Architectural Engineering 2013 Senior Thesis

Technical Assignment 2

FOR

BLOCK 12

DEVELOPED BY

Josue Fernandez

[BLOCK 12]

ROCKVILLE, MD

Advisor: Dr. Dubler

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FOR

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DEVELOPED BY

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SECTION A: EXECUTIVE SUMMARY

This report will analyze the major architectural engineering systems to gain a thorough understanding of the technical and construction issues affecting Block 12. Data will be compiled on current key issues facing the building and on the technical system analysis. A defined area of investigation will be developed for a thesis proposal.

Block 12 is part of a new community development in the heart of Rockville, MD. The developed, Federal Realty Investment Trust, will own, operate, and manage the newly constructed building, which is intended to achieve LEED certified status. Within the structure's four total floors and two sublevels, various usage types will be incorporated. A parking garage will provide 163 spaces over 72,266 square feet spanning over 2 levels. In various locations across two levels, retail space will occupy 44,254 square feet and consist of 13 individual retail spaces. The residential space makes up 175,284 square feet of the building and includes 174 units, a fitness center for the tenants, and an outdoor courtyard with a swimming pool.

The existing conditions of Block 12 are ideal. Block 12 sits at on a large open commercial lot. Existing stored include Starbucks, Bank of America, AC Moor, Chipotle, and Bally Total Fitness among others. As part of phase 1 of the overall project, Bally Total Fitness will be under demolition. The existing building does not affect Block 12's construction progress, but it does affect Block 10 and 11, which are the other 2 buildings being built adjacent. Utilities are readily accessible, but due to the high occupancy demands of the overall project, most of the utilities will have to be upsized. Construction traffic flow is of a concern due to the high car flow and accessibility issues on the two primary roads. Based on the geotechnical reports, Block 12 sits above 3 feet of the water level, facilitated with the drainage concerns during excavation.

The project schedule has a critical finish date of May 2014. Federal Realty Investment Trust plans on leasing the apartments to recent college graduates, whom seek a place to live after having accepted a job near the densely populated DC/Northern Virginia Area. The project is fast paced, with a construction schedule lasting only 20 months. This was achieved through prefabricating wood framing into sections. The production rate was increased by systematically managing workflow and through effectively splitting the building into four sections as seen on Figure 1.2. The project had a 5 day delay due to Hurricane Sandy hitting the job site. The effect was mitigated by proactively planning accumulated water deposits within the excavation. The only activity in the schedule that lies on the critical path is close-out, which also marks the period of most workforce demand.

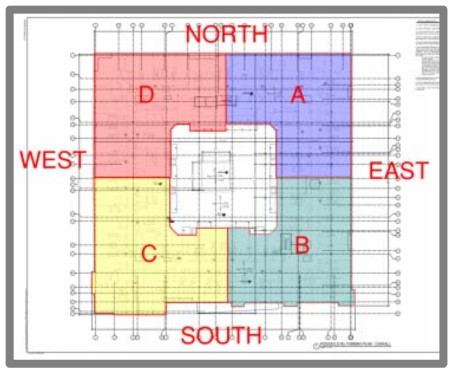


Figure 1.2: Wood framing sequence

The wood frame building sits on spread footing set 3 feet below the slab on grade level with two post tensioned concrete slabs. The cast-in-place concrete was pumped and poured using concrete barrels, to reach the building's extremes. The residential units will be heated by split system heat pumps and cooled with a cooling system. The mechanical equipment will primarily be located on the roof, including 2 RTU's. The parking garage will circulate air with 3 exhaust fans, which will be activated with CO_2 sensors. Active fire protection measures are taken by 2hr fire rated shafts and fire rated I-beams. Passive fire protection measures are additionally taken by a wet pipe system in the stairs & residential areas and a dry pipe system in the garage & retail slabs. The electrical system is a 3 phase 480/277V low voltage fed from one location to electrical closets on each level. The building will contain 1 diesel 250 KW generator for emergency power outages with an auto start specification of 10 seconds max and minimum fuel storage of 24 hours at rated load. Load bearing concrete masonry walls will house the stair shafts. The exterior retail space façade will primarily be composed of curtain walls, to be designed, furnished, and installed by the subcontractor. The systems to support excavation walls were steel soldier piles and wood lagging boards with tiebacks on the north, south, and east. The west side was laid back to facilitate truck flow traffic inside the excavation. Temporary pumps were used only used during excavation, due to the building sitting on 3 feet above the water line.

The patented system by SCA Consulting Engineers, Inc. was incorporated for faster production time installing drywall. Full sheets of drywall can be placed and drilled in place, compared to traditionally trimming the drywall to fit properly. Zip system sheathing and tape was used as a moisture resistant barrier to enclose the building and reduce air leakage. This system discards the need for house wrap and felt typically required. The owner is seeking LEED Accreditation through implementing a green roof, a waste management plan, and an indoor air quality management plan.

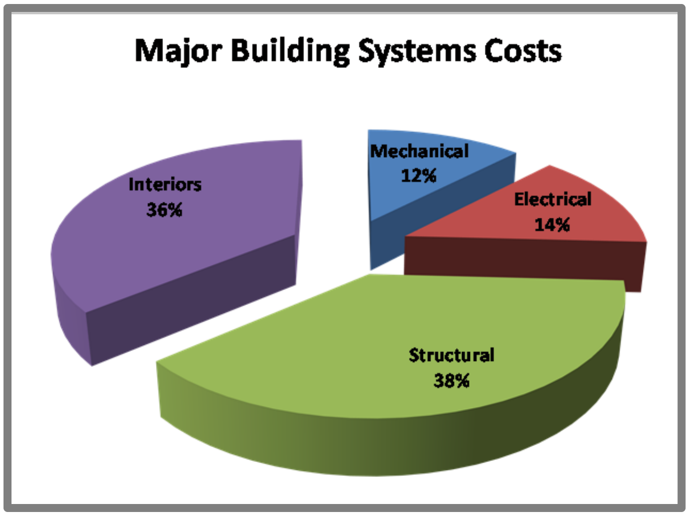


Figure 1.1: Major building systems costs of actual construction cost

The actual construction cost for Block 12 is $30M, which does not include land cost, site work, permitting, general conditions, designer's fees, construction management fees, liability insurance, nor any contingencies. Four of the major building systems breakdowns are mechanical at $2.5M, electrical $2.9M, structural $8.1M, and interiors $7.7M. The total project cost $36M, includes an additional $6M for the deficiencies in the construction cost. The RS Means square foot cost $24M was calculated through the assumption that the building was composed of three individual sections, an apartment space, a retail space, and a parking space. The square foot costs were added and further refined by subtracting the retail roof cost due to redundancy with the apartment floor already being accounted for. The discrepancies from the RS Means square foot estimate and the actual construction cost data yield a $6M deficit pointing primarily to the substructure and Interior costs bearing 3M, respectively. The substructure is $3M low due to 12" actual concrete walls rather than 5" calculated in RS Means. The additional $3M deficit is due to the interior finished being of higher quality with innovative appliances, as compared to a typical commercial apartment complex, whose main concern is not high quality materials.

The project delivery system is a traditional Design-Bid-Build project delivery system with the CM at risk providing a GMP. This was the chosen method due to the owner feeling comfortable with the delivery method and by previous project's success. The owner settled on a price with the general contractor, The Whiting-Turner Construction Company, through a negotiation. The owner's representative is compensated through a cost by fee basis, while the architects, engineers, and subcontractor's contract types are lump sums. It is worth noting, even though the architect and construction manager do not have a contract, they have a strong communication for the success of this project. The construction contract terms are typical AIA language stating explicitly each party's responsibilities. The schedule to abide is attached and the consequences for delay or non-compliance are stated. The contractor was selected based on a good relationship with the owner.

Block 12 is one of three buildings under construction at the same time, with a team dedicated to site work, due to the heavy site work involvement. Ted Border is the Vice President overseeing all the work performed throughout the overall project. Adam Haubert is the Sr. Project Manager primarily in charge of scheduling. Luther Hildreth is the Senior Superintendent making sure everything runs smoothly in the field. Site work and Block 12 are structured similarly with a project engineer being under a superintendent under a project manager.

Federal Realty Investment Trust is a large realty investment trust, which focuses on development and redevelopment. They typically own, operate, and manage their buildings. Federal Realty is a privately funded company who focuses on obtaining a quality building at a feasible cost.

SECTION B: DETAILED PROJECT SCHEDULE

The project delivery date for Block 12 is vital to the overall project success. The primary future occupants for this new construction will be recent college graduates, whom are in search of a new exciting location near their newly acquired jobs in the northern Virginia metropolitan region. The 20 month construction schedule was achieved primarily due to the utilization of prefabrication of certain building systems. The fully detailed baseline schedule for the project is composed of over 750 activities, but a condensed version of this project is available in the appendix section of this report. A summary of the key tasks of the schedule is available on Figure 2.1.

BLOCK 12 Schedule Highlight

Main Tasks	Start Date	End Date	Duration
Admin/ Procurement	11/30/2012	10/15/2013	228
Structure	10/1/2012	8/1/2013	219
Enclosure	6/24/2013	3/7/2014	185
Rough-Ins & Finishes	4/15/2013	4/1/2014	252
Close-Out	12/23/2013	5/28/2014	113

Figure 2.1: A summary of the key project tasks

Preconstruction began early in 2012, where various preliminary schedules and estimates were developed and analyzed. One of the major challenges at this phase was developing the adequate plan a strategy to methodically complete the project on time and on budget. To achieve the schedule of this project, it was decided at an early stage that prefabrication would be very beneficial for this specific project. The repetitive nature of the apartment complex and the size of the building were perfect candidates for prefabricating the wood framing and trusses.

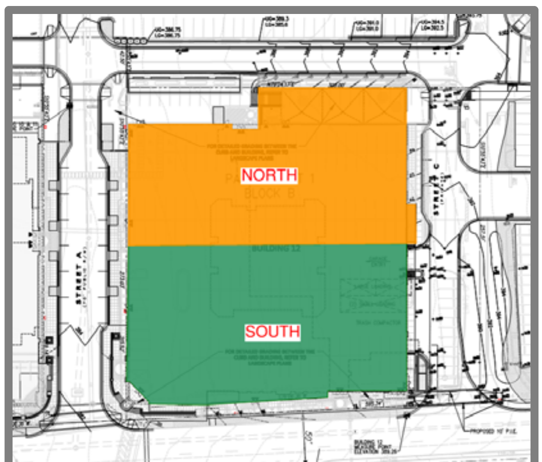


Figure 2.2: Excavation sequence

A great benefit for this project was the contractual agreement being a negotiated GMP. This allowed the contractor, The Whiting-Turner Contracting Company, to procure concrete, rebar, and windows before the official notice to proceed was given by the owner on October 1, 2012. This sequence of task accelerated the project start date, since it reduced the wait time on typical critical items like the concrete and rebar and on long lead items like windows.

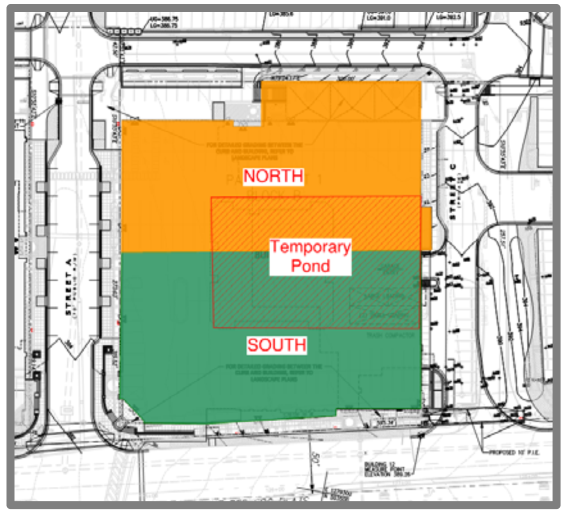


Figure 2.2: Excavation temporary pond for Hurricane Katrina

The first critical path item driving the schedule was the excavation, which began almost immediately after the notice to proceed was given. The building excavation was projected to be 10 feet deep, with a projected duration of 2 months. The excavation was being excavated in two sections, to more efficiently excavate and accelerate the process. While the north side was being lagged and tied back, the south side was being excavated, as shown on Figure 2.2.

Unfortunately, midway through excavation, the construction team was faced with a force of nature, Hurricane Katrina. The construction team knew ahead of time, that the hurricane would strike, so they planned accordingly. They built a temporary pond on the middle of their excavation and sloped the soil so the accumulated water can drain to one region, as shown on Figure 2.3. They then would drain the accumulated water with typical sump pumps off the site. This well thought proactive though of the construction team greatly helped reduce the effect of the hurricane on the schedule. The hurricane only caused a five day schedule delay.

The crane's footers were placed and reinforced after the final depth of excavation was reached, to facilitate pouring the slab on grade and the two sublevel floors of post tensioned concrete. At the completion of the concrete sublevels, the prefabricated wood frame sequence began. The production rate was increased by systematically managing workflow and through effectively splitting the building into four sections as seen on Figure 1.2. Two framing crews worked in a clockwise workflow, leading and lagging work to maximize their productivity.

The rough-ins and finishes of the two sublevels were scheduled to start, in concurrence with framing the residential units. This sequencing helped in roughing in the sublevels to begin providing power to the building. The final major tasks, being the enclosure and residential rough-ins and finishes, were also scheduled to occur concurrently. These concurring scheduling of tasks occur, due to the repetitive nature of building residential units.

Close-out was scheduled to begin on December 23, 2013, with the two sublevels and progressively move up to the residential units, and finish on May 28, 2014. It is evident the schedule was carefully planned out with optimizing productivity through linear scheduling. This method of scheduling was very helpful in efficiently fast-tracking this project.

SECTION C: DETAILED STRUCTURAL SYSTEMS ESTIMATE & ASSEMBLIES MEP ESTIMATES

Assembly MEP Estimate

Block 12's MEP system is primarily composed of heat pumps serving the amenity/common areas and the residential units. There are two large RTU's, which will serve the retail levels. The residential units will also feature a ductless system unit. There will be exhaust fans serving the garage levels, which will be activated by CO2 sensors. Heat will be provided by several unit heaters. An interesting feature for the residential level is that it will utilize plastic pipes, to save on cost. Additionally the main feeders will be composed of aluminum wiring, rather than the more traditional copper wires.

