Technical Assignment #2

Cost & Schedule Analysis

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Construction Option

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Executive Summary

The purpose of this report is to investigate and analyze different aspects of a building project located in Washington, D.C. known as *Louis at 14th*, owned by JBG Companies and being built by Balfour Beatty Construction. At the corner of 14th St & U St, this is an entirely new nine-story residential building with street level retail spaces. It is pursuing a LEED Silver green building certification and shall replace existing two-story retail buildings and a parking lot on the property. Construction of *Louis at 14th* began in March of 2012 and is scheduled for completion at the beginning of 2014.

The site layout planning is introduced first with excavation, superstructure, and finishing phase plans, the majority of which require the closing of the public sidewalk on 14th St. The excavation site plan portrays the different levels of excavation with appropriate support and means of entry & exit throughout the building footprint shown. The superstructure site plan implements the tower crane location and reveals the swing radius to potentially interfere with adjacent buildings where extra precautions are strongly recommended.

Estimations of the major building systems are provided and compared to the actual system expenses. Using R.S. Means 2012 cost data, the cast-in-place concrete structural system was estimated in a detailed manner, while the mechanical, electrical, & plumbing systems were estimated using assemblies as noted. Any details, assumptions & adjustments made to accurately portray the actual cost of the building are explained. Also included is a general conditions estimate that has been performed in a similar manner.

The project schedule included is a simplified version of the actual schedule with the same critical path and key milestones. Workflow in this schedule moves activities from the excavation up to the top floor until completion, whereas the actual schedule incorporates workflow throughout each floor level, too. The project concludes as lower floors are turned over for occupancy first, followed by the remaining top floors per their anticipated completion dates.

Critical constructability issues occurring on the project are also addressed, which include the window systems, dewatering wells, and the historic façade. The challenge of each issue is analyzed and resolved using methods practiced by the actual project team.

The report concludes with a LEED evaluation that analyzes the potential of the building to incorporate sustainability. The actual LEED goals referenced are compared by category to an approach practiced by the Pennsylvania State University for its own building projects.

Site Layout Planning

Located at the corner of 14th St and U St in Washington, D.C., the east side of the proposed building sits on the edge of the sidewalk of 14th St, while the rear of the building meets a public alley. Adjacent buildings, one of which houses the field office, adjoin the north and south sides of the property. The public sidewalk on 14th St will be closed for the majority of the construction, directing passerby through street parking spaces accompanied by flagmen as necessary. The trees shown will also be protected throughout the duration of construction.

Please see Appendix A for site layout plans.

Excavation

During the excavation phase, the deepest area of the foundation will be where the underground parking garage is located on the south side of the building footprint. The perimeter of this area will have soldier piles, lagging, and tiebacks installed to support the excavation, along with extra support protecting the historic façade on the east edge. Sump pits and dewatering systems are to be installed in this area, as well.

Temporary ramps will be put in place to adjoin the garage level, north foundation level, and the street level. Soil shall be hauled out using these ramps and the gates on 14th St. Contractors will have extra access for equipment and accessories through the west public alley.

Superstructure

Prior to the superstructure taking its place, a tower crane is to be installed with the pad being located at the center east edge of the building footprint. The swing radius is able to reach the farthest northwest corner of the property at this point. The adjacent buildings on the south are not of significant concern to the swing radius, but the 9-story building to the west is a critical obstacle that requires careful attention.

Changes will commence as the structure rises, one being the loading dock and trash chute located in the public alley. Material hoists will also be installed as necessary. Once the cast-in-place concrete work is completed in the garage levels, contractors will be able to use the garage entrance for parking and material storage pending the demands of remaining work in those spaces.

Finishes

Prior the closing phases of the project, the tower crane will be removed and its pad concealed. For the façade's brick veneer work, a masons staging area will be established with material hoists and scaffolding as needed. After the first few floors have been completed and turned over, the 14th St sidewalk will be reopened to the public as demobilization & safety allows.

Estimates

Detailed Structural System

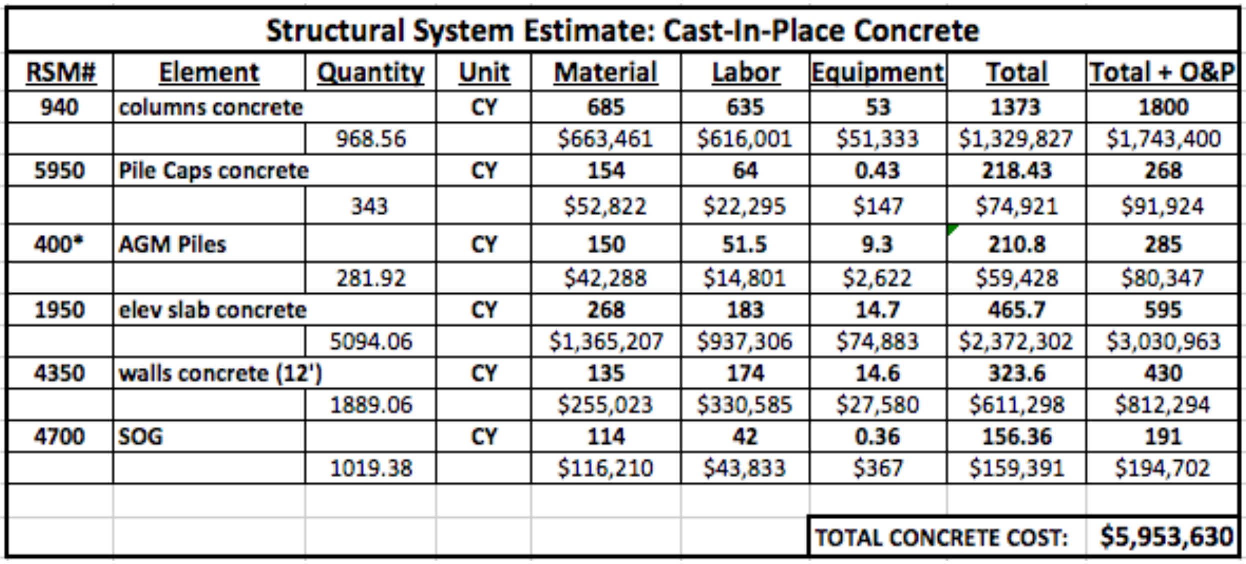
The structural system estimate includes cast-in-place concrete slabs, columns, walls, and auger-cast piles. The foundation, slab-on-grade, and roof were quantified separately, as well as the above-grade and below-grade structures. These areas were separated due to their similar reoccurring features of each that could easily be repeated to provide quick & accurate quantity estimation.

The foundation system included auger-cast piles, pile caps, foundation walls, and shear walls in the elevator shaft. Since there were several size types of pile caps, all pile caps were assumed to be the same average size of 7'x7'. The same approach was used for the auger-cast piles, as their depths ranged slightly, but a uniform depth was used for all 54 piles. The foundation walls and shear walls were calculated more accurately by their exact dimensions. Small grade beams, foundation wall steps, and garage ramp slopes were not included in the calculations.

The remainder of the quantity take-off performed is based on a typical reoccurring bay between columns lines D&E and 3&4 (see Appendix B). The quantities generated by this bay are then multiplied by the number of times a similar bay reoccurs on that floor since the floor area varies by floor. This particular bay was chosen because it seemed to be the most average, reoccurring bay on every floor of the building that would yield an accurate representation of the rest of each floor.

Using this method, the slabs and columns were calculated for that particular bay and then multiplied to match the total area of each floor. The penthouse and roof slab were calculated separately and more precisely due to their more manageable size.

The pricing of these quantities is designated by line items in R.S. Means 2012 cost data as referenced. R.S. Means items were assigned to take-off items as similar as possible. The only possible source of significant pricing error may occur for the auger-cast piles, as there was not an exact item in R.S. Means to match it. The pile costs were estimated based on the costs of other individual items such as concrete, rebar, & drilling as referenced. The actual cost of the superstructure is slightly higher than this estimated cost, which can possibly be due to scheduling differences or post-tensioning complications.



Structural System Estimate: Cast-In-Place Concrete

RSM#	Element	Quantity	Unit	Material	Labor	Equipment	Total	Total + O&P
940	columns concrete		CY	685	635	53	1373	1800
		968.56		$663,461	$616,001	$51,333	$1,329,827	$1,743,400
5950	Pile Caps concrete		CY	154	64	0.43	218.43	268
		343		$52,822	$22,295	$147	$74,921	$91,924
400*	AGM Piles		CY	150	51.5	9.3	210.8	285
		281.92		$42,288	$14,801	$2,622	$59,428	$80,347
1950	elev slab concrete		CY	268	183	14.7	465.7	595
		5094.06		$1,365,207	$937,306	$74,883	$2,372,302	$3,030,963
4350	walls concrete (12')		CY	135	174	14.6	323.6	430
		1889.06		$255,023	$330,585	$27,580	$611,298	$812,294
4700	SOG		CY	114	42	0.36	156.36	191
		1019.38		$116,210	$43,833	$367	$159,391	$194,702
						TOTAL CONCRETE COST:		$5,953,630

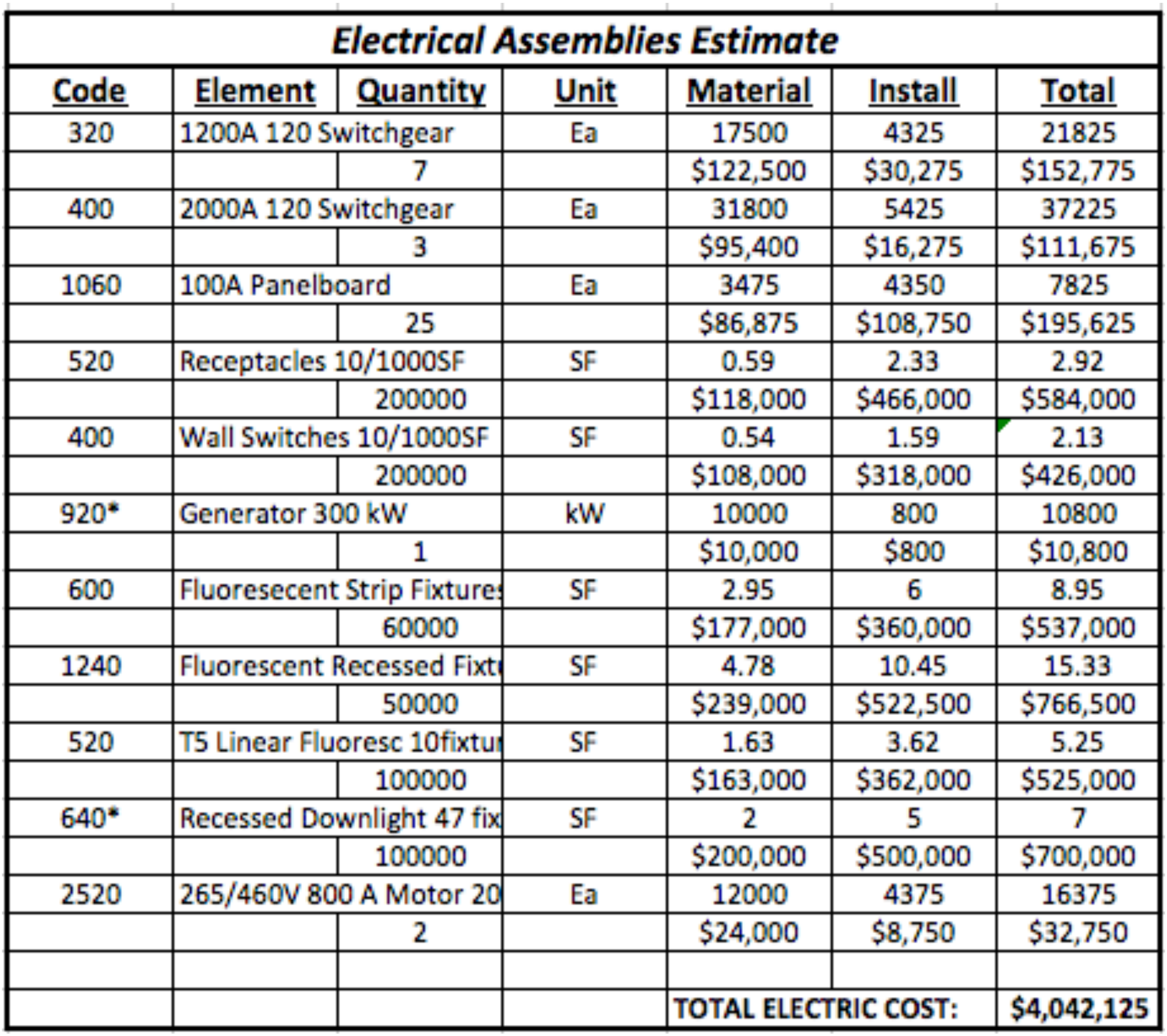
Actual Cost: $7,090,000

Electrical Assemblies

All major electrical systems were assigned to line item assemblies priced by R.S. Means 2012. The major components of the electrical system such as the switchgears, generator, and panelboards were accurately represented by the pricing data. Quantities of these major components were quantified very accurately, as well.

Minor components including the receptacles, wall switches, and lighting fixtures, all of a wide variety of types, were grouped into the same type that best represented the majority of the item. Light fixtures, in particular, were not as accurately matched with R.S. Means items due to its limited fixture types available. Quantities of these minor items were also simplified similarly to the concrete approach in which quantities were generated from a typical reoccurring section of the building, and then multiplied to appropriately match the entire area. The parking garage lighting and the apartment lighting areas were approached differently due to the drastically different demands of their respective spaces.

The actual cost of the electrical system is very close to that estimated, which is likely because this electrical design is fairly common amongst other residential buildings.



Electrical Assemblies Estimate

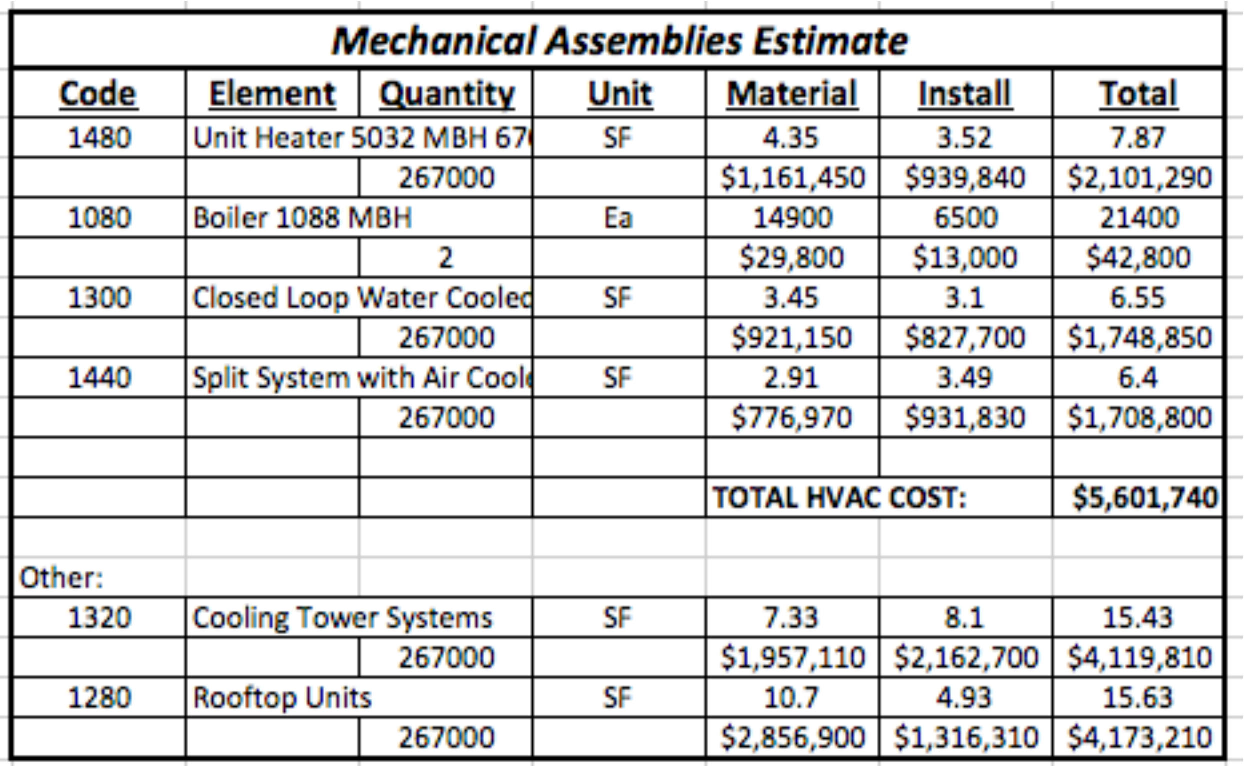
Code	Element	Quantity	Unit	Material	Install	Total
320	1200A 120 Switchgear		Ea	17500	4325	21825
		7		$122,500	$30,275	$152,775
400	2000A 120 Switchgear		Ea	31800	5425	37225
		3		$95,400	$16,275	$111,675
1060	100A Panelboard		Ea	3475	4350	7825
		25		$86,875	$108,750	$195,625
520	Receptacles 10/1000SF		SF	0.59	2.33	2.92
		200000		$118,000	$466,000	$584,000
400	Wall Switches 10/1000SF		SF	0.54	1.59	2.13
		200000		$108,000	$318,000	$426,000
920*	Generator 300 kW		kW	10000	800	10800
		1		$10,000	$800	$10,800
600	Fluoresecent Strip Fixture		SF	2.95	6	8.95
		60000		$177,000	$360,000	$537,000
1240	Fluorescent Recessed Fixt		SF	4.78	10.45	15.33
		50000		$239,000	$522,500	$766,500
520	T5 Linear Fluoresc 10fixtu		SF	1.63	3.62	5.25
		100000		$163,000	$362,000	$525,000
640*	Recessed Downlight 47 fix		SF	2	5	7
		100000		$200,000	$500,000	$700,000
2520	265/460V 800 A Motor 20		Ea	12000	4375	16375
		2		$24,000	$8,750	$32,750
				TOTAL ELECTRIC COST:		$4,042,125

Actual Cost: $4,242,000

Mechanical Assemblies

The mechanical systems were represented as accurately as possible while keeping in mind the components serving different parts of the building since there are retail spaces, apartments, and underground parking. By carefully examining the included items in each R.S. Means assembly, the cooling tower assembly and the rooftop unit assembly were eliminated to avoid double counting conditioned areas, as the assemblies included in the estimate are similar enough to represent the entire building system with their included components.

