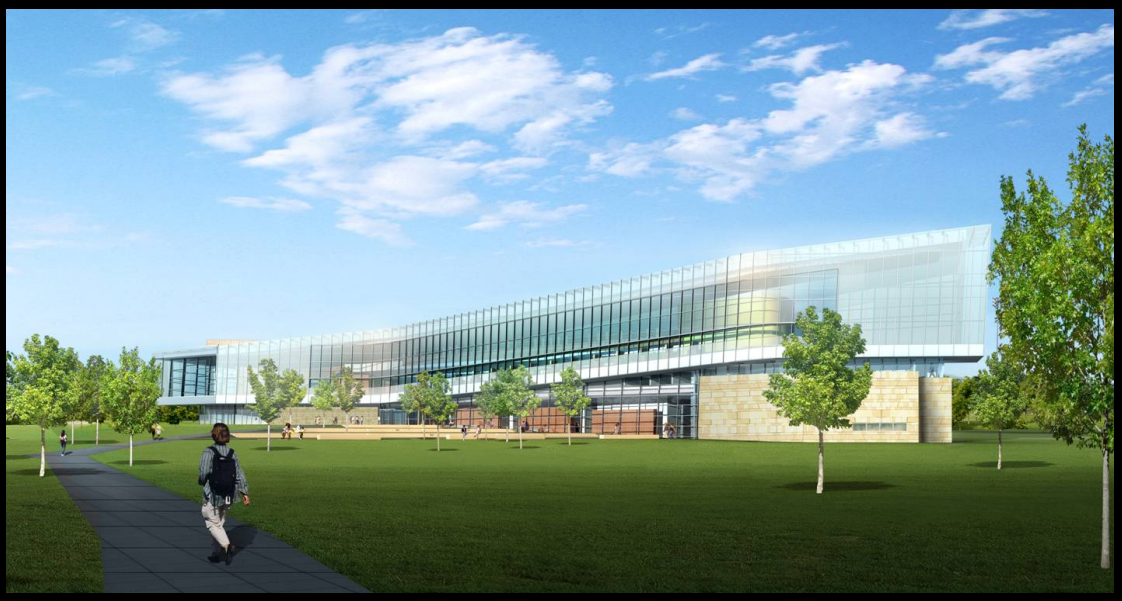
·THE NEW DICKINSON SCHOOL OF LAW·

University Park, PA
Steve Ayer
Construction Management Option



Technical Assignment No. 2

Submitted: Friday, November 2nd, 2007

CPEP Website: http://www.engr.psu.edu/ae/thesis/portfolios/2008/ska124/

Faculty Consultant: Dr. Messner

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EXECUTIVE SUMMARY:

This Technical Assignment looks at the construction management techniques employed on the new Dickinson School of Law project located in University Park, PA. The techniques used for management of this construction process were examined through a myriad of analyses including:

- **A detailed project schedule:** This schedule is organized by the different trades in the project and includes pertinent dates and durations of different activity and phasing requirements of the work.
- **Site Layout Planning:** A site plan has been developed to show strategic site layout for facilitating the erection of the project's steel superstructure.
- **Assemblies Estimate:** An assemblies estimation analysis has been performed for the building's fire protection systems.
- **Detailed Structural Systems Estimate:** The structure of the building has been methodically "taken off" and estimated based on the quantity takeoffs and unit costs.
- **General Conditions Estimate:** A general conditions estimate has been tailored specifically to this building to give an idea of estimated general costs associated with construction of this type of project.

Through these different analyses, a few facts were concluded:

- The project's structure is being constructed from East to West and all MEP and interior carpentry trades are constructed by floor.
- The site layout allows steel and other material deliveries to enter the site from the Bigler Road entrance and proceed south on the site where it will be picked and placed by the 100 ton crawler crane.
- The project's fire protection system includes predominantly wet sprinkler pipe with a small amount of dry pipe and is estimated to cost just over $624,000.
- The building's structural system is a complex curving matrix of steel and concrete which has been estimated at a value of $3.75 Million.
- Finally, the general conditions estimate has been customized for this project and estimated at approximately $6 Million.

DETAILED PROJECT SCHEDULE:

A detailed project schedule can be found in Appendix A of this document. The main feature of the project schedule that is worth noting is related to the Steel Sequencing on the project.

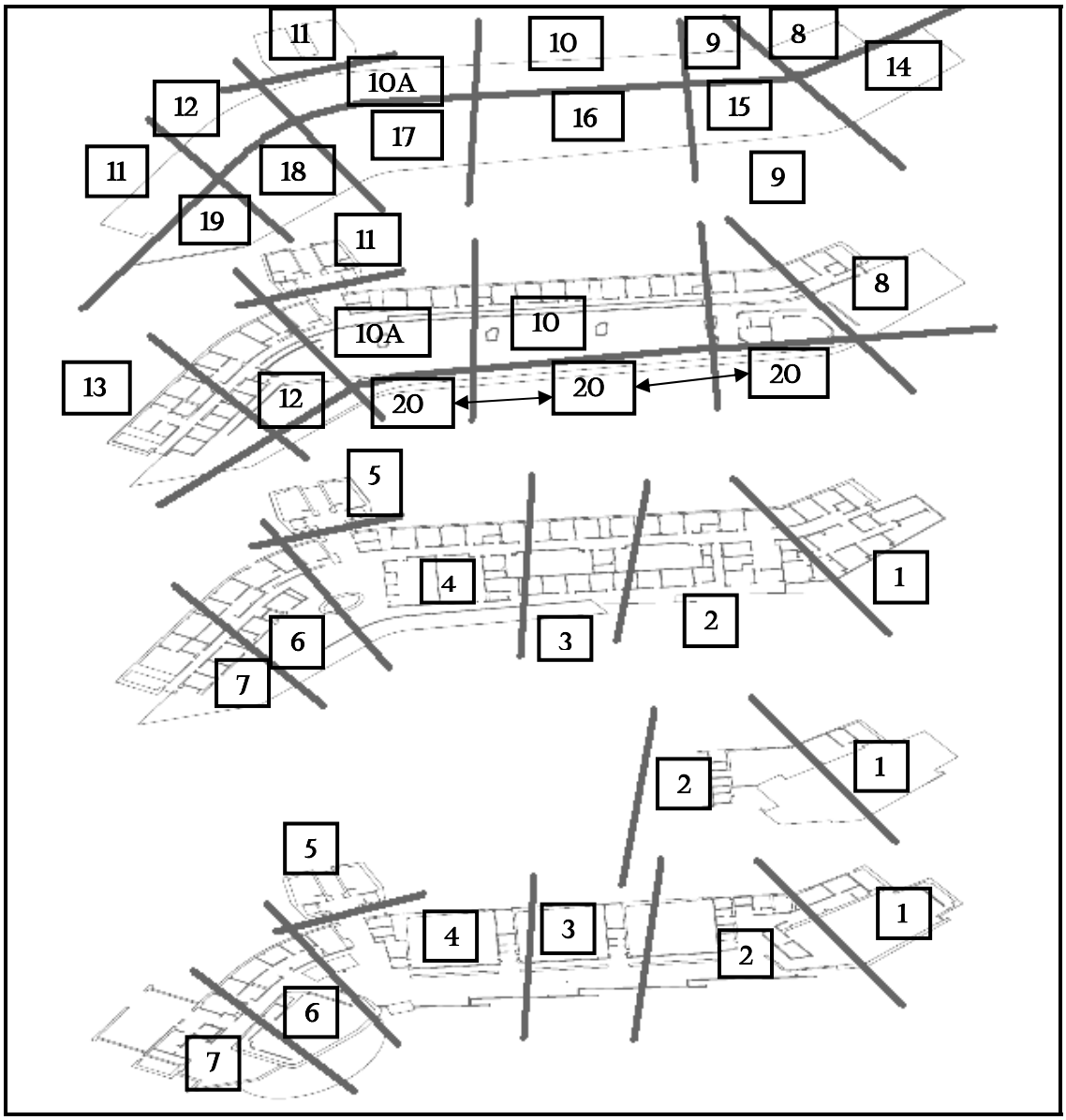


Figure 1: **Building key plans indicating steel lift sequencing**.

Figure 1 shows the steel sequencing scheme used for the project. It can be seen that there are 20 different lift sequences. The steel erection flows from east to west (Right to Left in the diagram.) The first, mezzanine, and second floor framing and column steel members are lifted in the same sequences as shown. The third and low roof level framing steel and

columns are lifted in the same sequences as well. Finally after the low roof has been framed, the high roof framing (sequences 14-19) are erected.

The steel for this project had a clear flow from one side of the building to the other. The interior trades were not as strictly scheduled as to where and when they were to complete work. The main method of phasing used for the MEP and other interior trades was by floor. For some trades work was completed from the bottom of the building up. Others began work on the third floor and worked down through the building.

SITE LAYOUT PLAN:

The site plan included in Appendix B shows the construction management strategies as they relate to the steel erection phase of the Dickinson School of Law project. While a great deal of information can be seen on the site plan itself, it may be helpful to examine (in words) how the steel erection process works.

As indicated on the drawings, steel delivery trucks enter the site via the Bigler Road extension entrance. They then will travel to the south side of the building to just south of the crane. The 100 ton crawler crane then unloads the steel to the steel / curtain wall lay down area just south of the crane path. The crane operator can then pick the appropriate steel member and lift if to its end destination in the building.

While this explains the specifics of how the actual pick process flows, let's now examine the macroscopic steel erection process. It can be seen on the site plan that the crane has various positions from which to pick and place steel. This is necessary because of the size of the crane and the curving footprint of the building. The exact steel sequence is indicated on the detailed project schedule in Appendix A and Figure 1, but essentially the process is fairly simple - steel erection starts at the east end of the building and is assembled westward.

There are a few factors to note that require special consideration related to steel erection for this project. For instance, the main air handlers and switchgears for the building are located in the basement. At the time of steel erection, this equipment had not yet been fabricated and delivered to site. Therefore a bay on the north east side of the building had to be left open to allow for these units to be placed after the steel was erected. Admittedly, this was not an extremely difficult problem to mitigate, but it did require some extra care and planning to ensure proper execution of the steel erection.

Another site specific consideration related to the steel erection on this project was related to the steel to be placed in the building's core. (The "core" is the stairwell/restroom area at the northernmost point of the building.) To make this pick, the crane had to be moved fairly close to the building's footprint as indicated by the middle crane position on the site plan. Special attention needed to be given to ensure that the crane would not get so close to the building footprint that it would induce a shearing of the soil against the basement foundation walls and cause a collapse.

