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CM
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Library in Metropolitan Washington, D.C
10/16/2013

Library in Metropolitan Washington D.C

Technical Assignment 2

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Executive Summary

Design started in 2009 with the project going out to bid in April of 2012. Notice to proceed was issued in early January of 2013. Site utility work, excavation and deep & shallow foundation work was started immediately and would last until mid-October 2013. Structural steel erection on the project is scheduled to start in late June 2013 and will end with the Foundation and Structure complete milestone. This milestone is currently delayed on the project. Fit-out, Rough-in, and finish work will cycle through each floor in a repetitive manor. Each floor has a Floor Completion milestone associated with it. Cleaning, commissioning, and closeout work are to start in mid-August 2014 and end in late September 2014 with opening day set on October 29, 2014.

In the detailed structural estimate the caissons, mat foundations, shear walls, wall footings, steel reinforcing, structural steel columns & beams, concrete columns, grade beams, composite floor decks, and roof decks were all taken into consideration. Because of the complex building geometry, no two structural bays are alike and therefore the entire building was taken-off. In total the structural detailed estimate came to a direct cost of $5,560,000 or $6,454,000 including 6% sales tax and a 10 % overhead. Overall this estimate was only a few $100,000 higher than the actual estimated structural costs, which could be because the contractor self-performed most of the structural work.

Included in the MEP assembly estimates are the general mechanical equipment, electrical equipment and plumbing fixtures. Of these three scopes the mechanical portion was estimated to be the highest costs at $6,140,000, with electrical being the second highest at $4,069,000, and plumbing at $253,000. A large portion of the mechanical system could not be properly estimated because it lies in the integrated packaged equipment center (IPEC) on the roof, so the equipment in this unit was taken-off individually. On the electrical side of the building, there are two utility feeds for the building; 3000A and 400A.

General conditions costs on this project were estimated to be on the high side at $2,300,000 or 6.6% of the total project costs. Most of these costs are originated equipment/ crane costs, construction management fees (which are grouped into the general condition costs on this project), labor costs, insurance/ bonds required for the project via the specifications.

There are three major phases of the project that site planes were developed for. These include excavation, superstructure, and finishes. No formal site logistical planes were created for the project in advance because site coordination will be changing and volatile throughout the project. A large site logistical issue is that the adjacent site that is being used as a soil stock pile and staging must be cleared and turned back over to the owner in March 2014 because construction will be starting on another residential tower at that location.

Three constructability concerns or challenges faced/ will be faced on this project were caissons varying in depth, IPEC coordination, and the field welding of the slices in the roof trusses. Each caisson differed in depth than the planned depth, which resulted in the contractor having to field alter each rebar cage individually causes delays in the project schedule. The IPEC has a great deal of coordination issues because there is a large number of scopes that must tie into this unit once placed and the manufacturer changed in a change order. Two of the 15 feet high roof trusses must be sliced with a full penetration weld in three locates per truss because they are too long to have delivered to the site in one peace and these trusses cantilever 50 feet over the future train stop platform.

As determined through the BIM use analysis, it would be beneficial for this project to use BIM through cost estimation, 4D modeling, 3D coordination in both design and construction, design reviews, and design authoring. It also may be of benefit for the owner in record modeling for facility maintenance purposes. More than likely the construction manager would be chosen to coordinate the BIM usage and provide the BIM Champion because this party already is capable of doing BIM and has an extensive BIM program set up. In conclusion, BIM would benefit the progress and work flow of this project.

Detailed Project Schedule

In Appendix A the detailed schedule is provided in '*11x17'* format for your connivance. The schedule in this section was derived using the contractor's baseline schedule. As a result, the actual start and end dates may differ slightly then actually start and end dates because of delays that may have been encountered.

Planning & Preconstruction

In early 2009, the current county's library was becoming heavily used and over extended for their 16,000 SF facility. At this time planning was started and a piece of property was chosen. While the multiple plots of land where being produced by the County, the architect was chosen and the charrette design process was kicked-off in late-2009. By early-2012 Design development was well underway with the Construction Documents at 75%, and a request for expression of interest (REOI) was made public. In April of 2012 the Construction Documents reached 100%, and a group of six contractors where chosen from the REOI and notified to bid on the project. By January 2013, a contract was awarded to the contractor with Notice to Proceed (NTP) being January 7th, 2013.

Once NTP was issued, a number of preconstruction meetings had to take place and be coordinated, such as; LEED Kick-off, Safety Planning, Traffic Control, Temporary Facilities, Testing Program, Mock-up Testing, Quality Control, and Waste Management. Along with these meetings material and labor procurement and ordering took place throughout the duration of the project.

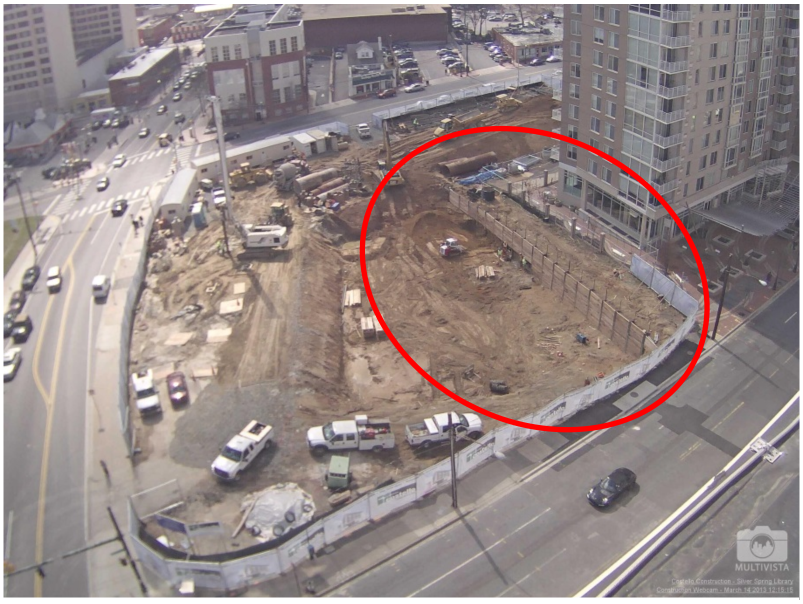


Figure 1 Excavation & Lagging (Provided by Multivista.com)

Structure

Excavation for the footings started after site mobilization and caisson testing took place on February 14, 3013. It was required to install lagging and tiebacks to only the west side of the excavation because of the neighboring existing residential tower (As seen in Figure 1 above). Also during excavation water was encountered and had to be removed from the northwest corner of the excavation.

Caisson installation along with mat foundation A, B, and C where drilled/ excavated, formed, and poured over a month period in February 20th, 2013 through April 15th, 2013. Most caissons

Figure 2 Foundation Walls & Shear Walls Installation (Provided by Multivista.com)

were required to be either shorter or longer than previously planned (ranging from 30" to 84" in diameter) which created delays in the schedule because each caisson's rebar cage had to be altered and redesigned on-site on an individual basis.

With the finish of the mat foundations, the three concrete shear walls could start to be installed using a system of aluminum forms that inner lock and are self-supporting/ bracing. This process was lengthy and was in progress from mid-May to mid-June because the shear walls needed to be raised one floor at a time with a gap build into the schedule before the next level was started to allow the previous level adequate time to cure and grain strength. These shear walls are the elevator shafts for the building and tie into the rebar in the mat foundations. Concurrently with the shear walls, the concrete foundation walls also were being installed (as seen in Figure 2 above).

After the completion of the foundation walls, the slab-on-grad (SOG) can be poured and structural steel can start to be erected but concurrently with the completion of the shear walls. Once the shear walls are completed then structural steel can progress uninterrupted through the rest of the floors to the roof on the portion of the building that is not cantilevering. Once the roof trusses are set, only then can the structural steel for the overhang be filled in and hung from the trusses. Midway through steel erection the metal floor composite decking and elevated floor slabs can start to be placed. Once the elevated floor slab on each level is poured and finished the Foundation and Structure Complete mile stone is achieved, which was originally scheduled to be September 27th, 2013. As of now, this milestone has been delayed an unknown duration, and has not yet been achieved.

Rough-in

Wasting no time, rough-in is started on level one as soon as the floor slab on that level has been cured for an adequate time frame. Rough-in primarily progresses through each floor similarly in a linear manor per floor. Each floor is laid out and framed while also installing the in-wall MEP rough-in. Once completed, the walls are inspected and certified to be closed. In conjunction to the in-wall MEP rough-in, the overhead MEP rough-in is also installed. There will also be a small quantity of equipment that gets installed in each level's ceiling and the plumbing that feeds this equipment. Much of the curtain wall and store fronts are completed at this time as well. The last piece of rough-in that gets installed per floor is the lighting and electrical rough-in. Also, while floors four and five are being roughed-in, the Integrated Packaged Equipment Center (IPEC) unit will be set on the roof and the duct, plumbing, and electrical connection will be made.

Finishes

A large majority of the first and second floor space will be roughly finished and left for a fit out of these spaces buy the nonprofit art organization that will be occupying these spaces at a later date. On the other floors the finishes procedure is as follows. First the ceilings and drop ceilings are framed in. Once the final MEP finish work is complete in the ceiling, a ceiling close-in inspection is made before the ceilings are finished. In the rest of the floor the floor finishes, casework, final MEP wall fit outs, wall finishes, and furniture is installed. In the first floor and basement there is extra finish work that must be installed which includes the library's Radio Frequency Inventory Device (RFID), which is essentially the book return/ sorting system, the coffee bar's specific equipment and finishes, and other essential specialty finishes for these two floors. At this point the milestone for the individual floor being complete is reached, which mean all work on that floor is finished.

Close-out

During close-out and after each floor as reached its Floor completed milestone, that floor goes through a presses called final cleaning which takes about five days to complete. Then all MEP systems will be tested, inspected, and balanced throughout the building. As a requirement, the zoning commission and fire marshal must do an extensive walk through in order for the building to receive a certificate of occupancy. A number of final tasked must also be completed under the punch list with the owner. Training for the librarians and operations & maintenance crew will be given at this time. Substantial completion is then scheduled to be on September 29th, 2014. On this date the move-in process will begin and last exactly one month with Opening Day set to be on October 29th, 2014.

Estimates

Detailed Structural System Estimate

In Appendix B the Detailed Structural Estimate is provided for your connivance. Most if not all price information was either taken or derived using the Unit Price portion of 2013 RSMeans Reference Guide.

Structural Description

The structural network of this library uses a number of different systems. (46) 5000psi concrete caissons are used to distribute the building's load to soil with a suitable bearing capacity, which in most cases is slightly fractured rock, according to the Geotechnical Report. In three separate areas 16 of the caissons tie into Mat Slabs A, B, and C. These mat slabs act as a base for the three 5000psi concrete shear wall/ elevator shaft towers. The remaining 30 caissons support the exterior 5000psi concrete wall footings and the concentrated structural steel column loads.

Most of the superstructure consists of a structural steel frame braced by the shear walls mentioned above. This frame supports the 4000 psi composite floor deck, which consists of steel composite decking, spot welded shear studs spaced on average one foot apart, 4000 psi concrete, and 6"x6" welded wire fabric. Floor three, four, and five are cantilevered 50 feet on the Northeast corner. These floors in this area are hung from five 15 feet high roof trusses that range that have member cord sizes from W14x109 to W14x283 and are 60 feet to 110 feet in length. Also bearing on the roof trusses is the built up green roof that is covering most of the build's roof or in some places a PVC membrane roof.

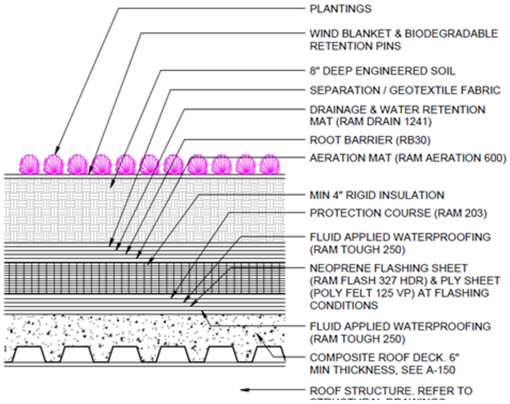


Figure 3 Green Roof (From Construction Documents Provided by MBP)

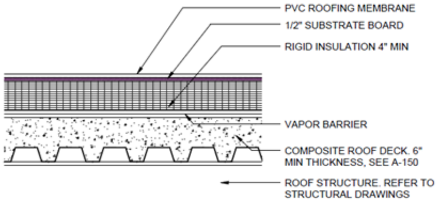


Figure 4 PVC Roof (From Construction Documents Provided by MBP)

Substructure

The entire substructure consists of concrete and reinforcing. In estimating its cost, the substructure system was recreated mentally. First the caisson quantity was taken-off, in which a spread sheet (provided by the contractor) of each of the caisson's diameter and actual as-built final depth was used. As the next step, the concrete volume that is to be placed in the mat foundations was calculated. These three mat foundations were not the largest volume of concrete in the building, however they are the largest continues pores. Logically, the concrete for the shear walls were taken-off next, in which was self-explanatory because the cross sections of the walls does not change throughout the height of the walls. There are two different typical types of wall footings, one of which is only used for a small portion of a pit in the pavilion. The other typical wall footing was used extensively as the foundation walls around the exterior of the building. Other concrete elements that were taken into consideration in this detailed cost estimate were; the small quantity of grade beams, the two structural steel columns that get encased in concrete by the cantilevered portion of the building, the two concrete columns that are tied into the south and pavilion shear walls for level of extra stability, and the south portion of the first floor that is a system of concrete beams and slab instead of an elevated floor slab on composite decking. All these estimates are assumed to have the cost of formwork included in the unit price. Concrete placement during this project varied from using a shoot in small easy to reach pours from using a crane-and-bucket and concrete pump to place concrete in shear walls, mat foundations, and wall footings.

It is important to note at this time the methodology used to account for concrete reinforcing and waste factors. All the rebar was calculated separately for each of the different types of uses and then totaled into one total tonnage of each specific bar size of rebar. This calculation can be seen in Table 1 below. Waste factors were taken into account by applying a 5% increase in material costs to both rebar and concrete when running the calculations.

Table 1 Reinforcing Steel Length to Weight Conversion

Bar Size	Length per Bar Size (LF)	Weight (lb per LF)	Total Weight per Type (lb)	Total Weight per Type (ton)
#4	120490	0.668	80488	40.2
#5	95477	1.043	99583	49.8
#6	59387	1.502	89199	44.6
#7	7032	2.044	14374	7.2
#8	942	2.67	2515	1.3
#9	4672	3.4	15886	7.9
#10	17420	4.303	74958	37.5
#11	11417	5.313	60657	30.3

Superstructure

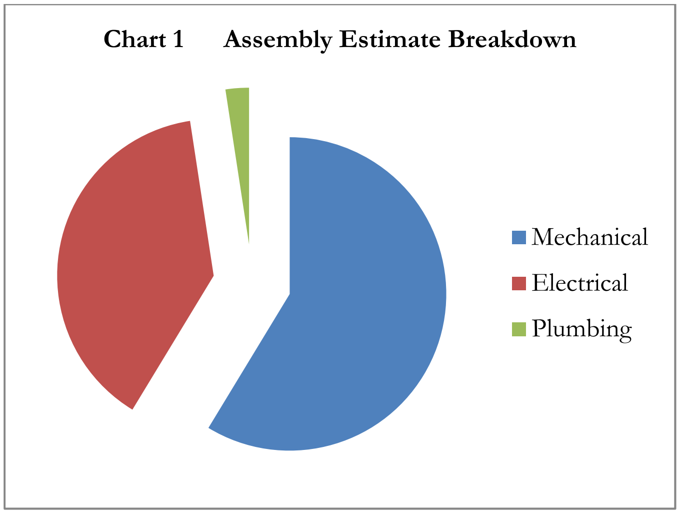
To estimate the superstructure it was broken down into two spate categories; structural steel framing and floor slabs. Unfortunately, there is no way to break the superstructure down into a manageable size typical bay because of the complexity of the structural system and the various overhangs and cantilevers. Because of this, the entire superstructure had to be taken-off on a piece by piece basis.

Each column line intersection was examined individually and taken-off based on member size and linear footage. Roof trusses where also grouped into this section in the estimate because like the columns, each truss is designed differently and is therefore different in length and made up of a variety of different member sizes. Each roof truss will be assembled on-site, because of their shear size, and lifted into place. For the structural steel flooring members the first, second, and third floors all have different profiles and structure. Floors three through five are similar in shape, but have different loading patterns, in turn having different member sizes. A small number of key structural members for floors three though five are the same and taken into consideration when performing the take-off. Most of the structural members used in this building are in the wide flange family with the exception of a about 1,400 linear feet of hollow structural section members primarily used to frame in the curtain wall in the pavilion space. At the end of the structural estimate an allowance was included to cover the costs of the structural steel connections; primarily bolted and numerous welded members.

