	Sun 11/28/10
Install Temp Storm Water	14 days	Mon 6/21/10	Thu 7/8/10
Install Sanitary, Storm, Water	39 days	Tue 7/13/10	Fri 9/3/10
Install Rain Water tank/outfall 1 & 2	37 days	Thu 9/9/10	Fri 10/29/10
Chilled Water	15 days	Sat 10/30/10	Thu 11/18/10
Tie Storm/Storm Completed	0 days	Sat 10/30/10	Sat 10/30/10
Electric/Telecom	7 days	Fri 11/19/10	Sun 11/28/10
Site Work	145 days	Thu 5/20/10	Wed 12/8/10
Survey and Site Layout	3 days	Thu 5/20/10	Sun 5/23/10
Install Site Fence/Construction Entrances	11 days	Mon 5/24/10	Sat 6/5/10
Site Demolition	17 days	Thu 6/10/10	Fri 7/2/10
Rough Grade Site	37 days	Wed 7/7/10	Thu 8/26/10
Excavation Basement,Tunnel,Rock	39 days	Wed 7/7/10	Sun 8/29/10
Complete Excavation	4 days	Tue 8/10/10	Fri 8/13/10
Install Temp Waterline	10 days	Fri 8/20/10	Thu 9/2/10
Disconnect/Demo Existing Storm/Water Line	3 days	Fri 9/3/10	Tue 9/7/10
Bring Site to Grade	8 days	Mon 11/29/10	Wed 12/8/10
Central Utility Plant	184 days	Tue 12/14/10	Fri 8/26/11
Make "safe" gear, transformers, switches	105 days	Tue 12/14/10	Mon 5/9/11



Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

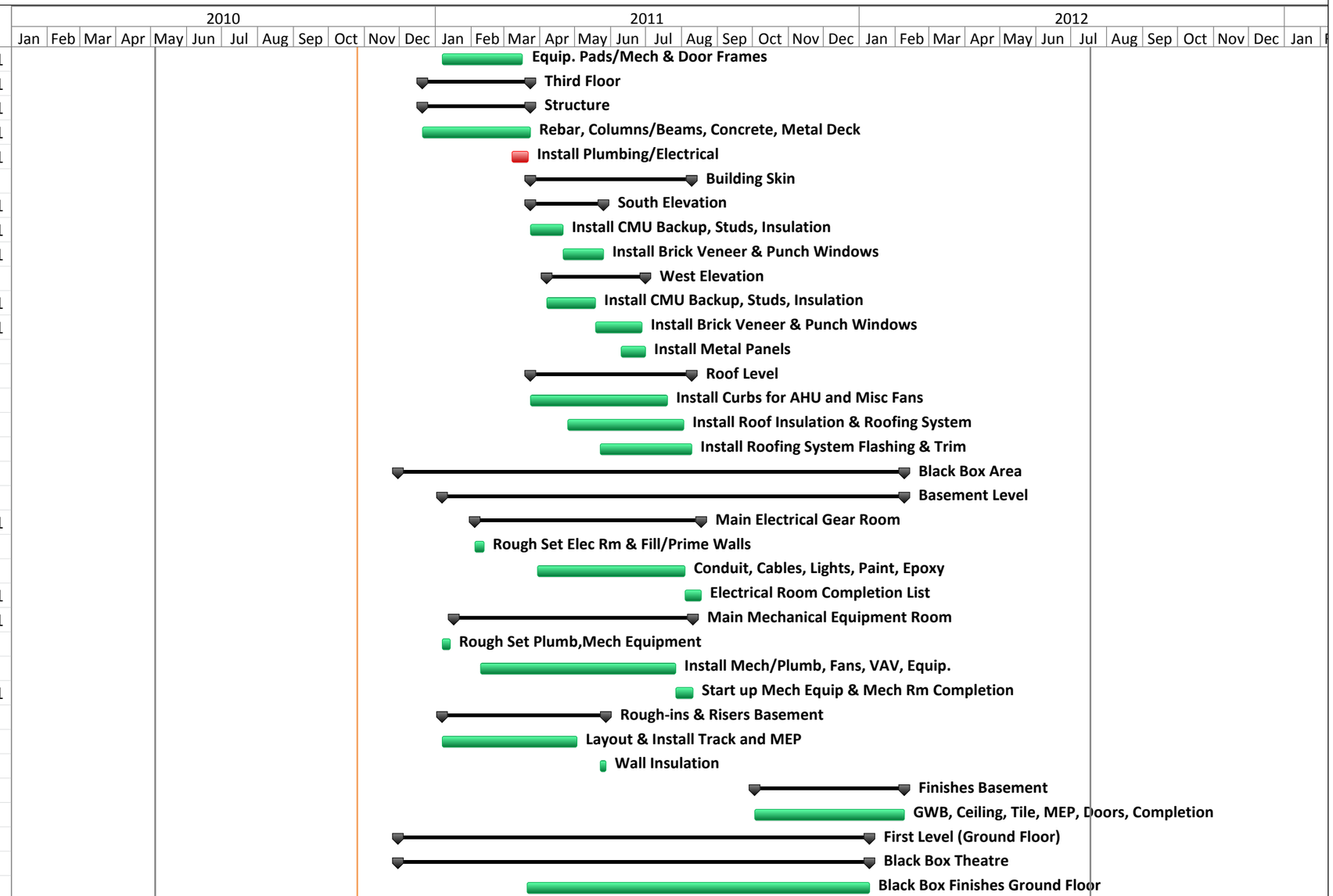
Task Name	Duration	Start	Finish
Energize new gear, transformers, switches	2 days	Tue 5/10/11	Wed 5/11/11
Make "safe" 5kV gear for expansion	27 days	Thu 5/12/11	Fri 6/17/11
Demo,Replace,Install,Start-up CT 1-6	47 days	Sat 6/18/11	Mon 8/22/11
Energize new section in 5kV switchgear	2 days	Tue 8/23/11	Wed 8/24/11
Start-up new chiller	2 days	Thu 8/25/11	Fri 8/26/11
Tunnel	78 days	Mon 8/30/10	Wed 12/15/10
Mud slab/Tunnel slab	17 days	Mon 8/30/10	Tue 9/21/10
Tunnel Walls/Tunnel Lid	53 days	Wed 9/22/10	Fri 12/3/10
Tunnel Electrical/Mech Rough In	7 days	Sat 12/4/10	Mon 12/13/10
Apply Waterproofing/Backfill Tunnel	9 days	Sat 12/4/10	Wed 12/15/10
Hardscape/Landscaping	98 days	Wed 8/3/11	Fri 12/16/11
Import & Grade Top Soil	8 days	Wed 8/3/11	Fri 8/12/11
Install Plaza & Dock Aprin	25 days	Wed 8/3/11	Tue 9/6/11
Install Site Concrete	22 days	Sat 8/13/11	Sun 9/11/11
Install Irrigation System	7 days	Sat 8/13/11	Mon 8/22/11
Install Curb & Gutter	11 days	Mon 9/12/11	Mon 9/26/11
Install Plantings	19 days	Mon 9/12/11	Thu 10/6/11
Install Generator & Connect	8 days	Mon 9/12/11	Wed 9/21/11
Install Paving	11 days	Tue 9/27/11	Tue 10/11/11
Fine Grade Seed/Sod	7 days	Fri 10/7/11	Sun 10/16/11
Install Striping/Signage	4 days	Wed 10/12/11	Sun 10/16/11
Black Box & BOH	410 days	Thu 7/15/10	Wed 2/8/12
Structure	180 days	Thu 7/15/10	Wed 3/23/11
Basement Level	95 days	Thu 7/15/10	Wed 11/24/10
Structure	95 days	Thu 7/15/10	Wed 11/24/10
Crane, Foundations & Cure	62 days	Thu 7/15/10	Fri 10/8/10
Install MEP/ Masonry Walls	31 days	Wed 10/13/10	Wed 11/24/10
First Level (Ground Floor)	112 days	Mon 9/20/10	Tue 2/22/11
Structure	112 days	Mon 9/20/10	Tue 2/22/11
Foundation, Struct Stl., Metal Deck	112 days	Mon 9/20/10	Tue 2/22/11
Install Plumbing/Electrical	5 days	Thu 12/16/10	Wed 12/22/10
Second Floor	82 days	Tue 11/30/10	Wed 3/23/11
Structure	82 days	Tue 11/30/10	Wed 3/23/11
Install Masonry,Steel,Metal Deck	82 days	Tue 11/30/10	Wed 3/23/11
Install Plumbing/Electrical	6 days	Tue 12/28/10	Tue 1/4/11



Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

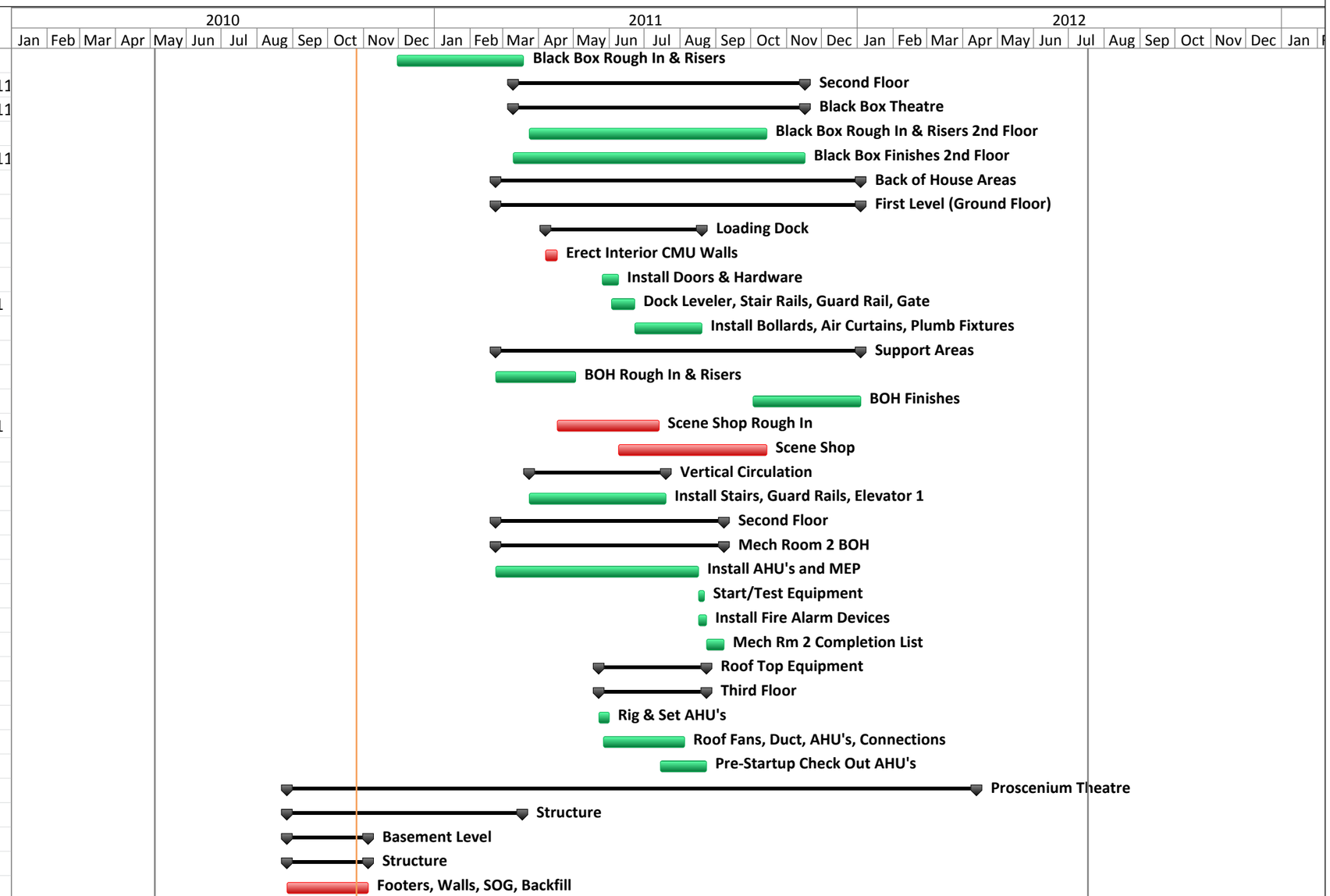
Task Name	Duration	Start	Finish
Equip. Pads/Mech & Door Frames	49 days	Fri 1/7/11	Wed 3/16/11
Third Floor	67 days	Tue 12/21/10	Wed 3/23/11
Structure	67 days	Tue 12/21/10	Wed 3/23/11
Rebar, Columns/Beams, Concrete, Metal Deck	67 days	Tue 12/21/10	Wed 3/23/11
Install Plumbing/Electrical	10 days	Tue 3/8/11	Mon 3/21/11
Building Skin	99 days	Thu 3/24/11	Tue 8/9/11
South Elevation	45 days	Thu 3/24/11	Wed 5/25/11
Install CMU Backup, Studs, Insulation	20 days	Thu 3/24/11	Wed 4/20/11
Install Brick Veneer & Punch Windows	25 days	Thu 4/21/11	Wed 5/25/11
West Elevation	61 days	Thu 4/7/11	Thu 6/30/11
Install CMU Backup, Studs, Insulation	30 days	Thu 4/7/11	Wed 5/18/11
Install Brick Veneer & Punch Windows	28 days	Thu 5/19/11	Mon 6/27/11
Install Metal Panels	15 days	Fri 6/10/11	Thu 6/30/11
Roof Level	99 days	Thu 3/24/11	Tue 8/9/11
Install Curbs for AHU and Misc Fans	84 days	Thu 3/24/11	Tue 7/19/11
Install Roof Insulation & Roofing System	72 days	Mon 4/25/11	Tue 8/2/11
Install Roofing System Flashing & Trim	57 days	Mon 5/23/11	Tue 8/9/11
Black Box Area	312 days	Tue 11/30/10	Wed 2/8/12
Basement Level	284 days	Fri 1/7/11	Wed 2/8/12
Main Electrical Gear Room	139 days	Fri 2/4/11	Wed 8/17/11
Rough Set Elec Rm & Fill/Prime Walls	6 days	Fri 2/4/11	Fri 2/11/11
Conduit, Cables, Lights, Paint, Epoxy	91 days	Wed 3/30/11	Wed 8/3/11
Electrical Room Completion List	10 days	Thu 8/4/11	Wed 8/17/11
Main Mechanical Equipment Room	148 days	Mon 1/17/11	Wed 8/10/11
Rough Set Plumb,Mech Equipment	5 days	Fri 1/7/11	Thu 1/13/11
Install Mech/Plumb, Fans, VAV, Equip.	120 days	Wed 2/9/11	Tue 7/26/11
Start up Mech Equip & Mech Rm Completion	11 days	Wed 7/27/11	Wed 8/10/11
Rough-ins & Risers Basement	101 days	Fri 1/7/11	Fri 5/27/11
Layout & Install Track and MEP	82 days	Fri 1/7/11	Mon 5/2/11
Wall Insulation	5 days	Mon 5/23/11	Fri 5/27/11
Finishes Basement	93 days	Mon 10/3/11	Wed 2/8/12
GWB, Ceiling, Tile, MEP, Doors, Completion	93 days	Mon 10/3/11	Wed 2/8/12
First Level (Ground Floor)	290 days	Tue 11/30/10	Mon 1/9/12
Black Box Theatre	290 days	Tue 11/30/10	Mon 1/9/12
Black Box Finishes Ground Floor	211 days	Mon 3/21/11	Mon 1/9/12



Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

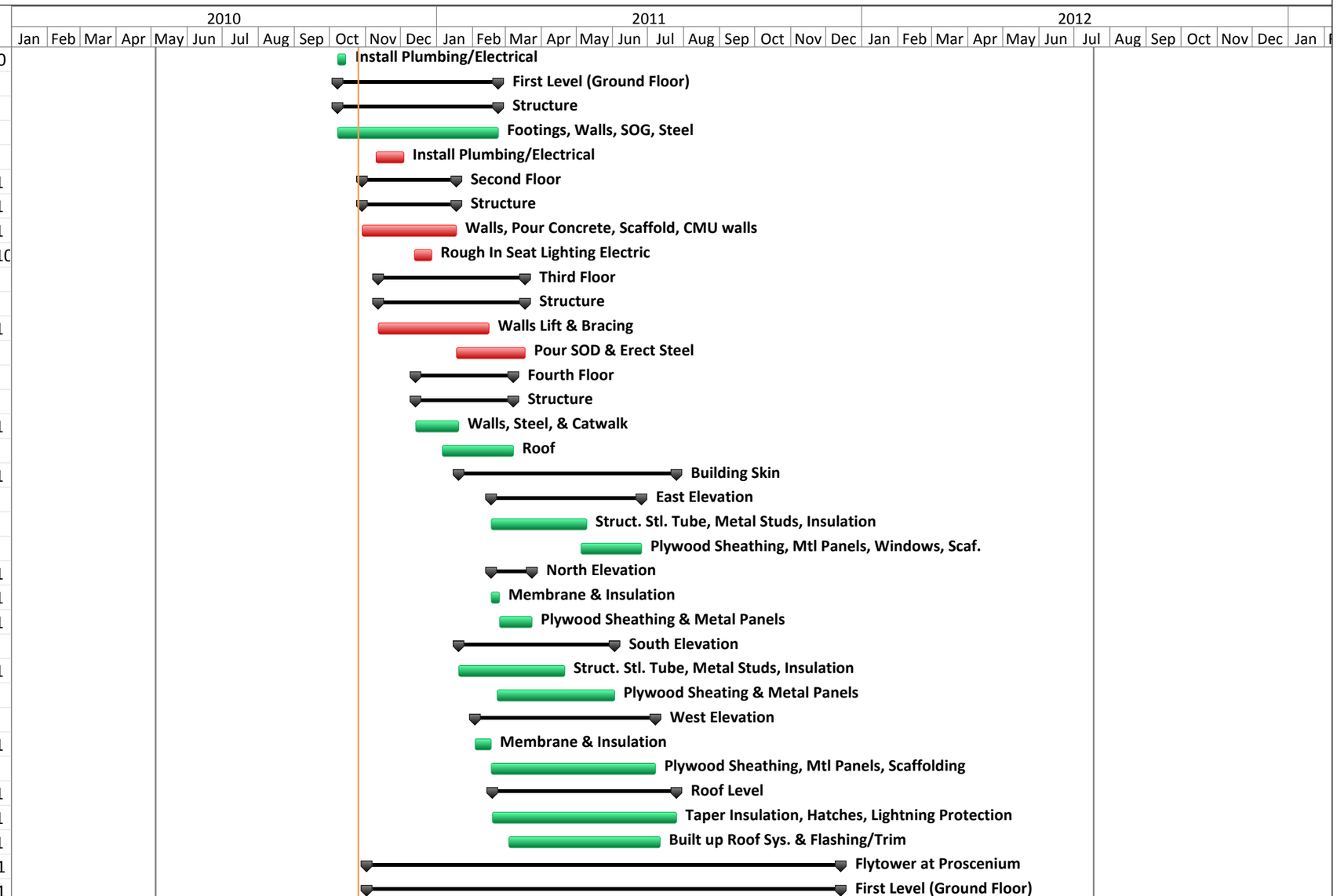
Task Name	Duration	Start	Finish
Black Box Rough In & Risers	79 days	Tue 11/30/10	Fri 3/18/11
Second Floor	180 days	Thu 3/10/11	Wed 11/16/11
Black Box Theatre	180 days	Thu 3/10/11	Wed 11/16/11
Black Box Rough In & Risers 2nd Floor	147 days	Thu 3/24/11	Fri 10/14/11
Black Box Finishes 2nd Floor	180 days	Thu 3/10/11	Wed 11/16/11
Back of House Areas	225 days	Wed 2/23/11	Tue 1/3/12
First Level (Ground Floor)	225 days	Wed 2/23/11	Tue 1/3/12
Loading Dock	97 days	Thu 4/7/11	Fri 8/19/11
Erect Interior CMU Walls	8 days	Thu 4/7/11	Sat 4/16/11
Install Doors & Hardware	10 days	Thu 5/26/11	Wed 6/8/11
Dock Leveler, Stair Rails, Guard Rail, Gate	14 days	Fri 6/3/11	Wed 6/22/11
Install Bollards, Air Curtains, Plumb Fixtures	42 days	Thu 6/23/11	Fri 8/19/11
Support Areas	225 days	Wed 2/23/11	Tue 1/3/12
BOH Rough In & Risers	49 days	Wed 2/23/11	Mon 5/2/11
BOH Finishes	67 days	Mon 10/3/11	Tue 1/3/12
Scene Shop Rough In	64 days	Sun 4/17/11	Wed 7/13/11
Scene Shop	92 days	Thu 6/9/11	Fri 10/14/11
Vertical Circulation	84 days	Thu 3/24/11	Tue 7/19/11
Install Stairs, Guard Rails, Elevator 1	84 days	Thu 3/24/11	Tue 7/19/11
Second Floor	141 days	Wed 2/23/11	Wed 9/7/11
Mech Room 2 BOH	141 days	Wed 2/23/11	Wed 9/7/11
Install AHU's and MEP	125 days	Wed 2/23/11	Tue 8/16/11
Start/Test Equipment	4 days	Wed 8/17/11	Sun 8/21/11
Install Fire Alarm Devices	5 days	Wed 8/17/11	Tue 8/23/11
Mech Rm 2 Completion List	11 days	Wed 8/24/11	Wed 9/7/11
Roof Top Equipment	67 days	Mon 5/23/11	Tue 8/23/11
Third Floor	67 days	Mon 5/23/11	Tue 8/23/11
Rig & Set AHU's	7 days	Mon 5/23/11	Tue 5/31/11
Roof Fans, Duct, AHU's, Connections	50 days	Fri 5/27/11	Thu 8/4/11
Pre-Startup Check Out AHU's	28 days	Fri 7/15/11	Tue 8/23/11
Proscenium Theatre	425 days	Fri 8/27/10	Thu 4/12/12
Structure	145 days	Fri 8/27/10	Thu 3/17/11
Basement Level	50 days	Fri 8/27/10	Thu 11/4/10
Structure	50 days	Fri 8/27/10	Thu 11/4/10
Footers, Walls, SOG, Backfill	50 days	Fri 8/27/10	Thu 11/4/10



Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

Task Name	Duration	Start	Finish
Install Plumbing/Electrical	5 days	Fri 10/8/10	Thu 10/14/10
First Level (Ground Floor)	98 days	Fri 10/8/10	Tue 2/22/11
Structure	98 days	Fri 10/8/10	Tue 2/22/11
Footings, Walls, SOG, Steel	98 days	Fri 10/8/10	Tue 2/22/11
Install Plumbing/Electrical	18 days	Wed 11/10/10	Fri 12/3/10
Second Floor	57 days	Fri 10/29/10	Mon 1/17/11
Structure	57 days	Fri 10/29/10	Mon 1/17/11
Walls, Pour Concrete, Scaffold, CMU walls	57 days	Fri 10/29/10	Mon 1/17/11
Rough In Seat Lighting Electric	11 days	Mon 12/13/10	Mon 12/27/10
Third Floor	90 days	Fri 11/12/10	Thu 3/17/11
Structure	90 days	Fri 11/12/10	Thu 3/17/11
Walls Lift & Bracing	67 days	Fri 11/12/10	Mon 2/14/11
Pour SOD & Erect Steel	43 days	Tue 1/18/11	Thu 3/17/11
Fourth Floor	60 days	Tue 12/14/10	Mon 3/7/11
Structure	60 days	Tue 12/14/10	Mon 3/7/11
Walls, Steel, & Catwalk	27 days	Tue 12/14/10	Wed 1/19/11
Roof	43 days	Thu 1/6/11	Mon 3/7/11
Building Skin	133 days	Thu 1/20/11	Mon 7/25/11
East Elevation	93 days	Thu 2/17/11	Sat 6/25/11
Struct. Stl. Tube, Metal Studs, Insulation	58 days	Thu 2/17/11	Mon 5/9/11
Plywood Sheathing, Mtl Panels, Windows, Scaf.	38 days	Thu 5/5/11	Sat 6/25/11
North Elevation	25 days	Thu 2/17/11	Wed 3/23/11
Membrane & Insulation	5 days	Thu 2/17/11	Wed 2/23/11
Plywood Sheathing & Metal Panels	20 days	Thu 2/24/11	Wed 3/23/11
South Elevation	96 days	Thu 1/20/11	Thu 6/2/11
Struct. Stl. Tube, Metal Studs, Insulation	65 days	Thu 1/20/11	Wed 4/20/11
Plywood Sheating & Metal Panels	73 days	Tue 2/22/11	Thu 6/2/11
West Elevation	111 days	Thu 2/3/11	Thu 7/7/11
Membrane & Insulation	10 days	Thu 2/3/11	Wed 2/16/11
Plywood Sheathing, Mtl Panels, Scaffolding	101 days	Thu 2/17/11	Thu 7/7/11
Roof Level	112 days	Fri 2/18/11	Mon 7/25/11
Taper Insulation, Hatches, Lightning Protection	112 days	Fri 2/18/11	Mon 7/25/11
Built up Roof Sys. & Flashing/Trim	92 days	Fri 3/4/11	Mon 7/11/11
Flytower at Proscenium	291 days	Tue 11/2/10	Tue 12/13/11
First Level (Ground Floor)	291 days	Tue 11/2/10	Tue 12/13/11



Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

Task Name	Duration	Start	Finish
Scaffolding, Lights, Door, Misc Metals	161 days	Tue 11/2/10	Tue 6/14/11
Paint, Flooring, Curtains, Punchlist	130 days	Wed 6/15/11	Tue 12/13/11
Second Floor	20 days	Mon 4/11/11	Fri 5/6/11
Large Duct & Sprinkler Rough In	15 days	Mon 4/11/11	Fri 4/29/11
Install Mtl Landing/Cage Ladder to L3	5 days	Mon 5/2/11	Fri 5/6/11
Third Floor	35 days	Mon 2/21/11	Fri 4/8/11
Stair Tower, Catwalk, Power/Lights, Sprinkler	16 days	Mon 2/21/11	Mon 3/14/11
Deck Grating, Mtl Stair, Rails, Scaffolding	15 days	Mon 3/21/11	Fri 4/8/11
Fourth Floor	30 days	Mon 1/10/11	Fri 2/18/11
Catwalk, Power/Light, Sprinkler	6 days	Mon 1/10/11	Mon 1/17/11
Deck Grating, Mtl Stair, Paint, Scaffolding	20 days	Mon 1/24/11	Fri 2/18/11
Fifth Floor	34 days	Tue 11/23/10	Fri 1/7/11
Frame Grid, Roof Drains, Deck Grating, Power	22 days	Tue 11/23/10	Wed 12/22/10
Sprinklers, Guard Rail, Paint, Scaffolding	22 days	Thu 12/9/10	Fri 1/7/11
Proscenium Theatre	288 days	Tue 3/8/11	Thu 4/12/12
First Level (Ground Floor)	288 days	Tue 3/8/11	Thu 4/12/12
Rehearsal Studio	244 days	Wed 4/20/11	Mon 3/26/12
Rehearsal Ground Floor Rough In & Risers	79 days	Wed 4/20/11	Mon 8/8/11
Rehearsal Ground Floor Finishes	126 days	Mon 10/3/11	Mon 3/26/12
Theatre House Tech Level	162 days	Wed 4/20/11	Thu 12/1/11
Rough In & Risers	74 days	Wed 4/20/11	Mon 8/1/11
Finishes	88 days	Tue 8/2/11	Thu 12/1/11
Theatre House Area Level 2	131 days	Fri 8/5/11	Fri 2/3/12
Finishes	131 days	Fri 8/5/11	Fri 2/3/12
Theatre House Area Level 1	190 days	Fri 7/22/11	Thu 4/12/12
Finishes	190 days	Fri 7/22/11	Thu 4/12/12
Vertical Circulation	20 days	Tue 3/8/11	Mon 4/4/11
Install Stair & Guard Rails	20 days	Tue 3/8/11	Mon 4/4/11
Humanities Class Rooms	362 days	Thu 10/21/10	Fri 3/9/12
Structure	82 days	Thu 10/21/10	Fri 2/11/11
Basement Level	38 days	Thu 10/21/10	Mon 12/13/10
Foundations, SOG, Plumb/Elec	38 days	Thu 10/21/10	Mon 12/13/10
First Level (Ground Floor)	18 days	Tue 12/14/10	Thu 1/6/11
Columns/Beams, Mtl Deck, Concrete	18 days	Tue 12/14/10	Thu 1/6/11
Install Plumbing/Electrical	6 days	Tue 12/28/10	Tue 1/4/11

Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

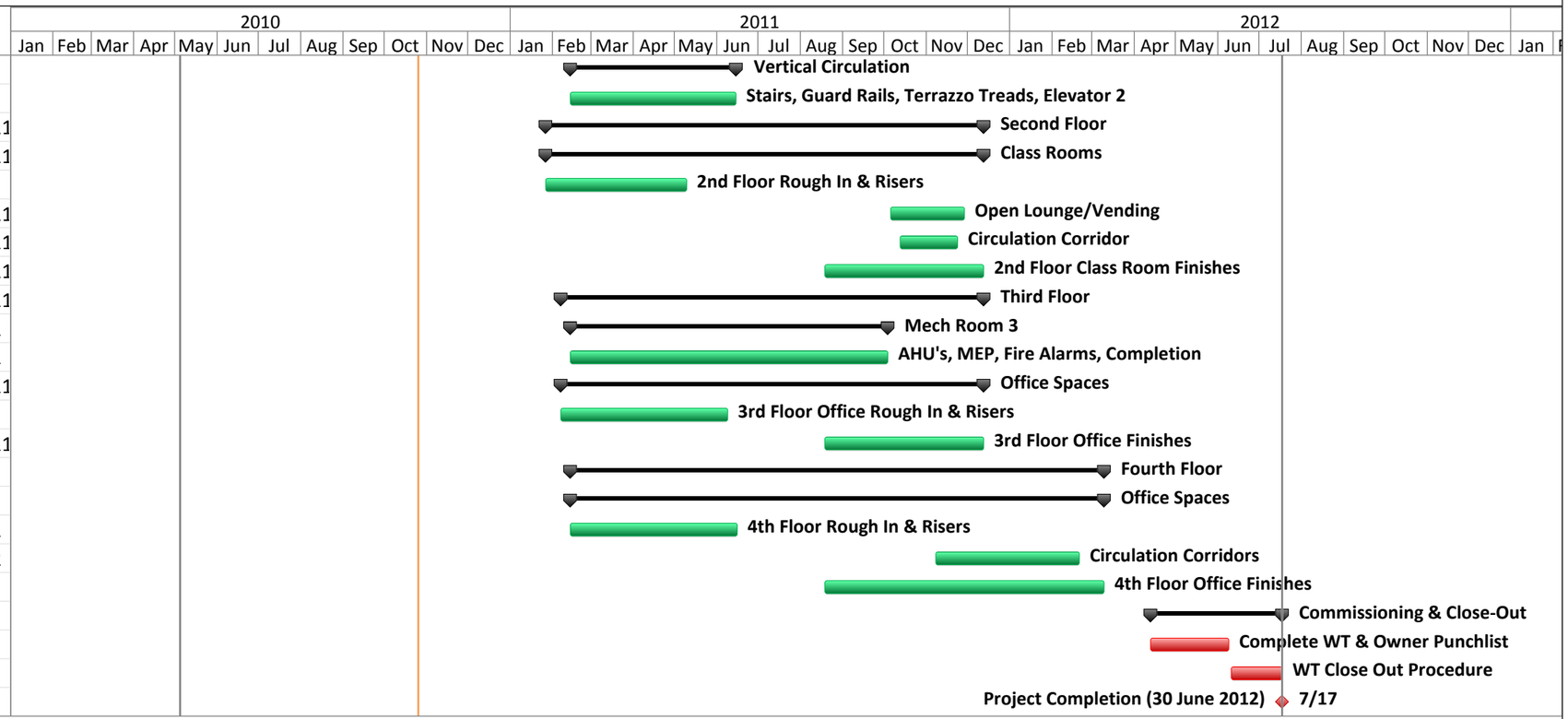
Early Bar | Milestone | Summary | Progress Bar | Critical Activity