I had the opportunity to speak to the crane operator for the Steel crew on this job and hear his thoughts on the process. While he may have a slightly biased opinion, he mentioned an interesting suggestion for this project – Get a larger crane for construction that would allow for less risk of approaching the building footprint and also eliminate the need to move the crane. Admittedly this would have a higher cost per day to operate, however if a larger crane was used for this project, it may have been possible to erect steel faster. Given the fact that this building was not enclosed as early in the project as initially projected, this could be a good method of making up some schedule time. This may prove to be an interesting path of study for future analysis of this building project.

ASSEMBLIES ESTIMATE:

For this project, an assemblies estimate was performed on the fire protection systems used in the building.

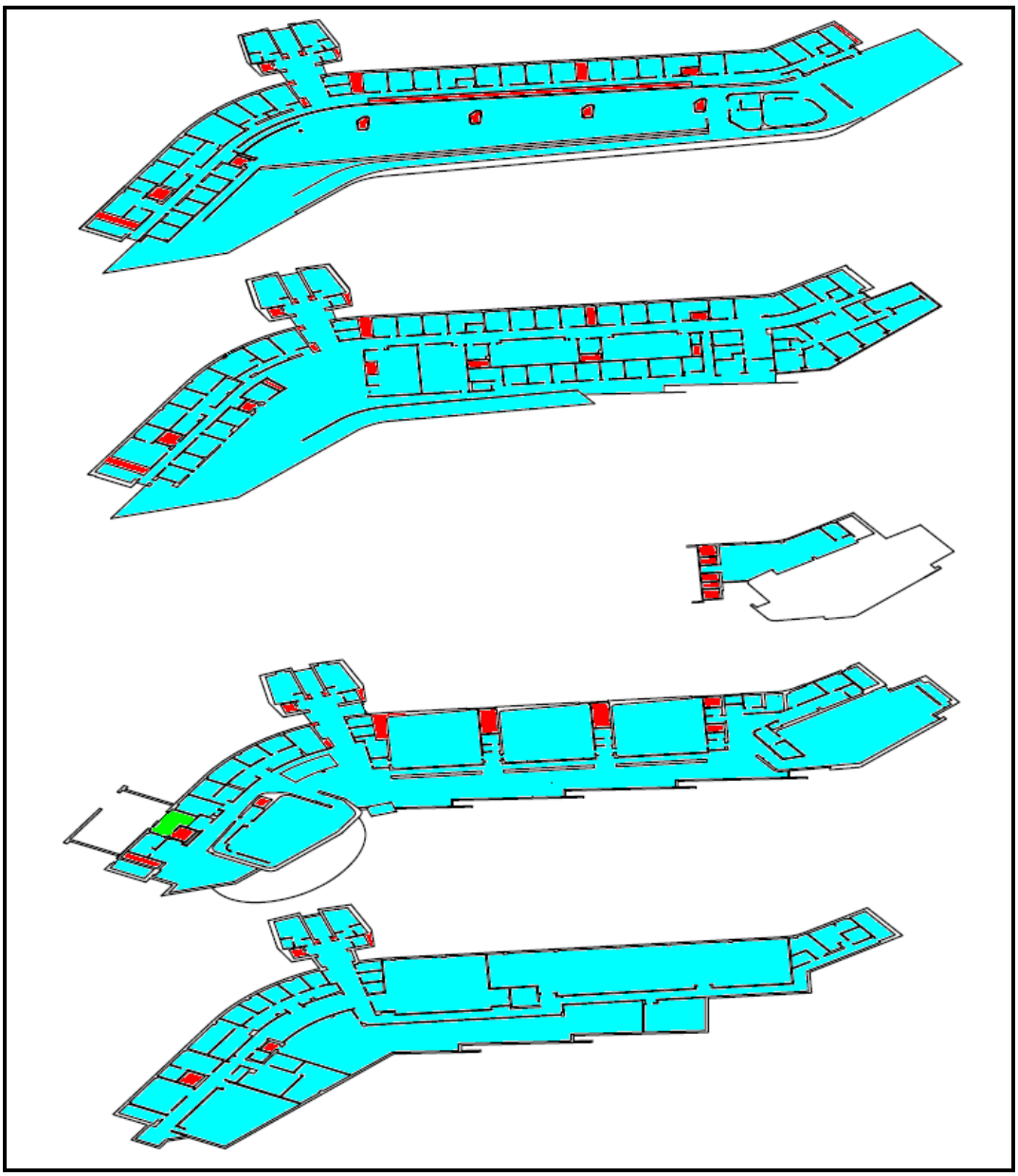


Figure 2: Building key plans indicating sprinkler coverage. Blue represents wet sprinkler pipes. Green represents dry sprinkler pipes. Red represents areas not covered by sprinklers.

This seemed to be an appropriate system to estimate for this project because there are areas in the building that utilize wet sprinkler pipes, dry sprinkler pipes, and no sprinkler coverage at all. Figure 2 shows the building key plans and indicates based on a color code what type of coverage is used in each area of the building. Because there are these

different areas with different levels of sprinkler coverage square footage estimates were made of every room with any sprinkler coverage. The actual take-off spread sheet can be found in Appendix C.

It is apparent from the diagram that, where there is sprinkler coverage, wet pipe is used almost exclusively. The one exception to this rule is in room 108. This can be seen on the ground floor key plan on the left side of the diagram. This room is a loading dock. The main reason that a dry pipe is necessary here is because it will not be fully insulated and (in theory) could lead to issues with water freezing in the pipes.

So looking now at the actual estimate it can be seen in table 3 below that there is just under 100,000SF of area covered by wet sprinkler pipes in the building and slightly over 230SF of dry pipe areas. In addition to increased area of wet pipe coverage, there are also more standpipes that must rise to all floors while the dry standpipe only rises from the lower level to the ground level.

Sprinkler Costs

D. Services - D40 Fire Protection - D4010 Sprinkler Systems

Sprinklers

	Total Cost	Quantity	Total Costs
Wet Pipe	5.14 $/SF	99765 SF	$512,792
Dry Pipe	5.85 $/SF	230 SF	$1,346

D. Services - D40 Fire Protection - D4020 Stand Pipe and Hose Systems

Standpipes

	Quantity	Floors Covered	Cost/Unit	Cost
Wet Standpipes	5	5	$16,515	$82,575
Dry Standpipes	1	1	$7,875	$7,875

Fire Hose Equipment

	Quantity	Cost/Unit	Cost
Recessed Wall Cabinet Assembly	22	$835	$18,370
6" Siamese Fire Dept. Connection	1	$1,135	$1,135

Total Sprinkler System Estimate $624,093

Figure 3: Summary of the Fire Protection assemblies estimate.

DETAILED STRUCTURAL ESTIMATE:

To say the structure of the new Dickinson School of Law building is basic and straight-forward would be a gross understatement. The structure is far from it. The building's curving footprint requires many different shapes and lengths of beams and columns. It utilizes standard and non-standard W-shapes and lengths. To take off every member of steel would require more time and effort than would be practical for the scope of this project. As an alternate to taking off every piece of framing steel, I have elected to take off only the ground level's framing steel. I then took the aggregate tonnage of steel over the ground floor's area which yielded a weight per area figure that I could apply to the rest of the building. A full summary of the takeoff results can be found in Appendix D.

The only potential problem that one might think would arise with this type of approximation is related to the fact that typically the weight of steel at the top of the building will be less than that of the steel at the bottom. This would be an appropriate assumption for most buildings. By the nature of this building, however, there is actually more steel in its upper floors. This is due mainly to the library stacks and the curtain walls overhangs. Heavy loads from the stacks require more steel and the curtain wall overhangs create cantilevers that also require more steel to ensure structural soundness. To deal with this fact, I have incorporated a multiplier of 1.2 to the weight per area figure that I referenced earlier. The steel framing quantity estimate summary can be seen below in figure 4.

Total First Floor Framing Steel Tonnage	88
Total First Floor Square Footage	28500
Average Framing Weight in Lb/SF on First Floor	6.19
1.2 Modifier to Account for Additional Tonnage on Upper Floors	7.43
Remaining Square Footage Framing to be Estimated	88122
Estimated Remaining Steel Framing Tonnage	327
Total Estimated Steel Framing Tonnage for Entire Building	416

Figure 4: Calculation summary of the structural steel framing takeoff.

The structural concrete in this project also posed an interesting challenge for estimation purposes. There are numerous different locations on the lower level of the building where the slabs change elevation. This requires workers to place the footers, grade beams, and foundation walls at various stepped elevations according to the slabs. This extra forming effort requires extra materials and extra labor. With this extra effort comes extra cost as well. To account for this fact, I applied a 10% contingency modifier to my quantity estimate for spread footers, grade beams, and foundation walls.

While there will be some extra work associated with forming and pouring the foundation concrete as a result of the elevation changes slabs, there will also be some extra work for forming the slabs in the rest of the building as well. Any time the slab elevations change a small concrete wall will have to be formed and poured to connect the upper slab to the

lower one. Therefore a 10% contingency modifier was also applied to the square footages of the slabs estimate.

Therefore, given my different assumptions, I get a total structural estimate of:

Concrete:	$1,854,662
Steel Members:	$1,124,673
Steel Deck:	$ 775,635
TOTAL:	$3,754,970

GENERAL CONDITIONS ESTIMATE:

A cost breakdown for this project can be seen in the diagram below. Many of the costs associated with the different line items were estimated with the help of the Construction Management team. Most of the items listed on the cost breakdown are fairly standard items. There are a number of different items that could have been included in this general conditions estimate that were not included for one reason or another. Inspection and Permitting fees can often be seen in a GC estimate. For this project, they were not included because Penn State pays for these services directly. The same also goes for testing fees which Penn State also pays directly. Another commonly seen line item would be an elevator or hoist. For this project the service elevator on the west side of the building will be used for a construction elevator so a temporary hoist would not necessary to incorporate in the general conditions costs. The fees associated with the work were also not included in this estimate because the general conditions is a lump sum contract with Penn State, and all other work on the project is performed via a cost-plus-fee contract which is where the CM collects their fee.

