The Pennsylvania State University
Health and Human Development Building

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Construction

Technical Assignment 2

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Executive Summary

Technical Report 2 analyzes several features of the Health and Human Development building and was a major learning experience for different construction processes. The first analysis was a more detailed breakdown of the project schedule. The information learned about running a live schedule on a project that has continuously changing start and finish times benefited me in learning the P6 software. Order of placement for several items was more critical than others such as the Stair C and architectural screen wall placement. The schedule shows the sequencing of the project with an overall duration of 29 months.

A study was then done for the cost breakdown of structural steel and an assemblies estimate for MEP systems. This analysis looked at a more detailed breakdown for the building's superstructure. Quantity takeoffs were derived from extrapolation of building drawings for logical modules. This project has a steel structure that sits on spread footings. The total estimate does not match up well with the square foot estimate due to the comparison of new and renovation construction, RSMeans cost data, and other reasons that will be discussed in the detailed structural systems estimate section. The assemblies estimate arrived at estimated costs for HVAC, Electrical, and Plumbing systems for the new construction. It was found that the plumbing and electrical systems were fairly close to the square foot estimate predictions.

A general conditions estimate was also investigated in greater detail. The general conditions estimate was found to be higher than the one on the project. Project staffing has been estimated in greater detail on the project so that is a reason for a majority of the difference between the estimates

Site layout plans were then created to analyze different phases of the project and how the logistics of the site changed. Phases that were analyzed include soil nail wall and blasting, excavation, and superstructure. These three phases rely on site egress as well as safety.

A leading practice evaluation was then conducted. This was a section where research on trends that are making a push in the industry could be done. For this section, prefabrication and modularization was analyzed in order to see if these methods could be used on the Health and Human Development building.

Lastly, the project team was consulted to analyze constructability concerns. Most of the concerns related to project schedule and coordination. Finishes that require tempered space or protection are critical. Also, with any renovation project, unforeseen conditions can always cause issues. When activities do go wrong, it's important to have a team that is able to adjust the plan and make the situation work.

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Detailed Project Schedule

With the Penn State Health and Human Development building, it is important to create a schedule that creates a smooth flow to the project as well as maintaining the utmost safety measures. The project began February 4, 2013 and is scheduled to have owner occupancy June 30, 2013. The project is composed of two separate buildings: an existing to remain renovation and new construction. The existing to remain (E.T.R.) is a three level building that will require a complete shell demolition and renovation, abatement, and interior renovation. The new construction consists of 5 levels and a mechanical penthouse. According to the schedule, the project planning phase consists of submittal processes, BIM coordination, and the building mockup. These activities have long durations because they go throughout multiple tasks and activities throughout the project. The building mockup is for the foundation wall with an exposed finish. A summary of the major phases of the construction sequence is displayed in Table 1 below.

Table 1 Project Schedule Summary

Project Schedule Summary	
Activity	Duration (days)
Project Planning	233
Sitework	75
E.T.R. Shell	124
E.T.R. Interior Renovation	405
New Construction Shell	127
New Construction Structural Steel	80
New Construction Concrete Slabs	142
New Construction Building Envelope	228
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Existing To Remain Shell and Interior Renovation

Based on logistical planning of other work that will be ongoing, it was found that the best sequence for the shell reconstruction was north, east, south, west, and then penthouse. The shell reconstruction includes the demolition of the existing shell, structural steel, concrete foundations (where necessary), structural metal steel, windows install, limestone, and brick veneer. For the interior, it was found that working from the ground floor to the top floor would be the most efficient. This was because the ground floor consisted of classrooms and labs so a learning curve would be able to be achieved for the second and third floors. The abatement is an activity that could fluctuate with the amount of days due to the unknown conditions inside the renovation. The duration that is estimated is something that could easily fluctuate with the amount of abatement that is required. The interior renovation also includes demolition, framing layout, HVAC demo, MEP rough-in, MEP install and insulate, MEP finishes, and interior finishes. A renovation project can cause many constructability concerns due to unforeseen conditions. The constructability concerns within the E.T.R. are discussed later in the report. For this reason, the way that the E.T.R. renovation is scheduled allows for more time because it is started in the beginning of the project and could potentially extend further into the project. Figure 1 shows an elevation of the E.T.R. that depicts the sequencing order with the mechanical penthouse on top which will only receive the shell facelift. One benefit of having this renovation along with the new construction is the fact that the work can be done at the same time. The construction of the new building could be performed while the E.T.R. is being renovated.

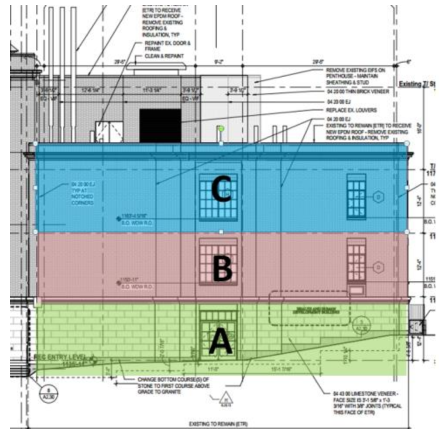


Figure 1 Existing To Remain Interior Sequencing

New Construction

The new building construction has a sequencing scheduled differently from the E.T.R. section. As opposed to the vertical sequencing that the E.T.R. is scheduled with, the new construction is scheduled in a horizontal fashion. The new construction will be done in 3 areas. These three areas are depicted in Figure 2.

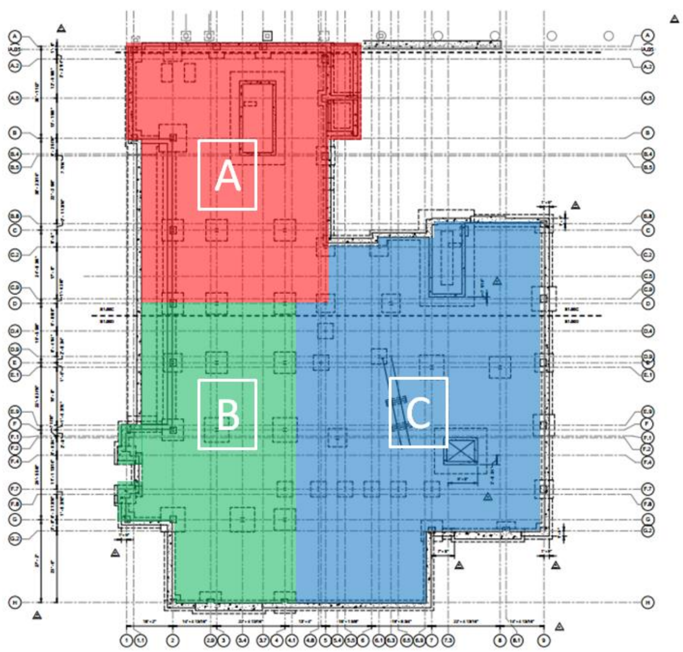


Figure 2 New Construction Sequencing

New Construction Shell

For the shell section of the schedule, there are components that are broken down within the subsequent area. Area A consists of the soil nail wall installation. It is important to begin the soil nail wall excavation first due to the logistical implications that it carries. Concrete trucks need to come on the site and work to install the soil nail wall will be going on while excavation will begin elsewhere. The foundation of the area in A will consist of excavation, foundation walls and footings, and backfill. The structure of the building is steel framing with shear walls in the stair and elevator towers. For this reason, it is important to have the stair towers complete and cured before structural steel appears on site. So, areas A and C consist of some type of foundation work and stair or elevator tower concrete pouring.

New Construction Structural Steel and Concrete Slabs

The structural steel erection sequence will be performed with the same horizontal movement. It will begin in area A, then move to B, and end at C. The sequencing within these areas consists of the erection of steel, detailing, and the installation of the deck. The decking will be placed every two floors in order to meet safety requirements instilled by Massaro CMS. This is done as a fall protection standard and also so the concrete slabs can be poured whenever the steel erection in that area is completed. The site logistics for the steel sequencing will be discussed later in the report. A simple lift plan is shown in figure 3. The major takeaway is that one crane will be used and will begin in area C in order to work in area A and it will back itself out of the site as it moves towards area C. Safety of steel erection will be critical and it will be important to make sure that the crane swing radius does not go over the HHD East building as it will be occupied with students and faculty throughout the steel erection sequence. The shakeout area will be in area B. So, as mentioned previously, the concrete slabs will follow the steel erection with the exception of the slab-on-grade which will be poured prior to steel erection. The concrete slab pour sequence will be performed in the order of the areas in the same fashion as the steel erection. Once the frame is in place and the deck is erected, the concrete slab will be poured. The concrete slab sequence consists of rough-in, prep work, and the physical pour. It will be

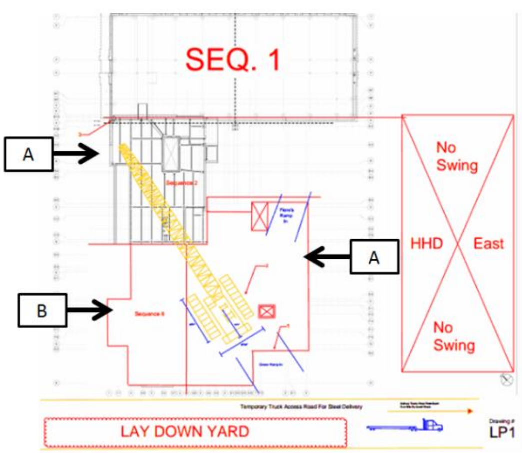


Figure 3 Structural Steel Sequencing (Courtesy of Kinsley)

important to monitor concrete placement and curing times for these slabs as it will be difficult to tear out and re-pour.

Building Envelope

The next item for the schedule is the construction of the building envelope. With Massaro working on this project as Phase II of the Henderson South renovation, they have developed a learning curve from Phase I with the Biobehavioral Health Building. Since the Health and Human Development building has been designed to match the façade of that building, they will be able to understand the difficulties and work around any issues that resulted from Phase I. This should result in a reduction of duration required for the HHD building. The building envelope construction consists of CMU walls, rough-in, window blocking, window installation, veneer, and scaffolding removal. Figure 4 shows a typical wall section of the building envelope. On the south elevation of the site, there is also a curtain wall for the atrium. This is a lot of on-site work from scaffolding equipment which could be a safety issue. One way of cutting down on schedule time as well as reducing safety concerns would be prefabricated wall panels. This is a leading industry trend that we are seeing more and more of now today and it will be discussed further in the report.

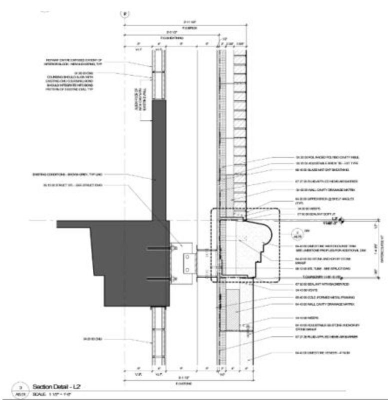


Figure 4 Typical Wall Detail (Courtesy of BCJ)

Roof

The roof is divided into three sections: the west wing slate, east wing slate, and the EPDM roofs. The west wing slate will take a good period of time due to the installation of the chimney. The chimney installation will consist of rough-in, installation, and demobilization. Installation of the slate roof will also be made up of rough-in, install, and demobilization. EPDM roofs are different and consist of metal framing, skylight, and the roof system. It is critical that the roofs are installed and the building is enclosed on time. For the interior work to begin, the building needs to be watertight so that finishes can be protected and a tempered environment can be established. So, roof installation is on the critical path on the project in order to ensure that interior work can begin and get completed on time.

Interior

The interior of the building will be done in three sections: the central commons areas, the west wing, and the east wing. The central commons area will be the most difficult as it will require intense coordination of trades. The atrium area will contain a very detailed Stair C as well as an architectural screen wall which will consist of a large amount of scaffolding that will need to be worked around. Figure 5 shows how congested this space will be with the scaffolding as well as the installation of Stair C and the architectural screen wall. The constructability concerns of this area are discussed in greater detail later in the report. For the schedule derived here, it was decided that Stair C be installed first and the scaffolding for the architectural screen wall work around the installation of Stair C. This area will begin with MEP rough-in and install in order to establish a tempered environment for finishes preservation. Framing layout, installation, insulation, and interior finishes will also be completed for this area. This area is scheduled as one floor because it is a big open space with features that extend to the top. The east and west wings will be completed in a vertical fashion from the ground level up to the top level. Each level will consist of MEP rough-in, MEP installation, framing layout, install, insulation, and interior finishes.


Figure 5 Atrium Scaffolding set-up

Closeout

The closeout stage will consist of a final cleaning and punch lists. Substantial completion is estimated to be May 21, 2015 with owner occupancy and project completion being June 30, 2015.

Detailed Structural Systems Estimate

A detailed estimate of the superstructure and substructure has been created for the Health and Human Development building new construction. Understanding that the project consists of new construction and renovation to an existing structure, it made logical sense to focus on the new construction as the superstructure and substructure of the existing to remain section is a variable number. The building consists of 5 stores and spans 92,596 square feet (SF) with varying bay sizes on each floor. Due to this arrangement, the building's structural steel was estimated on a "per floor" basis. Due to the bulkiness of the foundation level, the entire foundation was taken off and estimated. The third floor of the structural steel was considered the "mean floor" which would account for the bulkier floors below and the lighter floors above it. The third floor was multiplied for all other floors in order to get a total of the structural steel. RSMeans was used to calculate the estimate. The data used was from year 2013 and the location factor was already added into the cost value. A breakdown of the estimate can be found in the Appendix. A comparison to the square foot estimate is shown in Table 1 below.

Table 1 Superstructure Estimate Comparison

	Square Foot Cost Estimate		Detailed Estimate Cost	
Material	*Total Cost*	*Cost/SF*	*Total Cost*	*Cost/SF*
Superstructure	**$ 2,515,073.39**	**$ 16.77**	**$ 1,651,900.89**	**$ 17.84**

The Square Foot estimate was completed for the entire project (including renovation) for a square footage of 150,000 SF. As a result, the total cost is higher, but the square footage for the detailed estimate is lower (92,596SF). So, the cost/SF actually comes out to be very close to the Square Foot estimate. The estimate that was completed by Massaro for the structural steel added to a total of $1,498,297.00. A possible reason for the slight difference could be the values used in R.S. Means.

The rest of the detailed estimate was broken down into different categories for the foundation, slabs, formwork, and backfill. The material and equipment totals show a tax of 6% while the labor total is not taxed. The grand total for each category represents a subtotal of the material, labor, and equipment costs with an overhead and profit of 10% applied. More detail regarding the estimate takeoffs and breakdowns is provided in the appendix.

Table 2 Detailed Estimate Summary

Structural Detailed Estimate Summary				
Material	Grand Total	Material Total	Labor Total	Equipment Total
Structural Steel Total	$ 1,222,907.06	$ 998,024.10	$ 72,818.45	$ 40,891.15
Total Concrete	$ 1,133,515.37	$ 298,397.31	$ 277,062.80	$ 81,931.76
Total Rebar Cost	$ 47,710.67	$ 22,135.13	$ 21,238.20	$ -
Total WWF Cost	$ 87,537.63	$ 16,956.50	$ 20,745.00	$ 41,878.16
Total Deck Cost	$ 341,456.20	$ 255,590.10	$ 50,160.57	$ 4,664.05
Spread Footing Formwork	$ 17,481.66	$ 7,540.42	$ 8,352.00	$ -
Wall Footing Formwork	$ 22,997.65	$ 9,919.65	$ 10,987.31	$ -
Wall Formwork	$ 246,507.45	$ 28,388.18	$ 195,709.50	$ -
Slab Formwork	$ 13,428.20	$ 912.55	$ 11,294.90	$ -
Backfill	$ 18,514.19	$ 12,502.55	$ 3,931.62	$ 396.91
Grand Total	**$ 3,152,056.07**	**$ 1,650,366.49**	**$ 672,300.35**	**$ 169,762.03**

This table shows that the grand total for the superstructure and substructure was found to be $3,152,056.07. The square foot estimate that was completed in technical report 1 found that this total should sum to be $2,956,028.22. This would include any structure that would be included in the Existing To Remain as well as the new construction. Hence, the detailed estimate is high or the square foot estimate is low. The reliability of RSMeans is a factor for the lack of proximity both with the square foot estimate and the detailed estimate. The detailed estimate is more likely much closer for the new construction than the square foot estimate. The square foot estimate has error due to RSMeans lack of ability to differentiate between new construction and renovation and also between mixed use buildings. The detailed estimate represents the actual pieces of material that are used for the structural system in the new construction and the cost per square foot values derived in Table 3 are based on only the new construction section of the project. Using a square foot method, the following costs per square foot can be found for the structural system:

Table 3 Square foot comparison for materials, labor, and equipment

Square Foot Comparison				
	Grand Total	Material Total	Labor Total	Equipment Total
Cost/SF	**$ 34.04**	**$ 17.82**	**$ 7.26**	**$ 1.83**

Assembly MEP Estimate

An assemblies estimate was completed for the MEP system of the Health and Human Development building. This estimate was completed using RSMeans Online Assembly Estimate. Similar to the structural steel, the MEP estimate focused only on the new construction of the project. The following table shows the total cost of the plumbing, HVAC, and electrical systems respectively. More information regarding the backup assembly takeoff can be found in the appendix.

Table 4 Assemblies Cost Comparison

	Assemblies Estimate		Square Foot Cost	
System	*Total Cost*	*Cost/SF*	*Total Cost*	*Cost/SF*
Plumbing	**$ 229,410.00**	**$ 2.48**	**$ 689,016.89**	**$ 4.59**
HVAC	**$ 2,150,751.55**	**$ 23.23**	**$ 2,122,810.30**	**$ 14.15**
Electrical	**$ 1,782,032.00**	**$ 11.88**	**$ 2,404,429.11**	**$ 16.03**

When analyzing these prices, it is important to note that the assemblies estimate for RSMeans Online looks at the pieces of equipment based on each piece or an amount per square foot. Distribution is not always analyzed in the proper way as compared to how it is actually installed in the building. So, for the plumbing system, the total cost from the square foot estimate is significantly higher. It should be higher because it includes the Existing To Remain section. However, the estimate that was prepared by Massaro estimated the plumbing to be a total of $611,797.00 with a piping distribution amount to be $361,004.00. So, if this pipe distribution was accounted for in the assemblies estimate, the total would come pretty close.

The HVAC assembly estimate did not compare very well to the Square foot cost. When looking at the cost/SF for the two estimates, it is apparent that the assemblies estimate was significantly higher. This could be because of the mix of building types for the square foot estimate that lead to a low number. The estimate from the actual project estimates the HVAC total to be $3,173,200 for the new construction. A reason for the difference again could be the distribution difference or the lack of equipment that was taken off in the assemblies estimate.