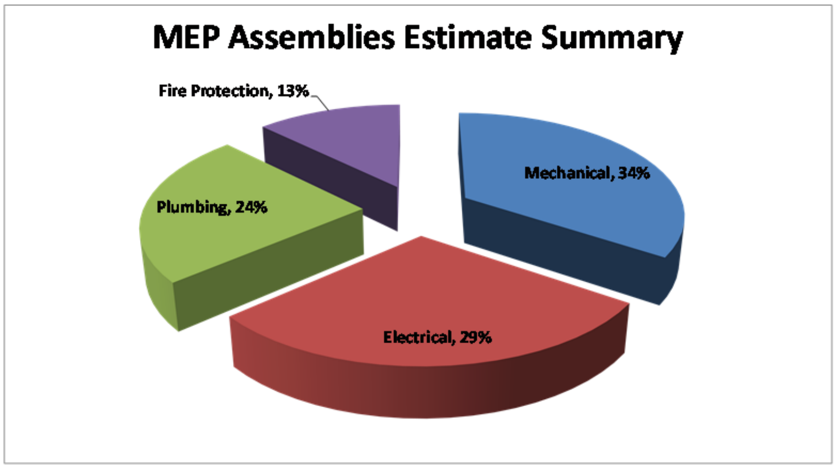


Figure 3.1: MEP Assemblies Estimate Summary Visual

MEP Assembly Estimate

Category	Estimated Cost	Cost per GSF	% of MEP Assembly Estimate
Mechanical	$2,600,000.00	$10	34%
Electrical	$2,200,000.00	$9	29%
Plumbing	$1,800,000.00	$7	24%
Fire Protection	$950,000.00	$4	13%
Total	**$7,550,000**	**$30**	**100%**

Figure 3.2: MEP Assemblies Estimate Chart

Figure 3.1: MEP Assemblies Estimate Summary Visual

Detailed Structural System Estimate

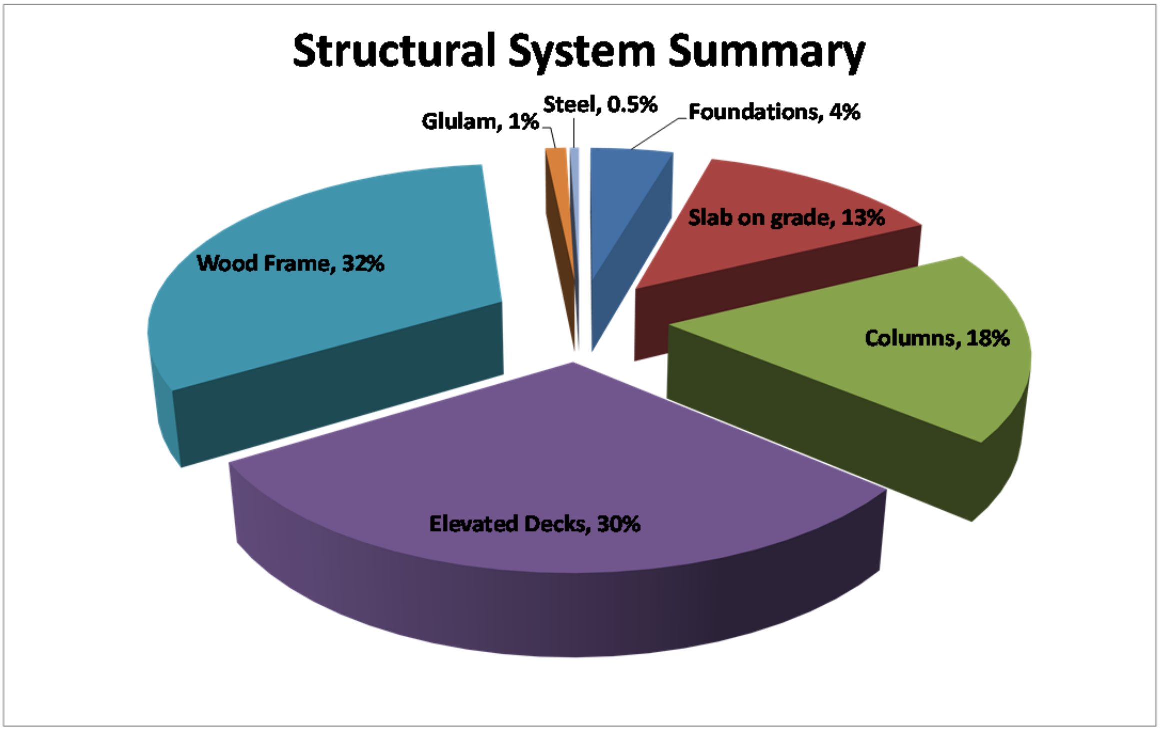


Figure 3.3: Detailed Structural System Estimate Summary Visual

Structural Systems Summary

Category	Estimated Cost	Cost per GSF	% of Structural System
Foundations	$320,000.00	$1	4%
Slab on grade	$950,000.00	$4	13%
Columns	$1,320,000.00	$5	18%
Elevated Decks	$2,165,000.00	$9	30%
Wood Frame	$2,300,000.00	$9	32%
Glulam	$80,000.00	$0	1%
Steel	$35,000.00	$0	0%
Total	**$7,170,000**	**$29**	**100%**

Figure 3.4: Detailed Structural System Estimate Chart

SECTION D: SITE LAYOUT PLANNING

To successfully manage the complex logistics required in Block 12, various site logistics plans are required. After carefully analyzing and understanding the existing conditions of the site, the site logistics plan was created for the major phases of construction. The site logistics plan of the substructure was developed, showing critical locations for trailers, staging, and truck mobilization among others.

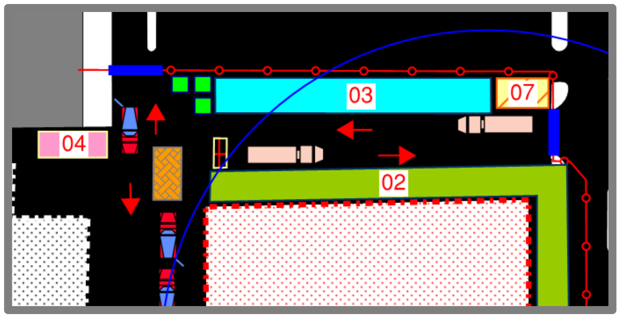


Figure 4.1: Truck flow of substructure site logistics plan

The substructure site logistics plan shown in the appendix section seems basic and efficient. The trailer locations for the major parties are placed to a side, to avoid any conflicts. The major concrete delivery and material delivery flow of traffic is very efficient. The flow of traffic, as shown on Figure 4.1, resembles an industrial assembly line, where there is an efficient linear path of movement. The staging area used by the contractors seems very adequate, since it is situated near the building. The large crane used in this phase has a maximum swing radius of 246'-1" with a jib elevation of 525'-0", which was utilized primarily for pouring the heavy concrete. The large crane located in the structure seems to be well placed to be able to pick up the adequate loads for this phase of the project. Based on the existing conditions and work performed during the substructure phase of the project, the site logistics plan utilized by the contractor seems very adequate.

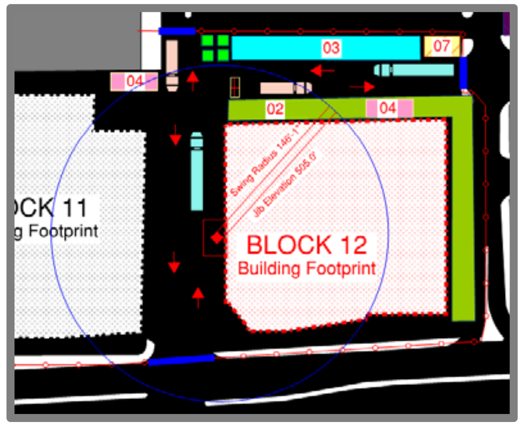


Figure 4.2: Crane location in structure site logistics plan

For the construction of the structure phase, the site logistics plan that the contractor implemented, removed the crane and replaced it with a mobile crane, as shown on Figure 4.2. This was done to minimize the heavy cost of renting the larger crane. The versatile mobile crane can easily move the prefabricated wood frames to their exact locations. There is an additional temporary portable toilet, due to the increase manpower in this phase of the project.

The site logistics plan for the enclosure phase of Block 12, required the use of a construction hoist. The construction hoist, shown on Figure 4.3, helps with the vertical work flow of equipment and material. The construction hoist along with the mobile crane is the perfect combination to effectively move material in and out of the building. The site logistics plan used in this phase of the project is acceptable, based on the existing conditions.

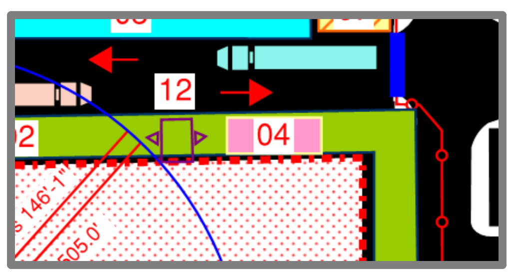


Figure 4.3: Construction hoist in enclosure site logistics plan

SECTION E: GENERAL CONDITIONS ESTIMATE

Comparable to other construction projects, Block 12 has a need for general conditions. The general conditions are primarily composed of the personnel, utilities, insurance, and supporting facilities. A detailed estimate of the general conditions was produced by utilizing data provided by the construction manager and cost values by RS Means Online 2013. This detailed estimate can be seen in the appendix. The monthly cost of the facilities was based on the 20 month project duration. The total cost of the general conditions for Block 12 amounts to $1,829,749. A summary breakdown of the general conditions detailed estimate can be seen on Figure 5.1, shown below.

General Conditions Summary

Category	Estimated Cost	Cost per Month	% of General Conditions
Personnel	$706,000	$35,300	39%
Temporary Services	$108,000	$5,400	6%
Temporary Structures	$44,965	$2,248	2%
Field Office Cost	$194,234	$9,712	11%
Site Cost	$385,701	$19,285	21%
Utilities	$55,849	$2,792	3%
Close-Out	$15,000	$750	1%
Insurance	$320,000	$16,000	17%
Total	**$1,829,749**	**$91,487**	**100%**

Figure 5.1: General conditions summary breakdown

From Figure 5.2, the most significant contribution to the general conditions estimate is personnel, which comprises 39% of the total cost. For Block 12, two project managers, a project manager, two superintendents, and a laborer were specifically assigned to the Block 12 project for the 20 month duration. The individuals assigned to the project have all had previous experience with a similar project successfully completed, on time and on budget, within a 15 mile radius of the site's location. The second largest costs for this project is the site cost. The site cost include costs for rental equipment, small tools and supplies,

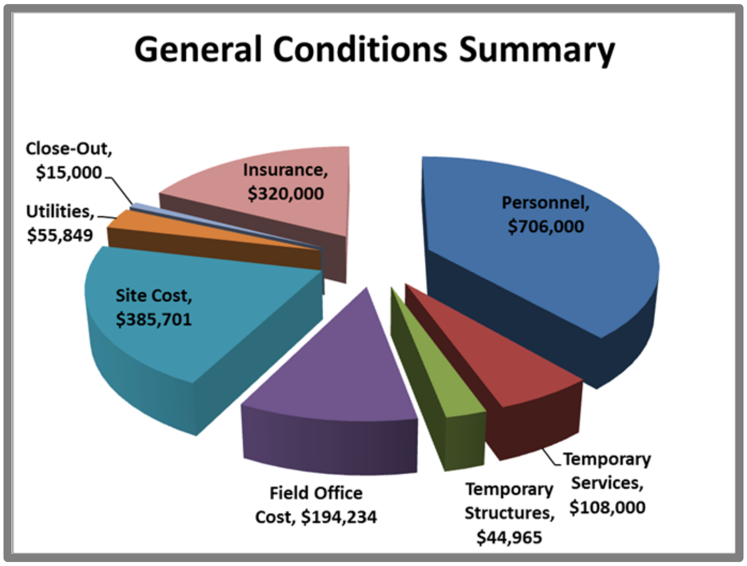


Figure 5.1: General conditions summary illustration

project signs, etc. Most of the cost incurred are low, but add up very quickly throughout the duration of the project.

The insurance fees are responsible for nearly 17% of the $1,829,749 general conditions costs. The insurance fee is solely a percentage of the total project value, which protect both the owner and the contractor from various risks associated with construction. The policies that make up this cost include general liability insurance and a builder's risk insurance. It is worth mentioning that a performance bonds for the construction manager was not required for this specific project.

While temporary services, temporary structures, field office cost, utilities, and close-out only account for a combined 23% of the construction manager's general conditions, these costs vary based on time. If the project finishes early, this can signify increased saving in the general conditions. On the other hand, if the project is delayed, then even more costs will be added to the project, due to these incurred costs.

Various items which are traditionally included in the general conditions estimate of a construction project have not been included due to subcontractors providing those services through their individual agreements. Some of these items include scaffolding and temporary site heating.

SECTION F: CONSTRUCTABILITY CHALLENGES

For the successful completion of Block 12, several constructability issues had to be mitigated. The first and most prominent is managing the various prefabricated wood frame trusses are delivered on time and are designed in small enough pieces to assemble it on site. Apart from the coordination issues with the prefabricated wood frame and MEP systems, Hurricane Sandy hitting the jobsite, and design discrepancies in finished concrete elevations have all contributed to the constructability challenges faced in Block 12.

Prefabricated Wood Frame and MEP System Clashes

There were several coordination issues with the MEP system clashing with the wood trusses and wood frames. Some of the issues occurred due to design changes from the mechanical engineer, which were not known being reflected on the wood frame shop drawings. Several of the MEP shafts collide with at least two wood frame trusses. The project is currently waiting for a response to the RFI sent to the architect and engineers. Another issue with the MEP system and the wood frame is that some of the duct sizes do not fit in between the wood truss spans. The root cause of this issue was that the MEP drawings were not overlaid on top of the floor trusses and load bearing walls. The implementation of BIM in fabricating the wood frame frames and trusses would have vastly reduced these coordination issues.

Hurricane Sandy

An unexpected constructability issue that arose during construction was the arrival or Hurricane Sandy to the construction site. Due to the construction team having knowledge of the hurricane ahead of time, they took proactive measurements to reduce the impact the storm would have on the project. They built a temporary pond on the middle of their excavation and sloped the soil so the accumulated water can drain to one region, as shown on Figure 2.3. They then would drain the accumulated water with typical sump pumps off the site. This well thought proactive though of the construction team greatly helped reduce the effect of the hurricane on the schedule. The hurricane only stopped excavation for 5 days.

Figure 6.1: Aftermath of Hurricane Sandy on Block 12's building footprint

Design Discrepancies

When the construction team was ready to pour the concrete, they were faced with drawing discrepancies. The structural and architectural drawings varied. The construction team had to request slab edge drawings from the structural engineer, to proceed with pouring the concrete to the adequate finished elevation. This issue could have greatly impacted the schedule to work being redone. Fortunately, these drawing discrepancies were caught at an adequate time to take the adequate changes.