As for the structural floor slabs, each floor has a different floor area so a square footage evaluation was done per floor and combined with the average thickness of each of the floors to calculate the volume of concrete needed per level. This same square foot estimate was used to determine the approximate square foot of each type of composite metal deck, roof deck, and the total square footage of WWF needed. Shear studs are also used to tie the elevated slabs into the structural steel floor members. These were estimated by taking the total linear foot of structural steel beams, and applying an allowance of one shear stud per one linear foot. In some areas this allowance will be over conservative and in other areas this allowance will be under conservative, but it serves as a good general estimate as to how many shear studs will be placed.

Assembly MEP Estimate

In Appendix C the Assembly Estimates are provided for your connivance. Most if not all price information was either taken or derived using the Assembly Estimate portion of 2013 RSMeans Online. Chart 1 shows a summary how the costs for the three estimates compare.



Mechanical

Of the assemblies estimates, the mechanical was the most difficult to estimate because much of the mechanical equipment is located in the IPEC (as seen in Figure 5, below), which is a specialty item and therefore has a different price than if all the equipment was installed in a mechanical room. In an effort to estimate the mechanical system each piece of equipment in the IPEC was accounted for in this assembly estimate using the references available. It was reasonable to start with the biggest and most expensive equipment first and then work down to the smallest. In all cases if the exact capacity equipment was not available, then the closest was used for the sake of this estimate.

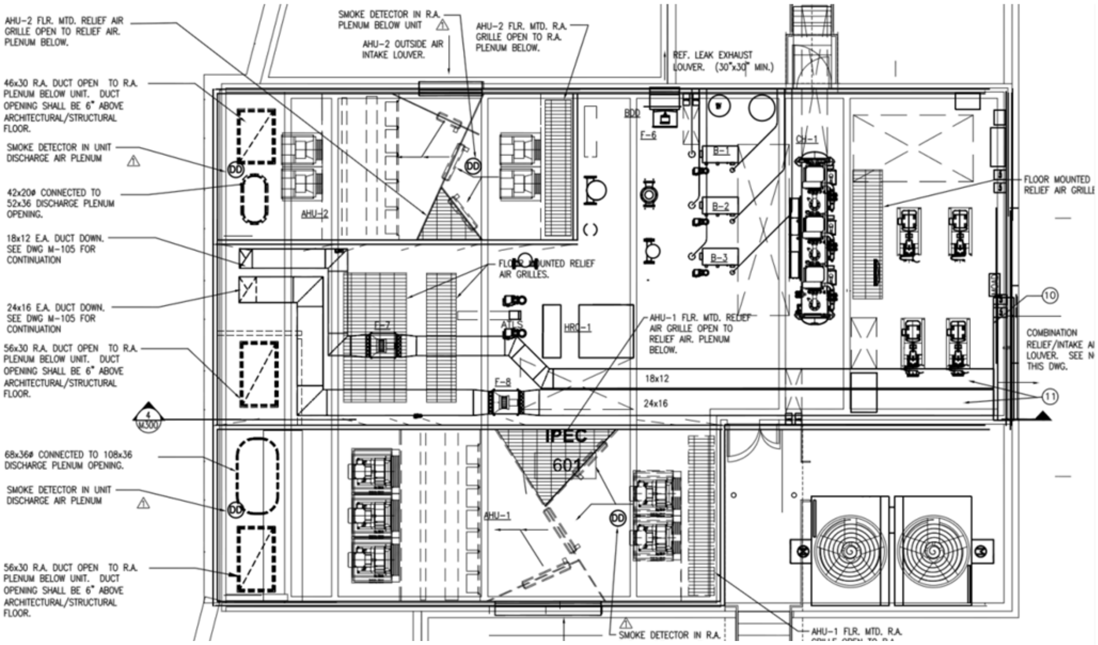


Figure 5 IPEC (From Construction Documents Provided by MBP)

There will be three 800 MBH gas fired boilers in the IPEC with two 143 ton cooling towers and one 226 ton chiller to serve as the primary heating and cooling source for the building. The system is also equipped with a heat exchanger, and an auxiliary heat recovery chiller. Build into the system is also a variety of 13 pumps that range in size from 1HP to 20 HP. To circulate the required volume of air, two air handler units are incorporated into the IPEC system; one at 40,000 CFM and the other at 16,000 CFM.

Heating and cooling distribution throughout the building is done by forced air, to satisfy ventilation requirements and part of the heating and cooling loads. The rest of the loads are satisfied by a network of hydronic piping that along with the forced air feeds a variety of variable air volume boxes, perimeter radiators, hot water unit heaters, heat pumps, a number of supply air outlets (with reheat), and a hydronic in slab heating piping network that is located in areas where overhangs may cause problems with differential conditioning. All distribution ducts and pipes that come from the IPEC will travel through the west duct shaft to the appropriate level (as seen in Figure 6, to the right). Other smaller equipment and distributions systems are located in small mechanical rooms in the first/ second floors or pavilion to condition those spaces.

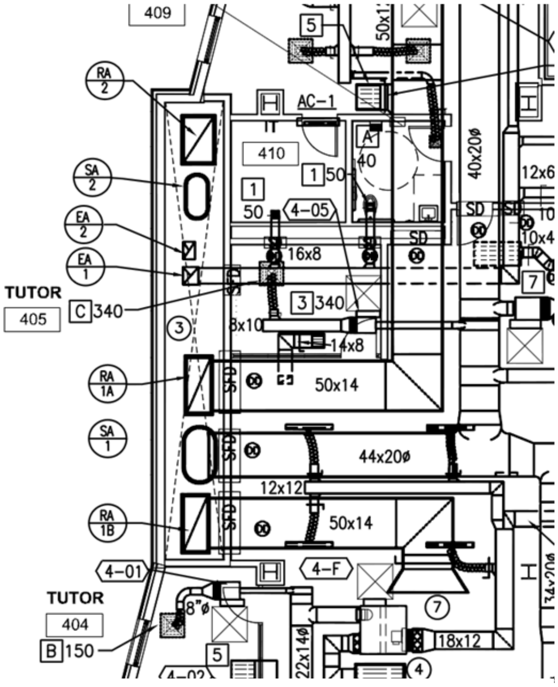


Figure 6 IPEC Distribution Shaft (From Construction Documents Provided by MBP)

Electrical

Pepco is the electrical utility provider for the building and has added two new electrical service entrances to the building. One of which is a 400A feeder that is only used for the Coffee Shop and the other a 3000A feeder that feeds a switch board, which powers the rest of the building. The switch board is 277/480 and is feeds the 600A Main Distribution Panel, the 800A IPEC, a smaller 100A circuit board, and is tied in with two automatic transfer switches for the 250KW natural gas powered generator that sits on the roof. In total there are eight transformers that step 277/480V down to 120/208V with 19 circuit boards throughout the building which power the lighting loads, electrical loads, and mechanical loads.

Branch circuiting is done through panels that are located on each floor for that floor. The lighting control system is made up of a complex integration of numerous day light and occupancy sensors. A network of low voltage controllers manage the energy usage and lighting options using multiple Light Management Hubs throughout the library and other levels of the building that can be manually manipulated via an internet connection. Wall switches were estimated to be at a density of approximately 2.5 per 1000 square foot of floor area. Lutron is the manufacturer of the lighting control system for the building and is not directly involved with the power distribution.

Power distribution in this building is primary powering motors, mechanical equipment, or receptacles. About 62 motors are at a variety of locations throughout the build. Receptacles were estimated to be at a spacing of 7 feet at a high density. All unit costs for the electrical system include the wire, materials, conduit, labor for install, labor for running wires, and equipment cost, if any is needed.

Plumbing

In general the plumbing estimates include all general fixtures and distribution piping for those fixtures. One thing it does not included is the distribution piping for the mechanical system, which should be included in the mechanical systems estimate. For the most part these are the types of things that were included in the plumbing assemblies estimate; water closets, urinals, lab sinks, service sinks, drinking fountains, water electric coolers, electric water heaters, and the 8" roof drain system. Quantities of each of these were combined with a per unit total cost rate to calculate a grand total general plumbing cost estimate.

General Conditions Estimate

In Appendix D the General Conditions Estimate is provided for your connivance. Most if not all price information was either taken or derived using the General Conditions portion of 2013 RSMeans Online or from actual expenses that occurred on the project.

General conditions for this project are not out of the ordinary. Anticipated total general conditions duration is 22 month. This duration is used to calculate all time dependent general condition items as appropriate. Site signage and perimeter fencing are tied together in that the chain link perimeter fencing that is used also has a cloth attached to it has the project description and pictures printed on it. Items such as the two office trailers, portable toilets, air conditioning, and the bills accumulated from the office trailers all have a 22 month duration. Because of limited space, there will only be two office trailers permitted to be set up on site, with a small possibility of a third for a subcontractor depending on how congested the site is later into the project. A single backhoe was assumed to be provided in the general conditions for the entire project duration to assist in small site work jobs and back-filling procedures. Two excavators are to be on site for half of the project duration while one will remain on site until the end of the project for loading/ unloading procedures, excavating/ backfilling, and other small tasks. An example of how the contractor put these excavators to good use was when they used them to load the shear wall forms for transportation and to clean up the site instead of tying up the smaller of the two mobile cranes. This is also beneficial because this reduces the length of time the 125 ton cranes is needed on site from the entire project to 20 months or less, which is directly beneficial for the contractor because this crane was just purchased by the general contractor, in other words it can be utilized and be billed on a different project sooner. On the other hand, the 200 ton crane used for structural steel erection was not included in the general conditions costs because it was already accounted for in the detailed structural estimate, built into each member's unit equipment costs. A dumpster will be needed for the entire project durations. Five 500 BTU propane fired heaters were assumes to be used in the building during a period of three months to create a favorable working environment in the coldest winter months. Temporary power from Pepco for the site was assumed to be a 600A feet with a 75kVA transformer, with two office trailer hookups. Construction documentation and web cam services are provided from Multivista for approximately 23 months.

Field staffing costs are calculated with the assumption that the Field Engineer, Project Manager, Superintendent, and LEED submittals will be staffed to the project full time for the length of the project. On the other hand the Project Executive will only be charging to the project ¼ of his time because he also is managing numerous other projects. Other General conditions costs were estimates using a fixed percent of the total construction cost. These include main office expenses, permits, builders risk insurance, liability insurance, performance bonds, construction management fees, schedule management fees, after construction clean up fees, and commissioning fees.

Overall, the estimated general conditions costs are substantially higher than what was originally provided in the base line cost break down. This could be caused by a number of influencing factors such as; such costs may be included in other portions of the contractor's estimate, special discounts felt by the contractor for repeat business or using their own resources, or errors in specific assumes about time utilization or percentages.

Site Layout Planning

In Appendix E the Site Layouts are provided for your connivance.

It is important to note that the site planes referenced and included in Appendix E were not derived from the contractor's site logistical planes because no such planes exist because the contractor is coordinating site logistics and layout throughout the project. Rather these three site plans were developed from observations taken while on site, from the project webcam, and from a series of phone interviews with the contractor as to what the future site may look like. Also, it is important to note the items appearing in all three site plans that do not change location from one to the others, which are the site office trailer, the building footprint, the temporary toilet locations, the site gates, the dumpster, and the location of the truck upload/ load/ drive-in area.

Excavation Site Plan

During excavation the truck upload/ load/ drive-in area actually extends between the two building footprint areas and out the other side to allow a straight flow of dump trucks in and out of the site. Top soil will be stored on an adjacent plot of land that is also enclosed with the site fence during the excavation phase and superstructure phase. Bulk excavation will be in the building foot print leaving a ramp for equipment to exit the East side of the excavation. On the west side of the excavation there will be a shoring and lagging effort to ensure proper soil retainage and not to disturb the foundation of the neighboring residential tower. The rest of the excavation did not need such soil retainage because it was adequate room for sloping back. A small isolated ground water problem was encountered in the West corner of the excavation in which pumps had to be set up to remove the water and prevent it from filling the excavation.

Superstructure Site Plan

Figure 7 Superstructure Crane Placement (Provided by Multivista.com)

During the superstructure phase two main cranes will be brought in, one 125 ton crane to do general lifting and one 200 ton crane (seen in Figure 7) to place structural steel on the project. The smaller of the two cranes will move from on the future train platform to beside of the pavilion, while the large crane will primarily be on the train platform and has the ability to craw to one side of the building to the other to reach all areas of the building. Eventually the large crane will back out towards the South of where the building over hangs the train platform to place the structure for the overhang. In general, structural steel is complete from level one through five in the portion of the building that is not overhung, and then the overhanging portion of the building is installed and is hang from the roof trusses. During some occasions and critical lifts, one lane of the adjacent road will be shut down for uploading purposes.

Finishes Site Plan

Once the finishes start to go in, the site plan drastically changes in that the adjacent lot that was used to stockpile top soil must be cleared and the site fence must be rerouted as to not include this lot, drastically cutting the size of the site down, because construction of another residential tower will beginning on that lot. By this time in the construction process the building should be on permanent power with no need for a temporary electrical service. Around the exterior of the building there will be masonry and curtain wall work taking place.

Constructability Challenges

Caisson Variation in Depth

In the Geotechnical report, The Robert B. Balter Company evaluates the feasibility of using shallow and deep foundation types for the library. Shallow foundation types are rules out in the very beginning of the report because of inadequate soiling bearing capacity. Three different types of deep foundations are examined to evaluate which would be more practical for the library; micropiles, caissons, and auger cast piles. However, auger cast piles are also eliminated early on in the report and a detailed evaluation is done on micropiles and caissons. In the end, the foundation type was chosen to be a network of caissons. Also, the geotechnical report states that the first few feet of soil on the side consists of backfilled material and that soil/rock that may be of appropriate bearing capacity varies in depth across the site. On every caisson the planned depth that the caisson would have to penetrate rock was either 5 feet or 6 feet depending on the load being carried and the composition of the nearest test bore. The depth of soil that had to be penetrated was different for each caisson because the rock was thought to be located at a different depth for each. Figure 8 and 9 below shows an example of one such caisson that was 8 feet shorter than originally planned from the test boring log.