The electrical system comparison between the assemblies and square foot estimate is very close. This is because the electrical takeoff was completed for the entire building (including the ETR). The difference for the change in $4 per SF could result in miscalculation of numbers as well as RSMeans cost variations. However, the cost comparison to Massaro is differing by a significant amount. This could result again from the lack of distribution that is accounted for running wire as well as temporary utilities, extra security that Penn State requires, higher quality equipment for labs, and devices such as strobes, pull stations, and smoke detectors that were not accounted for in the assemblies estimate.

The Penn State Health and Human Development Building poses many challenges to a construction manager as it is a very tight site with an operable building in the middle. Being on a college campus, focus for a site logistics plan turns directly to the safety of pedestrians around the site. With an operable HHD East building at the site entrance, it is important to develop a plan that ensures the safety of the students and faculty that are using that building as well as the safety of the students on College Avenue. One of the first things to analyze was the establishment of the site perimeter. Once the perimeter was established, the entrance into the site needed to be formed. Penn State treats its tree protection very seriously. For this reason, a headache bar was created to establish a 14' maximum height for delivery trucks entering the site and tree protection zones were established throughout the site. In order to gain access into the site, a sliding operable gate was created for site entrance which could be opened and closed by a traffic control person. This traffic control person will have eyes on the pedestrians entering and exiting the HHD East building to ensure safety. Other measures taken to ensure pedestrian safety was a temporary sidewalk on College Avenue, around the northeast side of the HHD East Building (to ensure ADA requirements), and around the north side of the site (to create easy passage for students). With a tight site like this one, egress into and out of the site is critical for trucks on each phase of the project. This site layout planning will analyze the project for three different phases: Blasting and soil nail wall phase, excavation phase, and the superstructure phase.

Blasting and Soil Nail Wall Phase

Any time blasting is done on a project, it is important to make a plan that will maximize the safety of the employees as well as the general public. For the blasting phase, it was important to have a 300 foot safety perimeter radius established in which pedestrians could not be present. Establishing this with the proper personnel is of utmost importance. More information regarding the blasting procedures is located in the constructability concerns section of this report.

When creating a site logistics plan for this phase of the project, coordination of all trades on the job is critical. While the blasting is going on (twice a day for 3 weeks), all work must be stopped for 10 minutes so blasting procedures can occur. This includes soil nail wall activities as well as ETR renovations. So, it was important to make sure that the blaster and other trades were able to have quick egress points from where they are working. The blasting team was able to enter the site from the southwest gate and set up their area for a blast while the soil nail wall workers and the ETR workers were able to exit the site from the northeast end.

The soil nail wall is a very tricky activity in itself. The way that a soil nail wall is constructed is by rows. So, a row is excavated. Then, holes are drilled 20' deep at an angle into the ground with a large machine followed by the placement of the nails. Then, a layer of shotcrete is applied to the row and requires time to cure. Then, the process begins again for the next row down. The soil nail wall for this project was 5 rows deep at about 10' depth per row. This means that the soil nail wall installation takes time and requires a good amount of excavation outward from the wall as well as deep into the ground. So, coordination with where the blaster was to set his shots and when shotcrete was pouring was critical. Concrete trucks for the shotcrete placement were able to enter the area from the northeast corner where it could be fed into a shotcrete placement machine and applied to the wall. The ETR building was completely off limits when blasting was to occur so accountability of all employees was crucial during this phase.

Excavation Phase

The excavation phase was crucial on this project. This was because it was the time in which the team was able to see if the blasting paid off and allowed for the speed of excavation to be improved as compared to the rock hammering that would have been required otherwise. As with all phases on this project, site entrance and exit is very important. One of the major concerns was how to get trucks into and out of the lower gate for soil removal. The site logistics map shows a dotted black and yellow line that depicts how a typical truck would back into the lower gate in order to receive soil from the excavator on site and also leave by pulling straight out and turning to go out to College Avenue. If a truck is unable to make that turn out of the site onto College Avenue, they are able to pull out and go up to the north area of the site in order to turn around in a much larger space and have an easy pull-out from the site. As shown, the excavation began in the southeast corner of the site and finished in the northwest corner. This was done mostly due to the soil nail wall taking longer than expected. One problem with this logistics plan is the efficiency of the trucks getting into and out of the site. When a truck backs in to the site, they have to wait until the previous driver pulls out and then fit themselves through the gate in order to get to the excavation. It would be much easier and much more efficient if the trucks could enter the site from one end (perhaps the northeast entrance between the ETR and HHD East) and exit from the other end (perhaps the southeast gate). This would allow for faster excavation and trucker efficiency. A site layout with this type of truck route would also allow for the possibility of utilizing multiple excavators on site and having a faster excavation phase. However, during the excavation phase on the site logistics, workers are able to enter into the ETR from the east side of the building and are able to work on the façade demolition at the same time.

Superstructure Phase

The superstructure phase is very challenging due to the site being as tight as it is. In order to utilize the staging areas that are present and hit all areas of the structure, an extended position crawler crane will be used. This crawler crane will be used in three different locations to hit the three areas that the structural system erection is broken up into. Figure 1 shows how the sections are broken up into areas A, B, and C. The structural steel erection will begin in area A with the crane positioned in area C as shown in Figure 2 (a). A temporary access road will be constructed in the south area of the site in order to allow trucks to back into the area with the steel deliveries. The deliveries will then be taken off of the trucks and placed in a staging area where the crane can pick and erect. The crane will swing north the south from the west end of the site only. This is to ensure that the crane does not swing over the HHD East Building. This will minimize safety risks and will allow the crane operator to establish a pattern for his lifts. Another concern with the crane lift path is the tree protection areas in the southwest areas of the site. The crane operator will need to ensure that the boom on the crane is lifted vertically when swinging close to those areas. The crane will have critical picks in two areas: the last penthouse beam in

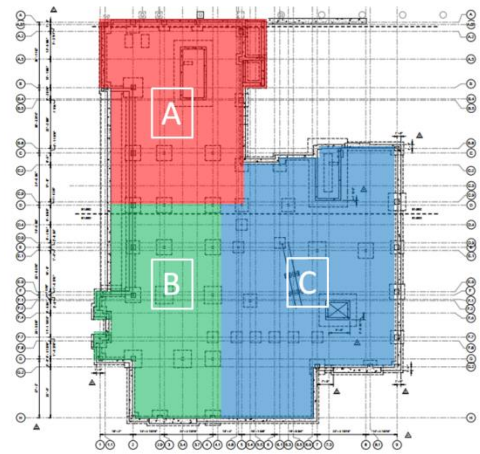
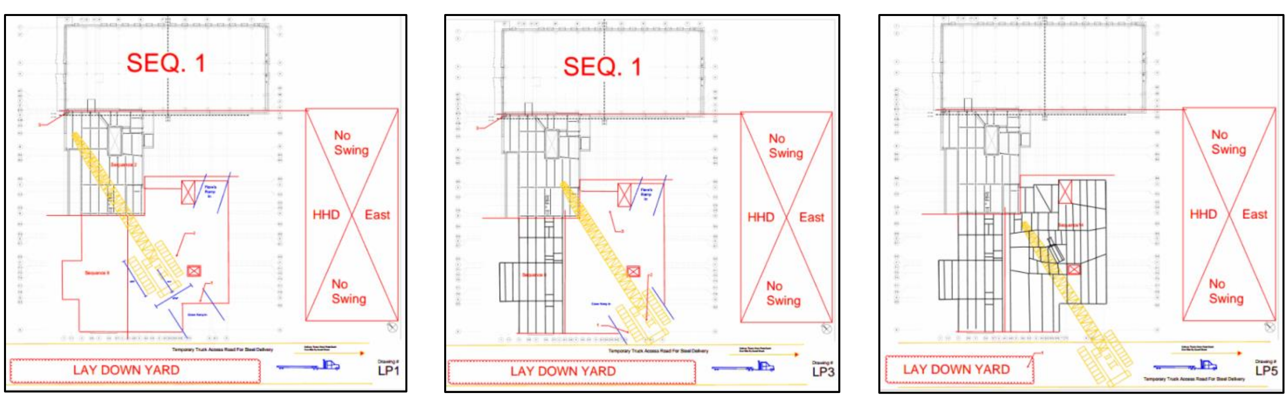


Figure 1 Superstructure Sequencing Areas



(a) (b) (c)

Figure 2 Steel Erections Sequencing (Courtesy of Kinsley)

the sequence due to its distance for the crane operator and the beam at Stair C closest to the atrium due to weight and distance. The shakeout area for this phase will be in area B. Alternate staging areas for this lift includes the north east area of the excavation along the area of the ETR.

Looking at Figure 2 (b), we can see that the crane is moving outwards out of the excavation area in order to erect area B. In this region, the shakeout area will be in area C or in the lay down yard. The lift path will remain the same so as not to swing over the HHD East building. Figure 2(c) shows the final stage of the erection sequence where the crane is out of the excavation completely. The placement of the steel off of the truck will be critical for this sequence so that the crane can reach the steel and hit the areas of furthest reach for this area. Also, it will be important to place the crane in an area where the steel delivery trucks can still access the temporary road. Although this plan seems to be the best choice, an alternative could be the use of a large tower crane which could be placed in the center of the site and could reach all areas of the steel erection sequence. This tower crane would only need to be set up once and then demobilized once rather than having the crawler crane in three different locations.

The general conditions estimate was developed from a series of values established from Massaro CMS pricing standards. The first item analyzed was the project management. This section contained all of the staffing for the Health and Human Development building. In order to establish a quantity on the number of hours that each staff member has on the project, a takeoff was done for every month with the amount of hours per month estimated for each person. Full-time employees on the project have the highest number of hours, followed by the BIM Coordinator who is only working on the project part of the month, then interns who have less due to part time hours during the school hear, and the safety coordinator having the least amount. This takeoff can be found in the appendix. The hourly rates for this staffing plan were taken from Massaro CMS. Items included in these general conditions, but not in the project general conditions, include construction equipment (crane, forklifts, hoists, and lifts) as well as temporary utilities. So, the general conditions that was created was higher than the general conditions on the project.

The next section analyzed was the temporary utilities on the project. The site will be lasting 29 months with requirements for phone/data, electric, temporary heat, water, generators, and porta johns throughout the project. The material costs are at a cost per month rate and are taken from the actual prices paid by Massaro CMS.

The project consists of 17 primes who are working in collaboration with each other in 2 trailers. So, the equipment section includes trailer costs for 29 months of the project. This section also includes the mobile crane which is used for the steel erection, 4 forklifts, hoists, and 12 lifts. The durations on these pieces of equipment have been estimated based on schedule durations for what they are being used for.

This general conditions also includes materials and supplies as well as safety and preparation. The materials and supplies include items in the trailer such as computers, cell phones, PPE, printing, fire extinguishers, BIM management, and drinking water/coffee. The BIM management is priced at a lump sum cost as an estimate for items such as meetings, programs, and model creation. The safety and preparation section includes items like temporary fencing, tree protection, temporary roads, signs, dumpsters, trash removal, and a truck wash station. The truck wash station cost is a lump sum that is taken directly from Massaro CMS.

Bonds, permits, and insurance make up the back end of the general conditions estimate. These are lump sum costs for the construction manager agent. As an agent, bonds and insurance will not need to be purchased.

A breakdown of the general conditions is shown in the table below:

General Conditions Estimate

Table 1 General Conditions Summary Breakdown

General Conditions		
Item	Cost	Percentage
Project Management	$ 3,920,150.00	81.5%
Temporary Utilities	$ 86,050.00	1.8%
Equipment	$ 451,500.00	9.4%
Materials and Supplies	$ 225,200.00	4.7%
Safety and Preparation	$ 121,675.00	2.5%
Bonds, Permits, and Insurance	$ 2,500.00	0.1%
	$ 4,807,075.00	100%

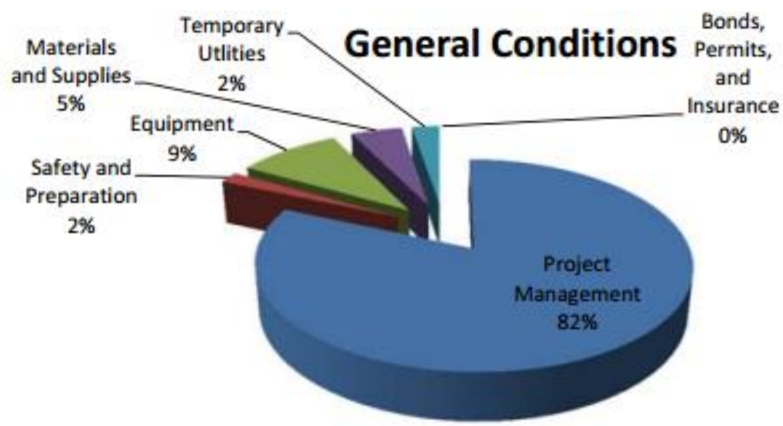


Figure 1 General Conditions Breakdown

Constructability Concerns

Architectural Screen Wall / Stair C

The architectural screen wall is the most important project from a scheduling standpoint. It is a dynamic feature in the atrium designed by The Architectural Woodwork Institute to combine an architectural face wall into furniture. This architectural feature is as high as 4 stories in some areas. An image depicting how the screen wall is to look at the finish and how it ties into furniture pieces is shown in Figure 1. The screen wall connects not only to the slabs, but to steel connections as well. Due to the size and complexity of this feature, it is very important to have coordination of all other trades in that area.

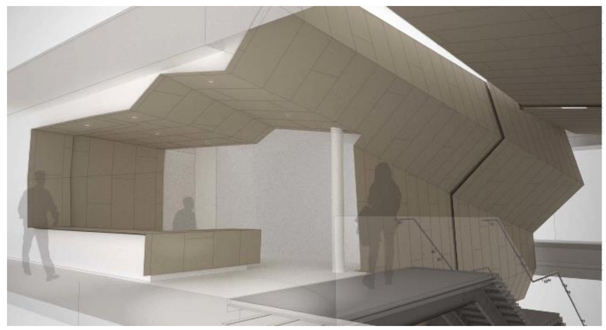


Figure 1 Architectural screen wall

One of the major concerns with the construction of the screen wall is the scheduling coordination. The wood panels are required to be placed in a tempered space. If the proper temperature or humidity is not maintained, the wood panels will crack. So, this means that the screen wall must be placed when the building is completely enclosed. Then, the issue of how the prefabricated framing panels will be lifted into place. Since, the crane will not be able to lift the pieces into the space due to the enclosure, alternative methods will need to be analyzed. The concern is whether a simple scissor lift could be used to hoist the prefabricated panels. It is also important to analyze how installation personnel will be able to get to a point 4 stories above the ground to tie in the framing and wood panels. A model that depicts how the scaffolding could be set up in the atrium is shown in Figure 2 to the left. The figure shows how congested the area is going to be with the scaffolding erected and the obstacles that will need to be worked around in order to install the screen wall. Scaffolding will need to be set up 4 stories high in the atrium and it will need to be installed in a way such

Figure 2 Model depicting the scaffolding set up in atriu2m

that other activities can continue to be performed. It will also be important to have the scaffolding set up in a way that the scissor lift can maneuver and perform its lifts through and around the scaffolding.

Continuing with the timing concern, the installation of stair C concurrently with the screen wall is a concern. The question becomes which one gets installed first so that the other can still be installed properly and efficiently. If stair C gets installed first, the scaffolding needed to install the screen wall needs to be configured around the stairs. Also, when the stairs are placed, the slate finish will be placed and they will need to be protected from 1 year worth of full construction. If the screen wall is placed first, the protection of the wood panels will also need protected from 1 year worth of full construction. Also, there is an area in which only a 4" space is provided between the screen wall and glass railing of the stair. The glass railing consists of buttons that need to be screwed into the glass and there is a concern of whether the buttons can be properly installed in that space.

The last issue concern regarding this activity is safety. When working with large pre-fabricated pieces, it is important to establish a system that works in an efficient manner and is safe for employees to install. This is especially important when the employees are 4 stories high and on scaffolding. It will be important to have the scissor lift pick only pieces that it can sustain and the pieces will need to be either lifted with a pulley system or just connected right off of the lift. Minimizing on overhead work for the installers will decrease their risk of injury and safety concerns.

Underground Rock Excavation Blasting

When the geotechnical report was done for this project, it was found that the soil was composed of solid rock. Then, when initial excavation began, it was confirmed that it would take a long period of time (estimated 3 months) to hammer out the rock and excavate. Thus, the idea of rock excavation blasting was proposed as a method of reducing schedule time and decreasing the amount of noise that would occur from long periods of rock hammering. A blasting plan needed to be organized to discuss qualifications, storage of explosives, blast loading procedures, safety signals, danger area clearance, and vibration monitoring.

During the initial planning phase, it was important to analyze the entire site and how the blasting would affect the surrounding areas. For this project, it was established that a 300-foot safety radius would be needed for a complete automobile and pedestrian shutdown. This requires a huge effort from a management standpoint. In order to establish a safety barrier, it is important to ensure that a proper staff will be provided. Figure 3 depicts the perimeter safety radius and the personnel required. A professional traffic control team was hired in order to handle all automobile and pedestrian traffic on the very busy College Avenue. Hiring a professional traffic control company not only ensured a professional group of people, but also helped to establish traffic control based on

PENNDOT standards. For the campus side of the project, an additional 15-20 people would be needed. This group was made up of Massaro and on site personnel. The difficulties presented on this site are that there are many small alleyways as well as large open lawn spaces. One way to ensure that the large, open spaces were covered was through the use of caution tape and saw horses. In order to reduce the number of people necessary, caution tape was strung across the area and monitored during the blast time. With the large staffing effort that was constantly changing, it was important to have daily meetings to ensure that proper training processes were covered and daily concerns were discussed.

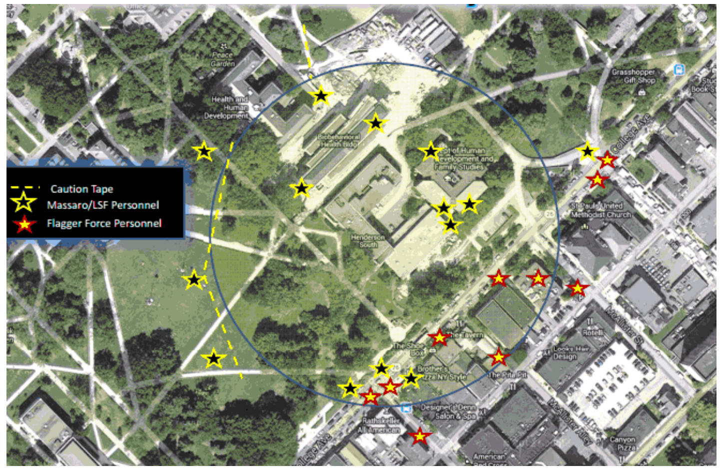


Figure 3 Perimeter Safety Radius

With such a large effort and the idea of explosives being used, it is important to educate everyone who is involved. An email was created and sent out to the employees of the surrounding buildings. This email included detailed information about the blasting process, safety precautions, blast times (twice a day for 3 weeks), who will be performing the blast, and a short video showing a typical blast. Then, it was important to notify all of the businesses that are located on College Avenue. With the businesses being open during the blast times, Massaro decided to create postcards that could be distributed to the storeowners that they could hand out to their customers. The postcards were also given to the pedestrians that needed to be stopped during the blast time. This was done to ease the concerns of the public.