General Conditions Estimate

Site Conditions

Description	Cost Per Unit	Units	Budgeted Cost
Temp Toilets	$1,667	Months	$40,000
Temp Fencing	$1,667	Months	$40,000
Temp Building Heat	$15,625	Months	$375,000
Signage	$417	Months	$10,000
Safety	$833	Months	$20,000
Building Subsistence	$5,000	Months	$120,000
Progress Photographer	$354	Months	$8,500
Surveying	$5,000	Months	$120,000
Ceremonies	$417	Months	$10,000
Testing & Inspection	$4,167	Months	$100,000
Dumpsters	$5,417	Months	$130,000
Clean-up Services	$14,583	Months	$350,000
Weather Protection / Temp Enclosures	$4,167	Months	$100,000
Snow Removal	$833	Months	$20,000
Staff Storage	$833	Months	$20,000
	Site Condition Total		**$1,463,500**

Construction Management Staff

Description	Cost Per Unit	Units	Budgeted Cost
Project Executive	$6,667	Months	$200,000
Project Manager	$10,000	Months	$300,000

Project Superintendant	$10,000	Months	$300,000
MEP Superintendant	$8,333	Months	$250,000
Asst. Superintendant	$6,667	Months	$200,000
Accountant	$10,000	Months	$300,000
Manager of Engineering	$10,000	Months	$300,000
Project Engineer	$8,333	Months	$250,000
Project Engineer	$6,667	Months	$200,000
Project Engineer	$6,667	Months	$200,000
Office Administrator	$6,667	Months	$200,000
Safety Inspector	$6,667	Months	$200,000
BIM Coordinator	$6,667	Months	$200,000
Other Support Staff	$30,000	Months	$900,000
	CM Staff Total		**$4,000,000**

Cost Reimbursables

Description	**Cost Per Unit**	**Units**	**Budgeted Cost**
CM Office	$6,250	Months	$150,000
Travel Expenses	$2,083	Months	$50,000
Company Vehicles	$2,500	Months	$60,000
Office Supplies	$10,417	Months	$250,000
Petty Cash	$417	Months	$10,000
	Cost Reimbursable Total		**$520,000**

Insurance

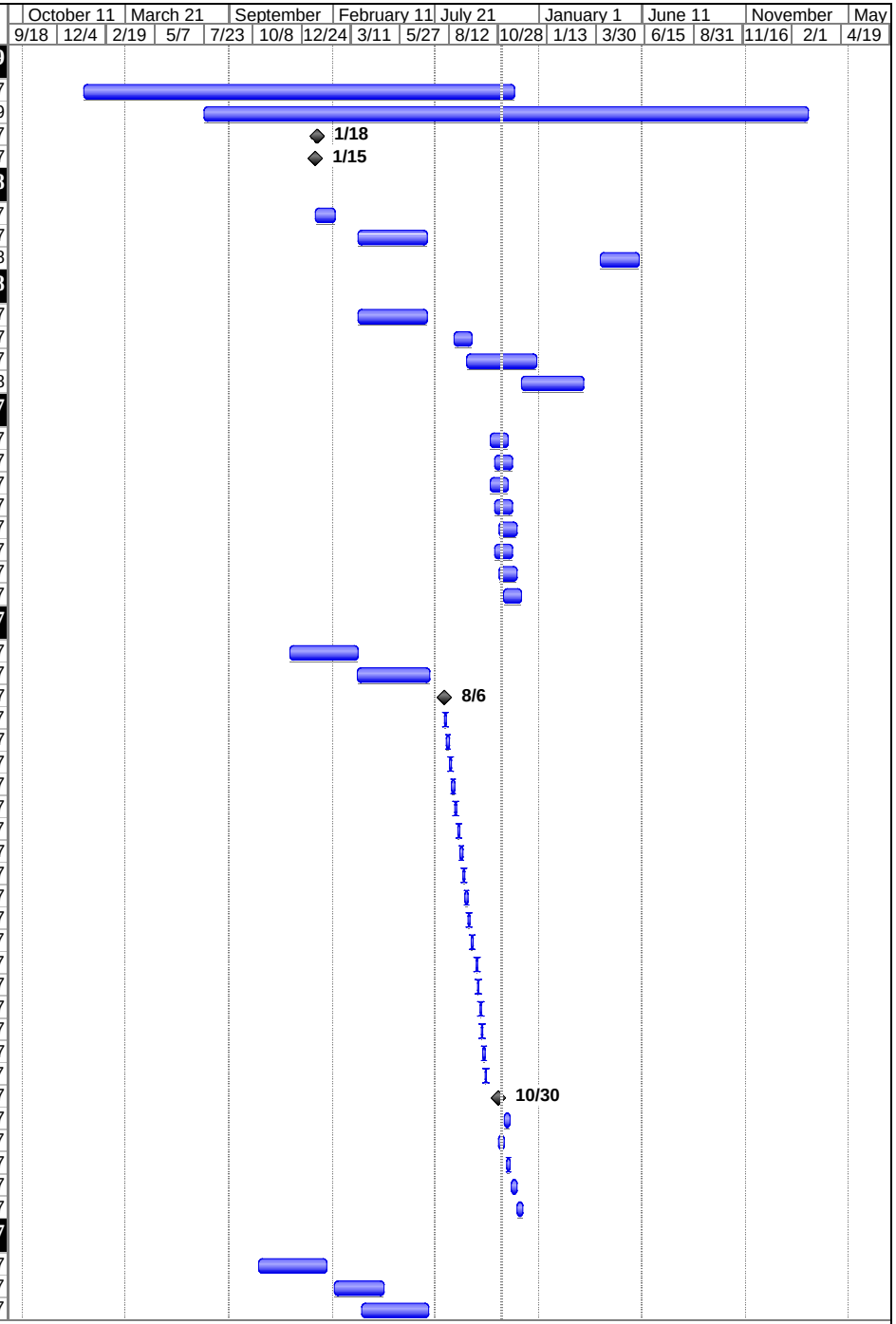
Description	**Cost Per Unit**	**Units**	**Budgeted Cost**
General & Excess Liability	$1,667	Months	**$40,000**

General Conditions Grand Total $6,023,500

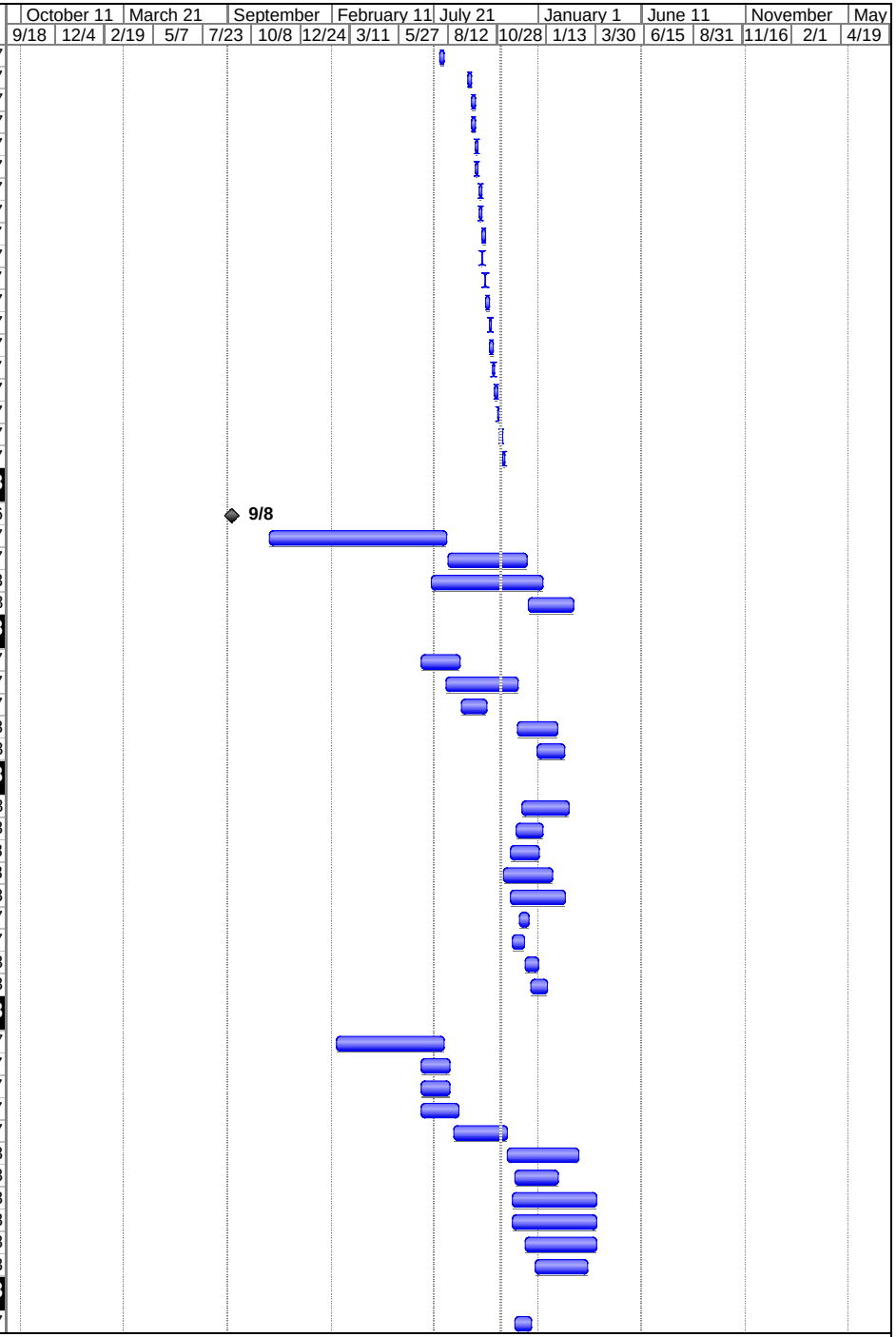
APPENDIX A:

