

77 K STREET

Washington, DC



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Construction Management

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77 K Street

Technical Assignment #2

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Executive Summary

Technical assignment #2 was a means of delving deeper into the 77 K Street project and beginning to explore possible topics for future research. Through this report one will find many of the topics studied in technical report #1 but in much greater detail. This report contains a more detailed project schedule, a site layout plan for the structural concrete sequence, an assemblies estimate of the roofing system, a detailed concrete estimate, and a general conditions estimate.

Through the process of creating the critical path method (CPM) schedule, I began to see opportunities for the implementation of a short interval production schedule (SIPS). By beginning to utilize the labor force more efficiently the project could begin to operate in a more lean and productive manner, not only saving time but saving money as well. I also see opportunities for incorporating building information modeling to help plan crew movement and prevent interference in the schedule.

The creation of the critical path method schedule also opened up the opportunity to exploring the precast and glazing façade in further detail. The interesting sequencing of the facades utilizing both mobile as well as tower cranes in combination with the owner's desire to get the building enclosed as soon as possible presents an area to study further.

The project also did consider pursuing LEED certification but not until well into the design and planning. Another area to research could be the feasibility and cost implications of making this building green earlier in the development of the project.



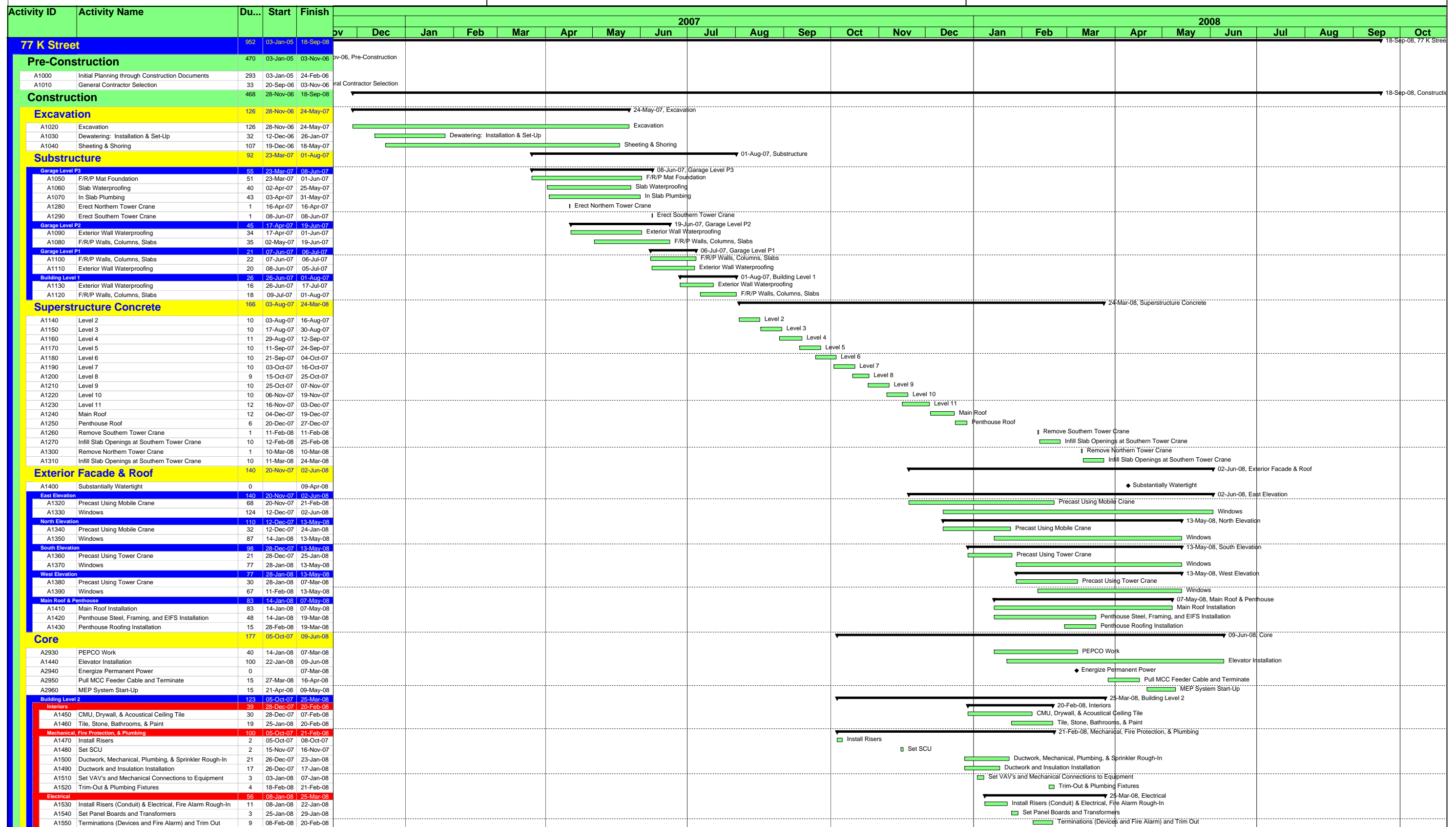
Detailed Project Schedule

A project schedule was developed in order to assess the current status of the project, as well as begin exploring potential solutions to reduce the overall schedule duration. Being a core and shell office building with typical floor layouts, the potential to maximize crew productivity became of particular interest. The repetition of activities being performed lends well to a crew improving their production as they proceed through the building.

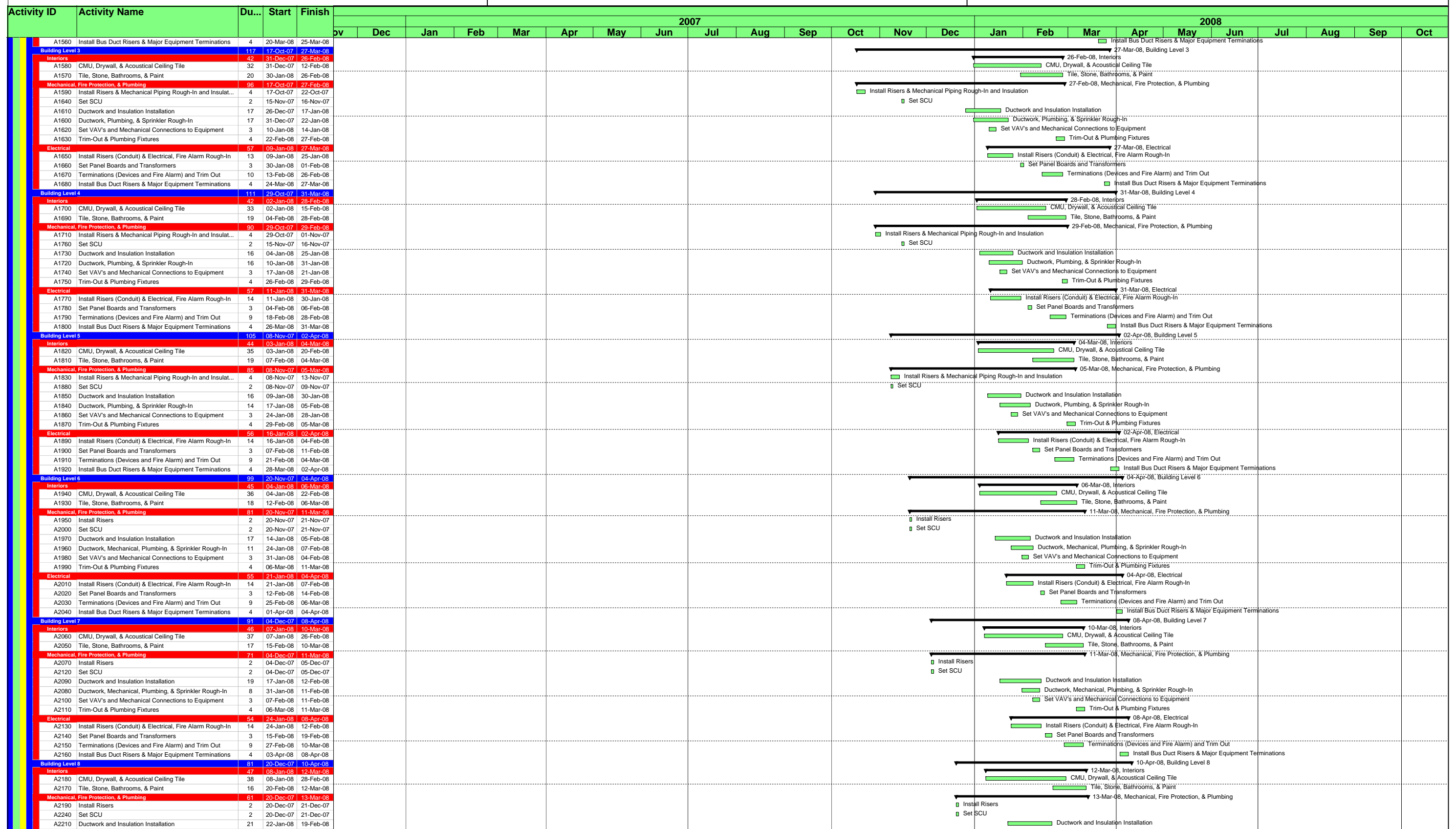
In order to begin analyzing these work flows, the construction schedule was broken down into floors, rather than trades. By seeing the flow of activities, one could begin to develop a sense of the “parade of trades” throughout the building. The critical path method schedule posed a particular challenge at assessing this flow and consequently, an activity grid was developed. The grid plots out the exact dates each activity will take place, as well as on which floors of the building. The grid helps visually depict not only when and where activities are taking place but also gaps in the work sequence and inefficiencies in the schedule.