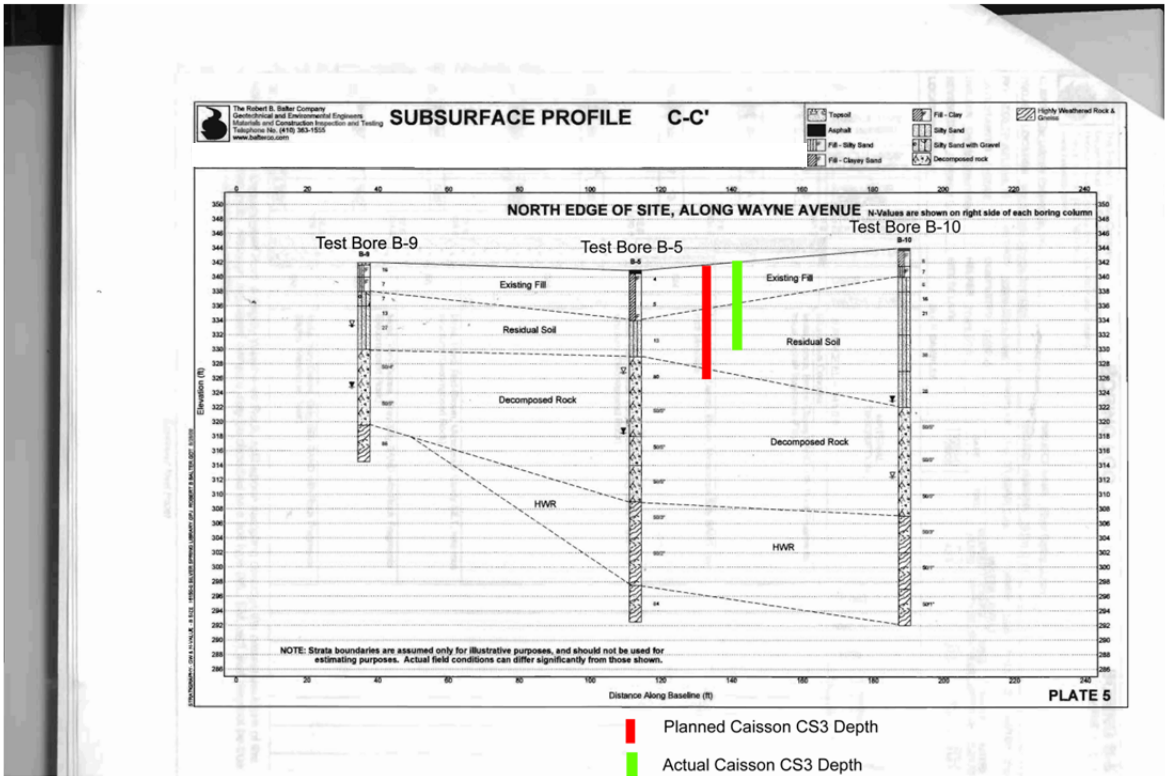


Figure 8 Test Bores B-9, B-5, and B10 Compared to Depth of CS3 (From Geotechnical Report Provided by MBP)

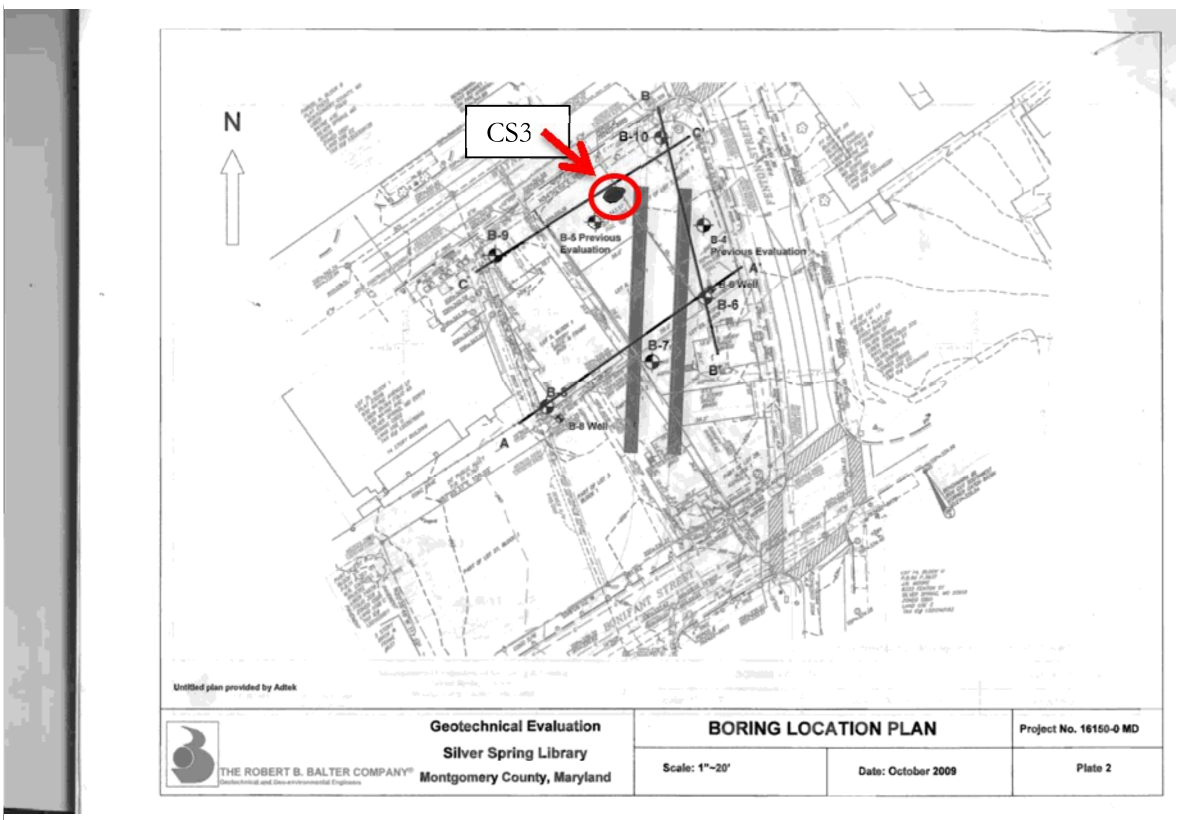


Figure 9 Test Plan Showing B-9, B-5, B10, and CS3 (From Geotechnical Report Provided by MBP)

When the contractor was having the caissons drilled in the field the actual depth of the unsuitable soil and the actual depth of rock needing to be penetrated for proper bearing capacity was different than what was originally assumed. This was a problem because the rebar cages for each of the caissons was premanufactured and shipped to the site already. Most of the rebar cages were too long or too short for the revised caisson depths. In order to keep work flowing without enormous delays, the contractor, in which was self-performing the concrete and rebar work, altered each rebar cage one at a time to match the revised required caisson length. These still created delays that are felt on the project to this day and that the contractor is still trying made up.

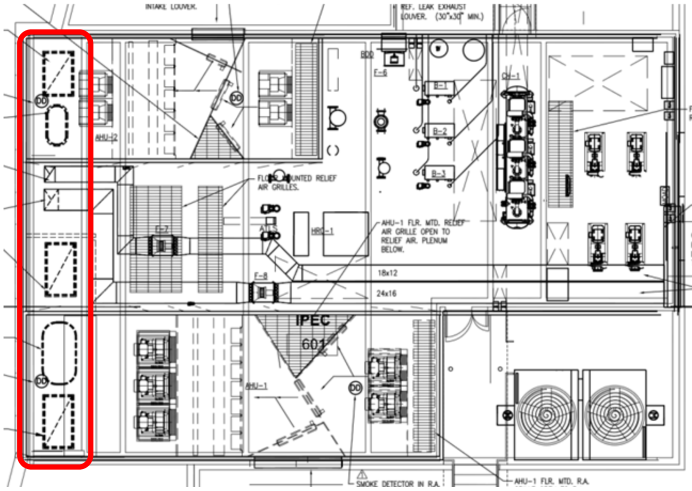


Figure 10 IPEC Duct Connections (From Construction Documents Provided by MBP)

IPEC Coordination

Much of the project team is on edge about the IPEC unit and how it is being coordinated through the structure connections, duct connections, electrical connections, plumbing connections, and the installation of the roof. In the specification it was written that the IPEC shall be of a specific model from a specific manufacturer. However, while trying to procure the IPEC from that manufacturer it was discovered that the manufacturer does not make that type of IPEC system. An RFI sent out to the architect and a change order was produced as a result. In the change order the architect addresses this problem by specifying a different manufacturer. While coordinating the issues mentioned above, the contractor has been having difficulties acquiring the appropriate information on the IPEC in order to complete these coordination issues. At this point the construction manager has stepped in and is also trying to do the appropriate coordination. Because there are a lot of trades that must line up and coordinate the connections to the IPEC this is still and ongoing issue will be better resolved when MEP rough-in starts. Some of the connections for the ducts in the IPEC are shown above in Figure 10.

Figure 11 Roof Truss Example (Provided by Multivista.com)

Field Welding& Setting of Trusses

As designed the roof trusses will be delivered to the site in 60 feet lengths. This will allow only the roof trusses in line 3 and 4 to be delivered as one truss and set into place (as seen in Figure 11, to the right). Roof trusses in line 1 and 2 will require three in-felid splices each. This is a constructability concern because this requires field full penetration welding either on the ground or 80 feet in the air at roof level. Figure 12 shows the splices that must be welded along with the cantilevered loading that is then going to be hung from the trusses. These two roof trusses are located over the cantilevered portion of the North corner. To ensure the proper quality of welding for the trusses, it is a requirement by specification to test the welds using ultra sonic testing means. Also, to lower the cost of the field welds they will occur on ground level which saves the costs of having the welders in boom lifts.

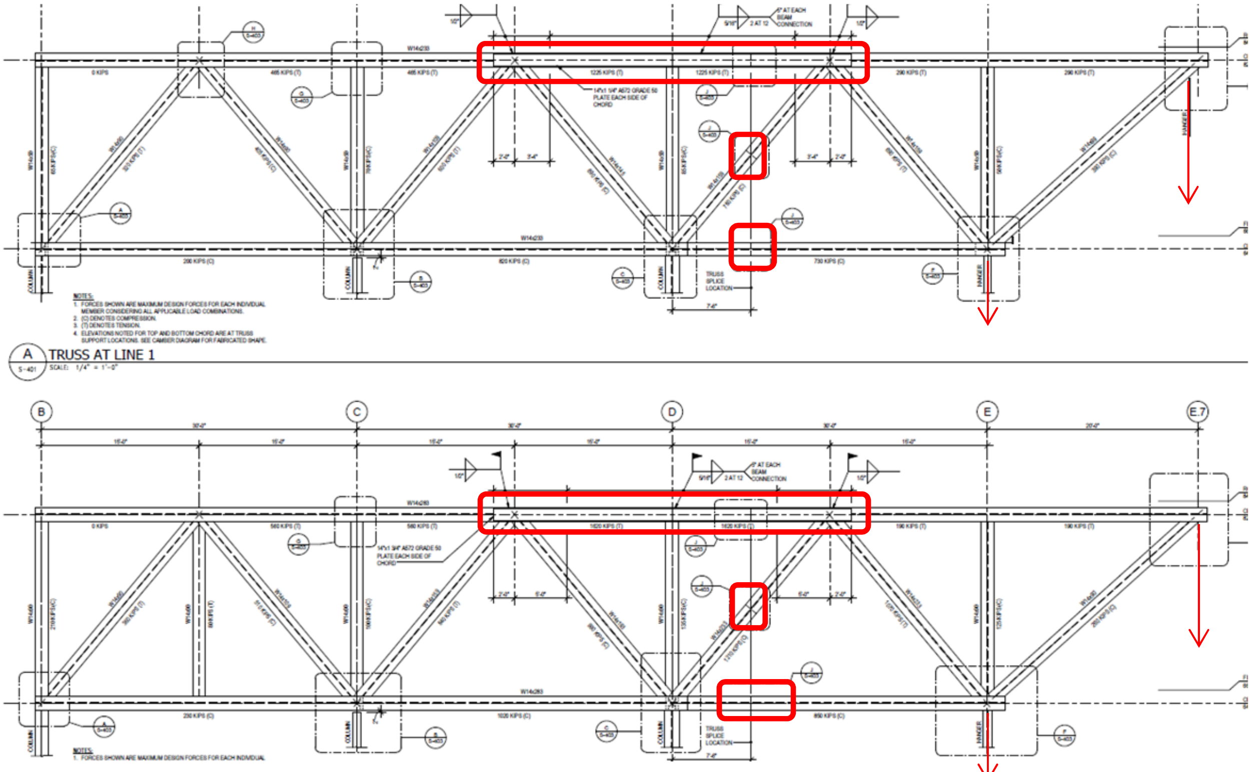


Figure 12 **Roof Truss Splices and Loading (From Construction Documents Provided by MBP)**

BIM Use Evaluation

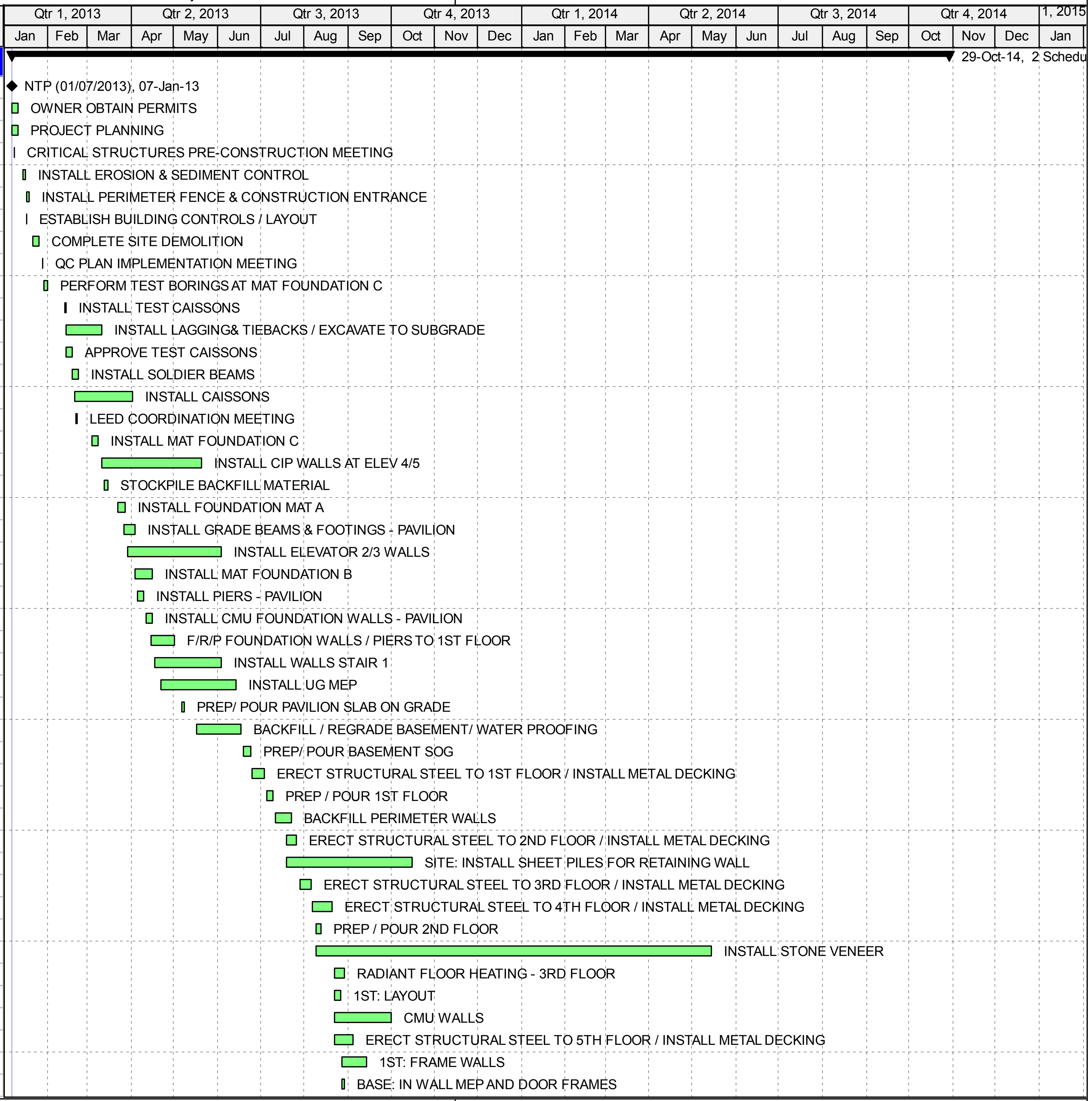
In Appendix G the BIM Use Analysis and BIM Execution Planning Process is provided for your connivance. These were derived from templates located on Penn State's BIM reference website (http://bim.psu.edu/).

BIM coordination should be conducted by one entity or one person, the BIM Champion. It is understood that this person would be the construction manager's BIM Coordinator. The BIM Coordinator is already experienced in the BIM process and has the tools and knowledge to implement a BIM execution plan. Also, the BIM Coordinator would be able and is willing to train other parties on the project how to use and implement BIM. In this case if BIM was to be used, then the construction manager would have needed to be brought on board earlier than previously planned.

In evaluating the types of BIM usage that could be used on this project, the end result was first considered, which is the whys BIM would be used by the facility managers. Because it is unclear whether this would or could be used by the owner, this usage is still a possibility, but is not the primary function of using BIM. It was determined that cost estimation would benefit greatly on the project through the use of BIM because both the contractor, construction manager, and the subcontractors all could pull quantities from the BIM model. Keeping this in mind, it would be important to use a level of detail in the model that would allow such parties to pull accurate quantities from the model. 3D and 4D modeling would benefit the contractor greatly in pre-coordinating work and the construction sequence because they would have been able to solve some of their coordination issues months in advance and possibly be on schedule as of today. One of the most invaluable ways BIM would have affected this project is through the early use of BIM into the planning and design phases to more effectively communicate to the public during the multiple “Charrette” design meetings.