Detailed Project Schedule

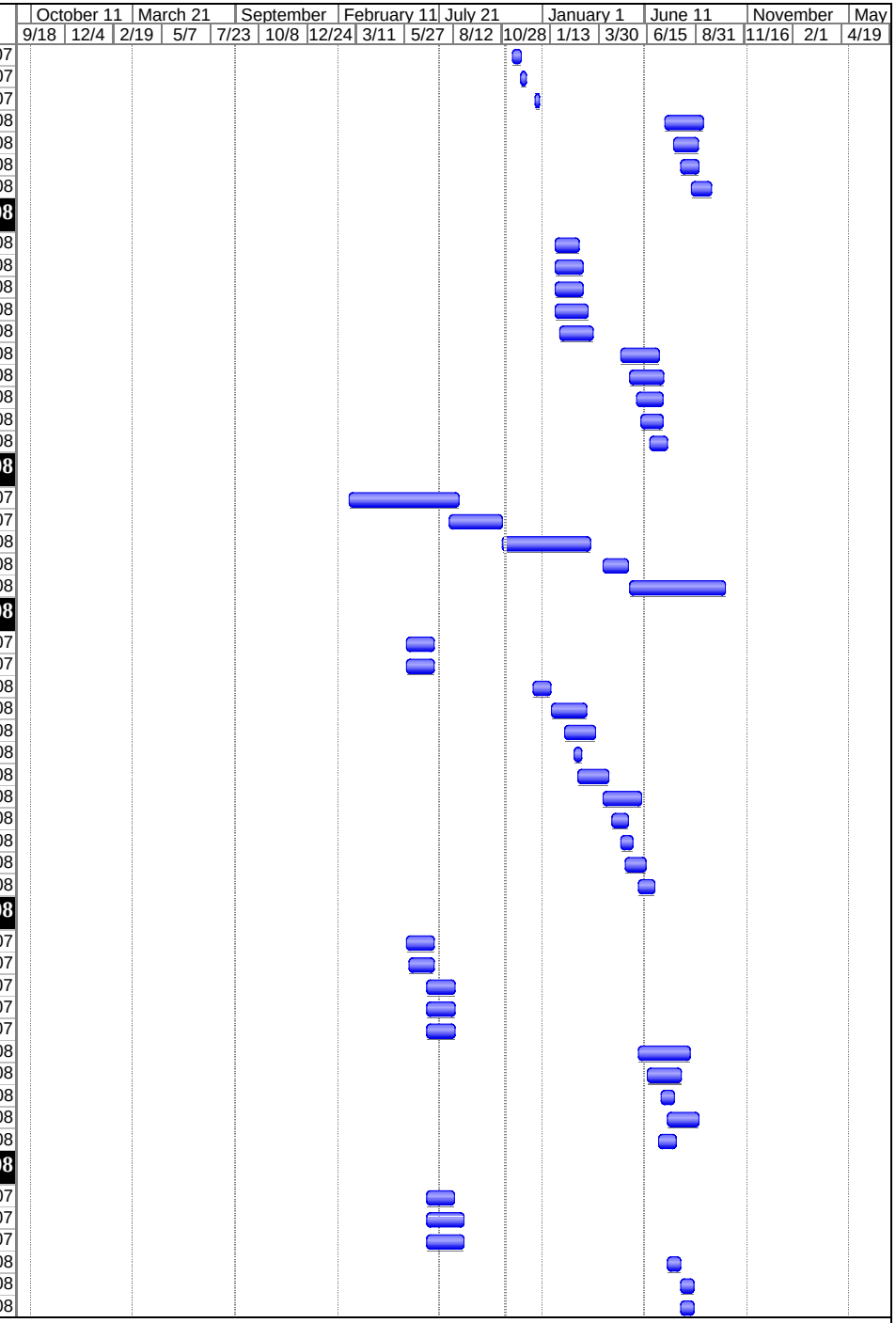
ID	Task Name	Duration	Start	Finish
1	**PRE-CONSTRUCTION**	**815 days**	**Mon 1/16/06**	**Fri 2/27/09**
2	Design Phase	485 days	Mon 1/16/06	Fri 11/23/07
3	Construction Manager Hired	680 days	Mon 7/24/06	Fri 2/27/09
4	Groundbreaking Ceremony	0 days	Thu 1/18/07	Thu 1/18/07
5	Procurement of Subcontractors Begins	0 days	Mon 1/15/07	Mon 1/15/07
6	**SITE WORK**	**365 days**	**Mon 1/15/07**	**Fri 6/6/08**
7	Excavation	23 days?	Mon 1/15/07	Wed 2/14/07
8	Bid and Award Landscaping Contractor	77 days?	Fri 3/23/07	Mon 7/9/07
9	Landscaping	45 days?	Mon 4/7/08	Fri 6/6/08
10	**MASONRY**	**253 days**	**Fri 3/23/07**	**Tue 3/11/08**
11	Bid and Award Site Masonry Contractor	77 days?	Fri 3/23/07	Mon 7/9/07
12	Fab/Deliver Site Masonry	20 days?	Tue 8/21/07	Mon 9/17/07
13	Fab/Deliver Building Masonry	80 days?	Mon 9/10/07	Fri 12/28/07
14	Exterior Masonry/Stone	70 days?	Wed 12/5/07	Tue 3/11/08
15	**EXTERIOR FRAMING**	**35 days**	**Wed 10/17/07**	**Tue 12/4/07**
16	Ground Level Exterior Framing	20 days?	Wed 10/17/07	Tue 11/13/07
17	Ground Level Exterior Sheathing	20 days?	Wed 10/24/07	Tue 11/20/07
18	Mezzanine Level Exterior Framing	20 days?	Wed 10/17/07	Tue 11/13/07
19	Mezzanine Level Exterior Sheathing	20 days?	Wed 10/24/07	Tue 11/20/07
20	Second Floor Exterior Sheathing	20 days?	Wed 10/31/07	Tue 11/27/07
21	Second Floor Exterior Framing	20 days?	Wed 10/24/07	Tue 11/20/07
22	Third Floor Exterior Framing	20 days?	Wed 10/31/07	Tue 11/27/07
23	Third Floor Exterior Sheathing	20 days?	Wed 11/7/07	Tue 12/4/07
24	**STEEL**	**262 days**	**Wed 12/6/06**	**Thu 12/6/07**
25	Bid and Award Steel Contractor	77 days	Wed 12/6/06	Thu 3/22/07
26	Steel Shop Drawings	82 days?	Thu 3/22/07	Fri 7/13/07
27	Steel Erection Begins	0 days	Mon 8/6/07	Mon 8/6/07
28	Steel Sequence 1	3 days?	Mon 8/6/07	Wed 8/8/07
29	Steel Sequence 2	3 days?	Thu 8/9/07	Mon 8/13/07
30	Steel Sequence 3	3 days?	Tue 8/14/07	Thu 8/16/07
31	Steel Sequence 4 & 5	3 days?	Fri 8/17/07	Tue 8/21/07
32	Steel Sequence 6	3 days?	Wed 8/22/07	Fri 8/24/07
33	Steel Sequence 7	3 days?	Mon 8/27/07	Wed 8/29/07
34	Steel Sequence 8	3 days?	Thu 8/30/07	Mon 9/3/07
35	Steel Sequence 9	3 days?	Tue 9/4/07	Thu 9/6/07
36	Steel Sequence 10 & 20	3 days?	Fri 9/7/07	Tue 9/11/07
37	Steel Sequence 10A & 11	3 days?	Wed 9/12/07	Fri 9/14/07
38	Steel Sequence 12 & 13	3 days?	Mon 9/17/07	Wed 9/19/07
39	Steel Sequence 14	2 days?	Tue 9/25/07	Wed 9/26/07
40	Steel Sequence 15	2 days?	Thu 9/27/07	Fri 9/28/07
41	Steel Sequence 16	2 days?	Mon 10/1/07	Tue 10/2/07
42	Steel Sequence 17	2 days?	Wed 10/3/07	Thu 10/4/07
43	Steel Sequence 18	2 days?	Fri 10/5/07	Mon 10/8/07
44	Steel Sequence 19	2 days?	Tue 10/9/07	Wed 10/10/07
45	Topping Out Ceremony	0 days	Tue 10/30/07	Tue 10/30/07
46	Basement Spray on Fireproofing	7 days?	Thu 11/8/07	Fri 11/16/07
47	Ground Level Spray on Fireproofing	7 days?	Tue 10/30/07	Wed 11/7/07
48	Mezzanine Level Spray on Fireproofing	5 days?	Mon 11/12/07	Fri 11/16/07
49	Second Floor Spray on Fireproofing	7 days?	Mon 11/19/07	Tue 11/27/07
50	Third Floor Spray on Fireproofing	7 days?	Wed 11/28/07	Thu 12/6/07
51	**CONCRETE**	**278 days**	**Wed 10/18/06**	**Fri 11/9/07**
52	Bid and Award Concrete Contractor	77 days	Wed 10/18/06	Thu 2/1/07
53	Foundations	56 days	Wed 2/14/07	Wed 5/2/07
54	FRP Foundation Walls	75 days?	Thu 3/29/07	Wed 7/11/07