Another issue was the potential of the public to take advantage of the blast for insurance purposes. It was noted up front that people like say that they have a crack in their windows due to the blast, when in reality it was there before the blast occurred. A surveying company (Terra Mechanics) was hired in order to survey the surrounding buildings, videotape areas of concerns, and place seismograph monitors in surrounding buildings to check vibration limitations. Also, videos were taken of car windows before each blast so the pre-blast conditions were considered in full.

The blasting coordinator established that he wanted to have two blasts per day in order to meet his projected schedule. So, it was important to establish two blast times that worked out for the surrounding buildings and to minimize on the amount of pedestrians that needed to be stopped. Massaro checked the openings of the adjacent stores, outdoor seating lunch times, class schedules, pedestrian traffic, bus schedules, orientation schedules, and community activities. With all of these variables, obviously not every precaution will be met. The major focus was the class schedule of the Health and Human Development East building. It was important to make sure that a blast time did not fall when a class was starting or finishing. Once all of these variables were analyzed, a blast time was established. Blasting was done between July 22nd and August 16th. This procedure happened twice a day for 3 weeks with no issues and with minimal complaints.

Existing To Remain – Unforeseen Conditions

This project is very unique as it is composed of two parts: new construction and renovation. With any type of renovation, there are always concerns about items that you are not able to see. Until the ceiling is removed, you cannot create drawings for the renovation. With this project, the existing building was built on top of a mining school so it is a renovation on top of a renovation.

One particular instance that has been noticed on the project so far was a crack in column B-6. During the demolition of the building, the column was exposed and a crack was found. This column is at the tie-in point between the existing building and the new construction so it is critical to have it structurally sound. So once the crack was analyzed, the question became how to fix it. The structural engineer was consulted and a design for temporary bracing was created. This temporary bracing was constructed in a stairway and created an issue with getting materials into the renovation area. Figure 4 shows this area and the congestion that it presents. So, not only does the crack present a structural concern, but it also caused a logistics concern with building entrance.

Leading Industry Practice Evaluation

Prefabrication and Modular Construction

What is Modular Construction?

Modular construction is a method of time saving which combines prefabrication in a factory and simultaneous onsite preparation followed by installation and finishing. Within a building, prefabrication and modular construction are used in a variety of areas but most often in the building superstructure (27%), mechanical, electrical and plumbing systems (21%) and exterior walls (20%) [McGraw-Hill Construction]. Modular buildings often cost less than their site-built counterparts and improve schedule times. This is due to a multitude of reasons. With the recent improvements of BIM and the quality provided by modern materials and manufacturing facilities, prefabrication and modular construction offer the opportunity to obtain significant productivity gains. Modular construction is done off-site and is done simultaneously with onsite preparation, which reduces the overall completion schedule on the project. One reason for the schedule time decrease is the fact that the prefabricated pieces are constructed in an indoor, factory environment. The assembly is independent of weather, which increases worker efficiency. Figure 1 shows graphically how

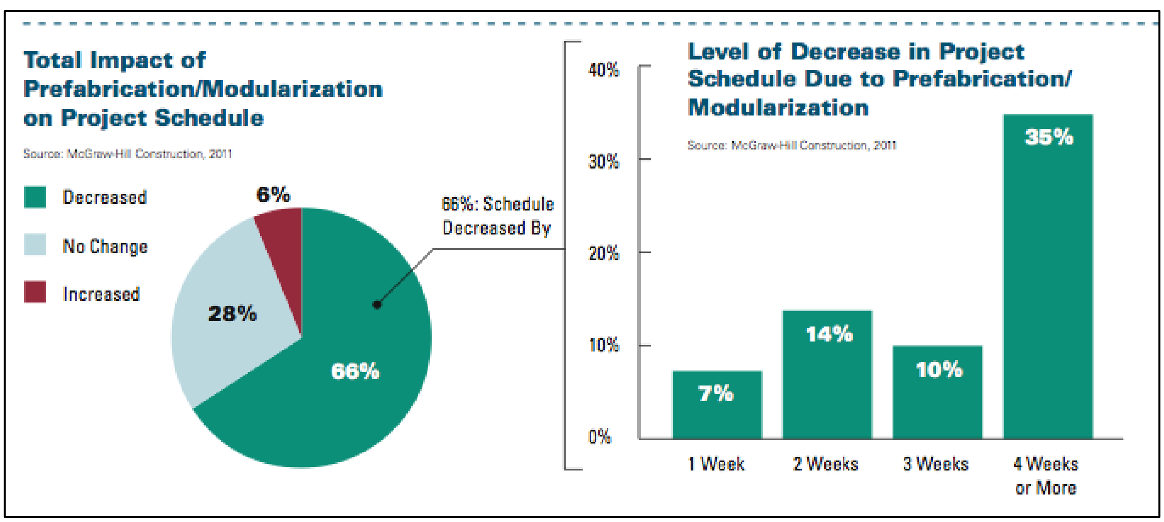


Figure 1 Impact of Prefabrication/Modularization on Project Schedule

prefabrication can impact the schedule of a project. Not only does it cut down on schedule, but also it decreases the amount of waste that is produced from site-built construction. The manufacturer has records of exactly what quantities of materials are needed for a given prefabricated piece. With the controlled work environment and the manufacturer products at the fingertips of the assembler, the quality of the construction is greater in a factory setting than on site. Another advantage is the fact that the construction in a factory setting creates a healthier work environment. The materials are stored indoors in a controlled environment, eliminating the risk of mold, mildew, rust, and sun damage that can be present on site. This could lead to reaching the highest levels of green standards, including LEED certifications. The safety of the installers is also much improved as compared to the on-site installation.

However, there are also disadvantages to modular construction. First off, the pieces that are brought to the site must be analyzed carefully to ensure that they will be able to be put into the space. Often, pieces are very large and take up a lot of space. It will be important that the pieces are able to be stored on site and lifted into place when the time comes. Large prefabricated sections require heavy-duty cranes and precision measurement in order to place into position. Also, leaks can form at joints in prefabricated components. Transportation costs may be higher for larger sections than for the materials of which they are composed. Figure 1 shows a timeline that represents how time saving is achieved through modular construction.

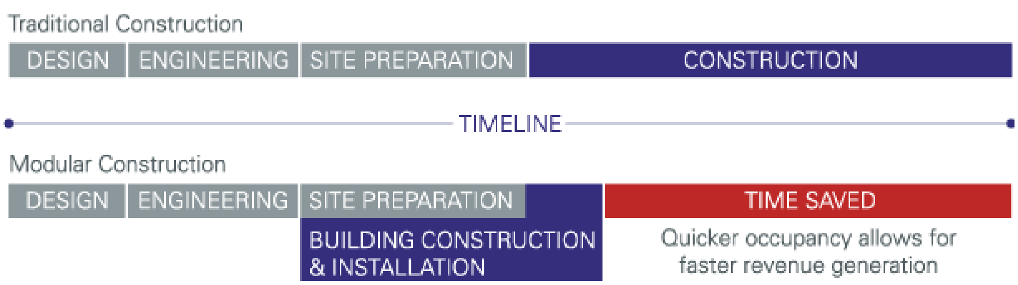


Figure 2 Modular Construction vs. Traditional Construction

Prefabrication Process

When deciding whether or not to use prefabrication or modularization, the most important factors to analyze are job site accessibility, number of building stories, and the type of building exterior. It is very important to establish the use of prefabrication early in the project in order give time to design the prefabricated components. Modular components are typically pre-designed by the combination of the architect and the manufacturer. During the design phase, it is important to consider how the pieces will be placed. If the building is enclosed, the piece will not be able to be placed with a crane. The drawings go to the manufacturer where it will be produced and transported to the site. The prefabricated pieces are typically constructed indoors on assembly lines where pieces are added as it moves down the line. Independent building inspectors are usually present to supervise the construction and ensure that the company follows all building codes during the assembly process. While the assembly of the prefabricated pieces is being done, onsite preparation is critical. This includes ensuring that access to the placement area is available, proper equipment is in place, or proper staffing is provided for the installation. Completed modules are then transported to the site and put into place.

Applications in the Industry

Prefabrication and modularization are not new to the construction industry, but we are seeing them used more and more now due to the increasing interest in lean construction, BIM technologies, and the influence of green construction. Currently prefabrication and modularization is being used on a multitude of building types. The most common types are healthcare, higher education, manufacturing, low-rise office, and public. Some of the most commonly used prefabricated and modular building elements include exterior walls, MEP building systems, and building superstructure. MEP system prefabrication can help reduce the space required for ductwork. Also, off-site assembly can positively impact the project schedule and keep ductwork cleaner for sensitive projects like high-tech or biomedical facilities. Prefabrication of exterior walls can reduce the schedule time as well as improve quality due to the reduction of exposure to the elements during construction.

At the Fort Sam Houston Medical Education and Training Complex Barracks project, crews installed 1 million square feet of permanent modular construction. In order to meet the tight schedule of 42 months along with budget constraints, a modular construction plan was created. There was a mix of modular and site-built construction. Site-built steel structures were used for a mix of classrooms, storage rooms, offices, elevators and mechanical rooms. Then, the modules were added. Standard modules included two living quarters per module, separated by a central corridor. Each weighed 35,000 pounds and was 60 feet by 13.6 feet wide. The rooms included the shell, sheet rock, doors, light fixtures, vanities, ceramic bathroom tiles, all utilities, and even the poles and shelves in the closet. The modules were constructed at an off-site location two and a half hours away. Each module was then shipped to the site and lifted from the carrier bed by a 250-ton crawler crane. Figure 2 shows how these were lifted and stored on site. They were stacked directly on top of each other with no additional structure required. The crew was able to install 8 to 12 modules per day. After work inside each

Figure 3 Modules lifted by crawler crane and stacked on top of each other

module was completed, finishes like carpet and paint were added. Installation of the entire building with 341 modules takes about 8 weeks.

On one particular hospital project, the use of multirade racks was used. These combined the work of multiple trades including ductwork, hot water supply and return, domestic water piping, electrical conduits, and low-voltage systems. Nothing like this was ever done in the United States, so the company went to the UK in order to learn more about it. They combined the use of BIM models to establish a list of materials and parts required for the racks and they were assembled in a fabrication shop adjacent to the project site. This created clear advantages in manpower, safety, and quality. Other opportunities included conducting studies of the headwalls for patient satisfaction. This was to decrease the amount of sound that was transported between patient rooms. These studies were done in a warehouse with multiple scenarios, which is something that cannot necessarily be established on site.

Potential Uses on the Health and Human Development Building

The Health and Human Development building is a very unique project that can utilize recent innovative uses of prefabrication to cut down on costs and schedule, while improving the quality of product for Penn State. One method of prefabrication that could be integrated is the use of lightweight, load-bearing, prefabricated exterior walls. On a project at CUNY Queens College, this innovative practice was used. The system that was created consisted of wall sections measuring 30 feet long. Each wall included a metal stud structure with all components factory installed. These included glazing, exterior skin, insulation, and vapor barriers. Every component was included except the electric wiring and interior sheetrock. In order for the system to work properly, it needed to be lightweight so it could be transported and would reduce the weight in the bottom of the building and the size of the footing. Proper bracing and balancing were important in the placement of the walls. This type of prefabrication is accomplished in many large-scale department businesses including Home Depot. An important factor to consider is whether the manufacturer can produce enough sections in time in order to actually save on schedule time. This can be accomplished with early research on the subject. Images that depict this process are shown in Figure 4.

Figure 4 Construction of prefabricated, load-bearing wall sections

The Health and Human Development building could get a significant amount of benefits from using this prefabrication strategy. One particular benefit would be the reduction of onsite resources. No scaffolding was required for this project because the brick was attached to the prefabricated wall in a factory rather than on site. With as tight of a site as this project, the reduction on scaffolding required around the perimeter would be very helpful. Green goals could also be easily achieved with this type of work. Prefabrication in a controlled environment creates less waste, and whatever waste is produced can be recycled by the manufacturer. Also, the lack of scaffolding reduces the site impact. Quality is also improved with this type of work. There is a consistency that is established across the building that is a result of the factory production.

Another option would be the implementation of prefabricated ductwork or conduit pieces. This would be particularly beneficial in the renovation building. With it being a very tight ceiling, BIM coordination would be required to establish the coordination of conduit and ductwork placement. This could include switchgears, distribution boards, consumer units, pan assembly units, and many more. Figure 5 shows how a section is lifted onto site in a way that allows it to be easily placed.

Figure 5 Prefabricated conduit system being lifted into a building

These are just a few of the possibilities that could be utilized on the Penn State Health and Human Development building. With this particular project, it is important to maintain a constant schedule, within budget, and with a high quality product. With prefabrication and modularization, quality can be improved while saving time and money.

Appendix A

Health and Human Development Building				Classic Schedule Layout	15-Oct-13 23:58

Activity Name	Original Duration	Start	Finish
Health and Human Development Bu	622	04-Feb-13	30-Jun-15
Project Milestones	504	22-Jul-13	30-Jun-15
Excavation Start Date	0	22-Jul-13	
Steel Erection Start Date	0	11-Nov-13*	
Steel Erection Completion	0		20-Jun-14
Building Dry-In	0		16-Dec-14
Substantial Completion	0		21-May-15
Owner Occupancy	0		30-Jun-15
Project Completion	0		30-Jun-15
Project Planning	233	04-Feb-13	01-Jan-14
Submittal Processing	231	04-Feb-13	30-Dec-13
BIM	233	04-Feb-13	01-Jan-14
Building Mockup	47	21-Aug-13	25-Oct-13
Sitework	75	01-May-13	15-Aug-13
Site Utilities	75	01-May-13	15-Aug-13
Demo	56	01-May-13	19-Jul-13
Existing To Remain	405	29-Apr-13	21-Nov-14
Shell	124	12-Aug-13	04-Feb-14
North	104	12-Aug-13	07-Jan-14
Demo Existing	7	12-Aug-13	20-Aug-13
Structural Steel	5	21-Aug-13	27-Aug-13
Concrete Foundations	19	21-Aug-13	17-Sep-13
Structural Metal Studs	9	28-Aug-13	10-Sep-13
Windows Install, Limestone, and Brick Veneer	83	11-Sep-13	07-Jan-14
East	103	09-Sep-13	31-Jan-14
Demo Existing	7	09-Sep-13	17-Sep-13
Concrete Foundations	5	18-Sep-13	24-Sep-13
Structural Steel	5	16-Oct-13*	22-Oct-13
Structural Metal Studs	11	22-Oct-13*	05-Nov-13
Windows Install, Limestone, and Brick Veneer	61	06-Nov-13*	31-Jan-14
South	85	07-Oct-13	04-Feb-14
Demo Existing	7	07-Oct-13	15-Oct-13
Structural Steel	5	16-Oct-13*	22-Oct-13
Concrete Foundations	10	16-Oct-13*	29-Oct-13
Structural Metal Studs	5	23-Oct-13*	29-Oct-13
Windows Install, Limestone, and Brick Veneer	68	30-Oct-13*	04-Feb-14
West	73	21-Oct-13	31-Jan-14
Demo Existing	7	21-Oct-13*	29-Oct-13
Concrete Foundations	10	30-Oct-13*	12-Nov-13
Structural Steel	5	13-Nov-13*	19-Nov-13
Structural Metal Studs	5	20-Nov-13*	26-Nov-13
Windows Install, Limestone, and Brick Veneer	46	27-Nov-13*	31-Jan-14
Penthouse	48	21-Aug-13	28-Oct-13
Demo Existing	7	21-Aug-13	29-Aug-13
Structural Metal Studs	11	30-Aug-13	16-Sep-13
Sheathing and Blocking	5	17-Sep-13	23-Sep-13

Actual Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | summary

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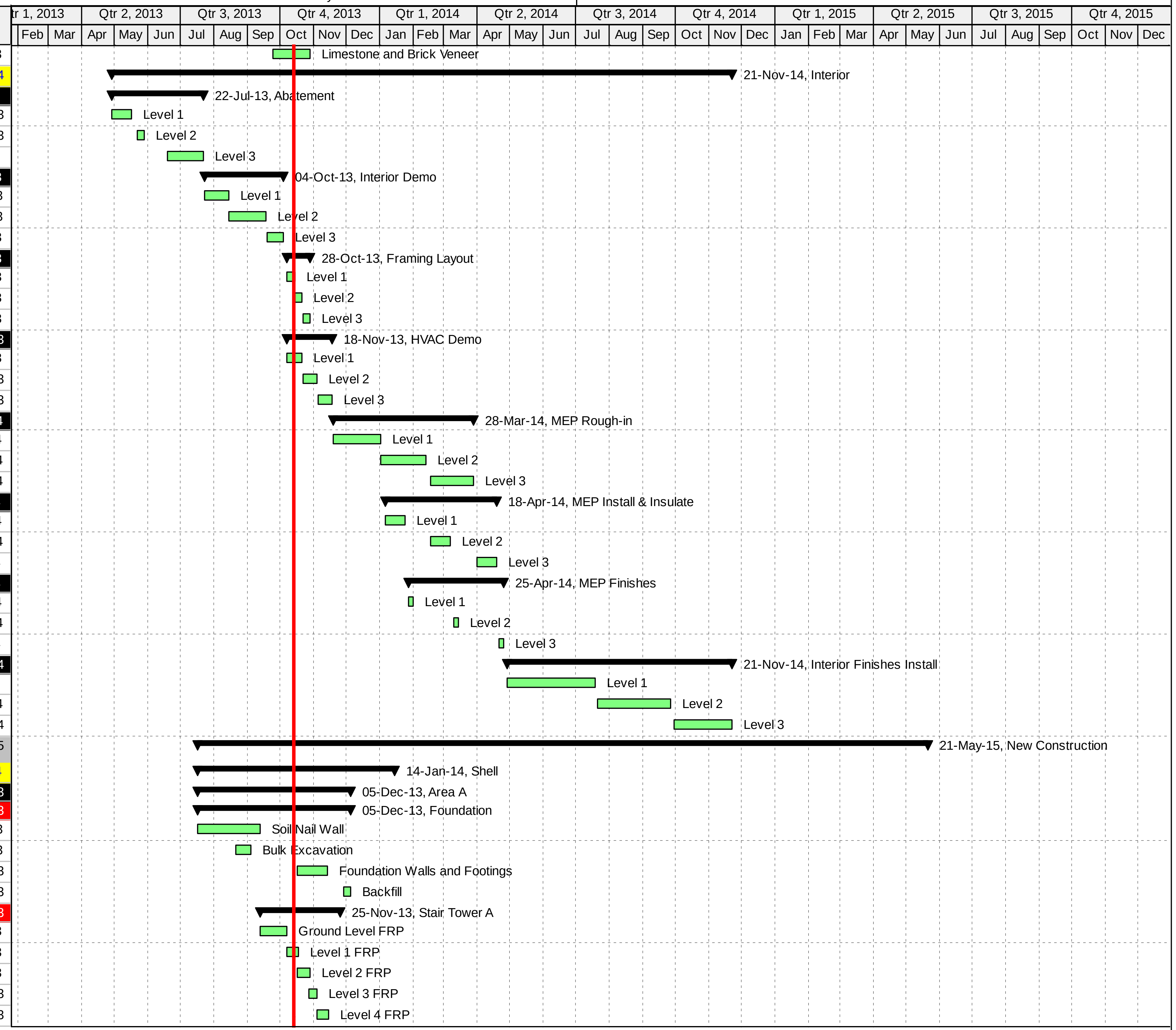
TASK filter: All Activities