SECTION G: BUILDING INFORMATION MODELING IMPLEMENTATION

Due to the early involvement of the construction manager in the project, there was a great potential for Building Information Modeling (BIM) to be successfully implemented in the Block 12 project. Based on the major BIM goals and objectives determined on chart 1 of attachment 9, it is clear that the owner is seeking to acquire the project on time and on budget. Some of the major priorities include reducing construction costs and minimizing coordination issues in pre-construction for construction. These tasks are effortlessly attainable through the correct BIM Use by all the project team members, as seen in attachment 10.

BIM Implementation in Block 12

BIM was utilized in Block 12 to "supplement the coordination process between building trades," as defined in the project's VCD execution plan. The BIM model will incorporate separate trade models generated by each of the major subcontractors, which will enable clash detection to be performed before the actual work is set in place. The primary use for BIM, was in coordinating the MEP system coordination. There are several other BIM capabilities, which could have seamlessly been implemented, poor owner experience and implementation has lead the project to fail in achieving these potential benefits.

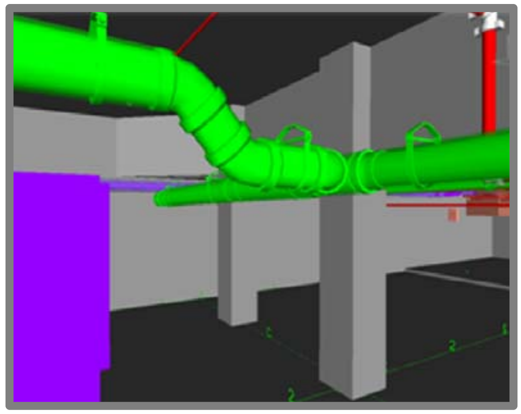


Figure 7.1: Coordinated MEP system in subfloor level

The clash detection of the MEP systems is led by a 3rd party firm, whose sole task is to performed clash detection utilizing Navisworks Manage. The 3rd party acquired the three dimensional model from the architecture firm, who created the BIM model through REVIT Architecture. Each subcontractor was then responsible for the creation of their 3 dimensional model of their respective system. Fortunately for this project, all the major subcontractors hired the same 3rd party firm to perform their 3 dimensional modeling. To perform clash detection, the 3rd party firm used the Navisworks Manage software to gather all the subcontractor's 3 dimensional system models and overlay them on top of the base model. Weekly group meeting with all the major subcontractors, the CM, and the 3rd party firm through an internet meeting service.

The BIM execution plan used in this project to coordinate the MEP system seems logical, but was possibly not the most effective. A more efficient method of coordinating this process would be if the major subcontractors would be performing their MEP modeling in house and if the general contractor would be leading the MEP coordination efforts. It seems very troublesome and problematic to rely of the response of a 3rd party, for the critical installation of an MEP system. In this case, it is possible the subcontractors would attempt to avoid coordination all together, so they can perform their work with their crew, time is money. They would only ask for help with coordination, when there is a major issue, which is always more costly for the owner. The following section analyzes potential BIM uses for the Block 12 project.

Potential BIM Uses

Block 12 could have greatly benefited from an early involvement in the Building Information Modeling in the project development phase as seen in the building information planning process in attachment 12. The early involvement of the construction manager in the design development phase would have yielded very valuable advice for the adequate constructability of the building. Scheduling early milestone meetings after major milestones, as seen in the level 1 team process overview map in attachment 11, would have more effectively guided the project team down the same project goal and adequate BIM use.

Based on the owner's goals, the BIM uses that seem feasible are 4D modeling, digital fabrication, 3D coordination, and site utilization planning. 4D modeling is a great tool to be proactive in managing the project sequence to avoid future conflict, maintain a tight schedule, and to orient the project team with a visual representation of the daily or weekly tasks that are to be performed. The digital fabrication of the prefabricated wood frame would have dramatically reduced the amount of clashed the current wood frame trusses has with the MEP system. Another great opportunity for prefabrication could have been the exterior façade, which would have helped with productivity and lowered waste. 3D coordination was implemented for the MEP system, but could have also been very effective in coordinating the storefront embeds and curtain wall system. Utilization planning would have also been very valuable, so coordinate the complex delivery and installation schedule. An effective site utilization plan could have also increased the safety of the overall project. The owner did not express any plans to utilize the BIM model after it was turned over. A full list of the BIM uses can be found in chart 3 of attachment 10.

SECTION O: ATTACHMENTS

1. **RS Means SF Estimate of Building Types** [FROM SECTION A]
2. **SF Assembly Breakdown Summary (RS MEANS)** [FROM SECTION A]
3. **Construction Cost SF Assembly Breakdown Summary** [FROM SECTION A]
4. **SF Assembly Breakdown Summary Replaced Values** [FROM SECTION A]
5. **BLOCK 12 Condensed Schedule** [FROM SECTION B]
6. **General Conditions Estimate** [FROM SECTION E]
7. **Existing Conditions Plan** [FROM SECTION D]
8. **Site Logistics Plans** [FROM SECTION D]
9. **Project Goals / BIM Use** [FROM SECTION G]
10. **BIM Goals & Use Worksheet** [FROM SECTION G]
11. **Level One Team Process Overview Map** [FROM SECTION G]
12. **Level One BIM Process Overview Map** [FROM SECTION G]

Square Foot Building Type 1 Estimate

RS Means Source	2012	Model #	M.010
Page(s)	78,79	Ext Wall Type	Brick Veneer
Area	172,000	Frame	Wood Frame
L.F. Perimeter	1,500		
Story Additional Hgt.	1		

Area Falls Between	32,000	36,000
Values	149.00	147.90
L.F. Perimeter Between	480	520
Additional Perimeter Adj. (per 100 L.F.)	5.40	4.80
Additional Hgt Adj. (per 1 Ft.)	2.35	2.20

Base cost per SF $110.50

Cost Adj Type:	Perimeter	Per SF Adj	$ 59.28
Cost Adj Type:	Floor Height	Per SF Adj	$ (2.90)

Adj Base cost per SF $166.88

Base Bldg Cost	$ 166.88 Adj Base Cost / SF	x	172,000 FloorArea	=	$28,703,360.00
Basement Cost	 Basement Cost / SF	x	 Basement Area	=	$0.00

Total Base Bldg Cost $28,703,360.00

RS Means Additions		Amount	
RS Means Additions		Amount	

New Subtotal Cost $28,703,360.00

Multiplier Type	RS Means Conv. To 2013	Value	1.02
Multiplier Type	Time	Value	1.00
Multiplier Type	Location	Value	0.91

New Subtotal Cost $26,660,179.15

Allowance		Amount	
Allowance		Amount	

New Subtotal Cost $26,660,179.15

Total Cost $ $26,660,179.15

Cost based on RS Means

Square Foot Building Type 1 Estimate Assembly Breakdown

	Assembly	% of Total	Cost per SF	Total Cost
A	Substructure	4.20%	$4.36	$750,217.44
B	Shell	25.30%	$26.27	$4,519,166.97
	B10 Superstructure	13.10%	$13.60	$2,339,963.92
	B20 Exterior Enclosure	10.60%	$11.01	$1,893,405.92
	B30 Roofing	1.60%	$1.66	$285,797.12
C	Interiors	23.20%	$24.09	$4,144,058.25
D	Services	47.30%	$49.12	$8,448,877.37
	D10 Conveying	4.00%	$4.15	$714,492.80
	D20 Plumbing	15.80%	$16.41	$2,822,246.56
	D30 HVAC	15.40%	$15.99	$2,750,797.28
	D40 Fire Protection	2.80%	$2.91	$500,144.96
	D50 Electrical	9.30%	$9.66	$1,661,195.76
E	Equipment & Furnishings	0.00%	$0.00	$0.00
F	Special Construction	0.00%	$0.00	$0.00
G	Building Sitework	0.00%	$0.00	$0.00
	Additions	0.00%	$0.00	$0.00
			Subtotal	$17,862,320.03
	Jobsite OH & GC's	15.00%		$3,999,026.87
	Profit	10.00%		$2,666,017.91
	Designer's Fee	8.00%		$2,132,814.33
			Total	$26,660,179.15

Cost based on RS Means

Square Foot Building Type 2 Estimate

RS Means Source	2012	Model #	M.630
Page(s)	212,213	Ext Wall Type	Face Brick on Concrete Block
Area	45,000	Frame	Steel Joist
L.F. Perimeter	1,000		
Story Additional Hgt.	-3		

Area Falls Between	20,000	22,000
Values	111.35	109.85
L.F. Perimeter Between	565	594
Additional Perimeter Adj. (per 100 L.F.)	3.25	2.95
Additional Hgt Adj. (per 1 Ft.)	0.90	0.85

Base cost per SF $92.60

Cost Adj Type:	Perimeter	Per SF Adj	$ (0.36)
Cost Adj Type:	Floor Height	Per SF Adj	$ (0.82)

Adj Base cost per SF $91.41

Base Bldg Cost	$ 91.41 Adj Base Cost / SF	x	45,000 FloorArea	=	$4,113,562.50
Basement Cost	 Basement Cost / SF	x	 Basement Area	=	$0.00

Total Base Bldg Cost $4,113,562.50

RS Means Additions		Amount	
RS Means Additions		Amount	

New Subtotal Cost $4,113,562.50

Multiplier Type	RS Means Conv. To 2013	Value	1.02
Multiplier Type	Time	Value	1.00
Multiplier Type	Location	Value	0.91

New Subtotal Cost $3,820,748.27

Allowance		Amount	
Allowance		Amount	$ -

New Subtotal Cost $3,820,748.27

Total Cost $ $3,820,748.27

Cost based on RS Means

Square Foot Building Type 2 Estimate Assembly Breakdown

	Assembly	% of Total	Cost per SF	Total Cost
A	Substructure	12.10%	$6.88	$309,748.06
B	Shell	29.30%	$16.67	$750,051.09
	B10 Superstructure	7.80%	$4.44	$199,672.30
	B20 Exterior Enclosure	14.60%	$8.31	$373,745.60
	B30 Roofing	6.90%	$3.93	$176,633.19
C	Interiors	16.10%	$9.16	$412,144.12
D	Services	42.50%	$24.18	$1,087,958.07
	D10 Conveying	0.00%	$0.00	$0.00
	D20 Plumbing	11.00%	$6.26	$281,589.15
	D30 HVAC	8.40%	$4.78	$215,031.71
	D40 Fire Protection	6.30%	$3.58	$161,273.78
	D50 Electrical	16.80%	$9.56	$430,063.43
E	Equipment & Furnishings	0.00%	$0.00	$0.00
F	Special Construction	0.00%	$0.00	$0.00
G	Building Sitework	0.00%	$0.00	$0.00
	Additions	0.00%	$0.00	$0.00
			Subtotal	$2,559,901.34
	Jobsite OH & GC's	15.00%		$573,112.24
	Profit	10.00%		$382,074.83
	Designer's Fee	8.00%		$305,659.86
			Total	$3,820,748.27

Cost based on RS Means

Square Foot Building Type 3 Estimate

RS Means Source	2012	Model #	M.280
Page(s)	139, 140	Ext Wall Type	Reinforced Concrete
Area	69,000	Frame	R/Conc. Frame
L.F. Perimeter	1,000		
Story Additional Hgt.	1		

Area Falls Between	50,000	75,000
Values	84.30	80.05
L.F. Perimeter Between	650	775
Additional Perimeter Adj. (per 100 L.F.)	2.30	1.55
Additional Hgt Adj. (per 1 Ft.)	1.45	1.15

Base cost per SF $81.07

Cost Adj Type:	Perimeter	Per SF Adj	$ 4.41
Cost Adj Type:	Floor Height	Per SF Adj	$ 1.22

Adj Base cost per SF $86.70

Base Bldg Cost	$ 86.70 (Adj Base Cost / SF)	x	69,000 (FloorArea)	=	$5,982,541.50
Basement Cost	(Basement Cost / SF)	x	(Basement Area)	=	$0.00
			Total Base Bldg Cost		$5,982,541.50

RS Means Additions		Amount	
RS Means Additions		Amount	
		New Subtotal Cost	$5,982,541.50

Multiplier Type	RS Means Conv. To 2013	Value	1.02
Multiplier Type	Time	Value	1
Multiplier Type	Location	Value	0.91
		New Subtotal Cost	$5,556,688.42

Allowance		Amount	
Allowance		Amount	
		New Subtotal Cost	$5,556,688.42

Total Cost $ $5,556,688.42

Cost based on RS Means

Square Foot Building Type 3 Estimate Assembly Breakdown

	Assembly	% of Total	Cost per SF	Total Cost
A	Substructure	21.90%	$11.82	$815,332.89
B	Shell	55.20%	$29.78	$2,055,085.65
	B10 Superstructure	44.60%	$24.06	$1,660,449.63
	B20 Exterior Enclosure	6.80%	$3.67	$253,162.72
	B30 Roofing	3.80%	$2.05	$141,473.29
C	Interiors	2.30%	$1.24	$85,628.57
D	Services	19.90%	$10.74	$740,873.27
	D10 Conveying	3.10%	$1.67	$115,412.42
	D20 Plumbing	2.80%	$1.51	$104,243.47
	D30 HVAC	0.30%	$0.16	$11,168.94
	D40 Fire Protection	7.40%	$3.99	$275,500.61
	D50 Electrical	6.30%	$3.40	$234,547.82
E	Equipment & Furnishings	0.70%	$0.38	$26,060.87
F	Special Construction	0.00%	$0.00	$0.00
G	Building Sitework	0.00%	$0.00	$0.00
	Additions	0.00%	$0.00	$0.00
			Subtotal	$3,722,981.24
	Jobsite OH & GC's	15.00%		$833,503.26
	Profit	10.00%		$555,668.84
	Designer's Fee	8.00%		$444,535.07
			Total	$5,556,688.42

Cost based on RS Means

SF Assembly Breakdown Summary (RS MEANS)