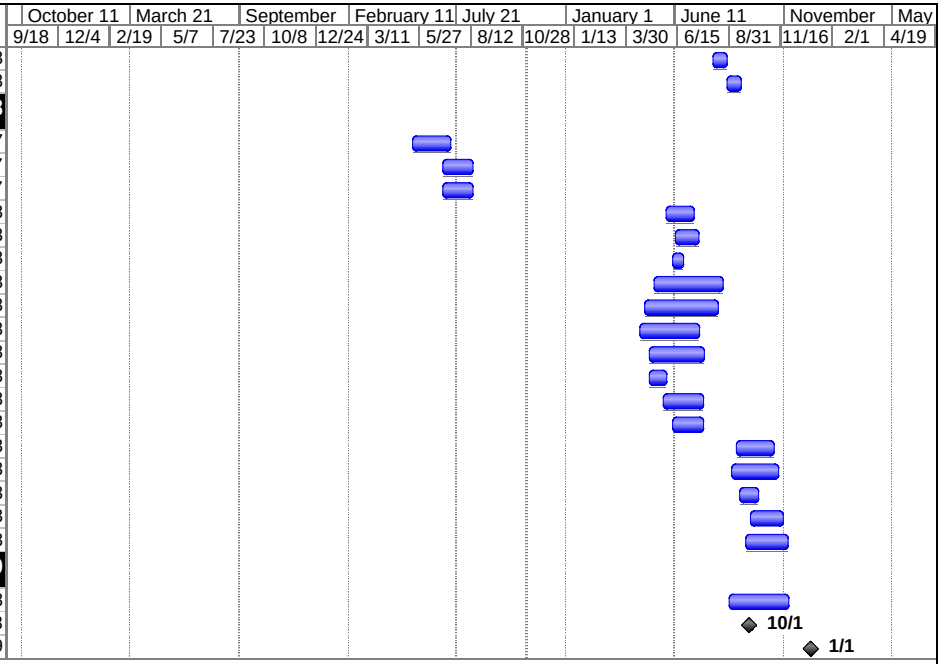
ID	Task Name	Duration	Start	Finish
55	Basement SOG	5 days?	Tue 7/31/07	Mon 8/6/07
56	Slab on Metal Deck 1st Floor Col Line 20-16	4 days?	Thu 9/13/07	Tue 9/18/07
57	Slab on Metal Deck 2nd Floor Col Line 20-16	4 days?	Wed 9/19/07	Mon 9/24/07
58	Slab on Metal Deck 1st Floor Col Line 16-14	4 days?	Wed 9/19/07	Mon 9/24/07
59	Slab on Metal Deck 2nd Floor Col Line 16-14	4 days?	Tue 9/25/07	Fri 9/28/07
60	Slab on Metal Deck 1st Floor Col Line 14-11	4 days?	Tue 9/25/07	Fri 9/28/07
61	Slab on Metal Deck 2nd Floor Col Line 14-11	4 days?	Mon 10/1/07	Thu 10/4/07
62	Slab on Metal Deck 1st Floor Col Line 11-7.5	4 days?	Mon 10/1/07	Thu 10/4/07
63	Slab on Metal Deck 2nd Floor Col Line 11-7.5	4 days?	Fri 10/5/07	Wed 10/10/07
64	Slab on Metal Deck 1st Floor Col Line 7.5-4	1 day?	Fri 10/5/07	Fri 10/5/07
65	Slab on Metal Deck 2nd Floor Col Line 7.5-4	1 day?	Wed 10/10/07	Wed 10/10/07
66	Slab on Metal Deck 1st Floor Col Line 4-1	4 days?	Thu 10/11/07	Tue 10/16/07
67	Slab on Metal Deck 3rd Floor Col Line 20-16	3 days?	Wed 10/17/07	Fri 10/19/07
68	Slab on Metal Deck 2nd Floor Col Line 4-1	4 days?	Wed 10/17/07	Mon 10/22/07
69	Slab on Metal Deck 3rd Floor Col Line 16-14	3 days?	Mon 10/22/07	Wed 10/24/07
70	Slab on Metal Deck 3rd Floor Col Line 14-11	3 days?	Thu 10/25/07	Mon 10/29/07
71	Slab on Metal Deck 3rd Floor Col Line 11-7.5	3 days?	Tue 10/30/07	Thu 11/1/07
72	Slab on Metal Deck 3rd Floor Col Line 7.5-4	3 days?	Fri 11/2/07	Tue 11/6/07
73	Slab on Metal Deck 3rd Floor Col Line 4-1	3 days?	Wed 11/7/07	Fri 11/9/07
74	**CURTAIN WALL**	**382 days**	**Fri 9/8/06**	**Mon 2/25/08**
75	Curtain Wall Sub Procured for Design Assist	0 days	Fri 9/8/06	Fri 9/8/06
76	Complete Curtain Wall Shop Drawings	200 days?	Mon 11/6/06	Fri 8/10/07
77	Fab and Deliver Curtain Wall	90 days?	Mon 8/13/07	Fri 12/14/07
78	Install Curtain Wall 4 North	125 days?	Wed 7/18/07	Tue 1/8/08
79	Install Curtain Walls 1, 2, 3, 5, 7	51 days?	Mon 12/17/07	Mon 2/25/08
80	**ROOFING**	**161 days**	**Mon 7/2/07**	**Mon 2/11/08**
81	Green Roof Shop Drawings	45 days?	Mon 7/2/07	Fri 8/31/07
82	Roofing	81 days?	Fri 8/10/07	Fri 11/30/07
83	Fab and Deliver Green Roof	30 days?	Mon 9/3/07	Fri 10/12/07
84	Install Green Roof	45 days?	Fri 11/30/07	Thu 1/31/08
85	Install Coping/Flashing	31 days?	Mon 12/31/07	Mon 2/11/08
86	**MECHANICAL**	**73 days**	**Thu 11/8/07**	**Mon 2/18/08**
87	Third Floor Ductwork	52 days?	Fri 12/7/07	Mon 2/18/08
88	Second Floor Ductwork	30 days?	Wed 11/28/07	Tue 1/8/08
89	Mezzanine Level Ductwork	33 days?	Mon 11/19/07	Wed 1/2/08
90	Ground Level Ductwork	55 days?	Thu 11/8/07	Wed 1/23/08
91	Basement Ductwork	62 days?	Mon 11/19/07	Tue 2/12/08
92	Basement Mechanical Equipment	11 days?	Mon 12/3/07	Mon 12/17/07
93	Ground Level Mechanical Equipment	13 days?	Thu 11/22/07	Mon 12/10/07
94	Second Floor Mechanical Equipment	15 days?	Wed 12/12/07	Tue 1/1/08
95	Third Floor Mechanical Equipment	18 days?	Fri 12/21/07	Tue 1/15/08
96	**ELECTRICAL**	**292 days**	**Mon 2/19/07**	**Tue 4/1/08**
97	Bid and Award Elevator Contractor	121 days?	Mon 2/19/07	Mon 8/6/07
98	Bid and Award Telecom Wire and Equipment Contr	33 days?	Mon 7/2/07	Wed 8/15/07
99	Bid and Award Security Wire and Equipment Contra	33 days?	Mon 7/2/07	Wed 8/15/07
100	Bid and Award Audiovisual Contractor	43 days?	Mon 7/2/07	Wed 8/29/07
101	Switchgear Shop Drawings	60 days?	Wed 8/22/07	Tue 11/13/07
102	Switchgear Fabrication and Delivery	80 days?	Wed 11/14/07	Tue 3/4/08
103	Basement Elec. And Fire Alarm	50 days?	Mon 11/26/07	Fri 2/1/08
104	Ground Level Elec and Fire Alarm	94 days?	Thu 11/22/07	Tue 4/1/08
105	Mezzanine Level Elec and Fire Alarm	94 days?	Thu 11/22/07	Tue 4/1/08
106	Second Floor Elec and Fire Alarm	80 days?	Wed 12/12/07	Tue 4/1/08
107	Third Floor Elec and Fire Alarm	58 days?	Fri 12/28/07	Tue 3/18/08
108	**PLUMBING**	**226 days**	**Thu 11/15/07**	**Thu 9/25/08**
109	Basement Sanitary and Vent Piping	20 days?	Mon 11/26/07	Fri 12/21/07



ID	Task Name	Duration	Start	Finish
110	Ground Level Sanitary and Vent Piping	10 days?	Thu 11/15/07	Wed 11/28/07
111	Second Floor Sanitary and Vent Piping	7 days?	Wed 11/28/07	Thu 12/6/07
112	Third Floor Sanitary and Vent Piping	5 days?	Fri 12/21/07	Thu 12/27/07
113	Basement Fixtures and Finishes	45 days?	Mon 7/14/08	Fri 9/12/08
114	Ground Level Fixtures and Finishes	29 days?	Mon 7/28/08	Thu 9/4/08
115	Second Floor Fixtures and Finishes	21 days?	Fri 8/8/08	Fri 9/5/08
116	Third Floor Fixtures and Finishes	24 days?	Mon 8/25/08	Thu 9/25/08
117	**FIRE PROTECTION**	**128 days**	**Tue 1/22/08**	**Thu 7/17/08**
118	Basement Sprinkler Rough-In	28 days?	Tue 1/22/08	Thu 2/28/08
119	Ground Floor Sprinkler Rough-In	32 days?	Tue 1/22/08	Wed 3/5/08
120	Mezzanine Sprinkler Rough-In	32 days?	Tue 1/22/08	Wed 3/5/08
121	2nd Floor Sprinkler Rough-In	38 days?	Tue 1/22/08	Thu 3/13/08
122	3rd Floor Sprinkler Rough-In	39 days?	Tue 1/29/08	Fri 3/21/08
123	Third Floor Sprinkler Heads/Drops	45 days?	Mon 5/5/08	Fri 7/4/08
124	Second Floor Sprinkler Heads/Drops	40 days?	Mon 5/19/08	Fri 7/11/08
125	Mezzanine Sprinkler Heads/Drops	30 days?	Fri 5/30/08	Thu 7/10/08
126	Ground Floor Sprinkler Heads/Drops	25 days?	Fri 6/6/08	Thu 7/10/08
127	Basement Sprinkler Heads/Drops	20 days?	Fri 6/20/08	Thu 7/17/08
128	**ELEVATORS**	**427 days**	**Thu 3/1/07**	**Fri 10/17/08**
129	Bid and Award Electrical Contractor	124 days?	Thu 3/1/07	Tue 8/21/07
130	Elevator Shop Drawings	60 days?	Tue 8/7/07	Mon 10/29/07
131	Elevator Fabrication and Delivery	100 days?	Tue 10/30/07	Mon 3/17/08
132	Elevator Shaft Walls	30 days?	Mon 4/7/08	Fri 5/16/08
133	Elevator Rail and Cabs Installation	110 days?	Mon 5/19/08	Fri 10/17/08
134	**INTERIOR FRAMING**	**282 days**	**Thu 5/31/07**	**Fri 6/27/08**
135	Bid and Award Interior Framing Contractor	32 days?	Thu 5/31/07	Fri 7/13/07
136	Bid and Award Drywall Contractor	32 days?	Thu 5/31/07	Fri 7/13/07
137	Basement Level Interior Framing	20 days?	Tue 12/18/07	Mon 1/14/08
138	Third Floor Interior Framing	40 days?	Wed 1/16/08	Tue 3/11/08
139	Second Floor Interior Framing	35 days?	Wed 2/6/08	Tue 3/25/08
140	Mezzanine Level Interior Framing	8 days?	Thu 2/21/08	Mon 3/3/08
141	Ground Level Interior Framing	35 days?	Wed 2/27/08	Tue 4/15/08
142	Third Floor Drywall, Tape, & Sand	45 days?	Mon 4/7/08	Fri 6/6/08
143	Second Floor Drywall, Tape, & Sand	20 days?	Mon 4/21/08	Fri 5/16/08
144	Mezzanine Level Drywall, Tape & Sand	15 days?	Mon 5/5/08	Fri 5/23/08
145	Ground Level Drywall, Tape, & Sand	25 days?	Mon 5/12/08	Fri 6/13/08
146	Basement Level Drywall, Tape & Sand	20 days?	Mon 6/2/08	Fri 6/27/08
147	**FLOORING**	**332 days**	**Thu 5/31/07**	**Fri 9/5/08**
148	Bid and Award Interior Glass and Glazing Contracto	32 days?	Thu 5/31/07	Fri 7/13/07
149	Bid and Award Ornamental & Misc. Metals Contract	30 days?	Mon 6/4/07	Fri 7/13/07
150	Bid and Award Interior Stone Floor Contractor	33 days?	Mon 7/2/07	Wed 8/15/07
151	Bid and Award Floor Coverings Contractor	33 days?	Mon 7/2/07	Wed 8/15/07
152	Bid and Award Terrazzo Flooring Contractor	33 days?	Mon 7/2/07	Wed 8/15/07
153	Third Floor Flooring	60 days?	Mon 6/2/08	Fri 8/22/08
154	Second Floor Flooring	40 days?	Mon 6/16/08	Fri 8/8/08
155	Mezzanine Level Flooring	15 days	Tue 7/8/08	Mon 7/28/08
156	Ground Level Flooring	36 days?	Fri 7/18/08	Fri 9/5/08
157	Basement Flooring	20 days?	Fri 7/4/08	Thu 7/31/08
158	**MILLWORK**	**319 days**	**Mon 7/2/07**	**Thu 9/18/08**
159	Bid and Award Millwork Contractor	32 days?	Mon 7/2/07	Tue 8/14/07
160	Bid and Award Library and Casework Contractor	43 days?	Mon 7/2/07	Wed 8/29/07
161	Bid and Award High Density Shelving Contractor	43 days?	Mon 7/2/07	Wed 8/29/07
162	Basement Millwork	15 days?	Fri 7/18/08	Thu 8/7/08
163	Ground Floor Millwork	15 days?	Fri 8/8/08	Thu 8/28/08
164	Mezzanine Millwork	15 days?	Fri 8/8/08	Thu 8/28/08