This estimate is slightly over the actual system cost, which is likely because of the different types of spaces previously noted that R.S. Means cannot represent as accurately.



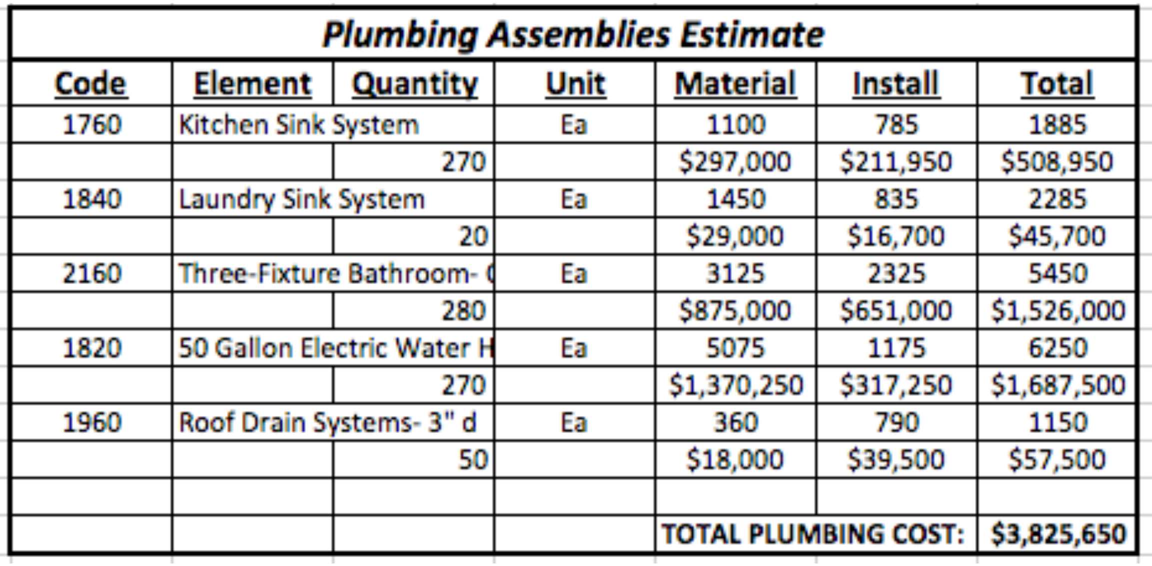
Mechanical Assemblies Estimate

Code	Element	Quantity	Unit	Material	Install	Total
1480	Unit Heater 5032 MBH 67		SF	4.35	3.52	7.87
		267000		$1,161,450	$939,840	$2,101,290
1080	Boiler 1088 MBH		Ea	14900	6500	21400
		2		$29,800	$13,000	$42,800
1300	Closed Loop Water Coole		SF	3.45	3.1	6.55
		267000		$921,150	$827,700	$1,748,850
1440	Split System with Air Cool		SF	2.91	3.49	6.4
		267000		$776,970	$931,830	$1,708,800
				TOTAL HVAC COST:		$5,601,740
Other:						
1320	Cooling Tower Systems		SF	7.33	8.1	15.43
		267000		$1,957,110	$2,162,700	$4,119,810
1280	Rooftop Units		SF	10.7	4.93	15.63
		267000		$2,856,900	$1,316,310	$4,173,210

Actual Cost: $4,365,000

Plumbing Assemblies

R.S. Means 2012 cost data accurately represented the components of the plumbing system through its available items. Most of the items priced were quantified by analyzing a typical apartment and its plumbing components, then multiplying them by the number of other apartments and similar areas. The actual cost of the system is very close to this assemblies estimate which is likely due to the number of repeated apartment units in the building, which is simple to accurately represent.



Plumbing Assemblies Estimate

Code	Element	Quantity	Unit	Material	Install	Total
1760	Kitchen Sink System		Ea	1100	785	1885
		270		$297,000	$211,950	$508,950
1840	Laundry Sink System		Ea	1450	835	2285
		20		$29,000	$16,700	$45,700
2160	Three-Fixture Bathroom-		Ea	3125	2325	5450
		280		$875,000	$651,000	$1,526,000
1820	50 Gallon Electric Water H		Ea	5075	1175	6250
		270		$1,370,250	$317,250	$1,687,500
1960	Roof Drain Systems- 3" d		Ea	360	790	1150
		50		$18,000	$39,500	$57,500
				TOTAL PLUMBING COST:		$3,825,650

Actual Cost: $3,739,000

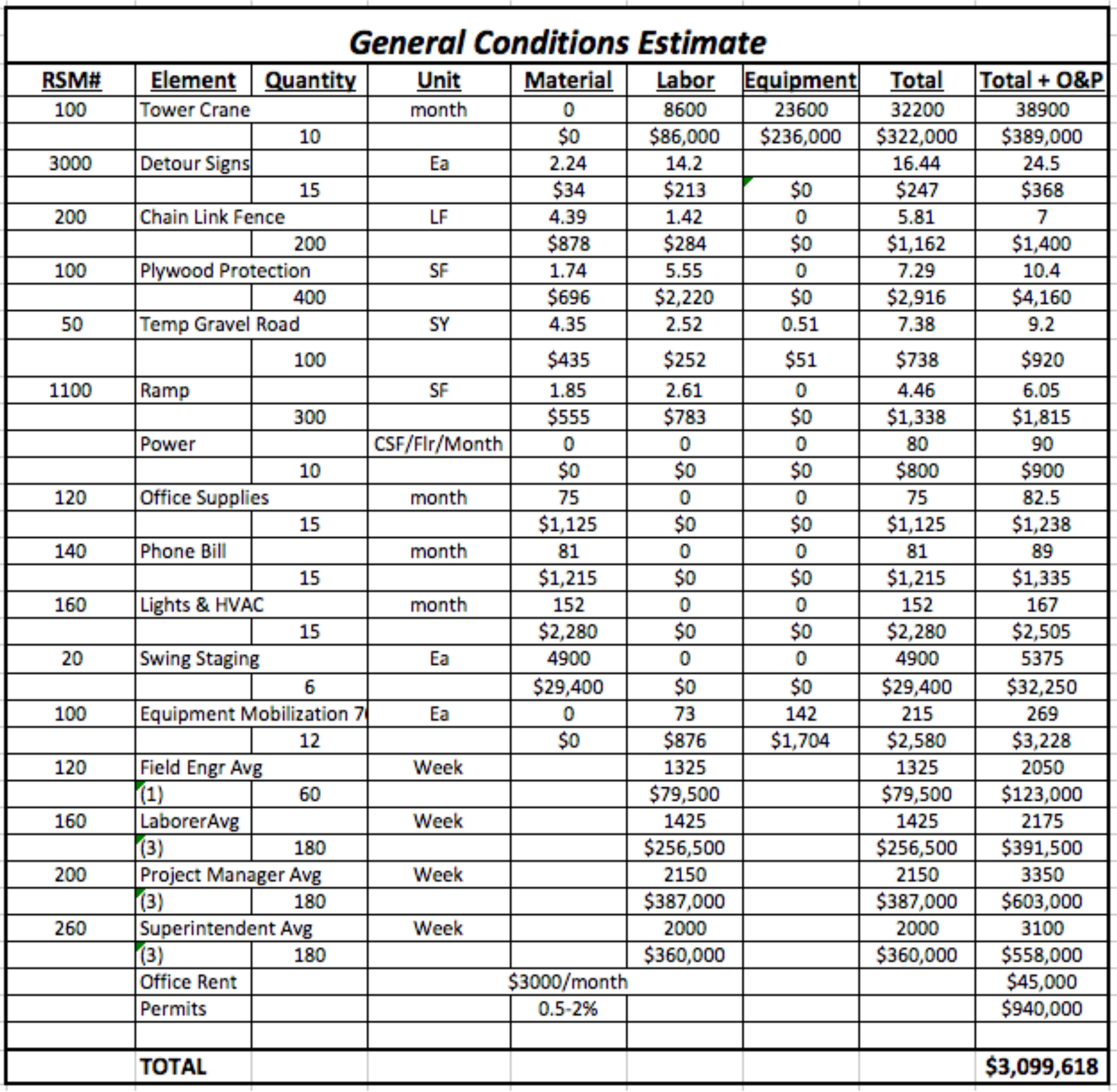
General Conditions Estimate

The general conditions expenses for Louis at the 14th are portrayed in this estimate using R.S. Means 2012 cost data. Ordinary items on the actual project have been assigned to similar or exact items in the cost data to be as realistic as possible. Specific items not included in this estimate are identified in Appendix C for reference.

The tower crane is the most costly item of the materials & equipment in the estimate. Swing staging serves as another critical item as much of the building façade requires these types of lifts for installation. Other material items that are not as critical include signage, fencing, plywood protection, and material for temporary pathways during excavation.

HVAC, power, and lighting expenses result from the project site and the field office. The field office located in the north adjacent building is responsible for other items such as rent, phone bills, and office supplies. The project staff wages include that of one project executive, two project managers, one project engineer, three superintendents, and three laborers.

The actual general conditions cost of the project is very similar to the estimate priced by R.S. Means. This suggests that the actual general conditions are common to the industry, the only differing aspects being the field office located in an existing building. The closing of the public sidewalk yields extra costs in the actual project scenario, but being on a tight site saves on expenses in other areas, as well, since space must be more efficiently utilized and may save on costs.



General Conditions Estimate

RSM#	Element	Quantity	Unit	Material	Labor	Equipment	Total	Total + O&P
100	Tower Crane		month	0	8600	23600	32200	38900
		10		$0	$86,000	$236,000	$322,000	$389,000
3000	Detour Signs		Ea	2.24	14.2		16.44	24.5
		15		$34	$213	$0	$247	$368
200	Chain Link Fence		LF	4.39	1.42	0	5.81	7
		200		$878	$284	$0	$1,162	$1,400
100	Plywood Protection		SF	1.74	5.55	0	7.29	10.4
		400		$696	$2,220	$0	$2,916	$4,160
50	Temp Gravel Road		SY	4.35	2.52	0.51	7.38	9.2
		100		$435	$252	$51	$738	$920
1100	Ramp		SF	1.85	2.61	0	4.46	6.05
		300		$555	$783	$0	$1,338	$1,815
	Power		CSF/Flr/Month	0	0	0	80	90
		10		$0	$0	$0	$800	$900
120	Office Supplies		month	75	0	0	75	82.5
		15		$1,125	$0	$0	$1,125	$1,238
140	Phone Bill		month	81	0	0	81	89
		15		$1,215	$0	$0	$1,215	$1,335
160	Lights & HVAC		month	152	0	0	152	167
		15		$2,280	$0	$0	$2,280	$2,505
20	Swing Staging		Ea	4900	0	0	4900	5375
		6		$29,400	$0	$0	$29,400	$32,250
100	Equipment Mobilization 7		Ea	0	73	142	215	269
		12		$0	$876	$1,704	$2,580	$3,228
120	Field Engr Avg		Week		1325		1325	2050
	(1)	60			$79,500		$79,500	$123,000
160	LaborerAvg		Week		1425		1425	2175
	(3)	180			$256,500		$256,500	$391,500
200	Project Manager Avg		Week		2150		2150	3350
	(3)	180			$387,000		$387,000	$603,000
260	Superintendent Avg		Week		2000		2000	3100
	(3)	180			$360,000		$360,000	$558,000
	Office Rent			$3000/month				$45,000
	Permits			0.5-2%				$940,000
	TOTAL							**$3,099,618**

Actual Cost: $2,966,400

Detailed Project Schedule

With the design phase taking fourteen months to complete starting in March of 2011, the notice to proceed the construction of Louis at 14th was not issued until March of 2012. Final completion was scheduled for the end of year 2013 as the ninth and final floor would be turned over.

The following schedule (see Appendix D) was assembled using Primavera P6 software and is meant to simplify the actual project schedule into its major phases & sequences. The primary workflow of each sequence is portrayed from the ground level up to penthouse.

The actual project schedule incorporates workflow moving across different areas of the building footprint at each level. It also includes more detailed activities focusing on work occurring in more specific areas of the building such as the fitness center, rooftop lounge area, and interior suites.

The first several activities portrayed are the fabrication & delivery of materials, as many are long-lead items and/or require prefabrication work prior to arriving on the jobsite. The initial work to take place on the actual jobsite includes the demolition of several 2-story retail spaces and a parking lot. A section of an existing historic building façade needs appropriate protection installed before excavation begins, as well.

The excavation phase includes the installation of lagging & tiebacks, drilled piles, sump pits, and dewatering wells. This is one of the most unpredictable durations and critical activities on the project because of the dewatering systems being installed and the unknown groundwater conditions. The actual project schedule suffered major delays due to these complications.

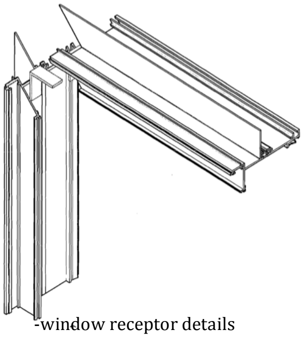
Another critical element follows with the cast-in-place concrete structure extending to the highest elevations of the building. Included in these activities are all slabs, columns, stairwells, shafts, and, also, concrete masonry units.

The critical path then follows all trades involved in the enclosing the building to reach the watertight milestone as soon as possible. This work includes primarily framing, sheathing, windows, masonry assemblies, and roofing.

The remaining activities are organized by floor because the project is turned over as floors are completed, the ninth floor being the last. Mechanical, plumbing, and electrical rough-in work control the critical path on each floor, followed by insulation & drywall, fixtures & GRD's, doors, casework, and finally all finishes. The ground level retail spaces do not require finishes as that scope of work is excluded from the project contract.

Constructability Concerns

Window System



-window receptor details

The amount of glazing that encloses *Louis at 14th* makes the window systems a critical element of success in itself, but they also require precise attention to detail during installation as well as the scheduled activities for the window assemblies and adjacent ongoing work. All window system installation lies on the critical path of the schedule since it contributes to the watertight enclosure milestone.

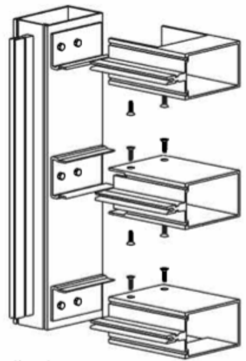


Illustration 1

A mockup schedule was exercised to serve different areas of the building façade that demanded different assembly and trade coordination. It was critical for all subcontractors involved in these assemblies to have all adequate materials, such as flashing, on site and ready for installation to avoid delays or trade clashes. Upon their delivery, windows were stocked on their designated level until installation.

The receptors were the first pieces of the window to be installed, which immediately followed the installation of exterior sheathing and channels. The installation of these receptors precedes air & vapor barrier detailing and spray, which are then followed by the brick veneer & metal panels. The masonry work ongoing for the brick veneer would take place two stories below the window receptor installation. It was between these to stories where the glass would be put into place. Coordination issues with the channels came up where they had clashed with window height dimensions & flashing details, while flashing issues posed other complications involving its installation before & after the necessary trades.

The primary challenge of the window assemblies was its demanding attention to detail and the criticalness of trade coordination. The façade of the building during the enclosure phases was very busy at multiple levels, and the successful installation of these window systems influenced several trades and was affected by others, as well. The amount of times this work was repeated on the project was enough to have a critical impact on its success.

Dewatering Wells

The dewatering well system proved to be a critical element of the project schedule, as unforeseen groundwater conditions caused major delays early in construction. The original dewatering plan was designed according to the geotechnical investigation, which suggested less groundwater than what was discovered once excavation commenced.

The dewatering process required investigation regarding its effects on adjacent properties, as well as the monitoring of drilling spoils for contaminants, which were found in some wells. The water spoils also needed to be controlled as found necessary, since there was one instance where the spoils escaped the sediment control barriers and found its way into the alley.

Once the bracket pile was installed, the temporary dewatering system running off of generator power was actively pumping to mitigate subsurface water conditions, an environmental consultant was required to test the discharge water. The dewatering contractor also needed to validate the presence of underpinning pits near the adjacent building that had recorded settlement due to local undermining in the past.

The project team better judgment was challenged to determine at which point it was necessary to turn off the dewatering system and leave it to the sump pits & subdrainage to manage the remaining groundwater.

Historic Façade Protection

Located on the east edge of the building footprint is an existing historical brick façade that required support and protection throughout every phase of the project. It is the façade of the east existing building that was demolished earlier in the job, and the contractor would receive allowances as necessary for the work required to preserve it.

After it was questioned that, in its condition, the façade would not be able to sustain itself once the rest of the existing building was demolished, it was determined by the restoration contractor that bracket piles would be installed along the edge of the façade with beams connecting the piles to the façade masonry with bracket plates.

This temporary structure would be the main means of support and protection during excavation and other phases. Extra precaution was taken during the excavation next to the façade, as extra steel plates were installed at the top of the piles to deflect debris and avoid damage to the façade.

The extra bricks removed during demolition were required to be salvaged, palletized, and stored for future use by the new tenant, as well. This extra material was picked off the site with a boom truck and transported to another JBG Companies nearby.

Photo by Balfour Beatty Construction

LEED Evaluation

In order to promote sustainability in building design & construction, the U.S. Green Building Council has developed a green building rating system known as the Leadership in Energy & Environmental Design rating system. Louis at 14th is pursing the LEED Silver certification upon its completion.