Task Name	Duration	Start	Finish
Second Floor	20 days	Thu 12/23/10	Wed 1/19/11
Columns/Beams, Mtl Deck, Concrete	20 days	Thu 12/23/10	Wed 1/19/11
Install Plumbing/Electrical	5 days	Fri 1/7/11	Thu 1/13/11
Third Floor	18 days	Wed 1/5/11	Fri 1/28/11
Columns/Beams, Mtl Deck, Concrete	18 days	Wed 1/5/11	Fri 1/28/11
Install Plumbing/Electrical	5 days	Tue 1/18/11	Mon 1/24/11
Fourth Floor	16 days	Fri 1/14/11	Fri 2/4/11
Columns/Beams, Mtl Deck, Concrete	16 days	Fri 1/14/11	Fri 2/4/11
Install Plumbing/Electrical	5 days	Thu 1/27/11	Wed 2/2/11
Fifth Floor	14 days	Tue 1/25/11	Fri 2/11/11
Columns/Beams, Metal Deck	14 days	Tue 1/25/11	Fri 2/11/11
Building Skin	132 days	Mon 2/14/11	Tue 8/16/11
East Elevation	59 days	Mon 3/14/11	Thu 6/2/11
Metal Studs, Sheathing, Insulation	23 days	Mon 3/14/11	Wed 4/13/11
Brick Veneer, Punch Windows, Curtain Wall	36 days	Thu 4/14/11	Thu 6/2/11
North Elevation	91 days	Mon 2/14/11	Mon 6/20/11
Metal Studs, Sheathing, Insulation	30 days	Mon 2/14/11	Fri 3/25/11
Brick Veneer, Punch Windows, Curtain Wall	61 days	Mon 3/28/11	Mon 6/20/11
South Elevation	71 days	Mon 4/4/11	Mon 7/11/11
Metal Studs, Sheathing, Insulation	63 days	Mon 4/4/11	Wed 6/29/11
Brick Veneer, Punch Windows, Metal Panels	54 days	Wed 4/27/11	Mon 7/11/11
West Elevation	44 days	Thu 6/16/11	Tue 8/16/11
Metal Studs, Sheathing, Insulation	23 days	Thu 6/16/11	Mon 7/18/11
Brick Veneer, Mtl Panels, Windows, Curtain Wall	25 days	Wed 7/13/11	Tue 8/16/11
Roof Level	40 days	Mon 3/14/11	Fri 5/6/11
Roof Insulation, Built up Roof System	20 days	Mon 3/14/11	Fri 4/8/11
Flashing/Trim & Lightning Protection	20 days	Mon 4/11/11	Fri 5/6/11
Humanities Building	299 days	Tue 1/18/11	Fri 3/9/12
First Level (Ground Floor)	257 days	Tue 1/18/11	Wed 1/11/12
Class Rooms	257 days	Tue 1/18/11	Wed 1/11/12
Acting/Directing Studio	64 days	Fri 9/16/11	Wed 12/14/11
Ground Floor Rough Ins & Risers	72 days	Tue 1/18/11	Wed 4/27/11
Open Lounge/Vending	25 days	Thu 10/6/11	Wed 11/9/11
Circulation Corridor	54 days	Thu 10/13/11	Tue 12/27/11
Ground Floor Class Room Finishes	104 days	Fri 8/19/11	Wed 1/11/12

Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

Task Name	Duration	Start	Finish
Vertical Circulation	87 days	Mon 2/14/11	Tue 6/14/11
Stairs, Guard Rails, Terrazzo Treads, Elevator 2	87 days	Mon 2/14/11	Tue 6/14/11
Second Floor	228 days	Thu 1/27/11	Mon 12/12/11
Class Rooms	228 days	Thu 1/27/11	Mon 12/12/11
2nd Floor Rough In & Risers	73 days	Thu 1/27/11	Mon 5/9/11
Open Lounge/Vending	38 days	Thu 10/6/11	Mon 11/28/11
Circulation Corridor	30 days	Thu 10/13/11	Wed 11/23/11
2nd Floor Class Room Finishes	82 days	Fri 8/19/11	Mon 12/12/11
Third Floor	221 days	Mon 2/7/11	Mon 12/12/11
Mech Room 3	166 days	Mon 2/14/11	Mon 10/3/11
AHU's, MEP, Fire Alarms, Completion	166 days	Mon 2/14/11	Mon 10/3/11
Office Spaces	221 days	Mon 2/7/11	Mon 12/12/11
3rd Floor Office Rough In & Risers	88 days	Mon 2/7/11	Wed 6/8/11
3rd Floor Office Finishes	82 days	Fri 8/19/11	Mon 12/12/11
Fourth Floor	280 days	Mon 2/14/11	Fri 3/9/12
Office Spaces	280 days	Mon 2/14/11	Fri 3/9/12
4th Floor Rough In & Risers	88 days	Mon 2/14/11	Wed 6/15/11
Circulation Corridors	75 days	Tue 11/8/11	Mon 2/20/12
4th Floor Office Finishes	146 days	Fri 8/19/11	Fri 3/9/12
Commissioning & Close-Out	68 days	Fri 4/13/12	Tue 7/17/12
Complete WT & Owner Punchlist	41 days	Fri 4/13/12	Fri 6/8/12
WT Close Out Procedure	27 days	Mon 6/11/12	Tue 7/17/12
Project Completion (30 June 2012)	0 days	Tue 7/17/12	Tue 7/17/12



Project: DETAILED PROJECT SCHED
Date: Tue 10/26/10

Early Bar | Milestone | Summary | Progress Bar | Critical Activity

APPENDIX B – Site Layout Plans

LEGEND:

Existing Utilities

- Water
- Gas
- Storm Drain
- Sanitary
- Electric

Symbols

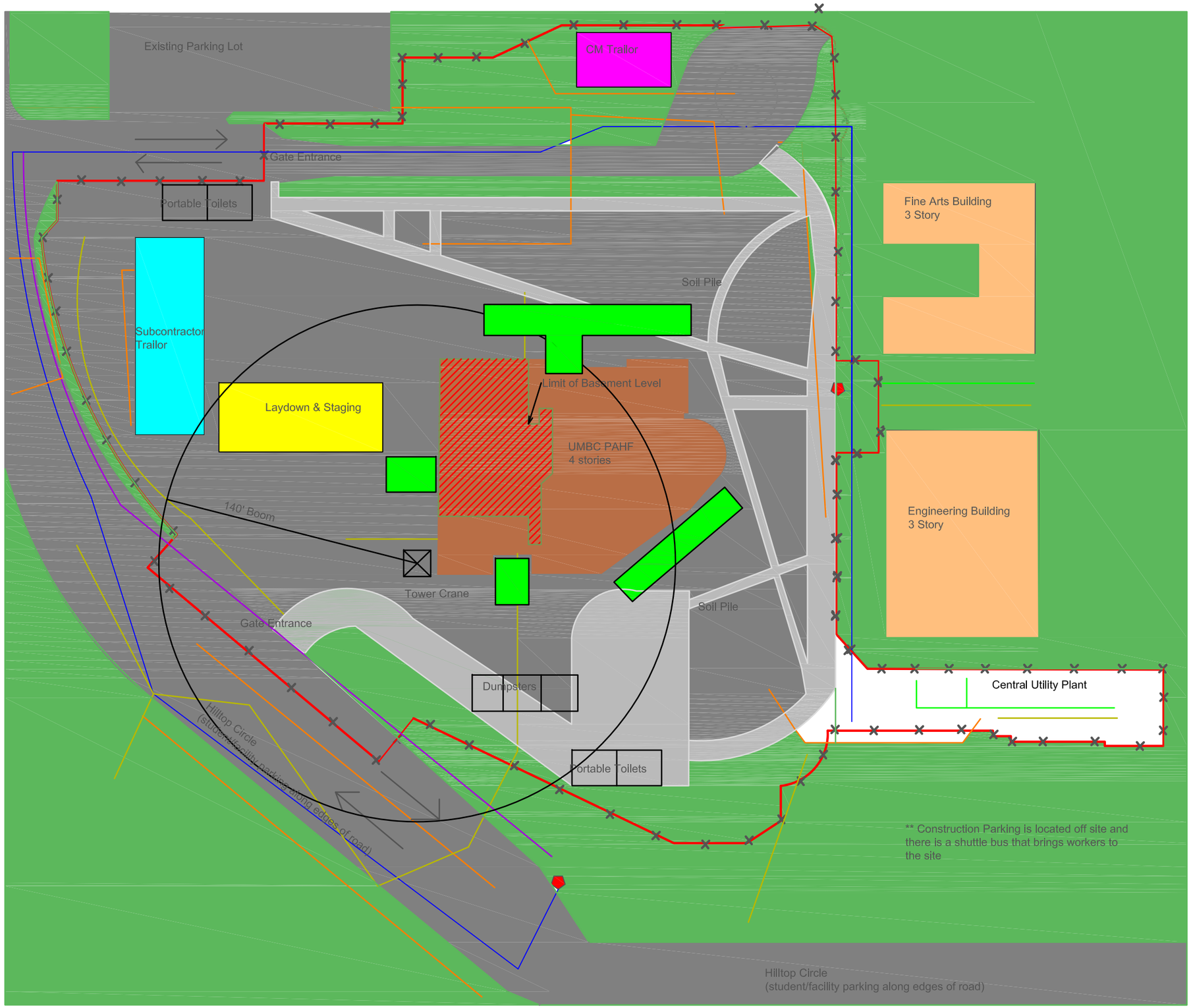
- Fire Hydrant
- Vehicular Traffic
- Construction Fence

