TECHNICAL REPORT TWO

CHEMISTRY BUILDING

October 27, 2010

Michael Gallagher

Construction Management

Dr. Riley

EXECUTIVE SUMMARY

Technical Report Two is intended to perform an in depth analysis of key features and parameters that influenced the project execution of the 265,000 SF Chemistry Building. This project started off with two years of preconstruction and design, which then lead into demolition of a large parking lot and armory before construction started. The Chemistry building is very unique which lead to some challenges during construction. The majority of the materials came from all over the world which lead to the biggest challenge because of lead time and if there was a problem with a particular material. For example, if a piece of the glass façade broke it needed to be fabricated in Italy, shipped, and then finally received about two months later. This was also incorporated with the challenge of the owner deciding the building should be completed almost four months prior to the original contract date.

In order to overcome those challenges a well thought out **site layout plans** along with a **detailed project schedule** needed to be comprised. After an in-depth analysis it was aware that preplanning was the key to success in these areas. Two years of preconstruction helped form an extremely detailed schedule comprising of around thirty-six thousand items. In order to execute this schedule and construction process the site needed to be properly equipped. This refers to the **general conditions**, which are estimated to be about $24,706,724.00. This totaled to be approximately 9.64% of the total cost of the job, which is typical for most construction jobs.

What keeps the Chemistry Building standing is about 1,256 tons of structural steel and 16,036 CY of concrete. A **structural estimate** of this building came out to be around $7,587,700.84. This cost however does not reflect the cost of 900 moment welds that connect the steel or the cost so shorten the schedule four months.

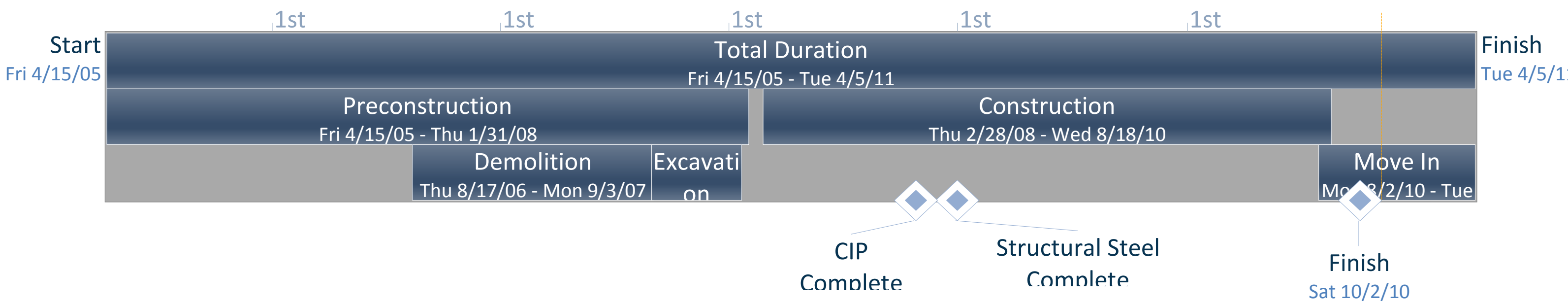
After analyzing the information contained in this report and the findings from the previous technical report, one area to research further would be shorting the schedule and costs related to it. What are the cheapest parts of the critical path to reduce time on will be the key focus. I also like to analyze the cost difference associated with shorting the schedule by four months and how it was successfully achieved. Another focus, which was presented during the PACE roundtable meeting, is research ways BIM could have been a better resource for this project.

TABLE OF CONTENTS

DETAILED SCHEDULE SUMMARY

***See Appendix C for the Project Summary Schedule**

The Chemistry Building's schedule was broken down into different phases. The phases were preconstruction, demolition, excavation, construction, and move-in. The durations of these phases can be seen in the timetable below.



Looking at the above chart, the components that make up the preconstruction part are selecting the project team and the design process. The project started off with the Owner choosing Hopkins Architects to be the design Architect. Soon after they were selected, Turner Construction was brought on for preconstruction planning. The owner, Hopkins Architects, Turner Construction, and ARUP worked together for roughly two years before construction started.

The next phase was Demolition. Even though the timetable above shows demolition taking over a year, it only involved Turner Construction for about the last month of it. The majority of the time consisted of the owner clearing out the building. Next, the utilities to the armory were cut and capped before Turner Construction demolished the building and large parking lot.

Finally demolition was complete on 9/3/07 and excavation began. Because the geotechnical reports showed there was a lot of shallow bedrock, blasting was required in order to complete the foundation. Almost 50,000 CY or rock were blasted and hauled off site. This was a long and complex process because blasts were only permitted to take place during a one hour time frame each day. It was also required that any dynamite placed in the ground needed to be blasted that day and could not remain in the ground and active overnight.

Once the sheeting and Shoring were installed, the construction process began on February 28th, 2008. The first part of the critical path for this portion was pouring the footers and foundation. Just like the excavation, the foundation work started at the south end of the building and worked north. The superstructure started on March 3rd, 2008 with the erection of the south concrete cores and south CIP columns. The concrete worked continued moving south to north completing the CIP Columns, CIP Beams, and CIP Concrete Cores. Because the concrete cores act as shear walls and the structural steel ties into them, steel erection could not begin until September 15th, 2008 when the south cores were complete.

One of the first milestones during the construction process was the completion of the cast in place concrete on October 24th, 2008. The steel quickly topped out after on December 29th, 2008.

The next part of the schedule is broken down into portions of the building. Because the lab and office portions of the building are completely independent once the superstructure is complete, two separate schedules were formed for this point forward. The schedule formed by Turner Construction broke the schedule down even further and resulted in around 36,000 items. Because the detailed schedule in Appendix C was limited to 200 items, the furthest it was broken down into was by floor. Included in this is framing the walls, rough in, inspections, closing the walls, and MEP.

The next milestone for the Chemistry Building was the Exterior Façade and Roof were completed on December 18th, 2009.

The building turnover process was in phases and began on August 2nd, 2010. Moving in would then continue until April 5th, 2011. By Contract the Chemistry Building was to be completed by October 2nd, 2010.

GENERAL CONDITIONS ESTIMATE

***See APPENDIX A for complete General Conditions Estimate**

The estimate for the general conditions for the Chemistry Building is summarized in the table below. The way this project was contracted it was broken down into general conditions and general requirements. This estimate below does not represent actual amounts contracted between the owner and Turner Construction. Most of the information used to calculate these figures came from RS Means Cost Works.

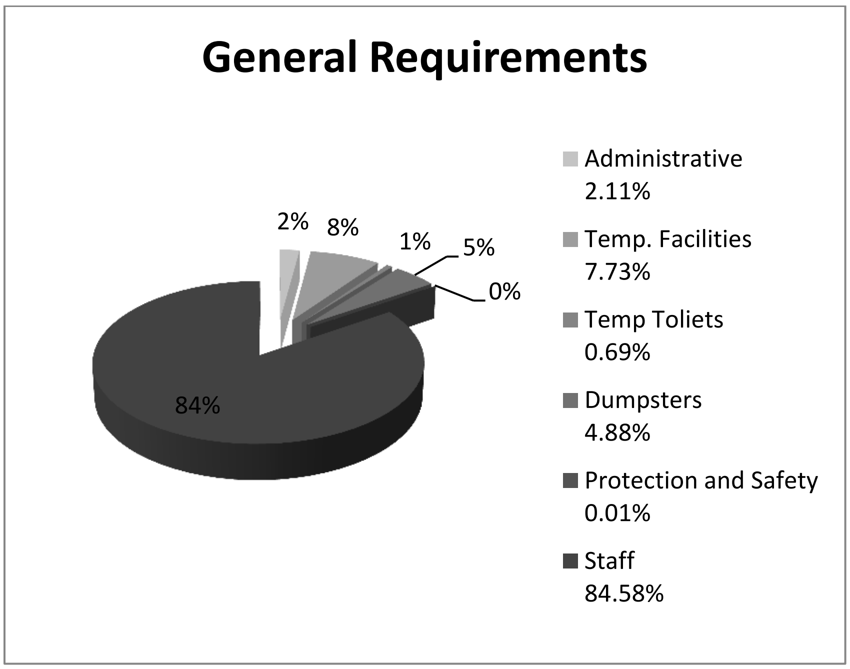
Item	Unit Rate	Unit	Total Units	Total Cost ($)
Preconstruction General Conditions	14,143,50	Weeks	104	1,470924.00
General Conditions	79,089.70	Weeks	165	13,049,800.00
General Requirements	61,733.33	Weeks	165	10,186,000.00
Total	**154,996.53**		**159.43**	**24,706,724.00**

The Chemistry Building is a highly unique and sophisticated building which is shown by the extremely high cost per square foot of $971.74 / SF. Because of this a wide variety of expertise was required to build this project which resulted in a very large project team. The total cost for staffing this project based on RS Means cost works and the schedule of the project was $11,103,100.

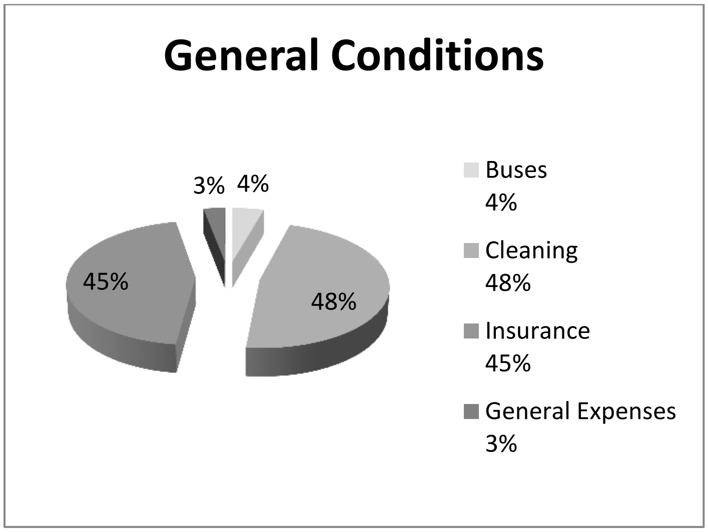
This project had two years of preconstruction where Turner Construction worked with the owner, architect, and engineers. The costs associated with this are included in the total staff budget above and summary table above. Although there was a small staff and not too many other general condition costs associated with the preconstruction process, it increased the total cost for this section by about 6.64%.

The general conditions and general requirements comprise of about 9.64% of the total cost of this $257,508,998 building. This percentage is a reasonable number and 8-10% of the total building cost is usually typical. An interesting part about these particular general conditions that differs from typical projects is the owner pays for all the temporary utilities during construction. This includes gas, electric, chilled water, etc. This is a substantial cost considering the project is just over three years and would drive the 9.64 percentage up. However, not many projects have two years of preconstruction which is why this value is reasonable.

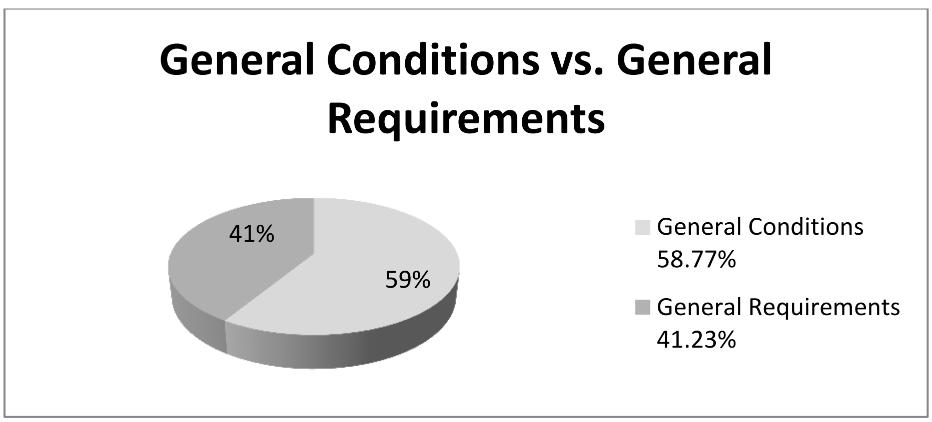
There are four main divisions included in the General Requirements portion above which are as follows: Busses, Cleaning, General Expenses, and Insurance. Subcontractors were not allowed to park onsite; therefore a bus constantly ran between the parking lot about a mile away and the jobsite. The cleaning portion included the final cleanup before turning the building over along with cleaning that was done daily to keep the site clean and safe. Computers, surveys, testing, and inspections were the main components of the General Expenses. Last of all, the insurance for this project was a contractor controlled insurance program (CCIP). The pie chart below shows the percentages of these costs.



The General Conditions portion of the total presented in summary table above encompasses Administrative costs, Temporary Facilities, Temporary Toilets, Dumpsters, Protection and Safety, and Staff. As stated above the Staff portion is the largest and is included for construction and preconstruction. A very large and unique trailer was used to provide enough workspace for the entire project team to be onsite. The main trailer had two levels and was as wide as two typical jobsite trailers and was manufactured in China. Because the insurance program was a CCIP, another trailer was onsite for the duration of the project housing a full time safety manager and a full time EMS individual. The pie chart below shows the percentages of these costs.



The pie chart below shows what percentage of the total cost are general conditions and general requirements.



STRUCTURAL ESTIMATE

***See Appendix B for complete structural estimate**

What holds the Chemistry building together is spread, perimeter, and mat footings with CIP concrete foundation walls. The basement has a slab on grade concrete floor ranging from 6” to 12” in depth. All of the columns and beams that support level A are CIP concrete. There are then six CIP concrete shear walls that terminate on the mat footings and go all the way up to the penthouse. All of the concrete used is reinforced 5,000 psi concrete. In this report the shear walls are referred to as concrete cores. Three being located on the lab side and the other three are located on the office side. These cores break up the buildings into different parts and are all connected with structural steel. The slabs for all the concrete cores are a CIP 6” floor. Level A is also cast in place slab. The rest of the floors are comprised of a 3” composite metal deck with 4 ½” to 6” topping.

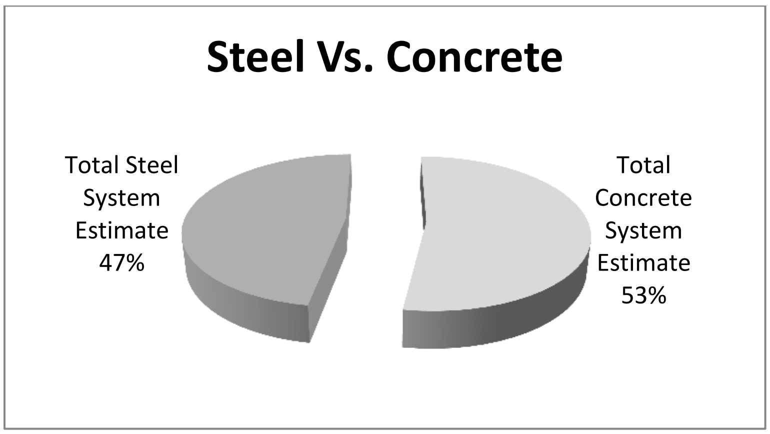
An estimate of the structural system above is summarized in the table below.

	Cost/SF	Total Cost
Estimate	28.63	7,587,700.84
Actual from Tech 1	123.01	32,598,375.00

Looking at this information presented above the structural estimate I did based on RS Means Cost works is only about 25% of the actual value that was derived in Tech 1 based upon the data provided by Turner. There are two main reasons for this large difference. The main one being there were 900 moment connections in this building. My estimate does not include the cost of them because I did not know how long the duration would be for each one of the welds. This type of work also involves a highly skilled welder resulting in a high hourly rate. If this was included it would drive the cost way up. The next reason is after the original contracts were agreed upon the owner decided they wanted the building completed almost four full months earlier. Because of losing that time, a lot of overtime was required to hit that date. The structural system is on the critical path of the schedule and there are not many trades onsite yet; which makes it a desirable area to decrease time. There are fewer trades onsite which decreases the overtime cost because there are less people to pay verses other during other parts of the project. The actual amount from Tech 1 includes all the overtime costs for the structural system, while the amount I estimated is based on normal rates and normal time for erection.