Health and Human Development Building | Classic Schedule Layout | 15-Oct-13 23:58

Activity Name	Original Duration	Start	Finish
Limestone and Brick Veneer	25	24-Sep-13*	28-Oct-13
Interior	405	29-Apr-13	21-Nov-14
Abatement	59	29-Apr-13	22-Jul-13
Level 1	15	29-Apr-13	17-May-13
Level 2	4	22-May-13	28-May-13
Level 3	23	19-Jun-13	22-Jul-13
Interior Demo	53	23-Jul-13	04-Oct-13
Level 1	17	23-Jul-13	14-Aug-13
Level 2	24	15-Aug-13	18-Sep-13
Level 3	12	19-Sep-13	04-Oct-13
Framing Layout	16	07-Oct-13	28-Oct-13
Level 1	6	07-Oct-13	14-Oct-13
Level 2	5	15-Oct-13*	21-Oct-13
Level 3	5	22-Oct-13*	28-Oct-13
HVAC Demo	31	07-Oct-13	18-Nov-13
Level 1	11	07-Oct-13	21-Oct-13
Level 2	10	22-Oct-13*	04-Nov-13
Level 3	10	05-Nov-13*	18-Nov-13
MEP Rough-in	92	19-Nov-13	28-Mar-14
Level 1	30	19-Nov-13*	01-Jan-14
Level 2	30	02-Jan-14*	12-Feb-14
Level 3	30	17-Feb-14*	28-Mar-14
MEP Install & Insulate	75	06-Jan-14	18-Apr-14
Level 1	15	06-Jan-14*	24-Jan-14
Level 2	15	17-Feb-14*	07-Mar-14
Level 3	15	31-Mar-14*	18-Apr-14
MEP Finishes	65	27-Jan-14	25-Apr-14
Level 1	5	27-Jan-14	31-Jan-14
Level 2	5	10-Mar-14*	14-Mar-14
Level 3	5	21-Apr-14*	25-Apr-14
Interior Finishes Install	150	28-Apr-14	21-Nov-14
Level 1	60	28-Apr-14*	18-Jul-14
Level 2	50	21-Jul-14*	26-Sep-14
Level 3	40	29-Sep-14*	21-Nov-14
New Construction	479	17-Jul-13	21-May-15
Shell	127	17-Jul-13	14-Jan-14
Area A	100	17-Jul-13	05-Dec-13
Foundation	100	17-Jul-13	05-Dec-13
Soil Nail Wall	41	17-Jul-13	12-Sep-13
Bulk Excavation	10	21-Aug-13	04-Sep-13
Foundation Walls and Footings	20	17-Oct-13*	13-Nov-13
Backfill	5	29-Nov-13*	05-Dec-13
Stair Tower A	52	13-Sep-13	25-Nov-13
Ground Level FRP	17	13-Sep-13	07-Oct-13
Level 1 FRP	9	07-Oct-13	17-Oct-13
Level 2 FRP	8	17-Oct-13*	28-Oct-13
Level 3 FRP	6	28-Oct-13*	04-Nov-13
Level 4 FRP	9	04-Nov-13*	14-Nov-13



Actual Level of Effort | Remaining Work | ◆ ◆ Milestone
Actual Work | Critical Remaining Work | summary

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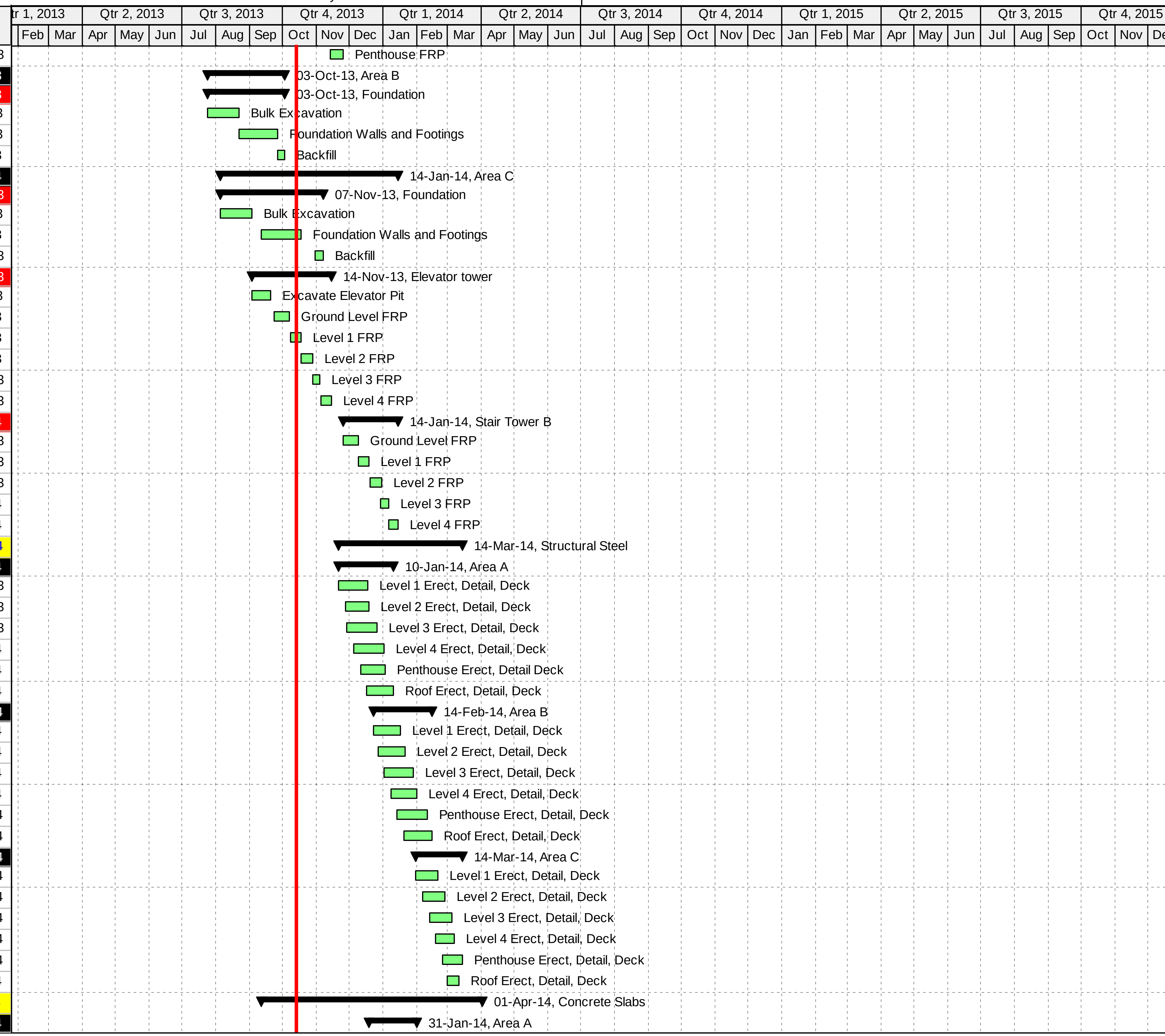
TASK filter: All Activities

Health and Human Development Building				Classic Schedule Layout	15-Oct-13 23:58

Activity Name	Original Duration	Start	Finish
Penthouse FRP	8	14-Nov-13*	25-Nov-13
Area B	51	24-Jul-13	03-Oct-13
Foundation	51	24-Jul-13	03-Oct-13
Bulk Excavation	22	24-Jul-13	22-Aug-13
Foundation Walls and Footings	25	22-Aug-13	26-Sep-13
Backfill	6	26-Sep-13	03-Oct-13
Area C	114	05-Aug-13	14-Jan-14
Foundation	68	05-Aug-13	07-Nov-13
Bulk Excavation	21	05-Aug-13	03-Sep-13
Foundation Walls and Footings	26	12-Sep-13	17-Oct-13
Backfill	6	31-Oct-13*	07-Nov-13
Elevator tower	53	03-Sep-13	14-Nov-13
Excavate Elevator Pit	14	03-Sep-13	20-Sep-13
Ground Level FRP	11	23-Sep-13	07-Oct-13
Level 1 FRP	8	08-Oct-13	17-Oct-13
Level 2 FRP	7	18-Oct-13*	28-Oct-13
Level 3 FRP	5	29-Oct-13*	04-Nov-13
Level 4 FRP	8	05-Nov-13*	14-Nov-13
Stair Tower B	35	25-Nov-13	14-Jan-14
Ground Level FRP	10	25-Nov-13*	09-Dec-13
Level 1 FRP	9	09-Dec-13*	19-Dec-13
Level 2 FRP	6	20-Dec-13*	30-Dec-13
Level 3 FRP	6	30-Dec-13*	06-Jan-14
Level 4 FRP	7	06-Jan-14*	14-Jan-14
Structural Steel	80	21-Nov-13	14-Mar-14
Area A	35	21-Nov-13	10-Jan-14
Level 1 Erect, Detail, Deck	18	21-Nov-13*	17-Dec-13
Level 2 Erect, Detail, Deck	16	27-Nov-13*	19-Dec-13
Level 3 Erect, Detail, Deck	19	29-Nov-13*	26-Dec-13
Level 4 Erect, Detail, Deck	19	05-Dec-13*	01-Jan-14
Penthouse Erect, Detail Deck	17	11-Dec-13*	03-Jan-14
Roof Erect, Detail, Deck	18	17-Dec-13*	10-Jan-14
Area B	39	23-Dec-13	14-Feb-14
Level 1 Erect, Detail, Deck	18	23-Dec-13*	16-Jan-14
Level 2 Erect, Detail, Deck	18	27-Dec-13*	21-Jan-14
Level 3 Erect, Detail, Deck	19	02-Jan-14*	28-Jan-14
Level 4 Erect, Detail, Deck	18	08-Jan-14*	31-Jan-14
Penthouse Erect, Detail, Deck	20	14-Jan-14*	10-Feb-14
Roof Erect, Detail, Deck	20	20-Jan-14*	14-Feb-14
Area C	31	31-Jan-14	14-Mar-14
Level 1 Erect, Detail, Deck	15	31-Jan-14*	20-Feb-14
Level 2 Erect, Detail, Deck	15	06-Feb-14*	26-Feb-14
Level 3 Erect, Detail, Deck	15	12-Feb-14*	04-Mar-14
Level 4 Erect, Detail, Deck	14	18-Feb-14*	07-Mar-14
Penthouse Erect, Detail, Deck	15	24-Feb-14*	14-Mar-14
Roof Erect, Detail, Deck	8	28-Feb-14*	11-Mar-14
Concrete Slabs	142	12-Sep-13	01-Apr-14
Area A	31	19-Dec-13	31-Jan-14



Actual Level of Effort — Remaining Work — ◆ Milestone
Actual Work — Critical Remaining Work — summary

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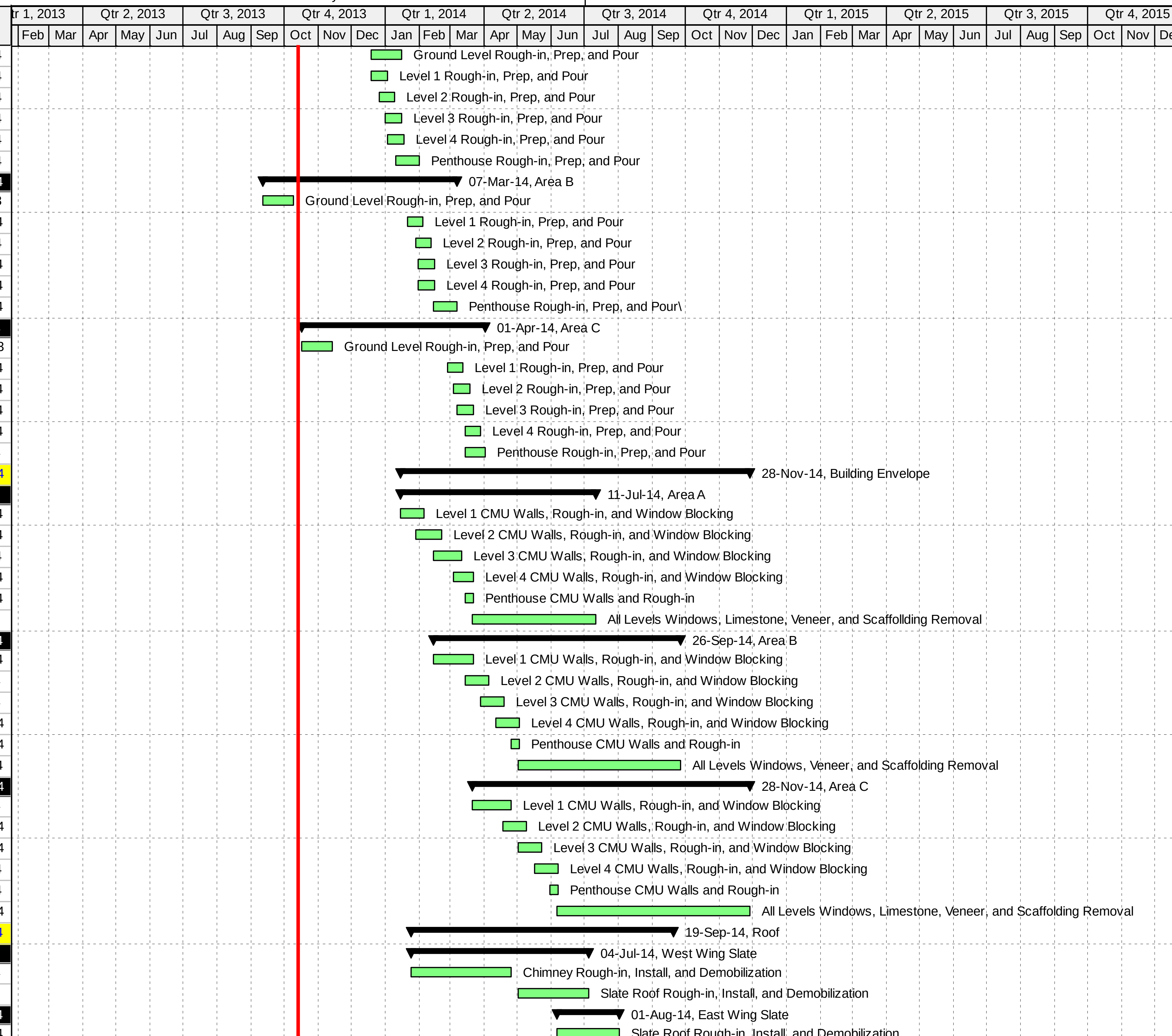
TASK filter: All Activities

Health and Human Development Building | Classic Schedule Layout | 15-Oct-13 23:58

Activity Name	Original Duration	Start	Finish
Ground Level Rough-in, Prep, and Pour	19	19-Dec-13*	15-Jan-14
Level 1 Rough-in, Prep, and Pour	10	19-Dec-13*	02-Jan-14
Level 2 Rough-in, Prep, and Pour	11	26-Dec-13*	09-Jan-14
Level 3 Rough-in, Prep, and Pour	11	01-Jan-14*	15-Jan-14
Level 4 Rough-in, Prep, and Pour	11	03-Jan-14*	17-Jan-14
Penthouse Rough-in, Prep, and Pour	16	10-Jan-14*	31-Jan-14
Area B	125	12-Sep-13	07-Mar-14
Ground Level Rough-in, Prep, and Pour	20	12-Sep-13	09-Oct-13
Level 1 Rough-in, Prep, and Pour	11	21-Jan-14*	04-Feb-14
Level 2 Rough-in, Prep, and Pour	11	28-Jan-14*	11-Feb-14
Level 3 Rough-in, Prep, and Pour	11	31-Jan-14*	14-Feb-14
Level 4 Rough-in, Prep, and Pour	11	31-Jan-14*	14-Feb-14
Penthouse Rough-in, Prep, and Pour\	16	14-Feb-14*	07-Mar-14
Area C	117	17-Oct-13	01-Apr-14
Ground Level Rough-in, Prep, and Pour	20	17-Oct-13*	13-Nov-13
Level 1 Rough-in, Prep, and Pour	11	26-Feb-14*	12-Mar-14
Level 2 Rough-in, Prep, and Pour	11	04-Mar-14*	18-Mar-14
Level 3 Rough-in, Prep, and Pour	11	07-Mar-14*	21-Mar-14
Level 4 Rough-in, Prep, and Pour	11	14-Mar-14*	28-Mar-14
Penthouse Rough-in, Prep, and Pour	13	14-Mar-14*	01-Apr-14
Building Envelope	228	15-Jan-14	28-Nov-14
Area A	128	15-Jan-14	11-Jul-14
Level 1 CMU Walls, Rough-in, and Window B	16	15-Jan-14*	05-Feb-14
Level 2 CMU Walls, Rough-in, and Window B	18	29-Jan-14*	21-Feb-14
Level 3 CMU Walls, Rough-in, and Window B	18	14-Feb-14*	11-Mar-14
Level 4 CMU Walls, Rough-in, and Window B	14	04-Mar-14*	21-Mar-14
Penthouse CMU Walls and Rough-in	6	14-Mar-14*	21-Mar-14
All Levels Windows, Limestone, Veneer, and	81	21-Mar-14*	11-Jul-14
Area B	161	14-Feb-14	26-Sep-14
Level 1 CMU Walls, Rough-in, and Window B	26	14-Feb-14*	21-Mar-14
Level 2 CMU Walls, Rough-in, and Window B	16	14-Mar-14*	04-Apr-14
Level 3 CMU Walls, Rough-in, and Window B	16	28-Mar-14*	18-Apr-14
Level 4 CMU Walls, Rough-in, and Window B	16	11-Apr-14*	02-May-14
Penthouse CMU Walls and Rough-in	6	25-Apr-14*	02-May-14
All Levels Windows, Veneer, and Scaffolding	106	02-May-14*	26-Sep-14
Area C	181	21-Mar-14	28-Nov-14
Level 1 CMU Walls, Rough-in, and Window B	26	21-Mar-14*	25-Apr-14
Level 2 CMU Walls, Rough-in, and Window B	16	18-Apr-14*	09-May-14
Level 3 CMU Walls, Rough-in, and Window B	16	02-May-14*	23-May-14
Level 4 CMU Walls, Rough-in, and Window B	16	16-May-14*	06-Jun-14
Penthouse CMU Walls and Rough-in	6	30-May-14*	06-Jun-14
All Levels Windows, Limestone, Veneer, and	126	06-Jun-14*	28-Nov-14
Roof	171	24-Jan-14	19-Sep-14
West Wing Slate	116	24-Jan-14	04-Jul-14
Chimney Rough-in, Install, and Demobilization	66	24-Jan-14*	25-Apr-14
Slate Roof Rough-in, Install, and Demobilizatio	46	02-May-14*	04-Jul-14
East Wing Slate	41	06-Jun-14	01-Aug-14
Slate Roof Rough-in, Install, and Demobilizatio	41	06-Jun-14*	01-Aug-14