Appendix A- Detailed Project Schedule

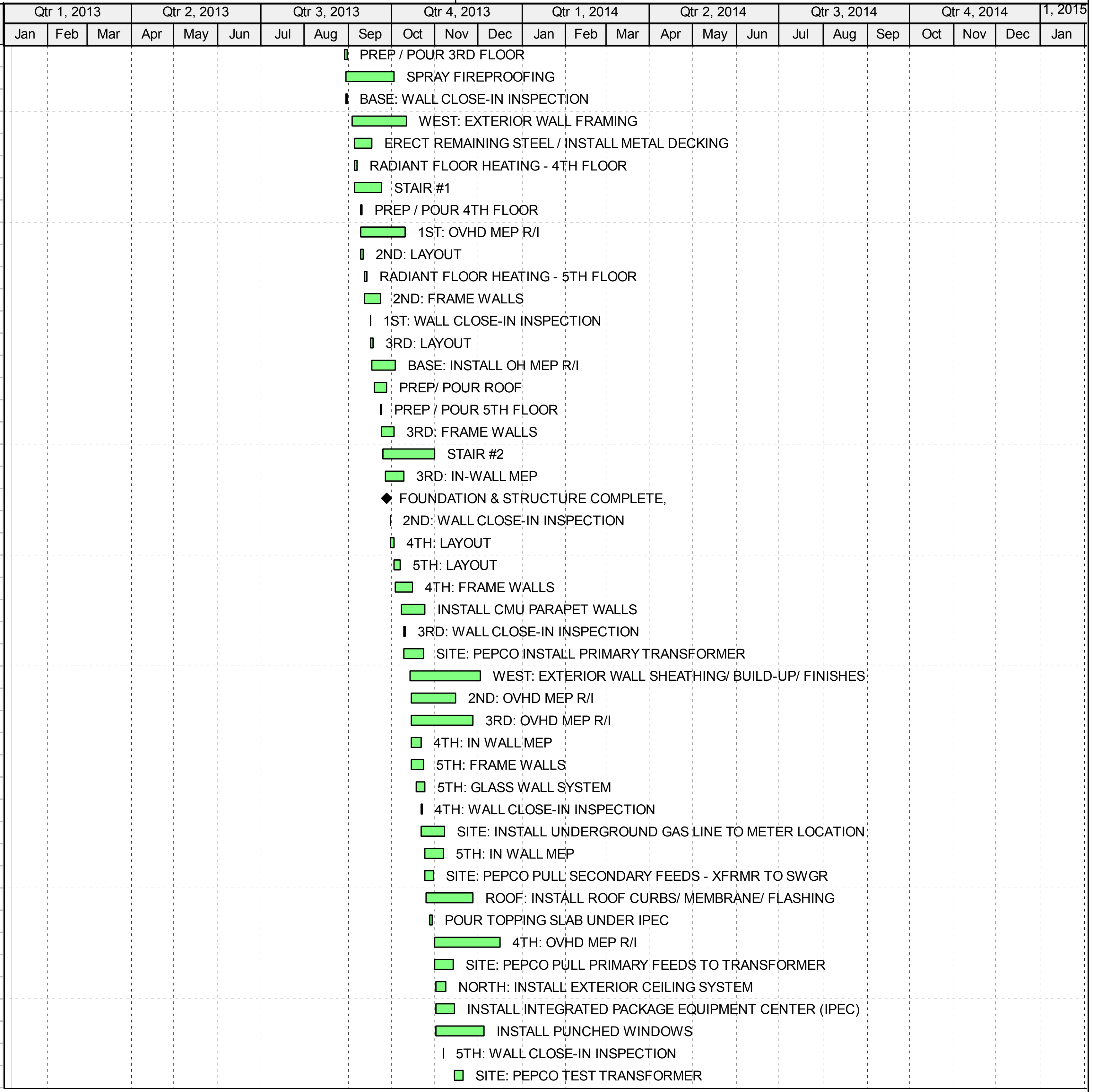
#	Activity ID	Activity Name	Original Duration	Start	Finish
1	**2 Schedule**	**Library In Metropolitan Washington, D.C.**	473	07-Jan-13	29-Oct-14
2	1	NTP (01/07/2013)	0	07-Jan-1	
3	5	OWNER OBTAIN PERMITS	5	07-Jan-1	11-Jan-13
4	340	PROJECT PLANNING	5	07-Jan-1	11-Jan-13
5	10	CRITICAL STRUCTURES PRE-CONSTRUCTION MEETING	1	08-Jan-1	08-Jan-13
6	2910	INSTALL EROSION & SEDIMENT CONTROL	3	14-Jan-1	16-Jan-13
7	2920	INSTALL PERIMETER FENCE & CONSTRUCTION ENTRANC	2	17-Jan-1	18-Jan-13
8	2930	ESTABLISH BUILDING CONTROLS / LAYOUT	1	17-Jan-1	17-Jan-13
9	2940	COMPLETE SITE DEMOLITION	5	21-Jan-1	25-Jan-13
10	20	QC PLAN IMPLEMENTATION MEETING	1	28-Jan-1	28-Jan-13
11	3080	PERFORM TEST BORINGS AT MAT FOUNDATION C	2	29-Jan-1	31-Jan-13
12	3075	INSTALL TEST CAISSONS	1	13-Feb-	13-Feb-13
13	3030	INSTALL LAGGING& TIEBACKS / EXCAVATE TO SUBGRADE	13	14-Feb-	11-Mar-13
14	3085	APPROVE TEST CAISSONS	3	14-Feb-	18-Feb-13
15	3020	INSTALL SOLDIER BEAMS	3	18-Feb-	22-Feb-13
16	3110	INSTALL CAISSONS	21	20-Feb-	01-Apr-13
17	30	LEED COORDINATION MEETING	1	21-Feb-	21-Feb-13
18	3140	INSTALL MAT FOUNDATION C	4	04-Mar-	08-Mar-13
19	3460	INSTALL CIP WALLS AT ELEV 4/5	35	11-Mar-	20-May-13
20	3070	STOCKPILE BACKFILL MATERIAL	2	13-Mar-	15-Mar-13
21	3230	INSTALL FOUNDATION MAT A	3	22-Mar-	27-Mar-13
22	3490	INSTALL GRADE BEAMS & FOOTINGS - PAVILION	4	27-Mar-	03-Apr-13
23	3260	INSTALL ELEVATOR 2/3 WALLS	32	29-Mar-	03-Jun-13
24	3160	INSTALL MAT FOUNDATION B	7	03-Apr-13	15-Apr-13
25	3485	INSTALL PIERS - PAVILION	3	05-Apr-13	09-Apr-13
26	3495	INSTALL CMU FOUNDATION WALLS - PAVILION	3	11-Apr-13	15-Apr-13
27	3190	F/R/P FOUNDATION WALLS / PIERS TO 1ST FLOOR	9	15-Apr-13	01-May-13
28	3170	INSTALL WALLS STAIR 1	23	17-Apr-13	03-Jun-13
29	3510	INSTALL UG MEP	26	22-Apr-13	13-Jun-13
30	3530	PREP/ POUR PAVILION SLAB ON GRADE	2	06-May-	08-May-13
31	3300	BACKFILL / REGRADE BASEMENT/ WATER PROOFING	15	17-May-	17-Jun-13
32	3330	PREP/ POUR BASEMENT SOG	3	19-Jun-1	24-Jun-13
33	3600	ERECT STRUCTURAL STEEL TO 1ST FLOOR / INSTALL ME	6	25-Jun-1	03-Jul-13
34	3610	PREP / POUR 1ST FLOOR	3	05-Jul-13	09-Jul-13
35	3620	BACKFILL PERIMETER WALLS	7	11-Jul-13	22-Jul-13
36	3925	ERECT STRUCTURAL STEEL TO 2ND FLOOR / INSTALL ME	5	19-Jul-13	26-Jul-13
37	4700	SITE: INSTALL SHEET PILES FOR RETAINING WALL	50	19-Jul-13	15-Oct-13
38	3630	ERECT STRUCTURAL STEEL TO 3RD FLOOR / INSTALL ME	5	29-Jul-13	05-Aug-13
39	3640	ERECT STRUCTURAL STEEL TO 4TH FLOOR / INSTALL ME	8	06-Aug-	20-Aug-13
40	3660	PREP / POUR 2ND FLOOR	2	09-Aug-	12-Aug-13
41	SF160	INSTALL STONE VENEER	146	09-Aug-	14-May-14
42	3670	RADIANT FLOOR HEATING - 3RD FLOOR	5	22-Aug-	29-Aug-13
43	1F1010	1ST: LAYOUT	3	22-Aug-	26-Aug-13
44	1F1020	CMU WALLS	28	22-Aug-	01-Oct-13
45	3645	ERECT STRUCTURAL STEEL TO 5TH FLOOR / INSTALL ME	8	22-Aug-	04-Sep-13
46	1F1030	1ST: FRAME WALLS	13	27-Aug-	13-Sep-13
47	B1050	BASE: IN WALL MEP AND DOOR FRAMES	3	27-Aug-	29-Aug-13



▬ Actual Level of Effort
🟦 Actual Work
🟩 Remaining Work
🟩 Critical Remaining Work
◆ ◆ Milestone
▬ summary

TASK filter: All Activities

#	Activity ID	Activity Name	Original Duration	Start	Finish
48	3680	PREP / POUR 3RD FLOOR	2	29-Aug-	30-Aug-13
49	4810	SPRAY FIREPROOFING	23	30-Aug-	02-Oct-13
50	B1070	BASE: WALL CLOSE-IN INSPECTION	1	30-Aug-	30-Aug-13
51	W0310	WEST: EXTERIOR WALL FRAMING	24	03-Sep-	11-Oct-13
52	3650	ERECT REMAINING STEEL / INSTALL METAL DECKING	8	05-Sep-	17-Sep-13
53	3690	RADIANT FLOOR HEATING - 4TH FLOOR	2	05-Sep-	06-Sep-13
54	ST100	STAIR #1	14	05-Sep-	24-Sep-13
55	3700	PREP / POUR 4TH FLOOR	2	09-Sep-	10-Sep-13
56	1F1090	1ST: OVHD MEP R/I	24	09-Sep-	10-Oct-13
57	2F1010	2ND: LAYOUT	3	09-Sep-	11-Sep-13
58	3710	RADIANT FLOOR HEATING - 5TH FLOOR	2	12-Sep-	13-Sep-13
59	2F1035	2ND: FRAME WALLS	8	12-Sep-	23-Sep-13
60	1F1070	1ST: WALL CLOSE-IN INSPECTION	1	16-Sep-	16-Sep-13
61	3F1010	3RD: LAYOUT	3	16-Sep-	18-Sep-13
62	B1390	BASE: INSTALL OH MEP R/I	13	17-Sep-	03-Oct-13
63	3750	PREP/ POUR ROOF	6	19-Sep-	27-Sep-13
64	3720	PREP / POUR 5TH FLOOR	2	23-Sep-	24-Sep-13
65	3F1030	3RD: FRAME WALLS	7	24-Sep-	02-Oct-13
66	ST200	STAIR #2	27	25-Sep-	31-Oct-13
67	3F1045	3RD: IN-WALL MEP	9	27-Sep-	09-Oct-13
68	STRUCT	FOUNDATION & STRUCTURE COMPLETE	0		27-Sep-13
69	2F1070	2ND: WALL CLOSE-IN INSPECTION	1	30-Sep-	30-Sep-13
70	4F1010	4TH: LAYOUT	3	30-Sep-	02-Oct-13
71	5F1010	5TH: LAYOUT	3	03-Oct-13	07-Oct-13
72	4F1030	4TH: FRAME WALLS	8	04-Oct-13	15-Oct-13
73	4010	INSTALL CMU PARAPET WALLS	10	08-Oct-13	24-Oct-13
74	3F1070	3RD: WALL CLOSE-IN INSPECTION	1	10-Oct-13	10-Oct-13
75	4610	SITE: PEPCO INSTALL PRIMARY TRANSFORMER	10	10-Oct-13	23-Oct-13
76	W1010	WEST: EXTERIOR WALL SHEATHING/ BUILD-UP/ FINISHES	28	14-Oct-13	02-Dec-13
77	2F1120	2ND: OVHD MEP R/I	24	15-Oct-13	15-Nov-13
78	3F1090	3RD: OVHD MEP R/I	32	15-Oct-13	27-Nov-13
79	4F1050	4TH: IN WALL MEP	5	15-Oct-13	21-Oct-13
80	5F1030	5TH: FRAME WALLS	7	15-Oct-13	23-Oct-13
81	5F1035	5TH: GLASS WALL SYSTEM	5	18-Oct-13	24-Oct-13
82	4F1070	4TH: WALL CLOSE-IN INSPECTION	1	22-Oct-13	22-Oct-13
83	4400	SITE: INSTALL UNDERGROUND GAS LINE TO METER LOCA	10	22-Oct-13	07-Nov-13
84	5F1050	5TH: IN WALL MEP	10	24-Oct-13	06-Nov-13
85	4620	SITE: PEPCO PULL SECONDARY FEEDS - XFRMR TO SWG	5	24-Oct-13	30-Oct-13
86	4050	ROOF: INSTALL ROOF CURBS/ MEMBRANE/ FLASHING	19	25-Oct-13	27-Nov-13
87	4030	POUR TOPPING SLAB UNDER IPEC	2	28-Oct-13	29-Oct-13
88	4F1090	4TH: OVHD MEP R/I	32	31-Oct-13	16-Dec-13
89	4630	SITE: PEPCO PULL PRIMARY FEEDS TO TRANSFORMER	10	31-Oct-13	13-Nov-13
90	N1110	NORTH: INSTALL EXTERIOR CEILING SYSTEM	5	01-Nov-	08-Nov-13
91	4120	INSTALL INTEGRATED PACKAGE EQUIPMENT CENTER (IPI	10	01-Nov-	14-Nov-13
92	W1040	INSTALL PUNCHED WINDOWS	19	01-Nov-	05-Dec-13
93	5F1070	5TH: WALL CLOSE-IN INSPECTION	1	06-Nov-	06-Nov-13
94	4640	SITE: PEPCO TEST TRANSFORMER	5	14-Nov-	20-Nov-13



▬ Actual Level of Effort
▬ Actual Work
🟩 Remaining Work
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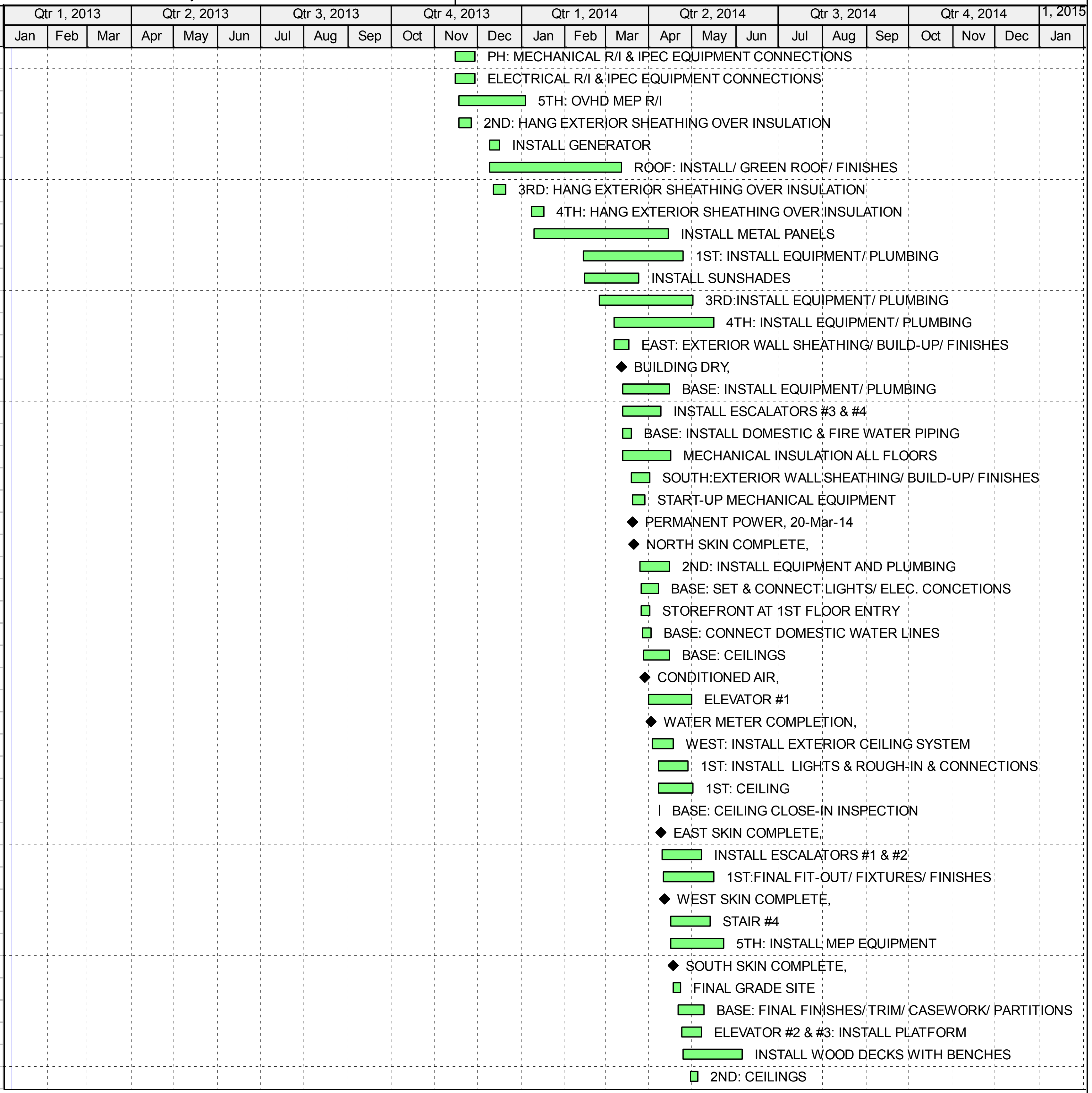
◆ ◆ Milestone
▬ summary