The Table below is a more detailed breakdown of the estimate I comprised.

	Cost/SF	Total Cost
Total Concrete System Estimate	15.06	3,989,875.34
Total Steel System Estimate	13.58	3,597,825.50
Total	**28.63**	**7,587,700.84**

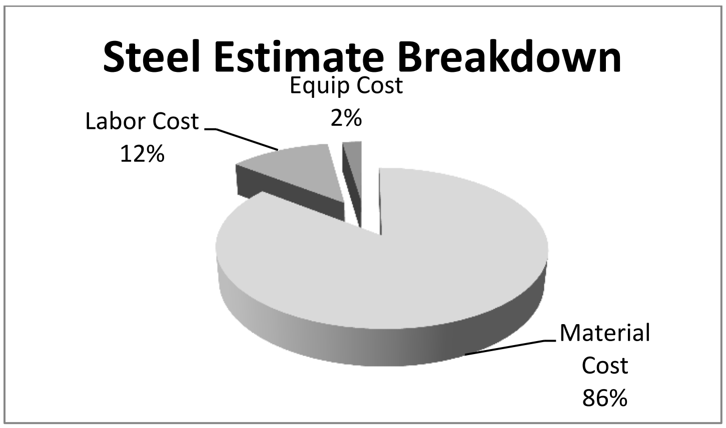


As you can see in the pie chart above the Chemistry Building the cost of the structural system is almost evenly distributed between the Steel and Concrete systems.

Below is a more detailed breakdown of how the Steel estimate was calculated.

Steel					
	Amount	**Material Cost**	**Labor Cost**	**Equip Cost**	**Total Cost**
Beams	1081 tons	2,346,259.90	266,120.86	64,291.01	2,676,671.80
Columns	175 Tons	412,032.18	17,047.28	10,078.84	439,158.34
Metal Deck	174,636 SF	321,330.24	151,933.32	8,731.80	481,995.36
Total		**3,079,622.32**	**435,101.46**	**83,101.65**	**3,597,825.50**

The structural steel estimate comprised of Beams, Columns, and Metal Deck. There was a total of 1256 tons of structural steel and about 174,636 SF of Metal Deck. The largest cost associated with the structural steel was the material cost. If the labor for the 900 moment connections and overtime costs were included the distribution of the pie chart below would look different. The Equipment cost also appears to be a little low based on the fact that multiple cranes were onsite erecting the steel about 151 days.

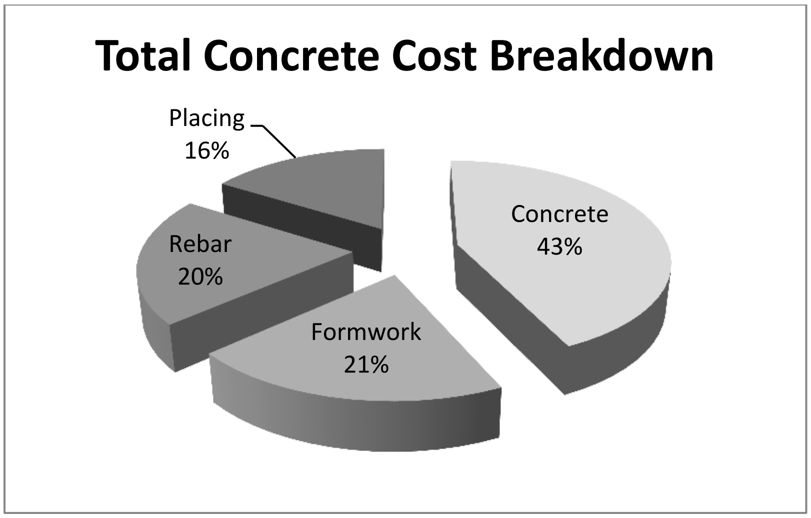


Below is a more detailed breakdown of how the Steel estimate was calculated.

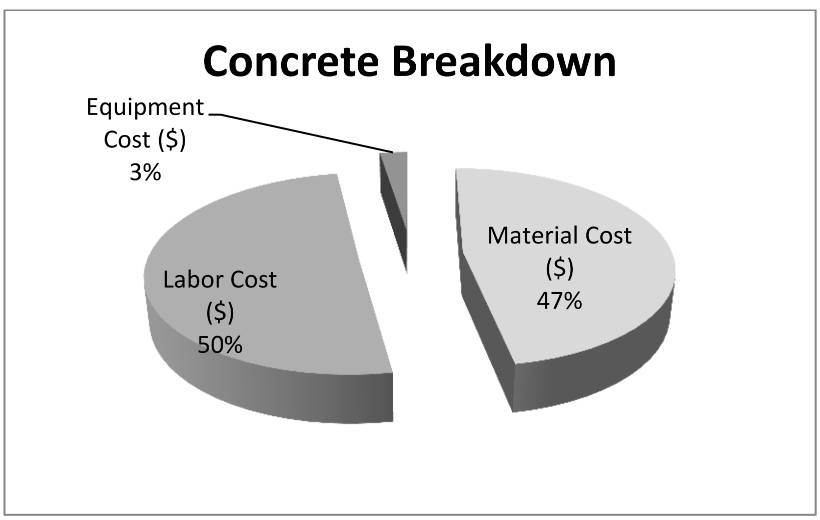
Concrete

	Amount	Material Cost ($)	Labor Cost ($)	Equipment Cost ($)	Total Cost ($)
Concrete	16036 CY	1,718,310.60	0.00	0.00	1,718,310.60
Formwork	73,226 SFCA	72,692.16	715,390.96	0.00	788,083.12
	935 LF	9697.65	16,491.70	0.00	26,189.35
Rebar	94.4 Tons	82,389.81	731,882.66	0.00	814,272.47
Placing	16036 CY	0.00	543,476.68	99,543.12	643,019.80
Total		**1,883,090.22**	**2,007,242.00**	**99,543.12**	**3,989,875.34**

The Concrete estimate comprised of Concrete, Formwork, Rebar, and Placement of the concrete. The Chemistry Building has a total of about 16,036 CY of concrete. All of this concrete is reinforced 5,000 psi and majority of it was placed using a pump truck. Ten percent was added to the total amount of rebar to account for rebar ties and waste. Below is a pie chart comparing the cost values of the items included in this part of the estimate.



Below is another pie chart for the concrete estimate which compares the cost of equipment, material and labor.



*Note all values for the estimate were based on RS Means Costworks and quantity takeoffs from the drawings. More details of this estimate can be found in Appendix B.

Critical Industry Issues

The PACE Roundtable conference started off with Professor David Riley, John Messner, and Rob Leicht introducing the group. After welcoming everyone, thanking the industry members for attending, and giving a brief rundown of the schedule for the day, Dr. Riley gave an overview of current happenings in the Penn State Architectural Engineering department. There were three major happenings that I remembered from this. The two of which I already knew about were there Horman Memorial and Rob Leicht becoming a new faculty member. The one that I did not know about was a huge surprise. Dr. Freihaut will be the technical director of a research group for the DOE Energy Innovation Hub. The group has received more than 129 million dollars, which is the largest grant Penn State has ever received. The goal of this research is to create the tools and technologies needed to drastically improve the energy efficiency of building systems. This is a huge achievement for Penn State, especially the AE department, and shows this university is one of the best for the building industry.

After listening to a brief speech from each of the Construction Management professors, Dr. Riley gave a brief description of each of the three morning breakout sessions. The different topics for each roundtable discussion are listed 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 smart Grid: Energy impacts in the building Industry	**Session 2B:** Carrying BIM to the field -- new responsibilities, roles, & competencies	**Session 2C:** Operations & Maintenance process integration in new and retrofit projects

The first session I attend was 1C: IPD: Exploring the Drivers behind highly integrated delivery of projects. Although the other sessions interested me, I did not know much about IPD and had a strong interest in learning more about it. Because of this, I took a lot of notes and a backseat role in the discussion. There were four main topics that were discussed within IPD which are as follows:

1. Barriers, concerns, and Risks
2. Challenges
3. Opportunities

4. Research

This session, led by Rob Leicht, started off by talking about barriers, concerns and risks associated with Integrated Project Deliveries (IPD). Everything that was brought up in this part of the discussion came back to the problem of no one wants to change and legal issues. The mindset of the phrase of “I’ve been doing this for thirty years…why should I change” is a major barrier. Everyone is use to the traditional method of design-bid-build and its culture. Because of this, even if an IPD approach is implemented a concern is it might not run smoothly. In the traditional method it is usually clear who to blame for a particular problem. However, this is not the case in the IPD because everyone is on the same team and working together. As a result there is a need to place blame and point fingers when a problem arises instead of figure out a solution. Another concern is assembling the project team. All members must be onboard and fully support IPD from day one and continue to do so throughout the project. One member or a previous poor relationship could easy ruin everything.

One of the Industry members mentioned that a survey showed that only 40% of Architects would be open to doing an IPD. There are two major reasons for this. The first being legal reasons. Insurance companies do not understand IPD and feel the Architects are opening themselves up to too much risk. Therefore, some architects that are onboard for an IPD project are waiting on an answer for their insurance company or they are searching for another insurance company that will cover them. Besides insurance reasons same states do not allow this delivery method to be practiced. The second reason is there are few to no case studies on IPD. There needs to be proof that shows IPD’s are successful or research that shows how it saves time or cost.

The discussion of challenges of IPD blended with discussions from barriers, concerns, and risks. The primary challenge discussed was getting everyone to buy into IPD. Many owners do not want to be the “Ginny pig” or try to overcome the assumed risks associated with Integrated Project Delivery. Besides the owners buying in, the engineers, managers, architects, and everyone associated needs to move away from the old behaviors for this delivery method to work.

The opportunities discussed made it clear that implementing IPD on projects could be extremely beneficial. The benefits range from a quicker delivery to a better design. The key with integrated project delivery is more players on the team are introduced to the project early. A wide variety of expertise from day one will increase collaboration and innovation resulting in a project with a better value. Another benefit is an improved process for problem solving by eliminating wait time for information or approvals. Compared to the traditional method, IPD can result in a better product for the owner at the same cost while along with more money for everyone involved. It was referred to a “win-win situation.”

As the roundtable discussion started to conclude, it was clear research and factual based evidence needed to be performed and published in order for IPD to be more in the construction industry.

In the afternoon, I attended session 2B: Carrying BIM to the filed -- new responsibilities, roles, & competencies. Although I had a strong interest in the smart grid, I felt carrying BIM to the field would benefit me more based on my career goals. The key points touched upon during this discussion are as follows: uses, paperless jobs, tablets, computer limitations, and benefits.

BIM has been a huge topic in the construction industry. There has been a substantial amount of news presenting BIM as the tool that can do almost anything. This is true to a certain extent but the biggest problem is educating people how to properly use the resource of BIM. A prime example of this came forth when a student shared an experience he had while on a jobsite this past summer. The student approached a supervisor in the field using a tablet as a resource and asked him what exactly he used the tablet for. The supervisor responded by saying he likes it because it is easier to take notes and organize them while on the jobsite. This expensive piece of equipment and valuable resource is being wasted. The tablet, if used properly, can bring up drawings, schedules, or basically any information about the job. This eliminates the need to walk back to the jobsite trailer to search for answers or information, thus saving time. Tracking commissioning and job progress are easier and more accurate when using the tablet. Another benefit is having the ability to look at the 3D model as your standing in that space. This helps the superintendents notice problems sooner. Although the costs of tablets are expensive, the implementation of them could result in paperless jobs to even out the costs. Two other interesting features associated with BIM and the tablets are the uses of barcodes/tagging and using the model with the total station. Using barcodes makes a project more organized and provides management with the information of where a piece is located during transit and where it belongs on the job. The New Meadowlands stadium had great success doing this. Using the model with the total station also has huge advantages for renovations and new construction. Asbuilts can be taken using the total station and laser then uploaded into the model.

There are two downfalls associated with BIM and carrying it to the field. The expensive cost to produce the model and constantly update it is a huge deterrent. Although it may save you money throughout the job, many owners do not consider this and only look at the high upfront cost. The next major problem is not everyone is properly educated how to use this technology. If the knowledge is not there BIM will not be beneficial.

I learned a lot in both sessions and was constantly thinking about how what is being discussed relates to my project. An integrated project delivery sounds great on paper but very hard to implement. I can see how aspects of it would have improved situations that were faced throughout the project; but it is difficult to research how a different delivery method would have improved the project. Many of the issues discussed in the second discussion were present in my project. Although my thesis building used BIM, I felt the project could have benefited more from this resource. One of the major problems during construction was the exhaust duct for five of the air handler units were positioned in a matter that resulted in another inch of static pressure within the AHU. Because of this, the fans needed to work harder and run at a higher speed to get the proper cfm. The solution was to cut into the AHU, make the exhaust duct larger, and reroute the ductwork to account for the larger size. As an afterthought, could BIM been used to layout the penthouse and location of the AHU's different? Another resource that would have worked well on this job that was discussed is barcoding and scanning. The glass for the curtain wall system was manufactured in Italy and could show up onsite any day. Also, to reduce the high shipment costs pieces of glass from different parts of the building were shipped together. This made it very confusing to what pieces went where and where was a piece of glass located that you needed. If every piece had a barcode it would have eliminated this confusion.

I really enjoyed the team collaboration exercise. It was a great example and represents our industry very well. The construction industry is highly competitive and regularly involves negotiations. However, this activity showed it doesn't always have to be that way. This activity showed there was a way that the two competing teams could work together and both win. When realizing this I immediately thought of IPD. In IPD everyone benefits and works together just like in this activity.

The final discussion was about getting a job in a poor economy. This left the day on a positive note. The conclusion was companies are still hiring, however, students need to work harder to get a job. Therefore, choose the companies you really want to work for and go after them. Make sure you prepare yourself for the interview and do research on the company was highly stressed. Also send a thank you letter after the interview. One other thing that will help is try to visit the company and continue to follow up with the people you talk to.

SITE LAYOUT PLANNING

During the demolition of the parking lot and armory building there were two ways in and out of the site. One is located on the Northwest corner of the site and the other is located on the Northeast of the site. Both of these gates were in use for the excavation process and for about a year into the construction process. The Chemistry Building was eventually constricted to one entrance and exit gate due to the start of construction of a bridge spanning the main road to the west of the building. The Northeast gate was used as the only gate to the site until the bridge was completed in the summer of 2010. When the Northwest gate reopened the Northeast gate was then closed because construction started on a neighboring building along this road.