UMBC
Performing Arts & Humanities Facility

Site Utilization Plan
Excavation

October 27, 2010

Courtney Glaub - CM



LEGEND:

Existing Utilities

- Water
- Gas
- Storm Drain
- Sanitary
- Electric

Symbols

- Fire Hydrant
- Vehicular Traffic
- Construction Fence

Crane Paths

UMBC
Performing Arts & Humanities
Facility

Site Utilization Plan
Structure

October 27, 2010

Courtney Glaub - CM

APPENDIX C – Detailed Structural Systems Estimate

Structural Steel Estimate Take-Off Charts						
Columns						
ID	Type	Length (ft)	# of 16' Sections	Quantity	Total Sections	Total (ft)
BA-100	HSS10x10x5/16	31	2	1	2	32
BA-103	W12x40	31	-	1	0	31
BA-106	W12x40	31	-	1	0	31
BA-111	W12x58	31	-	1	0	31
BA-123	W12x53	31	-	1	0	31
BB-100	HSS10x10x5/16	31	2	1	2	32
BB-106	W12x40	31	-	1	0	31
BB-110	W12x40	31	-	1	0	31
BC.1-100	HSS10x14x5/8	31	2	1	2	32
BC.1-106	W12x72	31	-	1	0	31
BC.2-110	W12x65	31	-	1	0	31
BC.7-106	W12x40	31	-	1	0	31
BD-100	HSS10x10x5/16	31	2	1	2	32
BD-102	W12x40	46	-	1	46	46
BD-106	W12x45	46	-	1	46	46
BD-108	W12x53	46	-	1	46	46
BE-108	W12x50	46	-	1	46	46
BE-109	W12x40	46	-	1	46	46
BE.4-102	W12x40	15	-	1	15	15
BE.4-105	W12x40	15	-	1	15	15
BF-108	W12x50	46	-	1	46	46
BF-109	W12x40	46	-	1	46	46
BF-112	W12x72	31	-	1	31	31
BF-115	W12x58	31	-	1	31	31
BF.7-109	W12x50	72	-	1	72	72
BF.7-112	W12x96	57	-	1	57	57
BG-102	W12x53	15	-	1	15	15
BG-105	W12x50	15	-	1	15	15
BH-114.8	HSS14x14x5/8	14.5	1	1	1	16
	HSS10x10x1/2	30.5	2	1	2	32
BH-116	HSS10x10x1/2	45	3	1	45	48
BH-117	HSS10x10x1/2	45	3	1	45	48
BH-119	W12x40	12	-	1	12	12
BH-120	HSS10x10x3/8	57	4	1	4	64
BH-122	HSS10x14x5/8	57	4	1	4	64
BH.1-100	HSS10x10x5/16	42.5	3	1	3	48
BH.1-101	W12x65	72	-	1	72	72
BH.1-104	W12x53	72	-	1	72	72

BH.1-108	W12x72	72	-	1	72	72
BH.1-109	W12x65	57	-	1	57	72
BH.1-112	HSS10x10x5/8	57	4	1	4	64
BH.1-115	W12x40	12	-	1		12
BH.2-116	W12x40	12	-	1		12
BH.6-122	HSS10x14x5/8	57	4	1		64
BH.2-117	W12x40	12	-	1		12
BJ-114	W12x40	12	-	1		12
BJ-115	W12x40	12	-	1		12
BJ-116.3	W12x40	26	-	1		12
BJ-117	W12x40	26	-	1		12
BJ-119	W12x53	57	-	1		12
BJ-122	HSS20x12x5/8	57	4	1		64
BJ.1-100	HSS10x10x5/8	42.5	3	1		48
BJ.1-101	W12x79	72	-	1		72
BJ.1-104	W12x58	72	-	1		72
BJ.1-107	W12x53	72	-	1		72
BJ.1-109	W12x65	31	-	1		31
BJ.1-114	W12x58	31	-	1		31
BJ.1-115	W12x53	31	-	1		31
BJ.7-122	HSS20x8x5/8	57	4	1		64
BK-116	HSS12x12x5/8	31	2	1		32
BK-117	HSS12x12x5/8	31	2	1		32
BL-100	HSS10x10x5/16	42.5	3	1		48
BL-101	W12x50	42.5	-	1		42.5
BL-104	W12x40	42.5	-	1		42.5
BL-107	W12x40	42.5	-	1		42.5
BL-109	W12x40	42.5	-	1		42.5
BL-114	W12x40	31	-	1		31
BL-115	W12x53	57	-	1		57
BL-116	W12x40	26	-	1		26
BL-117	W12x40	26	-	1		26
BL-119	W12x65	57	-	1		57
BL-121	W12x72	57	-	1		57
BL-122	HSS14x10x5/8	57	4	1		64
BN-124	W12x40	31	-	1		31
BN-125	HSS12x12x1/2	57	4	1		64
BN-126	W12x40	14.5	-	1		14.5
BN-126.9	W12x40	14.5	-	1		14.5
BN.1-127.7	W12x40	14.5	-	1		14.5
BN.2-129	W12x40	45	-	1		45

BN.3-131	W12x40	45	-	1		45
BN.4-132	W12x72	45	-	1		45
BN.6-133	W12x79	45	-	1		45
BN.8-123.4	W12x40	14.5	-	1		14.5
BN.8-124	W12x40	31	-	1		31
BP-132	W12x72	45	-	1		45
BP-135	W12x72	45	-	1		45
BQ-132	W12x72	45	-	1		45
BQ-137	W12x72	45	-	1		45
BR-132	W12x72	45	-	1		45
BR-137.1	W12x72	45	-	1		45
BR.1-123	W12x65	31	-	1		31
BR.1-123.4	W12x53	31	-	1		31
BR.1-124	W12x96	31	-	1		31
BR.4-132	W12x72	45	-	1		45
BR.4-136	W12x72	45	-	1		45
BR.7-132	W12x72	45	-	1		45
BR.7-134	W12x72	45	-	1		45
BS-123.4	W12x53	31	-	1		31
BS-124	W12x72	31	-	1		31
BS.1-134.1	HSS8x8x5/16	14.5	1	1		16
BT-117	W12x72	57	-	1		57
BT-127	W12x58	45	-	1		45
BT-132	W12x50	45	-	1		45
BU-124	W12x65	45	-	1		45
BU-126	W12x65	45	-	1		45
BU-127	W12x87	45	-	1		45