The following is a custom LEED analysis based on the Penn State approach. Its purpose is to act as a suggestive guide to which level of LEED certification can be reasonably pursued on this project.

The custom analysis is then compared by category to the actual approach used by Balfour Beatty Construction to achieve the LEED Silver certification for this building. Although each LEED scorecard (see Appendix E) is slightly different due to different issue dates, the goals & ideas behind each category still accurately compare.

Sustainable Sites

The Penn State University Park campus and the 14th & U apartment complex have very different site constraints, making the LEED points targeted on each scorecard very different, as well.

The actual scorecard actively pursues all transportation and community-related credits being in a more urban environment, except the parking capacity credit is not considered due to a tight building footprint with costly underground parking.

Unlike the actual approach, the Penn State approach places heavy emphasis on storm water design, which is likely because on campus, regulatory compliance protecting natural water sources in the area generally results in achieving these credits easily. The 14th & U site does not have as many nearby natural water sources to maintain at a good quality.

The heat-island credits to be pursued in each approach are likely different because of different building materials common amongst buildings in each area. For example, Louis at 14th has a lot of metal panels & glazing systems while many Penn State buildings maintain a trend using brick and more traditional window systems.

Water Efficiency

Both approaches commit efforts towards water use reduction to some degree, which is easily achieved between common building compliances and modern plumbing fixtures. Both also incorporate the use of green roof systems in achieving other credits in this category.

Energy & Atmosphere

Louis at 14th does not pursue many credits other than the prerequisites in this category, as it is likely most economical to achieve optimized energy performance only to the degree necessary to have a manageable energy consumption. Penn State aims to construct buildings that last and, being the owner of the building for the extent of its life, demands energy efficiency and effective commissioning for future building maintenance & energy expenses.

Materials & Resources

The Balfour Beatty approach and the Penn State approach both take advantage of material resources in their respective regions. They each have resources with which they are confident in getting the materials necessary to earn several of these credits. Credits involving building reuse are not as reliable because they are not always suitable for the demands of the new construction or the extent of the demolition for existing structures.

Indoor Environmental Quality

Both Penn State and JBG Companies strive to provide comfortable spaces for their building occupants and therefore pursue a lot of credits in this category. The major differences between the two approaches begins with outdoor air delivery monitoring, which is mainly for more precise control of the ventilation to eliminate energy waste. Penn State being more concerned with life cycle cost and maintenance makes this credit mandatory, while the actual building is likely reluctant to fund the extra precision & design to make the strategy effective.

Low-emitting materials and indoor chemical/pollutant source control are credits heavily pursued by the Penn State approach, but not considered in the actual approach which is surprising because they have a fairly significant impacts on the health of the building occupants and are relatively easy to attain given common industry standards. The composite wood & agrifiber products specified by the designer of the building are not likely flexible enough to suit these requirements.

Innovation & Design

Innovation & design is commonly pursued in any way possible that is usually very specific to the opportunities created by that specific project. Extra opportunities have been recognized on the actual project in maximizing public transportation, non-roof heat island effect, maximizing open space, and maximizing green power. The Penn State approach, being from an educational institution, especially emphasizes this category for the sake of teaching & encouraging students to be creative in their own efforts and education.

Conclusion

Judging by the Penn State approach & analyzing potential opportunities in each category, the 14th & U building project is pursing a very attainable LEED Silver certification. With common industry standards and the economic benefits stemming from these requirements, this level of certification will pay back both the owner and the building occupants equally. Should the project pursue a higher level of certification, costs would likely become significantly more expensive with a longer payback period while adding minor benefits to the occupants.

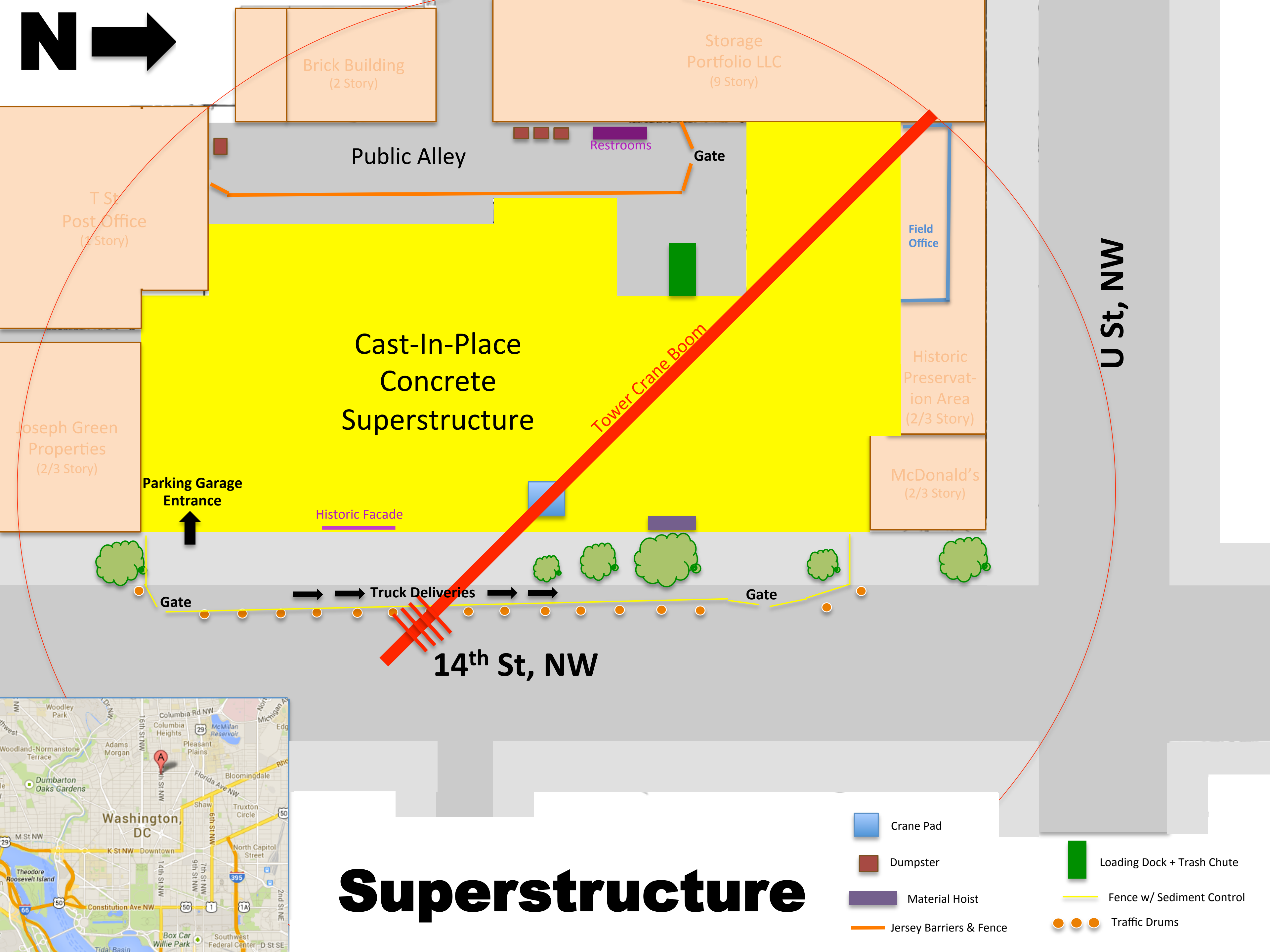
Appendix

A: Site Layout Plans (see next 3 pgs)

Excavation


N
Brick Building
(2 Story)
Storage
Portfolio LLC
(9 Story)
T St
Post Office
(1 Story)
Restrooms
Gate
Public Alley
Field
Office
U St, NW
Excavation Area
RAMP
RAMP
Historic
Preservat-
ion Area
(2/3 Story)
Joseph Green
Properties
(2/3 Story)
McDonald's
(2/3 Story)
Historic Facade
Gate
Truck Deliveries
Gate
14th St, NW
Washington, DC
Google Maps
Water Quality Dewatering System
Dumpster
Sump Pit
Jersey Barriers & Fence
Soldier Piles, Lagging, & Tiebacks
Fence w/ Sediment Control
Traffic Drums

Superstructure



🟦 Crane Pad

🟥 Dumpster

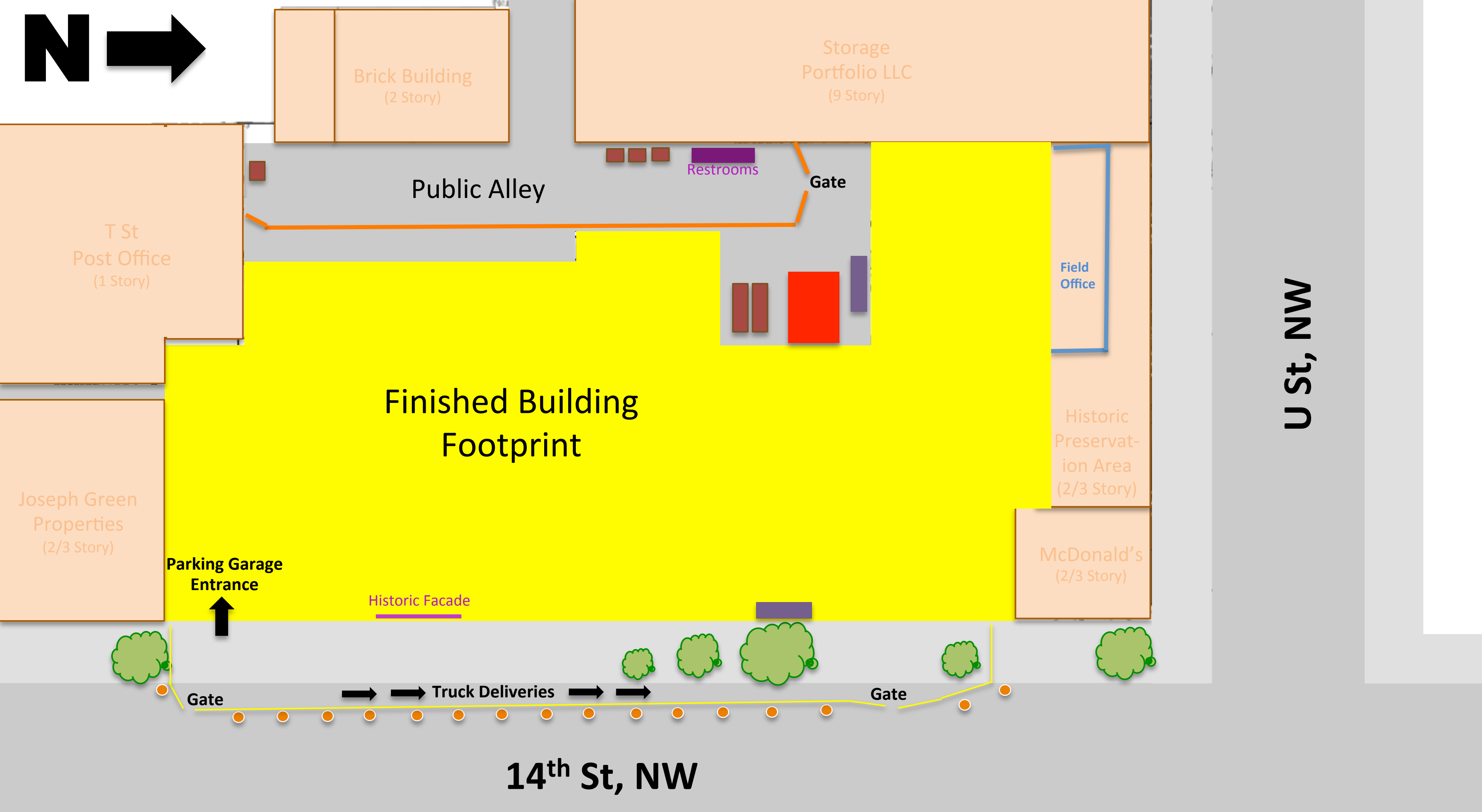
🟪 Material Hoist

Jersey Barriers & Fence

🟩 Loading Dock + Trash Chute

Fence w/ Sediment Control

● ● ● Traffic Drums

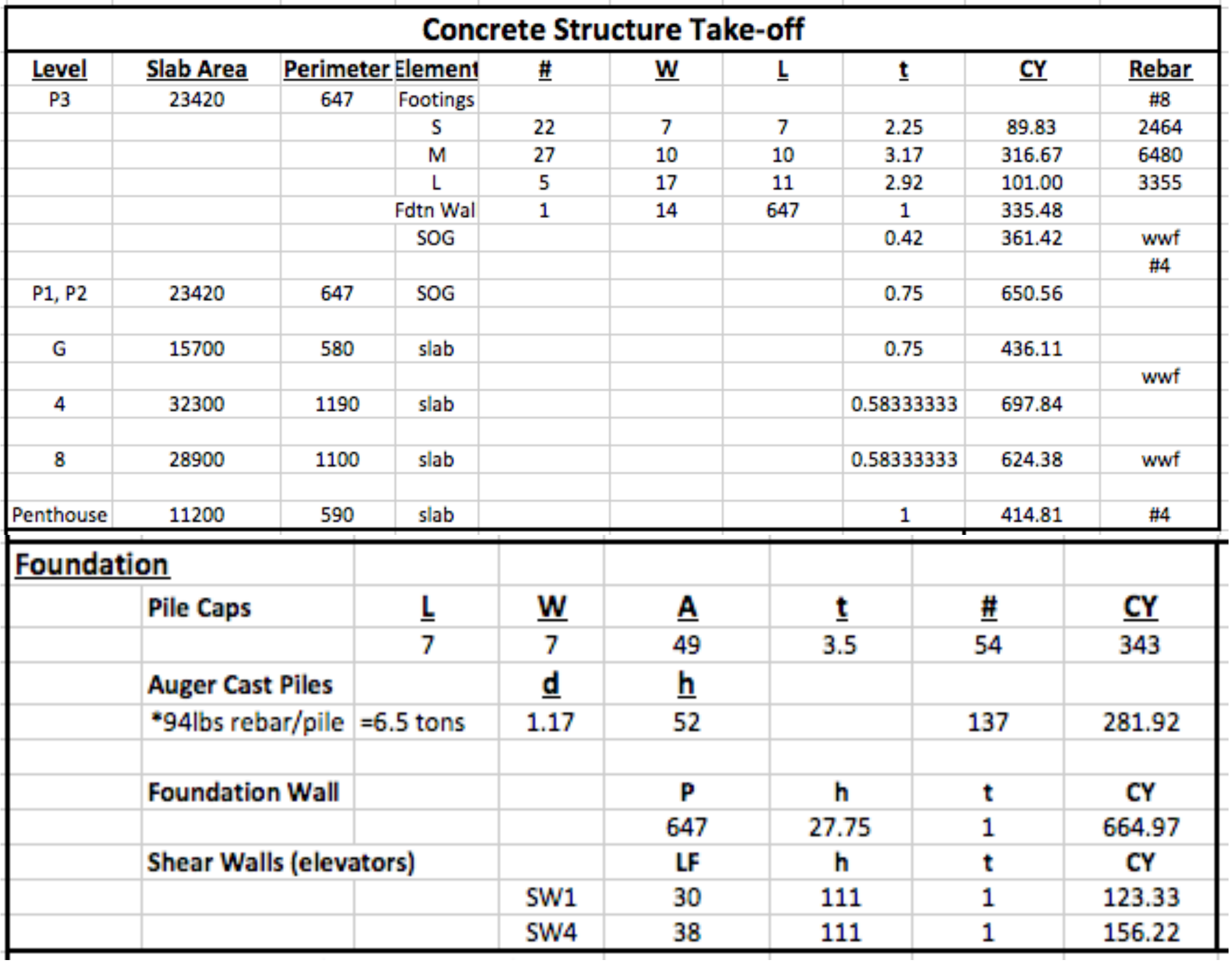


Finishing Phases

🟥	Masons Staging Area
🟫	Dumpster
▬	Material Hoist
▬	Jersey Barriers & Fence
▬	Fence w/ Sediment Control
● ● ●	Traffic Drums