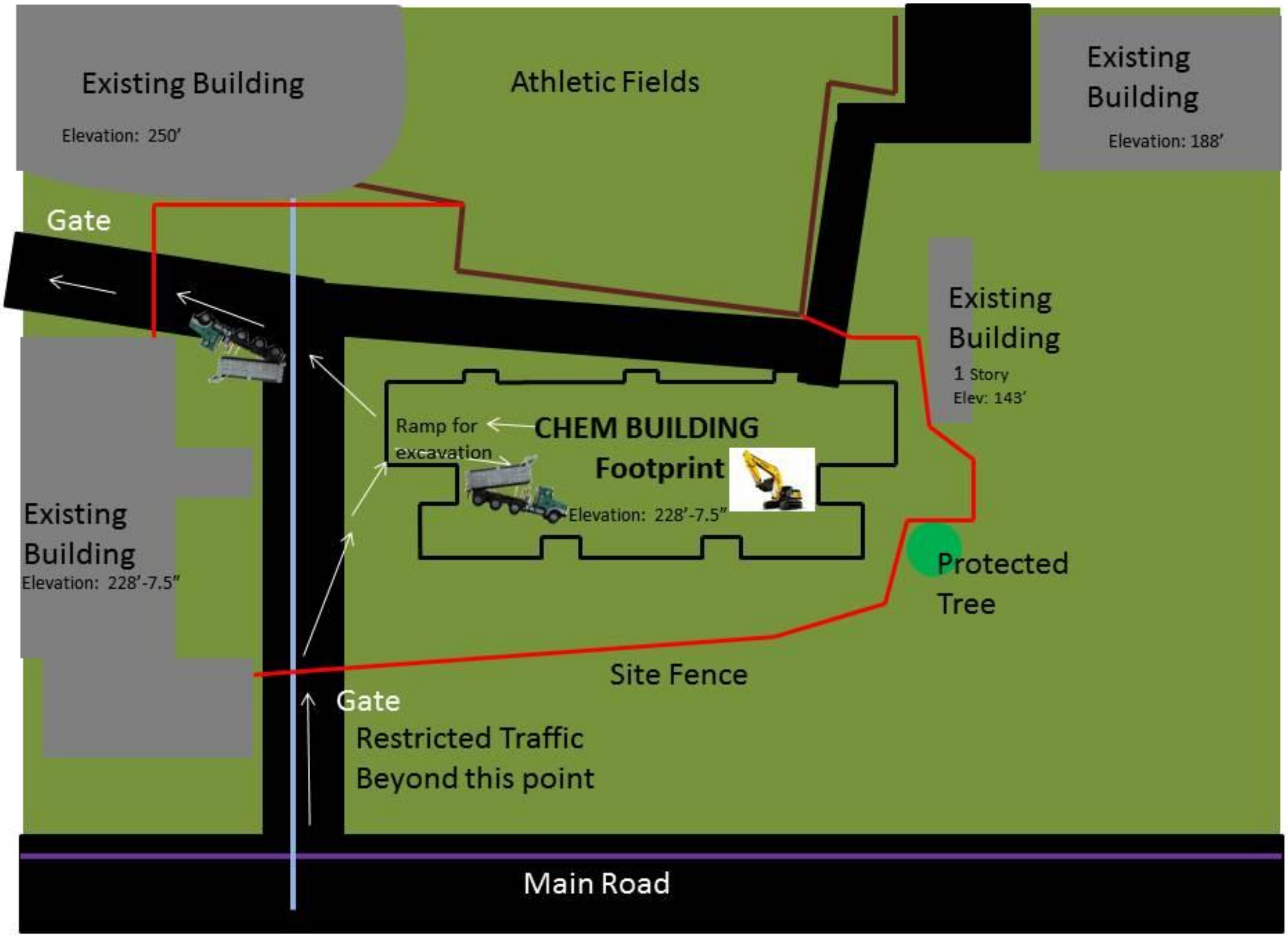
All excavation and erection started at the South end of the site and worked its way towards the North. The way the building is setup the lab and office parts were erected separately and then connected by the atrium steel. Typically there were at least two cranes onsite and multiple crews. One crane worked on the lab building while the other was working on the office side. All areas around the site were stable and suitable for a crane to be positioned. Mobile cranes were used for this project and they were typically around 100 tons.

The loading dock and hoisting lifts were located on the Northeast corner of the building. They were positioned where the north exterior stair tower is located and connected onto the North lab concrete core. The hoist was a two car system. One was used for materials and the other was used for the workers. This was erected once the north concrete core was finished and cured and stayed until the elevators for the building were operable. The reason for this location is it was closest to the Northeast gate, which was the only gate for majority of the construction process. It was also located in a position where tractor trailers with deliveries could easily turn around, back into the loading dock, and then exit the site.

The trailers were all positioned in the Northeast corner of the site by the entrance gate. Next to the trailers is a small parking lot for the Tuner employee's onsite. There is a large parking lot about a mile down the road from the site where the rest of the workers parked. A bus constantly ran back and forth transporting the workers. Each subcontractor was permitted to have a small trailer and/or an equipment trailer onsite until the landscaping and finishing site work around the site needed to start.

The dumpsters were located next to the loading dock for easy access.

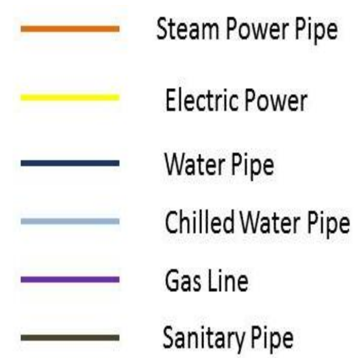
*Note: No site layout plan was provided by the contractor to critique. Also due to the fact that the location cannot be revealed surrounding buildings and road names or a zoomed out location of the site are not included.



MIKE GALLAGHER
Tech. 2

EXCAVATION SITE LAYOUT PLAN

NORTH ARROW

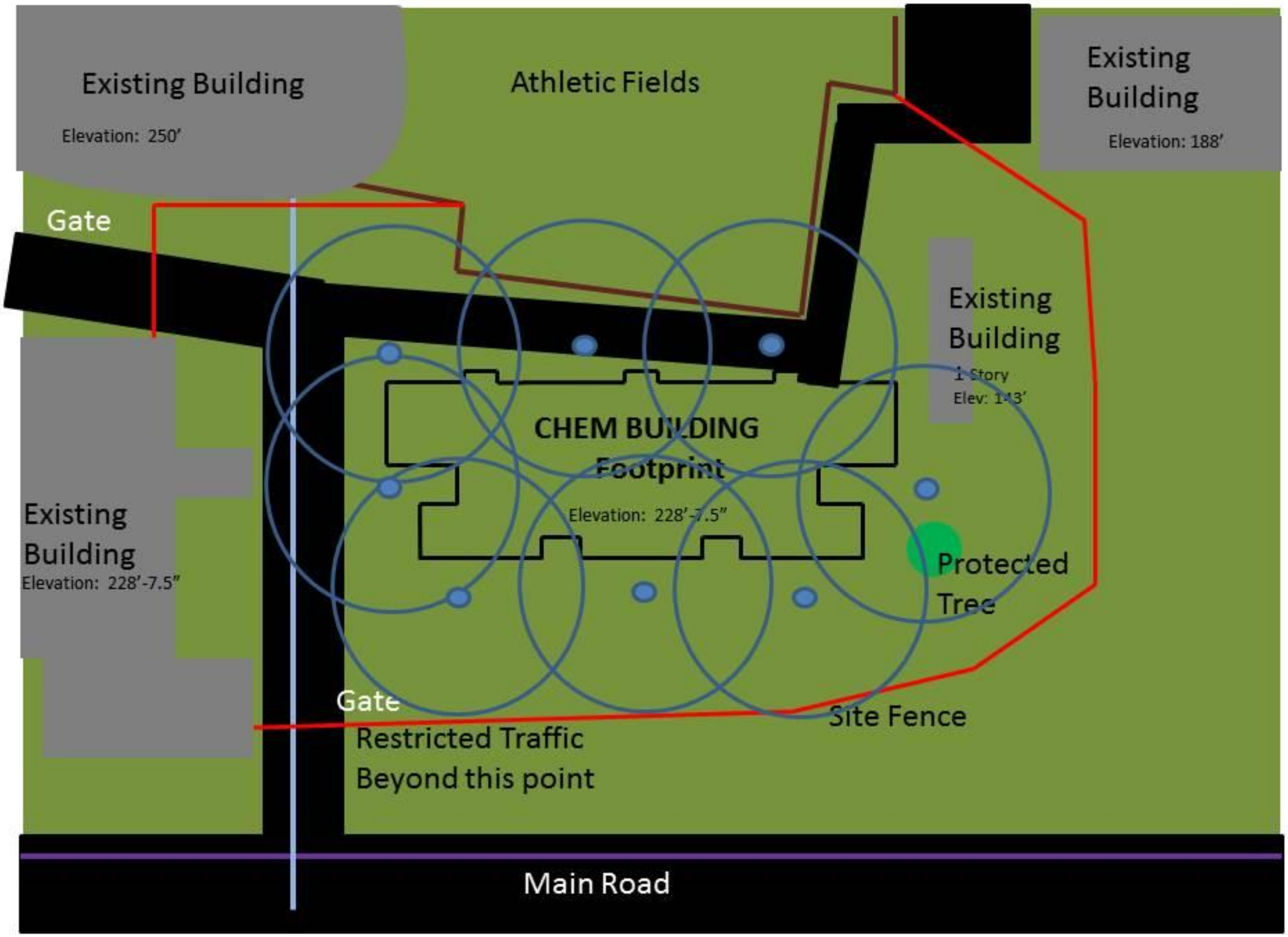


1 OF 3
10/27/10

MIKE GALLAGHER
Tech. 2

CRANE LOACTIONS
SITE LAYOUT PLAN

NORTH ARROW

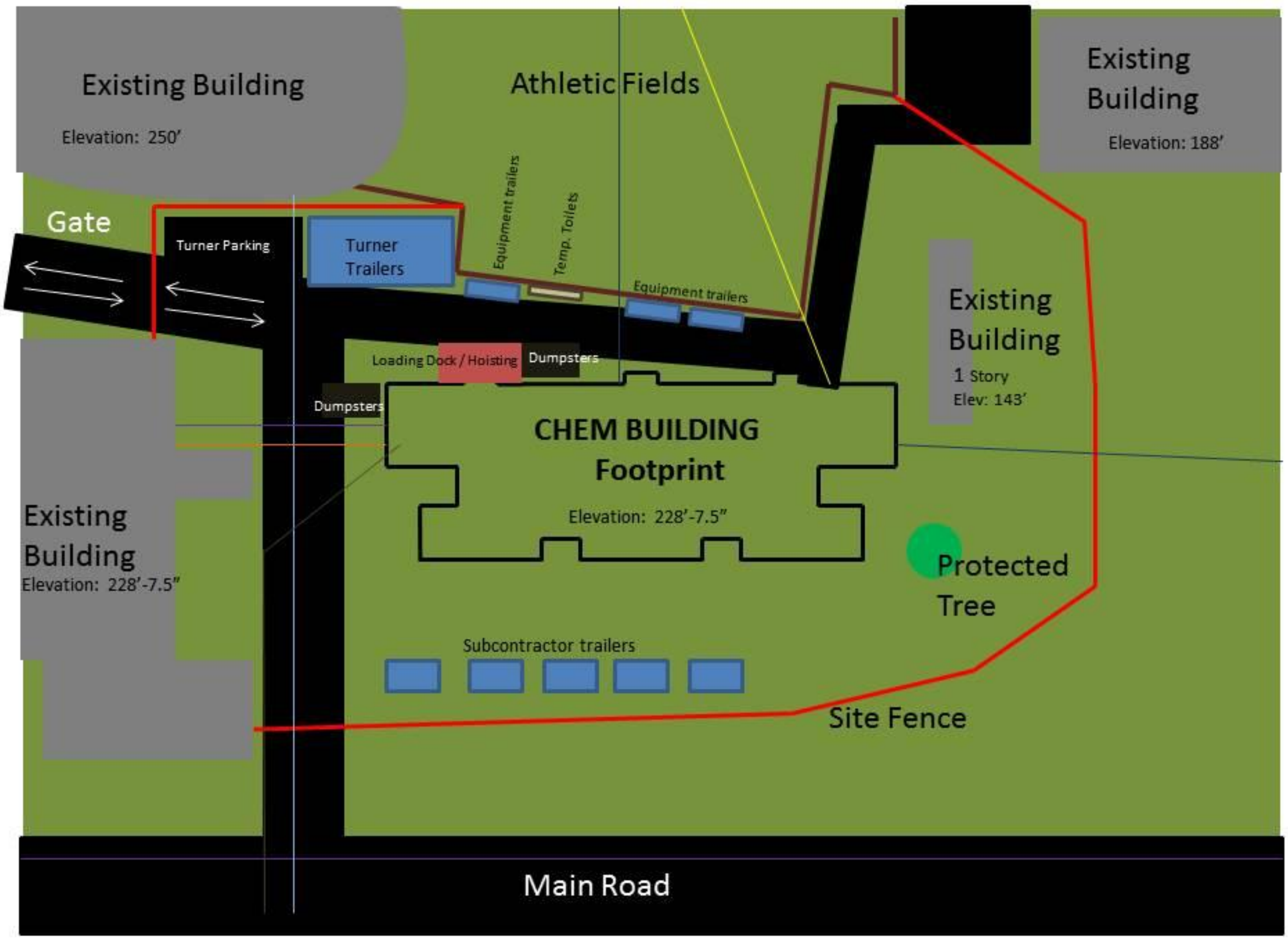


Steam Power Pipe
Electric Power
Water Pipe
Chilled Water Pipe
Gas Line
Sanitary Pipe

2 OF 3
10/27/10

MIKE GALLAGHER
Tech. 2

CONSTRUCTION SITE LAYOUT PLAN



NORTH ARROW

Steam Power Pipe
Electric Power
Water Pipe
Chilled Water Pipe
Gas Line
Sanitary Pipe

3 OF 3
10/27/10

Appendix A - General Conditions Estimate

GENERAL REQUIREMENTS				
Item	**Unit Rate**	**Unit**	**Total Units**	**Total Cost ($)**
Buses 4%	2,745.46	Weeks	165	453,000.00
Cleaning 48%	34,521.43	Weeks	140	4,833,000.00
Insurance 45%	27,830.00	Weeks	165	4,592,000.00
General Expenses 3%	1,540.00	Weeks	200	308,000.00
Total				**10,186,000.00**

GENERAL CONDITIONS				
Item	**Unit Rate**	**Unit**	**Total Units**	**Total Cost ($)**
Administrative	743.5	Weeks	165	200,000
Temp. Facilities	6,151.52	Weeks	165	1,015,000
Temp Toliets	545.46	Weeks	165	90,000
Dumpsters	3,878.79	Weeks	165	640,000
Protection and Safety	10.3	Weeks	165	1,700
Staff	588,454.55	Weeks	165	9,709,500
Total	**13,049,800**		**165**	**13,049,800**

PRECONSTRUCTION GENERAL CONDITIONS				
Item	**Unit Rate**	**Unit**	**Total Units**	**Total Cost ($)**
Administrative	743.5	Weeks	104	77,324
Precon Staff	13,400.00	Weeks	104	1,393,600
Total	**14,143.50**		**104**	**1,470,924.00**

PRECONSTRUCTION STAFF					
Position	**Unit Rate**	**Unit**	**Total Units**	**# of People**	**Total Cost ($)**
Project Exectutive	2,200.00	Weeks	104	2	457,600.00
Senior Estimator	1,950.00	Weeks	104	1	202,800.00
Estimator	1,700.00	Weeks	104	1	176,800.00
Scheduler	1,700.00	Weeks	104	1	176,800.00
Project Superintendent	1,950.00	Weeks	52	1	101,400.00
Project Engineer	1,950.00	Weeks	52	1	101,400.00
Cost Engineer	1,700.00	Weeks	104	1	176,800.00
Total					**1,393,600.00**