Actual Level of Effort | Remaining Work | Milestone
Actual Work | Critical Remaining Work | summary

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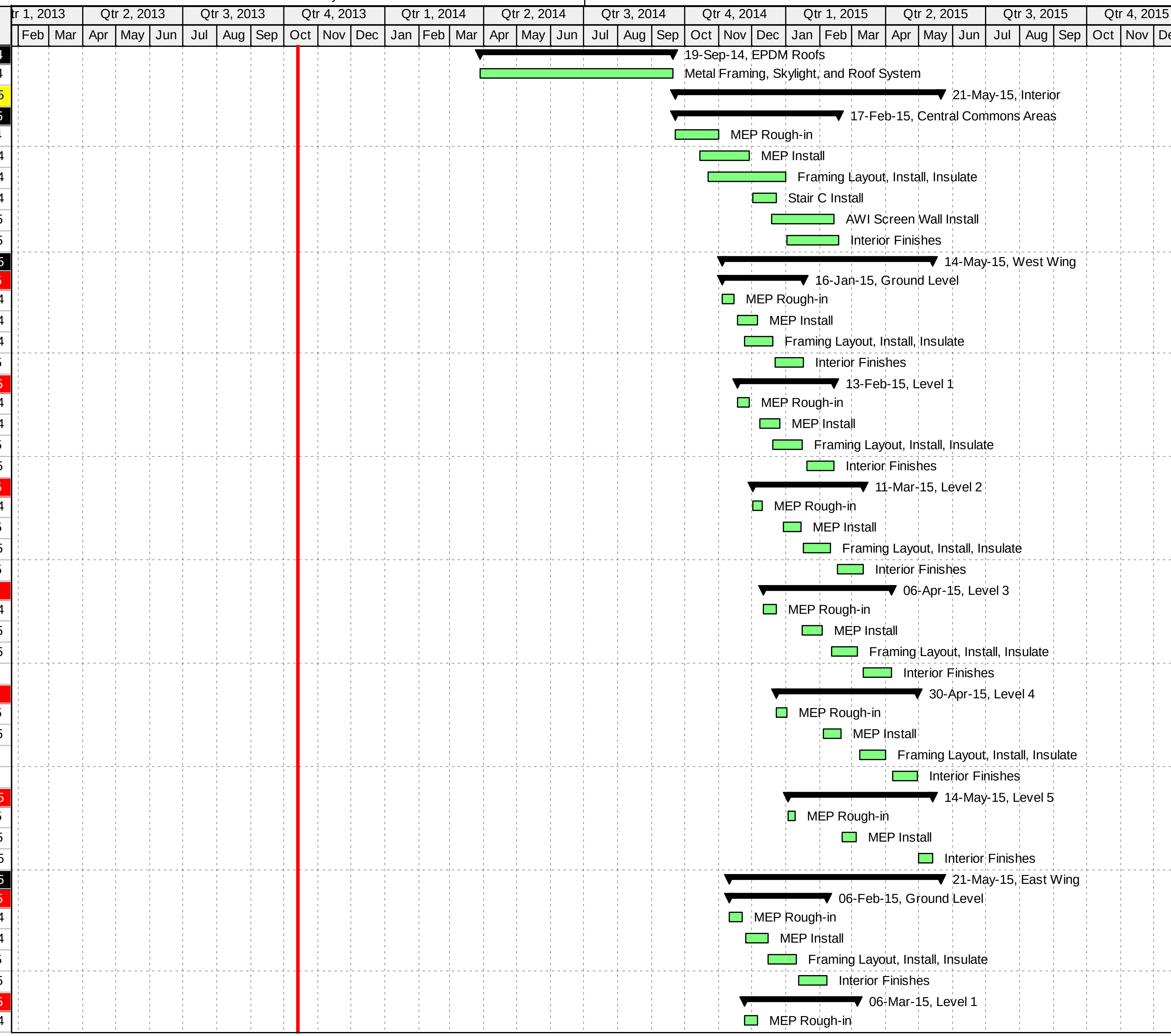
TASK filter: All Activities

Activity Name	Original Duration	Start	Finish
EPDM Roofs	126	28-Mar-14	19-Sep-14
Metal Framing, Skylight, and Roof System	126	28-Mar-14*	19-Sep-14
Interior	174	22-Sep-14	21-May-15
Central Commons Areas	107	22-Sep-14	17-Feb-15
MEP Rough-in	30	22-Sep-14*	31-Oct-14
MEP Install	34	14-Oct-14*	28-Nov-14
Framing Layout, Install, Insulate	51	22-Oct-14*	31-Dec-14
Stair C Install	16	01-Dec-14*	22-Dec-14
AWI Screen Wall Install	42	18-Dec-14*	13-Feb-15
Interior Finishes	34	01-Jan-15*	17-Feb-15
West Wing	139	03-Nov-14	14-May-15
Ground Level	55	03-Nov-14	16-Jan-15
MEP Rough-in	10	03-Nov-14*	14-Nov-14
MEP Install	15	17-Nov-14*	05-Dec-14
Framing Layout, Install, Insulate	20	24-Nov-14*	19-Dec-14
Interior Finishes	20	22-Dec-14*	16-Jan-15
Level 1	65	17-Nov-14	13-Feb-15
MEP Rough-in	10	17-Nov-14*	28-Nov-14
MEP Install	15	08-Dec-14*	26-Dec-14
Framing Layout, Install, Insulate	20	19-Dec-14*	15-Jan-15
Interior Finishes	20	19-Jan-15*	13-Feb-15
Level 2	73	01-Dec-14	11-Mar-15
MEP Rough-in	8	01-Dec-14*	10-Dec-14
MEP Install	13	29-Dec-14*	14-Jan-15
Framing Layout, Install, Insulate	18	16-Jan-15*	10-Feb-15
Interior Finishes	18	16-Feb-15*	11-Mar-15
Level 3	83	11-Dec-14	06-Apr-15
MEP Rough-in	8	11-Dec-14*	22-Dec-14
MEP Install	13	15-Jan-15*	02-Feb-15
Framing Layout, Install, Insulate	18	11-Feb-15*	06-Mar-15
Interior Finishes	18	12-Mar-15*	06-Apr-15
Level 4	93	23-Dec-14	30-Apr-15
MEP Rough-in	8	23-Dec-14*	01-Jan-15
MEP Install	13	03-Feb-15*	19-Feb-15
Framing Layout, Install, Insulate	18	09-Mar-15*	01-Apr-15
Interior Finishes	18	07-Apr-15*	30-Apr-15
Level 5	95	02-Jan-15	14-May-15
MEP Rough-in	5	02-Jan-15*	08-Jan-15
MEP Install	10	20-Feb-15*	05-Mar-15
Interior Finishes	10	01-May-15*	14-May-15
East Wing	139	10-Nov-14	21-May-15
Ground Level	65	10-Nov-14	06-Feb-15
MEP Rough-in	10	10-Nov-14*	21-Nov-14
MEP Install	15	25-Nov-14*	15-Dec-14
Framing Layout, Install, Insulate	20	15-Dec-14*	09-Jan-15
Interior Finishes	20	12-Jan-15*	06-Feb-15
Level 1	75	24-Nov-14	06-Mar-15
MEP Rough-in	10	24-Nov-14*	05-Dec-14



Actual Level of Effort | Remaining Work | ◆ ◆ Milestone
Actual Work | Critical Remaining Work | summary

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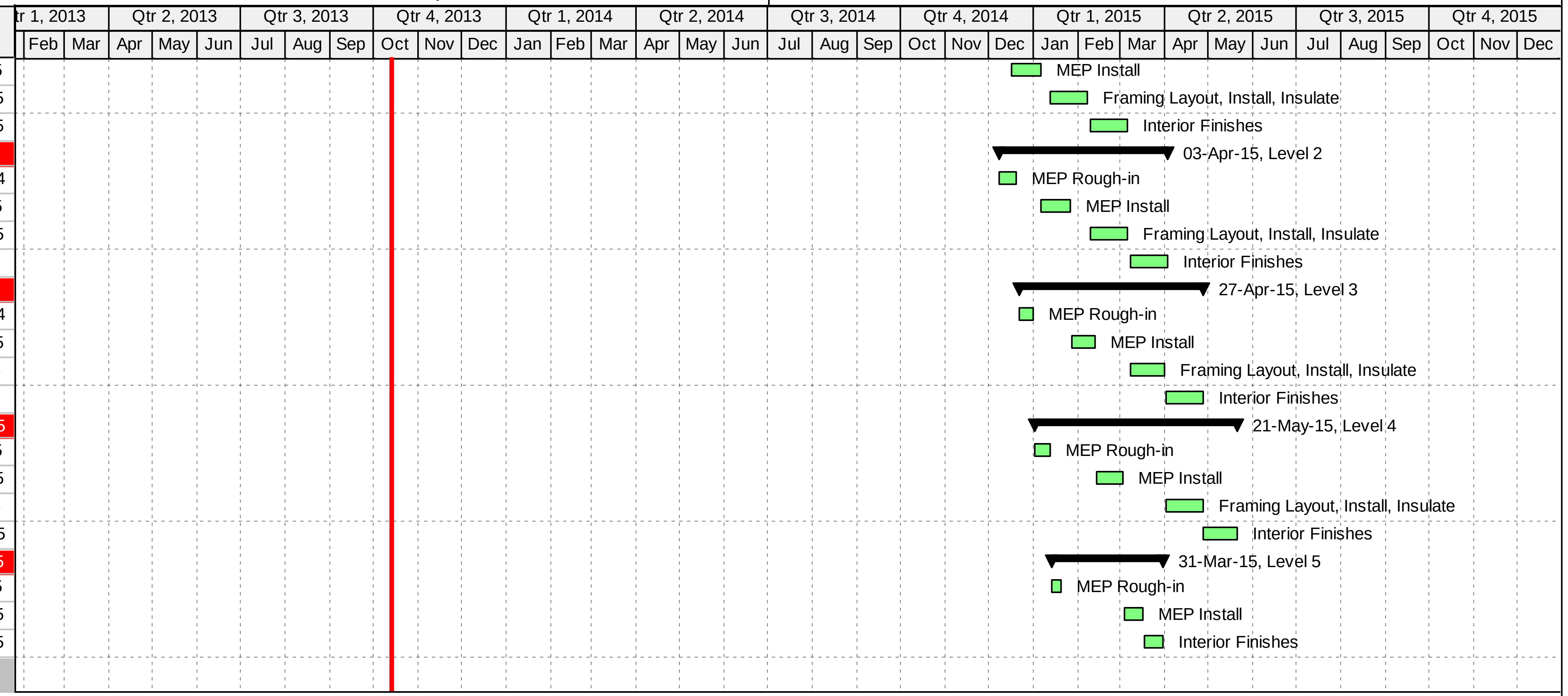
TASK filter: All Activities

Activity Name	Original Duration	Start	Finish
MEP Install	15	16-Dec-14*	05-Jan-15
Framing Layout, Install, Insulate	20	12-Jan-15*	06-Feb-15
Interior Finishes	20	09-Feb-15*	06-Mar-15
Level 2	85	08-Dec-14	03-Apr-15
MEP Rough-in	10	08-Dec-14*	19-Dec-14
MEP Install	15	06-Jan-15*	26-Jan-15
Framing Layout, Install, Insulate	20	09-Feb-15*	06-Mar-15
Interior Finishes	20	09-Mar-15*	03-Apr-15
Level 3	91	22-Dec-14	27-Apr-15
MEP Rough-in	8	22-Dec-14*	31-Dec-14
MEP Install	13	27-Jan-15*	12-Feb-15
Framing Layout, Install, Insulate	18	09-Mar-15*	01-Apr-15
Interior Finishes	18	02-Apr-15*	27-Apr-15
Level 4	101	01-Jan-15	21-May-15
MEP Rough-in	8	01-Jan-15*	12-Jan-15
MEP Install	13	13-Feb-15*	03-Mar-15
Framing Layout, Install, Insulate	18	02-Apr-15*	27-Apr-15
Interior Finishes	18	28-Apr-15*	21-May-15
Level 5	56	13-Jan-15	31-Mar-15
MEP Rough-in	5	13-Jan-15*	19-Jan-15
MEP Install	10	04-Mar-15*	17-Mar-15
Interior Finishes	10	18-Mar-15*	31-Mar-15
Closeout	0		



Actual Level of Effort | Remaining Work | Milestone
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TASK filter: All Activities

Appendix B

Structural Steel Estimate

S1.10C - L1C FLOOR FOUNDATION AND FRAMING PLAN-NEW													
MEMBER	**QUANTITY**	**LENGTHS**	**SUM OF LENGTHS**	**LB/LF**	**LB**	**TON**	**MATERIAL UNIT COST**	**TOTAL MATERIAL**	**LABOR UNIT COST**	**TOTAL LABOR**	**EQUIPMENT UNIT COST**	**TOTAL EQUIPMENT COST**	**TOTAL COST**
W16X36	1	30.82	30.82	36	1109.52	0.55476	$48.50	$1,494.77	$3.39	$104.48	$1.88	$57.94	$1,657.19
W21X50	1	29.36	29.36	50	1468	0.734	$71.50	$2,099.24	$3.73	$109.51	$1.57	$46.10	$2,254.85
W8X10	16	13, 12.5, 11.5, 10, 11.5, 9, 2, 4.5, 4, 5, 5, 7, 5, 3.5, 4, 4	111.5	10	1115	0.5575	$14.30	$1,594.45	$4.58	$510.67	$2.54	$283.21	$2,388.33
W12X14	4	17.5, 13.4, 17.5, 17.5, 23.5	89.4	14	1251.6	0.6258	$23.00	$2,056.20	$3.12	$278.93	$1.73	$154.66	$2,489.79
W16X26	8	10.5, 14.5, 24, 24, 14, 13.5, 22.5, 14	137	26	3562	1.781	$37.00	$5,069.00	$2.75	$376.75	$1.52	$208.24	$5,653.99
W16X31	2	21.5, 30	51.5	31	1596.5	0.79825	$44.50	$2,291.75	$3.05	$157.08	$1.69	$87.04	$2,535.86
W18X35	4	21.5, 30, 22.5, 22.5	96.53	35	3378.55	1.689275	$50.00	$4,826.50	$4.13	$398.67	$1.74	$167.96	$5,393.13
W30X90	1	30	30	90	2700	1.35	$134.00	$4,020.00	$3.33	$99.90	$1.40	$42.00	$4,161.90
W14X22	14	15.5, 24, 24, 24, 24, 24, 24, 24, 24, 14, 20.5, 20.5, 24, 24	310.5	22	6831	3.4155	$31.50	$9,780.75	$3.12	$968.76	$1.73	$537.17	$11,286.68
W21X44	2	26, 14.5	40.5	44	1782	0.891	$63.00	$2,551.50	$3.73	$151.07	$1.57	$63.59	$2,766.15
W12X26	1	16.5	16.5	26	429	0.2145	$36.00	$594.00	$3.07	$50.66	$40.77	$672.71	$1,317.36
W8X48	1	4	4	48	192	0.096	$65.50	$262.00	$2.66	$10.64	$1.48	$5.92	$278.56
W12X16	4	10,15.5, 18.5, 19.5	63.5	16	1016	0.508	$23.00	$1,460.50	$3.12	$198.12	$1.73	$109.86	$1,768.48
W24X55	1	24	24	55	1320	0.66	$78.50	$1,884.00	$3.57	$85.68	$1.50	$36.00	$2,005.68
W18X40	1	21.5	21.5	40	860	0.43	$57.00	$1,225.50	$4.13	$88.80	$1.74	$37.41	$1,351.71
				Totals		14.305585		$41,210.16		$3,589.70		$2,509.79	$47,309.65
S1.10D - L1D FLOOR FOUNDATION AND FRAMING PLAN-NEW													
W18X35	10	20, 22.5, 22.5, 17.5, 19.5, 27, 28, 22.5, 28, 14	221.5	35	7752.5	3.87625	$50.00	$11,075.00	$4.13	$914.80	$1.74	$385.41	$12,375.21
W14X22	11	20, 11.5, 21, 21, 23, 22.5, 19.5, 22, 11.5, 11, 10	193	22	4246	2.123	$31.50	$6,079.50	$3.12	$602.16	$1.73	$333.89	$7,015.55
W12X14	7	20, 20, 20, 19, 9, 9, 9	106	14	1484	0.742	$23.00	$2,438.00	$3.12	$330.72	$1.73	$183.38	$2,952.10
W8X10	25	7.5, 7.5, 4.5, 2.5, 7.5, 9, 7, 10.5, 6.5, 6.5, 3, 8.5, 8.5, 4.5, 7.5, 8, 6.5, 2.5, 11, 3.5, 3.5, 7.5, 7.5,4, 3.5	158.5	10	1585	0.7925	$14.30	$2,266.55	$4.58	$725.93	$2.54	$402.59	$3,395.07
W12X19	12	20, 20, 17.5, 20.5, 15, 22, 22, 22, 15, 15, 18, 23,	230	19	4370	2.185	$31.50	$7,245.00	$3.12	$717.60	$1.73	$397.90	$8,360.50
W12X16	10	14.5, 19, 18, 17.5, 22.5, 15, 24.5, 22.5, 21.5, 15,	190	16	3040	1.52	$23.00	$4,370.00	$3.12	$592.80	$1.73	$328.70	$5,291.50
W12X65	1	21	21	65	1365	0.6825	$124.00	$2,604.00	$2.79	$58.59	$1.55	$32.55	$2,695.14
W21X44	1	22	22	44	968	0.484	$63.00	$1,386.00	$3.73	$82.06	$1.57	$34.54	$1,502.60
W16X26	10	22, 22, 24, 22.5, 14.5, 13.5, 28, 28, 28, 28	230.5	26	5993	2.9965	$37.00	$8,528.50	$2.75	$633.88	$1.52	$350.36	$9,512.74
W16X31	6	25, 22, 23, 11.5, 9.5, 10.5,	101.5	31	3146.5	1.57325	$44.50	$4,516.75	$3.05	$309.58	$1.69	$171.54	$4,997.86
W10X12	2	16, 17	33	12	396	0.198	$17.50	$577.50	$4.58	$151.14	$2.54	$83.82	$812.46
W27X102	1	34.5	34.5	102	3519	1.7595	$157.00	$5,416.50	$3.39	$116.96	$1.41	$48.65	$5,582.10
W24X68	1	17.5	17.5	68	1190	0.595	$97.00	$1,697.50	$3.57	$62.48	$1.50	$26.25	$1,786.23
W18X55	1	22.5	22.5	55	1237.5	0.61875	$78.50	$1,766.25	$4.35	$97.88	$1.83	$41.18	$1,905.30
W16X50	1	30	30	50	1500	0.75	$71.50	$2,145.00	$3.43	$102.90	$1.91	$57.30	$2,305.20
W16X45	2	30, 30	60	45	2700	1.35	$66.00	$3,960.00	$4.13	$247.80	$1.74	$104.40	$4,312.20
W16X40	2	30, 30	60	40	2400	1.2	$57.00	$3,420.00	$3.43	$205.80	$1.91	$114.60	$3,740.40
W16X36	1	31	31	36	1116	0.558	$48.50	$1,503.50	$3.39	$105.09	$1.88	$58.28	$1,666.87
W24X62	1	23	23	62	1426	0.713	$88.50	$2,035.50	$3.57	$82.11	$1.50	$34.50	$2,152.11
W18X158	2	38, 38	76	158	12008	6.004	$230.00	$17,480.00	$3.45	$262.20	$1.45	$110.20	$17,852.40
W18X130	2	38, 38	76	130	9880	4.94	$186.00	$14,136.00	$3.50	$266.00	$1.47	$111.72	$14,513.72
W24X103	1	28	28	103	2884	1.442	$149.00	$4,172.00	$3.78	$105.84	$1.59	$44.52	$4,322.36
				Totals		37.10325		$108,819.05		$6,774.29		$3,456.27	$119,049.61
				Foundation Level Subtotals		**51.408835**		**$150,029.21**		**$10,363.99**		**$5,966.05**	**$166,359.25**