The ultimate goal of developing the activity grid is to pursue the development of a short interval production schedule (SIPS) as part of my future research. When looking at one activity, white space in the grid indicates gaps in an activity’s work sequence. A crew is being pulled off of their task and diverted to another activity, only to return to such task on another floor at a later time. By balancing work crews and production rates, an efficient flow of trades can be developed where workers are operating most efficiently and activities are scheduled sequentially.

Additionally, I hope to take the SIPS schedule one step further. By displaying in tandem both the current schedule and lean SIPS schedule in a 4D model of 77 K Street, the user can show interested parties how production has increased and the construction is operating in a efficient manner. Using building information modeling to allocate work areas, the user will be capable of easily displaying the efficiency of the SIPS schedule as well as detecting any collisions between trades. A visual “parade of trades” will flow through the building. With each crew highlighted in a different color within the model, a flow of colors, representing the flow of crews, will travel through the model in a smooth, efficient manner.



█ Actual Work
 █ Critical Remaining Work
 ▶ Summary
█ Remaining Work
 ◆ Milestone



█ Actual Work
 █ Critical Remaining Work
 ▶ Summary
█ Remaining Work
 ◆ Milestone

Activity ID	Activity Name	Du...	Start	Finish	2007												2008											
					Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
					Inspections and Close-Out																							
A2870	As-Builts, O&M's, Warranties	83	27-May-08	18-Sep-08																								
A2900	System Training and MEP Commissioning	20	27-May-08	23-Jun-08																								
A2880	Final Inspections	31	01-Jul-08	12-Aug-08																								
A2890	Substantial Completion	11	02-Jul-08	16-Jul-08																								
A2910	Punchlist	0		17-Jul-08																								
A2920	Final Completion	45	18-Jul-08	18-Sep-08																								
		0		18-Sep-08																								

Legend:

- As-Builts, O&M's, Warranties
- System Training and MEP Commissioning
- Final Inspections
- Substantial Completion
- Punchlist
- Final Completion

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Site Layout Plan

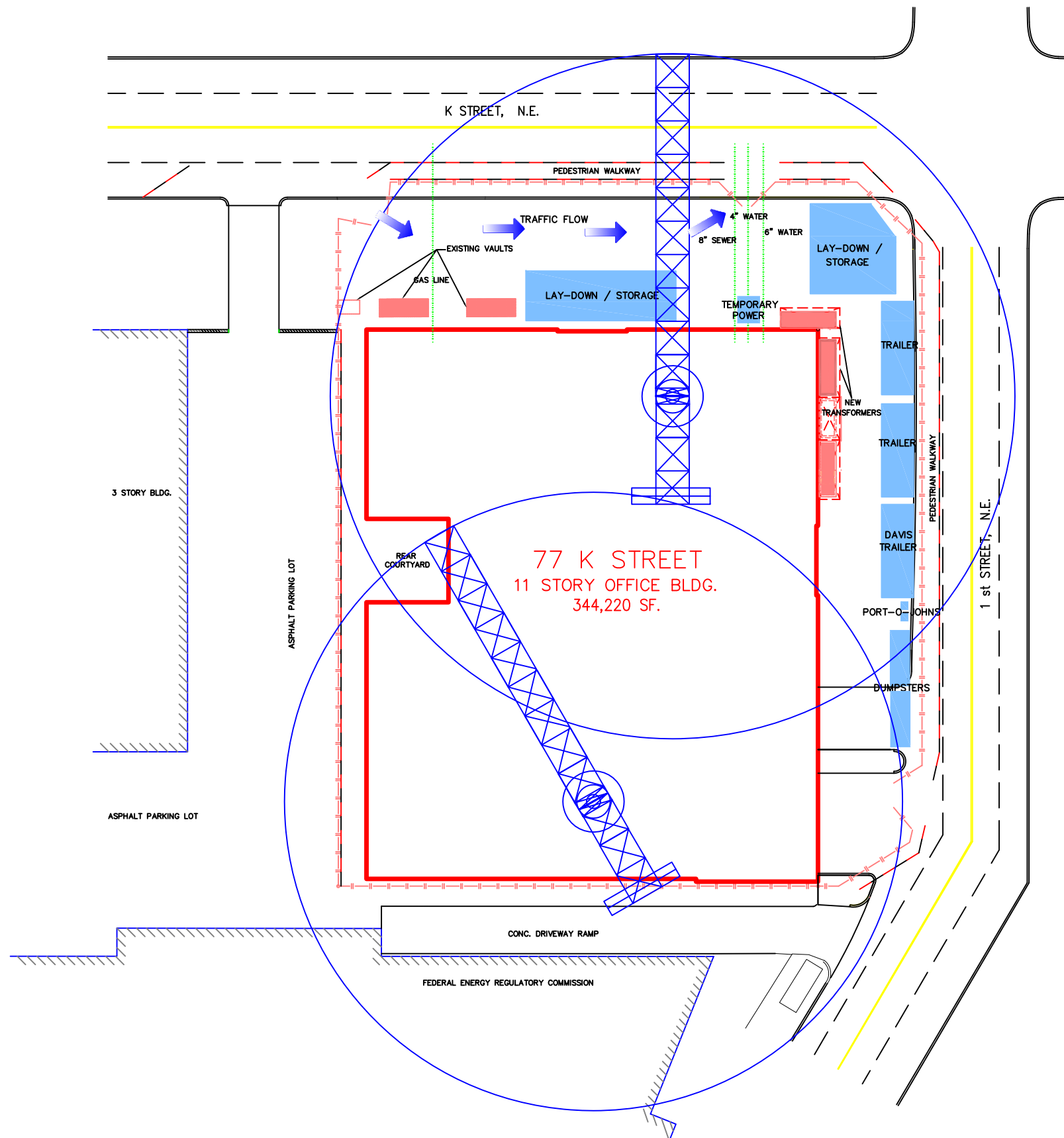
A site layout was developed for the concrete sequence of the project, which extends from April through December 2007. Concrete trucks will enter the site from K Street at the northwestern corner of the site or from the single entrance on 1st street. Their entrance location will depend on which tower crane they will be supplying concrete to.