CONSTRUCTION STAFF					
Position	Unit Rate	Unit	Total Units	# of People	Total Cost ($)
Assistant Superintendent	1,500	Weeks	150	2	450,000.00
Superintendent	1,700	Weeks	165	9	2,524,500.00
Project Superintendent	1,950	Weeks	165	1	321,750.00
Laborers and Carpenters	1,200	Weeks	120	14	2,016,000.00
Assistant Engineer	1,500	Weeks	150	2	450,000.00
Field Engineer	1,700	Weeks	165	5	1,402,500.00
Project Engineer	1,950	Weeks	165	2	643,500.00
Safety Manager	1,700	Weeks	165	1	280,500.00
Change Order Manager	1,950	Weeks	150	1	292,500.00
Cost Engineer	1,700	Weeks	165	1	280,500.00
Project Executive	2,200	Weeks	165	2	726,000.00
Senior Estimator	1,950	Weeks	165	1	321,750.00
Total					**9,709,500.00**

Appendix B – Detailed Structural Systems Estimate

Steel Columns

Quantity	Description	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total Inc. O&P
700	Structural steel member, 100-ton project, 1 to 2 story building, W16x67, A992 steel, shop fabricated, incl shop primer, bolted connections	760	0.074	L.F.	$ 66.42	$ 3.26	$ 2.02	$ 71.70	$ 50,190.00
293.48	Structural steel member, 100-ton project, 1 to 2 story building, W12x72, A992 steel, shop fabricated, incl shop primer, bolted connections	640	0.088	L.F.	$ 71.34	$ 3.88	$ 2.40	$ 77.62	$ 22,779.92
132.4	Structural steel member, 100-ton project, 1 to 2 story building, W12x87, A992 steel, shop fabricated, incl shop primer, bolted connections	640	0.088	L.F.	$ 86.10	$ 3.88	$ 2.40	$ 92.38	$ 12,231.11
412.78	Column, structural, 2-tier, W10x112, A992 steel, incl shop primer, splice plates, bolts	960	0.058	L.F.	$ 111.52	$ 2.58	$ 1.60	$ 115.70	$ 47,758.65
63.28	Column, structural, 2-tier, W12x50, A992 steel, incl shop primer, splice plates, bolts	1032	0.054	L.F.	$ 49.61	$ 2.40	$ 1.49	$ 53.50	$ 3,385.48
224.4	Column, structural, 2-tier, W8x67, A992 steel, incl shop primer, splice plates, bolts	984	0.057	L.F.	$ 66.42	$ 2.52	$ 1.56	$ 70.50	$ 15,820.20

126.56	Structural steel member, 100-ton project, 1 to 2 story building, W12x50, A992 steel, shop fabricated, incl shop primer, bolted connections	750	0.075	L.F.	$ 49.61	$ 3.31	$ 2.05	$ 54.97	$ 6,957.00
296.64	Structural steel member, 100-ton project, 1 to 2 story building, W16x40, A992 steel, shop fabricated, incl shop primer, bolted connections	800	0.07	L.F.	$ 39.77	$ 3.10	$ 1.92	$ 44.79	$ 13,286.51
135.28	Structural steel member, 100-ton project, 1 to 2 story building, W18x76, A992 steel, shop fabricated, incl shop primer, bolted connections	900	0.089	L.F.	$ 75.44	$ 3.99	$ 1.85	$ 81.28	$ 10,995.56
253.12	Structural steel member, 100-ton project, 1 to 2 story building, W18x65, A992 steel, shop fabricated, incl shop primer, bolted connections	900	0.089	L.F.	$ 64.37	$ 3.99	$ 1.85	$ 70.21	$ 17,771.56
92	Column, structural tubing, 10" x 10" x 1/2" x 16'-0", incl shop primer, cap & base plate, bolts	48	1.167	Ea.	$ 984.00	$ 51.89	$ 31.82	$1,067.71	$ 98,229.32
397.2	Structural steel member, 100-ton project, 1 to 2 story building, W24x146, A992 steel, shop fabricated, incl shop primer, bolted connections	1050	0.076	L.F.	$ 145.14	$ 3.42	$ 1.59	$ 150.15	$ 59,639.58
322.24	Column, structural, 2-tier, W12x87, A992 steel, incl shop primer, splice plates, bolts	984	0.057	L.F.	$ 86.10	$ 2.52	$ 1.56	$ 90.18	$ 29,059.60
165.5	Column, structural, 2-tier, W10x112, A992 steel, incl shop primer, splice plates, bolts	960	0.058	L.F.	$ 111.52	$ 2.58	$ 1.60	$ 115.70	$ 19,148.35

202.92	Column, structural, 2-tier, W12x120, A992 steel, incl shop primer, splice plates, bolts	960	0.058	L.F.	$ 118.90	$ 2.58	$ 1.60	$ 123.08	$ 24,975.39
11	Column, structural, 8" dia x 14'-0" H, extra strong pipe, incl shop primer, cap & base plate, exlc bolts	50	1.12	Ea.	$ 549.40	$ 49.77	$ 30.84	$ 630.01	$ 6,930.11

Total Steel Column Estimate	**$439158.34**

Steel Beam Estimate

Quantity	Description	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total O&P	Total Inc. O&P
378	Structural steel member, 100-ton project, 1 to 2 story building, W10x12, A992 steel, shop fabricated, incl shop primer, bolted connections	600	0.093	L.F.	$ 11.89	$ 4.14	$ 2.56	$ 18.59	$ 23.04	$ 8,709.12
21	Structural steel member, 100-ton project, 1 to 2 story building, W8x31, A992 steel, shop fabricated, incl shop primer, bolted connections	550	0.102	L.F.	$ 30.75	$ 4.51	$ 2.79	$ 38.05	$ 44.87	$ 942.27

2336.25	Structural steel member, 100-ton project, 1 to 2 story building, W8x15, A992 steel, shop fabricated, incl shop primer, bolted connections	600	0.093	L.F.	$ 14.88	$ 4.14	$ 2.56	$ 21.58	$ 26.32	$ 61,490.10
162.75	Structural steel member, 100-ton project, 1 to 2 story building, W8x10, A992 steel, shop fabricated, incl shop primer, bolted connections	600	0.093	L.F.	$ 9.92	$ 4.14	$ 2.56	$ 16.62	$ 20.87	$ 3,396.59
31.5	Structural steel member, 100-ton project, 1 to 2 story building, W10x33, A992 steel, shop fabricated, incl shop primer, bolted connections	550	0.102	L.F.	$ 32.80	$ 4.51	$ 2.79	$ 40.10	$ 46.92	$ 1,477.98
63	Structural steel member, 100-ton project, 1 to 2 story building, W14x53, A992 steel, shop fabricated, incl shop primer, bolted connections	800	0.07	L.F.	$ 52.48	$ 3.10	$ 1.92	$ 57.50	$ 65.26	$ 4,111.38
105	Structural steel member, 100-ton project, 1 to 2 story building, W12x50, A992 steel, shop fabricated, incl shop primer, bolted connections	750	0.075	L.F.	$ 49.61	$ 3.31	$ 2.05	$ 54.97	$ 62.50	$ 6,562.50
441	Structural steel member, 100-ton project, 1 to 2 story building, W12x22, A992 steel, shop fabricated, incl shop primer, bolted	880	0.064	L.F.	$ 21.73	$ 2.82	$ 1.74	$ 26.29	$ 30.98	$ 13,662.18

	connections									
378	Structural steel member, 100-ton project, 1 to 2 story building, W16x31, A992 steel, shop fabricated, incl shop primer, bolted connections	900	0.062	L.F.	$ 30.75	$ 2.75	$ 1.70	$ 35.20	$ 40.68	$ 15,377.04
141.75	Structural steel member, 100-ton project, 1 to 2 story building, W16x26, A992 steel, shop fabricated, incl shop primer, bolted connections	1000	0.056	L.F.	$ 25.83	$ 2.48	$ 1.54	$ 29.85	$ 34.26	$ 4,856.36
213	Structural steel member, 100-ton project, 1 to 2 story building, W18x76, A992 steel, shop fabricated, incl shop primer, bolted connections	900	0.089	L.F.	$ 75.44	$ 3.99	$ 1.85	$ 81.28	$ 91.85	$ 19,564.05
1512	Structural steel member, 100-ton project, 1 to 2 story building, W18x50, A992 steel, shop fabricated, incl shop primer, bolted connections	912	0.088	L.F.	$ 49.61	$ 3.94	$ 1.82	$ 55.37	$ 63.42	$ 95,891.04
3265.5	Structural steel member, 100-ton project, 1 to 2 story building, W18x35, A992 steel, shop fabricated, incl shop primer, bolted connections	960	0.083	L.F.	$ 34.85	$ 3.74	$ 1.73	$ 40.32	$ 46.61	$152,204.96

1512	Structural steel member, 100-ton project, 1 to 2 story building, W21x83, A992 steel, shop fabricated, incl shop primer, bolted connections	1000	0.08	L.F.	$ 82.00	$ 3.59	$ 1.66	$ 87.25	$ 98.33	$148,674.96
657.5	Structural steel member, 100-ton project, 1 to 2 story building, W18x76, A992 steel, shop fabricated, incl shop primer, bolted connections	900	0.089	L.F.	$ 75.44	$ 3.99	$ 1.85	$ 81.28	$ 91.85	$ 60,391.38
525	Structural steel member, 100-ton project, 1 to 2 story building, W21x62, A992 steel, shop fabricated, incl shop primer, bolted connections	1036	0.077	L.F.	$ 61.50	$ 3.46	$ 1.61	$ 66.57	$ 75.50	$ 39,637.50
472.5	Structural steel member, 100-ton project, 1 to 2 story building, W18x55, A992 steel, shop fabricated, incl shop primer, bolted connections	912	0.088	L.F.	$ 54.53	$ 3.94	$ 1.82	$ 60.29	$ 68.75	$ 32,484.38
2362.5	Structural steel member, 100-ton project, 1 to 2 story building, W21x44, A992 steel, shop fabricated, incl shop primer, bolted connections	1064	0.075	L.F.	$ 43.46	$ 3.38	$ 1.57	$ 48.41	$ 55.62	$131,402.25
477	Structural steel member, 100-ton project, 1 to 2 story building, W24x117, A992 steel, shop fabricated, incl shop primer, bolted	1050	0.076	L.F.	$ 116.44	$ 3.42	$ 1.59	$ 121.45	$ 135.64	$ 64,700.28

	connections									
96	Structural steel member, 100-ton project, 1 to 2 story building, W24x94, A992 steel, shop fabricated, incl shop primer, bolted connections	1080	0.074	L.F.	$ 93.48	$ 3.33	$ 1.54	$ 98.35	$ 110.01	$ 10,560.96
3339	Structural steel member, 100-ton project, 1 to 2 story building, W24x62, A992 steel, shop fabricated, incl shop primer, bolted connections	1110	0.072	L.F.	$ 61.50	$ 3.24	$ 1.50	$ 66.24	$ 74.96	$250,291.44
84	Structural steel member, 100-ton project, 1 to 2 story building, W36x260, A992 steel, shop fabricated, incl shop primer, bolted connections	1035	0.077	L.F.	$ 258.30	$ 3.47	$ 1.61	$ 263.38	$ 290.76	$ 24,423.84
420	Structural steel member, 100-ton project, 1 to 2 story building, W36x194, A992 steel, shop fabricated, incl shop primer, bolted connections	1125	0.071	L.F.	$ 192.70	$ 3.20	$ 1.48	$ 197.38	$ 218.80	$ 91,896.00
1890	Structural steel member, 100-ton project, 1 to 2 story building, W27x146, A992 steel, shop fabricated, incl shop primer, bolted connections	1150	0.07	L.F.	$ 145.14	$ 3.12	$ 1.45	$ 149.71	$ 166.13	$313,985.70

2583	Structural steel member, 100-ton project, 1 to 2 story building, W33x130, A992 steel, shop fabricated, incl shop primer, bolted connections	1134	0.071	L.F.	$ 128.74	$ 3.17	$ 1.47	$ 133.38	$ 149.04	$384,970.32
126	Structural steel member, 100-ton project, 1 to 2 story building, W27x114, A992 steel, shop fabricated, incl shop primer, bolted connections	1150	0.07	L.F.	$ 113.16	$ 3.12	$ 1.45	$ 117.73	$ 131.69	$ 16,592.94
63	Structural steel member, 100-ton project, 1 to 2 story building, W27x94, A992 steel, shop fabricated, incl shop primer, bolted connections	1190	0.067	L.F.	$ 93.48	$ 3.02	$ 1.40	$ 97.90	$ 109.32	$ 6,887.16
4221	Structural steel member, 100-ton project, 1 to 2 story building, W27x84, A992 steel, shop fabricated, incl shop primer, bolted connections	1190	0.067	L.F.	$ 83.64	$ 3.02	$ 1.40	$ 88.06	$ 98.66	$416,443.86
189	Structural steel member, 100-ton project, 1 to 2 story building, W30x148, A992 steel, shop fabricated, incl shop primer, bolted connections	1160	0.069	L.F.	$ 146.78	$ 3.10	$ 1.43	$ 151.31	$ 168.52	$ 31,850.28
16	Column, structural tubing, 6" x 6" x 1/4" x 12'-0", incl shop primer, cap & base plate, bolts	54	1.037	Ea.	$ 243.54	$46.07	$ 28.39	$ 318.00	$ 377.26	$ 6,036.16

117	Column, structural tubing, 10" x 10" x 1/2" x 16'-0", incl shop primer, cap & base plate, bolts	48	1.167	Ea.	$ 984.00	$51.89	$ 31.82	$ 1,067.71	$ 1,211.23	$141,713.91
76	Column, structural tubing, 5" x 3" x 1/4" x 12'-0", incl shop primer, cap & base plate, bolts	58	0.966	Ea.	$ 144.32	$42.89	$ 26.43	$ 213.64	$ 262.09	$ 19,918.84
409.5	Channel framing, structural steel, field fabricated, C7x9.8, incl cutting & welding	40	0.6	L.F.	$ 5.29	$27.53	$ 3.24	$ 36.06	$ 59.68	$ 24,438.96
1071	Channel framing, structural steel, field fabricated, C8x11.5, incl cutting & welding	36	0.667	L.F.	$ 6.23	$30.71	$ 3.59	$ 40.53	$ 66.41	$ 71,125.11

Total Steel Beam Estimate	**$2676671.80**

Metal Deck Estimate

Quantity	Description	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total O&P	Total Inc. O&P
174636	Metal decking, steel, non-cellular, composite, galvanized, 3" D, 20 ga	3000	0.011	S.F.	$ 1.68	$0.48	$ 0.04	$ 2.20	$ 2.76	$ 481,995.36
Total Metal Deck Estimate										**$481995.36**

Total Concrete Estimate

Quantity	Description	Unit	Material	Labor	Equipment	Total	Total O&P	Total Inc. O&P
42	Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	C.Y.	$ 97.34	$ -	$ -	$ 97.34	$ 107.16	$ 4,500.72
991	Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	C.Y.	$ 97.34	$ -	$ -	$ 97.34	$ 107.16	$ 106,195.56

1196	Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	C.Y.	$ 97.34	$ -	$ -	$ 97.34	$ 107.16	$ 128,163.36
2279	Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	C.Y.	$ 97.34	$ -	$ -	$ 97.34	$ 107.16	$ 244,217.64
1030	Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	C.Y.	$ 97.34	$ -	$ -	$ 97.34	$ 107.16	$ 110,374.80
9254	Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	C.Y.	$ 97.34	$ -	$ -	$ 97.34	$ 107.16	$ 991,658.64
1243	Structural concrete, ready mix, normal weight, 5000 psi, includes local aggregate, sand, portland cement and water, delivered, excludes all additives and treatments	C.Y.	$ 97.34	$ -	$ -	$ 97.34	$ 107.16	$ 133,199.88
Total Concrete Estimate								**$1,718,310.60**