TASK filter: All Activities

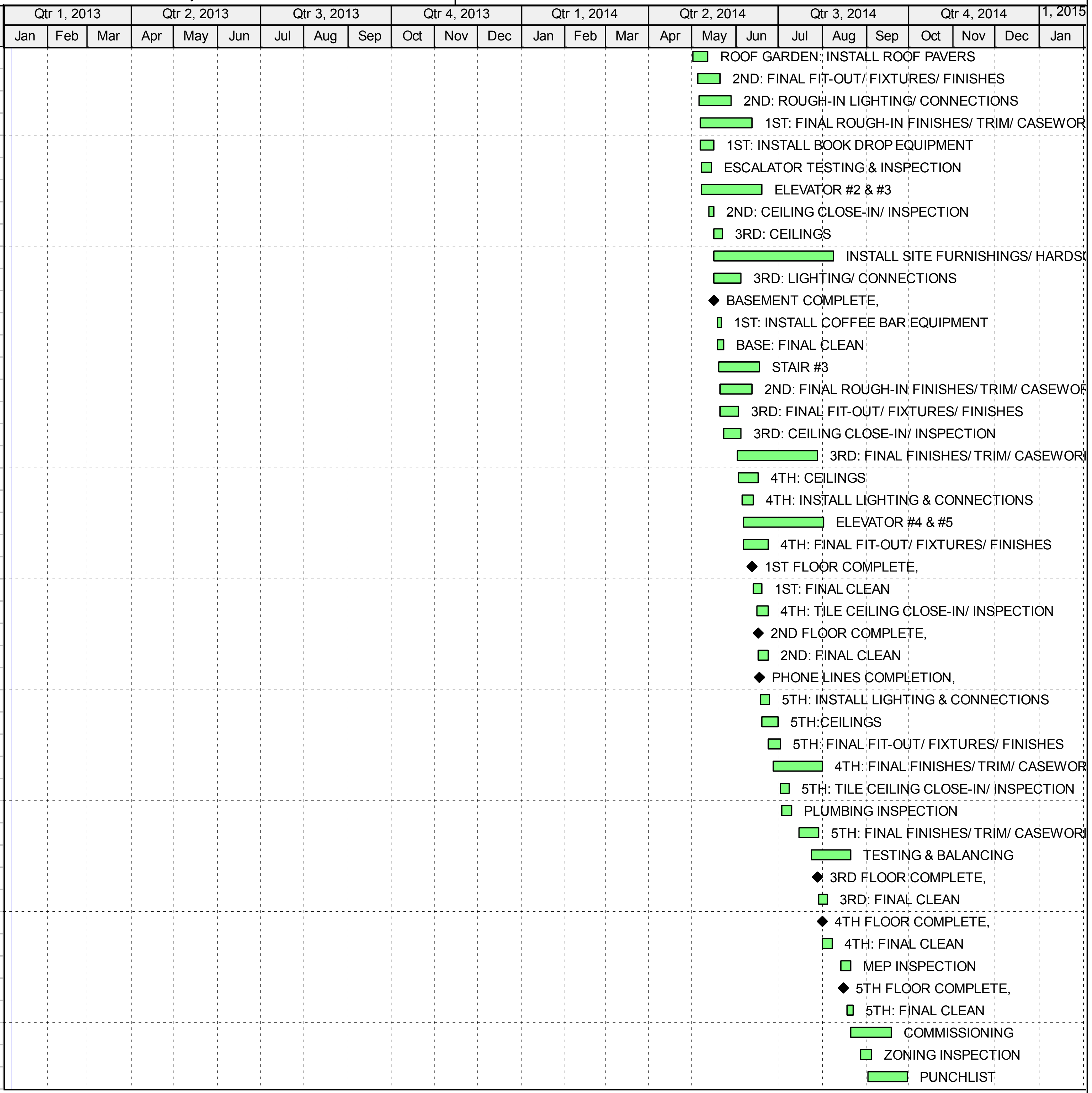
#	Activity ID	Activity Name	Original Duration	Start	Finish
95	4150	PH: MECHANICAL R/I & IPEC EQUIPMENT CONNECTIONS	10	15-Nov-	29-Nov-13
96	4140	ELECTRICAL R/I & IPEC EQUIPMENT CONNECTIONS	10	15-Nov-	29-Nov-13
97	5F1090	5TH: OVHD MEP R/I	32	18-Nov-	03-Jan-14
98	2F0930	2ND: HANG EXTERIOR SHEATHING OVER INSULATION	7	18-Nov-	26-Nov-13
99	4160	INSTALL GENERATOR	5	09-Dec-	16-Dec-13
100	4170	ROOF: INSTALL/ GREEN ROOF/ FINISHES	48	09-Dec-	12-Mar-14
101	3F0930	3RD: HANG EXTERIOR SHEATHING OVER INSULATION	7	12-Dec-	20-Dec-13
102	4F0930	4TH: HANG EXTERIOR SHEATHING OVER INSULATION	7	08-Jan-1	16-Jan-14
103	S1060	INSTALL METAL PANELS	47	10-Jan-1	14-Apr-14
104	1F1510	1ST: INSTALL EQUIPMENT/ PLUMBING	51	13-Feb-	24-Apr-14
105	S1010	INSTALL SUNSHADES	20	14-Feb-	24-Mar-14
106	3F1510	3RD:INSTALL EQUIPMENT/ PLUMBING	48	25-Feb-	01-May-14
107	4F1510	4TH: INSTALL EQUIPMENT/ PLUMBING	51	07-Mar-	16-May-14
108	E1090	EAST: EXTERIOR WALL SHEATHING/ BUILD-UP/ FINISHES	5	07-Mar-	17-Mar-14
109	DRY	BUILDING DRY	0		12-Mar-14
110	B1085	BASE: INSTALL EQUIPMENT/ PLUMBING	24	13-Mar-	15-Apr-14
111	ESC300	INSTALL ESCALATORS #3 & #4	20	13-Mar-	09-Apr-14
112	B1310	BASE: INSTALL DOMESTIC & FIRE WATER PIPING	5	13-Mar-	19-Mar-14
113	1F1135	MECHANICAL INSULATION ALL FLOORS	25	13-Mar-	16-Apr-14
114	S1100	SOUTH:EXTERIOR WALL SHEATHING/ BUILD-UP/ FINISHE	10	19-Mar-	01-Apr-14
115	4210	START-UP MECHANICAL EQUIPMENT	5	20-Mar-	28-Mar-14
116	POWER	PERMANENT POWER	0	20-Mar-	
117	NORTH SKIN	NORTH SKIN COMPLETE	0		21-Mar-14
118	2F1450	2ND: INSTALL EQUIPMENT AND PLUMBING	16	25-Mar-	15-Apr-14
119	B1155	BASE: SET & CONNECT LIGHTS/ ELEC. CONCETIONS	9	26-Mar-	07-Apr-14
120	W1170	STOREFRONT AT 1ST FLOOR ENTRY	4	26-Mar-	01-Apr-14
121	B1330	BASE: CONNECT DOMESTIC WATER LINES	5	27-Mar-	02-Apr-14
122	B1150	BASE: CEILINGS	13	28-Mar-	15-Apr-14
123	AIR	CONDITIONED AIR	0		28-Mar-14
124	EL110	ELEVATOR #1	23	31-Mar-	30-Apr-14
125	METER	WATER METER COMPLETION	0		02-Apr-14
126	W1180	WEST: INSTALL EXTERIOR CEILING SYSTEM	8	03-Apr-14	17-Apr-14
127	1F1380	1ST: INSTALL LIGHTS & ROUGH-IN & CONNECTIONS	16	07-Apr-14	28-Apr-14
128	1F1280	1ST: CEILING	19	07-Apr-14	01-May-14
129	B1160	BASE: CEILING CLOSE-IN INSPECTION	1	08-Apr-14	08-Apr-14
130	EAST SKIN	EAST SKIN COMPLETE	0		09-Apr-14
131	ESC100	INSTALL ESCALATORS #1 & #2	20	10-Apr-14	07-May-14
132	1F1305	1ST:FINAL FIT-OUT/ FIXTURES/ FINISHES	26	11-Apr-14	16-May-14
133	WEST SKIN	WEST SKIN COMPLETE	0		11-Apr-14
134	ST400	STAIR #4	20	16-Apr-14	13-May-14
135	5F1390	5TH: INSTALL MEP EQUIPMENT	28	16-Apr-14	23-May-14
136	SOUTH SKIN	SOUTH SKIN COMPLETE	0		17-Apr-14
137	SF180	FINAL GRADE SITE	3	18-Apr-14	23-Apr-14
138	B1200	BASE: FINAL FINISHES/ TRIM/ CASEWORK/ PARTITIONS	15	21-Apr-14	09-May-14
139	EL200	ELEVATOR #2 & #3: INSTALL PLATFORM	10	24-Apr-14	07-May-14
140	SF190	INSTALL WOOD DECKS WITH BENCHES	20	25-Apr-14	05-Jun-14
141	2F1150	2ND: CEILINGS	4	30-Apr-14	05-May-14



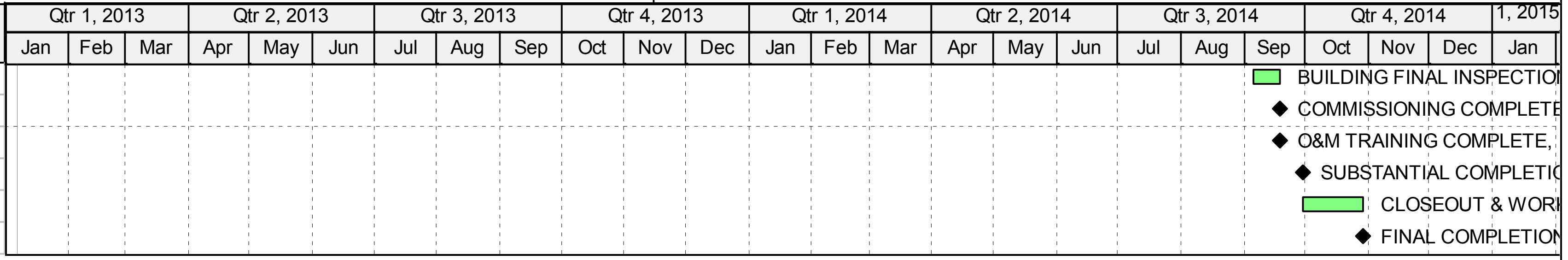
▬ Actual Level of Effort
▬ Actual Work
🟩 Remaining Work
🟩 Critical Remaining Work
◆ ◆ Milestone
▬ summary

TASK filter: All Activities

#	Activity ID	Activity Name	Original Duration	Start	Finish
142	4360	ROOF GARDEN: INSTALL ROOF PAVERS	5	02-May-	12-May-14
143	2F1270	2ND: FINAL FIT-OUT/ FIXTURES/ FINISHES	12	05-May-	20-May-14
144	2F1165	2ND: ROUGH-IN LIGHTING/ CONNECTIONS	16	06-May-	28-May-14
145	1F1180	1ST: FINAL ROUGH-IN FINISHES/ TRIM/ CASEWORK/ PART	26	07-May-	12-Jun-14
146	1F1500	1ST: INSTALL BOOK DROP EQUIPMENT	8	07-May-	16-May-14
147	9010	ESCALATOR TESTING & INSPECTION	5	08-May-	14-May-14
148	EL210	ELEVATOR #2 & #3	30	08-May-	19-Jun-14
149	2F1160	2ND: CEILING CLOSE-IN/ INSPECTION	4	13-May-	16-May-14
150	3F1150	3RD: CEILINGS	5	16-May-	22-May-14
151	SF210	INSTALL SITE FURNISHINGS/ HARDSCAPES/ SITE LIGHTIN	45	16-May-	08-Aug-14
152	3F1530	3RD: LIGHTING/ CONNECTIONS	13	16-May-	04-Jun-14
153	BASEMENT	BASEMENT COMPLETE	0		16-May-14
154	1F1195	1ST: INSTALL COFFEE BAR EQUIPMENT	3	19-May-	21-May-14
155	B1560	BASE: FINAL CLEAN	5	19-May-	23-May-14
156	ST300	STAIR #3	20	20-May-	17-Jun-14
157	2F1185	2ND: FINAL ROUGH-IN FINISHES/ TRIM/ CASEWORK/ PART	16	21-May-	12-Jun-14
158	3F1270	3RD: FINAL FIT-OUT/ FIXTURES/ FINISHES	8	21-May-	02-Jun-14
159	3F1160	3RD: CEILING CLOSE-IN/ INSPECTION	8	23-May-	04-Jun-14
160	3F1165	3RD: FINAL FINISHES/ TRIM/ CASEWORK/ PARTITIONS	40	02-Jun-1	28-Jul-14
161	4F1150	4TH: CEILINGS	10	03-Jun-1	16-Jun-14
162	4F1380	4TH: INSTALL LIGHTING & CONNECTIONS	7	05-Jun-1	13-Jun-14
163	EL400	ELEVATOR #4 & #5	40	06-Jun-1	01-Aug-14
164	4F1270	4TH: FINAL FIT-OUT/ FIXTURES/ FINISHES	12	06-Jun-1	23-Jun-14
165	1ST	1ST FLOOR COMPLETE	0		12-Jun-14
166	1F1650	1ST: FINAL CLEAN	5	13-Jun-1	19-Jun-14
167	4F1300	4TH: TILE CEILING CLOSE-IN/ INSPECTION	6	16-Jun-1	23-Jun-14
168	2ND	2ND FLOOR COMPLETE	0		16-Jun-14
169	2F1550	2ND: FINAL CLEAN	5	17-Jun-1	23-Jun-14
170	PHONE	PHONE LINES COMPLETION	0		17-Jun-14
171	5F1380	5TH: INSTALL LIGHTING & CONNECTIONS	5	18-Jun-1	24-Jun-14
172	5F1150	5TH:CEILINGS	8	19-Jun-1	30-Jun-14
173	5F1270	5TH: FINAL FIT-OUT/ FIXTURES/ FINISHES	7	24-Jun-1	02-Jul-14
174	4F1185	4TH: FINAL FINISHES/ TRIM/ CASEWORK/ PARTITIONS	24	27-Jun-1	31-Jul-14
175	5F1300	5TH: TILE CEILING CLOSE-IN/ INSPECTION	4	02-Jul-14	08-Jul-14
176	9020	PLUMBING INSPECTION	5	03-Jul-14	10-Jul-14
177	5F1185	5TH: FINAL FINISHES/ TRIM/ CASEWORK/ PARTITIONS	11	15-Jul-14	29-Jul-14
178	TAB	TESTING & BALANCING	20	24-Jul-14	20-Aug-14
179	3RD	3RD FLOOR COMPLETE	0		28-Jul-14
180	3F1550	3RD: FINAL CLEAN	5	29-Jul-14	04-Aug-14
181	4TH	4TH FLOOR COMPLETE	0		31-Jul-14
182	4F1550	4TH: FINAL CLEAN	5	01-Aug-	07-Aug-14
183	9030	MEP INSPECTION	5	14-Aug-	20-Aug-14
184	5TH	5TH FLOOR COMPLETE	0		15-Aug-14
185	5F1550	5TH: FINAL CLEAN	5	18-Aug-	22-Aug-14
186	CX	COMMISSIONING	20	21-Aug-	18-Sep-14
187	9090	ZONING INSPECTION	5	28-Aug-	04-Sep-14
188	9510	PUNCHLIST	20	02-Sep-	29-Sep-14