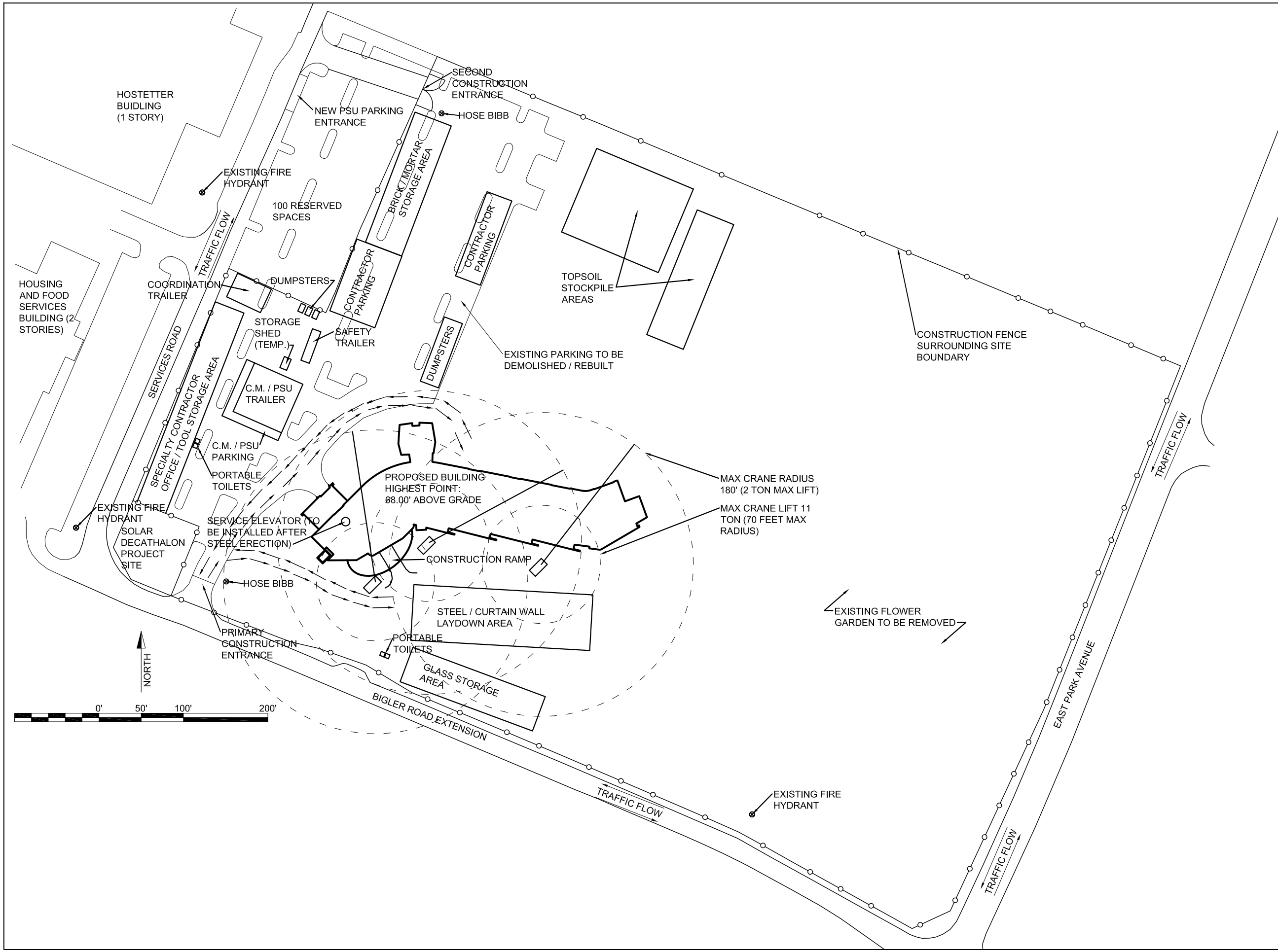


ID	Task Name	Duration	Start	Finish
165	Second Floor Millwork	15 days?	Fri 8/8/08	Thu 8/28/08
166	Third Floor Millwork	15 days?	Fri 8/29/08	Thu 9/18/08
167	**GENERAL TRADES**	**400 days**	**Fri 5/18/07**	**Thu 11/27/08**
168	Bid and Award Metal Panels Contractor	41 days?	Fri 5/18/07	Fri 7/13/07
169	Bid and Award Paint/Wall Coatings Contractor	33 days?	Mon 7/2/07	Wed 8/15/07
170	Bid and Award Signage Contractor	33 days?	Mon 7/2/07	Wed 8/15/07
171	Ground Level Ceiling Finishes	30 days?	Fri 5/30/08	Thu 7/10/08
172	Basement Ceiling Finishes (Grid, Lights, Diffusers, (	25 days?	Fri 6/13/08	Thu 7/17/08
173	Mezzanine Level Ceiling Finishes	12 days?	Mon 6/9/08	Tue 6/24/08
174	Second Floor Ceiling Finishes	75 days?	Mon 5/12/08	Fri 8/22/08
175	Third Floor Ceiling Finishes	80 days?	Mon 4/28/08	Fri 8/15/08
176	Third Floor Painting	65 days?	Mon 4/21/08	Fri 7/18/08
177	Second Floor Painting	60 days?	Mon 5/5/08	Fri 7/25/08
178	Mezzanine Level Painting	20 days	Mon 5/5/08	Fri 5/30/08
179	Ground Level Painting	44 days?	Mon 5/26/08	Thu 7/24/08
180	Basement Painting	34 days?	Mon 6/9/08	Thu 7/24/08
181	Basement Punchlist	40 days?	Fri 9/12/08	Thu 11/6/08
182	Ground Level Punchlist	50 days?	Fri 9/5/08	Thu 11/13/08
183	Mezzanine Level Punchlist	20 days	Wed 9/17/08	Tue 10/14/08
184	Second Floor Punchlist	35 days?	Fri 10/3/08	Thu 11/20/08
185	Third Floor Punchlist	45 days?	Fri 9/26/08	Thu 11/27/08
186	**CLOSEOUT**	**89 days**	**Mon 9/1/08**	**Thu 1/1/09**
187	Testing and Commissioning	65 days?	Mon 9/1/08	Fri 11/28/08
188	Substantial Completion & C. of O.	0 days	Wed 10/1/08	Wed 10/1/08
189	Punchlist Complete	0 days	Thu 1/1/09	Thu 1/1/09



APPENDIX B:

Site Layout Plan – Steel Erection



THE NEW DICKINSON SCHOOL OF LAW

The Pennsylvania State University
The Dickinson School of Law

University Park, PA

Steve Ayer
C.M. Option

Faculty Consultant:
Dr. Messner

Date: 11/2/2007

Scale: N.T.S.

Technical Assignment #2
Steel Erection Plan

APPENDIX C:

Assemblies Estimate Data

Sprinkler Square Footage Schedule

Room Number	Square Footage	Pipe Type
	Lower Level	
M 008	1475 SF	Wet
Q 003	485 SF	Wet
Z 002	165 SF	Wet
P 007	475 SF	Wet
M 007	100 SF	Wet
M 006	270 SF	Wet
009 B	65 SF	Wet
009	440 SF	Wet
009 A	150 SF	Wet
009 B	480 SF	Wet
005 G	540 SF	Wet
Q 002	860 SF	Wet
005 F	145 SF	Wet
005 E	120 SF	Wet
005 D	120 SF	Wet
005 C	120 SF	Wet
005 B	105 SF	Wet
005	400 SF	Wet
011	4150 SF	Wet
Q 001	745 SF	Wet
R 002	255 SF	Wet
R 002 A	25 SF	Wet
R 001	255 SF	Wet
R 001 A	25 SF	Wet
Z 001	175 SF	Wet
J 001	55 SF	Wet
T 003	90 SF	Wet
P 003	80 SF	Wet
M 004	70 SF	Wet
012	2250 SF	Wet
M 014	180 SF	Wet
M 016	4650 SF	Wet
Q 004	800 SF	Wet
Q 005	750 SF	Wet
Q 006	70 SF	Wet
Q 007	250 SF	Wet
017	700 SF	Wet
M 018	85 SF	Wet
J 019	200 SF	Wet
020	280 SF	Wet

T 021	100 SF	Wet
Z 003	200 SF	Wet
Ground Floor		
110	2125 SF	Wet
110 A	70 SF	Wet
109	1030 SF	Wet
Q 102	1040 SF	Wet
F 103	1315 SF	Wet
Q 103	4475 SF	Wet
Q 101	630 SF	Wet
R 101	305 SF	Wet
J 101	55 SF	Wet
R 102	305 SF	Wet
Z 101	160 SF	Wet
F 101	75 SF	Wet
T 103	85 SF	Wet
P 103	80 SF	Wet
104	160 SF	Wet
F 106	60 SF	Wet
112	1755 SF	Wet
F 107	60 SF	Wet
113	20 SF	Wet
Q 104	25 SF	Wet
Q 113	65 SF	Wet
F 105	70 SF	Wet
109 A	345 SF	Wet
Z 102	150 SF	Wet
108 A	85 SF	Wet
108	230 SF	**Dry**
107	220 SF	Wet
106	155 SF	Wet
106 A	125 SF	Wet
105	355 SF	Wet
105 A	240 SF	Wet
105 B	140 SF	Wet
105 C	140 SF	Wet
105 D	200 SF	Wet
114	1755 SF	Wet
P 115	65 SF	Wet
115	20 SF	Wet
Q 105	25 SF	Wet
F 108	60 SF	Wet
116	1755 SF	Wet
F 109	60 SF	Wet

117	20 SF	Wet
Q 106	25 SF	Wet
F 113	635 SF	Wet
121	260 SF	Wet
F 114	55 SF	Wet
R 119	80 SF	Wet
R 120	120 SF	Wet
121 A	195 SF	Wet
121 B	150 SF	Wet
P 121	65 SF	Wet
F 111	35 SF	Wet
F 112	110 SF	Wet
118 A	115 SF	Wet
118	3045 SF	Wet
Z 103	145 SF	Wet

Mezzanine

Z 103	145 SF	Wet
T 125	100 SF	Wet
122	1395 SF	Wet

Second Floor

214 B	4595 SF	Wet
Q 203	890 SF	Wet
Q 205	145 SF	Wet
Z 202	150 SF	Wet
208	370 SF	Wet
208 A	130 SF	Wet
207	185 SF	Wet
207 A	95 SF	Wet
207 B	205 SF	Wet
207 C	155 SF	Wet
207 D	220 SF	Wet
207 E	105 SF	Wet
209	125 SF	Wet
210	125 SF	Wet
Q 202	1215 SF	Wet
Q 201	880 SF	Wet
Q 205	1600 SF	Wet
Q 206	415 SF	Wet
211	185 SF	Wet
212	130 SF	Wet
216	135 SF	Wet
215	150 SF	Wet
206	300 SF	Wet
205	180 SF	Wet