	Assembly	% of Total	Cost per SF	Total Cost
A	Substructure	7.77%	$ 6.56	$1,875,298.40
B	Shell	30.33%	$ 25.61	$7,324,303.71
	B10 Superstructure	17.40%	$ 14.69	$4,200,085.86
	B20 Exterior Enclosure	10.44%	$ 8.81	$2,520,314.24
	B30 Roofing	2.50%	$ 2.11	$603,903.60
C	Interiors	19.22%	$ 16.23	$4,641,830.93
D	Services	42.57%	$ 35.94	$10,277,708.71
	D10 Conveying	3.44%	$ 2.90	$829,905.22
	D20 Plumbing	13.29%	$ 11.22	$3,208,079.19
	D30 HVAC	12.33%	$ 10.41	$2,976,997.94
	D40 Fire Protection	3.88%	$ 3.28	$936,919.36
	D50 Electrical	9.63%	$ 8.13	$2,325,807.01
E	Equipment & Furnishings	0.11%	$ 0.09	$26,060.87
F	Special Construction	0.00%	$ -	$0.00
G	Building Sitework	0.00%	$ -	$0.00
	Additions	0.00%	$ -	$0.00
			Subtotal	$24,145,202.61
	Jobsite OH & GC's	12.00%		$2,897,424.31
	Profit	5.00%		$1,207,260.13
	Designer's Fee	10.00%		$2,414,520.26
			Total	$30,664,407.32

Building Type		GSF
Apartments	Type 1	172,000
Retail	Type 2	45,000
Parking	Type 3	69,000
Building Total		286,000

Construction Cost SF Assembly Breakdown Summary

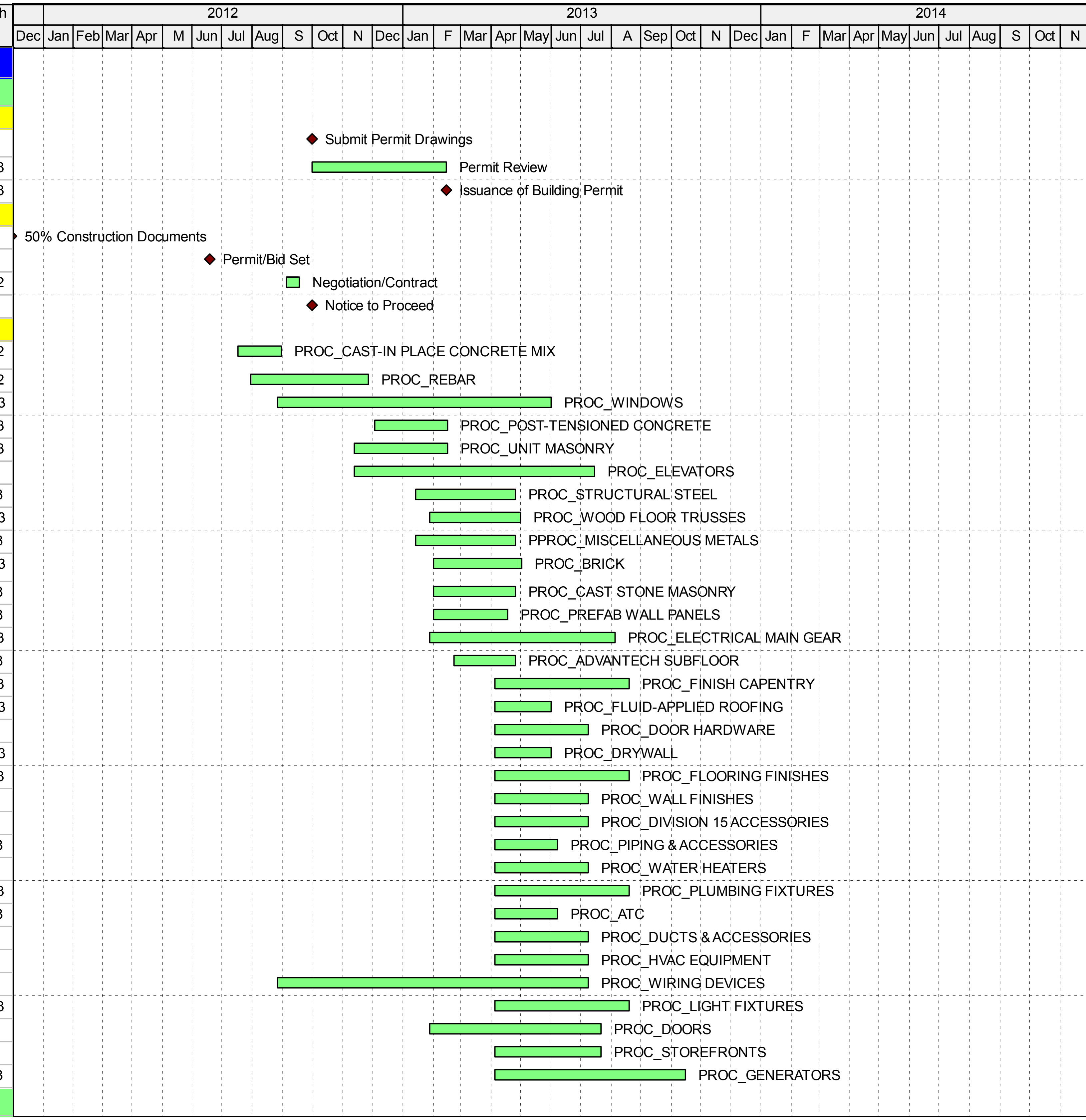
	Assembly	% of Total	Cost per SF	Total Cost
A	Substructure	15.58%	$ 16.38	$4,685,700.00
B	Shell	21.66%	$ 22.77	$6,512,436.00
	B10 Superstructure	8.72%	$ 9.17	$2,623,352.00
	B20 Exterior Enclosure	10.35%	$ 10.88	$3,110,719.00
	B30 Roofing	2.59%	$ 2.72	$778,365.00
C	Interiors	25.75%	$ 27.07	$7,741,802.00
D	Services	30.58%	$ 32.15	$9,195,005.00
	D10 Conveying	2.31%	$ 2.43	$695,060.00
	D20 Plumbing	7.47%	$ 7.85	$2,245,634.00
	D30 HVAC	8.80%	$ 9.25	$2,644,945.00
	D40 Fire Protection	2.20%	$ 2.31	$661,364.00
	D50 Electrical	9.80%	$ 10.31	$2,948,002.00
E	Equipment & Furnishings	6.43%	$ 6.76	$1,932,981.00
F	Special Construction	0.00%	$ -	$0.00
G	Building Sitework	0.00%	$ -	$0.00
	Additions	0.00%	$ -	$0.00
			Subtotal	$30,067,924.00
	Jobsite OH & GC's	12.00%		$3,608,150.88
	Profit	5.00%		$1,503,396.20
	Designer's Fee	8.00%		$2,405,433.92
			Total	$37,584,905.00

Building Type		GSF
Apartments	Type 1	172,000
Retail	Type 2	45,000
Parking	Type 3	69,000
Building Total		286,000

SF Assembly Breakdown Summary (Replaced with More Adequate SF Building Cost for Type)

	Assembly	SF Assembly Estimate Value		SF Assembly Estimate Replacement Value	SF Assembly Value
A	**Substructure**	$ 1,875,298.40			$1,875,298.40
B	**Shell**				
	B10 Superstructure	$ 4,200,085.86		$ 3,199,674.75	$3,199,674.75
	B20 Exterior Enclosure	$ 2,520,314.24			$2,520,314.24
	B30 Roofing	$ 603,903.60			$603,903.60
C	**Interiors**	$ 4,641,830.93			$4,641,830.93
D	**Services**				
	D10 Conveying	$ 829,905.22			$829,905.22
	D20 Plumbing	$ 3,208,079.19			$3,208,079.19
	D30 HVAC	$ 2,976,997.94			$2,976,997.94
	D40 Fire Protection	$ 936,919.36			$936,919.36
	D50 Electrical	$ 2,325,807.01			$2,325,807.01
E	**Equipment & Furnishings**	$ 26,060.87			$26,060.87
F	**Special Construction**	$ -			$0.00
G	**Building Sitework**	$ -			$0.00
	Additions	$ -			$0.00
				Subtotal	$23,144,791.50
	Jobsite OH & GC's	8 (time (months))	x	$ 362,178.00 (monthly cost)	$2,897,424.00
	Profit	5.00%			$1,157,239.58
	Designer's Fee	10.00%			$2,314,479.15
				Total	$29,513,934.23
					Cost based on RS Means

Activity ID	Activity Description	OD	RD	%	Early Start	Early Finish
Block 12						
ADMIN/PROCUREMENT						
PERMITS						
A1000	Submit Permit Drawings	0	0	0%	01-Oct-12	
A1010	Permit Review	96	96	0%	01-Oct-12	14-Feb-13
A1020	Issuance of Building Permit	0	0	0%		14-Feb-13
BIDDING & GMP						
A1030	50% Construction Documents	0	0	0%	30-Nov-11	
A1040	Permit/Bid Set	0	0	0%	18-Jun-12	
A1050	Negotiation/Contract	10	10	0%	04-Sep-12	17-Sep-12
A1060	Notice to Proceed	0	0	0%	01-Oct-12	
PROCUREMENT						
A1080	PROC_CAST-IN PLACE CONCRETE MIX	33	33	0%	17-Jul-12	30-Aug-12
A1090	PROC_REBAR	84	84	0%	30-Jul-12	26-Nov-12
A1100	PROC_WINDOWS	195	195	0%	27-Aug-12	31-May-13
A1110	PROC_POST-TENSIONED CONCRETE	53	53	0%	03-Dec-12	15-Feb-13
A1120	PROC_UNIT MASONRY	66	66	0%	13-Nov-12	15-Feb-13
A1130	PROC_ELEVATORS	170	170	0%	13-Nov-12	15-Jul-13
A1140	PROC_STRUCTURAL STEEL	74	74	0%	14-Jan-13	25-Apr-13
A1150	PROC_WOOD FLOOR TRUSSES	68	68	0%	28-Jan-13	01-May-13
A1160	PPROC_MISCELLANEOUS METALS	74	74	0%	14-Jan-13	25-Apr-13
A1170	PROC_BRICK	65	65	0%	01-Feb-13	02-May-13
A1180	PROC_CAST STONE MASONRY	60	60	0%	01-Feb-13	25-Apr-13
A1190	PROC_PREFAB WALL PANELS	55	55	0%	01-Feb-13	18-Apr-13
A1200	PROC_ELECTRICAL MAIN GEAR	134	134	0%	28-Jan-13	05-Aug-13
A1210	PROC_ADVANTECH SUBFLOOR	45	45	0%	22-Feb-13	25-Apr-13
A1220	PROC_FINISH CAPENTRY	95	95	0%	05-Apr-13	19-Aug-13
A1230	PROC_FLUID-APPLIED ROOFING	40	40	0%	05-Apr-13	31-May-13
A1240	PROC_DOOR HARDWARE	65	65	0%	05-Apr-13	08-Jul-13
A1250	PROC_DRYWALL	40	40	0%	05-Apr-13	31-May-13
A1260	PROC_FLOORING FINISHES	95	95	0%	05-Apr-13	19-Aug-13
A1270	PROC_WALL FINISHES	65	65	0%	05-Apr-13	08-Jul-13
A1280	PROC_DIVISION 15 ACCESSORIES	65	65	0%	05-Apr-13	08-Jul-13
A1290	PROC_PIPING & ACCESSORIES	45	45	0%	05-Apr-13	07-Jun-13
A1300	PROC_WATER HEATERS	65	65	0%	05-Apr-13	08-Jul-13
A1310	PROC_PLUMBING FIXTURES	95	95	0%	05-Apr-13	19-Aug-13
A1320	PROC_ATC	45	45	0%	05-Apr-13	07-Jun-13
A1330	PROC_DUCTS & ACCESSORIES	65	65	0%	05-Apr-13	08-Jul-13
A1340	PROC_HVAC EQUIPMENT	65	65	0%	05-Apr-13	08-Jul-13
A1350	PROC_WIRING DEVICES	220	220	0%	27-Aug-12	08-Jul-13
A1360	PROC_LIGHT FIXTURES	95	95	0%	05-Apr-13	19-Aug-13
A1370	PROC_DOORS	124	124	0%	28-Jan-13	22-Jul-13
A1380	PROC_STOREFRONTS	75	75	0%	05-Apr-13	22-Jul-13
A1390	PROC_GENERATORS	135	135	0%	05-Apr-13	15-Oct-13
ISSUES						