Also of note, the layout plan has lay down areas for structural steel rebar and formwork awaiting placement within the building. One critical feature of the site plan is the placement of the southern tower crane. The crane's placement intentionally just allowed the crane to reach the southwestern corner of the rear courtyard. At this location, the crane will make a critical precast concrete pick during the façade sequence of the project.

Included on the plan are the locations of Davis' trailer and spaces for subcontractor trailers. During this sequence, Miller & Long, the concrete subcontractor, will occupy one of the two remaining trailer locations. Port-O-Johns and dumpsters are also provided on the site plan. Both can be serviced via the 1st Street entrance.

Additionally, pedestrian safety is of paramount importance so pedestrian walkways have been added to protect from vehicular traffic and site equipment. Additionally, site traffic cannot exit directly at the intersection of 1st and K Street as this would be a danger to pedestrians and other vehicles alike.

The site plan developed by Davis Construction is not only appropriate but highly effective as well. It best utilizes the limited space available in an efficient, safe manner.



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Roofing Assemblies Estimate

The roofing system of the 77 K Street project is comprised of a hot fluid-applied roofing membrane directly above the concrete slab. Type VI rigid polystyrene insulation is placed above the roofing membrane. Finally, either a size 4 aggregate ballast ranging in size from 3/4" to 1-1/2" or two foot square roof pavers are placed above.

R.S. Means was used to perform the estimate. Because the Assemblies Cost Data guide did not contain an exact match to the roofing system used in this building, an assembly was created using detailed cost data for each item in the typical and terrace roofing systems. R.S. Means did contain the flashing detail used so the assembly data could be used for that item. A location factor of 0.981 was used based on R.S. Means' division 7 data.

In order to simplify the assembly estimate, an assumption was made that the slopes of the rigid insulation could be considered trivial. Additionally, Means did not contain cost data for 215 millimeter thick fluid-applied membrane. As a result an estimated square foot cost was extrapolated from thicknesses that were contained in the manual.

Of note, the actual cost of the roofing contract was approximately \$356,000. The estimate that was developed produced a value of roughly \$375,800 differing by less than \$20,000, or 5.5% from the actual construction cost.