Rebar Estimate

Quantity	Description	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total O&P	Total Inc. O&P
2.6	Reinforcing steel, in place, walls, #8 to #18, A615, grade 60, incl labor for accessories, excl material for accessories	4	8	Ton	$907.80	$405.38	$ -	$ 1,313.18	$ 1,658.38	$ 4,311.79
1.3	Reinforcing steel, in place, walls, #3 to #7, A615, grade 60, incl labor for accessories, excl material for accessories	3	10.667	Ton	$907.80	$540.50	$ -	$ 1,448.30	$ 1,881.63	$ 2,446.12
70	Reinforcing steel, in place, beams and girders, #8 to # 18, A615, grade 60, incl labor for accessories, excl material for accessories	2.7	11.852	Ton	$953.70	$599.25	$ -	$ 1,552.95	$ 2,026.63	$141,864.10
20.5	Reinforcing steel, in place, columns, #8 to #18, A615, grade 60, incl labor for accessories, excl material for accessories	2.3	13.913	Ton	$953.70	$705.00	$ -	$ 1,658.70	$ 2,197.00	$ 45,038.50
Total Rebar Estimate										**$193660.51**

Formwork Estimate

Quantity	Description	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total O&P	Total Inc. O&P
11118	C.I.P. concrete forms, equipment foundations, 4 use, includes erecting, bracing, stripping and cleaning	205	0.234	SFCA	$ 0.93	$ 10.98	$ -	$ 11.91	$ 18.12	$ 201,458.16
35700	C.I.P. concrete forms, wall, job built, plywood, 8 to 16' high, 4 use, includes erecting, bracing, stripping and cleaning	395	0.122	SFCA	$ 0.75	$ 5.69	$ -	$ 6.44	$ 9.64	$ 344,148.00
13260	C.I.P. concrete forms, wall, job built, plywood, 8 to 16' high, 4 use, includes erecting, bracing, stripping and cleaning	395	0.122	SFCA	$ 0.75	$ 5.69	$ -	$ 6.44	$ 9.64	$ 127,826.40
255	C.I.P. concrete forms, column, round fiber tube, recycled paper, 18" diameter, 1 use, includes erecting, bracing and stripping	140	0.229	L.F.	$ 4.53	$ 10.41	$ -	$ 14.94	$ 21.21	$ 5,408.55
680	C.I.P. concrete forms, column, round fiber tube, recycled paper, 30" diameter, 1 use, includes erecting, bracing and stripping	125	0.256	L.F.	$ 11.28	$ 11.67	$ -	$ 22.95	$ 30.56	$ 20,780.80
13148	C.I.P. concrete forms, elevated slab, flat plate, plywood, 15' to 20' high, includes shoring, erecting, bracing, stripping and cleaning	495	0.097	S.F.	$ 1.50	$ 4.54	$ -	$ 6.04	$ 8.72	$ 114,650.56

Total Formwork Estimate	$814272.47

Concrete Placing Estimate

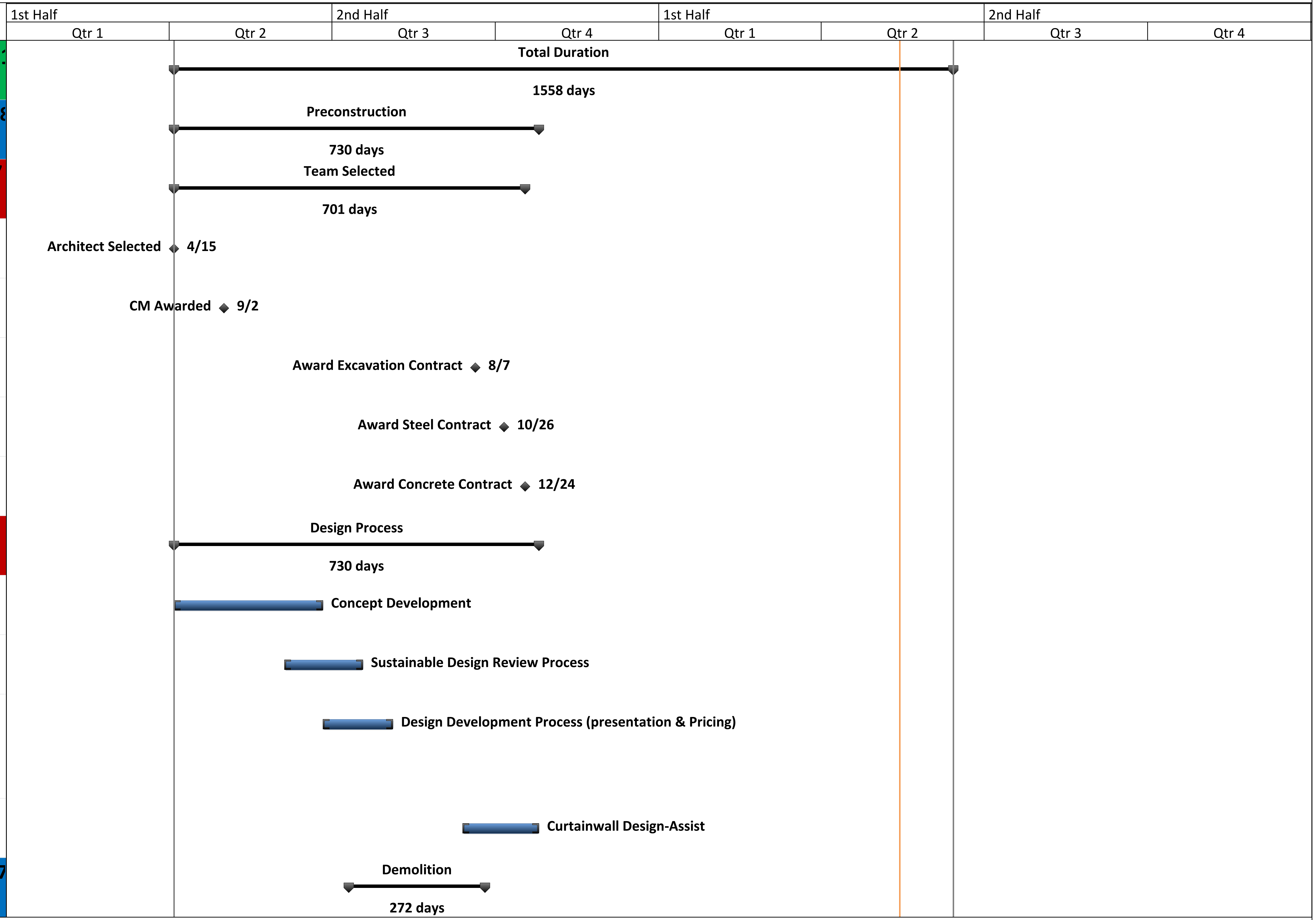
Quantity	Description	Daily Output	Labor Hours	Unit	Material	Labor	Equipment	Total	Total O&P	Total Inc. O&P
7	Structural concrete, placing, column, square or round, pumped, 18" thick, includes vibrating, excludes material	90	0.711	C.Y.	$ -	$ 29.92	$ 8.47	$ 38.39	$ 55.49	$ 388.43
33	Structural concrete, placing, column, square or round, pumped, 36" thick, includes vibrating, excludes material	140	0.457	C.Y.	$ -	$ 19.38	$ 5.43	$ 24.81	$ 35.89	$ 1,184.37
1	Structural concrete, placing, column, square or round, pumped, 12" thick, includes vibrating, excludes material	60	1.067	C.Y.	$ -	$ 44.88	$ 12.68	$ 57.56	$ 83.55	$ 83.55
2	Structural concrete, placing, column, square or round, pumped, 18" thick, includes vibrating, excludes material	90	0.711	C.Y.	$ -	$ 29.92	$ 8.47	$ 38.39	$ 55.49	$ 110.98
9254	Structural concrete, placing, elevated slab, pumped, less than 6" thick, includes vibrating, excludes material	140	0.457	C.Y.	$ -	$ 19.38	$ 5.43	$ 24.81	$ 35.89	$ 332,126.06

231	Structural concrete, placing, continuous footing, deep, direct chute, includes vibrating, excludes material	140	0.343	C.Y.	$ -	$ 14.12	$ 0.34	$ 14.46	$ 22.11	$ 5,107.41
396	Structural concrete, placing, spread footing, direct chute, over 5 C.Y., includes vibrating, excludes material	120	0.4	C.Y.	$ -	$ 16.52	$ 0.40	$ 16.92	$ 25.82	$ 10,224.72
616	Structural concrete, placing, column, square or round, pumped, 12" thick, includes vibrating, excludes material	60	1.067	C.Y.	$ -	$ 44.88	$ 12.68	$ 57.56	$ 83.55	$ 51,466.80
991	Structural concrete, placing, beam, large, elevated, pumped, includes vibrating, excludes material	90	0.711	C.Y.	$ -	$ 29.92	$ 8.47	$ 38.39	$ 55.49	$ 54,990.59
1196	Structural concrete, placing, walls, direct chute, 12" thick, includes vibrating, excludes material	100	0.48	C.Y.	$ -	$ 19.78	$ 0.48	$ 20.26	$ 31.11	$ 37,207.56
2279	Structural concrete, placing, walls, pumped, 12" thick, includes vibrating, excludes material	110	0.582	C.Y.	$ -	$ 24.65	$ 6.90	$ 31.55	$ 45.37	$ 103,398.23
1030	Structural concrete, placing, walls, pumped, 12" thick, includes vibrating, excludes material	110	0.582	C.Y.	$ -	$ 24.65	$ 6.90	$ 31.55	$ 45.37	$ 46,731.10

Total Concrete Placement Estimate	**$ 643,019.80**

Appendix C – Detailed Project Schedule

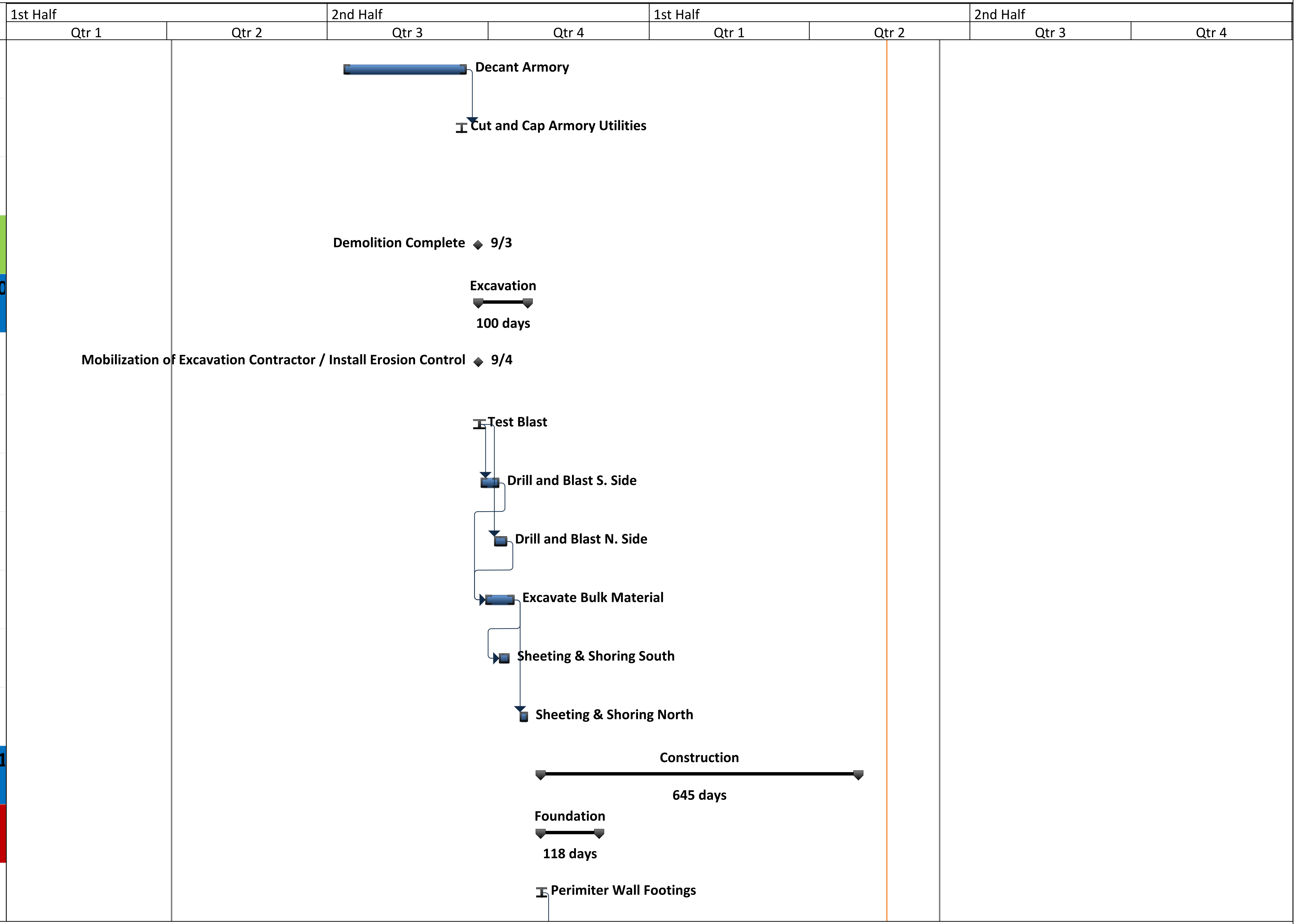
Task Name	Duration	Start	Finish
Total Duration	**1558 day**	**Fri 4/15/0**	**Tue 4/5/1**
Preconstruction	**730 days**	**Fri 4/15/05**	**Thu 1/31/08**
Team Selected	**701 days**	**Fri 4/15/05**	**Mon 12/24/07**
Architect Selected	0 days	Fri 4/15/05	Fri 4/15/05
CM Awarded	0 days	Fri 9/2/05	Fri 9/2/05
Award Excavation Contract	0 days	Tue 8/7/07	Tue 8/7/07
Award Steel Contract	0 days	Fri 10/26/07	Fri 10/26/07
Award Concrete Contract	0 days	Mon 12/24/07	Mon 12/24/07
Design Process	**730 days**	**Fri 4/15/05**	**Thu 1/31/08**
Concept Development	297 days	Fri 4/15/05	Mon 6/5/06
Sustainable Design Review Process	157 days	Sat 2/18/06	Mon 9/25/06
Design Development Process (presentation & Pricing)	140 days	Tue 6/6/06	Mon 12/18/06
Curtainwall Design-Assist	154 days	Mon 7/2/07	Thu 1/31/08
Demolition	**272 days**	**Thu 8/17/0**	**Mon 9/3/07**