#	Activity ID	Activity Name	Original Duration	Start	Finish
189	9099	BUILDING FINAL INSPECTIONS	10	05-Sep-	18-Sep-14
190	COMM	COMMISSIONING COMPLETE	0		18-Sep-14
191	O&M	O&M TRAINING COMPLETE	0		18-Sep-14
192	9999	SUBSTANTIAL COMPLETION (09/29/2014)	0		29-Sep-1
193	99998	CLOSEOUT & WORK TO COMPLETE/ MOVE-IN	30	30-Sep-	29-Oct-14
194	99999	FINAL COMPLETION/ OPENNING DAY	0		29-Oct-14



Actual Level of Effort
Actual Work
🟩 Remaining Work
🟩 Critical Remaining Work
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summary

TASK filter: All Activities

Appendix B- Detailed Structural System Estimate

Detailed Structural Estimate Summary

Item	Material $	Labor $	Equipment $	Total $
Composite Decking	$175,515.70	$40,307.50	$3,201.20	**$219,024.40**
Metal Roof Decking	$15,927.10	$3,174.50	$234.50	**$19,336.10**
WWF	$16,262.39	$20,127.02	$0.00	**$36,389.42**
Concrete Slabs	$396,250.74	$200,722.90	$21,616.31	**$618,589.94**
Mat Slabs	$143,215.04	$50,998.99	$404.86	**$194,618.89**
Concrete Column & Encasement	$28,388.25	$21,489.68	$2,070.92	**$51,948.85**
Wall Footings	$201,696.09	$175,944.26	$11,959.47	**$389,599.82**
Shear Walls	$260,459.35	$229,702.62	$22,257.95	**$512,419.92**
Grade Beams	$31,637.64	$42,581.89	$4,120.56	**$78,340.09**
Concrete Beams	$4,249.14	$5,717.80	$553.30	**$10,520.24**
Caissons	$249,907.85	$77,352.10	$892.52	**$328,152.48**
Reinforcing Steel	$416,364.31	$196,337.64	$0.00	**$612,701.95**
Structural Steel Beams	$1,324,386.93	$142,108.34	$52,251.76	**$1,518,747.03**
Structural Steel Trusses & Column	$736,048.68	$13,657.59	$7,389.59	**$757,095.86**
Allowances	$212,977.58	$0.00	$0.00	**$212,977.58**
Subtotal	$4,213,286.79	$1,220,222.82	$126,952.95	**$5,560,462.56**
Tax (6%)	$337,062.94	$0.00	$0.00	**$337,062.94**
Overhead & Profit (10%)	$421,328.68	$122,022.28	$12,695.30	**$556,046.26**
Grand Total	$4,971,678.41	$1,342,245.10	$139,648.25	**$6,453,571.76**

Code	Description	Quantity	Unit	Mat./Unit (1.05 W.F.)	Mat. Tot.	Lab./ Unit	Lab. Tot.	Equip./ Unit	Equip. Tot.	Total $
Composite Decking										
053113505300	2'' 20 GA.	70280	SF	$2.12	$148,994.65	$0.50	$35,140.00	$0.04	$2,811.20	$186,945.85
053113505400	2'' 18 GA.	9750	SF	$2.72	$26,521.05	$0.53	$5,167.50	$0.04	$390.00	$32,078.55
Metal Roof Decking										
053123502650	1.5'' 20 GA.	5150	SF	$1.90	$9,786.05	$0.43	$2,214.50	$0.03	$154.50	$12,155.05
053123502900	2'' 18 GA.	2000	SF	$3.07	$6,141.05	$0.48	$960.00	$0.04	$80.00	$7,181.05
WWF										
032205500200	6''x6'', WWF	849.6	CSF	$19.14	$16,262.39	$23.69	$20,127.02	$0.00	$0.00	$36,389.42
Concrete Slabs										
033053401950	Elevated, 3000 psi	1103	CY	$328.57	$362,249.48	$165.43	$182,386.58	$15.41	$16,989.53	$561,625.58
033053401950	Slab, 4000 psi	16	CY	$329.57	$5,158.21	$166.43	$2,604.32	$16.41	$256.79	$8,019.32
330534074820	On Grade, 5000 psi	8740	SF	$3.30	$28,843.05	$1.80	$15,732.00	$0.50	$4,370.00	$48,945.05
Mat Slabs										
033053404050	5000 psi	664	CY	$215.78	$143,215.04	$76.84	$50,998.99	$0.61	$404.86	$194,618.89
Concrete Column & Encasement										
033053401020	4000 psi	62	CY	$459.75	$28,388.25	$348.04	$21,489.68	$33.54	$2,070.92	$51,948.85
Wall Footings										
Blended	5000 psi	583	CY	$345.73	$201,696.09	$301.59	$175,944.26	$20.50	$11,959.47	$389,599.82
Shear Walls										
033053404500	5000 psi	1389	CY	$187.58	$260,459.35	$165.43	$229,702.62	$16.03	$22,257.95	$512,419.92
Grade Beams										
033053400300	5000 psi	82	CY	$386.19	$31,637.64	$519.80	$42,581.89	$50.30	$4,120.56	$78,340.09
Concrete Beams										
033053400300	4000 psi	11	CY	$386.19	$4,249.14	$519.80	$5,717.80	$50.30	$553.30	$10,520.24
Caissons										
033053405950	5000 psi	1,190	CY	$210.00	$249,907.85	$65.00	$77,352.10	$0.75	$892.52	$328,152.48

Code	Description	Quantity	Unit	Mat./Unit (1.05 W.F.)	Mat. Tot.	Lab./ Unit	Lab. Tot.	Equip./ Unit	Equip. Tot.	Total $
Reinforcing Steel										
Blended	#4	40.2	ton	$1,902.68	$76,571.11	$950.00	$38,231.63	$0.00	$0.00	$114,802.74
Blended	#5	49.8	ton	$1,902.68	$94,737.26	$950.00	$47,301.91	$0.00	$0.00	$142,039.17
Blended	#6	44.6	ton	$1,902.68	$84,858.84	$950.00	$42,369.66	$0.00	$0.00	$127,228.49
Blended	#7	7.2	ton	$1,902.68	$13,674.48	$950.00	$6,827.61	$0.00	$0.00	$20,502.10
Blended	#8	1.3	ton	$1,902.68	$2,392.75	$800.00	$1,006.06	$0.00	$0.00	$3,398.81
Blended	#9	7.9	ton	$1,902.68	$15,113.20	$800.00	$6,354.49	$0.00	$0.00	$21,467.70
Blended	#10	37.5	ton	$1,902.68	$71,310.79	$800.00	$29,983.30	$0.00	$0.00	$101,294.10
Blended	#11	30.3	ton	$1,902.68	$57,705.87	$800.00	$24,262.98	$0.00	$0.00	$81,968.85
Structural Steel Beams										
053113682000	Shear Studs 3/4" Diam. X 4"	29509	ea.	$2.20	$64,918.70	$2.25	$66,394.13	$0.50	$14,754.25	$146,067.08
051223750350	S8x18	112	LF	$31.35	$3,511.20	$4.94	$553.28	$2.66	$297.92	$4,362.40
051223175550	HSS6x10x3/8"	544	LF	$31.67	$17,228.48	$5.83	$3,171.52	$3.33	$1,811.52	$22,211.52
051223175600	HSS8x12x3/8"	41	LF	$57.14	$2,342.86	$5.83	$239.17	$3.33	$136.53	$2,718.55
051223175650	HSS10x4x3/8"	90	LF	$107.14	$9,642.86	$5.83	$525.00	$3.33	$299.70	$10,467.56
051223175650	HSS10x6x3/8"	94	LF	$107.14	$10,071.43	$5.83	$548.33	$3.33	$313.02	$10,932.78
051223175650	HSS10x8x3/8"	28	LF	$107.14	$3,000.00	$5.83	$163.33	$3.33	$93.24	$3,256.57
051223175650	HSS18x6x3/8"	258	LF	$125.00	$32,250.00	$6.00	$1,548.00	$3.50	$903.00	$34,701.00
051223175650	HSS20x8x3/8"	318	LF	$150.00	$47,700.00	$6.00	$1,908.00	$3.50	$1,113.00	$50,721.00
051223750620	W10x15	1975	LF	$22.47	$44,367.02	$4.94	$9,754.03	$2.66	$5,252.17	$59,373.22
051223750700	W10x22	136	LF	$32.92	$4,477.12	$4.94	$671.84	$2.66	$361.76	$5,510.72
051223751100	W12x16	962	LF	$24.04	$23,126.48	$3.36	$3,232.32	$1.81	$1,741.22	$28,100.02
051223751900	W14x22	1262	LF	$38.67	$48,782.21	$2.99	$3,771.89	$1.61	$2,031.02	$54,585.11
051223752100	W14x30	88	LF	$44.94	$3,954.72	$3.29	$289.52	$1.77	$155.76	$4,400.00
051223752700	W16x26	2522	LF	$38.67	$97,506.41	$2.96	$7,463.64	$1.59	$4,009.19	$108,979.23
051223753100	W16x40	630	LF	$59.57	$37,529.10	$3.70	$2,331.00	$2.00	$1,260.00	$41,120.10
051223751100	W18x13	102	LF	$24.04	$2,452.08	$3.36	$342.72	$1.81	$184.62	$2,979.42
051223753500	W18x40	516	LF	$59.57	$30,738.12	$4.45	$2,296.20	$1.82	$939.12	$33,973.44
051223751100	W21x16	102	LF	$24.04	$81,026.82	$3.36	$11,324.88	$1.81	$6,100.61	$98,452.31

051223754100	W21x44	3371	LF	$65.84	$160,485.00	$4.02	$9,798.75	$1.65	$4,021.88	$174,305.63
051223754900	W24x55	2438	LF	$82.03	$27,480.05	$3.85	$1,289.75	$1.57	$525.95	$29,295.75
051223754900	W24x62	335	LF	$92.48	$30,980.80	$3.85	$1,289.75	$1.57	$525.95	$32,796.50
051223755500	W24x76	502	LF	$113.91	$57,182.82	$3.85	$1,932.70	$1.57	$788.14	$59,903.66
051223755700	W27x84	1281	LF	$125.40	$160,637.40	$3.96	$5,072.76	$1.62	$2,075.22	$167,785.38
051223755780	W27x146	191	LF	$218.41	$41,716.31	$4.07	$777.37	$1.67	$318.97	$42,812.65
512237556100	W30x99	330	LF	$148.39	$48,968.70	$3.56	$1,174.80	$1.46	$481.80	$50,625.30
512237556300	W30x108	30	LF	$160.93	$4,827.90	$3.56	$106.80	$1.46	$43.80	$4,978.50
512237556700	W33x118	583	LF	$176.61	$102,963.63	$3.63	$2,116.29	$1.49	$868.67	$105,948.59
512237557300	W36x135	270	LF	$201.69	$54,355.46	$3.65	$983.68	$1.50	$404.25	$55,743.38
512237557500	W40x149	146	LF	$224.68	$32,803.28	$3.65	$532.90	$1.50	$219.00	$33,555.18
Blended	W40x183	94	LF	$280.00	$26,320.00	$4.00	$376.00	$1.75	$164.50	$26,860.50
Blended	W40x215	32	LF	$345.00	$11,040.00	$4.00	$128.00	$1.75	$56.00	$11,224.00

Code	Description	Quantity	Unit	Mat./Unit (1.05 W.F.)	Mat. Tot.	Lab./ Unit	Lab. Tot.	Equip./ Unit	Equip. Tot.	Total $
Structural Steel Trusses & Column										
051223170940	8" Dia. Pipe	96	LF	$78.00	$7,488.00	$2.70	$259.20	$1.46	$140.16	$7,887.36
051223175650	HSS 20"x12"x1/2"	603	LF	$150.00	$90,450.00	$6.00	$3,618.00	$3.50	$2,110.50	$96,178.50
051223752340	W14x53	45	LF	$79.42	$3,573.90	$3.70	$166.50	$2.00	$90.00	$3,830.40
051223752360	W14x61	167	LF	$110.77	$18,498.59	$3.99	$666.33	$2.11	$352.37	$19,517.29
051223177350	W14x74	90	LF	$110.77	$9,969.30	$3.01	$270.90	$1.62	$145.80	$10,386.00
051223177350	W14x82	41	LF	$110.77	$4,541.57	$3.01	$123.41	$1.62	$66.42	$4,731.40
051223177400	W14x99	1135	LF	$135.00	$153,225.00	$3.01	$3,416.35	$1.62	$1,838.70	$158,480.05
051223177400	W12x120	45	LF	$179.74	$8,088.30	$3.08	$138.60	$1.67	$75.15	$8,302.05
051223177400	W14x132	124	LF	$197.00	$24,428.00	$3.08	$381.92	$1.67	$207.08	$25,017.00
051223177450	W14x145	159	LF	$220.00	$34,936.00	$3.16	$501.81	$1.70	$269.96	$35,707.77
051223177450	W14x159	168	LF	$240.00	$40,272.00	$3.24	$543.67	$1.75	$293.65	$41,109.32
051223177450	W14x176	60	LF	$263.34	$15,800.40	$3.24	$194.40	$1.75	$105.00	$16,099.80
051223177450	W14x193	50	LF	$285.30	$14,379.12	$3.24	$163.30	$1.75	$88.20	$14,630.62
Blended	W14x211	39	LF	$315.00	$12,285.00	$4.00	$156.00	$2.00	$78.00	$12,519.00

Blended	W14x233	389	LF	$345.00	$134,308.50	$4.00	$1,557.20	$2.00	$778.60	$136,644.30
Blended	W14x257	68	LF	$385.00	$26,180.00	$4.00	$272.00	$2.00	$136.00	$26,588.00
Blended	W14x283	239	LF	$425.00	$101,575.00	$4.00	$956.00	$2.00	$478.00	$103,009.00
Blended	W14x398	27	LF	$500.00	$13,500.00	$4.00	$108.00	$2.00	$54.00	$13,662.00
Blended	W14x426	41	LF	$550.00	$22,550.00	$4.00	$164.00	$2.00	$82.00	$22,796.00

Code	Description	Quantity	Unit	Mat./Unit (1.05 W.F.)	Mat. Tot.	Lab./ Unit	Lab. Tot.	Equip./ Unit	Equip. Tot.	Total $
Allowances										
Steel Bolted Connections	5% of Steel Costs				$106,488.79	$0.00	$0.00	$0.00	$0.00	$106,488.79
Steel Welded Connections	5% of Steel Costs				$106,488.79	$0.00	$0.00	$0.00	$0.00	$106,488.79
Subtotals					**$4,213,286.79**		**$1,220,222.82**		**$126,952.95**	**$5,560,462.56**

Appendix C-Assemblies MEP Estimates

Reed Construction Data

Cost Estimate Report
RSMeansOnline

County
las5538psu@gmail.com

Date: 02-Oct-13

Mechanical Assembly Estimate- Library
Year 2013
Assembly Detail Report

Prepared By:
Lowell Stine
Penn State

Assembly Number	✎	T	Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D Services							
D30105202040		☐	Commercial building heating system, fin tube radiation, forced hot water, 100,000 SF, 1mil CF, total 3 floors	90,000.00	S.F.	$3.78	$340,200.00
D30201021440		☐	Small heating systems, electric boilers, hot water, 2 floors, 4,850 SF, 205 MBH	10,000.00	S.F.	$17.57	$175,700.00
D30201061080		☐	Boiler, gas, cast iron, hot water, 1,088 MBH	4.00	Ea.	$19,621.25	$78,485.00
D30201081280		☐	Heating systems, CI boiler, gas, terminal unit heaters, 80 MBH, 1,070 SF bldg	40,000.00	S.F.	$18.32	$732,800.00
D30203301010		☐	Pump, base mounted with motor, end-suction, 2-1/2" size, 3 HP, to 150 GPM	11.00	Ea.	$14,705.80	$161,763.80
D30203301020		☐	Pump, base mounted with motor, end-suction, 3" size, 5 HP, to 225 GPM	2.00	Ea.	$16,239.10	$32,478.20
D30203301030		☐	Pump, base mounted with motor, end-suction, 4" size, 7-1/2 HP, to 350 GPM	5.00	Ea.	$19,122.50	$95,612.50
D30203301040		☐	Pump, base mounted with motor, end-suction, 5" size, 15 HP, to 1000 GPM	2.00	Ea.	$26,770.85	$53,541.70
D30301103400		☐	Packaged chiller, air cooled, with fan coil unit, offices, 6,000 SF, 19.00 ton	90,000.00	S.F.	$15.39	$1,385,100.00
D30301154040		☐	Packaged chiller, water cooled, with fan coil unit, offices, 60,000 SF, 190.00 ton	90,000.00	S.F.	$12.95	$1,165,500.00
D30401161030		☐	AHU, rooftop, cool/heat coils, VAV, filters, 15,000 CFM	1.10	Ea.	$129,030.30	$141,933.33
D30401161050		☐	AHU, rooftop, cool/heat coils, VAV, filters, 30,000 CFM	1.33	Ea.	$190,322.20	$253,128.53
D30401341010		☐	VAV terminal, cooling, hot water reheat, with actuator/controls, 200 CFM	12.00	Ea.	$4,078.80	$48,945.60
D30401341020		☐	VAV terminal, cooling, hot water reheat, with actuator / controls, 400 CFM	7.00	Ea.	$4,994.00	$34,958.00
D30401341030		☐	VAV terminal, cooling, hot water reheat, with actuator / controls, 600 CFM	11.00	Ea.	$6,245.80	$68,703.80
D30401341040		☐	VAV terminal, cooling, hot water reheat, with actuator / controls, 800 CFM	8.00	Ea.	$6,891.23	$55,129.84
D30401341060		☐	VAV terminal, cooling, hot water reheat, with actuator / controls, 1250 CFM	18.00	Ea.	$9,086.00	$163,548.00
D30401341070		☐	VAV terminal, cooling, hot water reheat, with actuator / controls, 1500 CFM	8.00	Ea.	$10,482.45	$83,859.60
D30401341080		☐	VAV terminal, cooling, hot water reheat, with actuator / controls, 2000 CFM	4.20	Ea.	$13,560.53	$56,954.23
D30402401030		☐	Roof vent. system, power, centrifugal, aluminum, galvanized curb, back draft damper, 1500 CFM	1.00	Ea.	$7,463.50	$7,463.50
D30402401040		☐	Roof vent. system, power, centrifugal, aluminum, galvanized curb, back draft damper, 2750 CFM	2.00	Ea.	$15,025.18	$30,050.36
D30406101010		☐	Plate heat exchanger, 400 GPM	1.00	Ea.	$65,299.10	$65,299.10