Column Schedule - Drawing S4.00													
Column Type	Quantity	Length/Member	Total Length	Lb/LF	LB	Tons	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
8x31	1	28	28	31	868	0.434	$ 44.50	$ 1,246.00	$ 2.54	$ 71.12	$ 1.41	$ 39.48	$ 1,356.60
8x31	2	42	84	31	2604	1.302	$ 44.50	$ 3,738.00	$ 2.54	$ 213.36	$ 1.41	$ 118.44	$ 4,069.80
8x35	1	56	56	35	1960	0.98	$ 44.50	$ 2,492.00	$ 2.54	$ 142.24	$ 1.41	$ 78.96	$ 2,713.20
8x48	1	28	28	48	1344	0.672	$ 65.50	$ 1,834.00	$ 2.66	$ 74.48	$ 1.48	$ 41.44	$ 1,949.92
8x48	2	56	112	48	5376	2.688	$ 65.50	$ 7,336.00	$ 2.66	$ 297.92	$ 1.48	$ 165.76	$ 7,799.68
8x58	1	56	56	58	3248	1.624	$ 97.00	$ 5,432.00	$ 2.79	$ 156.24	$ 1.55	$ 86.80	$ 5,675.04
8x67	1	56	56	67	3752	1.876	$ 96.00	$ 5,376.00	$ 2.79	$ 156.24	$ 1.55	$ 86.80	$ 5,619.04
10x33	3	28	84	33	2772	1.386	$ 64.50	$ 5,418.00	$ 2.66	$ 223.44	$ 1.48	$ 124.32	$ 5,765.76
10x39	1	56	56	39	2184	1.092	$ 64.50	$ 3,612.00	$ 2.66	$ 148.96	$ 1.48	$ 82.88	$ 3,843.84
10x39	1	70	70	39	2730	1.365	$ 64.50	$ 4,515.00	$ 2.66	$ 186.20	$ 1.48	$ 103.60	$ 4,804.80
10x48	1	56	56	48	2688	1.344	$ 64.50	$ 3,612.00	$ 2.66	$ 148.96	$ 1.48	$ 82.88	$ 3,843.84
10x49	1	42	42	49	2058	1.029	$ 64.50	$ 2,709.00	$ 2.66	$ 111.72	$ 1.48	$ 62.16	$ 2,882.88
10x54	1	42	42	54	2268	1.134	$ 97.00	$ 4,074.00	$ 2.79	$ 117.18	$ 1.55	$ 65.10	$ 4,256.28
10x54	2	56	112	54	6048	3.024	$ 97.00	$ 10,864.00	$ 2.79	$ 312.48	$ 1.55	$ 173.60	$ 11,350.08
10x60	1	40	40	60	2400	1.2	$ 97.00	$ 3,880.00	$ 2.79	$ 111.60	$ 1.55	$ 62.00	$ 4,053.60
10x60	3	56	168	60	10080	5.04	$ 97.00	$ 16,296.00	$ 2.79	$ 468.72	$ 1.55	$ 260.40	$ 17,025.12
10x65	2	14	28	65	1820	0.91	$ 97.00	$ 2,716.00	$ 2.79	$ 78.12	$ 1.55	$ 43.40	$ 2,837.52
10x68	1	14	14	68	952	0.476	$ 97.00	$ 1,358.00	$ 2.79	$ 39.06	$ 1.55	$ 21.70	$ 1,418.76
10x68	2	56	112	68	7616	3.808	$ 97.00	$ 10,864.00	$ 2.79	$ 312.48	$ 1.55	$ 173.60	$ 11,350.08
10x68	2	70	140	68	9520	4.76	$ 97.00	$ 13,580.00	$ 2.79	$ 390.60	$ 1.55	$ 217.00	$ 14,187.60
12x40	1	56	56	40	2240	1.12	$ 71.50	$ 4,004.00	$ 2.66	$ 148.96	$ 1.48	$ 82.88	$ 4,235.84
12x45	1	56	56	45	2520	1.26	$ 71.50	$ 4,004.00	$ 2.66	$ 148.96	$ 1.48	$ 82.88	$ 4,235.84
12x53	1	56	56	53	2968	1.484	$ 71.50	$ 4,004.00	$ 2.66	$ 148.96	$ 1.48	$ 82.88	$ 4,235.84
12x56	1	70	70	56	3920	1.96	$ 124.00	$ 8,680.00	$ 2.79	$ 195.30	$ 1.55	$ 108.50	$ 8,983.80
12x58	1	70	70	58	4060	2.03	$ 124.00	$ 8,680.00	$ 2.79	$ 195.30	$ 1.55	$ 108.50	$ 8,983.80
12x65	2	70	140	65	9100	4.55	$ 124.00	$ 17,360.00	$ 2.79	$ 390.60	$ 1.55	$ 217.00	$ 17,967.60
12x72	1	28	28	72	2016	1.008	$ 124.00	$ 3,472.00	$ 2.79	$ 78.12	$ 1.55	$ 43.40	$ 3,593.52
12x72	3	60	180	72	12960	6.48	$ 124.00	$ 22,320.00	$ 2.79	$ 502.20	$ 1.55	$ 279.00	$ 23,101.20
12x72	3	70	210	72	15120	7.56	$ 124.00	$ 26,040.00	$ 2.79	$ 585.90	$ 1.55	$ 325.50	$ 26,951.40
12x79	2	56	112	79	8848	4.424	$ 124.00	$ 13,888.00	$ 2.79	$ 312.48	$ 1.55	$ 173.60	$ 14,374.08
12x79	1	70	70	79	5530	2.765	$ 124.00	$ 8,680.00	$ 2.79	$ 195.30	$ 1.55	$ 108.50	$ 8,983.80
12x96	1	14	14	96	1344	0.672	$ 172.00	$ 2,408.00	$ 2.86	$ 40.04	$ 1.59	$ 22.26	$ 2,470.30
12x96	1	60	60	96	5760	2.88	$ 172.00	$ 10,320.00	$ 2.86	$ 171.60	$ 1.59	$ 95.40	$ 10,587.00
12x170	1	14	14	170	2380	1.19	$ 172.00	$ 2,408.00	$ 2.86	$ 40.04	$ 1.59	$ 22.26	$ 2,470.30
14x99	1	70	70	99	6930	3.465	$ 172.00	$ 12,040.00	$ 2.86	$ 200.20	$ 1.59	$ 111.30	$ 12,351.50
14x120	1	70	70	120	8400	4.2	$ 172.00	$ 12,040.00	$ 2.86	$ 200.20	$ 1.59	$ 111.30	$ 12,351.50
16x31	4	70	280	31	8680	4.34	$ 172.00	$ 48,160.00	$ 3.01	$ 842.80	$ 1.67	$ 467.60	$ 49,470.40
					Total	87.532		$ 319,460.00		$ 8,158.08		$ 4,533.08	$ 332,151.16

S1.40C - L4C FLOOR FOUNDATION AND FRAMING PLAN-NEW													
MEMBER	QUANTITY	LENGTHS	SUM OF LENGTHS	/	LB	TON	MATERIAL UNIT COST	TOTAL MATERIAL	BOR UNIT CO	TOTAL LABOR	PMENT UNIT	TOTAL EQUIPMENT COST	TOTAL COST
27x84	1	29.5	29.5		2478	1.239	$120.00	$3,540.00	$3.33	$98.24	$1.40	$41.30	$3,679.54
16x26	7	30, 13, 15, 16, 27.5, 14.5, 14.5	116		3016	1.508	$37.00	$4,292.00	$2.75	$319.00	$1.52	$176.32	$4,787.32
24x84	1	30	30		2520	1.26	$109.00	$3,270.00	$3.57	$107.10	$1.50	$45.00	$3,422.10
16x31	6	30, 30, 14, 30, 30, 13.5	147.5		4573	2.28625	$44.50	$6,563.75	$3.05	$449.88	$1.69	$249.28	$7,262.90
10x12	2	5.5, 5.5	11		132	0.066	$17.50	$192.50	$4.58	$50.38	$2.54	$27.94	$270.82
18x35	3	13, 19, 22.5, 11, 13, 22.5	101		3535	1.7675	$50.00	$5,050.00	$4.13	$417.13	$1.74	$175.74	$5,642.87
8x10	6	11, 13, 13, 5.5, 8, 5,	55.5		555	0.2775	$14.30	$793.65	$4.58	$254.19	$2.54	$140.97	$1,188.81
18x40	2	21, 21.5	42.5		1700	0.85	$57.00	$2,422.50	$4.13	$175.53	$1.74	$73.95	$2,671.98
12x19	1	16	16		304	0.152	$31.50	$504.00	$3.12	$49.92	$1.73	$27.68	$581.60
12x14	4	18, 23, 14, 13.5	68.5		959	0.4795	$23.00	$1,575.50	$3.12	$213.72	$1.73	$118.51	$1,907.73
30x90	3	30, 30, 25.5	85.5		7695	3.8475	$134.00	$11,457.00	$3.33	$284.72	$1.40	$119.70	$11,861.42
12x16	1	21	21		336	0.168	$23.00	$483.00	$3.12	$65.52	$1.73	$36.33	$584.85
24x62	1	25	25		1550	0.775	$88.50	$2,212.50	$3.57	$89.25	$1.50	$37.50	$2,339.25
14x22	11	24, 24, 24, 24, 24, 24, 24, 24,23.5, 24, 14	253.5		5577	2.7885	$31.50	$7,985.25	$3.12	$790.92	$1.73	$438.56	$9,214.73
12x50	2	35.5, 22	57.5		2875	1.4375	$71.50	$4,111.25	$3.66	$210.45	$2.03	$116.73	$4,438.43
12x72	1	6	6		432	0.216	$124.00	$744.00	$2.79	$16.74	$1.55	$9.30	$770.04
21x80	1	19	19		1520	0.76	$120.00	$2,280.00	$3.60	$68.40	$1.60	$30.40	$2,378.80
24x55	3	24, 19, 3.5	46.5		2558	1.27875	$78.50	$3,650.25	$3.57	$166.01	$1.50	$69.75	$3,886.01
14x30	1	21	21		630	0.315	$39.50	$829.50	$3.60	$75.60	$1.75	$36.75	$941.85
21x44	2	17, 26	43		1892	0.946	$63.00	$2,709.00	$3.73	$160.39	$1.57	$67.51	$2,936.90
MC12x50	4	17.5, 17.5, 20, 20	75		3750	1.875	$71.50	$5,362.50	$3.66	$274.50	$2.03	$152.25	$5,789.25
			Total			24.293		$70,028.15		$4,337.57		$2,191.45	$76,557.17

S1.40D - L4C FLOOR FOUNDATION AND FRAMING PLAN-NEW													
MEMBER	QUANTITY	LENGTHS	SUM OF LENGTHS	/	LB	TON	MATERIAL UNIT COST	TOTAL MATERIAL	BOR UNIT CO	TOTAL LABOR	PMENT UNIT	TOTAL EQUIPMENT COST	TOTAL COST
18x35	2	19.5, 22.5	42		1470	0.735	$ 50.00	$ 2,100.00	$ 4.13	$ 173.46	$ 1.74	$ 73.08	$ 2,346.54
12x14	11	19.5, 19.5, 19.5, 19.5, 19.5, 10, 8.5, 37, 9, 9, 11	182		2548	1.274	$ 23.00	$ 4,186.00	$ 3.12	$ 567.84	$ 1.73	$ 314.86	$ 5,068.70
8x10	24	11, 11 , 4.5, 6.5, 13, 13, 16, 16, 12, 11, 3, 7, 8, 3, 11.5, 2.5, 8.5, 8.5, 9, 7, 4, 4, 17.5, 11	218.5		2185	1.0925	$ 14.30	$ 3,124.55	$ 4.58	$ 1,000.73	$ 2.54	$ 554.99	$ 4,680.27
14x22	13	19.5, 20, 20, 20, 20, 19.5, 15, 22, 22, 12.5, 24, 13.5, 13.5	241.5		5313	2.6565	$ 31.50	$ 7,607.25	$ 3.12	$ 753.48	$ 1.73	$ 417.80	$ 8,778.53
12x50	1	35	35		1750	0.875	$ 71.50	$ 2,502.50	$ 3.66	$ 128.10	$ 2.03	$ 71.05	$ 2,701.65
16x36	1	20	20		720	0.36	$ 48.50	$ 970.00	$ 3.39	$ 67.80	$ 1.88	$ 37.60	$ 1,075.40
12x19	8	19.5, 14.5, 22, 22, 13.5, 22.5, 21.5, 12.5	148		2812	1.406	$ 31.50	$ 4,662.00	$ 3.12	$ 461.76	$ 1.73	$ 256.04	$ 5,379.80
21x44	3	19, 22, 15	56		2464	1.232	$ 63.00	$ 3,528.00	$ 3.73	$ 208.88	$ 1.57	$ 87.92	$ 3,824.80
24x62	2	17, 6	23		1426	0.713	$ 88.50	$ 2,035.50	$ 3.57	$ 82.11	$ 1.50	$ 34.50	$ 2,152.11
16x31	13	23, 15, 14.5, 29.5, 29.5, 29.5, 29.5, 29.5, 29.5, 14, 22, 23, 24	312.5		9688	4.84375	$ 44.50	$ 13,906.25	$ 3.05	$ 953.13	$ 1.69	$ 528.13	$ 15,387.50
12x16	2	14, 19	33		528	0.264	$ 23.00	$ 759.00	$ 3.12	$ 102.96	$ 1.73	$ 57.09	$ 919.05
30x90	1	12, 13	25		2475	1.2375	$ 134.00	$ 3,350.00	$ 3.33	$ 83.25	$ 1.40	$ 35.00	$ 3,468.25
30x108	1	24	24		2592	1.296	$ 154.00	$ 3,696.00	$ 3.30	$ 79.20	$ 1.39	$ 33.36	$ 3,808.56
27x84	4	29.5, 27, 24.5, 24.5, 29.5	135		11340	5.67	$ 120.00	$ 16,200.00	$ 3.33	$ 449.55	$ 1.40	$ 189.00	$ 16,838.55
12x35	3	11, 18, 6	35		1225	0.6125	$ 50.00	$ 1,750.00	$ 3.39	$ 118.65	$ 1.88	$ 65.80	$ 1,934.45
12x22	5	11, 8.5, 9, 9, 11	48.5		1067	0.5335	$ 31.50	$ 1,527.75	$ 3.12	$ 151.32	$ 1.73	$ 83.91	$ 1,762.98
24x55	1	23	23		1265	0.6325	$ 78.50	$ 1,805.50	$ 3.57	$ 82.11	$ 1.50	$ 34.50	$ 1,922.11
24x76	1	27	27		2052	1.026	$ 109.00	$ 2,943.00	$ 3.57	$ 96.39	$ 1.50	$ 40.50	$ 3,079.89
16x26	13	27, 27, 27, 27, 12.5, 23, 23, 3.5, 5.5, 5.5, 8, 22, 22	233		6058	3.029	$ 37.00	$ 8,621.00	$ 2.75	$ 640.75	$ 1.52	$ 354.16	$ 9,615.91

18x40	2	20.5, 21	41.5	1660	0.83	$ 57.00	$ 2,365.50	$ 4.13	$ 171.40	$ 1.74	$ 72.21	$ 2,609.11
10x12	2	16, 16.5	32.5	390	0.195	$ 17.50	$ 568.75	$ 4.58	$ 148.85	$ 2.54	$ 82.55	$ 800.15
			Total		30.5138		$ 88,208.55		$ 6,521.71		$ 3,424.04	$ 98,154.30
			3rd Level Steel Total		**54.81**		**$158,236.70**		**$10,859.28**		**$5,615.49**	**$174,711.46**

3rd Level is taken to be an average for all other floors aside from the foundation level. So multiply the totals by 5 to get the grand total

Data	Tons	Material Total Cost	Labor Total Cost	Equipment Total Cost	Total Cost
Floors 1.20 - 1.60 Total	274	$ 791,183.50	$ 54,296.38	$ 28,077.43	$ 873,557.30
Foundation Subtotals	51.4	$ 150,029.21	$ 10,363.99	$ 5,966.05	$ 166,359.25
Columns Subtotal	87.5	$ 319.46	$ 8,158.08	$ 4,533.08	$ 13,010.62
		$ 941,532.17	$ 72,818.45	$ 38,576.56	
	Tax	$ 56,491.93		$ 2,314.59	
		$ 998,024.10	$ 72,818.45	$ 40,891.15	$ 1,111,733.69