Scheduled Tasks | Milestones | Total Duration

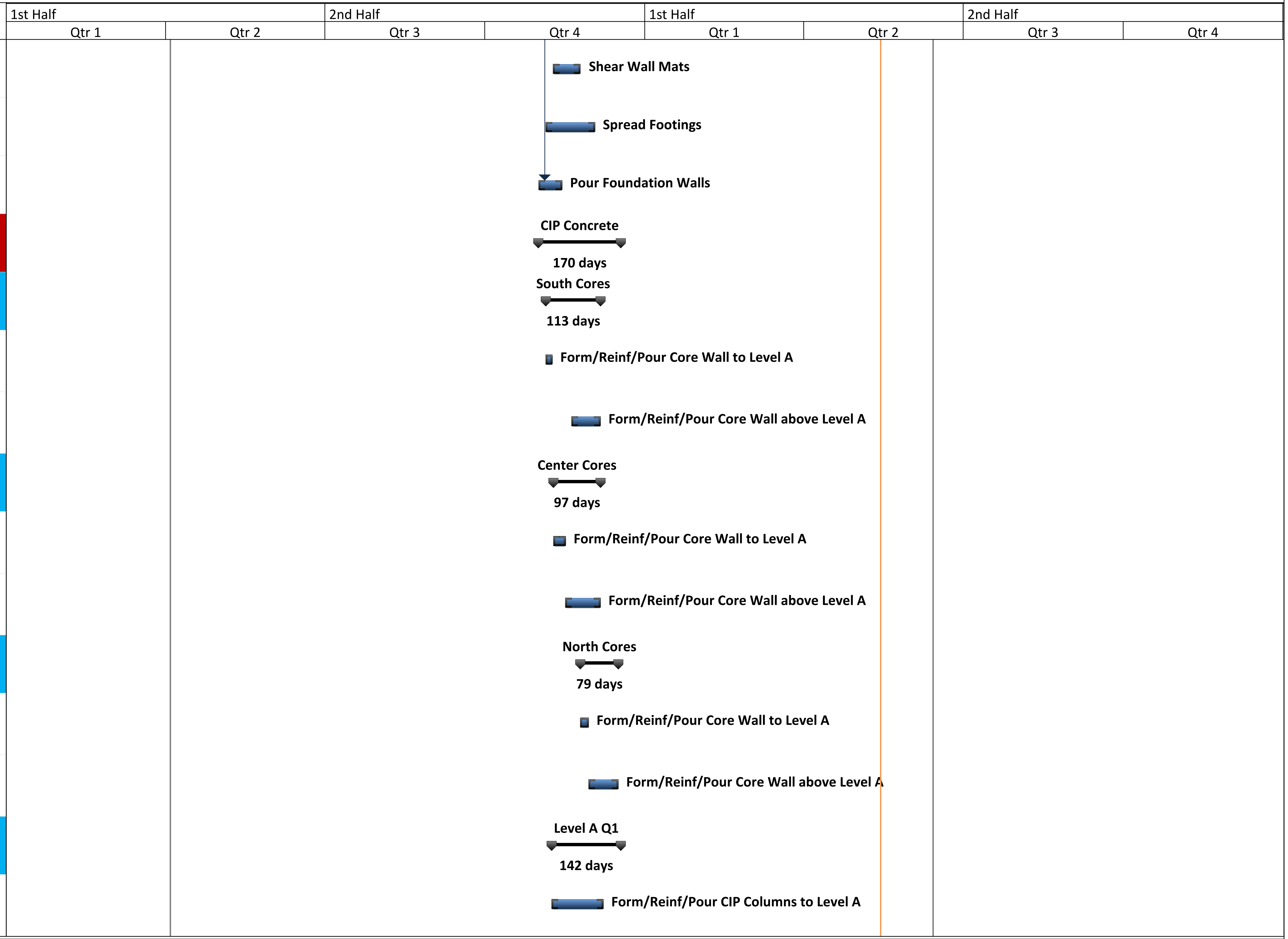
Chemistry Building | **Michael Gallagher**
Construction Option | **Tech Two - Detailed Schedule Summary**
October 27, 2010

Task Name	Duration	Start	Finish
Decant Armory	249 days	Thu 8/17/06	Tue 7/31/07
Cut and Cap Armory Utilities	5 days	Mon 7/16/07	Fri 7/20/07
Demolish Armory	24 days	Tue 7/31/07	Fri 8/31/07
Demolition Complete	0 days	Mon 9/3/07	Mon 9/3/07
Excavation	**100 days**	**Tue 9/4/07**	**Mon 1/21/0**
Mobilization of Excavation Contractor / Install Erosion Control	0 days	Tue 9/4/07	Tue 9/4/07
Test Blast	1 day	Fri 9/7/07	Fri 9/7/07
Drill and Blast S. Side	38 days	Tue 9/11/07	Thu 11/1/07
Drill and Blast N. Side	26 days	Fri 10/19/07	Fri 11/23/07
Excavate Bulk Material	60 days	Mon 9/24/07	Fri 12/14/07
Sheeting & Shoring South	21 days	Fri 11/2/07	Fri 11/30/07
Sheeting & Shoring North	16 days	Mon 12/31/07	Mon 1/21/08
Construction	**645 days**	**Thu 2/28/0**	**Wed 8/18/1**
Foundation	**118 days**	**Thu 2/28/08**	**Mon 8/11/08**
Perimiter Wall Footings	4 days	Thu 2/28/08	Tue 3/4/08



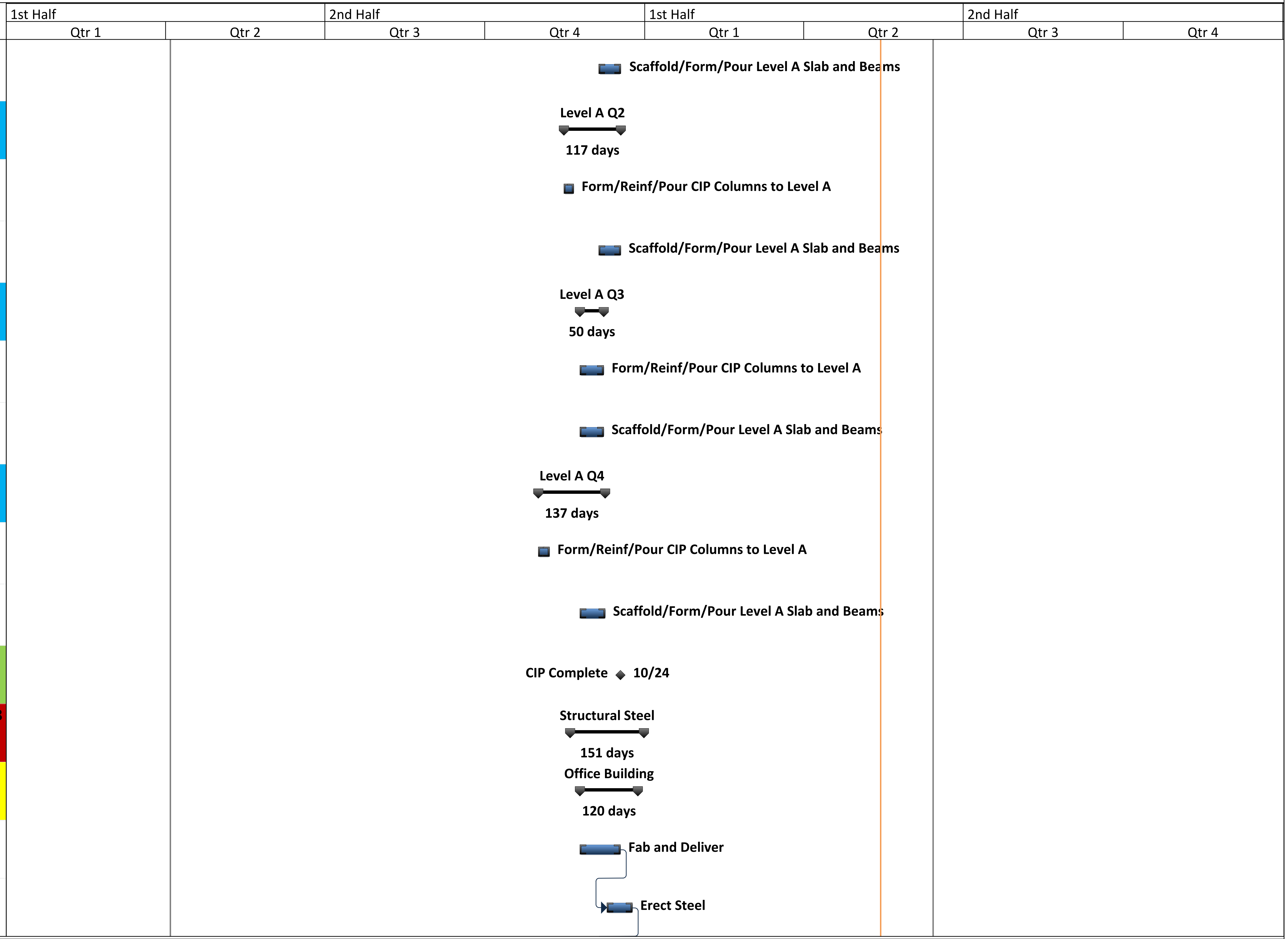
Scheduled Tasks | Milestones | Total Duration

Task Name	Duration	Start	Finish
Shear Wall Mats	56 days	Mon 4/14/08	Mon 6/30/08
Spread Footings	101 days	Mon 3/24/08	Mon 8/11/08
Pour Foundation Walls	49 days	Tue 3/4/08	Fri 5/9/08
CIP Concrete	**170 days**	**Mon 3/3/08**	**Fri 10/24/08**
South Cores	**113 days**	**Mon 3/24/08**	**Wed 8/27/08**
Form/Reinf/Pour Core Wall to Level A	15 days	Mon 3/24/08	Fri 4/11/08
Form/Reinf/Pour Core Wall above Level A	59 days	Fri 6/6/08	Wed 8/27/08
Center Cores	**97 days**	**Tue 4/15/08**	**Wed 8/27/08**
Form/Reinf/Pour Core Wall to Level A	25 days	Tue 4/15/08	Mon 5/19/08
Form/Reinf/Pour Core Wall above Level A	73 days	Mon 5/19/08	Wed 8/27/08
North Cores	**79 days**	**Tue 7/1/08**	**Fri 10/17/08**
Form/Reinf/Pour Core Wall to Level A	18 days	Tue 7/1/08	Thu 7/24/08
Form/Reinf/Pour Core Wall above Level A	61 days	Fri 7/25/08	Fri 10/17/08
Level A Q1	**142 days**	**Thu 4/10/08**	**Fri 10/24/08**
Form/Reinf/Pour CIP Columns to Level A	106 days	Thu 4/10/08	Thu 9/4/08



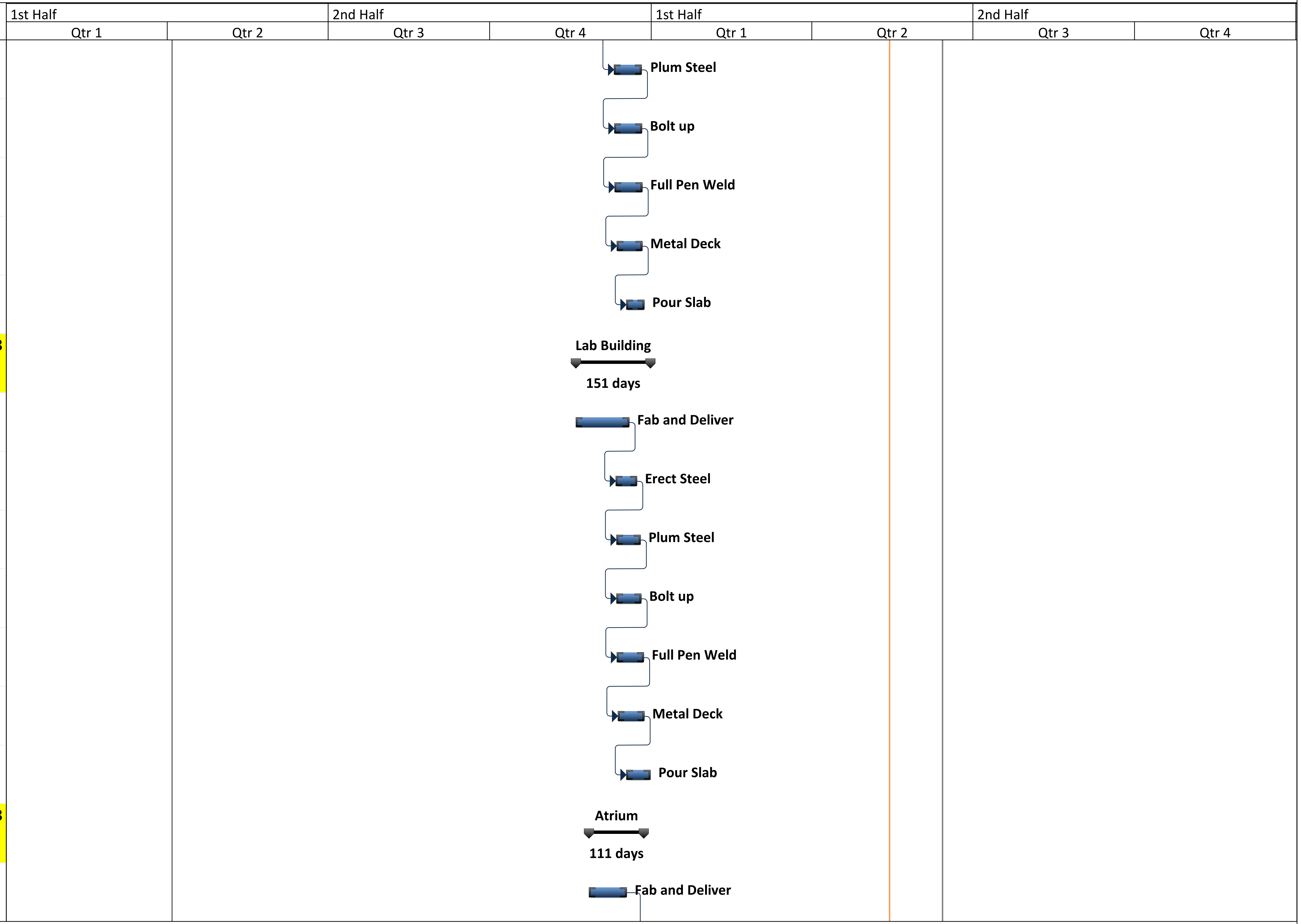
Scheduled Tasks | Milestones ◆ | Total Duration

Task Name	Duration	Start	Finish
Scaffold/Form/Pour Level A Slab and Beams	46 days	Sat 8/23/08	Fri 10/24/08
Level A Q2	**117 days**	**Thu 5/15/08**	**Fri 10/24/08**
Form/Reinf/Pour CIP Columns to Level A	20 days	Thu 5/15/08	Wed 6/11/08
Scaffold/Form/Pour Level A Slab and Beams	46 days	Sat 8/23/08	Fri 10/24/08
Level A Q3	**50 days**	**Mon 6/30/08**	**Fri 9/5/08**
Form/Reinf/Pour CIP Columns to Level A	50 days	Mon 6/30/08	Fri 9/5/08
Scaffold/Form/Pour Level A Slab and Beams	50 days	Mon 6/30/08	Fri 9/5/08
Level A Q4	**137 days**	**Mon 3/3/08**	**Tue 9/9/08**
Form/Reinf/Pour CIP Columns to Level A	24 days	Mon 3/3/08	Thu 4/3/08
Scaffold/Form/Pour Level A Slab and Beams	52 days	Mon 6/30/08	Tue 9/9/08
CIP Complete	0 days	Fri 10/24/08	Fri 10/24/08
Structural Steel	**151 days**	**Mon 6/2/08**	**Mon 12/29/08**
Office Building	**120 days**	**Mon 6/30/08**	**Fri 12/12/08**
Fab and Deliver	84 days	Mon 6/30/08	Thu 10/23/08
Erect Steel	53 days	Mon 9/15/08	Wed 11/26/08