ROOFING ASSEMBLIES ESTIMATE													
Quantity	Unit	2007 R.S. Means Cost Data											
		Material		Labor		Equipment		TOTAL		TOTAL, INCL. O&P			
		Nat'l Cost	77K	Nat'l Cost	77K	Nat'l Cost	77K	Nat'l Cost	77K	Nat'l Cost	77K		
Typical Roof Assembly													
07 56 10.10	120	Fluid Applied Asphalt, 215 mils.	SF	\$4.56		\$1.49		\$0.20		\$6.25		\$7.75	
07 22 16.10	1956	Rigid Insulation, 4" thick, 40 psi	SF	\$1.88		\$0.26		\$0.00		\$2.14		\$2.52	
		Ballast, 15 lb/SF	SF	\$0.25		\$0.50		\$0.00		\$0.75		\$0.90	
	26850	TOTAL ASSEMBLY	SF	\$6.69	\$179,546	\$2.25	\$60,359	\$0.20	\$5,410	\$9.14	\$245,315	\$11.13	\$298,841
Roof Terrace Assembly													
07 56 10.10	120	Fluid Applied Asphalt, 215 mils.	SF	\$3.09		\$1.01		\$0.25		\$4.35		\$5.22	
07 22 16.10	1956	Rigid Insulation, 4" thick, 40 psi	SF	\$1.88		\$0.26		\$0.00		\$2.14		\$2.21	
07 51 13.50	300	Roof Paver, 2' x 2'	SF	\$1.55		\$2.10		\$0.00		\$3.65		\$4.92	
	4375	TOTAL ASSEMBLY	SF	\$6.52	\$28,512	\$3.37	\$14,735	\$0.25	\$1,109	\$10.14	\$44,356	\$12.35	\$54,031
Base Flashing Assembly													
B3010 410	2700	4000 psi concrete	LF	\$8.08	\$9,219	\$13.09	\$14,936	\$0.00	\$0	\$21.17	\$24,155	\$26.46	\$30,194
											Total	\$383,065	
											Washington, D.C. Location Factor	0.981	
											TOTAL FACTORED COST	\$375,787	
											OVERALL, \$/SF ROOF	\$12.04	

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Detailed Structural Systems Estimate

77 K Street utilizes a cast in place concrete structural system. The foundation is a 4'-0" thick, 4,000 psi concrete mat foundation resting on a 4" mud mat. Below grade parking levels are 9" reinforced concrete flat slabs with 5-1/2" drop panels at select column locations. Floors above grade are 10" or 11" post-tensioned two-way slabs with 4-1/4" drop panels at all columns and around the slab perimeter. The upper roof of the mechanical penthouse is framed using a combination of concrete and hollow structural steel members with a 8" one-way slab roof. Typical columns have a compressive strength of 5,000 psi with select columns having increased capacity up to 10,000 psi. Slab concrete capacities range from 3,000 psi at the lowest garage level to 5,000 psi for above grade slabs. Concrete is placed using two tower cranes, both staged within the footprint of the building.

The estimating process began by breaking down the column schedule provided in the construction documents into concrete compressive strengths. Based on column size and strength, an estimate for the amount of 5000, 6000, 8000, and 10000 psi concrete was created. Using the R.S. Means rebar guides, an estimate for the amount of reinforcing steel was calculated. Additionally, a calculation for the surface area of formwork was developed.

Slab calculations were based off of a system estimate that included reinforcing steel, concrete, and formwork and an additional value was added for the post tensioning cable found on floors two through the roof. Foundations and shear wall estimates were calculated in a manner similar to that of the slabs and columns.

Adjustments were made to account for the locale of the project. Washington, D.C. time multipliers for division 3 cost data were as follows:

Division 3: Concrete			
Washington, DC Location Factors			
	Material	Installation	Total
Forming & Accessories	99.5%	82.3%	84.7%
Steel Reinforcement	102.1%	90.2%	96.4%
Cast-In-Place Concrete	125.5%	88.0%	111.6%
OVERALL	118.4%	87.0%	103.9%

Data was taken from the 2008 R.S. Means Construction Data manual which contains costs based on projects from 2007 and the latter part of 2006. Because the project was bid in this time frame, no time factor was required.

Assumptions were made in order to simplify the detailed estimate. For example, systems estimates as mentioned above were used when available rather than item by item (formwork, concrete, rebar, etc.) estimates. Slab thicknesses were considered uniform throughout each floor though there were areas with thicker or thinner slab depths. An overall average was utilized and considered uniform throughout. Waste factors were considered and are included in the take-offs. Crane usage was included in the equipment subcategory of the concrete placement estimates.

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The estimate predicted a cost of \$13.75 million or \$30.64 per square foot. The actual cost was closer to \$11.25 million. There are a few reasons for this large disparity. For one, the concrete contractor is an extremely large specialty contractor. In fact, Miller & Long for the third consecutive year has been named the #1 Concrete Contractor in the United States by Engineering News Record magazine based upon annual revenue. R.S. Means bases its data on the average of many projects. Miller & Long is above the average. Few concrete contractors own their own fleet of tower cranes but Miller & Long does. This is a very large cost savings. Additionally, because they are so large and they admittedly bid low on this project in order to win the project, their overhead and profit is likely far below what R.S. Means estimates. The R.S. Means estimate based solely on cost and not overhead and profit yielded a result of \$10.15 million. It is likely that the savings resulting from the tower crane in combination with their low profit margin, accounts for the \$2.5 million difference between actual and estimated costs.