204	195 SF	Wet
R 201	310 SF	Wet
J 201	55 SF	Wet
Z 201	155 SF	Wet
R 202	310 SF	Wet
T 203	90 SF	Wet
P 203	80 SF	Wet
228	170 SF	Wet
229	170 SF	Wet
230	170 SF	Wet
231	195 SF	Wet
233	50 SF	Wet
217	835 SF	Wet
232	810 SF	Wet
R 218	60 SF	Wet
234	115 SF	Wet
218	155 SF	Wet
207	1480 SF	Wet
235	170 SF	Wet
237	170 SF	Wet
238	170 SF	Wet
239	170 SF	Wet
242	170 SF	Wet
243	170 SF	Wet
244	170 SF	Wet
245	195 SF	Wet
247	170 SF	Wet
236	800 SF	Wet
240	115 SF	Wet
241	800 SF	Wet
241 A	40 SF	Wet
219	150 SF	Wet
220	150 SF	Wet
221	150 SF	Wet
222	150 SF	Wet
223	150 SF	Wet
224	150 SF	Wet
225	205 SF	Wet
226	105 SF	Wet
250	275 SF	Wet
250 C	165 SF	Wet
250 D	205 SF	Wet
250 E	125 SF	Wet
250 F	140 SF	Wet

249	400 SF	Wet
251	175 SF	Wet
253	160 SF	Wet
P 253	60 SF	Wet
Z 203	160 SF	Wet
252	555 SF	Wet
252 A	110 SF	Wet
252 D	145 SF	Wet
252 E	230 SF	Wet
252 F	245 SF	Wet
252 G	235 SF	Wet
252 H	200 SF	Wet
R 252	60 SF	Wet
252 J	370 SF	Wet
252 K	300 SF	Wet

Third Floor

Z 302	170 SF	Wet
Q 302	835 SF	Wet
Q 301	685 SF	Wet
308	295 SF	Wet
308 A	90 SF	Wet
308 B	95 SF	Wet
307	210 SF	Wet
307 A	370 SF	Wet
307 B	135 SF	Wet
307 C	135 SF	Wet
307 D	185 SF	Wet
307 E	100 SF	Wet
309	115 SF	Wet
310	115 SF	Wet
311	115 SF	Wet
312	115 SF	Wet
313	115 SF	Wet
306	170 SF	Wet
305	175 SF	Wet
304	200 SF	Wet
304 A	20 SF	Wet
R 301	260 SF	Wet
301 A	25 SF	Wet
J 301	55 SF	Wet
Z 301	170 SF	Wet
R 302	260 SF	Wet
302 A	25 SF	Wet
T 303	90 SF	Wet

P 303	80 SF	Wet
314	8165 SF	Wet
Q 304	220 SF	Wet
Q 303	1460 SF	Wet
319	405 SF	Wet
311 A	30 SF	Wet
Q 305	1085 SF	Wet
Q 306	365 SF	Wet
322	170 SF	Wet
323	170 SF	Wet
324	170 SF	Wet
325	195 SF	Wet
326	50 SF	Wet
327	170 SF	Wet
328	170 SF	Wet
329	170 SF	Wet
330	170 SF	Wet
331	170 SF	Wet
332	170 SF	Wet
333	170 SF	Wet
334	195 SF	Wet
335	170 SF	Wet
336	400 SF	Wet
337	175 SF	Wet
338	160 SF	Wet
P 338	60 SF	Wet
Z 303	160 SF	Wet
320	2115 SF	Wet
318	475 SF	Wet
316	200 SF	Wet
317	135 SF	Wet

Total Area Protected by Wet Pipes: 99765 SF

Total Area Protected by Dry Pipes: 230 SF

Sprinkler Cost Summary

D. Services - D40 Fire Protection - D4010 Sprinkler Systems

Sprinklers

	Total Cost	Quantity	Total Costs
Wet Pipe	5.14 $/SF	99765 SF	$512,792
Dry Pipe	5.85 $/SF	230 SF	$1,346

D. Services - D40 Fire Protection - D4020 Stand Pipe and Hose Systems

Standpipes

	Quantity	Floors Covered	Cost/Unit	Cost
Wet Standpipes	5	5	$16,515	$82,575
Dry Standpipes	1	1	$7,875	$7,875

Fire Hose Equipment

	Quantity	Cost/Unit	Cost
Recessed Wall Cabinet Assembly	22	$835	$18,370
6" Siamese Fire Dept. Connection	1	$1,135	$1,135

Total Sprinkler System Estimate $624,093

APPENDIX D:

Detailed Structural Systems Estimate Data

Detailed Structural Estimate

Concrete Estimate

Grade Beams

Description	Length (Ft)	Cross Section Area (SF)	Total Volume (YD3)
Grade Beam	105	3.125	12.2
Grade Beam	30	3.125	3.5
Grade Beam	6	3.125	0.7
Grade Beam	50	3.125	5.8
Grade Beam	6	3.125	0.7
Grade Beam	60	3.125	6.9
Grade Beam	28	3.125	3.2
Grade Beam	46	3.125	5.3
Grade Beam	17	3.125	2.0
Grade Beam	50	3.125	5.8
Grade Beam	28	3.125	3.2
Grade Beam	34	3.125	3.9
Grade Beam	12	3.125	1.4
Grade Beam	174	3.125	20.1
Grade Beam	16	3.125	1.9
Grade Beam	10	3.125	1.2
Grade Beam	10	3.125	1.2
Grade Beam	14	3.125	1.6
Grade Beam	23	3.125	2.7
Grade Beam	15	3.125	1.7
Grade Beam	3	3.125	0.3
Grade Beam	9	3.125	1.0
Grade Beam	3	3.125	0.3
Grade Beam	15	3.125	1.7
Grade Beam	23	3.125	2.7
Grade Beam	14	3.125	1.6
Grade Beam	10	3.125	1.2
Grade Beam	10	3.125	1.2
Grade Beam	16	3.125	1.9
Grade Beam	25	3.125	2.9
Grade Beam	25	3.125	2.9
Grade Beam	85	3.125	9.8
Grade Beam	18	3.125	2.1
Grade Beam	14	3.125	1.6
Grade Beam	15	3.125	1.7
Grade Beam	7	3.125	0.8
Grade Beam	10	3.125	1.2
Grade Beam	19	3.125	2.2

Total Grade Beam Yards 122

Concrete Foundation Walls

Description	Length (Ft)	Height (Ft)	Width (In)	Total Volume (YD3)
Foundation Wall	28	12	16	16.6
Foundation Wall	34	12	16	20.1
Foundation Wall	12	14	16	8.3
Foundation Wall	175	16	16	138.3
Foundation Wall	16	18	16	14.2
Foundation Wall	10	18	16	8.9
Foundation Wall	10	18	16	8.9
Foundation Wall	14	18	16	12.4
Foundation Wall	23	18	16	20.4
Foundation Wall	15	18	16	13.3
Foundation Wall	4	18	16	3.6
Foundation Wall	9	18	16	8.0
Foundation Wall	4	18	16	3.6
Foundation Wall	15	18	16	13.3
Foundation Wall	23	18	16	20.4
Foundation Wall	14	18	16	12.4
Foundation Wall	10	18	16	8.9
Foundation Wall	10	18	16	8.9
Foundation Wall	16	20	16	15.8
Foundation Wall	25	20	16	24.7
Foundation Wall	25	20	16	24.7
Foundation Wall	85	20	16	84.0
Foundation Wall	18	20	16	17.8
Foundation Wall	14	18	16	12.4
Foundation Wall	15	18	16	13.3
Foundation Wall	7	18	16	6.2
Foundation Wall	10	18	16	8.9
Foundation Wall	19	18	16	16.9
Foundation Wall	105	18	16	93.3
Foundation Wall	31	18	16	27.6
Foundation Wall	50	18	16	44.4
Foundation Wall	6	15	16	4.4
Foundation Wall	60	15	16	44.4
Foundation Wall	28	15	16	20.7
Foundation Wall	47	15	16	34.8
Foundation Wall	17	15	16	12.6
Foundation Wall	50	15	16	37.0

Total Foundation Wall Yards 885

Spread Footers

Type of Footer	Quantity	Volume (YD3)	Total Volume (YD3)
F5.0	34	1.4	47.2
F5.0A	9	1.9	16.7

F6.0	18	2.7	48.0
F8.0	3	7.1	21.3

Total Spread Footer Yards	133

Footing, Grade Beam, and Foundation Wall Cubic Yards Subtotal	1140
10% Contingency Modifier	114
Total Estimated Footing, Grade Beams, and Foundation Walls	1254
Unit Price (Including Mat'l, Labor, and O&P)	$600
Cost of all Foundations, Grade Beams, and Foundation Walls	$752,446

Concrete Slabs in Whole Building

Description	Slab Area (SF)	Slab Thickness (In)	Total Volume (YD3)
Lower Level	8335	5	128.6
	190	5	2.9
	570	5	8.8
	910	5	14.0
	3975	8	98.1
	10550	5	162.8
Ground Floor	1245	8	30.7
	2330	6	43.1
	7800	3.5	84.3
	5230	3.5	56.5
	6500	6	120.4
	1200	3.5	13.0
	3750	5	57.9
Mezzanine	1675	3.5	18.1
Second Floor	29030	3.5	313.6
Third Floor	28045	3.5	303.0
Total	111335		

Concrete Slab Area Subtotal	111335
10% Contingency Modifier	11134
Total Concrete Slab Area	122469
Unit Price (Including Mat'l Labor, and O&P)	$9.00
Total Estimated Cost of Slabs	$1,102,217

Total Estimated Cost of Concrete $1,854,662

Steel Estimate

Level: First Floor West Steel

Description	Lengths (Ft)	Weight (Lb/Ft)	Shear Studs	Total Weight (Lbs)
HSS4X4X1/2	0	0	0	0
HSS6X4X1/4	12	20	0	240
W6X20	10	20	0	200
	10	20	0	200
	6	20	0	120
	6	20	0	120
	11	20	0	220
	14	20	0	280
	10	20	0	200
	11	20	0	220
	12	20	0	240
	16	20	0	320
	13	20	0	260
	12	20	0	240
2L6X6X3/4	29	57.4	0	1664.6
	22	57.4	0	1262.8
W8X13	9	13	7	117
	7	13	0	91
	6	13	0	78
	7	13	0	91
	10	13	2	130
	9	13	0	117
	9	13	0	117
	15	13	0	195
	18	13	5	234
	16	13	12	208
	12	13	5	156
	13	13	6	169
	11	13	0	143
	12	13	0	156
	3	13	0	39
	12	13	5	156
	10	13	5	130
	10	13	5	130
	13	13	4	169
	14	13	5	182
	18	13	8	234