Assembly Number	✎	🔨	Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D30501703680		■	Split system, air cooled condensing unit, offices, 20,000 SF, 63.32 ton	90,000.00	S.F.	$10.10	$909,000.00
D	**Services Subtotal**						**$6,140,155.08**

County
las5538psu@gmail.com

Date: 02-Oct-13

Electrical Assembly Estimate- Library
Year 2013
Assembly Detail Report

Prepared By:
Lowell Stine
Penn State

Assembly Number	✎	T	Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D Services							
D50101301050		☐	Underground service installation, includes excavation, backfill, and compaction, 100' length, 4' depth, 3 phase, 4 wire, 277/480 volts, 2000 A, groundfault switch	1.50		$88,911.00	$133,366.50
D50101301550		☐	Underground service installation, includes excavation, backfill, and compaction, 100' length, 4' depth, 3 phase, 4 wire, 277/480 volts, 600 A w/switchboard	1.00	Ea.	$26,029.28	$26,029.28
D50102300240		☐	Feeder installation 600 V, including RGS conduit and XHHW wire, 100 A	110.00	L.F.	$25.35	$2,788.50
D50102300320		☐	Feeder installation 600 V, including RGS conduit and XHHW wire, 400 A	300.00	L.F.	$96.76	$29,028.00
D50102300400		☐	Feeder installation 600 V, including RGS conduit and XHHW wire, 800 A	110.00	L.F.	$213.81	$23,519.10
D50102300560		☐	Feeder installation 600 V, including RGS conduit and XHHW wire, 2000 A	300.00	L.F.	$542.17	$162,651.00
D50102400200		☐	Switchgear installation, incl switchboard, panels & circuit breaker, 120/208 V, 1 phase, 400 A	1.00	Ea.	$10,425.43	$10,425.43
D50102400400		☐	Switchgear installation, incl switchboard, panels & circuit breaker, 120/208 V, 2000 A	1.50	Ea.	$36,576.25	$54,864.38
D50102502020		☐	Panelboard, 4 wire w/conductor & conduit, NQOD, 120/208 V, 225 A, 5 stories, 50' horizontal	3.00		$10,507.93	$31,523.79
D50102502020		☐	Panelboard, 4 wire w/conductor & conduit, NQOD, 120/208 V, 225 A, 5 stories, 50' horizontal	14.00		$10,507.93	$147,111.02
D50102503000		☐	Panelboard, 4 wire w/conductor & conduit, NQOD, 120/208 V, 400 A, 5 stories, 50' horizontal	7.00		$15,340.88	$107,386.16
D50102503060		☐	Panelboard, 4 wire w/conductor & conduit, NQOD, 120/208 V, 600 A, 1 stories, 25' horizontal	2.00		$14,181.48	$28,362.96
D50201150320		☐	Receptacle systems, underfloor duct, 7' on center, high density	90,000.00	S.F.	$9.28	$835,200.00
D50201150720		☐	Receptacle systems, conduit system with floor boxes, low density	90,000.00	S.F.	$2.24	$201,600.00
D50201300320		☐	Wall switches, 2.5 per 1000 SF	90,000.00	S.F.	$0.54	$48,600.00
D50201700320		☐	Motor connections, three phase, 200/230/460/575 V, up to 5 HP	24.00	Ea.	$113.30	$2,719.20
D50201700480		☐	Motor connections, three phase, 200/230/460/575 V, up to 25 HP	7.00	Ea.	$253.21	$1,772.47
D50201750240		☐	Motor, drip proof, class B insulation, 1 HP, 1200 rpm, with magnetic starter	21.00	Ea.	$901.81	$18,938.01
D50201750360		☐	Motor, drip proof, class B insulation, 2 HP, 1200 rpm, with magnetic starter	1.00	Ea.	$1,100.39	$1,100.39

Assembly Number	✎	T	Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D50201750720		☐	Moter, drip proof, class B insulation, 5 HP, 1200 rpm, with magnetic starter	2.00	Ea.	$1,652.27	$3,304.54
D50201751120		☐	Moter, drip proof, class B insulation, 25 HP, 1800 rpm, with magnetic starter	7.00	Ea.	$3,598.62	$25,190.34
D50202080520		☐	Fluorescent fixtures, type A, 8 fixtures per 400 SF	90,000.00	S.F.	$9.90	$891,000.00
D50202905000		☐	Daylight dimming control system, 25 fixtures per 1000 SF	90,000.00	S.F.	$6.70	$603,000.00
D50303101020		☐	Telephone wiring for offices & laboratories, 8 jacks/MSF	90,000.00	S.F.	$2.01	$180,900.00
D50309100280		☐	Communication and alarm systems, includes outlets, boxes, conduit and wire, sound systems, 100 outlets	1.00	Ea.	$118,223.50	$118,223.50
D50309100456		☐	Communication and alarm systems, fire detection, addressable, 100 detectors, includes outlets, boxes, conduit and wire	1.00	Ea.	$70,212.60	$70,212.60
D50309100459		☐	Fire alarm control panel, 12 zone, excluding wire and conduit	1.00	Ea.	$4,276.48	$4,276.48
D50309100462		☐	Fire alarm command center, addressable with voice, excl. wire & conduit	1.00	Ea.	$11,707.50	$11,707.50
D50309100520		☐	Communication and alarm systems, includes outlets, boxes, conduit and wire, intercom systems, 12 stations	1.00	Ea.	$17,406.53	$17,406.53
D50309100840		☐	Communication and alarm systems, includes outlets, boxes, conduit and wire, master clock systems, 50 rooms	1.00	Ea.	$89,813.50	$89,813.50
D50309100960		☐	Communication and alarm systems, includes outlets, boxes, conduit and wire, master TV antenna systems, 12 outlets	1.00	Ea.	$14,382.35	$14,382.35
D50309200102		☐	Internet wiring, 2 data/voice outlets per 1000 S.F.	180.00	M.S.F.	$598.91	$107,803.80
D50902100880		☐	Generator sets, w/battery, charger, muffler and transfer switch, diesel engine with fuel tank, 250 kW	250.00	kW	$257.88	$64,470.00
D Services Subtotal							**$4,068,677.33**

County
las5538psu@gmail.com

Date: 02-Oct-13

Plumbing Assembly Estimate- Library
Year 2013
Assembly Detail Report

Prepared By:
Lowell Stine
Penn State

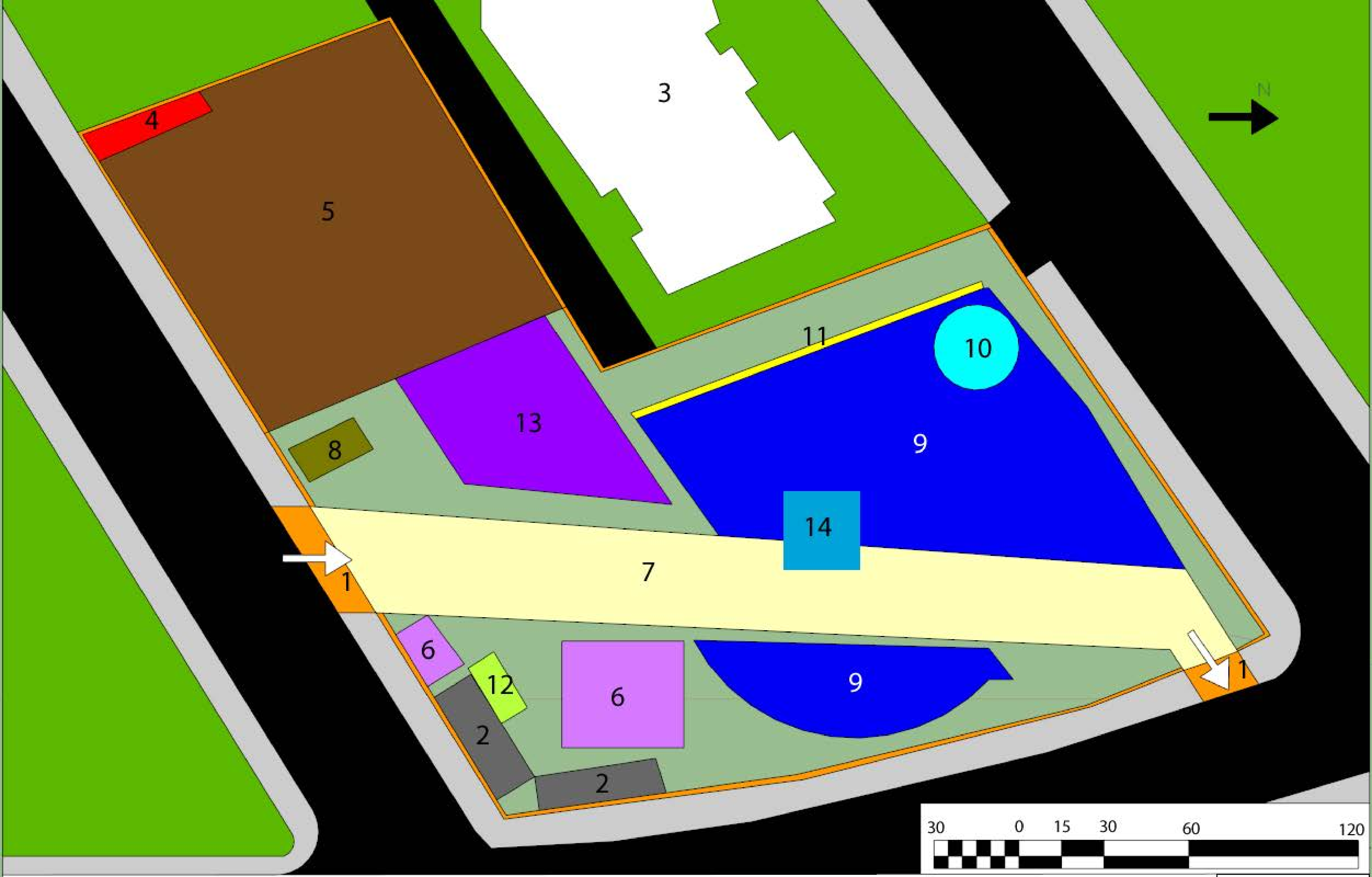
Assembly Number	✎	T	Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
D Services							
D20101102120		■	Water closet, vitreous china, bowl only with flush valve, floor mount	13.00	Ea.	$1,432.09	$18,617.17
D20101102160		■	Water closet, vitreous china, bowl only with flush valve, floor mount, 18" high bowl, ADA compliant	12.00	Ea.	$1,446.28	$17,355.36
D20102102000		■	Urinal, vitreous china, wall hung	5.00	Ea.	$1,235.80	$6,179.00
D20104301800		■	Lab sink w/trim, polyethylene, single bowl, flanged, 18-1/2" x 18-1/2" OD	26.00	Ea.	$1,286.18	$33,440.68
D20104404300		■	Service sink w/trim, PE on CI,wall hung w/rim guard, 22" x 18"	6.00	Ea.	$3,676.48	$22,058.88
D20108101920		■	Drinking fountain, 1 bubbler, wall mounted, non recessed, stainless steel, no back	7.00	Ea.	$1,886.01	$13,202.07
D20108201880		■	Water cooler, electric, wall hung, dual height, 14.3 GPH	7.00	Ea.	$1,929.18	$13,504.26
D20202401860		■	Electric water heater, commercial, 100< F rise, 80 gal, 12 KW 49 GPH	15.00	Ea.	$7,918.35	$118,775.25
D20402102280		■	Roof drain, DWV PVC, 8" diam, 10' high	1.00	Ea.	$4,348.30	$4,348.30
D20402102320		■	Roof drain, DWV PVC, 8" diam, for each additional foot add	80.00	Ea.	$72.96	$5,836.80
D Services Subtotal							**$253,317.77**

Appendix D- General Conditions Estimate

General Conditions Estimate

Description	Quantity	Unit	Per/Unit	Total
Site Signage (Fence Cloth)	4,588	SF	$36.04	$165,351.52
Perimater Fencing	1,185	LF	$6.32	$7,489.20
Office Trailers (2)	22	Month	$361.00	$15,884.00
Air Conditioning	22	Month	$48.76	$1,072.72
125 Ton Crane	20	Month	$16,000.00	$320,000.00
200 Ton (Crane Steel)			N/A	
1-1/2 CY Excavator	33	Month	$8,700.00	$287,100.00
Backhoe 1-1/4 CY	22	Month	$3,013.00	$66,286.00
500 BTU Heater	15	Month	$425.00	$6,375.00
Portable Toilet	22	Month	$191.78	$4,219.16
Permits	$3,589,000.00	%	0.50%	$17,945.00
Field Office Bills	22	Month	$377.00	$8,294.00
Main Office Expense	$3,589,000.00	%	3.90%	$139,971.00
Builders Risk Insurance	$3,589,000.00	%	0.42%	$15,000.00
Performance Bond	$3,589,000.00	%	2.79%	$100,000.00
Liability Insurance	$3,589,000.00	%	2.79%	$100,000.00
Multivista (Construction Documentations/ Webcam)	23	Month	$1,700.00	$39,100.00
Project Executive	22	Week	$2,475.00	$54,450.00
LEED Submittal Fees	22	Month	$727.27	$16,000.00
CM Fees	$3,589,000.00	%	7.50%	$269,175.00
Field Engineer	88	Week	$1,325.00	$116,600.00
Project Manager	88	Week	$2,150.00	$189,200.00
Superintendent	88	Week	$2,000.00	$176,000.00
General Purpose Laborer	88	Week	$1,425.00	$125,400.00
Schedule Maintainance	$3,589,000.00	%	0.03%	$1,076.70
Temp. 600 Amp Elec.	1	EA	$3,621.00	$3,621.00
Temp. 75kVA Transformer	1	EA	$3,993.00	$3,993.00
Office Trailer Hook-Up	2	EA	$374.00	$748.00
After Job Clean-up	$3,589,000.00	%	0.30%	$10,767.00
Waste Removal Dumpster	88	Week	$340.91	$30,000.00
Site Water	22	Month	$70.00	$1,540.00
Commissioning	$3,589,000.00	%	0.25%	$8,972.50
Total				**$2,301,630.80**

Appendix E- Site Layout Plans



Legend

🟧 1. Site Fence/ Gate
⬛ 2. Site Office Trailers
3. Surounding Buildings
🟥 4. Temp. Electric Panel

🟫 5. Soil Stockpile
🟪 6. Storage & Laydown
🟨 7. Truck Access Road
🟫 8. Dumpsters

🟦 9. Building Excavation
🟦 10. Dewatering Area
🟨 11. Excavation Support
🟩 12. Temp. Bathroom