STRUCTURAL DETAILED ESTIMATE

2008 R.S. Means Cost Data

	Quantity	Unit	Material			Labor			Equipment			TOTAL			TOTAL, INCLUDING OVERHEAD & PROFIT				
			Nat'l Avg.	D.C. Avg	77 K Street	Nat'l Avg.	D.C. Avg	77 K Street	Nat'l Avg.	D.C. Avg	77 K Street	Nat'l Avg.	D.C. Avg	77 K Street	Nat'l Avg.	D.C. Avg	77 K Street		
Foundation (Includes F/R/P, concrete, and finishing)																			
03 30 53.40	4650	Mud Mat, 4" thick	423	CY	\$122.00	\$144.45	\$61,102	\$55.00	\$47.85	\$20,241	\$0.41	\$0.43	\$180	\$177.41	\$192.72	\$81,519	\$221.00	\$229.62	\$97,129
03 30 53.40	4050	Foundation Mat, over 20 CY	5072	CY	\$173.00	\$204.83	\$1,038,908	\$72.50	\$63.08	\$319,916	\$0.44	\$0.46	\$2,319	\$245.94	\$268.36	\$1,359,070	\$305.00	\$316.90	\$1,607,291
Existing Building Abutment Foundation																			
03 31 05.35	150	3000 psi concrete	609	CY	\$100.00	\$125.50	\$76,430	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0	\$100.00	\$125.50	\$76,530	\$110.00	\$122.76	\$74,761
03 31 05.70	4700	Concrete placement	609	CY	\$0.00	\$0.00	\$0	\$16.30	\$14.34	\$8,735	\$8.20	\$9.15	\$5,573	\$24.50	\$23.50	\$8,760	\$34.00	\$37.94	\$23,108
Foundation Walls																			
03 31 05.35	300	4000 psi concrete	935	CY	\$106.00	\$125.50	\$117,346	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0	\$106.00	\$125.50	\$117,452	\$117.00	\$130.57	\$122,085
03 31 05.70	5200	Concrete placement	935	CY	\$0.00	\$0.00	\$0	\$26.50	\$23.32	\$21,804	\$13.20	\$14.73	\$13,774	\$39.70	\$38.05	\$21,844	\$55.00	\$61.38	\$57,390
03 21 10.60	700	Reinforcing Steel, #3 to #7	40.5	ton	\$890.00	\$908.69	\$36,802	\$460.00	\$414.92	\$16,804	\$0.00	\$0.00	\$0	\$1,350.00	\$1,323.61	\$54,956	\$1,725.00	\$1,662.90	\$67,347
03 11 13.85	4230	Below grade wall formwork	25240	SFCA	\$1.23	\$1.22	\$30,890	\$7.90	\$6.50	\$164,103	\$0.00	\$0.00	\$0	\$9.13	\$7.73	\$195,002	\$13.70	\$11.60	\$292,882
Columns																			
03 31 05.35	400	5000 psi concrete	1115	CY	\$109.00	\$136.80	\$152,526	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0	\$109.00	\$136.80	\$152,635	\$120.00	\$133.92	\$149,321
03 31 05.35	411	6000 psi concrete	136	CY	\$124.00	\$155.62	\$21,164	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0	\$124.00	\$155.62	\$21,288	\$137.00	\$152.89	\$20,793
03 31 05.35	412	8000 psi concrete	182	CY	\$203.00	\$254.77	\$46,367	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0	\$203.00	\$254.77	\$46,570	\$223.00	\$248.87	\$45,294
03 31 05.35	413	10000 psi concrete	73	CY	\$288.00	\$361.44	\$26,385	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0	\$288.00	\$361.44	\$26,673	\$315.00	\$351.54	\$25,662
03 21 10.60	250	Reinforcing Steel, #8 to #18	413.7	ton	\$935.00	\$954.64	\$394,932	\$600.00	\$541.20	\$223,894	\$0.00	\$0.00	\$0	\$1,535.00	\$1,495.84	\$620,362	\$2,000.00	\$1,928.00	\$797,614
03 31 05.70	850	Concrete placement	1506	CY	\$0.00	\$0.00	\$0	\$34.00	\$29.92	\$45,060	\$16.95	\$18.92	\$28,488	\$50.95	\$48.84	\$45,110	\$70.50	\$78.68	\$118,489
03 11 13.25	7750	Steel framed column formwork	77730	SFCA	\$1.58	\$1.57	\$122,199	\$2.63	\$2.16	\$168,246	\$0.00	\$0.00	\$0	\$4.21	\$3.74	\$290,449	\$5.65	\$4.79	\$371,981
Shear Walls																			
03 31 05.35	400	5000 psi concrete	678	CY	\$109.00	\$136.80	\$92,747	\$0.00	\$0.00	\$0	\$0.00	\$0.00	\$0	\$109.00	\$136.80	\$92,856	\$120.00	\$133.92	\$90,798
03 21 10.60	700	Reinforcing Steel, #3 to #7	36.4	ton	\$890.00	\$908.69	\$33,076	\$460.00	\$414.92	\$15,103	\$0.00	\$0.00	\$0	\$1,350.00	\$1,323.61	\$49,529	\$1,725.00	\$1,662.90	\$60,530
03 31 05.70	5200	Concrete placement	678	CY	\$0.00	\$0.00	\$0	\$26.50	\$23.32	\$15,811	\$13.20	\$14.73	\$9,988	\$39.70	\$38.05	\$15,851	\$55.00	\$61.38	\$41,616
03 11 13.85	9260	Steel framed wall formwork	30840	SFCA	\$0.37	\$0.37	\$11,354	\$3.96	\$3.26	\$100,510	\$0.00	\$0.00	\$0	\$4.33	\$3.63	\$111,868	\$6.55	\$5.55	\$171,096
Slabs (Includes F/R/P, concrete, and finishing)																			
03 30 53.40	1950	30' span flat slab with drop panels	14638	CY	\$275.00	\$325.60	\$4,766,133	\$156.00	\$135.72	\$1,986,669	\$14.75	\$15.33	\$224,331	\$445.75	\$476.65	\$6,753,248	\$560.00	\$581.84	\$8,516,974
03 23 05.50	1650	Post tensioning cable	545450	Lb.	\$0.51	\$0.52	\$284,021	\$0.82	\$0.74	\$403,437	\$0.02	\$0.02	\$10,516	\$1.35	\$1.28	\$687,459	\$1.92	\$1.85	\$1,009,562
															Total	\$10,141,575	Total	\$13,761,723	
															Total Cost/SF	\$22.58	Total Cost/SF	\$30.64	