Remaining Work ◆ Milestone
Critical Remaining Work

Date	Revision	Checked	Approved

Block 12

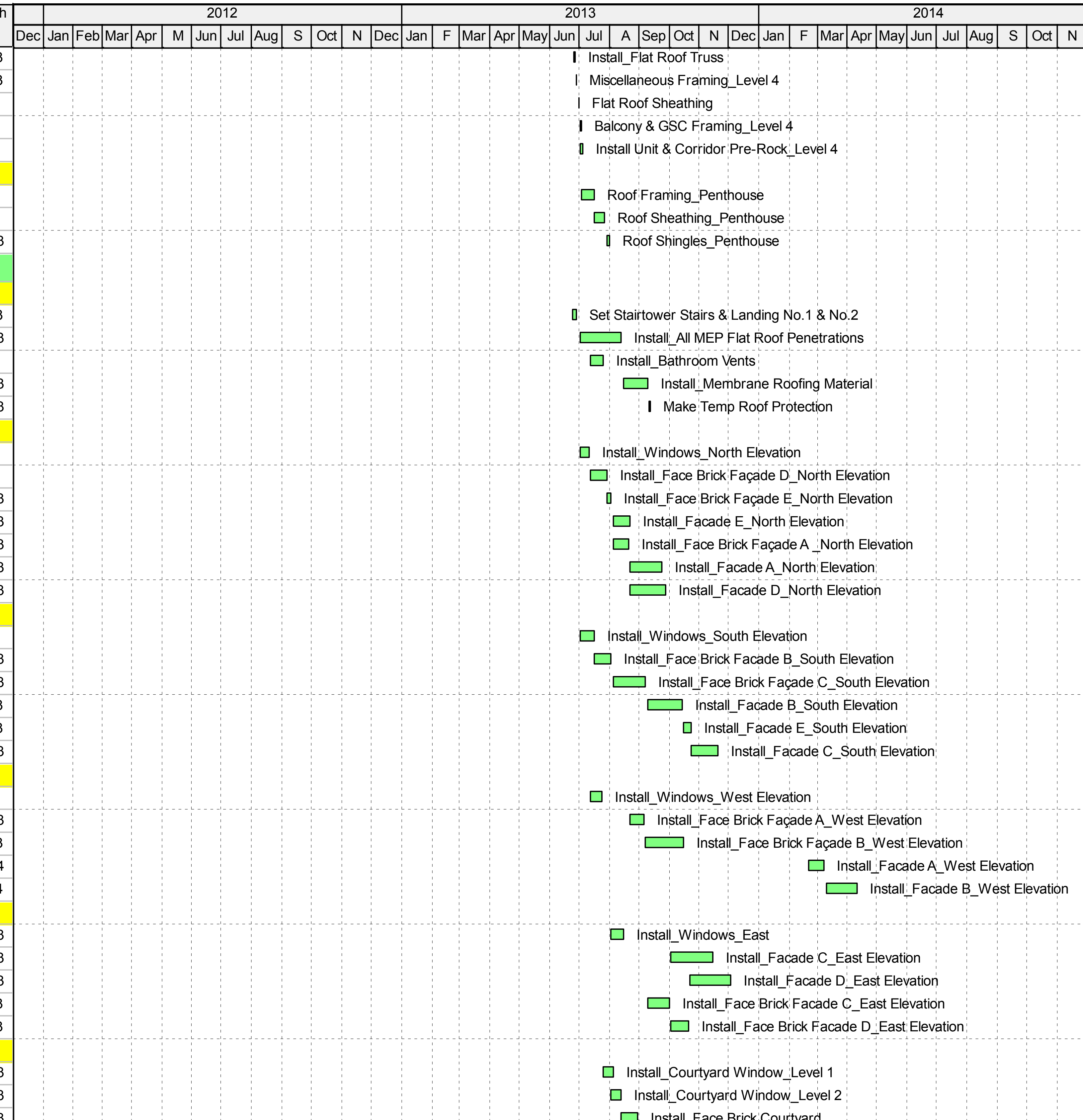
Activity ID	Activity Description	OD	RD	%	Early Start	Early Finish
NO WORK DUE TO HURRICANE SANDY						
A1400	NO WORK_HURRICANE SANDY	5	5	0%	29-Oct-12	02-Nov-12
STRUCTURE						
EXCAVATION						
A1420	Initial Surveying/Layout_Building Corners	1	1	0%	01-Oct-12	01-Oct-12
A1430	Excavate_Garage Column Lines A Thru F	16	16	0%	15-Oct-12	05-Nov-12
A1440	Sheeting & Shoring	25	25	0%	04-Oct-12	07-Nov-12
A1450	Excavate_Garage Column Line F Thru I	14	14	0%	05-Nov-12	23-Nov-12
SUBSTRUCTURE						
A1460	PREP & POUR_SPREAD FTG'S	31	31	0%	26-Nov-12	09-Jan-13
A1470	PREP & POUR & ERECT_TOWER CRANE FTG'S	5	5	0%	30-Nov-12	06-Dec-12
A1480	INSTALL_ELECTRICAL & PLUMBING_UNDESLAB	15	15	0%	19-Dec-12	10-Jan-13
A1490	POUR_SOG_PARKING LEVEL	23	23	0%	07-Jan-13	06-Feb-13
A1500	PREP & POUR_EXT WALL	28	28	0%	02-Jan-13	08-Feb-13
A1510	PREP & POUR_POOL_PODIUM LEVEL	28	28	0%	28-Feb-13	08-Apr-13
A1520	INSTALL_ELEVATOR CMU SHAFT_G1 TO PT ELEV SLAB	15	15	0%	01-Mar-13	21-Mar-13
A1530	INSTALL_STAIRTOWER NO.1 & NO.2_CMU G1 TO PT ELEV :	15	15	0%	01-Mar-13	21-Mar-13
SUPER-STRUCTURE CMU						
A1540	Install_CMU Stairtower_L1 To Roof	43	43	0%	09-Apr-13	07-Jun-13
A1550	Install_CMU Elevator_L1 To Roof	43	43	0%	09-Apr-13	07-Jun-13
LEVEL 1 FRAMING						
A1560	Set Exterior Walls Panels_Level 1	25	25	0%	09-May-13	13-Jun-13
A1570	Balcony & GSC Framing_Level 1	25	25	0%	13-May-13	17-Jun-13
A1580	Interior Partition Walls_Level 1	21	21	0%	13-May-13	11-Jun-13
A1590	Floor Truss System_Level 2	18	18	0%	20-May-13	13-Jun-13
A1600	Miscellaneous Framing_Level 1	17	17	0%	23-May-13	17-Jun-13
A1610	Subfloor Sheathing_Level 2	18	18	0%	28-May-13	20-Jun-13
A1620	Install Unit & Corridor Pre-Rock_Level 1	3	3	0%	21-Jun-13	25-Jun-13
LEVEL 2 FRAMING						
A1630	Set Exterior Walls Panels_Level 2	4	4	0%	16-May-13	21-May-13
A1640	Interior Partition Walls_Level 2	5	5	0%	20-May-13	24-May-13
A1650	Floor Truss System_Level 3	3	3	0%	23-May-13	28-May-13
A1660	Miscellaneous Framing_Level 2	2	2	0%	24-May-13	28-May-13
A1670	Subfloor Sheathing_Level 3	3	3	0%	28-May-13	30-May-13
A1680	Balcony & GSC Framing_Level 2	2	2	0%	30-May-13	31-May-13
A1690	Install Unit & Corridor Pre-Rock_Level 3	3	3	0%	31-May-13	04-Jun-13
LEVEL 3 FRAMING						
A1700	Set Exterior Walls Panels_Level 3	2	2	0%	03-Jun-13	04-Jun-13
A1710	Interior Partition Walls_Level 3	2	2	0%	06-Jun-13	07-Jun-13
A1720	Floor Truss System_Level 4	2	2	0%	10-Jun-13	11-Jun-13
A1730	Miscellaneous Framing_Level 3	2	2	0%	12-Jun-13	13-Jun-13
A1740	Subfloor Sheathing_Level 4	1	1	0%	14-Jun-13	14-Jun-13
A1750	Balcony &GSC Framing_Level 3	1	1	0%	17-Jun-13	17-Jun-13
A1760	Install Unit & Corridor Pre-Rock_Level 3	3	3	0%	17-Jun-13	19-Jun-13
LEVEL 4 FRAMING						
A1770	Set Exterior Walls Panels_Level 4	3	3	0%	18-Jun-13	20-Jun-13
A1780	Interior Partition Walls_Level 4	3	3	0%	21-Jun-13	25-Jun-13

Remaining Work ◆ Milestone
Critical Remaining Work

Date	Revision	Checked	Approved

Block 12

Activity ID	Activity Description	OD	RD	%	Early Start	Early Finish
A1790	Install_Flat Roof Truss	2	2	0%	26-Jun-13	27-Jun-13
A1800	Miscellaneous Framing_Level 4	1	1	0%	28-Jun-13	28-Jun-13
A1810	Flat Roof Sheathing	1	1	0%	01-Jul-13	01-Jul-13
A1820	Balcony & GSC Framing_Level 4	2	2	0%	02-Jul-13	03-Jul-13
A1830	Install Unit & Corridor Pre-Rock_Level 4	3	3	0%	02-Jul-13	05-Jul-13
PENTHOUSE FRAMING						
A1840	Roof Framing_Penthouse	9	9	0%	03-Jul-13	16-Jul-13
A1850	Roof Sheathing_Penthouse	8	8	0%	17-Jul-13	26-Jul-13
A1860	Roof Shingles_Penthouse	4	4	0%	29-Jul-13	01-Aug-13
ENCLOSURE						
ROOFING						
A1870	Set Stairtower Stairs & Landing No.1 & No.2	5	5	0%	24-Jun-13	28-Jun-13
A1880	Install_All MEP Flat Roof Penetrations	29	29	0%	02-Jul-13	12-Aug-13
A1890	Install_Bathroom Vents	10	10	0%	12-Jul-13	25-Jul-13
A1900	Install_Membrane Roofing Material	16	16	0%	16-Aug-13	09-Sep-13
A1910	Make Temp Roof Protection	3	3	0%	10-Sep-13	12-Sep-13
NORTH ELEVATION						
A1920	Install_Windows_North Elevation	7	7	0%	02-Jul-13	11-Jul-13
A1930	Install_Face Brick Façade D_North Elevation	12	12	0%	12-Jul-13	29-Jul-13
A1940	Install_Face Brick Façade E_North Elevation	4	4	0%	30-Jul-13	02-Aug-13
A1950	Install_Facade E_North Elevation	14	14	0%	05-Aug-13	22-Aug-13
A1960	Install_Face Brick Façade A _North Elevation	12	12	0%	05-Aug-13	20-Aug-13
A1970	Install_Facade A_North Elevation	22	22	0%	22-Aug-13	23-Sep-13
A1980	Install_Facade D_North Elevation	26	26	0%	22-Aug-13	27-Sep-13
SOUTH ELEVATION						
A1990	Install_Windows_South Elevation	10	10	0%	02-Jul-13	16-Jul-13
A2000	Install_Face Brick Facade B_South Elevation	13	13	0%	17-Jul-13	02-Aug-13
A2010	Install_Face Brick Façade C_South Elevation	24	24	0%	05-Aug-13	06-Sep-13
A2020	Install_Facade B_South Elevation	26	26	0%	09-Sep-13	14-Oct-13
A2030	Install_Facade E_South Elevation	7	7	0%	15-Oct-13	23-Oct-13
A2040	Install_Facade C_South Elevation	19	19	0%	24-Oct-13	19-Nov-13
WEST ELEVATION						
A2050	Install_Windows_West Elevation	9	9	0%	12-Jul-13	24-Jul-13
A2060	Install_Face Brick Façade A_West Elevation	10	10	0%	22-Aug-13	05-Sep-13
A2070	Install_Face Brick Façade B_West Elevation	28	28	0%	06-Sep-13	15-Oct-13
A2080	Install_Facade A_West Elevation	12	12	0%	20-Feb-14	07-Mar-14
A2090	Install_Facade B_West Elevation	24	24	0%	10-Mar-14	10-Apr-14
EAST ELEVATIONS						
A2100	Install_Windows_East	10	10	0%	02-Aug-13	15-Aug-13
A2110	Install_Facade C_East Elevation	32	32	0%	02-Oct-13	14-Nov-13
A2120	Install_Facade D_East Elevation	29	29	0%	22-Oct-13	02-Dec-13
A2130	Install_Face Brick Facade C_East Elevation	17	17	0%	09-Sep-13	01-Oct-13
A2140	Install_Face Brick Facade D_East Elevation	14	14	0%	02-Oct-13	21-Oct-13
COURTYARD ELEVATIONS						
A2150	Install_Courtyard Window_Level 1	7	7	0%	26-Jul-13	05-Aug-13
A2160	Install_Courtyard Window_Level 2	8	8	0%	02-Aug-13	13-Aug-13
A2170	Install_Face Brick Courtyard	13	13	0%	13-Aug-13	29-Aug-13