	10	13	0	130
	10	13	0	130
	15	13	4	195
	15	13	4	195
	15	13	4	195
	14	13	5	182
	14	13	5	182
	15	13	4	195
	15	13	4	195
	16	13	4	208
	15	13	4	195
	3	13	0	39
	6	13	0	78
	10	13	4	130
	9	13	4	117
	3	13	0	39
	3	13	0	39
	0	13	0	0
	0	13	0	0
W8X24	10	24	0	240
	8	24	0	192
	18	24	10	432
	20	24	10	480
	20	24	10	480
	18	24	10	432
	0	0	0	0
W8X31	24	31	22	744
W10X15	21	15	10	315
W12X19	22	19	19	418
	19	19	11	361
	17	19	11	323
	19	19	12	361
	20	19	8	380
	22	19	19	418
	16	19	8	304
	21	19	12	399
	16	19	8	304
	7	19	0	133
	22	19	11	418
	18	19	0	342
	4	19	0	76
	4	19	0	76
	26	19	0	494
	7	19	0	133
	19	19	8	361

	19	19	8	361
	25	19	0	475
W12X22	14	22	0	308
	4	22	0	88
	21	22	12	462
W14X22	36	22	8	792
	20	22	10	440
	10	22	10	220
	25	22	12	550
	19	22	23	418
	21	22	13	462
	22	22	0	484
	23	22	11	506
	23	22	11	506
	23	22	16	506
	23	22	10	506
W14X26	23	26	11	598
	23	26	10	598
W14X34	24	34	14	816
	26	34	15	884
W14X38	25	38	17	950
	25	38	17	950
	25	38	17	950
W14X43	25	43	16	1075
W16X26	18	26	16	468
	25	26	0	650
	25	26	12	650
	25	26	12	650
	21	26	10	546
	21	26	11	546
	26	26	10	676
	28	26	24	728
	28	26	11	728
	28	26	13	728
	28	26	13	728
	25	26	11	650
W16X26 + WT13.5	16	68	7	1088
W16X31	19	31	22	589
	17	31	0	527

	19	31	20	589
	17	31	0	527
	19	31	13	589
	26	31	26	806
	25	31	13	775
	28	31	12	868
W16X36	30	36	34	1080
W16X40	25	40	12	1000
	25	40	19	1000
	26	40	19	1040
	26	40	19	1040
	26	40	19	1040
W18X35	32	35	36	1120
	32	35	36	1120
W18X40	31	40	32	1240
W18X46	25	46	21	1150
W18X60	24	60	0	1440
	16	60	0	960
	25	60	0	1500
W18X97	34	97	74	3298
W21X44	30	44	0	1320
	17	44	0	748
	10	44	0	440
	23	44	44	1012
	25	44	40	1100
	3	44	0	132
	7	44	0	308
	12	44	0	528
W21X44 + WT9X2	9	64	0	576
	11	44	14	484
W21X44 + WT13.5	26	86	19	2236
W21X50	18	50	12	900
W21X122	36	122	42	4392
W24X94	22	94	0	2068

W27X84	35	84	28	2940
	21	84	18	1764
	15	84	0	1260
W27X94	39	94	0	3666
W30X90 + WT12X	32	132	0	4224
W30X99	35	99	29	3465
W30X108	35	108	40	3780
W30X132	39	132	0	5148
W40X183	50	183	85	9150

Level: First Floor East Steel

Description	Lengths (Ft)	Weight (Lb/Ft)	Shear Studs	Total Weight (Lbs)
2L6X6X3/4	24	57.4	0	1377.6
	26	57.4	0	1492.4
	14	57.4	0	803.6
W8X10	8	10	0	80
W8X13	19	13	8	247
	9	13	0	117
	9	13	0	117
	18	13	7	234
	16	13	7	208
	12	13	7	156
	10	13	4	130
W10X22	7	22	0	154
	7	22	0	154
W12X16	10	16	0	160
W12X19	5	19	19	95
	26	19	0	494
	7	19	0	133
	19	19	8	361
	19	19	8	361
	25	19	0	475
	16	19	0	304
	8	19	0	152

	5	19	0	95
	7	19	0	133
	7	19	11	133
	11	19	11	209
	14	19	11	266
	15	19	10	285
	25	19	16	475
	25	19	23	475
	16	19	15	304
	8	19	0	152
	8	19	0	152
	13	19	0	247
	55	19	0	1045
	7	19	0	133
	23	19	0	437
	23	19	11	437
	23	19	10	437
	23	19	19	437
	19	19	24	361
	6	19	0	114
W12X30	25	30	12	750
	25	30	12	750
W12X35	25	35	15	875
W14X22	23	22	11	506
	23	22	11	506
	23	22	11	506
	23	22	16	506
	23	22	10	506
	23	22	10	506
	15	22	8	330
	23	22	11	506
	23	22	11	506
	23	22	16	506
	23	22	10	506
	28	22	16	616
W14X26	23	26	10	598
W14X30	28	30	14	840
	28	30	14	840
W16X26	28	26	0	728
	28	26	11	728
	28	26	13	728
	28	26	13	728

	25	26	11	650
W16X26 + WT21X	22	68	0	1496
W16X31	28	31	12	868
W18X35	21	35	30	735
	15	35	13	525
	28	35	0	980
	21	35	34	735
W18X40	21	40	30	840
W18X60	15	60	0	900
	23	60	0	1380
	21	60	0	1260
	28	60	0	1680
	15	60	0	900
	23	60	0	1380
	28	60	0	1680
	15	60	0	900
W21X44	25	44	27	1100
	30	44	27	1320
W21X50	20	50	0	1000
W24X55	21	55	14	1155
	25	55	0	1375
	29	55	69	1595
	21	55	14	1155
	28	55	27	1540
W24X62	31	62	62	1922
W24X68	32	68	78	2176

First Floor East Steel Tonage	29
Total First Floor Framing Steel Tonnage	88
Total First Floor Square Footage	28500
Average Framing Weight in Lb/SF on First Floor	6.19
1.2 Modifier to Account for Additional Tonnage on Upper Floors	7.43
Remaining Square Footage Framing to be Estimated	88122
Estimated Remaining Steel Framing Tonnage	327
Total Estimated Steel Framing Tonnage for Entire Building	416

Steel Columns in Whole Building

Description	Lengths (Ft)	Weight (Lb/Ft)	Total Weight (Lbs)
HSS12.75X0.500	42	65.48	2750.16
	42	65.48	2750.16
	39	65.48	2553.72
	29	65.48	1898.92
	34	65.48	2226.32
	34	65.48	2226.32
	39	65.48	2553.72
	34	65.48	2226.32
	39	65.48	2553.72
	34	65.48	2226.32
	39	65.48	2553.72
	36	65.48	2357.28
	39	65.48	2553.72
	37	65.48	2422.76
	39	65.48	2553.72
	38	65.48	2488.24
	39	65.48	2553.72
HSS12.75X0.250	44	33.41	1470.04
	46	33.41	1536.86
	22	33.41	735.02
	29	33.41	968.89
	42	33.41	1403.22
	31	33.41	1035.71
	29	33.41	968.89
	29	33.41	968.89
	42	33.41	1403.22
	44	33.41	1470.04
	46	33.41	1536.86
HSS12.75X0.375	36	49.61	1785.96
	49	49.61	2430.89
	41	49.61	2034.01
	39	49.61	1934.79
	27	49.61	1339.47
	40	49.61	1984.4
	27	49.61	1339.47
	30	49.61	1488.3
	30	49.61	1488.3
	48	49.61	2381.28
W10X33	45	33	1485
	45	33	1485
	45	33	1485

	45	33	1485
	24	33	792
	24	33	792
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	26	33	858
	45	33	1485
	51	33	1683
	26	33	858
	26	33	858
	26	33	858
	22	33	726
	22	33	726
	22	33	726
	34	33	1122
	24	33	792
	24	33	792
	24	33	792
	24	33	792
W10X49	26	49	1274
	26	49	1274
	26	49	1274
	26	49	1274
	20	49	980
	20	49	980
	20	49	980
	20	49	980
	20	49	980
	20	49	980
	20	49	980
	20	49	980
	20	49	980
	24	49	1176
	26	49	1274
	24	49	1176
	24	49	1176
	23	49	1127
	24	49	1176

	23	49	1127
	24	49	1176
	24	49	1176
	24	49	1176
	24	49	1176
	24	49	1176
	42	49	2058
W10X54	22	54	1188
	22	54	1188
	26	54	1404
	42	54	2268
	22	54	1188
	22	54	1188
W10X60	42	60	2520
W10X68	22	68	1496
	26	68	1768
W10X77	22	77	1694
	26	77	2002
	42	77	3234
	40	77	3080
W10X88	24	88	2112
	42	88	3696
	42	88	3696
	42	88	3696
	42	88	3696
	42	88	3696
W10X100	26	100	2600
	42	100	4200
W10X112	42	112	4704
W12X65	42	65	2730
	32	65	2080
	32	65	2080
	24	65	1560
W12X72	25	72	1800
	29	72	2088
	31	72	2232
W12X96	39	96	3744
	32	96	3072

	39	96	3744
	32	96	3072
	39	96	3744
W12X190	39	190	7410
	39	190	7410
	38	190	7220
	39	190	7410
W12X252	42	252	10584
	42	252	10584
	42	252	10584
	42	252	10584

Total Building Steel Column Tonage 147

Total Estimated Building Steel Tonnage (Excluding Deck) 562

Steel Tonnage Unit Price (Including Mat'l, Labor, & O&P) $2,000

Estimated Cost of Steel $1,124,673

Metal Deck in Whole Building

Description	Area (SF)	Weight (Lb/SF)
Ground Floor		
Metal deck	2330	3" 16 gauge
Metal deck	7800	2" 18 gauge
Metal deck	5230	2" 18 gauge
Metal deck	6500	3" 16 gauge
Metal deck	1200	2" 18 gauge
Mezzanine		
Metal Deck	1675	2" 18 gauge
Second Floor		
Metal Deck	29030	2" 18 gauge
Third Floor		
Metal Deck	28045	2" 18 gauge
Roof Level		
Roof Deck	11305	3" 18 Gauge Roof Deck
Roof Deck	17690	3" 18 Gauge Roof Deck

Total 3" 16 Gauge Metal Deck Area (SF)	8830	
Total 3" 18 Gauge Metal Deck Area (SF)	72980	
Total 3" 18 Gauge Metal Roof Deck Area (SF)	28995	
Total Deck Square Footage	110805	
Square Footage Price for 16-18 Gauge Deck	$7.00	
Total Estimated Deck Price	$775,635	
Structural Estimate Grand Total		**$3,754,970**