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General Condition Estimate

The general conditions cover various management and operational expenses not necessarily directly dependent on one trade or activity. Please note that the supervisory and miscellaneous labor categories of the general conditions account only for an employee's base salaries. Additional expenses resulting from employee insurance coverage and benefits is added at the end of the report at a rate of 55% of the base salary. Note that the staff base salary to volume (SV) ratio is approximately 2.2%. With a goal of achieving an SV ratio of between 2 and 3 percent, 77 K Street is adequately staffed and managed.

Also of importance, there is no crane expense included in the general conditions. The crane is owned and operated by the concrete contractor and is included in their scope of work. The general conditions estimate does not include project overhead expenses of profit. These would be included in the general contractor's fee.

The general conditions estimate yielded a cost of \$2.34 million dollars or approximately 5.7% of the GMP value of the project's contract. This is a fair value of what to expect for a project of this size and type.



77 K Street General Conditions Estimate

Activity	Qty.	Unit	Rate	Cost	Total Cost
SUPERVISION					
Senior Project Superintendent					
Superintendents					
Layout engineer					
Time Keeper/Secretary					
Senior Project Manager					
Project Manager					
Asst. Project Manager					
Scheduling					
Estimating / Preconstruction					
MEP Coordinator -					
Cost Engineer					
Total Supervision					\$891,842
MISCELLANEOUS LABOR					
Laborer					
Courier					
Dump Truck - Driver					
Safety Coordinator					
Sales Tax (Materials)	5.75	%		\$169	
Total, Miscellaneous Labor					\$39,846
GENERAL COSTS					
Expediting	88	Wks	\$50	\$4,400	
As Built reproduction costs	3	Ls	\$2,000	\$6,000	
Photographs	20	Mos	\$800	\$16,000	
Survey & Wall check	3	EA	\$3,000	\$9,000	
Occupancy Permit	1	Ea	\$300	\$300	
Construction Sign	2	Ea	\$1,000	\$2,000	
Layout Engineers Supplies	15	Mos	\$100	\$1,455	
Inspection & Testing	1	Ls		By Owner	
Builder's Risk Insurance	1	Ls	\$75,705	\$75,705	
Sheeting & Shoring Monitoring	0	Mo		Job Cost	
Pre-Con Survey & Monitor Set-up	1	Ls	\$18,000	\$18,000	
Pumping & Bailing	0	Ls		Job Cost	
Winter Protection	0	Ls		Job Cost	
Elevator Protection	1	EA	\$1,420	\$1,420	
Survey/Layout/Grade Sheets	0	Ls		Job Cost	
Final cleaning	450,000	Sf	\$0.07	\$31,500	