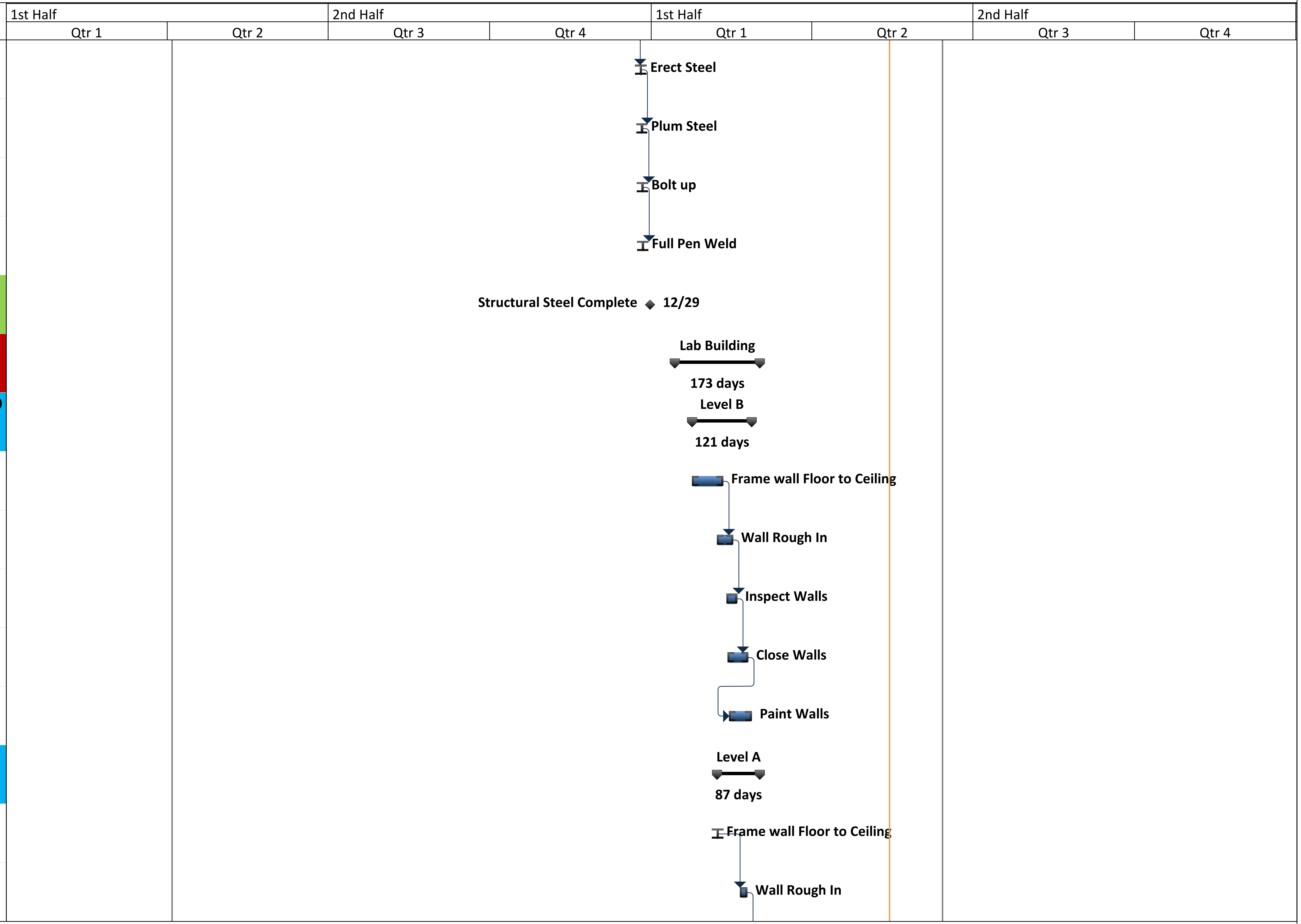
Scheduled Tasks | Milestones | Total Duration

Task Name	Duration	Start	Finish
Plum Steel	56 days	Thu 9/18/08	Thu 12/4/08
Bolt up	56 days	Fri 9/19/08	Fri 12/5/08
Full Pen Weld	57 days	Sat 9/20/08	Sat 12/6/08
Metal Deck	52 days	Fri 9/26/08	Sat 12/6/08
Pour Slab	37 days	Thu 10/23/08	Fri 12/12/08
Lab Building	**151 days**	**Mon 6/2/08**	**Mon 12/29/08**
Fab and Deliver	109 days	Mon 6/2/08	Thu 10/30/08
Erect Steel	44 days	Tue 9/23/08	Fri 11/21/08
Plum Steel	48 days	Thu 9/25/08	Mon 12/1/08
Bolt up	50 days	Thu 9/25/08	Wed 12/3/08
Full Pen Weld	54 days	Fri 9/26/08	Wed 12/10/08
Metal Deck	55 days	Mon 9/29/08	Fri 12/12/08
Pour Slab	48 days	Thu 10/23/08	Mon 12/29/08
Atrium	**111 days**	**Wed 7/9/08**	**Wed 12/10/08**
Fab and Deliver	77 days	Wed 7/9/08	Thu 10/23/08



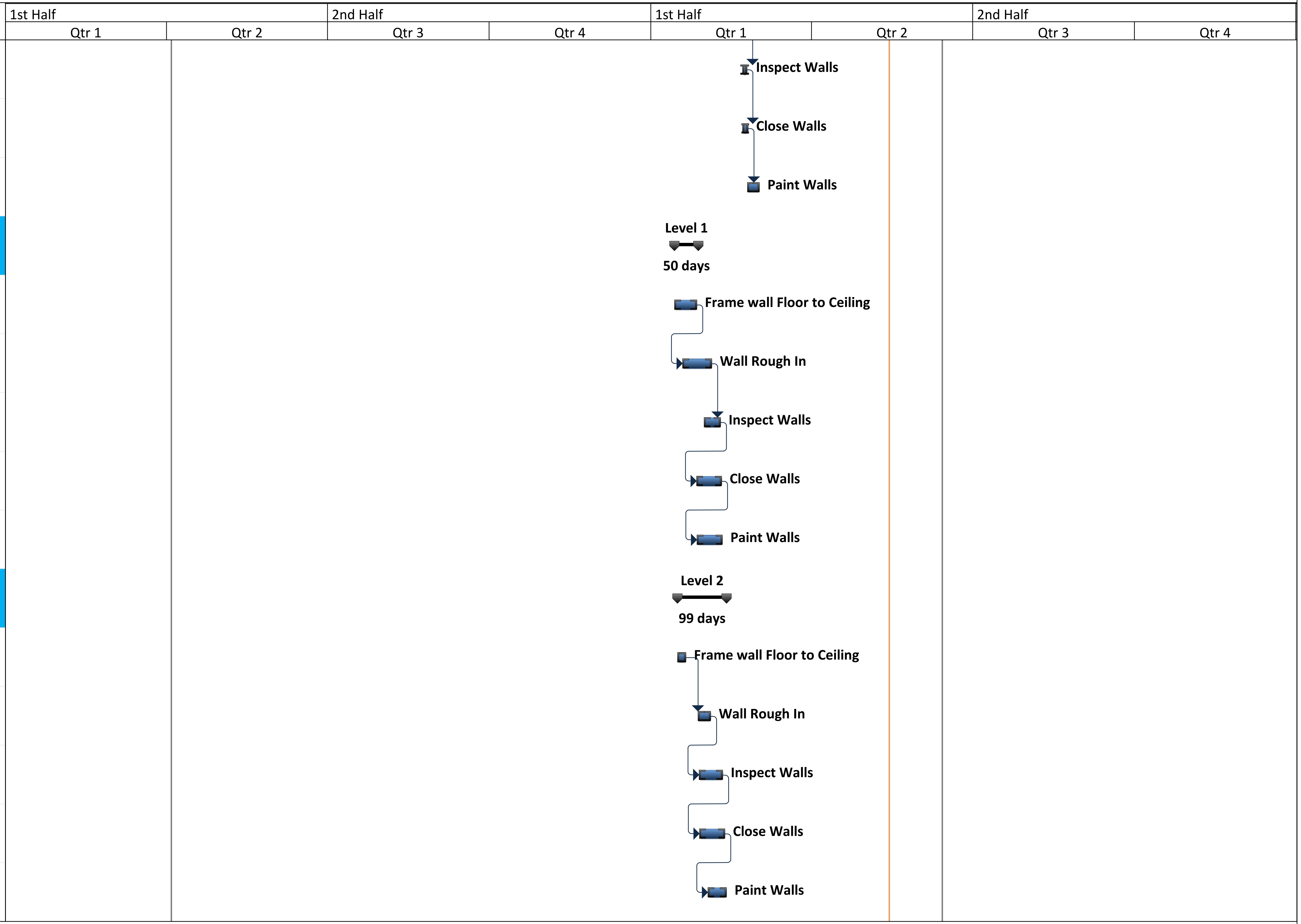
Scheduled Tasks | Milestones | Total Duration

Task Name	Duration	Start	Finish
Erect Steel	4 days	Mon 12/1/08	Thu 12/4/08
Plum Steel	4 days	Wed 12/3/08	Mon 12/8/08
Bolt up	3 days	Fri 12/5/08	Tue 12/9/08
Full Pen Weld	4 days	Sat 12/6/08	Wed 12/10/08
Structural Steel Complet	0 days	Mon 12/29/08	Mon 12/29/08
Lab Building	**173 days**	**Mon 3/9/09**	**Wed 11/4/09**
Level B	**121 days**	**Mon 4/27/09**	**Mon 10/12/09**
Frame wall Floor to Ceiling	64 days	Mon 4/27/09	Thu 7/23/09
Wall Rough In	33 days	Tue 7/7/09	Thu 8/20/09
Inspect Walls	22 days	Mon 8/3/09	Tue 9/1/09
Close Walls	42 days	Thu 8/6/09	Fri 10/2/09
Paint Walls	46 days	Mon 8/10/09	Mon 10/12/09
Level A	**87 days**	**Tue 7/7/09**	**Wed 11/4/09**
Frame wall Floor to Ceiling	4 days	Tue 7/7/09	Fri 7/10/09
Wall Rough In	14 days	Thu 9/10/09	Tue 9/29/09



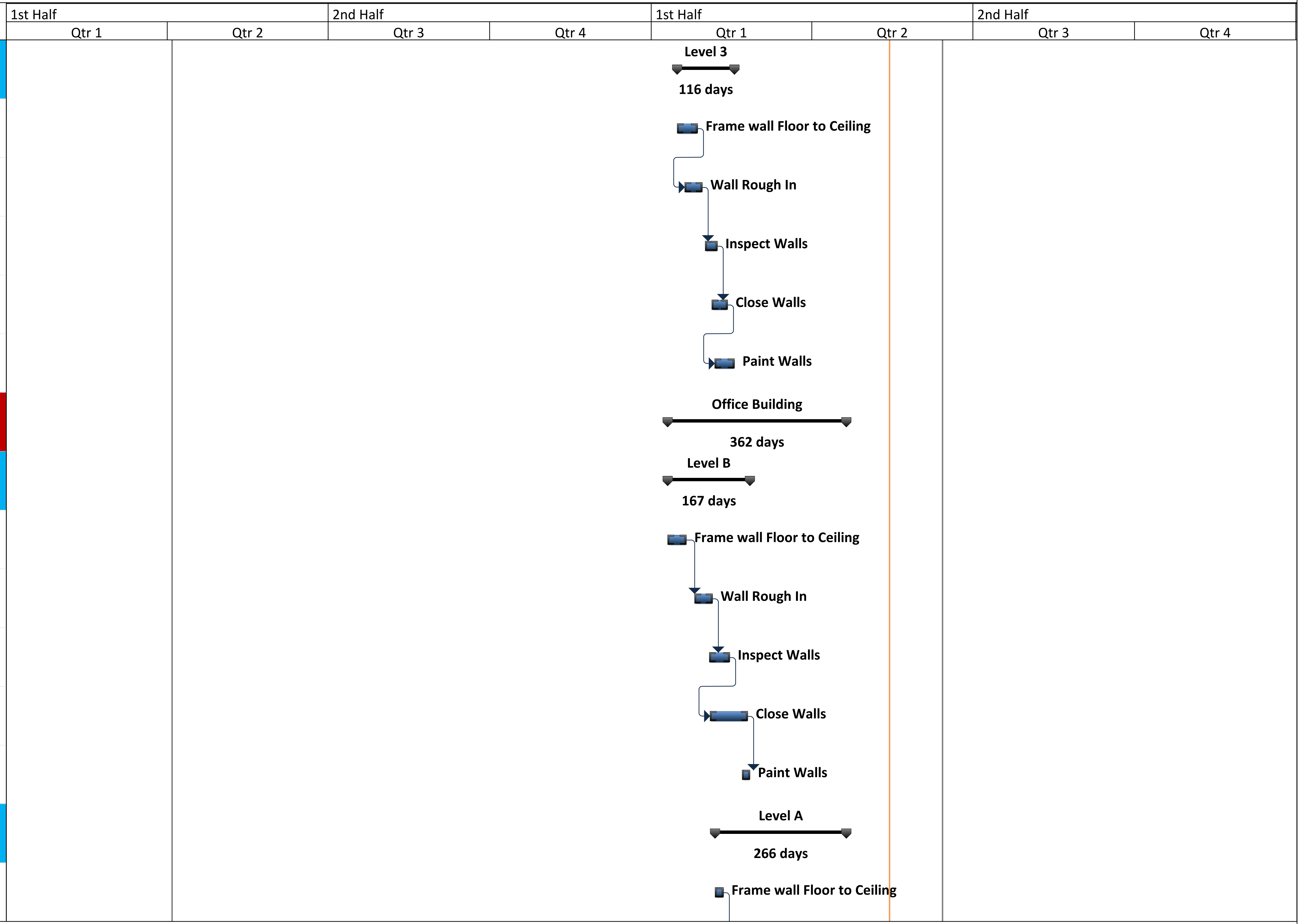
Scheduled Tasks | Milestones | Total Duration

Task Name	Duration	Start	Finish
Inspect Walls	9 days	Fri 9/18/09	Wed 9/30/09
Close Walls	12 days	Fri 9/18/09	Sat 10/3/09
Paint Walls	24 days	Fri 10/2/09	Wed 11/4/09
Level 1	**50 days**	**Mon 3/9/09**	**Fri 5/15/09**
Frame wall Floor to Ceiling	46 days	Mon 3/9/09	Mon 5/11/09
Wall Rough In	59 days	Wed 4/1/09	Mon 6/22/09
Inspect Walls	35 days	Mon 6/1/09	Fri 7/17/09
Close Walls	51 days	Mon 5/11/09	Mon 7/20/09
Paint Walls	52 days	Tue 5/12/09	Wed 7/22/09
Level 2	**99 days**	**Wed 3/18/09**	**Mon 8/3/09**
Frame wall Floor to Ceiling	18 days	Wed 3/18/09	Fri 4/10/09
Wall Rough In	26 days	Fri 5/15/09	Fri 6/19/09
Inspect Walls	49 days	Mon 5/18/09	Thu 7/23/09
Close Walls	52 days	Tue 5/19/09	Wed 7/29/09
Paint Walls	37 days	Fri 6/12/09	Mon 8/3/09