*Note: finish materials stored per floor

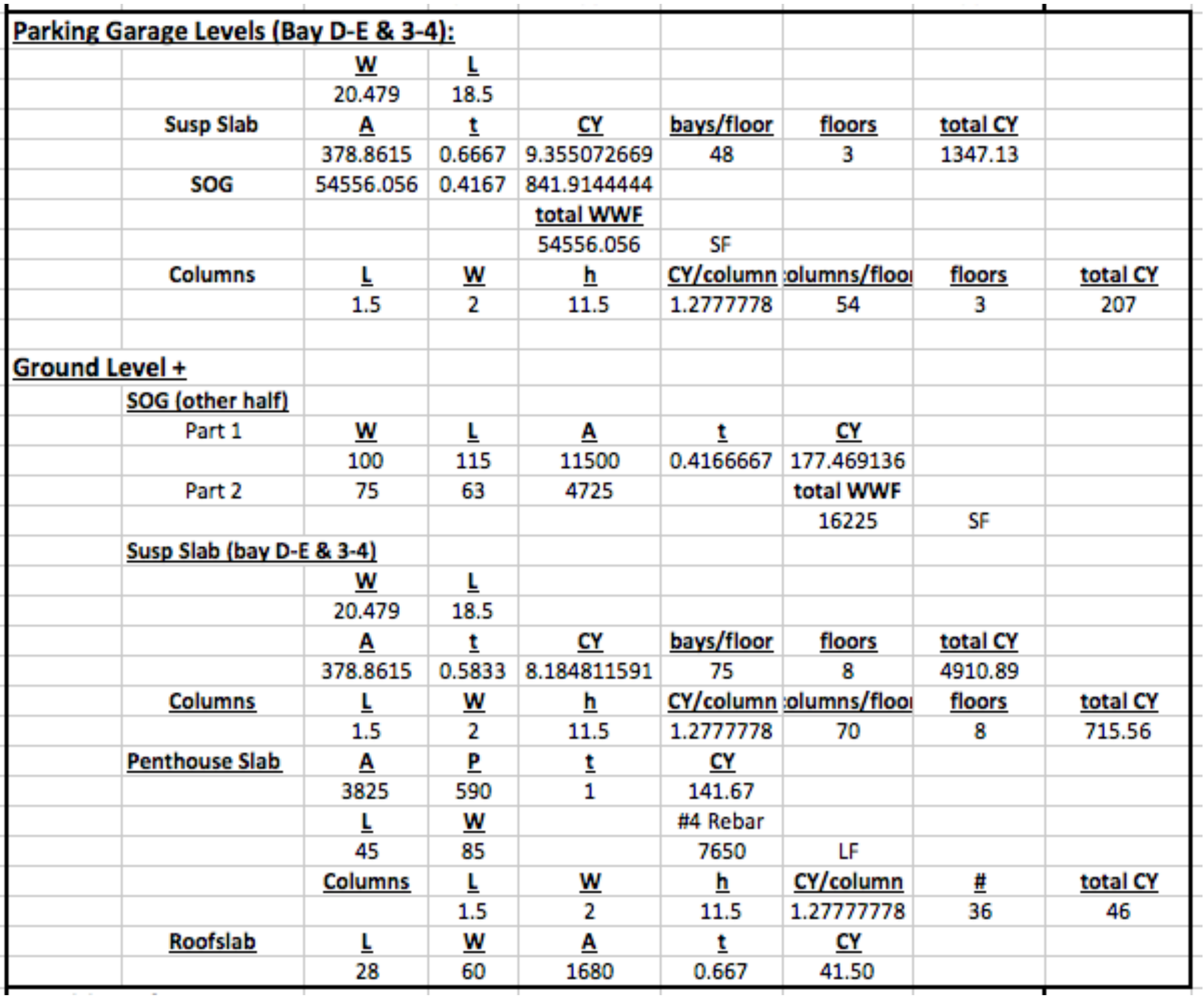
B: Structural Systems Take-off & Pricing Information



Concrete Structure Take-off

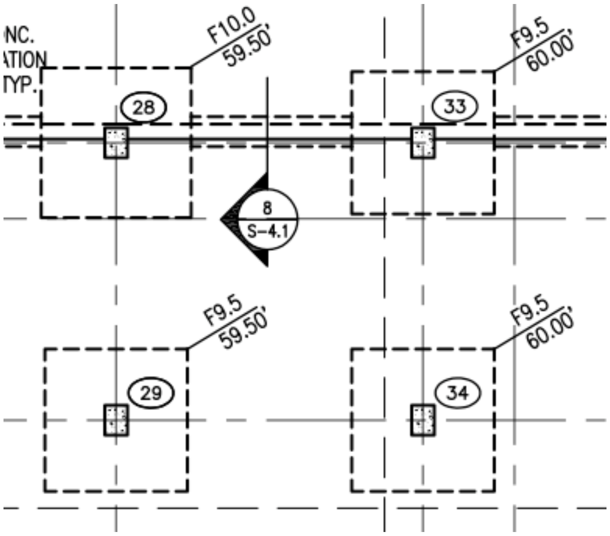
Level	Slab Area	Perimeter	Element	#	W	L	t	CY	Rebar
P3	23420	647	Footings						#8
			S	22	7	7	2.25	89.83	2464
			M	27	10	10	3.17	316.67	6480
			L	5	17	11	2.92	101.00	3355
			Fdtn Wal	1	14	647	1	335.48	
			SOG				0.42	361.42	wwf
									#4
P1, P2	23420	647	SOG				0.75	650.56	
G	15700	580	slab				0.75	436.11	
									wwf
4	32300	1190	slab				0.58333333	697.84	
8	28900	1100	slab				0.58333333	624.38	wwf
Penthouse	11200	590	slab				1	414.81	#4

Foundation							
	Pile Caps	**L**	**W**	**A**	**t**	**#**	**CY**
		7	7	49	3.5	54	343
	Auger Cast Piles		**d**	**h**			
	*94lbs rebar/pile	=6.5 tons	1.17	52		137	281.92
	Foundation Wall			**P**	**h**	**t**	**CY**
				647	27.75	1	664.97
	Shear Walls (elevators)			**LF**	**h**	**t**	**CY**
			SW1	30	111	1	123.33
			SW4	38	111	1	156.22

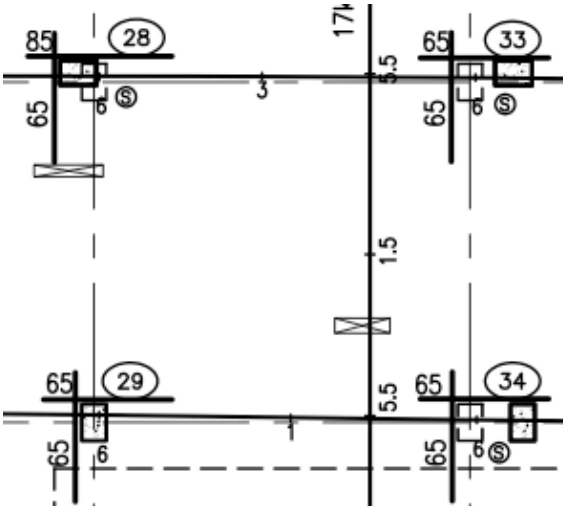


Parking Garage Levels (Bay D-E & 3-4):								
		W	L					
		20.479	18.5					
	Susp Slab	A	t	CY	bays/floor	floors	total CY	
		378.8615	0.6667	9.355072669	48	3	1347.13	
	SOG	54556.056	0.4167	841.9144444				
				total WWF				
				54556.056	SF			
	Columns	L	W	h	CY/column	olumns/floo	floors	total CY
		1.5	2	11.5	1.2777778	54	3	207
Ground Level +								
	SOG (other half)							
	Part 1	W	L	A	t	CY		
		100	115	11500	0.4166667	177.469136		
	Part 2	75	63	4725		total WWF		
						16225	SF	
	Susp Slab (bay D-E & 3-4)							
		W	L					
		20.479	18.5					
		A	t	CY	bays/floor	floors	total CY	
		378.8615	0.5833	8.184811591	75	8	4910.89	
	Columns	L	W	h	CY/column	olumns/floo	floors	total CY
		1.5	2	11.5	1.2777778	70	8	715.56
	Penthouse Slab	A	P	t	CY			
		3825	590	1	141.67			
		L	W		#4 Rebar			
		45	85		7650	LF		
		Columns	L	W	h	CY/column	#	total CY
			1.5	2	11.5	1.27777778	36	46
	Roofslab	L	W	A	t	CY		
		28	60	1680	0.667	41.50		

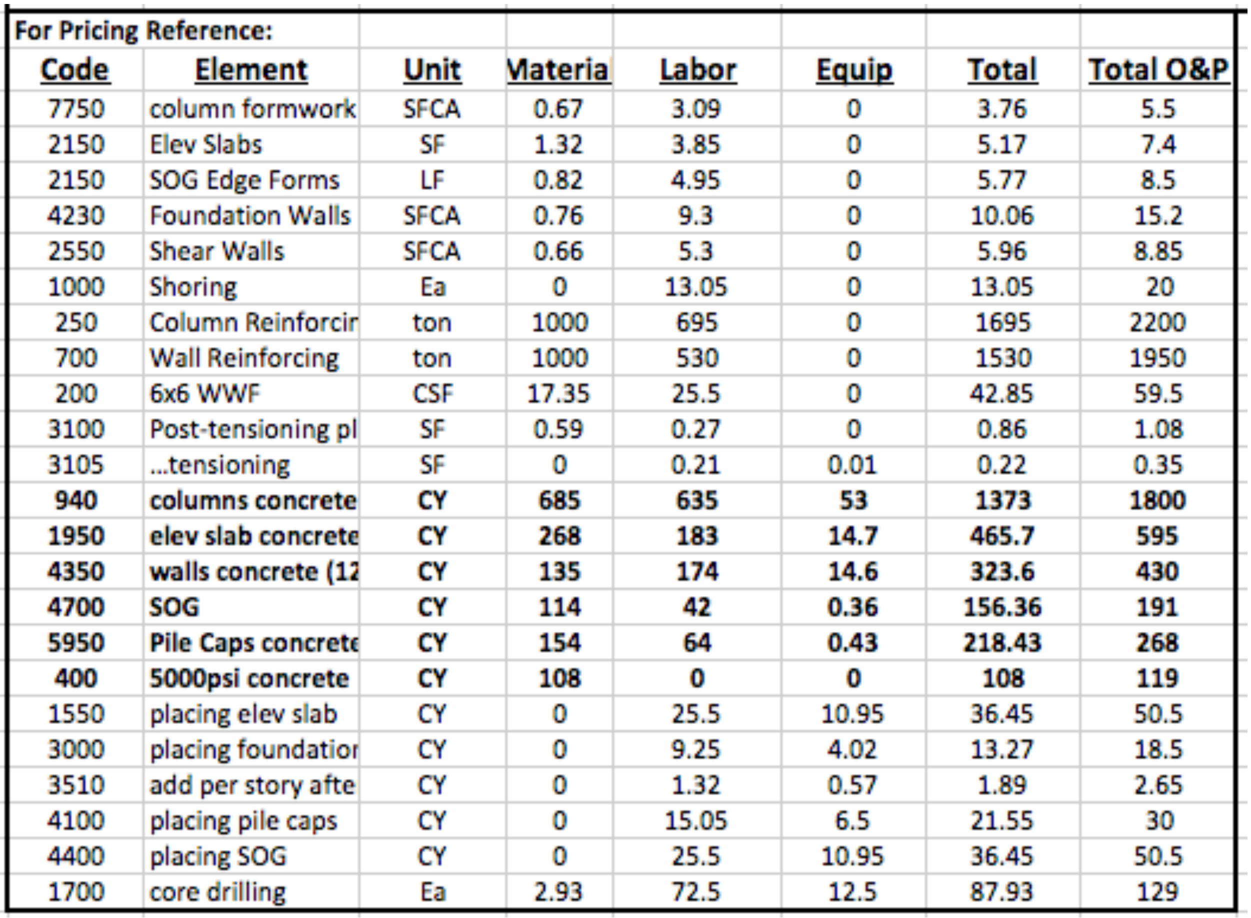
Typical Bay (column lines D-E & 3-4):



^ Garage Levels



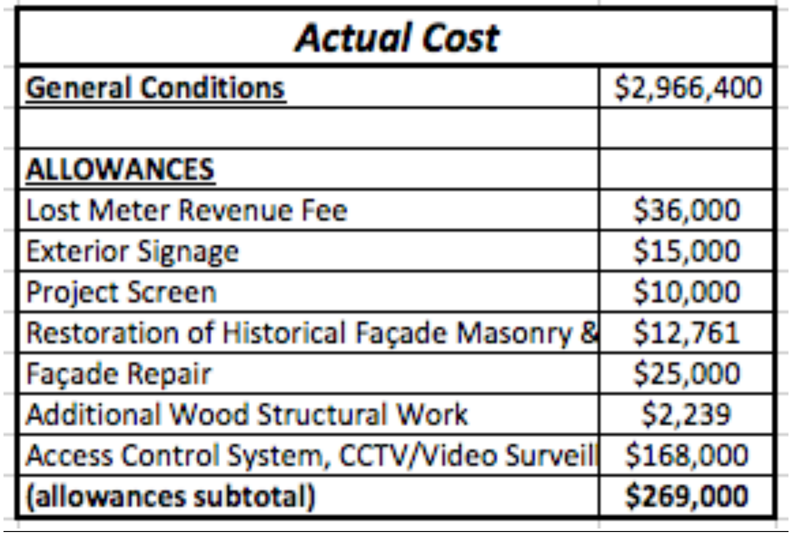
^Above-Grade Levels



For Pricing Reference:

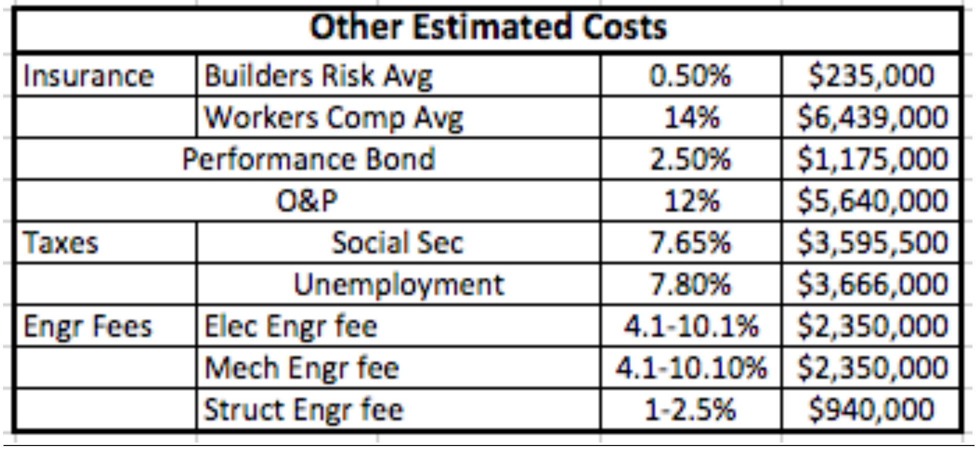
Code	Element	Unit	Materia	Labor	Equip	Total	Total O&P
7750	column formwork	SFCA	0.67	3.09	0	3.76	5.5
2150	Elev Slabs	SF	1.32	3.85	0	5.17	7.4
2150	SOG Edge Forms	LF	0.82	4.95	0	5.77	8.5
4230	Foundation Walls	SFCA	0.76	9.3	0	10.06	15.2
2550	Shear Walls	SFCA	0.66	5.3	0	5.96	8.85
1000	Shoring	Ea	0	13.05	0	13.05	20
250	Column Reinforcir	ton	1000	695	0	1695	2200
700	Wall Reinforcing	ton	1000	530	0	1530	1950
200	6x6 WWF	CSF	17.35	25.5	0	42.85	59.5
3100	Post-tensioning pl	SF	0.59	0.27	0	0.86	1.08
3105	...tensioning	SF	0	0.21	0.01	0.22	0.35
940	**columns concrete**	**CY**	**685**	**635**	**53**	**1373**	**1800**
1950	**elev slab concrete**	**CY**	**268**	**183**	**14.7**	**465.7**	**595**
4350	**walls concrete (12**	**CY**	**135**	**174**	**14.6**	**323.6**	**430**
4700	**SOG**	**CY**	**114**	**42**	**0.36**	**156.36**	**191**
5950	**Pile Caps concrete**	**CY**	**154**	**64**	**0.43**	**218.43**	**268**
400	**5000psi concrete**	**CY**	**108**	**0**	**0**	**108**	**119**
1550	placing elev slab	CY	0	25.5	10.95	36.45	50.5
3000	placing foundatior	CY	0	9.25	4.02	13.27	18.5
3510	add per story afte	CY	0	1.32	0.57	1.89	2.65
4100	placing pile caps	CY	0	15.05	6.5	21.55	30
4400	placing SOG	CY	0	25.5	10.95	36.45	50.5
1700	core drilling	Ea	2.93	72.5	12.5	87.93	129

C: General Conditions Supplemental Information



Actual Cost

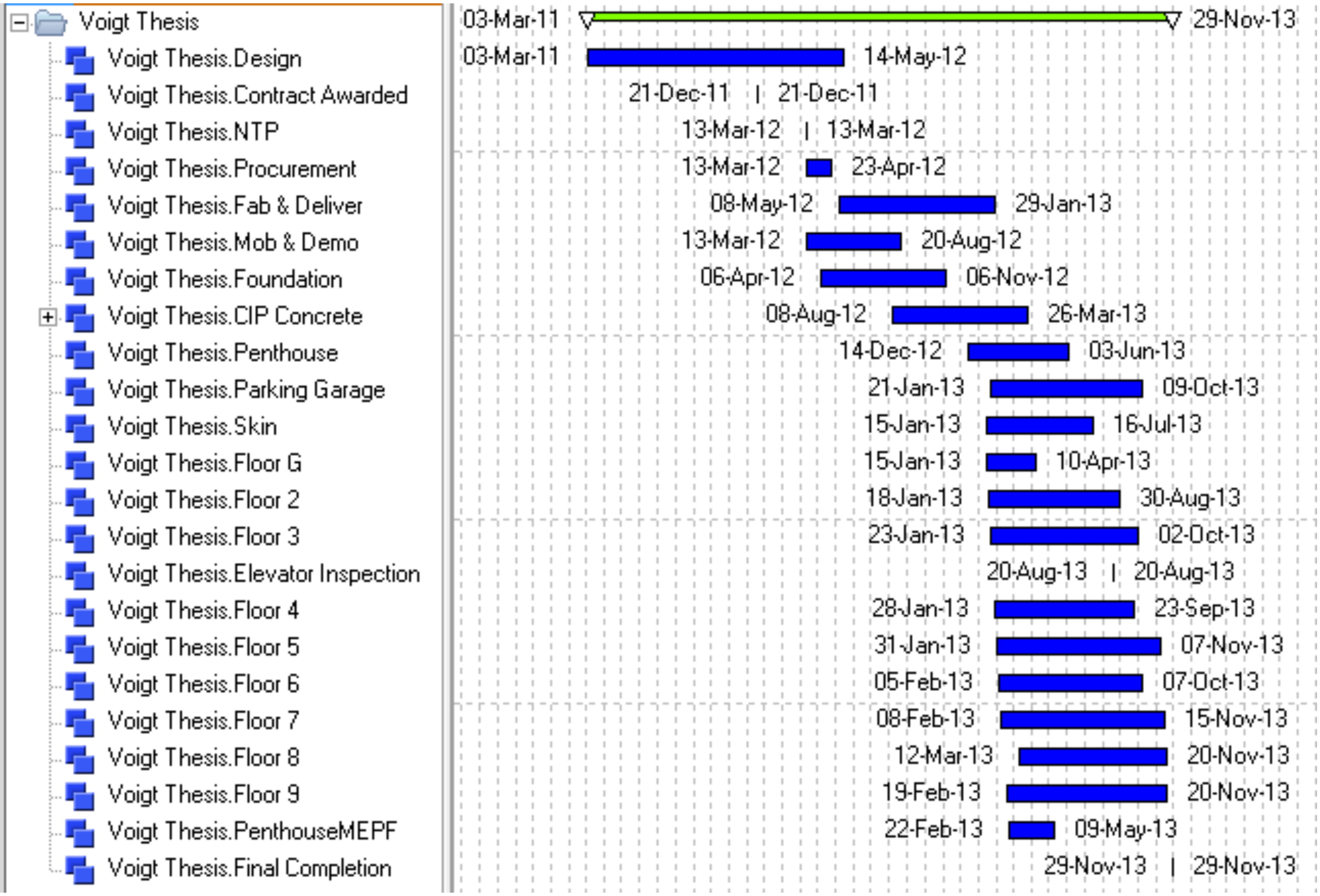
General Conditions	$2,966,400
ALLOWANCES	
Lost Meter Revenue Fee	$36,000
Exterior Signage	$15,000
Project Screen	$10,000
Restoration of Historical Façade Masonry &	$12,761
Façade Repair	$25,000
Additional Wood Structural Work	$2,239
Access Control System, CCTV/Video Surveil	$168,000
(allowances subtotal)	**$269,000**