🟪 13. Equipment Storage
🟦 14. Equipment Ramp into Excavation

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Excavation
Site Plan

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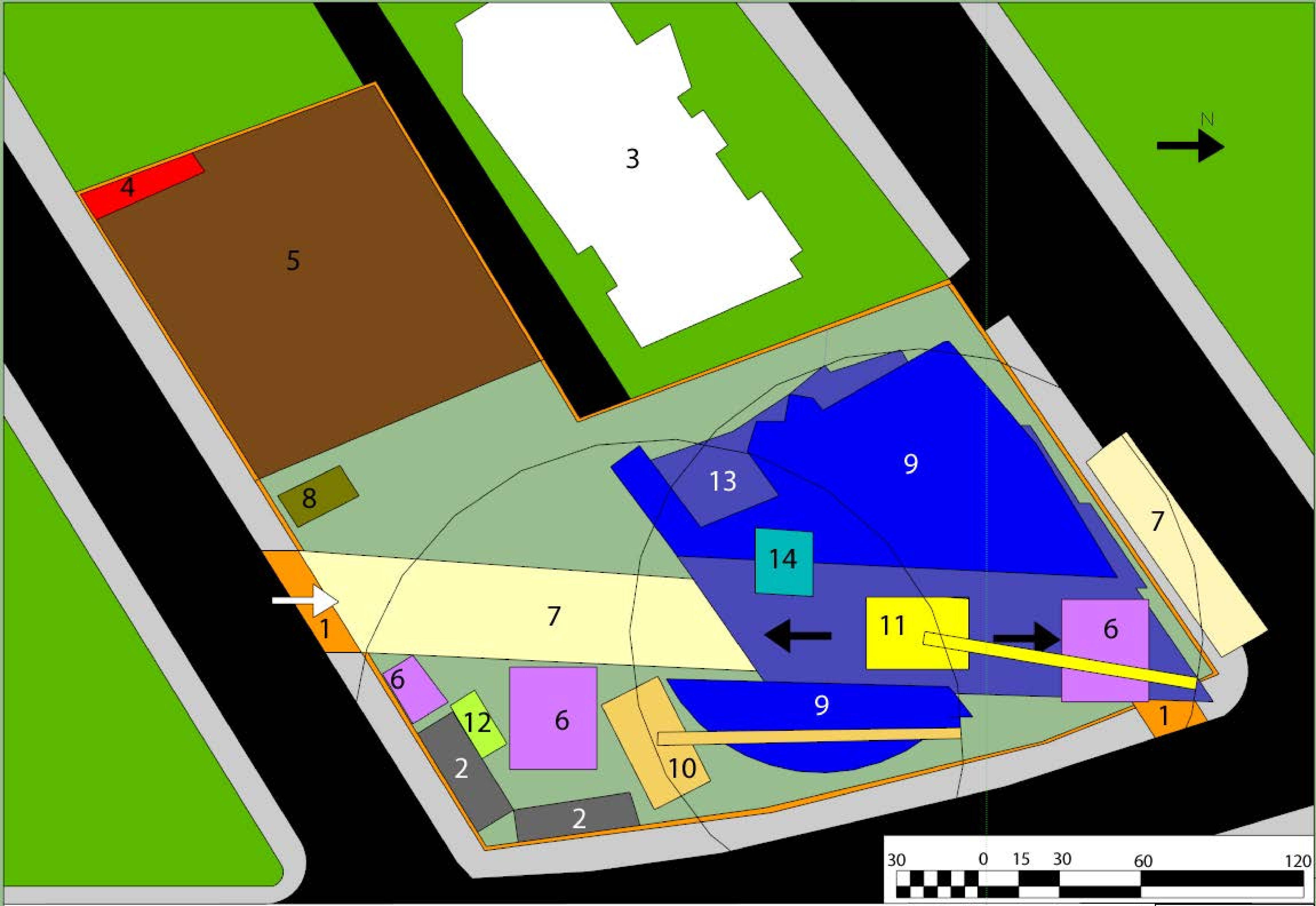
10/16/13



Legend

- 🟧 1. Site Fence/ Gate
- ⬛ 2. Site Office Trailers
- 3. Surounding Buildings
- 🟥 4. Temp. Electric Panel
- 🟫 5. Soil Stockpile
- 🟪 6. Storage & Laydown
- 🟨 7. Truck Unloading Area
- 🟫 8. Dumpsters
- 🟦 9. Building Footprint
- 🟧 10. 120 Ton Moble Crane
- 🟨 11. 200 Ton Crawler Crane
- 🟩 12. Temp. Bathroom
- 🟦 13. To Be Building Overhang
- 🟦 14. Equipment Ramp to be Removed in this Stage

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Superstructure
Site Plan

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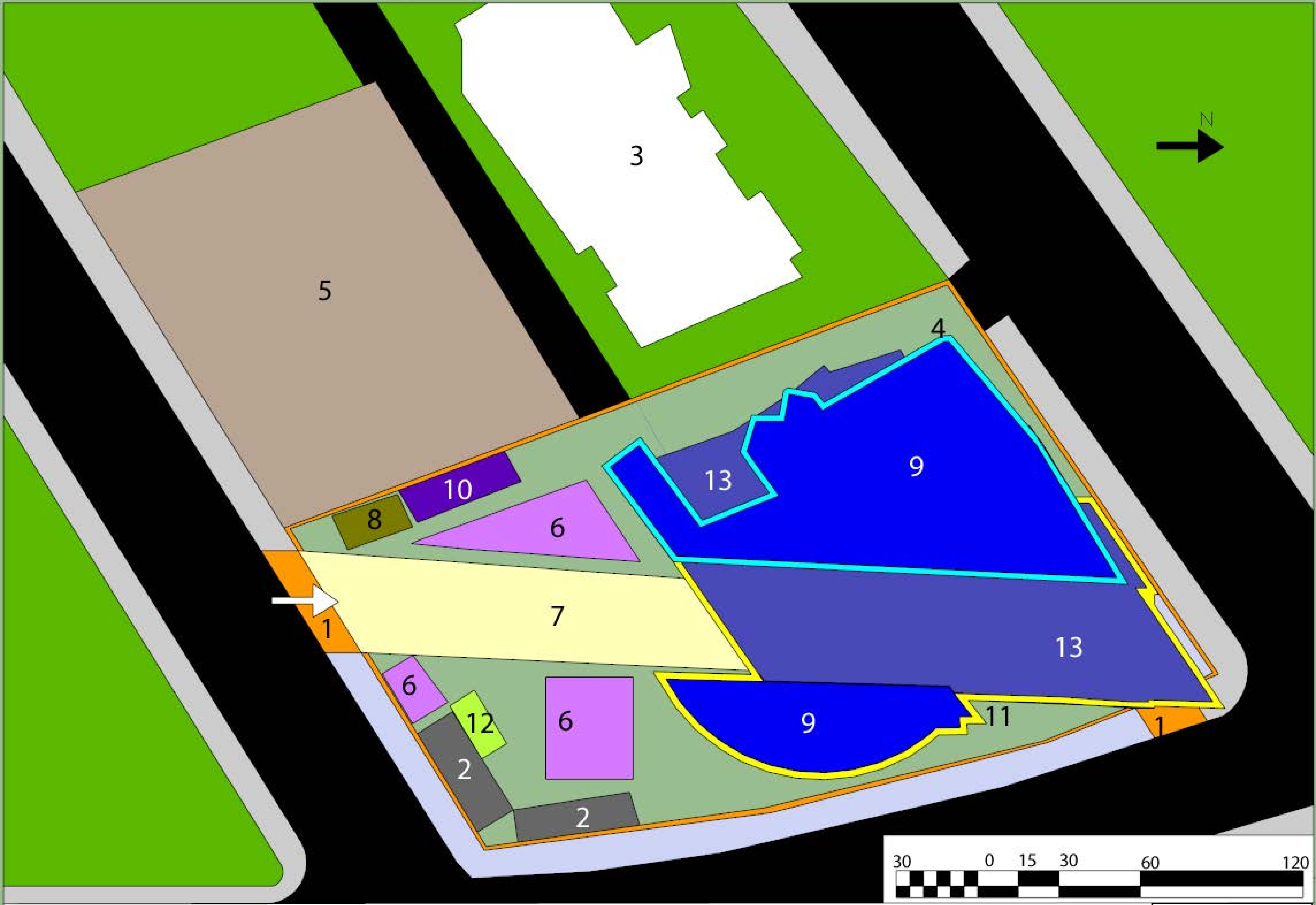

Legend

- 🟧 1. Site Fence/ Gate
- ⬛ 2. Site Office Trailers
- 3. Surounding Buildings
- 🟦 4. Masonry Work
- 🟫 5. Adjacent Construction Site
- 🟪 6. Storage & Laydown
- 🟨 7. Truck Unloading Area
- 🟫 8. Dumpsters
- 🟦 9. Building Footprint
- 🟪 10. Possible Sub. Office
- 🟨 11.Curtain Wall Work
- 🟩 12. Temp. Bathroom
- 🟦 13. Building Overhang

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Finishes
Site Plan

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Appendix F- BIM Evaluation

BIM USE ANALYSIS

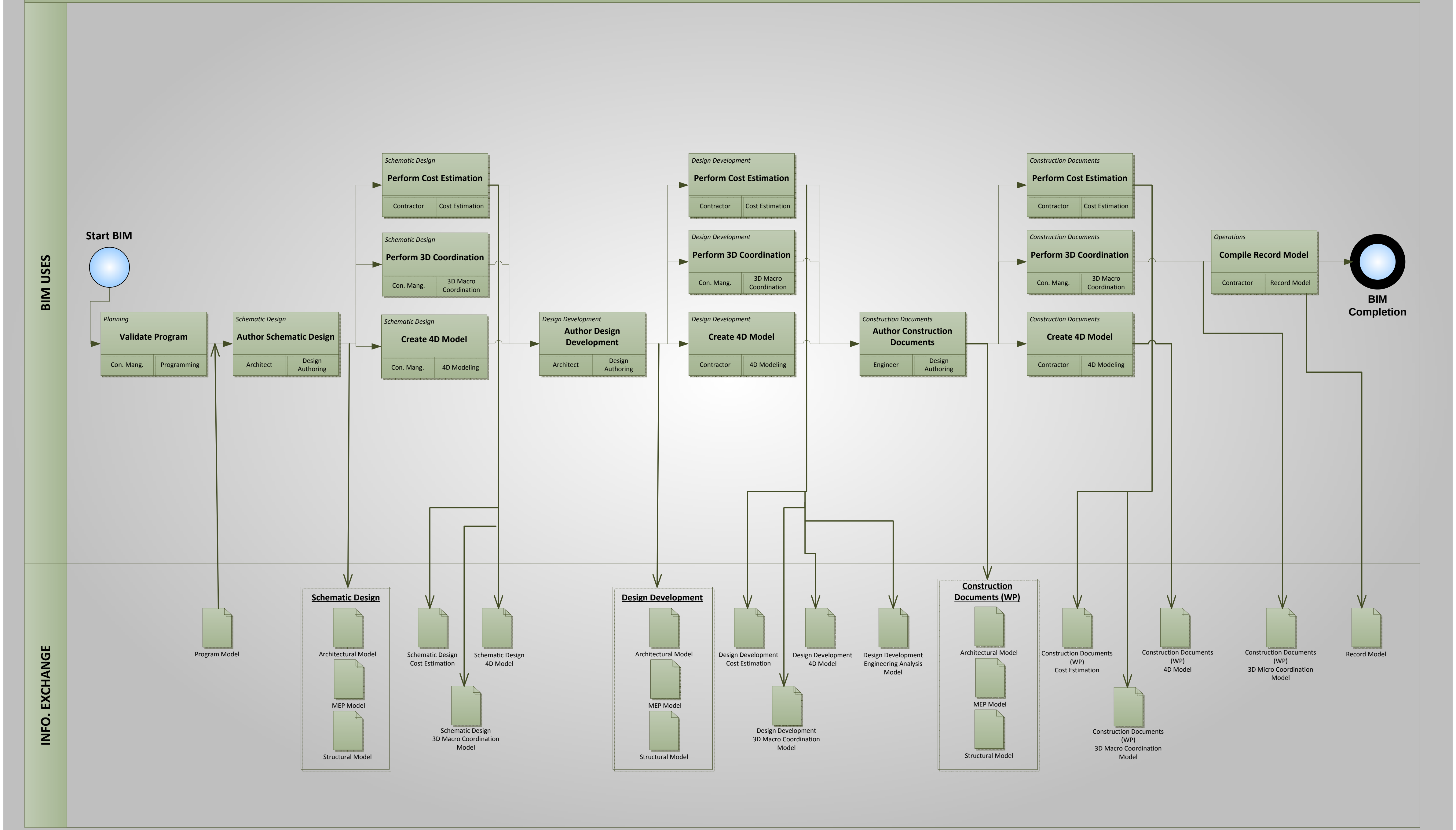
BIM Use*	Value to Project	Responsible Party	Value to Resp Party	Capability Rating			Additional Resources / Competencies Required to Implement	Notes	Proceed with Use
	High / Med / Low		High / Med / Low	Scale 1-3 (1 = Low)					YES / NO / MAYBE
				Resources	Competency	Experience			
Record Modeling	Med	Contractor	Med	2	2	2	Requires training and software		**Maybe**
		Facility Manager	High	1	2	1	Requires training and software		
		Con. Mang.	Med	3	3	3		Capable of leading BIM coordination	
Cost Estimation	Med	Contractor	High	2	2	2	Requires training and software		**Yes**
		Con. Mang.	High	3	3	3		Capable of leading BIM coordination	
4D Modeling	High	Contractor	High	3	2	2		Benefit in construction sequencing	**Yes**
		Con. Mang.	High	3	3	3		Capable of leading BIM coordination	
3D Coordination (Construction)	High	Contractor	High	3	3	3			**Yes**
		Subcontractors	High	1	3	3		Modeling learning curve possible	
		Designer	Med	2	3	3			
Engineering Analysis	Low	MEP Engineer	High	2	2	2			**No**
		Architect	Med	2	2	2			
Design Reviews	High	Architect	High	2	2	1		Reviews to be from design model	**Yes**
		Public Community	High	2	1	1		Charrette design input and better visualization.	
		Con. Mang.	Med	3	3	3	Has BIM specialist	Capable of leading BIM coordination	
3D Coordination (Design)	High	Architect	High	2	2	2	Coordination software required		**Yes**
		MEP Engineer	Med	2	2	2			
		Structural Engineer	High	2	2	2			
		Interior Designer	High	2	2	2			
Design Authoring	High	Architect	High	3	3	3	Coordination software required		**Yes**
		MEP Engineer	Med	3	3	3			
		Structural Engineer	High	3	3	3			
		Interior Designer	High	2	2	2			
Programming	Low	Owner	High	1	1	1		Program originated from owner needs.	**NO**

* Additional BIM Uses as well as information on each Use can be found at http://www.engr.psu.edu/ae/cic/bimex/

Level 1: BIM Execution Planning Process

Library In Metropolitan Washington, D.C.

Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team.
http://www.engr/psu.edu/ae/cic/bimex



BIM USES

Start BIM

Planning
Validate Program
Con. Mang. | Programming

Schematic Design
Author Schematic Design
Architect | Design Authoring

Schematic Design
Perform Cost Estimation
Contractor | Cost Estimation

Schematic Design
Perform 3D Coordination
Con. Mang. | 3D Macro Coordination

Schematic Design
Create 4D Model
Con. Mang. | 4D Modeling

Design Development
Author Design Development
Architect | Design Authoring

Design Development
Perform Cost Estimation
Contractor | Cost Estimation

Design Development
Perform 3D Coordination
Con. Mang. | 3D Macro Coordination

Design Development
Create 4D Model
Contractor | 4D Modeling

Construction Documents
Author Construction Documents
Engineer | Design Authoring

Construction Documents
Perform Cost Estimation
Contractor | Cost Estimation

Construction Documents
Perform 3D Coordination
Con. Mang. | 3D Macro Coordination

Construction Documents
Create 4D Model
Contractor | 4D Modeling

Operations
Compile Record Model
Contractor | Record Model

BIM Completion

INFO. EXCHANGE

Program Model

Schematic Design
Architectural Model
MEP Model
Structural Model

Schematic Design Cost Estimation

Schematic Design 4D Model

Schematic Design 3D Macro Coordination Model

Design Development
Architectural Model
MEP Model
Structural Model

Design Development Cost Estimation

Design Development 4D Model

Design Development Engineering Analysis Model

Design Development 3D Macro Coordination Model

Construction Documents (WP)
Architectural Model
MEP Model
Structural Model

Construction Documents (WP) Cost Estimation

Construction Documents (WP) 4D Model

Construction Documents (WP) 3D Macro Coordination Model

Construction Documents (WP) 3D Micro Coordination Model

Record Model

Appendix G- Take-off Reference Pages