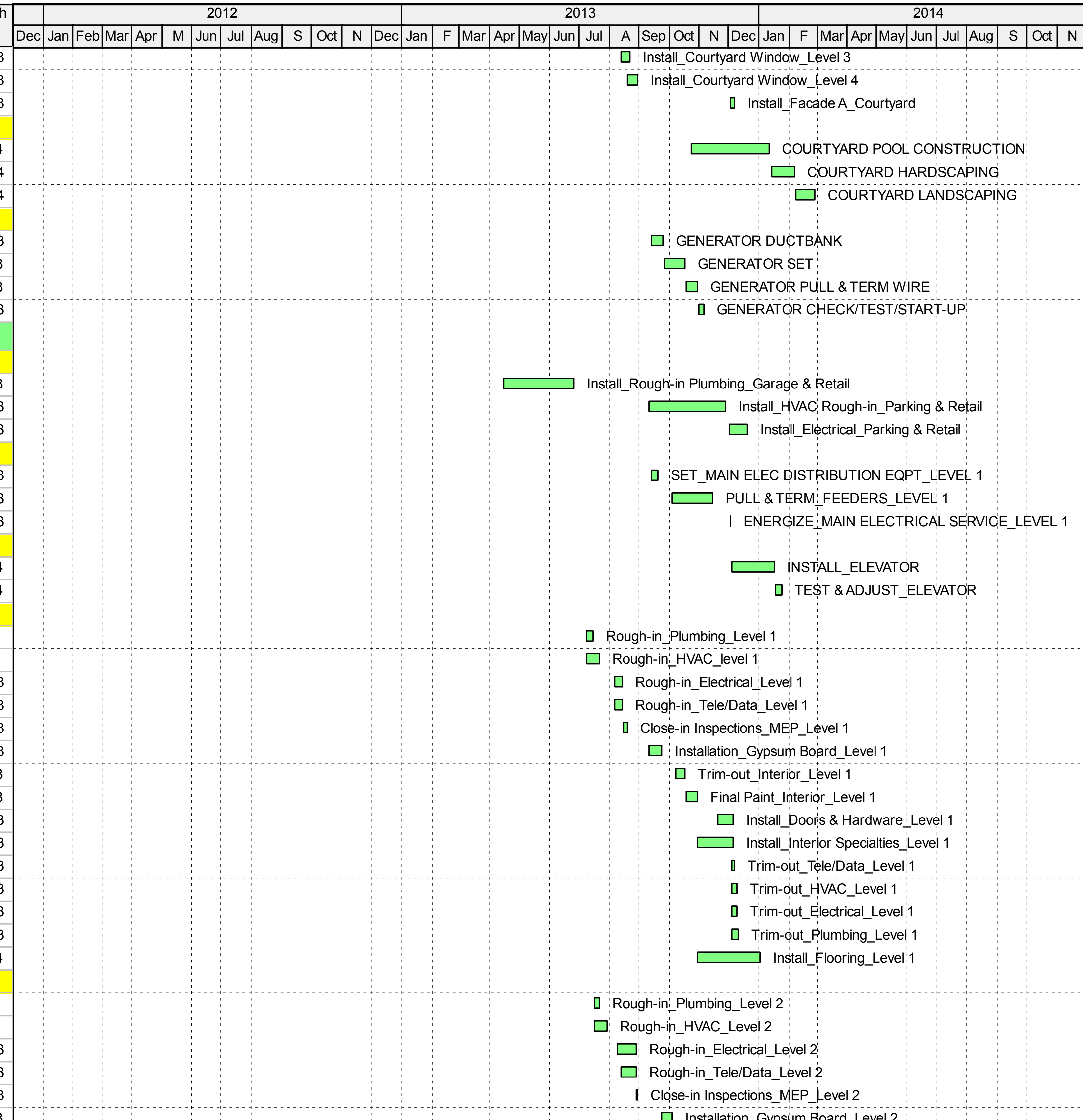


Remaining Work ◆ Milestone

Critical Remaining Work

Date	Revision	Checked	Approved

Activity ID	Activity Description	OD	RD	%	Early Start	Early Finish
A2190	Install_Courtyard Window_Level 3	7	7	0%	13-Aug-13	21-Aug-13
A2210	Install_Courtyard Window_Level 4	8	8	0%	20-Aug-13	29-Aug-13
A2230	Install_Facade A_Courtyard	4	4	0%	03-Dec-13	06-Dec-13
COURTYARD SITE FINISHES						
A2240	COURTYARD POOL CONSTRUCTION	55	55	0%	24-Oct-13	10-Jan-14
A2250	COURTYARD HARDSCAPING	19	19	0%	13-Jan-14	06-Feb-14
A2260	COURTYARD LANDSCAPING	14	14	0%	07-Feb-14	26-Feb-14
EMG GENERATOR						
A2270	GENERATOR DUCTBANK	8	8	0%	13-Sep-13	24-Sep-13
A2280	GENERATOR SET	16	16	0%	26-Sep-13	17-Oct-13
A2290	GENERATOR PULL & TERM WIRE	9	9	0%	18-Oct-13	30-Oct-13
A2300	GENERATOR CHECK/TEST/START-UP	4	4	0%	31-Oct-13	05-Nov-13
ROUGH-INS & FINISHES						
GARAGE & RETAIL ROUGH-INS & FINISHES						
A2310	Install_Rough-in Plumbing_Garage & Retail	51	51	0%	15-Apr-13	25-Jun-13
A2320	Install_HVAC Rough-in_Parking & Retail	57	57	0%	10-Sep-13	27-Nov-13
A2330	Install_Electrical_Parking & Retail	15	15	0%	02-Dec-13	20-Dec-13
MAIN ELECTRICAL ROOMS						
A2340	SET_MAIN ELEC DISTRIBUTION EQPT_LEVEL 1	5	5	0%	13-Sep-13	19-Sep-13
A2350	PULL & TERM_FEEDERS_LEVEL 1	30	30	0%	04-Oct-13	14-Nov-13
A2370	ENERGIZE_MAIN ELECTRICAL SERVICE_LEVEL 1	1	1	0%	03-Dec-13	03-Dec-13
ELEVATORS						
A2380	INSTALL_ELEVATOR	31	31	0%	04-Dec-13	16-Jan-14
A2390	TEST & ADJUST_ELEVATOR	5	5	0%	17-Jan-14	23-Jan-14
LEVEL 1 ROUGH-INS & FINISHES						
A2400	Rough-in_Plumbing_Level 1	5	5	0%	09-Jul-13	15-Jul-13
A2410	Rough-in_HVAC_level 1	10	10	0%	09-Jul-13	22-Jul-13
A2420	Rough-in_Electrical_Level 1	7	7	0%	06-Aug-13	14-Aug-13
A2430	Rough-in_Tele/Data_Level 1	7	7	0%	06-Aug-13	14-Aug-13
A2440	Close-in Inspections_MEP_Level 1	2	2	0%	16-Aug-13	19-Aug-13
A2450	Installation_Gypsum Board_Level 1	10	10	0%	10-Sep-13	23-Sep-13
A2460	Trim-out_Interior_Level 1	8	8	0%	08-Oct-13	17-Oct-13
A2470	Final Paint_Interior_Level 1	8	8	0%	18-Oct-13	29-Oct-13
A2480	Install_Doors & Hardware_Level 1	11	11	0%	20-Nov-13	05-Dec-13
A2490	Install_Interior Specialties_Level 1	26	26	0%	30-Oct-13	05-Dec-13
A2500	Trim-out_Tele/Data_Level 1	3	3	0%	04-Dec-13	06-Dec-13
A2510	Trim-out_HVAC_Level 1	4	4	0%	04-Dec-13	09-Dec-13
A2520	Trim-out_Electrical_Level 1	4	4	0%	04-Dec-13	09-Dec-13
A2530	Trim-out_Plumbing_Level 1	5	5	0%	04-Dec-13	10-Dec-13
A2540	Install_Flooring_Level 1	45	45	0%	30-Oct-13	02-Jan-14
LEVEL 2 ROUGH-INS & FINISHES						
A2550	Rough-in_Plumbing_Level 2	5	5	0%	16-Jul-13	22-Jul-13
A2560	Rough-in_HVAC_Level 2	10	10	0%	16-Jul-13	29-Jul-13
A2570	Rough-in_Electrical_Level 2	14	14	0%	09-Aug-13	28-Aug-13
A2580	Rough-in_Tele/Data_Level 2	12	12	0%	13-Aug-13	28-Aug-13
A2590	Close-in Inspections_MEP_Level 2	2	2	0%	29-Aug-13	30-Aug-13
A2600	Installation_Gypsum Board_Level 2	8	8	0%	24-Sep-13	03-Oct-13

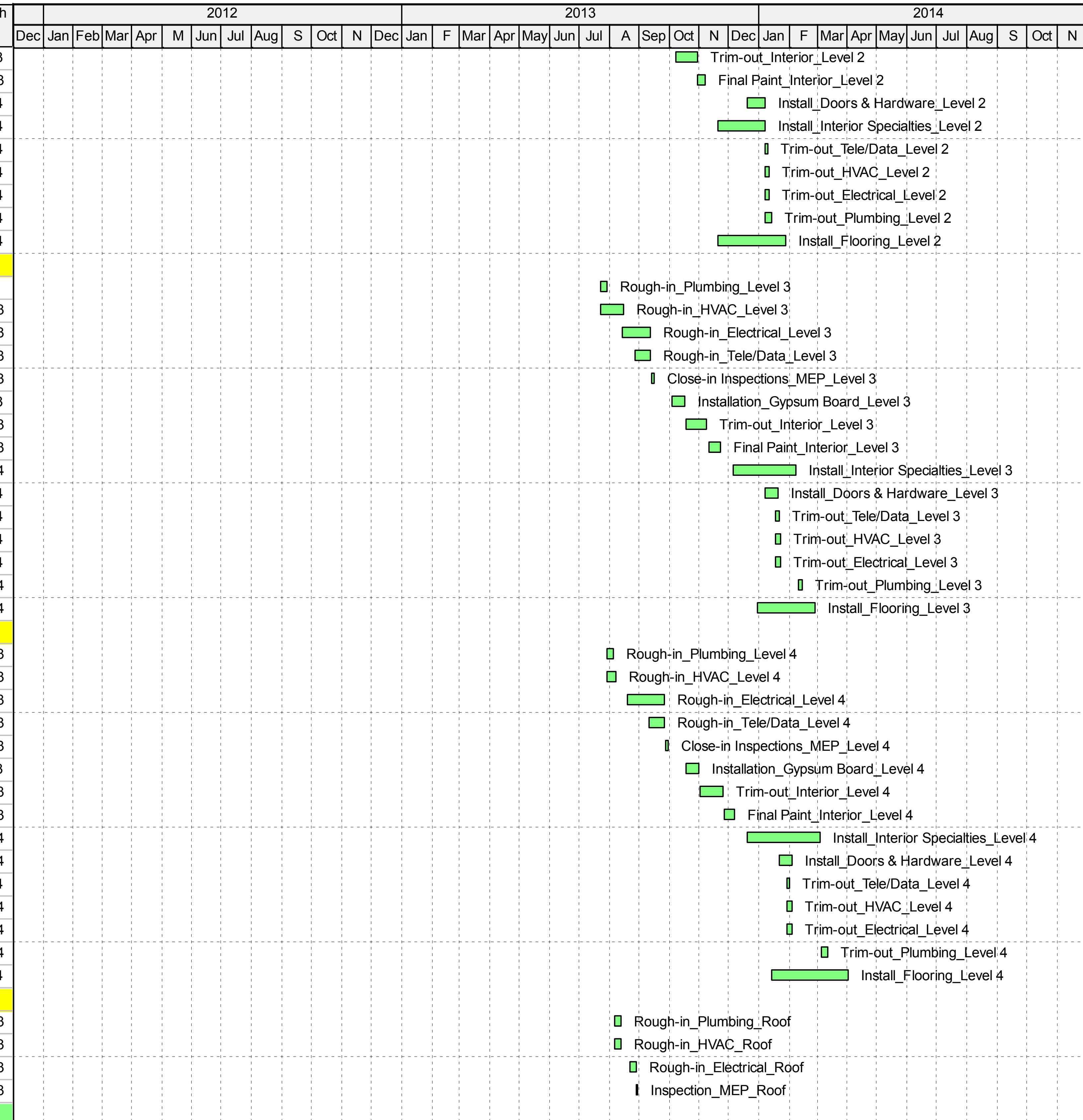


Remaining Work ◆ Milestone
Critical Remaining Work

Date	Revision	Checked	Approved

Block 12

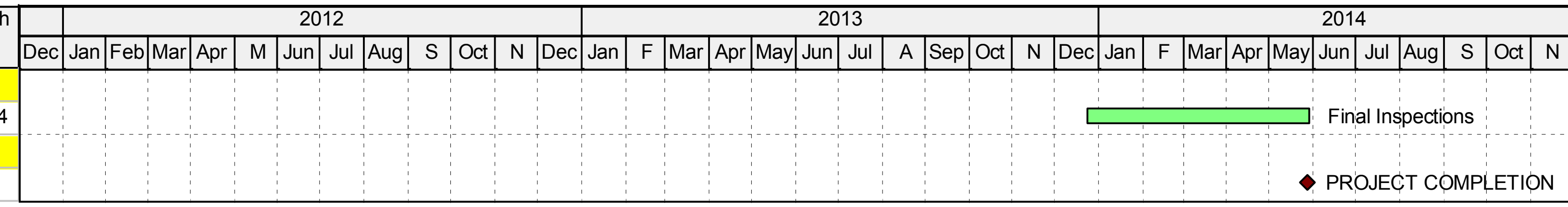
Activity ID	Activity Description	OD	RD	%	Early Start	Early Finish
A2610	Trim-out_Interior_Level 2	16	16	0%	08-Oct-13	29-Oct-13
A2620	Final Paint_Interior_Level 2	7	7	0%	30-Oct-13	07-Nov-13
A2630	Install_Doors & Hardware_Level 2	11	11	0%	20-Dec-13	06-Jan-14
A2640	Install_Interior Specialties_Level 2	32	32	0%	20-Nov-13	06-Jan-14
A2650	Trim-out_Tele/Data_Level 2	3	3	0%	07-Jan-14	09-Jan-14
A2660	Trim-out_HVAC_Level 2	4	4	0%	07-Jan-14	10-Jan-14
A2670	Trim-out_Electrical_Level 2	4	4	0%	07-Jan-14	10-Jan-14
A2680	Trim-out_Plumbing_Level 2	5	5	0%	07-Jan-14	13-Jan-14
A2690	Install_Flooring_Level 2	47	47	0%	20-Nov-13	27-Jan-14
LEVEL 3 ROUGH-INS & FINISHES						
A2740	Rough-in_Plumbing_Level 3	5	5	0%	23-Jul-13	29-Jul-13
A2750	Rough-in_HVAC_Level 3	18	18	0%	23-Jul-13	15-Aug-13
A2760	Rough-in_Electrical_Level 3	21	21	0%	14-Aug-13	12-Sep-13
A2770	Rough-in_Tele/Data_Level 3	12	12	0%	27-Aug-13	12-Sep-13
A2780	Close-in Inspections_MEP_Level 3	2	2	0%	13-Sep-13	16-Sep-13
A2790	Installation_Gypsum Board_Level 3	10	10	0%	04-Oct-13	17-Oct-13
A2800	Trim-out_Interior_Level 3	16	16	0%	18-Oct-13	08-Nov-13
A2810	Final Paint_Interior_Level 3	10	10	0%	11-Nov-13	22-Nov-13
A2820	Install_Interior Specialties_Level 3	45	45	0%	06-Dec-13	07-Feb-14
A2830	Install_Doors & Hardware_Level 3	10	10	0%	07-Jan-14	20-Jan-14
A2840	Trim-out_Tele/Data_Level 3	3	3	0%	17-Jan-14	21-Jan-14
A2850	Trim-out_HVAC_Level 3	4	4	0%	17-Jan-14	22-Jan-14
A2860	Trim-out_Electrical_Level 3	4	4	0%	17-Jan-14	22-Jan-14
A2870	Trim-out_Plumbing_Level 3	5	5	0%	10-Feb-14	14-Feb-14
A2880	Install_Flooring_Level 3	43	43	0%	30-Dec-13	26-Feb-14
LEVEL 4 ROUGH-INS & FINISHES						
A2890	Rough-in_Plumbing_Level 4	5	5	0%	30-Jul-13	05-Aug-13
A2900	Rough-in_HVAC_Level 4	7	7	0%	30-Jul-13	07-Aug-13
A2910	Rough-in_Electrical_Level 4	28	28	0%	19-Aug-13	26-Sep-13
A2920	Rough-in_Tele/Data_Level 4	12	12	0%	11-Sep-13	26-Sep-13
A2930	Close-in Inspections_MEP_Level 4	2	2	0%	27-Sep-13	30-Sep-13
A2940	Installation_Gypsum Board_Level 4	10	10	0%	18-Oct-13	31-Oct-13
A2950	Trim-out_Interior_Level 4	17	17	0%	01-Nov-13	25-Nov-13
A2960	Final Paint_Interior_Level 4	8	8	0%	26-Nov-13	06-Dec-13
A2970	Install_Interior Specialties_Level 4	52	52	0%	20-Dec-13	04-Mar-14
A2980	Install_Doors & Hardware_Level 4	10	10	0%	21-Jan-14	03-Feb-14
A2990	Trim-out_Tele/Data_Level 4	3	3	0%	29-Jan-14	31-Jan-14
A3000	Trim-out_HVAC_Level 4	4	4	0%	29-Jan-14	03-Feb-14
A3010	Trim-out_Electrical_Level 4	4	4	0%	29-Jan-14	03-Feb-14
A3020	Trim-out_Plumbing_Level 4	5	5	0%	05-Mar-14	11-Mar-14
A3030	Install_Flooring_Level 4	56	56	0%	14-Jan-14	01-Apr-14
ROOF LEVEL ROUGH-INS & FINISHES						
A3040	Rough-in_Plumbing_Roof	6	6	0%	06-Aug-13	13-Aug-13
A3050	Rough-in_HVAC_Roof	6	6	0%	06-Aug-13	13-Aug-13
A3060	Rough-in_Electrical_Roof	5	5	0%	22-Aug-13	28-Aug-13
A3070	Inspection_MEP_Roof	2	2	0%	29-Aug-13	30-Aug-13
CLOSE-OUT						



Remaining Work ◆ ◆ Milestone
Critical Remaining Work

Date	Revision	Checked	Approved

Activity ID	Activity Description	OD	RD	%	Early Start	Early Finish
CLOSE-OUT						
A30800	Final Inspections	112	112	0%	23-Dec-13	28-May-14
COMPLETION MILESTONES						
A30900	PROJECT COMPLETION	0	0	0%	28-May-14	