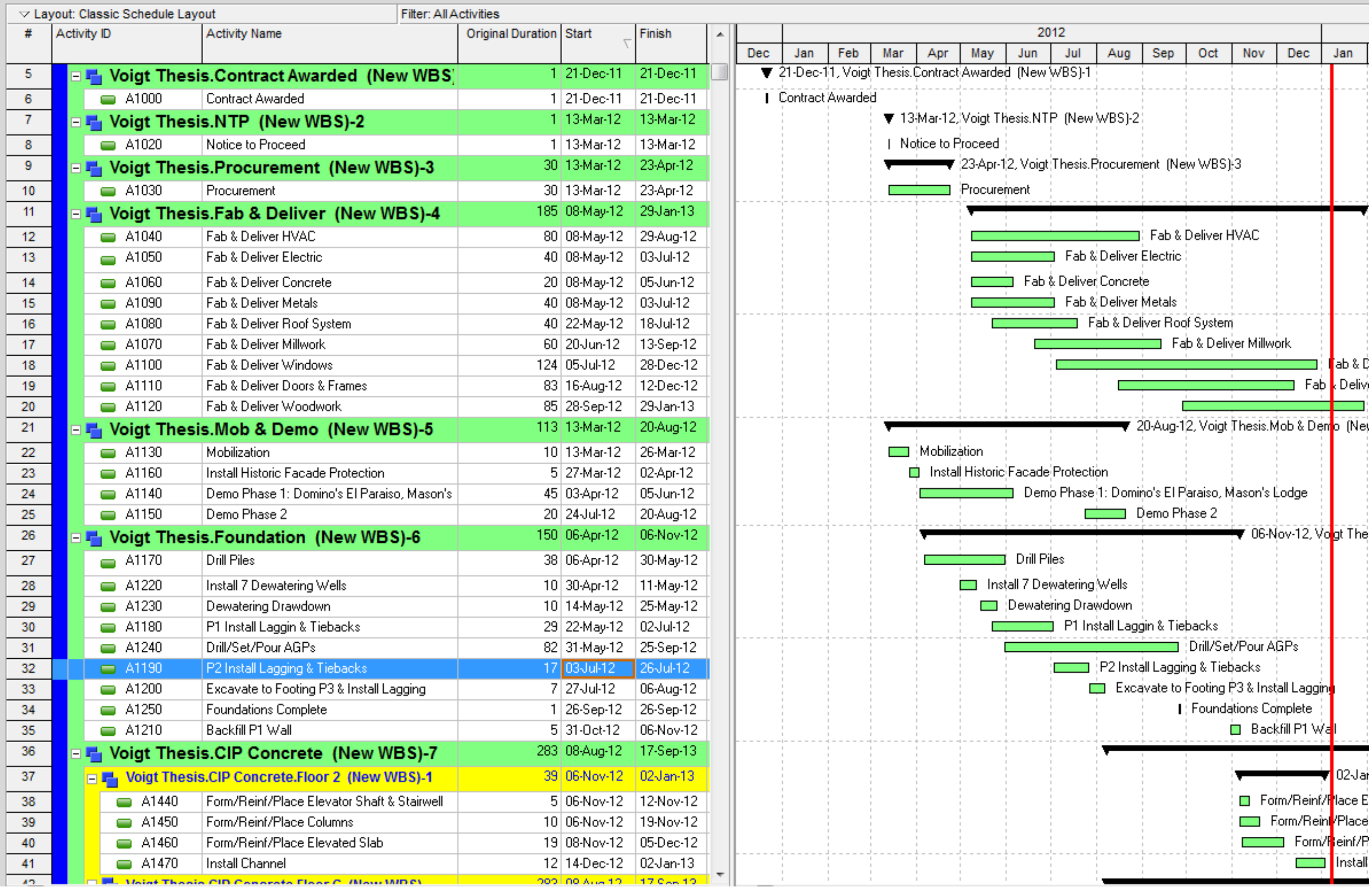
Other Estimated Costs

Insurance	Builders Risk Avg	0.50%	$235,000
	Workers Comp Avg	14%	$6,439,000
Performance Bond		2.50%	$1,175,000
O&P		12%	$5,640,000
Taxes	Social Sec	7.65%	$3,595,500
	Unemployment	7.80%	$3,666,000
Engr Fees	Elec Engr fee	4.1-10.1%	$2,350,000
	Mech Engr fee	4.1-10.10%	$2,350,000
	Struct Engr fee	1-2.5%	$940,000

D: Detailed Project Schedule (see next 7pgs)

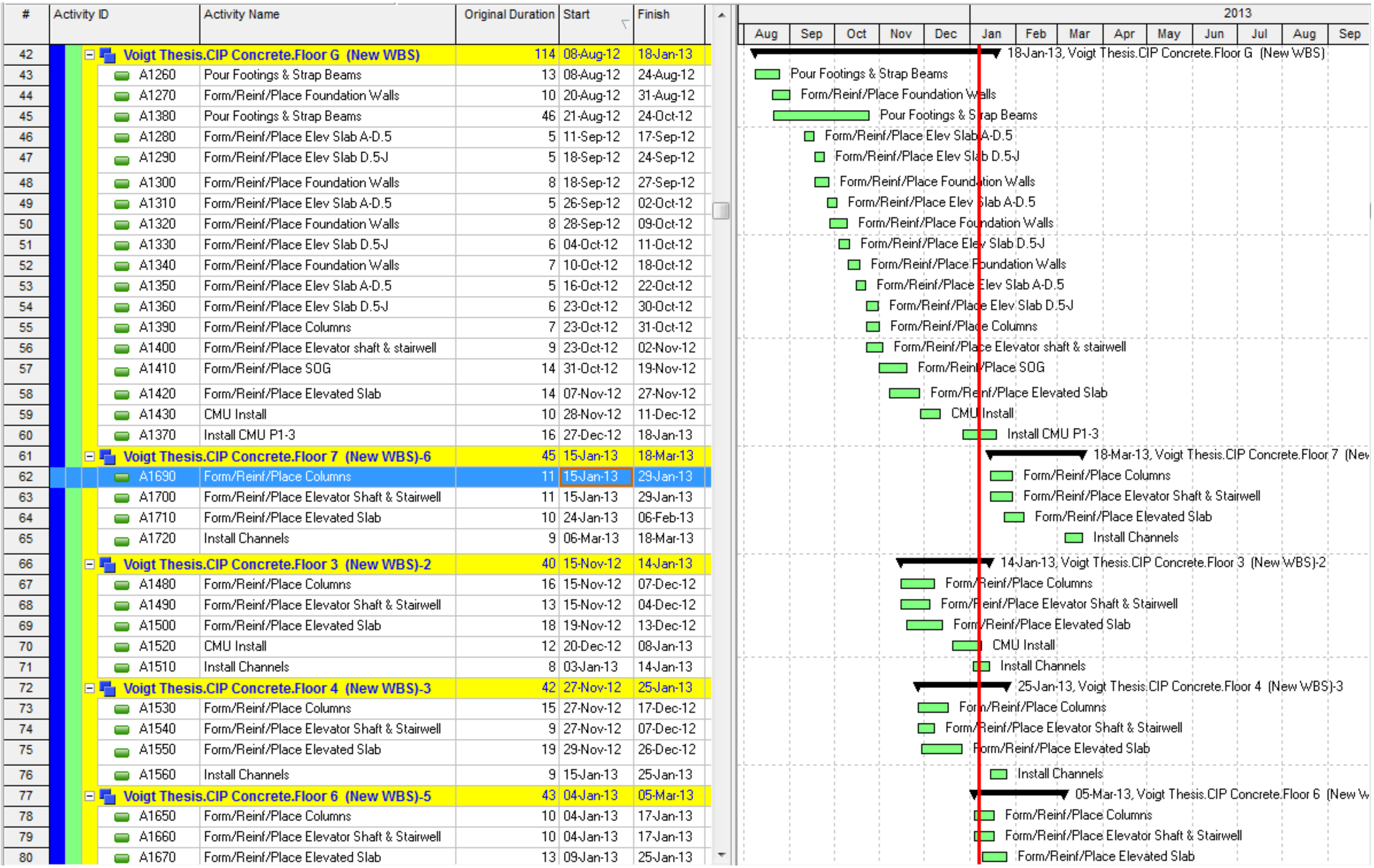


Voigt Thesis	03-Mar-11	29-Nov-13
Voigt Thesis.Design	03-Mar-11	14-May-12
Voigt Thesis.Contract Awarded	21-Dec-11	21-Dec-11
Voigt Thesis.NTP	13-Mar-12	13-Mar-12
Voigt Thesis.Procurement	13-Mar-12	23-Apr-12
Voigt Thesis.Fab & Deliver	08-May-12	29-Jan-13
Voigt Thesis.Mob & Demo	13-Mar-12	20-Aug-12
Voigt Thesis.Foundation	06-Apr-12	06-Nov-12
Voigt Thesis.CIP Concrete	08-Aug-12	26-Mar-13
Voigt Thesis.Penthouse	14-Dec-12	03-Jun-13
Voigt Thesis.Parking Garage	21-Jan-13	09-Oct-13
Voigt Thesis.Skin	15-Jan-13	16-Jul-13
Voigt Thesis.Floor G	15-Jan-13	10-Apr-13
Voigt Thesis.Floor 2	18-Jan-13	30-Aug-13
Voigt Thesis.Floor 3	23-Jan-13	02-Oct-13
Voigt Thesis.Elevator Inspection	20-Aug-13	20-Aug-13
Voigt Thesis.Floor 4	28-Jan-13	23-Sep-13
Voigt Thesis.Floor 5	31-Jan-13	07-Nov-13
Voigt Thesis.Floor 6	05-Feb-13	07-Oct-13
Voigt Thesis.Floor 7	08-Feb-13	15-Nov-13
Voigt Thesis.Floor 8	12-Mar-13	20-Nov-13
Voigt Thesis.Floor 9	19-Feb-13	20-Nov-13
Voigt Thesis.PenthouseMEPF	22-Feb-13	09-May-13
Voigt Thesis.Final Completion	29-Nov-13	29-Nov-13