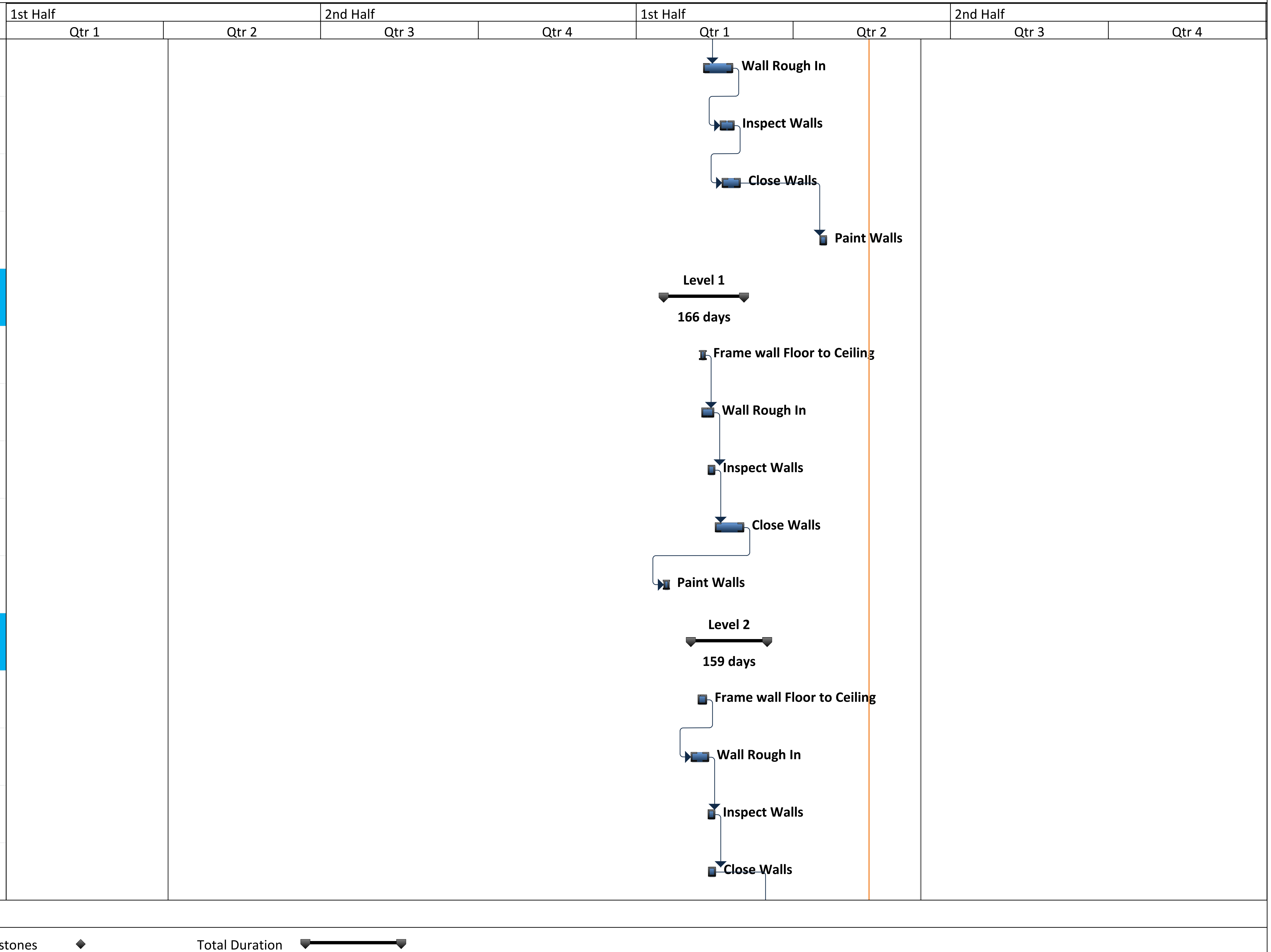
Scheduled Tasks | Milestones | Total Duration

Task Name	Duration	Start	Finish
Level 3	**116 days**	**Mon 3/16/09**	**Mon 8/24/09**
Frame wall Floor to Ceiling	42 days	Mon 3/16/09	Tue 5/12/09
Wall Rough In	36 days	Mon 4/6/09	Mon 5/25/09
Inspect Walls	25 days	Wed 6/3/09	Tue 7/7/09
Close Walls	33 days	Mon 6/22/09	Wed 8/5/09
Paint Walls	40 days	Tue 6/30/09	Mon 8/24/09
Office Building	**362 days**	**Tue 2/17/09**	**Wed 7/7/10**
Level B	**167 days**	**Tue 2/17/09**	**Wed 10/7/09**
Frame wall Floor to Ceiling	39 days	Tue 2/17/09	Fri 4/10/09
Wall Rough In	37 days	Mon 5/4/09	Tue 6/23/09
Inspect Walls	42 days	Mon 6/15/09	Tue 8/11/09
Close Walls	77 days	Wed 6/17/09	Thu 10/1/09
Paint Walls	16 days	Wed 9/16/09	Wed 10/7/09
Level A	**266 days**	**Wed 7/1/09**	**Wed 7/7/10**
Frame wall Floor to Ceiling	18 days	Wed 7/1/09	Fri 7/24/09

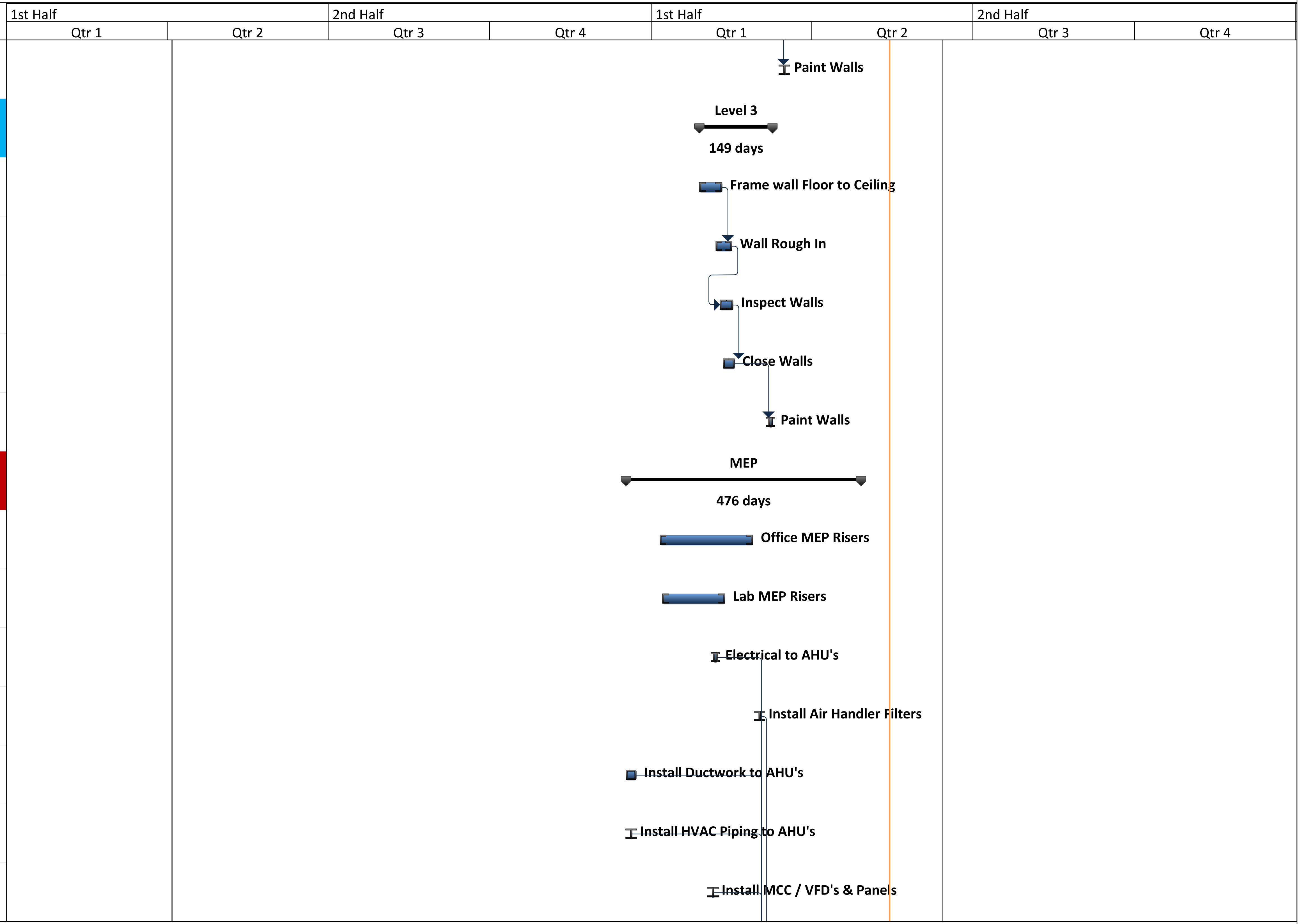


Scheduled Tasks | Milestones | Total Duration

Task Name	Duration	Start	Finish
Wall Rough In	62 days	Wed 7/15/09	Thu 10/8/09
Inspect Walls	30 days	Tue 9/1/09	Mon 10/12/09
Close Walls	40 days	Mon 9/7/09	Fri 10/30/09
Paint Walls	15 days	Thu 6/17/10	Wed 7/7/10
Level 1	**166 days**	**Sun 3/22/09**	**Mon 11/9/09**
Frame wall Floor to Ceiling	10 days	Tue 7/7/09	Mon 7/20/09
Wall Rough In	26 days	Fri 7/10/09	Fri 8/14/09
Inspect Walls	15 days	Tue 7/28/09	Mon 8/17/09
Close Walls	60 days	Tue 8/18/09	Mon 11/9/09
Paint Walls	12 days	Sun 3/22/09	Mon 4/6/09
Level 2	**159 days**	**Tue 6/9/09**	**Fri 1/15/10**
Frame wall Floor to Ceiling	20 days	Mon 6/29/09	Fri 7/24/09
Wall Rough In	38 days	Tue 6/9/09	Thu 7/30/09
Inspect Walls	15 days	Tue 7/28/09	Mon 8/17/09
Close Walls	16 days	Wed 7/29/09	Wed 8/19/09

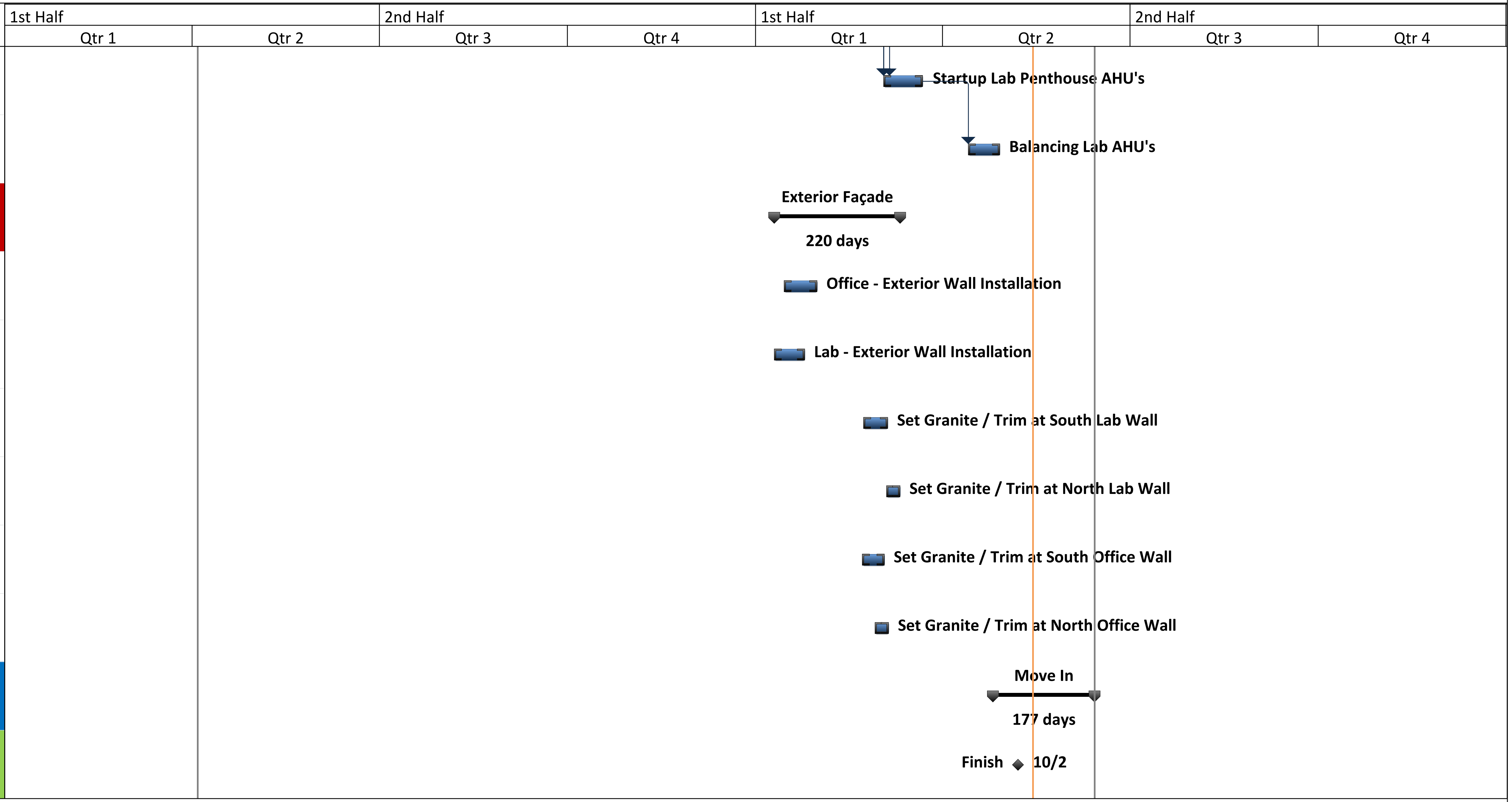


Task Name	Duration	Start	Finish
Paint Walls	5 days	Mon 1/11/10	Fri 1/15/10
Level 3	**149 days**	**Mon 5/18/09**	**Thu 12/10/09**
Frame wall Floor to Ceiling	46 days	Mon 5/18/09	Mon 7/20/09
Wall Rough In	32 days	Fri 7/3/09	Mon 8/17/09
Inspect Walls	27 days	Wed 7/15/09	Thu 8/20/09
Close Walls	22 days	Fri 7/24/09	Mon 8/24/09
Paint Walls	9 days	Mon 11/30/09	Thu 12/10/09
MEP	**476 days**	**Wed 10/22/0**	**Wed 8/18/10**
Office MEP Risers	189 days	Mon 1/26/09	Thu 10/15/09
Lab MEP Risers	127 days	Mon 2/2/09	Tue 7/28/09
Electrical to AHU's	8 days	Fri 6/26/09	Tue 7/7/09
Install Air Handler Filters	5 days	Mon 11/2/09	Fri 11/6/09
Install Ductwork to AHU's	21 days	Wed 10/22/08	Wed 11/19/08
Install HVAC Piping to AHU's	5 days	Mon 11/3/08	Fri 11/7/08
Install MCC / VFD's & Panels	3 days	Wed 6/24/09	Fri 6/26/09



Scheduled Tasks | Milestones | Total Duration

Task Name	Duration	Start	Finish
Startup Lab Penthouse AHU's	69 days	Mon 11/9/09	Thu 2/11/10
Balancing Lab AHU's	55 days	Thu 6/3/10	Wed 8/18/10
Exterior Façade	**220 days**	**Mon 2/16/09**	**Fri 12/18/09**
Office - Exterior Wall Installation	58 days	Thu 3/12/09	Sat 5/30/09
Lab - Exterior Wall Installation	54 days	Mon 2/16/09	Thu 4/30/09
Set Granite / Trim at South Lab Wall	43 days	Mon 9/21/09	Wed 11/18/09
Set Granite / Trim at North Lab Wall	25 days	Mon 11/16/09	Fri 12/18/09
Set Granite / Trim at South Office Wall	38 days	Fri 9/18/09	Tue 11/10/09
Set Granite / Trim at North Office Wall	25 days	Mon 10/19/09	Fri 11/20/09
Move In	**177 days**	**Mon 8/2/10**	**Tue 4/5/11**
Finish	0 days	Sat 10/2/10	Sat 10/2/10



Scheduled Tasks | Milestones | Total Duration