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Document Reproduction for Bid	1	Ls	\$25,000	\$25,000	
Security Service	1	Ls	\$6,000	\$6,000	
Travel Expense	0	Ls	\$50,000	\$0	
Miscellaneous Items	88	Wks	\$50	\$4,400	
Subtotal				\$201,180	
Sales Tax (Materials)	5.75	%		\$7,162	
Total General Costs					\$208,342
RENTALS					
Pickup truck (sup't)	140	Wks	\$300	\$41,944	
Courier vehicle	344	Hrs	\$7.49	\$2,577	
Dump truck	86	Hrs	\$28	\$2,408	
Field office trailer	20	Mos	\$350	\$7,113	
Storage/change house trailer	12	Mos	\$150	\$1,819	
Industrial vacuum	2	Ls	\$150	\$300	
Surveying instruments	15	Mos	\$161.77	\$2,354	
Gang box	20	Mos	\$72	\$1,463	
Vehicle (Senior Project Manager)	1,800	Hrs	\$7.49	\$13,482	
Vehicle (Proj. Manager)	92	Wks	\$300	\$27,563	
Pickup truck (Layout Engineer)	924	Hrs	\$7.49	\$6,921	
Cell Phone	14,937	Hrs	\$0.58	\$8,624	
Computer/IT/Fax/Lan/Phone System	14,937	Hrs	\$2.30	\$34,356	
Copier/Fax	1	Ls	\$5,000	\$5,000	
Hoist installation	1	Ls	\$25,000	\$25,000	
Hoist rental	6	Mos	\$3,500	\$21,000	
Allowance	1	Ls	\$10,000	\$10,000	
Subtotal				\$211,923	
Sales Tax (Materials)	5.75	%		\$12,186	
Total Rentals				\$224,109	\$224,109
TEMPORARY FACILITIES					
Field telephone - hookup	1	Ls	\$1,000	\$1,000	
- calls	20	Mos	\$500	\$10,000	
Field phone - Owner	1	Ls	\$4,000	\$4,000	
Temporary partitions	0	Ls		By Trade	
Temporary protection	0	Wks		By Trade	
Pest Control	10	Mos	\$500	\$5,000	
Field Office Set-up	1	Ls	\$10,000	\$10,000	
Field office expense	88	Wks	\$50	\$4,400	
Subtotal				\$34,400	
Sales Tax (Materials)	5.75	%		\$1,978	
Total Temporary Facilities					\$36,378
PUNCH LIST / WARRANTY	360	Hrs	\$25.89	\$9,320	\$9,320
HEALTH					
First aid kits & supplies	3	Ea	\$500	\$1,500	
Potable water	20	Mos	\$300	\$6,000	



Toilets	20	Mos	\$1,250	\$25,000
General area illumination (Bulbs only)	450,000	SF	\$0.02	\$9,000
Subtotal				\$41,500
Sales Tax (Materials)	5.75	%		\$2,386
Total Health				\$43,886
PROTECTION & LIFE SAVING EQUIPMENT				
Head protection	12	Ctns	\$100	\$1,200
Hearing protection	1	Ls	\$500	\$500
Eye & Face protection	1	Ls	\$1,500	\$1,500
Respiratory protection	1	Ls	\$500	\$500
Fire Extinguishers	300	Ea	\$25	\$7,500
Signs, Signals, & Barricades	1	LS	\$20,802	\$20,802
Subtotal				\$32,002
Sales Tax (Materials)	5.75	%		\$644
Total Protection & Life Saving Equipment				\$32,646
MATERIAL STORAGE & DISPOSAL				
Clean up labor	61	Wks	\$571.10	\$34,837
Disposal chute (Rental)	0	Mos	By Trade	
Disposal Service	111	Pull	\$425	\$47,175
Dump fees	10	Ea	\$125	\$1,250
Subtotal				\$83,262
Sales Tax (Materials)	5.75	%		\$2,784
Total Material Storage & Disposal				\$86,046
TEMPORARY POWER				
Electrical Energy	1	Ls	\$170,807	\$170,807
Sales Tax (Materials)	5.75	%		\$9,821
Total Temporary Power				\$180,629
PERSONNEL PROTECTION				
Construction fence	1	Ls	\$5,000.00	\$5,000.00
Guard rails & toeboards	26,400	Lf	\$1.00	\$26,400.00
Floor opening protection	60	Ea	\$62.87	\$3,772.20
Temp. stair rails	22,400	Lf	\$1.25	\$28,000.00
Subtotal				\$63,172.20
Sales Tax (Materials)	5.75	%		\$2,473
Total Personnel Protection				\$65,645
SUBTOTAL				
Insurances and Employee Benefits	55	%	Base Salaries	\$1,818,690
GRAND TOTAL				\$2,341,053