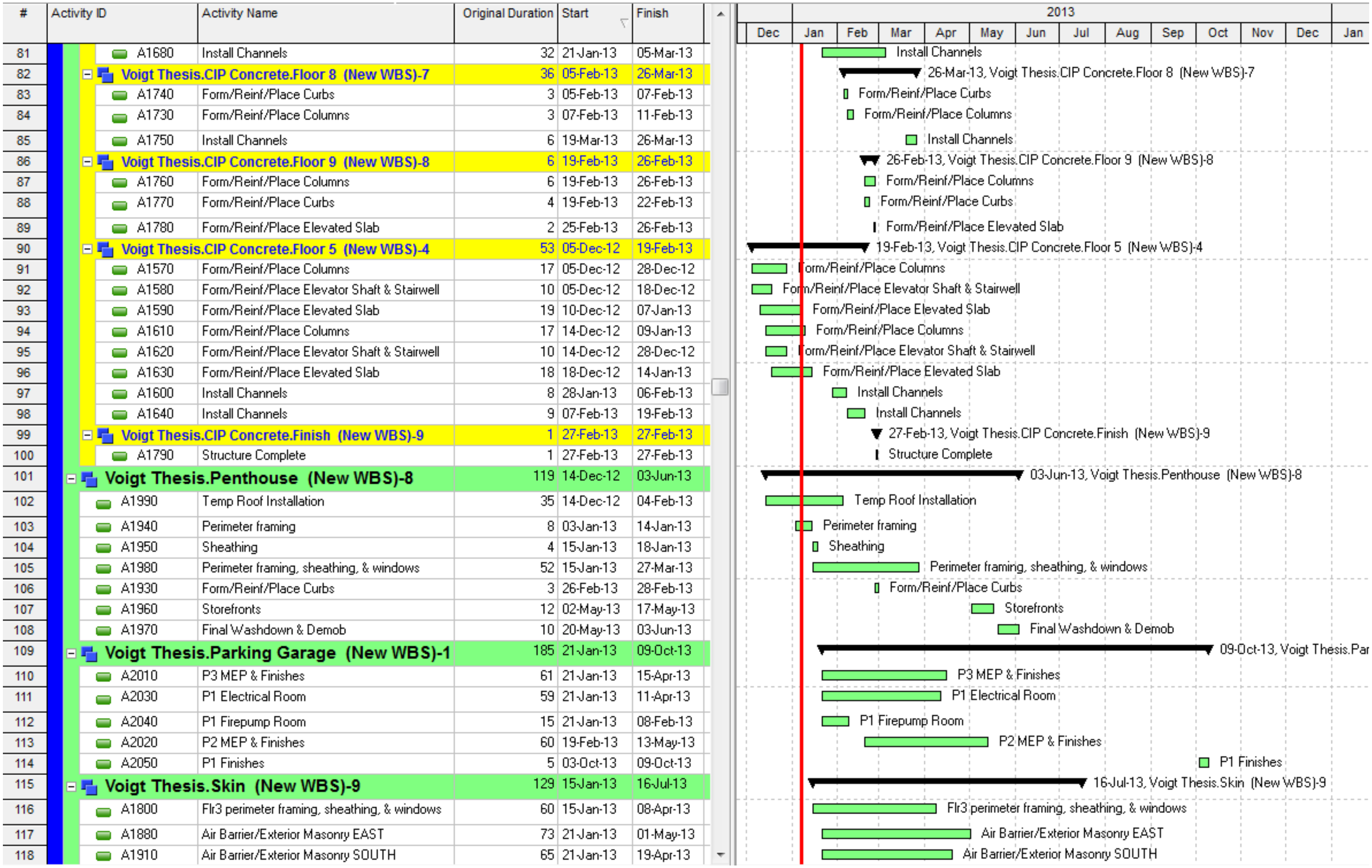


Layout: Classic Schedule Layout | Filter: All Activities

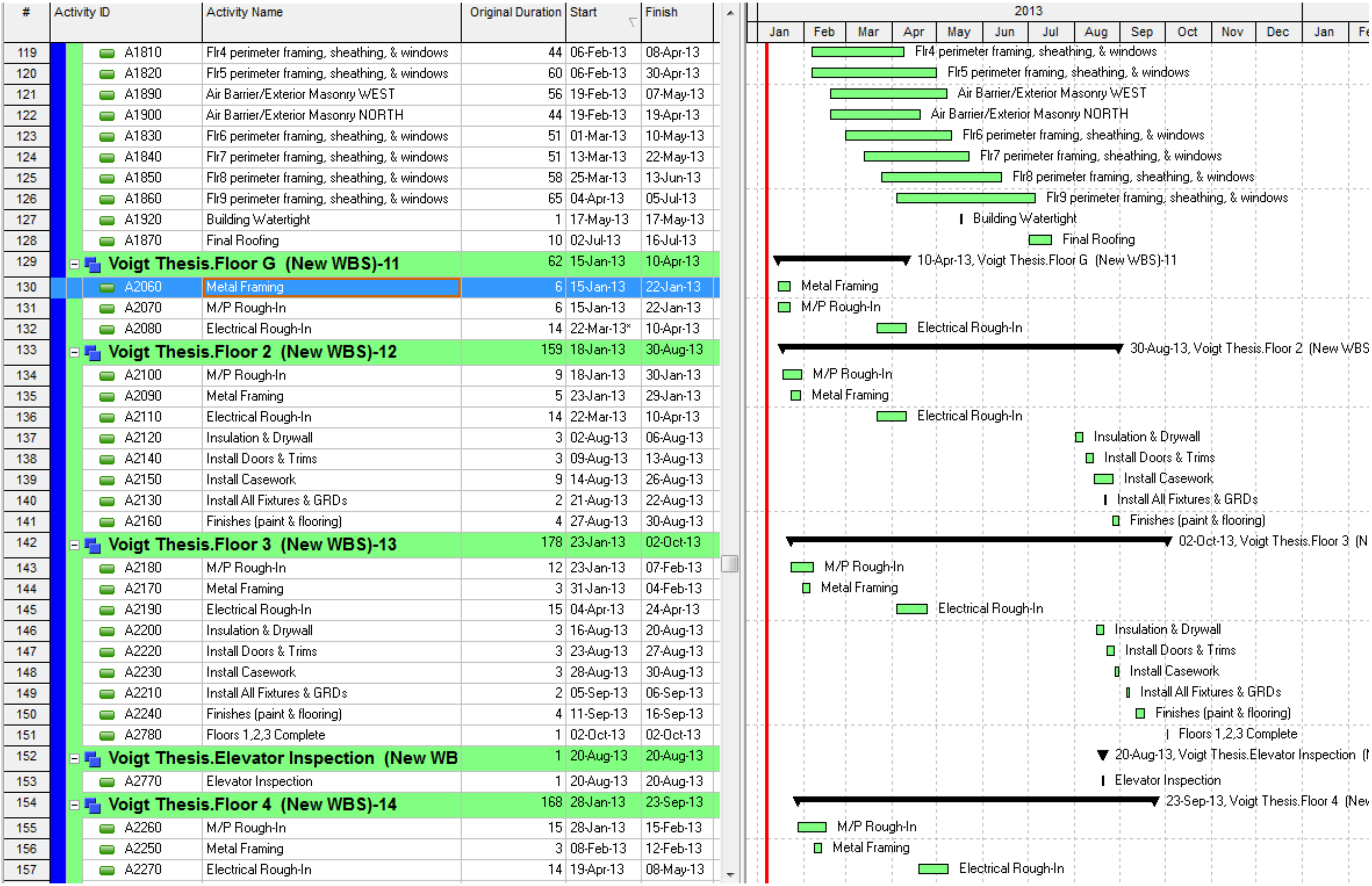
#	Activity ID	Activity Name	Original Duration	Start	Finish
5	**Voigt Thesis.Contract Awarded (New WBS**		1	21-Dec-11	21-Dec-11
6	A1000	Contract Awarded	1	21-Dec-11	21-Dec-11
7	**Voigt Thesis.NTP (New WBS)-2**		1	13-Mar-12	13-Mar-12
8	A1020	Notice to Proceed	1	13-Mar-12	13-Mar-12
9	**Voigt Thesis.Procurement (New WBS)-3**		30	13-Mar-12	23-Apr-12
10	A1030	Procurement	30	13-Mar-12	23-Apr-12
11	**Voigt Thesis.Fab & Deliver (New WBS)-4**		185	08-May-12	29-Jan-13
12	A1040	Fab & Deliver HVAC	80	08-May-12	29-Aug-12
13	A1050	Fab & Deliver Electric	40	08-May-12	03-Jul-12
14	A1060	Fab & Deliver Concrete	20	08-May-12	05-Jun-12
15	A1090	Fab & Deliver Metals	40	08-May-12	03-Jul-12
16	A1080	Fab & Deliver Roof System	40	22-May-12	18-Jul-12
17	A1070	Fab & Deliver Millwork	60	20-Jun-12	13-Sep-12
18	A1100	Fab & Deliver Windows	124	05-Jul-12	28-Dec-12
19	A1110	Fab & Deliver Doors & Frames	83	16-Aug-12	12-Dec-12
20	A1120	Fab & Deliver Woodwork	85	28-Sep-12	29-Jan-13
21	**Voigt Thesis.Mob & Demo (New WBS)-5**		113	13-Mar-12	20-Aug-12
22	A1130	Mobilization	10	13-Mar-12	26-Mar-12
23	A1160	Install Historic Facade Protection	5	27-Mar-12	02-Apr-12
24	A1140	Demo Phase 1: Domino's El Paraiso, Mason's	45	03-Apr-12	05-Jun-12
25	A1150	Demo Phase 2	20	24-Jul-12	20-Aug-12
26	**Voigt Thesis.Foundation (New WBS)-6**		150	06-Apr-12	06-Nov-12
27	A1170	Drill Piles	38	06-Apr-12	30-May-12
28	A1220	Install 7 Dewatering Wells	10	30-Apr-12	11-May-12
29	A1230	Dewatering Drawdown	10	14-May-12	25-May-12
30	A1180	P1 Install Laggin & Tiebacks	29	22-May-12	02-Jul-12
31	A1240	Drill/Set/Pour AGPs	82	31-May-12	25-Sep-12
32	A1190	P2 Install Lagging & Tiebacks	17	03-Jul-12	26-Jul-12
33	A1200	Excavate to Footing P3 & Install Lagging	7	27-Jul-12	06-Aug-12
34	A1250	Foundations Complete	1	26-Sep-12	26-Sep-12
35	A1210	Backfill P1 Wall	5	31-Oct-12	06-Nov-12
36	**Voigt Thesis.CIP Concrete (New WBS)-7**		283	08-Aug-12	17-Sep-13
37	**Voigt Thesis.CIP Concrete.Floor 2 (New WBS)-1**		39	06-Nov-12	02-Jan-13
38	A1440	Form/Reinf/Place Elevator Shaft & Stairwell	5	06-Nov-12	12-Nov-12
39	A1450	Form/Reinf/Place Columns	10	06-Nov-12	19-Nov-12
40	A1460	Form/Reinf/Place Elevated Slab	19	08-Nov-12	05-Dec-12
41	A1470	Install Channel	12	14-Dec-12	02-Jan-13



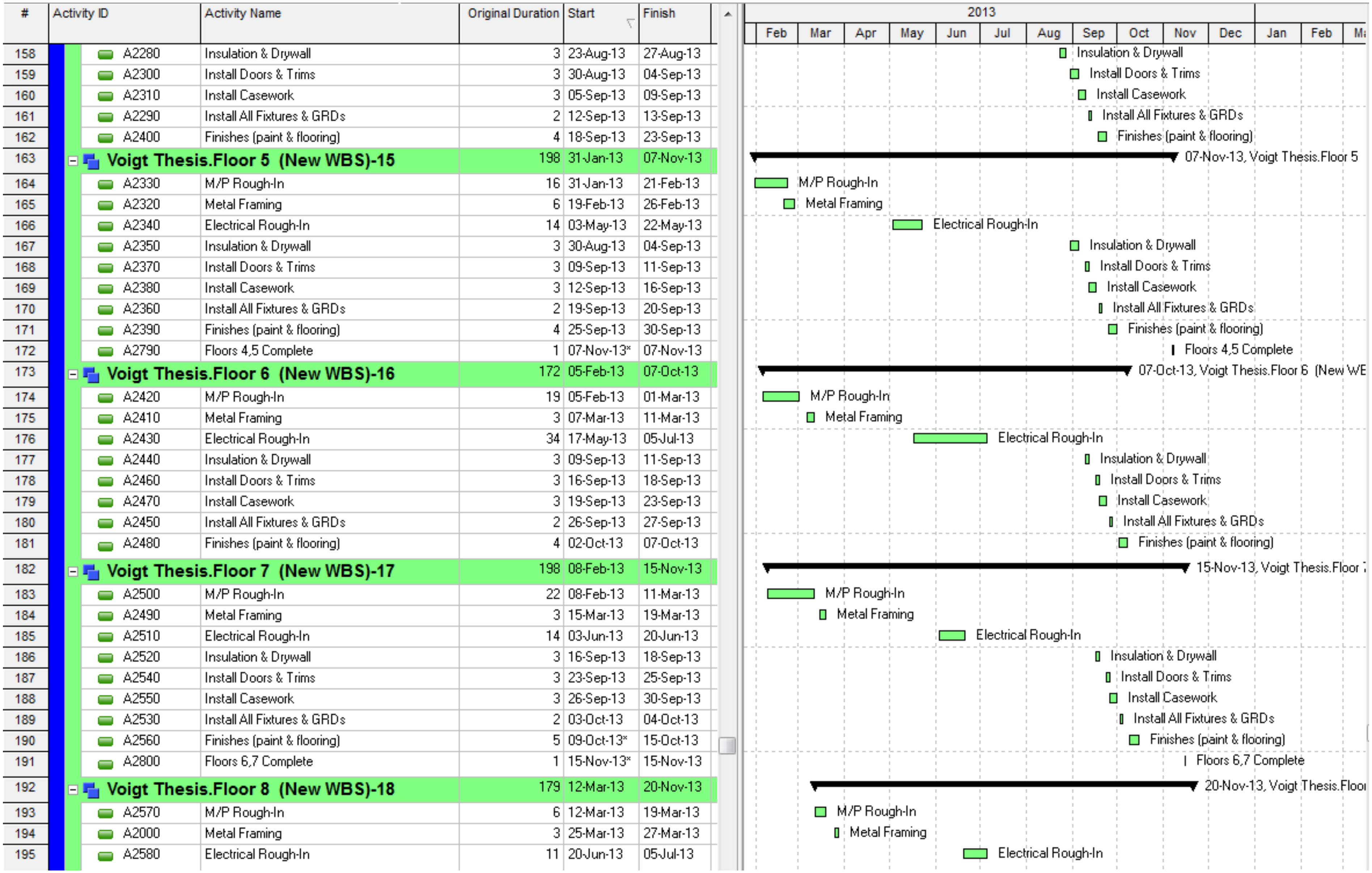
#	Activity ID	Activity Name	Original Duration	Start	Finish
42	**Voigt Thesis.CIP Concrete.Floor G (New WBS)**		114	08-Aug-12	18-Jan-13
43	A1260	Pour Footings & Strap Beams	13	08-Aug-12	24-Aug-12
44	A1270	Form/Reinf/Place Foundation Walls	10	20-Aug-12	31-Aug-12
45	A1380	Pour Footings & Strap Beams	46	21-Aug-12	24-Oct-12
46	A1280	Form/Reinf/Place Elev Slab A-D.5	5	11-Sep-12	17-Sep-12
47	A1290	Form/Reinf/Place Elev Slab D.5-J	5	18-Sep-12	24-Sep-12
48	A1300	Form/Reinf/Place Foundation Walls	8	18-Sep-12	27-Sep-12
49	A1310	Form/Reinf/Place Elev Slab A-D.5	5	26-Sep-12	02-Oct-12
50	A1320	Form/Reinf/Place Foundation Walls	8	28-Sep-12	09-Oct-12
51	A1330	Form/Reinf/Place Elev Slab D.5-J	6	04-Oct-12	11-Oct-12
52	A1340	Form/Reinf/Place Foundation Walls	7	10-Oct-12	18-Oct-12
53	A1350	Form/Reinf/Place Elev Slab A-D.5	5	16-Oct-12	22-Oct-12
54	A1360	Form/Reinf/Place Elev Slab D.5-J	6	23-Oct-12	30-Oct-12
55	A1390	Form/Reinf/Place Columns	7	23-Oct-12	31-Oct-12
56	A1400	Form/Reinf/Place Elevator shaft & stairwell	9	23-Oct-12	02-Nov-12
57	A1410	Form/Reinf/Place SOG	14	31-Oct-12	19-Nov-12
58	A1420	Form/Reinf/Place Elevated Slab	14	07-Nov-12	27-Nov-12
59	A1430	CMU Install	10	28-Nov-12	11-Dec-12
60	A1370	Install CMU P1-3	16	27-Dec-12	18-Jan-13
61	**Voigt Thesis.CIP Concrete.Floor 7 (New WBS)-6**		45	15-Jan-13	18-Mar-13
62	A1690	Form/Reinf/Place Columns	11	15-Jan-13	29-Jan-13
63	A1700	Form/Reinf/Place Elevator Shaft & Stairwell	11	15-Jan-13	29-Jan-13
64	A1710	Form/Reinf/Place Elevated Slab	10	24-Jan-13	06-Feb-13
65	A1720	Install Channels	9	06-Mar-13	18-Mar-13
66	**Voigt Thesis.CIP Concrete.Floor 3 (New WBS)-2**		40	15-Nov-12	14-Jan-13
67	A1480	Form/Reinf/Place Columns	16	15-Nov-12	07-Dec-12
68	A1490	Form/Reinf/Place Elevator Shaft & Stairwell	13	15-Nov-12	04-Dec-12
69	A1500	Form/Reinf/Place Elevated Slab	18	19-Nov-12	13-Dec-12
70	A1520	CMU Install	12	20-Dec-12	08-Jan-13
71	A1510	Install Channels	8	03-Jan-13	14-Jan-13
72	**Voigt Thesis.CIP Concrete.Floor 4 (New WBS)-3**		42	27-Nov-12	25-Jan-13
73	A1530	Form/Reinf/Place Columns	15	27-Nov-12	17-Dec-12
74	A1540	Form/Reinf/Place Elevator Shaft & Stairwell	9	27-Nov-12	07-Dec-12
75	A1550	Form/Reinf/Place Elevated Slab	19	29-Nov-12	26-Dec-12
76	A1560	Install Channels	9	15-Jan-13	25-Jan-13
77	**Voigt Thesis.CIP Concrete.Floor 6 (New WBS)-5**		43	04-Jan-13	05-Mar-13
78	A1650	Form/Reinf/Place Columns	10	04-Jan-13	17-Jan-13
79	A1660	Form/Reinf/Place Elevator Shaft & Stairwell	10	04-Jan-13	17-Jan-13
80	A1670	Form/Reinf/Place Elevated Slab	13	09-Jan-13	25-Jan-13



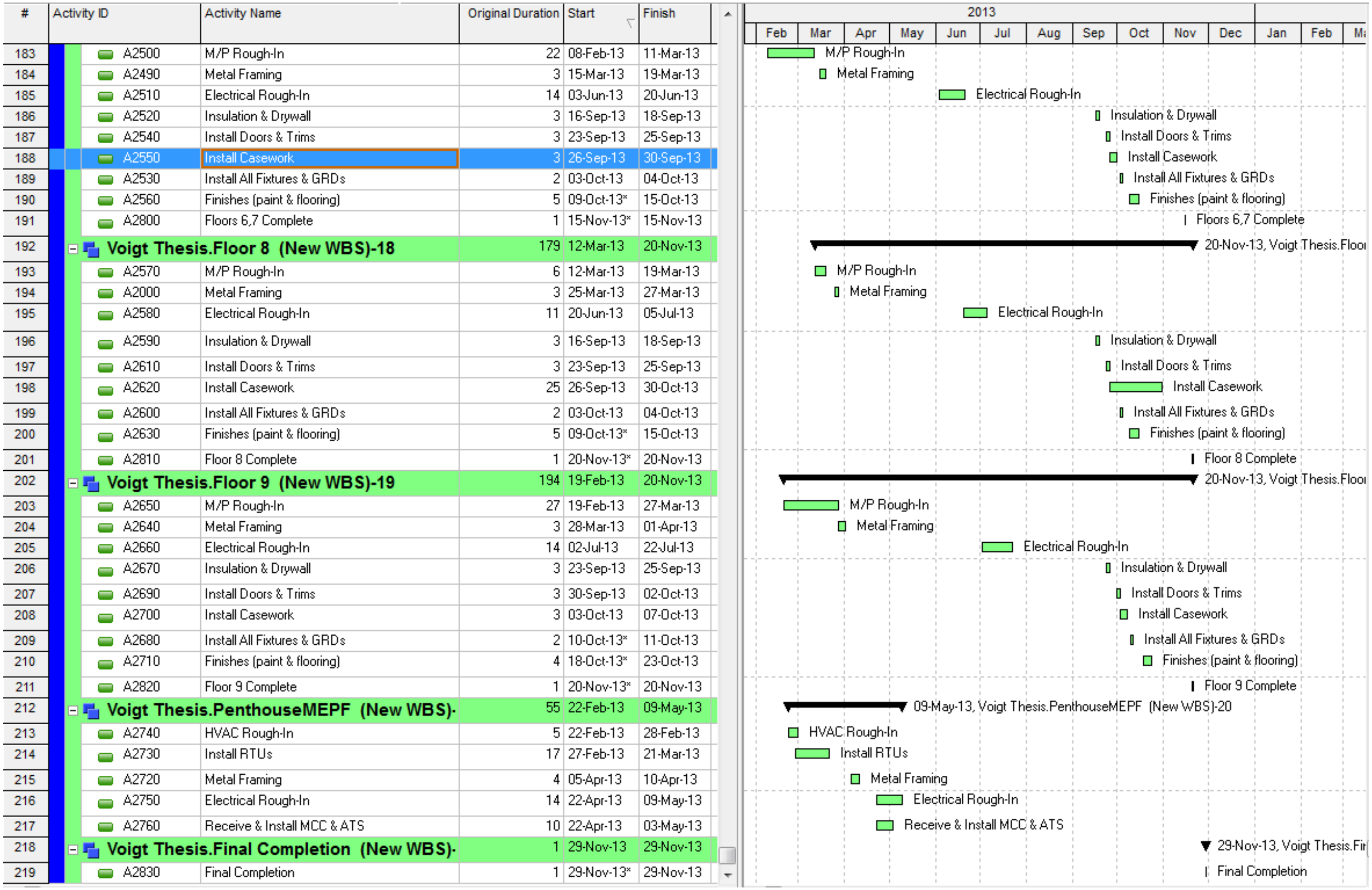
#	Activity ID	Activity Name	Original Duration	Start	Finish
81	A1680	Install Channels	32	21-Jan-13	05-Mar-13
82	**Voigt Thesis.CIP Concrete.Floor 8 (New WBS)-7**		36	05-Feb-13	26-Mar-13
83	A1740	Form/Reinf/Place Curbs	3	05-Feb-13	07-Feb-13
84	A1730	Form/Reinf/Place Columns	3	07-Feb-13	11-Feb-13
85	A1750	Install Channels	6	19-Mar-13	26-Mar-13
86	**Voigt Thesis.CIP Concrete.Floor 9 (New WBS)-8**		6	19-Feb-13	26-Feb-13
87	A1760	Form/Reinf/Place Columns	6	19-Feb-13	26-Feb-13
88	A1770	Form/Reinf/Place Curbs	4	19-Feb-13	22-Feb-13
89	A1780	Form/Reinf/Place Elevated Slab	2	25-Feb-13	26-Feb-13
90	**Voigt Thesis.CIP Concrete.Floor 5 (New WBS)-4**		53	05-Dec-12	19-Feb-13
91	A1570	Form/Reinf/Place Columns	17	05-Dec-12	28-Dec-12
92	A1580	Form/Reinf/Place Elevator Shaft & Stairwell	10	05-Dec-12	18-Dec-12
93	A1590	Form/Reinf/Place Elevated Slab	19	10-Dec-12	07-Jan-13
94	A1610	Form/Reinf/Place Columns	17	14-Dec-12	09-Jan-13
95	A1620	Form/Reinf/Place Elevator Shaft & Stairwell	10	14-Dec-12	28-Dec-12
96	A1630	Form/Reinf/Place Elevated Slab	18	18-Dec-12	14-Jan-13
97	A1600	Install Channels	8	28-Jan-13	06-Feb-13
98	A1640	Install Channels	9	07-Feb-13	19-Feb-13
99	**Voigt Thesis.CIP Concrete.Finish (New WBS)-9**		1	27-Feb-13	27-Feb-13
100	A1790	Structure Complete	1	27-Feb-13	27-Feb-13
101	**Voigt Thesis.Penthouse (New WBS)-8**		119	14-Dec-12	03-Jun-13
102	A1990	Temp Roof Installation	35	14-Dec-12	04-Feb-13
103	A1940	Perimeter framing	8	03-Jan-13	14-Jan-13
104	A1950	Sheathing	4	15-Jan-13	18-Jan-13
105	A1980	Perimeter framing, sheathing, & windows	52	15-Jan-13	27-Mar-13
106	A1930	Form/Reinf/Place Curbs	3	26-Feb-13	28-Feb-13
107	A1960	Storefronts	12	02-May-13	17-May-13
108	A1970	Final Washdown & Demob	10	20-May-13	03-Jun-13
109	**Voigt Thesis.Parking Garage (New WBS)-1**		185	21-Jan-13	09-Oct-13
110	A2010	P3 MEP & Finishes	61	21-Jan-13	15-Apr-13
111	A2030	P1 Electrical Room	59	21-Jan-13	11-Apr-13
112	A2040	P1 Firepump Room	15	21-Jan-13	08-Feb-13
113	A2020	P2 MEP & Finishes	60	19-Feb-13	13-May-13
114	A2050	P1 Finishes	5	03-Oct-13	09-Oct-13
115	**Voigt Thesis.Skin (New WBS)-9**		129	15-Jan-13	16-Jul-13
116	A1800	Flr3 perimeter framing, sheathing, & windows	60	15-Jan-13	08-Apr-13
117	A1880	Air Barrier/Exterior Masonry EAST	73	21-Jan-13	01-May-13
118	A1910	Air Barrier/Exterior Masonry SOUTH	65	21-Jan-13	19-Apr-13