Subtotal	$ 1,111,733.69
Overhead & Profit	$ 111,173.37
Grand Total	$ 1,222,907.06
Total Tonnage	413.0

Concrete Foundation Estimate

Spread Footings														
Spread Footing	Quantity	Length	Width	Thickness	CF/Footing	Total CF	CY	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
F60	19	5	5	1.5	37.5	712.5	26	$197.00	$5,198.61	$112.00	$2,955.56	$0.76	$20.06	$8,174.22
F72	14	6	6	2	72	1008	37	$197.00	$7,354.67	$112.00	$4,181.33	$0.76	$28.37	$11,564.37
F84	15	7	7	2.5	122.5	1837.5	68	$197.00	$13,406.94	$112.00	$7,622.22	$0.76	$51.72	$21,080.89
F96	6	8	8	2.5	160	960	36	$197.00	$7,004.44	$112.00	$3,982.22	$0.76	$27.02	$11,013.69
F108	1	9	9	3	243	243	9	$197.00	$1,773.00	$112.00	$1,008.00	$0.76	$6.84	$2,787.84
						Total	176		$34,737.67		$19,749.33		$134.01	$54,621.01
						TAX			$ 2,084.26		$ -		$ 8.04	
									$ 36,821.93		$ 19,749.33		$142.05	$ 56,713.31

Subtotal	$ 56,713.31
OH&P	$ 5,671.33
Grand Total	$ 62,384.65

Wall Footings												
Wall Footing	Length	Width	Thickness	CF	CY	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
WF 1	405	3.5	1.5	2126	79	$ 127.00	$ 10,001.25	$ 80.00	$ 6,300.00	$ 0.54	$ 42.53	$ 16,343.78
WF 2	104	3.333	3	1040	39	$ 127.00	$ 4,891.36	$ 80.00	$ 3,081.17	$ 0.54	$ 20.80	$ 7,993.33
WF 3	73	7	3	1533	57	$ 127.00	$ 7,210.78	$ 80.00	$ 4,542.22	$ 0.54	$ 30.66	$ 11,783.66
WF 4	23	4	2.5	230	9	$ 127.00	$ 1,081.85	$ 80.00	$ 681.48	$ 0.54	$ 4.60	$ 1,767.93
WF 5	92	4.25	1.5	587	22	$ 127.00	$ 2,758.72	$ 80.00	$ 1,737.78	$ 0.54	$ 11.73	$ 4,508.23
WF 6	48	4.333	3	624	23	$ 127.00	$ 2,934.89	$ 80.00	$ 1,848.75	$ 0.54	$ 12.48	$ 4,796.11
MF 1	30.5	18	2	1098	41	$ 176.00	$ 7,157.33	$ 80.00	$ 3,253.33	$ 0.54	$ 21.96	$ 10,432.63
MF 2	50	3	2	300	11	$ 176.00	$ 1,955.56	$ 80.00	$ 888.89	$ 0.54	$ 6.00	$ 2,850.44
RWF 1	89	9.5	1.5	1268	47	$ 127.00	$ 5,965.47	$ 80.00	$ 3,757.78	$ 0.54	$ 25.37	$ 9,748.62
				Total	326		$ 43,957.21		$ 26,091.40		$ 176.12	$ 70,224.73

Walls												
Wall	Length	Width	Avg. Height	CF	CY	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
RW 1	119	1.5	15	2677.5	99	$ 153.00	$ 15,172.50	$ 183.00	$ 18,147.50	$ 15.30	$ 1,517.25	$ 34,837.25
W 1	571	1.5	15	12847.5	476	$ 153.00	$ 72,802.50	$ 183.00	$ 87,077.50	$ 15.30	$ 7,280.25	$ 167,160.25
W 3	20	1.833	15	549.9	20	$ 153.00	$ 3,116.10	$ 183.00	$ 3,727.10	$ 15.30	$ 311.61	$ 7,154.81
W 4	3	0.67	15	30.15	1	$ 153.00	$ 170.85	$ 183.00	$ 204.35	$ 15.30	$ 17.09	$ 392.29
W 5	224	1	15	3360	124	$ 153.00	$ 19,040.00	$ 183.00	$ 22,773.33	$ 15.30	$ 1,904.00	$ 43,717.33
W 6	44	2.42	15	1597.2	59	$ 153.00	$ 9,050.80	$ 183.00	$ 10,825.47	$ 15.30	$ 905.08	$ 20,781.35
				Total	780		$ 119,352.75		$ 142,755.25		$ 11,935.28	$ 274,043.28
				TAX			$ 9,798.60				$ 726.68	
							$ 173,108.56		$ 168,846.65		$ 12,838.08	$ 354,793.29

Subtotal	$ 354,793.29
OH&P	$ 35,479.33
Grand Total	$ 390,272.61

Slab Types									
Slab Type	Quantity	Unit	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
S.O.G.	18722	S.F.	$ 1.88	$ 35,197.36	$ 0.88	$ 16,475.36	$ 0.01	$ 187.22	$ 51,859.94
S-1	74754	S.F.	$ 1.97	$ 147,265.38	$ 0.86	$ 64,288.44	$ 0.28	$ 20,931.12	$ 232,484.94
G-1	86	S.F.	$ 1.16	$ 99.76	$ 0.86	$ 73.96	$ 0.28	$ 24.08	$ 197.80
R-1	8871	S.F.	$ 1.16	$ 10,290.36	$ 0.86	$ 7,629.06	$ 0.28	$ 2,483.88	$ 20,403.30
Total	102433	S.F.		$ 192,852.86		$ 88,466.82		$ 23,626.30	$ 304,945.98

WWF and Metal Deck									
Item	Quantity	Unit	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
WWF	922	CSF	$ 17.35	$ 15,996.70	$ 22.50	$ 20,745.00	$ 42.85	$ 39,507.70	$ 76,249.40
Slab Deck	79482	SF	$ 2.74	$ 217,780.68	$ 0.57	$ 45,304.74	$ 0.05	$ 3,974.10	$ 267,059.52
Roof Deck	8519	SF	$ 2.74	$ 23,342.06	$ 0.57	$ 4,855.83	$ 0.05	$ 425.95	$ 28,623.84
Total				$ 257,119.44		$ 70,905.57		$ 43,907.75	$ 371,932.76

Rebar Types									
Type	Quantity	Unit	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
#4	354	EA	$ 5.95	$ 2,106.30	$ 6.60	$ 2,336.40	$ -	$ -	$ 4,442.70
#5	1700	EA	$ 7.25	$ 12,325.00	$ 7.35	$ 12,495.00	$ -	$ -	$ 24,820.00
#6	696	EA	$ 8.40	$ 5,846.40	$ 8.35	$ 5,811.60	$ -	$ -	$ 11,658.00
#7	62	EA	$ 9.75	$ 604.50	$ 9.60	$ 595.20	$ -	$ -	$ 1,199.70
Total				$ 20,882.20		$ 21,238.20			$ 42,120.40

	Concrete				
	Tax	$ 11,571.17		$ 1,417.58	
		$ 461,543.47	$ 88,466.82	$ 68,951.63	$ 618,961.92
Concrete	Subtotal	$ 618,961.92			
	OH&P	$ 61,896.19			
	Grand Total	$ 680,858.11			
	Rebar				
	Tax	$ 1,252.93			
		$ 22,135.13	$ 21,238.20		$ 43,373.33
Rebar	Subtotal	$ 43,373.33			
	OH&P	$ 4,337.33			
	Grand Total	$ 47,710.67			
	WWF				
	Tax	$ 959.80		$ 2,370.46	
		$ 16,956.50	$ 20,745.00	$ 41,878.16	$ 79,579.66
WWF	Subtotal	$ 79,579.66			
	OH&P	$ 7,957.97			
	Grand Total	$ 87,537.63			
	Deck				
	Tax	$ 14,467.36		$ 264.00	
		$ 255,590.10	$ 50,160.57	$ 4,664.05	$ 310,414.73
Deck	Subtotal	$ 310,414.73			
	OH&P	$ 31,041.47			
	Grand Total	$ 341,456.20			
	Concrete Total	$ 1,133,515.37			
	Rebar Total	$ 47,710.67			
	WWF Total	$ 87,537.63			
	Deck Total	$ 341,456.20			

Spread Footing Formwork													
Spread Footing	Quantity	Length	Width	Thickness	SFCA/Footing	Total SFCA	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
F60	19	5	5	1.5	30	570	$ 2.47	$ 1,407.90	$ 2.90	$ 1,653.00	$ -	$ -	$ 3,060.90
F72	14	6	6	2	48	672	$ 2.47	$ 1,659.84	$ 2.90	$ 1,948.80	$ -	$ -	$ 3,608.64
F84	15	7	7	2.5	70	1050	$ 2.47	$ 2,593.50	$ 2.90	$ 3,045.00	$ -	$ -	$ 5,638.50
F96	6	8	8	2.5	80	480	$ 2.47	$ 1,185.60	$ 2.90	$ 1,392.00	$ -	$ -	$ 2,577.60
F108	1	9	9	3	108	108	$ 2.47	$ 266.76	$ 2.90	$ 313.20	$ -	$ -	$ 579.96
					Total	2880		$ 7,113.60		$ 8,352.00		$ -	$ 15,465.60

Tax		$ 426.82			
		$ 7,540.42	$ 8,352.00		$ 15,892.42

Subtotal	$	15,892.42
OH&P	$	1,589.24
Grand Total	$	17,481.66

Wall Footing Formwork

Wall Footing	Length	Width	Thickness	SFCA	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
WF 1	405	3.5	1.5	1225.5	$ 2.47	$ 3,026.99	$ 2.90	$ 3,553.95	$ -	$ -	$ 6,580.94
WF 2	104	3.333	3	643.998	$ 2.47	$ 1,590.68	$ 2.90	$ 1,867.59	$ -	$ -	$ 3,458.27
WF 3	73	7	3	480	$ 2.47	$ 1,185.60	$ 2.90	$ 1,392.00	$ -	$ -	$ 2,577.60
WF 4	23	4	2.5	135	$ 2.47	$ 333.45	$ 2.90	$ 391.50	$ -	$ -	$ 724.95
WF 5	92	4.25	1.5	288.75	$ 2.47	$ 713.21	$ 2.90	$ 837.38	$ -	$ -	$ 1,550.59
WF 6	48	4.33	3	313.98	$ 2.47	$ 775.53	$ 2.90	$ 910.54	$ -	$ -	$ 1,686.07
MF 1	30.5	18	2	194	$ 2.47	$ 479.18	$ 2.90	$ 562.60	$ -	$ -	$ 1,041.78
MF 2	50	3	2	212	$ 2.47	$ 523.64	$ 2.90	$ 614.80	$ -	$ -	$ 1,138.44
RWF 1	89	9.5	1.5	295.5	$ 2.47	$ 729.89	$ 2.90	$ 856.95	$ -	$ -	$ 1,586.84
			Total	3788.728		$ 9,358.16		$ 10,987.31		$ -	$ 20,345.47

Wall Formwork

Wall	Length	Width	Avg. Height	SFCA	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
RW 1	119	1.5	15	3570	$ 0.91	$ 3,248.70	$ 6.65	$ 23,740.50	$ -	$ -	$ 26,989.20
W 1	571	1.5	15	17130	$ 0.91	$ 15,588.30	$ 6.65	$ 113,914.50	$ -	$ -	$ 129,502.80
W 3	20	1.833	15	600	$ 0.91	$ 546.00	$ 6.65	$ 3,990.00	$ -	$ -	$ 4,536.00
W 4	3	0.67	15	90	$ 0.91	$ 81.90	$ 6.65	$ 598.50	$ -	$ -	$ 680.40
W 5	224	1	15	6720	$ 0.91	$ 6,115.20	$ 6.65	$ 44,688.00	$ -	$ -	$ 50,803.20
W 6	44	2.42	15	1320	$ 0.91	$ 1,201.20	$ 6.65	$ 8,778.00	$ -	$ -	$ 9,979.20
			Total	29430		$ 26,781.30		$ 195,709.50		$ -	$ 222,490.80

Wall Footing				
Tax		$ 561.49		
		$ 9,919.65	$ 10,987.31	$ 20,906.96
Subtotal	$ 20,906.96			
OH&P	$ 2,090.70			
Grand Total	$ 22,997.65			
Wall				
Tax		$ 1,606.88		
		$ 28,388.18	$ 195,709.50	$ 224,097.68
Subtotal	$ 224,097.68			
OH&P	$ 22,409.77			
Grand total	$ 246,507.45			

Slab Edge Formwork

Slabs	Perimeter (LF)	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
SOG	710	$ 0.31	$ 220.10	$ 2.27	$ 1,611.70	$ -	$ -	$ 1,831.80
L1 Slab	700	$ 0.18	$ 126.00	$ 2.72	$ 1,904.00	$ -	$ -	$ 2,030.00
L2 Slab	720	$ 0.18	$ 129.60	$ 2.72	$ 1,958.40	$ -	$ -	$ 2,088.00
L3 Slab	720	$ 0.18	$ 129.60	$ 2.72	$ 1,958.40	$ -	$ -	$ 2,088.00
L4 Slab	720	$ 0.18	$ 129.60	$ 2.72	$ 1,958.40	$ -	$ -	$ 2,088.00
Roof Slab	700	$ 0.18	$ 126.00	$ 2.72	$ 1,904.00	$ -	$ -	$ 2,030.00
Total	4270		$ 860.90		$ 11,294.90		$ -	$ 12,155.80

Gravel Fill

Section	Area	Material Unit Cost	Total Material Cost	Labor Unit Cost	Total Labor Cost	Equipment Unit Cost	Total Equipment Cost	Total Cost
SOG Gravel Fill	18722	$ 0.63	$ 11,794.86	$ 0.21	$ 3,931.62	$ 0.02	$ 374.44	$ 16,100.92

		Slab						
		Tax	$ 51.65					
			$ 912.55		$ 11,294.90			$ 12,207.45
	Subtotal	$ 12,207.45						
	OH&P	$ 1,220.75						
	Grand Total	$ 13,428.20						
		Backfill						
		Tax	$ 707.69				$ 22.47	
			$ 12,502.55		$ 3,931.62		$ 396.91	$ 16,831.08
	Subtotal	$ 16,831.08						
	OH&P	$ 1,683.11						
	Grand Total	$ 18,514.19						