Beams					
ID	Type	Unit	Length (LF)	Quantity	Total (LF)
Sequence 1	W21x44	LF	17	1	17
Sequence 1	W18x40	LF	22	1	22
Sequence 1	W18x40	LF	19	1	19
Sequence 1	W18x40	LF	15	1	15
Sequence 1	W18x40	LF	7	1	7
Sequence 1	W18x35	LF	25	1	25
Sequence 1	W18x35	LF	22	1	22
Sequence 1	W18x35	LF	17	1	17
Sequence 1	W16x36	LF	16	1	16
Sequence 1	W16x31	LF	15	2	30
Sequence 1	W16x31	LF	10	2	20
Sequence 1	W16x31	LF	7	1	7
Sequence 1	W16x26	LF	25	1	25
Sequence 1	W16x26	LF	19	1	19
Sequence 1	W16x26	LF	16	6	96
Sequence 1	W16x26	LF	15	1	15
Sequence 1	W14x22	LF	25	1	25
Sequence 1	W12x53	LF	15	1	15
Sequence 1	W12x50	LF	15	1	15
Sequence 1	W12x40	LF	15	2	30
Sequence 1	W12x19	LF	22.5	1	22.5
Sequence 1	W12x16	LF	22	3	66
Sequence 1	W12x16	LF	21.5	1	21.5
Sequence 1	W12x16	LF	17	1	17
Sequence 1	W12x16	LF	15	1	15
Sequence 1	W12x16	LF	12	1	12
Sequence 1	W12x14	LF	22	2	44
Sequence 1	W12x14	LF	21.5	5	107.5
Sequence 1	W12x14	LF	17	1	17
Sequence 1	W12x14	LF	15	1	15
Sequence 1	W10x12	LF	17	1	17
Sequence 1	W10x12	LF	15	1	15
Sequence 1	W10x12	LF	12	2	24
Sequence 1	W10x12	LF	11	1	11
Sequence 1	W10x12	LF	9	11	99
Sequence 1	W10x12	LF	8	6	48
Sequence 1	W10x12	LF	7.5	4	30
Sequence 1	W10x12	LF	7	3	21
Sequence 1	W10x12	LF	6.5	1	6.5

Sequence 1	W10x12	LF	6	11	66
Sequence 1	W10x12	LF	5.5	1	5.5
Sequence 1	HSS4x4x1/4	LF	8.5	9	76.5
Sequence 1	HSS4x4x1/4	LF	8	3	24
Sequence 1	HSS4x4x1/4	LF	5.5	1	5.5
Metal Deck					
ID	Type	Unit	Area	Waste Factor	Total
Level 1	Comp. Steel Floor Deck	SF	36041	10%	39645.1
Level 2	Comp. Steel Floor Deck	SF	20279	10%	22306.9
Level 3	Comp. Steel Floor Deck	SF	14017	10%	15418.7
Level 4	Comp. Steel Floor Deck	SF	9241	10%	10165.1
Roof	Comp. Steel Floor Deck	SF	9241	10%	10165.1

Detailed Structural Steel Estimate Pricing								
Description	Quantity	Unit	Bare Material	Bare Labor	Bare Equipment	Bare Total	Total O & P	Total Cost
Columns								
HSS10x10x5/16	5	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$7,227.50
HSS10x14x5/8	3	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$4,336.50
HSS10x10x1/2	3	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$4,336.50
HSS10x10x3/8	1	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$1,445.50
HSS10x10x5/8	2	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$2,891.00
HSS20x12x5/8	1	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$1,445.50
HSS20x8x5/8	1	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$1,445.50
HSS12x12x5/8	2	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$2,891.00
HSS14x10x5/8	1	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$1,445.50
HSS12x12x1/2	1	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$1,445.50
HSS8x8x5/16	1	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$1,445.50
HSS14x14x5/8	1	EA	$1,200.00	$49.00	$32.50	$1,281.50	$1,445.50	$1,445.50
W12x40	32	LF	$60.50	$2.27	$1.52	$64.29	$72.09	$2,306.88
W12x45	1	LF	$60.50	$2.27	$1.52	$64.29	$72.09	$72.09
W12x50	6	LF	$60.50	$2.27	$1.52	$64.29	$72.09	$432.54
W12x53	10	LF	$60.50	$2.27	$1.52	$64.29	$72.09	$720.90
W12x58	5	LF	$60.50	$2.27	$1.52	$64.29	$72.09	$360.45
W12x65	8	LF	$60.50	$2.27	$1.52	$64.29	$72.09	$576.72
W12x72	17	LF	$105.00	$2.38	$1.59	$108.97	$121.86	$2,071.62
W12x79	2	LF	$105.00	$2.38	$1.59	$108.97	$121.86	$243.72
W12x87	1	LF	$105.00	$2.38	$1.59	$108.97	$121.86	$121.86
W12x96	2	LF	$105.00	$2.38	$1.59	$108.97	$121.86	$243.72
							TOTAL	$38,951.50
Beams - Sequence One - Only W-Flanges								
W10x12	343	LF	$14.50	$3.91	$2.61	$21.02	$25.57	$8,770.51
W12x14	184	LF	$16.95	$2.66	$1.78	$21.39	$25.21	$4,626.04
W12x16	131.5	LF	$26.50	$2.66	$1.78	$30.94	$36.06	$4,741.89
W12x19	22.5	LF	$26.50	$2.66	$1.78	$30.94	$36.06	$811.35
W12x40	30	LF	$60.50	$3.13	$2.09	$65.72	$74.20	$2,226.00
W12x50	15	LF	$60.50	$3.13	$2.09	$65.72	$74.20	$1,113.00
W12x53	15	LF	$60.50	$3.13	$2.09	$65.72	$74.20	$1,113.00
W14x22	25	LF	$31.50	$2.37	$1.58	$35.45	$40.33	$1,008.25
W16x26	155	LF	$31.50	$2.34	$1.57	$35.41	$40.27	$6,241.85
W16x31	57	LF	$37.50	$2.60	$1.74	$41.84	$47.92	$2,731.44
W16x36	16	LF	$48.50	$2.93	$1.96	$53.39	$60.20	$963.20
W18x35	64	LF	$42.50	$3.53	$1.77	$47.80	$54.65	$3,497.60
W18x40	63	LF	$48.50	$3.53	$1.77	$53.80	$61.15	$3,852.45
W21x44	17	LF	$53.00	$3.19	$1.60	$57.79	$65.86	$1,119.62
							TOTAL	$42,816.20
Estimate of Overall Total Sequences			$42,816.20	32 Total Sequences			TOTAL	$1,370,118.40
Metal Decking								
2" 20 gauge galvanized comp. deck	39645	SF	$1.69	$0.39	$0.04	$2.12	$2.60	$103,077.00
2" 20 gauge galvanized comp. deck	22,307	SF	$1.69	$0.39	$0.04	$2.12	$2.60	$57,997.94
2" 20 gauge galvanized comp. deck	15,419	SF	$1.69	$0.39	$0.04	$2.12	$2.60	$40,088.62
2" 20 gauge galvanized comp. deck	10,165	SF	$1.69	$0.39	$0.04	$2.12	$2.60	$26,429.26
2" 20 gauge galvanized comp. deck	10,165	SF	$1.69	$0.39	$0.04	$2.12	$2.60	$26,429.26
							TOTAL	$254,022.08

Concrete	Quantity	Unit	Unit Cost	Cost
Foundations				
Footings & Walls				
Spread Footings	195	CY	$375.00	$73,125.00
Wall Footings	453	CY	$450.00	$203,850.00
Grade Beams	44	CY	$450.00	$19,800.00
Stepped Wall Footings	22	CY	$450.00	$9,900.00
Piers	45	CY	$450.00	$20,250.00
Foundation/Basement Walls	480	CY	$750.00	$360,000.00
Loading Dock Footers & Walls	104	CY	$550.00	$57,200.00
Excavation (above and beyond 4' deep excav)	1	LS	$210,000.00	$210,000.00
North Wall & Foundation and turning East	1	LS	$150,000.00	$150,000.00
Excavation for Foundation for North Wall	1	LS	$20,000.00	$20,000.00
Slabs on Grade				
Slab on Grade 6"	630	CY	$400.00	$252,000.00
Slab on Grade 1'4"	30	CY	$450.00	$13,500.00
Loading Dock SOG	50	CY	$400.00	$20,000.00
Depressed Slab Area	0	SF	$0.00	$0.00
Thickened Slab	55	CY	$400.00	$22,000.00
Structure				
Concrete Fill for Elevated Slabs				
Fill for Slab on Deck 5 1/4" - LW	73,426	SF	$7.00	$513,982.00
Fill for Slab on Deck 5 1/4" - NW	3,521	SF	$7.00	$24,647.00
Fill for Slab on Deck 8" - NW	1,205	SF	$9.50	$11,447.50
Concrete Walls, Columns & Beams				
Concrete Walls	1,550	CY	$750.00	$1,162,500.00
Concrete Walls, Flytower & House	622	CY	$1,350.00	$839,700.00
Crane/Access for Flytower/Proscenium Theater	1	LS	$350,000.00	$350,000.00
Proscenium Theater Divider Beam above stage and pros support columns	75	CY	$550.00	$41,250.00
Concrete Footings & Wall at P2 Interface	160	CY	$600.00	$96,000.00
Misc				
PT Low Staired Area	35	CY	$950.00	$33,250.00
PT High Staired Area	20	CY	$950.00	$19,000.00
PT Box at Stairs	10	CY	$950.00	$9,500.00
Elevator/Lift Pit Walls	0	SF	$23.00	$0.00
Equipment Pads (M/E)	1	AL	$25,000.00	$25,000.00
SawCut Slab Detail	3,078	LF	$3.50	$10,773.00
Structural Isolation	380	LF	$100.00	$38,000.00
Concrete in Metal Pan Stairs	65	CY	$525.00	$34,125.00