#	Activity ID	Activity Name	Original Duration	Start	Finish
119	A1810	Flr4 perimeter framing, sheathing, & windows	44	06-Feb-13	08-Apr-13
120	A1820	Flr5 perimeter framing, sheathing, & windows	60	06-Feb-13	30-Apr-13
121	A1890	Air Barrier/Exterior Masonry WEST	56	19-Feb-13	07-May-13
122	A1900	Air Barrier/Exterior Masonry NORTH	44	19-Feb-13	19-Apr-13
123	A1830	Flr6 perimeter framing, sheathing, & windows	51	01-Mar-13	10-May-13
124	A1840	Flr7 perimeter framing, sheathing, & windows	51	13-Mar-13	22-May-13
125	A1850	Flr8 perimeter framing, sheathing, & windows	58	25-Mar-13	13-Jun-13
126	A1860	Flr9 perimeter framing, sheathing, & windows	65	04-Apr-13	05-Jul-13
127	A1920	Building Watertight	1	17-May-13	17-May-13
128	A1870	Final Roofing	10	02-Jul-13	16-Jul-13
129	**Voigt Thesis.Floor G (New WBS)-11**		62	15-Jan-13	10-Apr-13
130	A2060	Metal Framing	6	15-Jan-13	22-Jan-13
131	A2070	M/P Rough-In	6	15-Jan-13	22-Jan-13
132	A2080	Electrical Rough-In	14	22-Mar-13*	10-Apr-13
133	**Voigt Thesis.Floor 2 (New WBS)-12**		159	18-Jan-13	30-Aug-13
134	A2100	M/P Rough-In	9	18-Jan-13	30-Jan-13
135	A2090	Metal Framing	5	23-Jan-13	29-Jan-13
136	A2110	Electrical Rough-In	14	22-Mar-13	10-Apr-13
137	A2120	Insulation & Drywall	3	02-Aug-13	06-Aug-13
138	A2140	Install Doors & Trims	3	09-Aug-13	13-Aug-13
139	A2150	Install Casework	9	14-Aug-13	26-Aug-13
140	A2130	Install All Fixtures & GRDs	2	21-Aug-13	22-Aug-13
141	A2160	Finishes (paint & flooring)	4	27-Aug-13	30-Aug-13
142	**Voigt Thesis.Floor 3 (New WBS)-13**		178	23-Jan-13	02-Oct-13
143	A2180	M/P Rough-In	12	23-Jan-13	07-Feb-13
144	A2170	Metal Framing	3	31-Jan-13	04-Feb-13
145	A2190	Electrical Rough-In	15	04-Apr-13	24-Apr-13
146	A2200	Insulation & Drywall	3	16-Aug-13	20-Aug-13
147	A2220	Install Doors & Trims	3	23-Aug-13	27-Aug-13
148	A2230	Install Casework	3	28-Aug-13	30-Aug-13
149	A2210	Install All Fixtures & GRDs	2	05-Sep-13	06-Sep-13
150	A2240	Finishes (paint & flooring)	4	11-Sep-13	16-Sep-13
151	A2780	Floors 1,2,3 Complete	1	02-Oct-13	02-Oct-13
152	**Voigt Thesis.Elevator Inspection (New WB**		1	20-Aug-13	20-Aug-13
153	A2770	Elevator Inspection	1	20-Aug-13	20-Aug-13
154	**Voigt Thesis.Floor 4 (New WBS)-14**		168	28-Jan-13	23-Sep-13
155	A2260	M/P Rough-In	15	28-Jan-13	15-Feb-13
156	A2250	Metal Framing	3	08-Feb-13	12-Feb-13
157	A2270	Electrical Rough-In	14	19-Apr-13	08-May-13

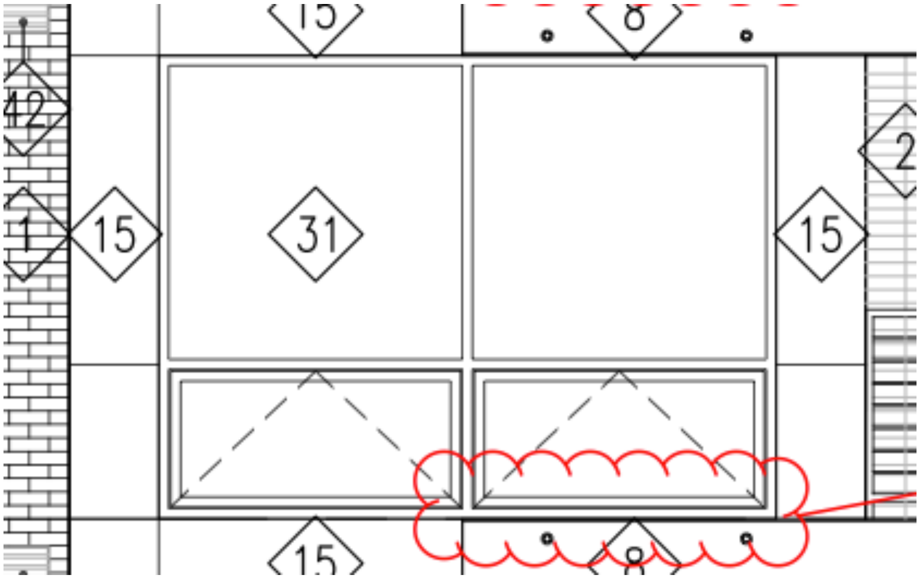


#	Activity ID	Activity Name	Original Duration	Start	Finish
158	A2280	Insulation & Drywall	3	23-Aug-13	27-Aug-13
159	A2300	Install Doors & Trims	3	30-Aug-13	04-Sep-13
160	A2310	Install Casework	3	05-Sep-13	09-Sep-13
161	A2290	Install All Fixtures & GRDs	2	12-Sep-13	13-Sep-13
162	A2400	Finishes (paint & flooring)	4	18-Sep-13	23-Sep-13
163	**Voigt Thesis.Floor 5 (New WBS)-15**		198	31-Jan-13	07-Nov-13
164	A2330	M/P Rough-In	16	31-Jan-13	21-Feb-13
165	A2320	Metal Framing	6	19-Feb-13	26-Feb-13
166	A2340	Electrical Rough-In	14	03-May-13	22-May-13
167	A2350	Insulation & Drywall	3	30-Aug-13	04-Sep-13
168	A2370	Install Doors & Trims	3	09-Sep-13	11-Sep-13
169	A2380	Install Casework	3	12-Sep-13	16-Sep-13
170	A2360	Install All Fixtures & GRDs	2	19-Sep-13	20-Sep-13
171	A2390	Finishes (paint & flooring)	4	25-Sep-13	30-Sep-13
172	A2790	Floors 4,5 Complete	1	07-Nov-13*	07-Nov-13
173	**Voigt Thesis.Floor 6 (New WBS)-16**		172	05-Feb-13	07-Oct-13
174	A2420	M/P Rough-In	19	05-Feb-13	01-Mar-13
175	A2410	Metal Framing	3	07-Mar-13	11-Mar-13
176	A2430	Electrical Rough-In	34	17-May-13	05-Jul-13
177	A2440	Insulation & Drywall	3	09-Sep-13	11-Sep-13
178	A2460	Install Doors & Trims	3	16-Sep-13	18-Sep-13
179	A2470	Install Casework	3	19-Sep-13	23-Sep-13
180	A2450	Install All Fixtures & GRDs	2	26-Sep-13	27-Sep-13
181	A2480	Finishes (paint & flooring)	4	02-Oct-13	07-Oct-13
182	**Voigt Thesis.Floor 7 (New WBS)-17**		198	08-Feb-13	15-Nov-13
183	A2500	M/P Rough-In	22	08-Feb-13	11-Mar-13
184	A2490	Metal Framing	3	15-Mar-13	19-Mar-13
185	A2510	Electrical Rough-In	14	03-Jun-13	20-Jun-13
186	A2520	Insulation & Drywall	3	16-Sep-13	18-Sep-13
187	A2540	Install Doors & Trims	3	23-Sep-13	25-Sep-13
188	A2550	Install Casework	3	26-Sep-13	30-Sep-13
189	A2530	Install All Fixtures & GRDs	2	03-Oct-13	04-Oct-13
190	A2560	Finishes (paint & flooring)	5	09-Oct-13*	15-Oct-13
191	A2800	Floors 6,7 Complete	1	15-Nov-13*	15-Nov-13
192	**Voigt Thesis.Floor 8 (New WBS)-18**		179	12-Mar-13	20-Nov-13
193	A2570	M/P Rough-In	6	12-Mar-13	19-Mar-13
194	A2000	Metal Framing	3	25-Mar-13	27-Mar-13
195	A2580	Electrical Rough-In	11	20-Jun-13	05-Jul-13

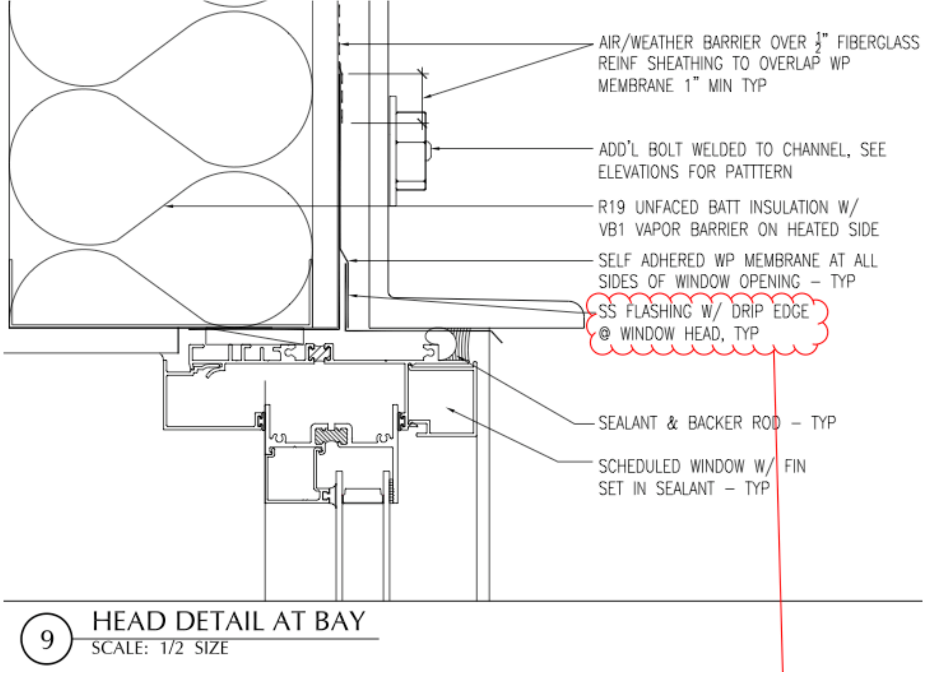


#	Activity ID	Activity Name	Original Duration	Start	Finish
183	A2500	M/P Rough-In	22	08-Feb-13	11-Mar-13
184	A2490	Metal Framing	3	15-Mar-13	19-Mar-13
185	A2510	Electrical Rough-In	14	03-Jun-13	20-Jun-13
186	A2520	Insulation & Drywall	3	16-Sep-13	18-Sep-13
187	A2540	Install Doors & Trims	3	23-Sep-13	25-Sep-13
188	A2550	Install Casework	3	26-Sep-13	30-Sep-13
189	A2530	Install All Fixtures & GRDs	2	03-Oct-13	04-Oct-13
190	A2560	Finishes (paint & flooring)	5	09-Oct-13*	15-Oct-13
191	A2800	Floors 6,7 Complete	1	15-Nov-13*	15-Nov-13
192	**Voigt Thesis.Floor 8 (New WBS)-18**		179	12-Mar-13	20-Nov-13
193	A2570	M/P Rough-In	6	12-Mar-13	19-Mar-13
194	A2000	Metal Framing	3	25-Mar-13	27-Mar-13
195	A2580	Electrical Rough-In	11	20-Jun-13	05-Jul-13
196	A2590	Insulation & Drywall	3	16-Sep-13	18-Sep-13
197	A2610	Install Doors & Trims	3	23-Sep-13	25-Sep-13
198	A2620	Install Casework	25	26-Sep-13	30-Oct-13
199	A2600	Install All Fixtures & GRDs	2	03-Oct-13	04-Oct-13
200	A2630	Finishes (paint & flooring)	5	09-Oct-13*	15-Oct-13
201	A2810	Floor 8 Complete	1	20-Nov-13*	20-Nov-13
202	**Voigt Thesis.Floor 9 (New WBS)-19**		194	19-Feb-13	20-Nov-13
203	A2650	M/P Rough-In	27	19-Feb-13	27-Mar-13
204	A2640	Metal Framing	3	28-Mar-13	01-Apr-13
205	A2660	Electrical Rough-In	14	02-Jul-13	22-Jul-13
206	A2670	Insulation & Drywall	3	23-Sep-13	25-Sep-13
207	A2690	Install Doors & Trims	3	30-Sep-13	02-Oct-13
208	A2700	Install Casework	3	03-Oct-13	07-Oct-13
209	A2680	Install All Fixtures & GRDs	2	10-Oct-13*	11-Oct-13
210	A2710	Finishes (paint & flooring)	4	18-Oct-13*	23-Oct-13
211	A2820	Floor 9 Complete	1	20-Nov-13*	20-Nov-13
212	**Voigt Thesis.PenthouseMEPF (New WBS)-**		55	22-Feb-13	09-May-13
213	A2740	HVAC Rough-In	5	22-Feb-13	28-Feb-13
214	A2730	Install RTUs	17	27-Feb-13	21-Mar-13
215	A2720	Metal Framing	4	05-Apr-13	10-Apr-13
216	A2750	Electrical Rough-In	14	22-Apr-13	09-May-13
217	A2760	Receive & Install MCC & ATS	10	22-Apr-13	03-May-13
218	**Voigt Thesis.Final Completion (New WBS)-**		1	29-Nov-13	29-Nov-13
219	A2830	Final Completion	1	29-Nov-13*	29-Nov-13

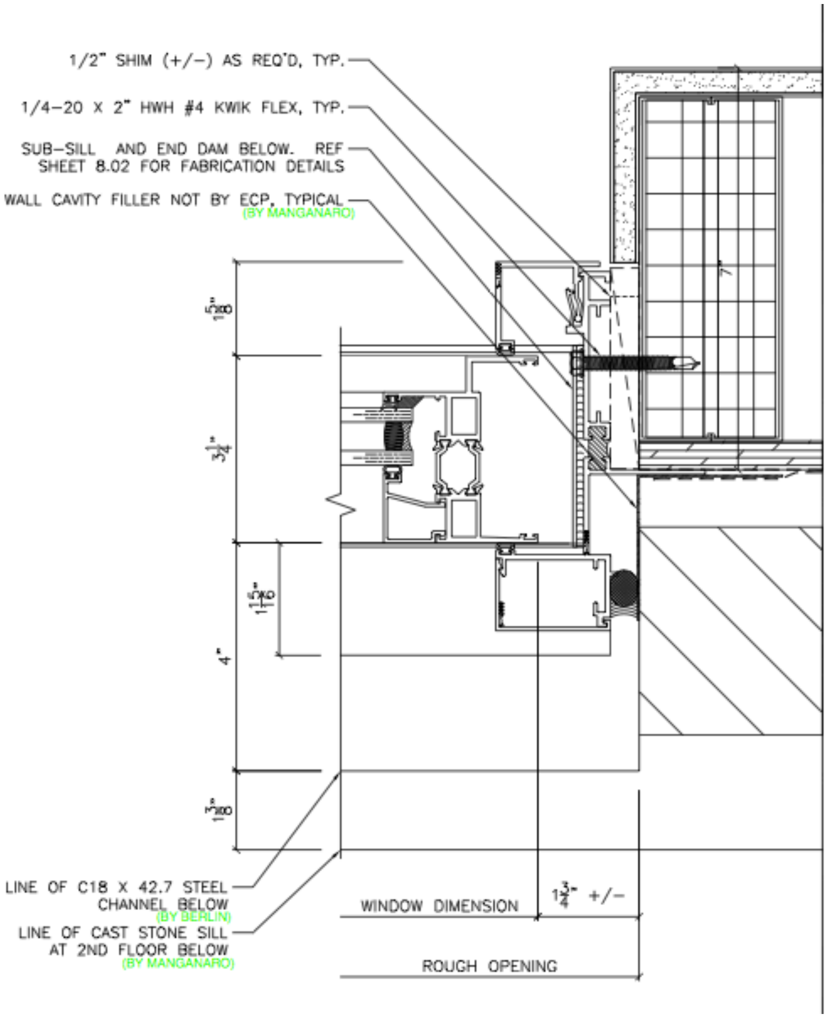
E: Constructability Concerns: Supporting Sketches