Appendix C

MEP Assembly Estimate

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State Colle PA 16801

Data Release :Year 2013 Quarter 3 **Assembly Cost Estimate**

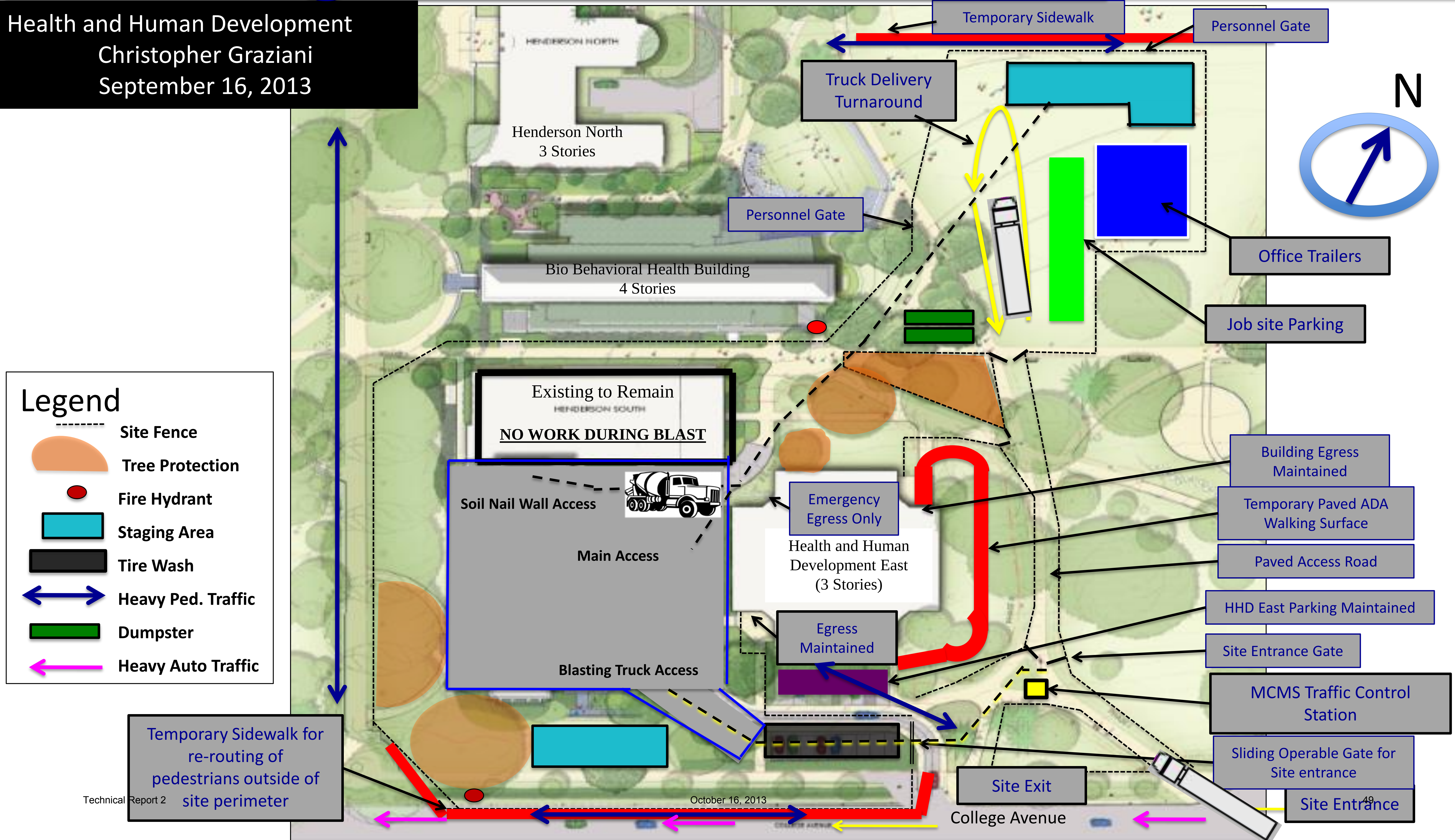
Quantity	Assembly Number	Sourc	SubCo	Description	Unit	Material O&P	Installation O&P	Total O&P	Ext. Material O&P	Ext. Installation O&P	Ext. Total O&P	Labor Type	Data Release	Zip Code	Notes
Plumbing															
1	D20101203000			Water closets, battery mount, wall hung, back to back, first pair of closets	Ea.	$ 3,450.00	$ 1,100.00	$ 4,550.00	$ 3,450.00	$ 1,100.00	$ 4,550.00	STD	Year 2013 Quarter 3		
1	D20101203100			Water closets, battery mount, wall hung, each additional pair of closets, back to back	Ea.	$ 3,400.00	$ 1,100.00	$ 4,500.00	$ 3,400.00	$ 1,100.00	$ 4,500.00	STD	Year 2013 Quarter 3		
5	D20102102000			Urinal, vitreous china, wall hung	Ea.	$ 625.00	$ 800.00	$ 1,425.00	$ 3,125.00	$ 4,000.00	$ 7,125.00	STD	Year 2013 Quarter 3		
27	D20103101800			Lavatory w/trim, vanity top, stainless, 17" x 22"	Ea.	$ 830.00	$ 715.00	$ 1,545.00	$ 22,410.00	$ 19,305.00	$ 41,715.00	STD	Year 2013 Quarter 3		
9	D20104101960			Kitchen sink w/trim, countertop, stainless steel, 33" x 22" double bowl	Ea.	$ 1,575.00	$ 845.00	$ 2,420.00	$ 14,175.00	$ 7,605.00	$ 21,780.00	STD	Year 2013 Quarter 3		
77	D20402104200			Roof drain, CI, soil,single hub, 4" diam, 10' high	Ea.	$ 920.00	$ 870.00	$ 1,790.00	$ 70,840.00	$ 66,990.00	$ 137,830.00	STD	Year 2013 Quarter 3		
6	D20108201920			Water cooler, electric, wall hung, wheelchair type, 7.5 GPH	Ea.	$ 1,375.00	$ 610.00	$ 1,985.00	$ 8,250.00	$ 3,660.00	$ 11,910.00	STD	Year 2013 Quarter 3		
											$ 229,410.00				
HVAC															
28	D20101102080			Water closet, vitreous china, bowl only with flush valve, wall hung	Ea.	$ 1,900.00	$ 810.00	$ 2,710.00	$ 53,200.00	$ 22,680.00	$ 75,880.00	STD	Year 2013 Quarter 3		
92565	D30105202040			Commercial building heating system, fin tube radiation, forced hot water, 100,000 SF, 1mil CF, total 3 floors	S.F.	$ 1.89	$ 2.48	$ 4.37	$ 174,947.85	$ 229,561.20	$ 404,509.05	STD	Year 2013 Quarter 3		
4	D30401101030			AHU, central station, cool/heat coils, constant volume, filters, 10,000 CFM	Ea.	$ 36,700.00	$ 9,623.00	$ 46,323.00	$ 146,800.00	$ 38,492.00	$ 185,292.00	OPN	Year 2013 Quarter 3		
1	D30401101020			AHU, central station, cool/heat coils, constant volume, filters, 5,000 CFM	Ea.	$ 24,900.00	$ 6,900.00	$ 31,800.00	$ 24,900.00	$ 6,900.00	$ 31,800.00	OPN	Year 2013 Quarter 3		
92565	D30301103400			Packaged chiller, air cooled, with fan coil unit, offices, 6,000 SF, 19.00 ton	S.F.	$ 9.70	$ 6.00	$ 15.70	$ 897,880.50	$ 555,390.00	$ 1,453,270.50	OPN	Year 2013 Quarter 3		
											$ 2,150,751.55				
Electrical															
1	D50102400620			Switchgear installation, incl switchboard, panels & circuit breaker, 277/480 V, 2000 A	Ea.	$ 42,500.00	$ 8,300.00	$ 50,800.00	$ 42,500.00	$ 8,300.00	$ 50,800.00	OPN	Year 2013 Quarter 3		
1	D50102400560			Switchgear installation, incl switchboard, panels & circuit breaker, 277/480 V, 1000 A	Ea.	$ 23,500.00	$ 6,100.00	$ 29,600.00	$ 23,500.00	$ 6,100.00	$ 29,600.00	OPN	Year 2013 Quarter 3		
20	D50102501020			Panelboard, 4 wire w/conductor & conduit, NQOD, 120/208 V, 100 A, 1 stories, 25' horizontal		$ 1,700.00	$ 1,675.00	$ 3,375.00	$ 34,000.00	$ 33,500.00	$ 67,500.00	OPN	Year 2013 Quarter 3		
35	D50102502000			Panelboard, 4 wire w/conductor & conduit, NQOD, 120/208 V, 225 A, 1 stories, 25' horizontal		$ 3,650.00	$ 2,425.00	$ 6,075.00	$ 127,750.00	$ 84,875.00	$ 212,625.00	OPN	Year 2013 Quarter 3		
2	D50102502080			Panelboard, 4 wire w/conductor & conduit, NQOD, 120/208 V, 400 A, 1 stories, 25' horizontal		$ 5,175.00	$ 3,750.00	$ 8,925.00	$ 10,350.00	$ 7,500.00	$ 17,850.00	OPN	Year 2013 Quarter 3		
1	D50102400300			Switchgear installation, incl switchboard, panels & circuit breaker, 120/208 V, 1000 A	Ea.	$ 16,500.00	$ 3,350.00	$ 19,850.00	$ 16,500.00	$ 3,350.00	$ 19,850.00	OPN	Year 2013 Quarter 3		
804	D50201250560			Receptacle duplex 120 V grounded, 20 A with box, plate, 3/4" EMT & wire	Ea.	$ 49.50	$ 188.00	$ 237.50	$ 39,798.00	$ 151,152.00	$ 190,950.00	OPN	Year 2013 Quarter 3		

30	D50201250600			Receptacle duplex G.F.I. 15 A with box, plate, 3/4" EMT & wire	Ea.	$ 79.50	$ 188.00	$ 267.50	$ 2,385.00	$ 5,640.00	$ 8,025.00	OPN	Year 2013 Quarter 3		
92565	D50201201280			Receptacles and wall switches, 2000 SF, 4 switches	S.F.	$ 0.10	$ 0.34	$ 0.44	$ 9,256.50	$ 31,472.10	$ 40,728.60	OPN	Year 2013 Quarter 3		
92565	D50202080960			Fluorescent fixtures, type B, 24 fixtures per 1000 SF	S.F.	$ 4.76	$ 7.60	$ 12.36	$ 440,609.40	$ 703,494.00	$ 1,144,103.40	OPN	Year 2013 Quarter 3		
											$ 1,782,032.00				
								Total	**$ 2170027.25**	**$ 1992166.30**	**$ 4162193.55**				

Appendix D

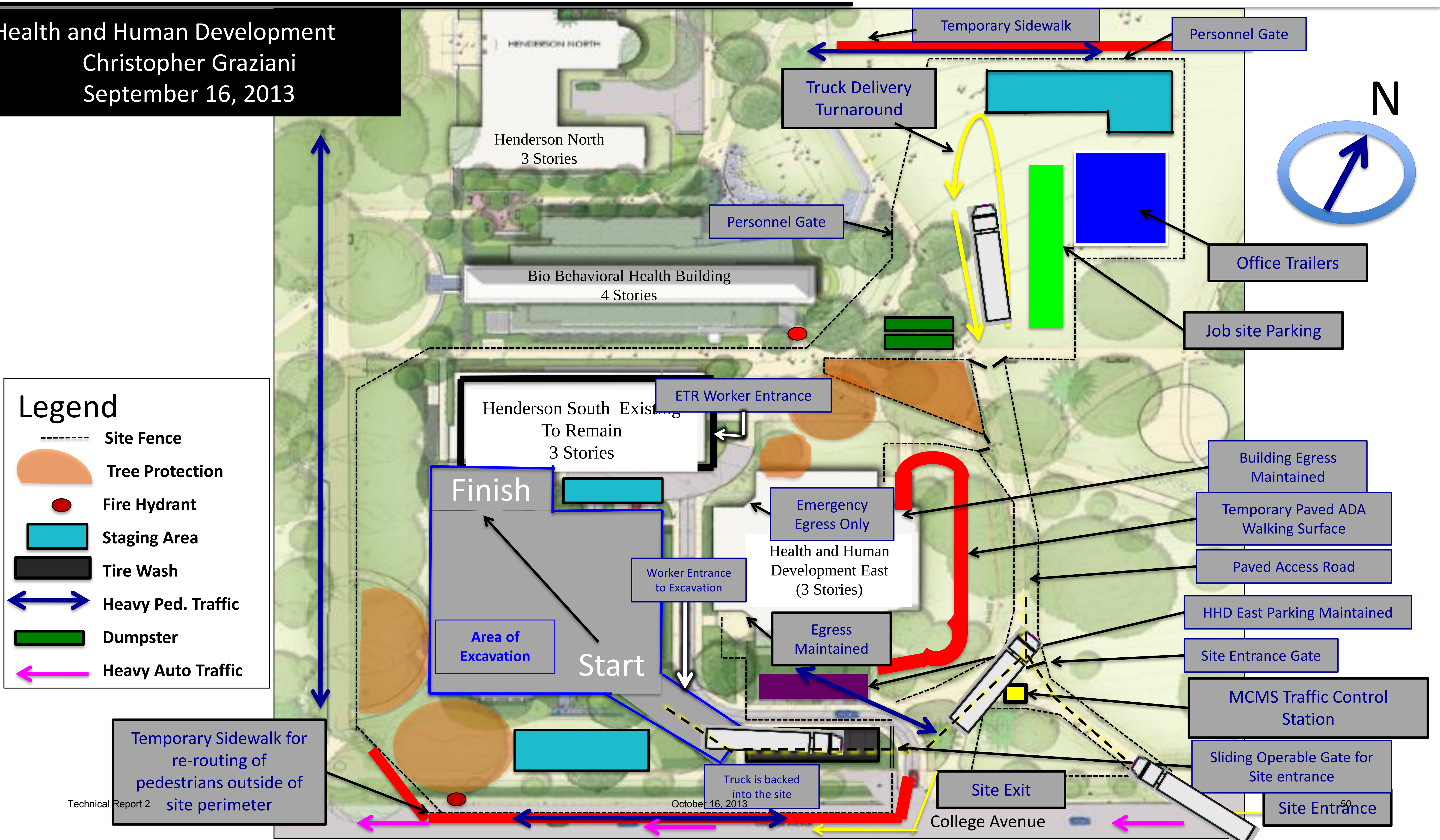
Blasting and Soil Nail Wall

Health and Human Development
Christopher Graziani
September 16, 2013



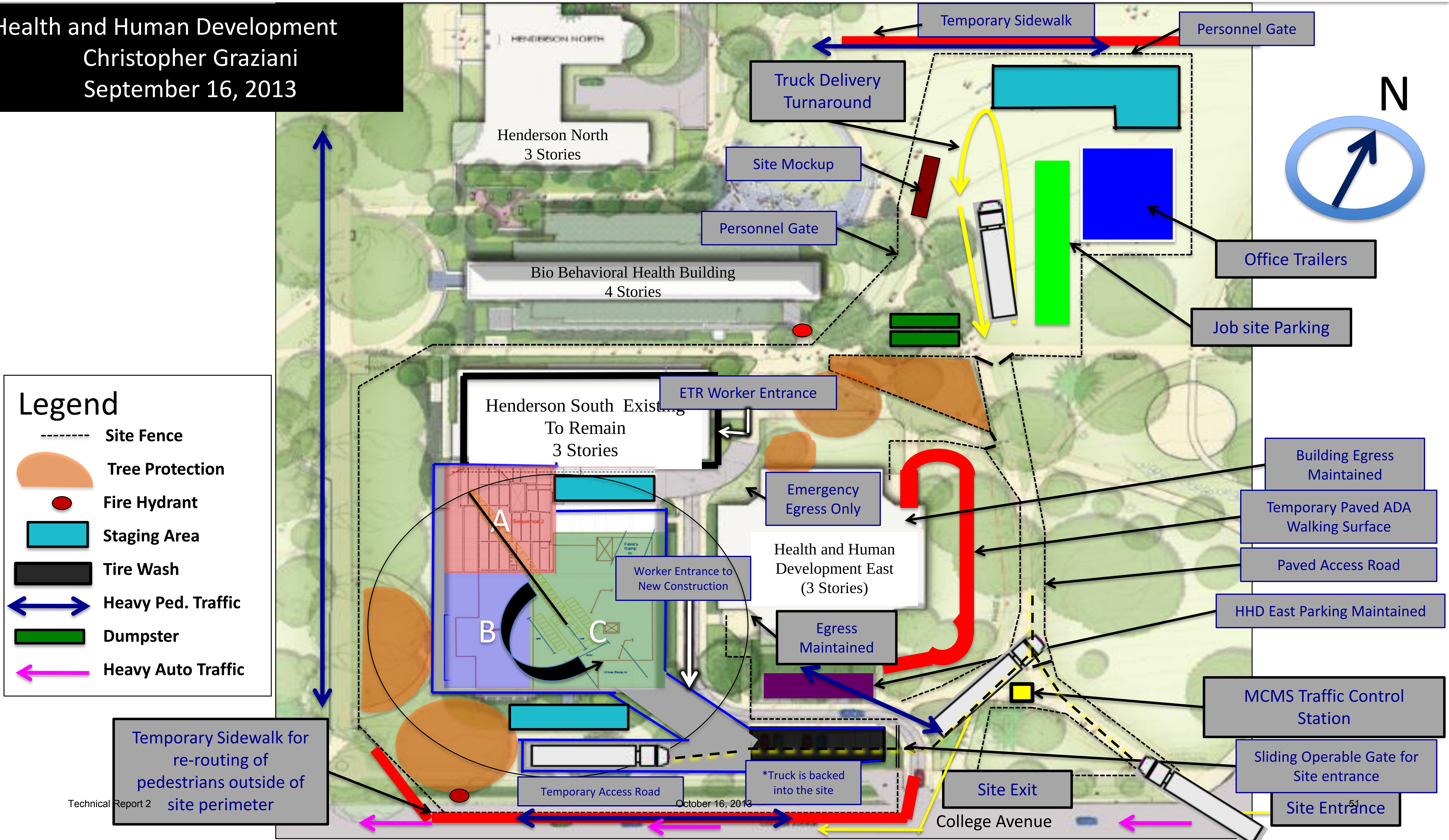
EXCAVATION PHASE

Health and Human Development
Christopher Graziani
September 16, 2013



SUPERSTRUCTURE PHASE

Health and Human Development
Christopher Graziani
September 16, 2013



Appendix E

General Conditions Estimate							
Code	**Description**	**Quantity**	**Unit**	**Material $/Unit**	**Labor $/Unit**	**Lump Sum/Unit**	**Total $**
Project Management							
PM001	Senior PM	4640	hr	0	100	0	$464,000.00
PM002	Asst. PM	4640	hr	0	95	0	$440,800.00
PM003	BIM Coord.	2900	hr	0	80	0	$232,000.00
PM004	Superintendent	4640	hr	0	100	0	$464,000.00
PM005	Project Engineer (1)	4640	hr	0	75	0	$348,000.00
PM006	Project Engineer (2)	4640	hr	0	75	0	$348,000.00
PM007	Project Engineer (3)	4640	hr	0	75	0	$348,000.00
PM008	Assistant Site Manager	4640	hr	0	85	0	$394,400.00
PM009	QA/QC Consultant	4640	hr	0	85	0	$394,400.00
PM010	Project Intern (1)	2000	hr	0	35	0	$70,000.00
PM011	Project Intern (2)	2000	hr	0	35	0	$70,000.00
PM012	Traffic Control Personnel	4640	hr	0	70	0	$324,800.00
PM013	Safety Coordinator	290	hr	0	75	0	$21,750.00
	Total						$3,920,150.00
Temporary Utilities							
T001	Phone/Data	29	mo	100	0	0	$2,900.00
T002	Electric	29	mo	250	0	0	$7,250.00
T003	Temporary Heat	12	mo	1250	0	0	$15,000.00
T004	Water	29	mo	100	0	0	$2,900.00
T005	Temporary Generators	29	mo	1200	0	0	$34,800.00
T006	Porta Johns	29	mo	800	0	0	$23,200.00
	Total						$86,050.00
Equipment							
E001	Office Trailers (2)	29	mo	2500	0	0	$72,500.00
E002	Mobile Crane	9	mo	25000	0	0	$225,000.00
E003	Forklifts (4)	29	mo	2000	0	0	$58,000.00
E004	Hoist	16	mo	1500	0	0	$24,000.00
E005	Lifts (12)	20	mo	3600	0	0	$72,000.00
	Total						$451,500.00
Materials and Supplies							
M001	Computers	29	mo	5000	0	0	$145,000.00
M002	Cell Phones (10)	29	mo	400	0	0	$11,600.00
M003	PPE	20	LS	0	0	100	$2,000.00
M004	Printing	29	mo	1200	0	0	$34,800.00
M006	Fire Extinguishers	10	LS	0	0	100	$1,000.00
M007	BIM Management (Programs/Meeting	1	LS			25000	$25,000.00
M008	Drinking Water/Coffee	29	mo	200	0	0	$5,800.00
	Total						$225,200.00
Safety and Preparation							
S001	Temporary Fence and Tree Protectio	4300	LF	2	12	0	$60,200.00
S002	Temporary Road	4000	SY	1.2	4	0	$20,800.00
S003	Signs	15	EA	200	100	0	$4,500.00
S004	Dumpsters (4)	29	mo	1,000	0	0	$29,000.00
S005	Trash Removal	29	mo	75	0	0	$2,175.00
S006	Truck Wash Station	1	LS	0	0	5000	$5,000.00
	Total						$121,675.00
Bonds, Permits, and Insurance							
B001	Occupancy Permit	1	LS	0	0	1000	$1,000.00
B002	Land Permit	1	LS	0	0	1500	$1,500.00
B003	Bonds	N/A	N/A	N/A	N/A	N/A	N/A
B004	Insurance	N/A	N/A	N/A	N/A	N/A	N/A
	Total						$2,500.00
	Grand Total						$4,807,075.00

Staffing Hours Breakdown

Months	Feb-13	Mar-13	Apr-13	May-13	Jun-13	Jul-13	Aug-13	Sep-13	Oct-13	Nov-13	Dec-13	Jan-14	Feb-14	Mar-14	Apr-14	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	May-15	Jun-15	Total (Hours)
Senior PM	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
PM	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
PE	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
PE	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
PE	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
Intern	40	40	40	40	160	160	160	40	40	40	40	40	40	40	40	40	160	160	160	40	40	40	40	40	40	40	40	40	160	2000
Intern	40	40	40	40	160	160	160	40	40	40	40	40	40	40	40	40	160	160	160	40	40	40	40	40	40	40	40	40	160	2000
BIM Manager	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	2900
Safety	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	290
Site Manager	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
Asst. Site Manager	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
QA / QC Consultant	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640
Traffic Control	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	4640