Remaining Work
Critical Remaining Work
Milestone

Date	Revision	Checked	Approved

General Conditions

CODE	DESCRIPTION OF WORK		Cost Per Month	Duration of Time	Units	Avg. Cost Per GSF	Avg. Cost Per Unit	Total Cost
	RS Means Description	ITEM						
	PERSONNEL							
13113200220	Field personnel, project manager, maximum	Sr. Project Manager	$7,600.00	20	Month	$0.61	$873.56	$152,000.00
13113200200	Field personnel, project manager, average	Project Manager	$6,600.00	20	Month	$0.53	$758.62	$132,000.00
13113200120	Field personnel, field engineer, average	Project Engineer	$4,100.00	20	Month	$0.33	$471.26	$82,000.00
13113200280	Field personnel, superintendent, maximum	Superintendent	$7,000.00	20	Month	$0.56	$804.60	$140,000.00
13113200240	Field personnel, superintendent, minumum	Asst. Superintendent	$5,600.00	20	Month	$0.45	$643.68	$112,000.00
13113200160	Field personnel, general purpose laborer, average	Laborer	$4,400.00	20	Month	$0.35	$505.75	$88,000.00
	TEMPORARY SERVICES							
		Vehicles	$45,000.00	1	LS	$0.18	$258.62	$45,000.00
	PROJECT RELATED TRAVEL							
		Vehicle Mileage Charges	$63,000.00	1	LS	$0.25	$362.07	$63,000.00
	TEMPORARY STRUCTURES							
		Site set-up	$15,000.00	1	LS	$0.06	$86.21	$15,000.00
15213200350	Office Trailer, furnished, rent per month, 32' x 8', w/ air cond.	Trailer rental	$1,397.58	20	Month	$0.11	$160.64	$27,951.60
15213201350	Storage Boxes, rent per month, 40' x 8'	Storage trailer	$100.67	20	Month	$0.01	$11.57	$2,013.40
	FIELD OFFICE COST							
15213400100	Field Office Expense, office equipment rental, average	Office equipment rental	$197.40	20	Month	$0.02	$22.69	$3,948.00
		PC support	$27,000.00	1	LS	$0.11	$155.17	$27,000.00
		Office supplies	$2,000.00	20	Month	$0.16	$229.89	$40,000.00
		Postage and shipping	$850.00	20	Month	$0.07	$97.70	$17,000.00
15213400140	Field Office Expense, telephone bill; avg. bill/month, incl. long distance	Phone system and Nextels	$79.95	20	Month	$0.01	$9.19	$1,599.00
		Drawings and specifications	$4,200.00	20	Month	$0.34	$482.76	$84,000.00
13233500500	Construction photographs, aerial photos, initial fly-over, 6 shots, 1 print ea., 8" x 10" prints	Progress photo's & as-built	$14,286.90	1	LS	$0.06	$82.11	$14,286.90
	Potable water and cofee	Coffee and drinking water	$320.00	20	Month	$0.03	$36.78	$6,400.00
	SITE COST							
15213400140	Field Office Expense, telephone bill; avg. bill/month, incl. long distance	Tool-box safety meetings & training	$79.95	20	Month	$0.01	$9.19	$1,599.00
15813500020	Project signs, sign, high intensity reflectorized, buy, excl. posts	Project Sign	$20,000.00	1	LS	$0.08	$114.94	$20,000.00
15813500020	Project signs, sign, high intensity reflectorized, buy, excl. posts	Safety signage	$14,000.00	1	LS	$0.06	$80.46	$14,000.00
		Rental equipment	$2,600.00	20	Month	$0.21	$298.85	$52,000.00
17413200050	Cleaning up, cleanup of floor area, continuous, per day, during construction	Common Area Cleaning	$5,505.00	1	LS	$0.02	$31.64	$5,505.00
		Window Breakage	$4,200.00	1	LS	$0.02	$24.14	$4,200.00
15213400120	Field Office Expense, office supplies, average	Small Tools and Supplies	$74.03	20	Month	$0.01	$8.51	$1,480.60
320130107430	Site maintenance, tree maintenance, pest control, spray, systemic	Pest Control	$545.00	1	LS	$0.00	$3.13	$545.00
15419600100	Crane crew, tower crane, static, 130' high, 106' jib, 6200 lb. capacity, monthly use	Large Crane	$28,822.60	6	Month	$0.69	$993.88	$172,935.60
15433603150	Rent crane, self-propelled, 4x4, telescoping boom, 40 ton, Incl. Hourly Oper. Cost	Self-Propelled Crane	$16,064.64	6	Month	$0.39	$553.95	$96,387.84
15433604000	Rent hoist & tower, portable electric, 5000 lb, 40' high, Incl. Hourly Oper. Cost	Hoist & Tower	$4,262.08	4	Month	$0.07	$97.98	$17,048.32
	UTILITIES							
15213400160	Field Office Expense, field office lights & HVAC	Temporary Electric	$150.02	20	Month	$0.01	$17.24	$3,000.40
	Potable water	Temporary Water	$80.00	20	Month	$0.01	$9.20	$1,600.00
15433406430	Rent toilet, fresh water flush, garden hose, Incl. Hourly Oper. Cost.	Temporary Toilets	$1,247.44	20	Month	$0.10	$143.38	$24,948.80
15523500050	Temporary, roads, gravel fill, 4" gravel depth, excl surfacing	Temporary Roads	$7,500.00	1	LS	$0.03	$43.10	$7,500.00
15626500250	Temporary Fencing, chain link, rented up to 12 months, 6' high, 11 ga, over 1000'	Temporary Fences	$16,500.00	1	LS	$0.07	$94.83	$16,500.00
15623100300	Barricades, wood barrier walls, stock units, plain buy, 6' high, 8' wide	Temporary Walls and Barricades	$2,300.00	1	LS	$0.01	$13.22	$2,300.00
	CLOSE-OUT							
		Punch-out supplies:	$2,500.00	6	MO	$0.06	$86.21	$15,000.00
				TOTAL		$6.04	$8,676.72	**$1,509,749.46**

Notes:
174 Units
250,000 GSF

KEY:

- Property Line
- Traffic Flow
- Existing Sanitary Sewer
- Existing Water Conduit
- Existing Overhead Wires
- Existing Telephone/ Communications Conduit
- Fire Extinguisher

BUILDING 12
EXISTING CONDITIONS

ROCKVILLE, MD

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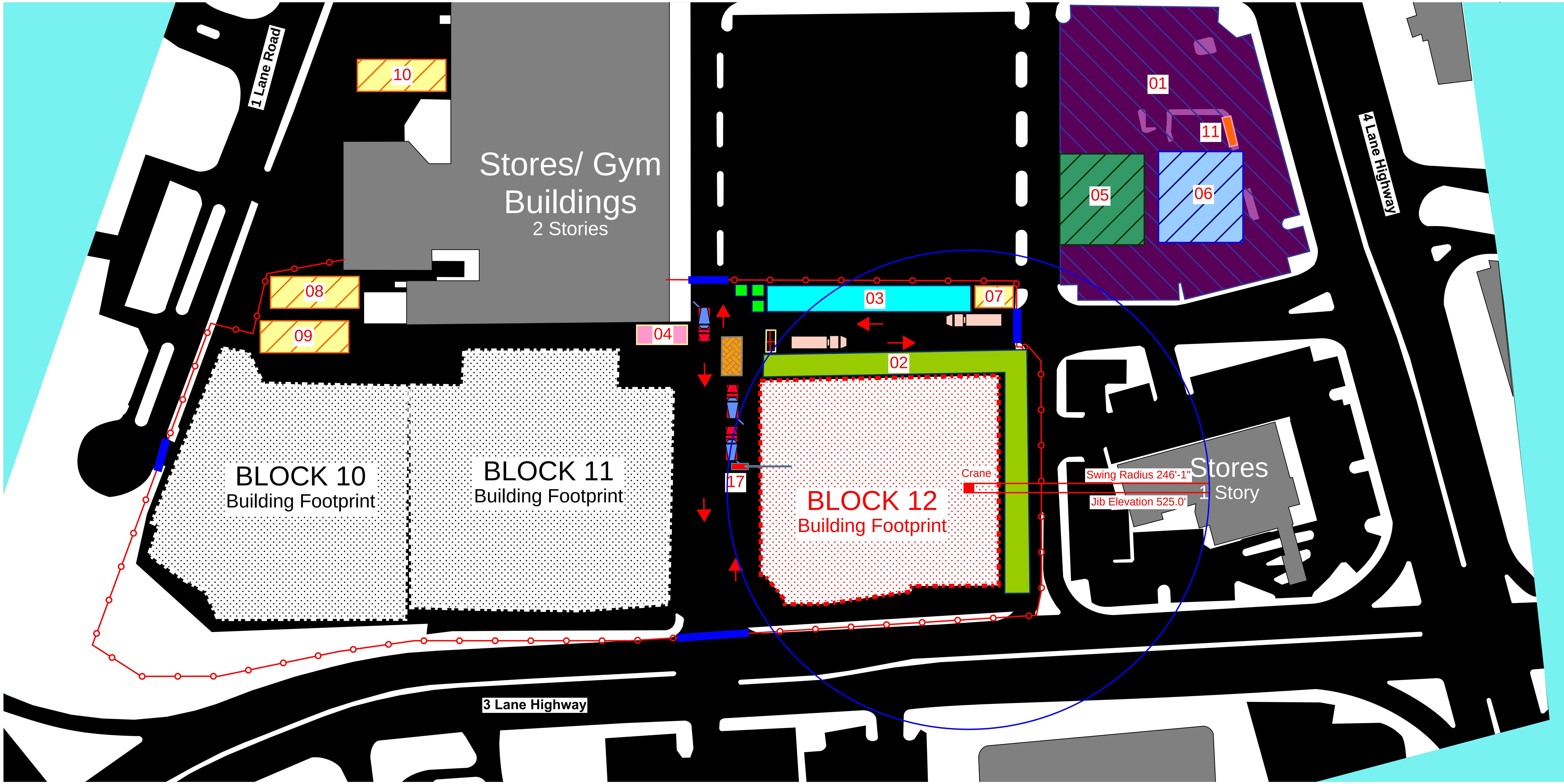
9.15.2013



LEGEND:

1. Parking
2. Contractor Staging Area
3. Material Storage Area
4. Dumpsters
5. CM Trailer
6. Owner's Rep. Trailer
7. Electrical Trailer
8. Mechanical Trailer
9. Concrete Trailer
10. Plumbing Trailer
11. Temporary Power
12. Concrete Wash Down Area
13. Construction Fence
14. Gate/ Construction
15. Tire Wash Racks
16. Portable Toilets
17. Concrete Pump/ Pipe
18. Concrete Truck
19. Delivery Truck

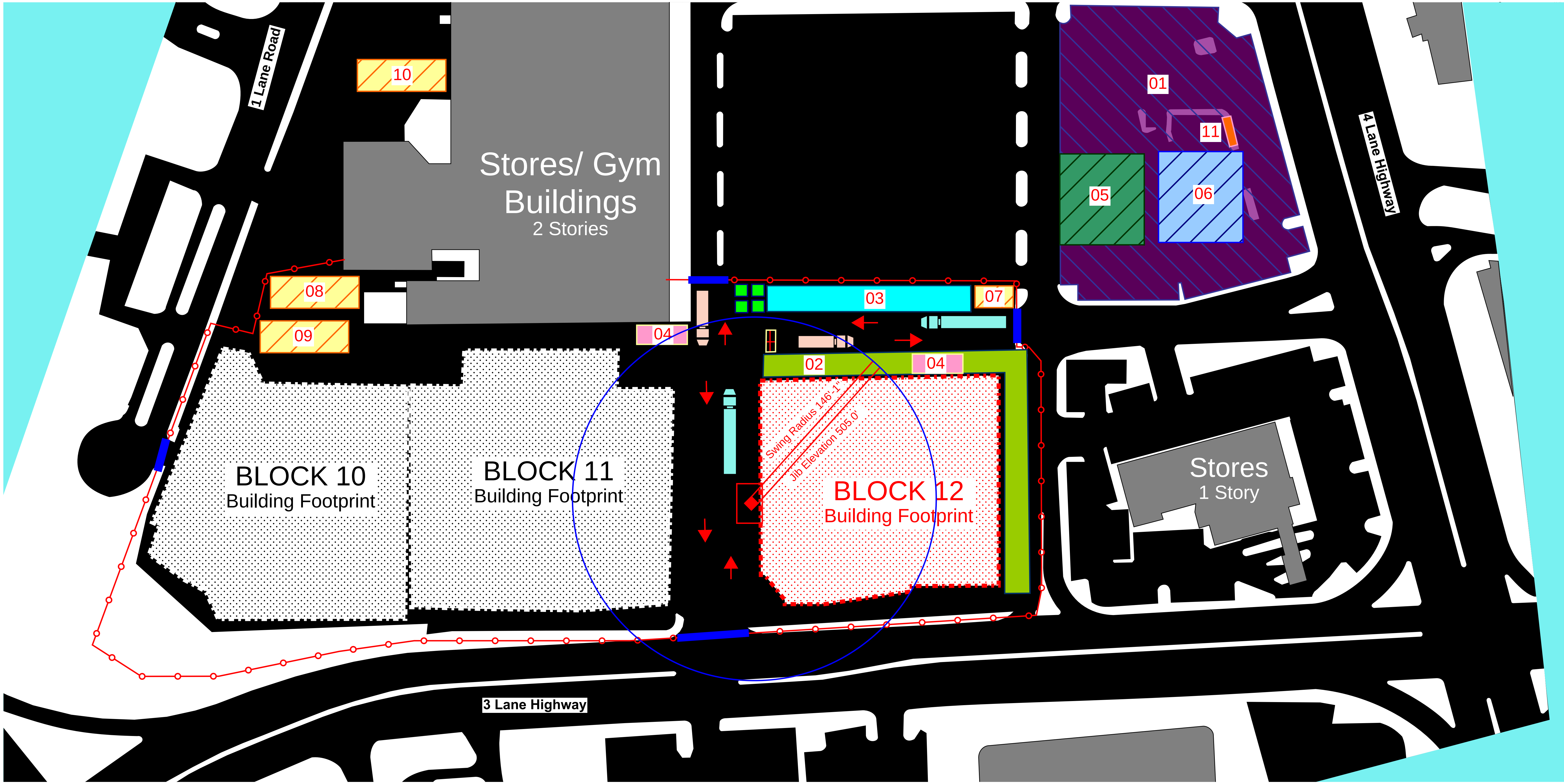
BLOCK 12

Site Logistics: Substructure

Scale:
1"= 100'