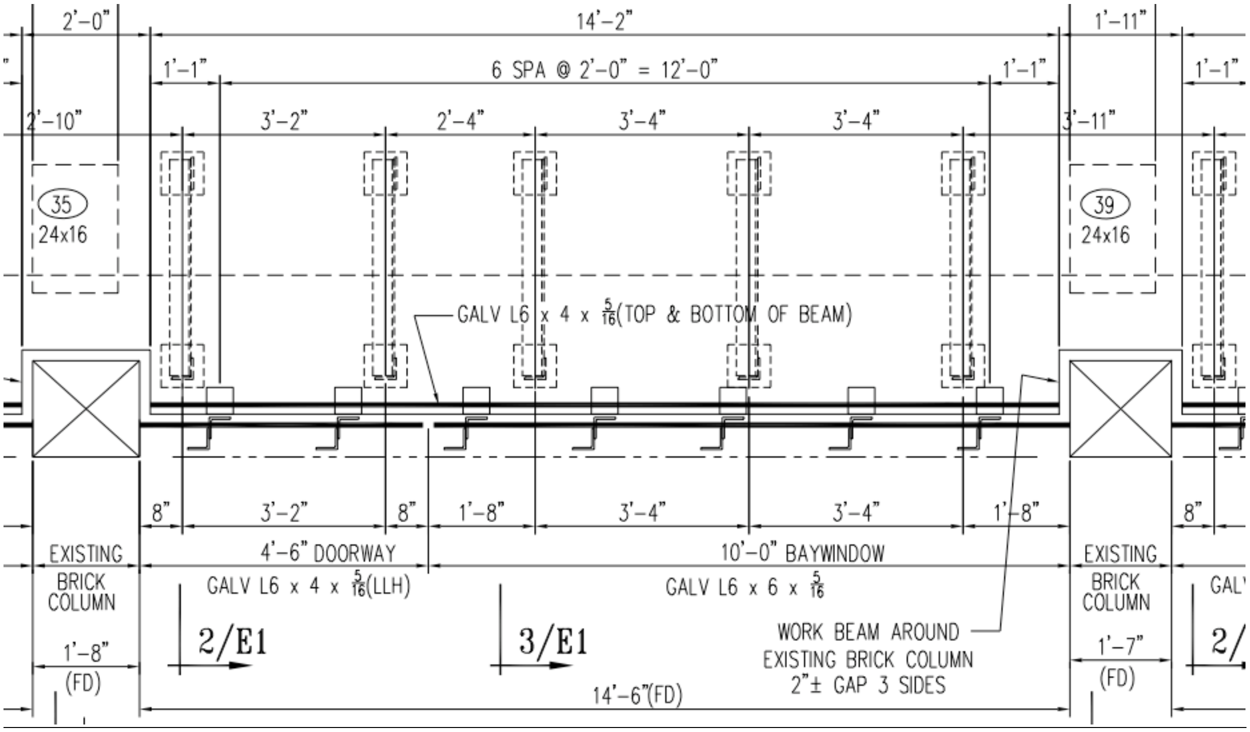
^common window detail with adjacent masonry & metal panels



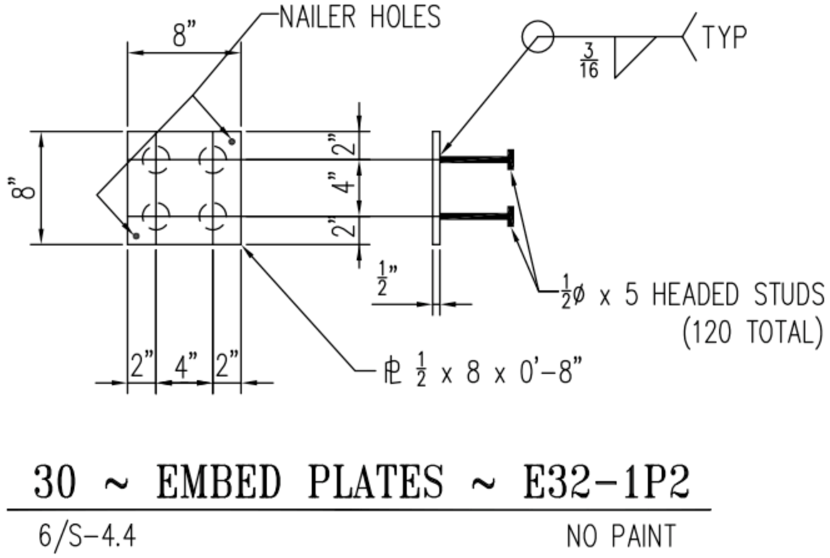
9 HEAD DETAIL AT BAY
SCALE: 1/2 SIZE



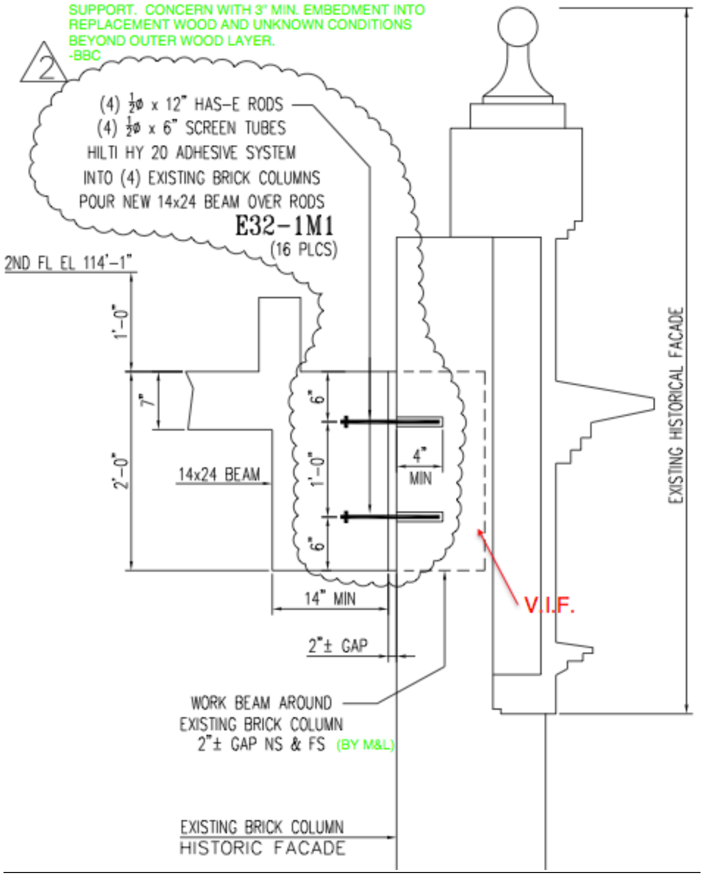
^window receptor installation detail



^historic façade support plan



^embed plates installed on historic facade



F: LEED Scorecards (see next two pages)

*includes Penn State scorecard & actual scorecard

LEED 2009 for New Construction and Major Renovations

14th & U - PSU Approach

Project Checklist

M = Mandatory

5 20 1

Sustainable Sites — Possible Points: 26

Y	?	N			
Y			Prereq 1	Construction Activity Pollution Prevention	
	x		Credit 1	Site Selection	1
	x		Credit 2	Development Density and Community Connectivity	5
	x		Credit 3	Brownfield Redevelopment	1
	x		Credit 4.1	Alternative Transportation—Public Transportation Access	6
x			Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
	x		Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
	x		Credit 4.4	Alternative Transportation—Parking Capacity	2
	x		Credit 5.1	Site Development—Protect or Restore Habitat	1
x			Credit 5.2	Site Development—Maximize Open Space	1
M			Credit 6.1	Stormwater Design—Quantity Control	1
x			Credit 6.2	Stormwater Design—Quality Control	1
	x		Credit 7.1	Heat Island Effect—Non-roof	1
x			Credit 7.2	Heat Island Effect—Roof	1
		x	Credit 8	Light Pollution Reduction	1

4 6

Water Efficiency — Possible Points: 10

Y	?	N			
Y			Prereq 1	Water Use Reduction—20% Reduction	
	X		Credit 1	Water Efficient Landscaping	2 to 4
	X		Credit 2	Innovative Wastewater Technologies	2
X			Credit 3	Water Use Reduction	2 to 4

25 7 3

Energy and Atmosphere — Possible Points: 35

Y	?	N			
Y			Prereq 1	Fundamental Commissioning of Building Energy Systems	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
M			Credit 1	Optimize Energy Performance	1 to 19
	X		Credit 2	On-Site Renewable Energy	1 to 7
M			Credit 3	Enhanced Commissioning	2
M			Credit 4	Enhanced Refrigerant Management	2
		X	Credit 5	Measurement and Verification	3
M			Credit 6	Green Power	2

7 7

Materials and Resources — Possible Points: 14

Y	?	N			
Y			Prereq 1	Storage and Collection of Recyclables	
	X		Credit 1.1	Building Reuse—Maintain Existing Walls, Floors, and Roof	1 to 3
	X		Credit 1.2	Building Reuse—Maintain 50% of Interior Non-Structural Elements	1
M			Credit 2	Construction Waste Management	1 to 2
	X		Credit 3	Materials Reuse	1 to 2

Materials and Resources, Continued

Y	?	N			
M			Credit 4	Recycled Content	1 to 2
M			Credit 5	Regional Materials	1 to 2
	X		Credit 6	Rapidly Renewable Materials	1
M			Credit 7	Certified Wood	1

13 1 1

Indoor Environmental Quality — Possible Points: 15

Y	?	N			
Y			Prereq 1	Minimum Indoor Air Quality Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
M			Credit 1	Outdoor Air Delivery Monitoring	1
		X	Credit 2	Increased Ventilation	1
M			Credit 3.1	Construction IAQ Management Plan—During Construction	1
M			Credit 3.2	Construction IAQ Management Plan—Before Occupancy	1
M			Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
M			Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
M			Credit 4.3	Low-Emitting Materials—Flooring Systems	1
M			Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
M			Credit 5	Indoor Chemical and Pollutant Source Control	1
M			Credit 6.1	Controllability of Systems—Lighting	1
X			Credit 6.2	Controllability of Systems—Thermal Comfort	1
X			Credit 7.1	Thermal Comfort—Design	1
M			Credit 7.2	Thermal Comfort—Verification	1
X			Credit 8.1	Daylight and Views—Daylight	1
	X		Credit 8.2	Daylight and Views—Views	1

2 1 0

Innovation and Design Process — Possible Points: 6

Y	?	N			
	X		Credit 1.1	Innovation in Design 1.0	1
M			Credit 1.2	Innovation in Design 2.0 LEED AP	1
			Credit 1.3		1
			Credit 1.4		1
			Credit 1.5		1
M			Credit 2	LEED Accredited Professional	1

1 1 0

Regional Priority Credits — Possible Points: 4

Y	?	N			
	X		Credit 1.1	Regional Priority: Specific Credit	1
			Credit 1.2	Regional Priority: Specific Credit	1
			Credit 1.3	Regional Priority: Specific Credit	1
			Credit 1.4	Regional Priority: Specific Credit	1

57 43 5

Total — Possible Points: 98

Certified 40 to 49 points Silver 50 to 59 points Gold 60 to 79 points Platinum 80 to 110

LEED® for New Construction

Credit Scorecard

LEED-NC Green Building Rating System, version 2.2, final version

14th and U Street - "Utopia"

Eric Colbert & Associates

April 4, 2012

36	5	28	**Total Project Score**	Possible Points **69**

Certified 26 to 32 points **Silver** 33 to 38 points **Gold** 39 to 51 points **Platinum** 52 or more points

Sustainable Sites

8	2	4	**Sustainable Sites**	Possible Points	14
Y	?	N			
Y	▨	▨	Prereq 1	**Construction Activity Pollution Prevention**	
1			Credit 1	**Site Selection**	1
1			Credit 2	**Development Density & Community Connectivity**	1
1			Credit 3	**Brownfield Redevelopment**	1
1			Credit 4.1	**Alternative Transportation:** Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation:** Bicycle Storage & Changing Rooms	1
1			Credit 4.3	**Alternative Transportation:** Low Emitting & Fuel Efficient Vehicles	1
		1	Credit 4.4	**Alternative Transportation:** Parking Capacity	1
	1		Credit 5.1	**Site Development:** Protect or Restore Habitat	1
1			Credit 5.2	**Site Development:** Maximize Open Space	1
		1	Credit 6.1	**Stormwater Design:** Quantity Control	1
		1	Credit 6.2	**Stormwater Design:** Quality Control	1
1			Credit 7.1	**Heat Island Effect:** Non-Roof	1
	1		Credit 7.2	**Heat Island Effect:** Roof	1
		1	Credit 8	**Light Pollution Reduction**	1

Water Efficiency

3	1	1	**Water Efficiency**	Possible Points	5
Y	?	N			
1			Credit 1.1	**Water Efficient Landscaping:** Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping:** No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction:** 20% Reduction	1
	1		Credit 3.2	**Water Use Reduction:** 30% Reduction	1

Energy & Atmosphere

5	1	11	**Energy & Atmosphere**	Possible Points	17
Y	?	N			
Y	▨	▨	Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	
Y	▨	▨	Prereq 2	**Minimum Energy Performance**	
Y	▨	▨	Prereq 3	**CFC Reduction in HVAC&R Equipment**	
2			Credit 1.1	**Optimize Energy Performance:** 14% New / 7% Existing	2
2			Credit 1.2	**Optimize Energy Performance:** 21% New / 14% Existing	2
	1	1	Credit 1.3	**Optimize Energy Performance:** 28% New / 21% Existing	2
		2	Credit 1.4	**Optimize Energy Performance:** 35% New / 28% Existing	2
		2	Credit 1.5	**Optimize Energy Performance:** 42% New / 35% Existing	2
		1	Credit 2.1	**On-Site Renewable Energy:** 2.5%	1
		1	Credit 2.2	**On-Site Renewable Energy:** 7.5%	1
		1	Credit 2.3	**On-Site Renewable Energy:** 12.5%	1
		1	Credit 3	**Enhanced Commissioning**	1
		1	Credit 4	**Enhanced Refrigerant Management**	1
		1	Credit 5	**Measurement & Verification**	1
1			Credit 6	**Green Power**	1

Materials & Resources

6		7	**Materials & Resources**	Possible Points	13
Y	?	N			
Y	▨	▨	Prereq 1	**Storage & Collection of Recyclables**	
		1	Credit 1.1	**Building Reuse:** Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse:** Maintain 95% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse:** Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management:** Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management:** Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse:** 5%	1
		1	Credit 3.2	**Materials Reuse:** 10%	1
1			Credit 4.1	**Recycled Content:** 10% (post-consumer + 1/2 pre-consumer)	1
1			Credit 4.2	**Recycled Content:** 20% (post-consumer + 1/2 pre-consumer)	1
1			Credit 5.1	**Regional Materials:** 10% Extracted, Processed & Manufactured Regionall	1
1			Credit 5.2	**Regional Materials:** 20% Extracted, Processed & Manufactured Regionall	1
		1	Credit 6	**Rapidly Renewable Materials**	1
		1	Credit 7	**Certified Wood**	1

Indoor Environmental Quality

9	1	5	**Indoor Environmental Quality**	Possible Points	15
Y	?	N			
Y	▨	▨	Prereq 1	**Minimum IAQ Performance**	
Y	▨	▨	Prereq 2	**Environmental Tobacco Smoke (ETS) Control**	
		1	Credit 1	**Outdoor Air Delivery Monitoring**	1
		1	Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan:** During Construction	1
	1		Credit 3.2	**Construction IAQ Management Plan:** Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials:** Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials:** Paints	1
1			Credit 4.3	**Low-Emitting Materials:** Carpet	1
		1	Credit 4.4	**Low-Emitting Materials:** Composite Wood & Agrifiber Products	1
		1	Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems:** Lighting	1
1			Credit 6.2	**Controllability of Systems:** Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort:** Design	1
1			Credit 7.2	**Thermal Comfort:** Verification	1
1			Credit 8.1	**Daylight & Views:** Daylight 75% of Spaces	1
		1	Credit 8.2	**Daylight & Views:** Views for 90% of Spaces	1

Innovation & Design Process

5			**Innovation & Design Process**	Possible Points		5
Y	?	N				
1			Credit 1.1	**Innovation in Design:**	Maximize Public Transportation	1
1			Credit 1.2	**Innovation in Design:**	Heat Island Effect: Non-Roof	1
1			Credit 1.3	**Innovation in Design:**	Maximize Open Space	1
1			Credit 1.4	**Innovation in Design:**	Maximize Green Power	1
1			Credit 2	**LEED Accredited Professional**		1