Concrete - CUP				
Concrete Tunnel Extension	723	CY	$800.00	$578,400.00
Concrete Repair to Cooling Towers	1	LS	$65,000.00	$65,000.00
Increase Fan Openings	1	LS	$50,000.00	$50,000.00
Pump Equipment Pads	1	LS	$5,000.00	$5,000.00
CONCRETE TOTAL				$5,339,199.50

Masonry	Quantity	Unit	Unit Cost	Cost
Masonry				
CMU Walls				
Wall Type A3 8" CMU	11,400	SF	$13.20	$150,480.00
Wall Type A5 12" CMU	1,750	SF	$17.75	$31,062.50
Wall Type C8 8" CMU Grouted	19,950	SF	$17.20	$343,140.00
Wall Type C8 8" CMU Grouted Split Face	1,525	SF	$19.20	$29,280.00
Wall Type C12 12" CMU Grouted	3,700	SF	$20.00	$74,000.00
Wall Type 12" CMU Grouted	4,400	SF	$20.00	$88,000.00
Wall Type P17 8" CMU	175	SF	$14.25	$2,493.75
Wall Type P18 8"	700	SF	$14.25	$9,975.00
Top of Wall Closure Detail	2,800	LF	$4.50	$12,600.00
CMU Lintel - Built in Place	0	LF	$0.00	$0.00
Veneer/Brick				
Face Brick	25,610	SF	$28.70	$735,007.00
Cast Stone				
Granite Stone Base (10")	0	LF	$100.00	$0.00
Precast Wall Caps	510	LF	$65.00	$33,150.00
Precast Sills	0	LF	$0.00	$0.00
Precase Base	400	LF	$65.00	$26,000.00
Precast Concrete Lintels	0	LF	$0.00	$0.00
Masonry at CUP				
Masonry Wall Patch	500	SF	$30.00	$15,000.00
MASONRY TOTAL				$1,550,188.25

APPENDIX D – General Conditions Estimate

Staff Reimbursable

Line Item	Quantity	Unit	Unit Cost	Cost
Senior Project Manager	3792	Hrs	$101	$382,992
Project Manager 1	3792	Hrs	$94.00	$356,448
Project Manager 2	3792	Hrs	$80.00	$303,360
Project Engineer 1	3792	Hrs	$58.00	$219,936
Project Engineer 2	3792	Hrs	$55.00	$208,560
Project Engineer 3	1896	Hrs	$52.00	$98,592
Superintendent	3792	Hrs	$98.00	$371,616
Assistant Superintendent	3792	Hrs	$62.00	$235,104
TOTAL				$2,176,608

CM-GMP Contingency

Line Item	Quantity	Unit	Unit Cost	Cost
GMP Contingency	1	LS	$1,000,000	$1,000,000
TOTAL CM-GMP CONTINGENCY				$1,000,000

Non-Personnel Reimbursable Costs

Line Item	Quantity	Unit	Unit Cost	Cost
Bonds	1	LS	$475,000	$475,000
Liability Insurance	1	LS	$285,000	$285,000
Builders Risk	1	LS	$130,000	$130,000
Mobilization	1	EA	$20,000	$20,000
Office Trailers (Triple Wide)	24	MO	$4,000	$96,000
Field Furniture & Setup	10	SET	$1,000	$10,000
Telephones & Service	24	MO	$400	$9,600
Setup Fee	1	LS	$1,500	$1,500
Phone Jacks	10	EA	$150	$1,500
Lease for Telephones	24	MO	$500	$12,000
Line Lease - Verizon DSL	24	EA	$250	$6,000
Cleaning Services, trailers	24	MO	$600	$14,400
Security System, trailers	24	MO	$100	$2,400
Electrical Power Connections	1	LS	$15,000	$15,000
Power Consumption, trailers	24	MO	$1,200	$28,800
Sanitary Facilities, trailer complex	1	LS	$4,500	$4,500
Temporary Construction	24	MO	$5,000	$120,000
Temporary Heat	6	MO	$20,000	$120,000
Misc, Trailer Supplies	24	MO	$200	$4,800
Small Tools for CM Field Staff	24	MO	$1,000	$24,000
Safety Supplies/Ladders/Cables/Vests	1	LS	$50,000	$50,000
Shipping/Receiving System	24	MO	$200	$4,800
Miscellaneous Materials	24	MO	$100	$2,400
Drawing Reproduction in Construction Phase	200	SET	$150	$30,000
Site Surveys	1	LS	$100,000	$100,000
Layout	1	LS	$50,000	$50,000
Permits (not required, state project)	0	LS	$0	$0
Third Party Inspection/Testing	1	Allow	$250,000	$250,000
E-Maryland Marketplace Fee	1	Allow	$15,000	$15,000
Safety Program, First Aid Supplies	24	MO	$1,500	$36,000
Daily Cleanup	24	MO	$1,000	$24,000
Trash Chutes	2	EA	$5,000	$10,000
Barricades & Warning Signs	24	MO	$500	$12,000
Ladders & Stairs	24	MO	$2,500	$60,000
Misc Supplies	24	MO	$1,500	$36,000
Employee Orientation	300	EA	$10	$3,000
Parking	0	MO	$0	$0
Site Fencing	1	LS	$45,000.00	$45,000
Snow Removal	1	LS	$12,000	$12,000
Clean up	0	MO	$0	$0

Laborer	8320	HR	$40	$332,800
Carpenter	4160	HR	$55	$228,800
Coffee, Water	24	MO	$150	$3,600
Final Cleaning	1	LS	$75,000	$75,000
Purchase of Staff Computers	10	EA	$1,800	$18,000
Purchase of UMB PM Computer	1	EA	$1,800	$1,800
Weather & Dust Protection	1	LS	$25,000	$25,000
Project Signage	2	EA	$2,000	$4,000
Progress Photos, Monthly Reports	24	MO	$1,000	$24,000
Progress Photos Professional	1	LS	$7,500	$7,500
Computers & WT IE Support	24	MO	$1,250	$30,000
Copy Machines	24	MO	$500	$12,000
Fax Machines	3	EA	$500	$1,500
Nextel Phones	24	MO	$500	$12,000
Office Phones	24	MO	$500	$12,000
Travel	1	LS	$15,000	$15,000
Postage	24	MO	$400	$9,600
Misc. Office Supplies	24	MO	$200	$4,800
Auto Allowances	24	MO	$3,500	$84,000
Final Site Clean up	1	LS	$60,000	$60,000
As-Built Drawings for A/E's Record Set	1	LS	$10,000	$10,000
Project File & Records for Univ. Archives	1	LS	$10,000	$10,000
UMB Partnering Allowances	1	Allow	$50,000	$50,000
TOTAL NON-PERSONNEL REIMBURSABLE COSTS				$3,152,100

General Conditions Summary

Line Item	Quantity	Unit	Unit Cost	Cost
Staff Reimbursables	$20,928.92	Week	104	$2,176,608
Total Construction Phase Non-Personnel	$30,308.65	Week	104	$3,152,100
CM-GMP Contingency	$9,615.38	Week	104	$1,000,000
TOTAL CM REIMBURSABLE COSTS	$60,852.95	Week	104	$6,328,708