ROCKVILLE, MD

Josue Fernandez
9.31.2013



LEGEND:

1. Parking
2. Contractor Staging Area
3. Material Storage Area
4. Dumpsters
5. CM Trailer
6. Owner's Rep. Trailer
7. Electrical Trailer
8. Mechanical Trailer
9. Concrete Trailer
10. Plumbing Trailer
11. Temporary Power
12. NOT USED
13. Construction Fence
14. Gate/ Construction
15. Tire Wash Racks
16. Portable Toilets
17. Mobile Crane
18. Flatbed Delivery Trucks
19. Delivery Trucks

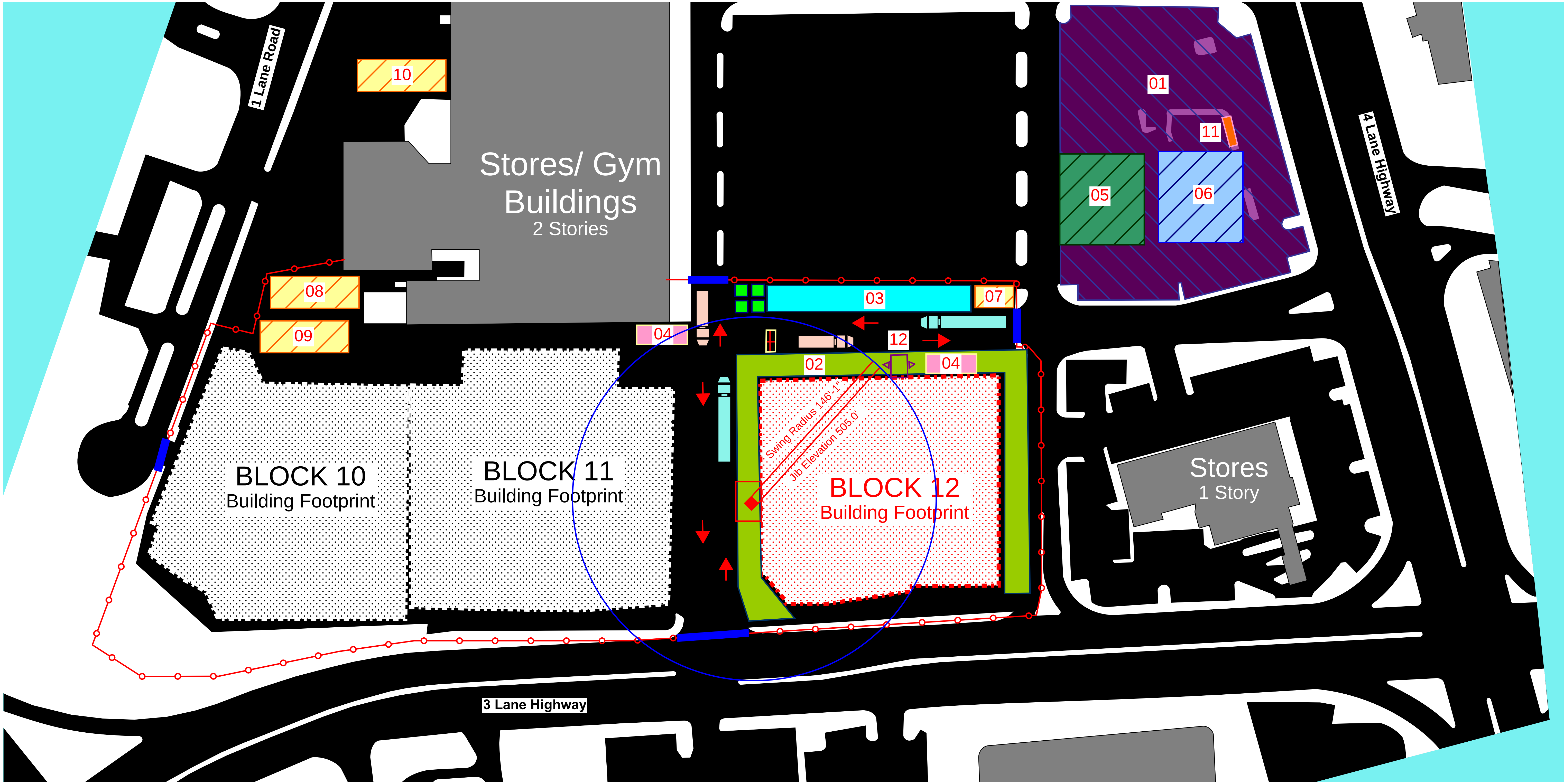
BLOCK 12

Site Logistics: Structure

Scale:
1"= 100'

ROCKVILLE, MD

Josue Fernandez
9.31.2013



LEGEND:

1. Parking
2. Contractor Staging Area
3. Material Storage Area
4. Dumpsters
5. CM Trailer
6. Owner's Rep. Trailer
7. Electrical Trailer
8. Mechanical Trailer
9. Concrete Trailer
10. Plumbing Trailer
11. Temporary Power
12. Construction Hoist
13. Construction Fence
14. Gate/ Construction
15. Tire Wash Racks
16. Portable Toilets
17. Mobile Crane
18. Flatbed Delivery Trucks
19. Delivery Trucks

BLOCK 12

Site Logistics: Enclosure

Scale:
1"= 100'

ROCKVILLE, MD

Josue Fernandez
9.31.2013

PROJECT GOALS / BIM USE

1. MAJOR BIM GOALS / OBJECTIVES:

PRIORITY (HIGH/ MED/ LOW)	GOAL DESCRIPTION	POTENTIAL BIM USES
HIGH	Minimize coordination issues in pre-construction for construction	3D Coordination (Design & Construction), Existing Conditions Modeling, Site Utilization Planning, Site Analysis, Design Authoring, 4D Modeling
HIGH	Accurate schedule and cost analysis	Phase Planning, Existing Conditions Modeling, Cost Estimation, Phase Planning
MED	Ensure high performance exterior enclosure (thermal, acoustic, and daylight)	Energy Modeling, Lighting Analysis, Energy Analysis, Other Eng. Analysis, Quality Assurance, Material Selection, Design Reviews
MED	Facility usage, operations, and maintenance	Building Maintenance Scheduling, Building System Analysis, Asset Management, Disaster Planning, Record Modeling
HIGH	Life-cycle analysis	Record Modeling, Engineering Analysis
HIGH	Reduce construction costs	Digital Fabrication, 3D Control and Planning, Construction System Design, Design Reviews

2. BIM GOALS & USE WORKSHEET: <u>ATTACHMENT 10</u>

3. BIM USES:

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
M	PROGRAMMING	X	DESIGN AUTHORING	X	SITE UTILIZATION PLANNING	X	BUILDING MAINTENANCE SCHEDULING
X	SITE ANALYSIS	X	DESIGN REVIEWS	X	CONSTRUCTION SYSTEM DESIGN	M	SPACE MANAGEMENT / TRACKING
		X	3D COORDINATION	X	3D COORDINATION	M	DISASTER PLANNING
		X	STRUCTURAL ANALYSIS	X	DIGITAL FABRICATION	X	RECORD MODELING
		X	LIGHTING ANALYSIS	X	3D CONTROL AND PLANNING		
		X	ENERGY ANALYSIS	X	RECORD MODELING		
		X	MECHANICAL ANALYSIS	X	QUALITY ASSURANCE		
		X	OTHER ENG. ANALYSIS				
		X	SUSTAINABLITY (LEED) EVALUATION				
		M	CODE VALIDATION				
X	PHASE PLANNING (4D MODELING)	X	PHASE PLANNING (4D MODELING)	X	PHASE PLANNING (4D MODELING)		
X	COST ESTIMATION	X	COST ESTIMATION	X	COST ESTIMATION		
X	EXISTING CONDITIONS MODELING	X	EXISTING CONDITIONS MODELING	X	EXISTING CONDITIONS MODELING		

BIM PROCESS DESIGN- LEVEL ONE

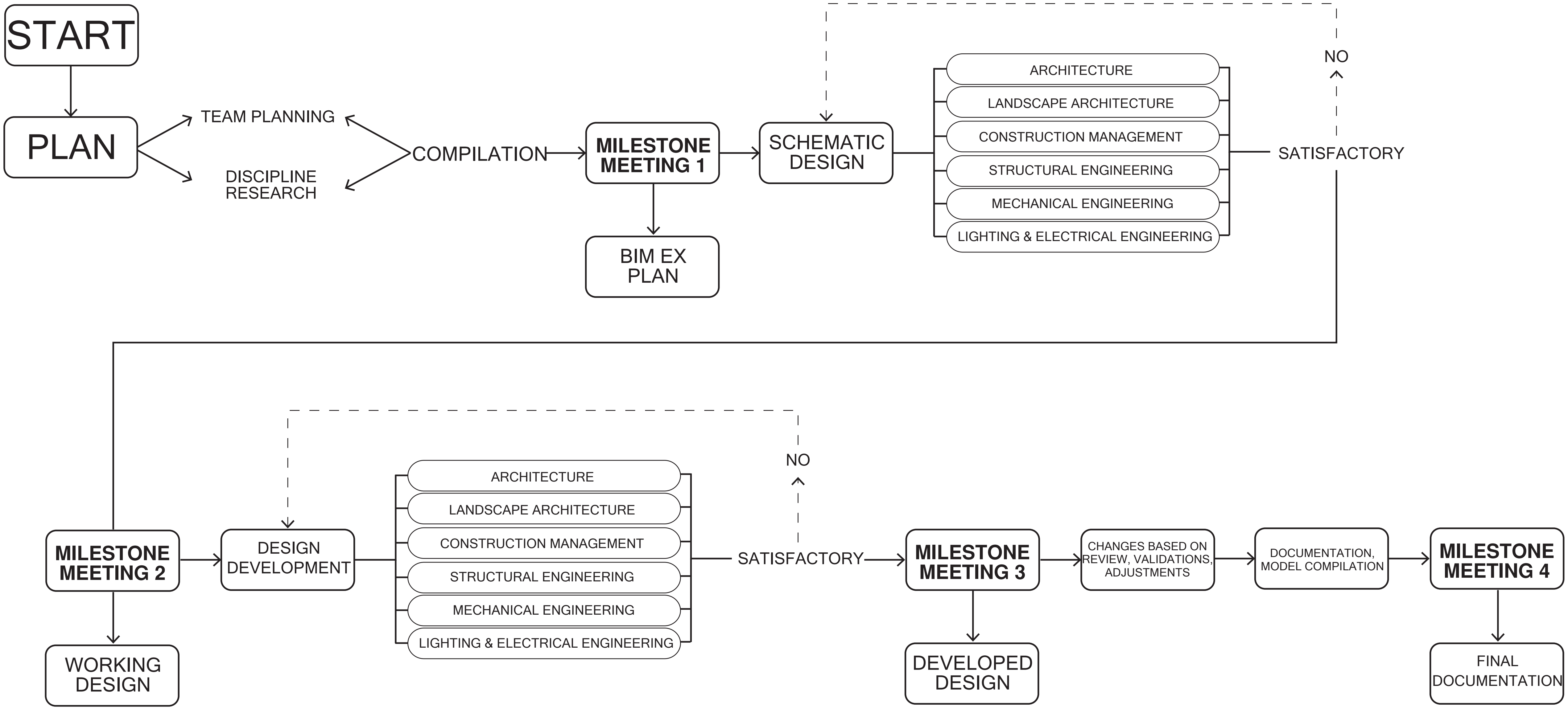
1. **LEVEL ONE TEAM PROCESS OVERVIEW MAP: ATTACHMENT 11**

2. **LEVEL ONE BIM PROCESS OVERVIEW MAP: ATTACHMENT 12**

BIM GOALS & USE WORKSHEET

BIM Use	Project Importance	Disciplines Involved	Discipline Importance	Necessary Data
Planning				
Site Analysis	MED	LA	1	Soil conditions, water table, geotechnical report
		SE	2	Geotechnical report
		A	1	Design information and programing requirements
		CM	3	Geotechnical report
Cost Estimation (ROM)	MED	CM	3	General design program/scope
Design				
Mechanical Analysis	HIGH	ME	3	Load calculations, ventilation req.
Structural Analysis	HIGH	SE	3	Wind, seismic, gravity load calculations
Lighting Analysis	HIGH	LE	3	Daylight analysis, light levels, space moods
Energy Analysis	HIGH	ME	3	Utility costs, system options, loads
LEED Evaluation	MED	ME	2	Ensure LEED req. are met in system design
		LE	1	Daylight, power savings
		CM	1	Trash reduction, transportation, materials
		A	1	Materials, daylighting
		SE	2	Sustainable materials, preliminary design
		LA	1	Rain water system, materials
Cost Estimation (SF)	MED	CM	3	Design scopes, take-offs
Layout Control and Planning	MED	A	3	Interior space layout, coordination with LA for exterior
		ME	2	Acoustical considerations, equipment space placed efficiently
		LA	3	Site layout, overall planning
3D Coordination	HIGH	A	1	Design goals for overall systems interactions
		ME	1	Systems interaction with other disciplines
		LE	1	Systems interaction with other disciplines
		SE	1	Systems interaction with other disciplines
		CM	2	Clash detection, resolve issues
4D Modeling	MED	CM	2	Site use, time considerations, construction methods
Design Reviews	HIGH	A	2	Ensure aesthetics, project goals conveyed
		LA	2	Aesthetically pleasing, materials, good use of spaces
		ME	2	Coordination, feasibility
		LE	2	Coordination with architecture, spatial impressions
		SE	2	Architectural coordination, aesthetics
		CM	2	Constructability, feasible solutions, potential savings
Construction				
3D Coordination	HIGH	A	1	Clashes, visualization
		SE	2	Clash detection
		ME	2	Clash detection
		LE	2	Clash detection
		CM	1	Clash detection
4D Modeling	HIGH	CM	2	Site planning with time considerations in mind, schedule
Site Utilization Planning	MED	CM	3	Site resource planning, scheduling, phasing construction
Operation				
Maintenance Scheduling	MED	ME	3	System specs, replacement, scheduled maintenance
		LE	3	System specs, lamp life, replacement, backup systems
		CM	3	As built records
		LA	3	Planting schedules, plant requirements
Record Modeling	MED	A	3	Design documentations for owner use and future clients
		LA	3	Design documentation, future clients
		ME	2	Usable records for future use
		LE	2	Usable records for future use
		CM	2	Quality model, as built
		SE	1	Usable records for future use

LEVEL 1 TEAM PROCESS OVERVIEW MAP



LEVEL 1: BIM EXECUTION PLANNING PROCESS
BLOCK 12

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