THE PENNSYLVANIA STATE UNIVERSITY
DEPARTMENT OF ARCHITECTURAL ENGINEERING
SENIOR THESIS

UPMC Passavant Pavilion

Pittsburgh, Pa

Technical Assignment 2

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Executive Summary

This technical report will further describe the construction management aspects of the UPMC Passavant Pavilion Addition project located in Pittsburgh, Pennsylvania. Within this report a detailed project schedule was developed for the major phases of the project. The schedule is divided into phases of construction relative to the construction of the new Pavilion and the renovation of the existing hospital. Activities are divided by floor and then by trade. This division allows the reader to visualize the movement of the trades through the floors of the building by contrasting the start dates of the activities.

Site layout plans are also described and analyzed within this report. Through this analysis the intricacies of the sequencing between major trades can be seen. It also shows how this relatively tight and constrained site was utilized to keep the flow of work moving smoothly with few conflicts among the contractors. The main focus of these site layout plans are the steel erection and concrete placing activities due to their space requirements within the site and their importance in maintaining the schedule of the project.

A detailed estimate was developed for the structural system of the Pavilion and the Central Plant. Each is constructed with structural steel superstructure and composite concrete slabs on deck. Within this estimate the cost of the steel members, concrete slabs, and foundation systems were calculated utilizing RS Means Building Construction Cost Data. The general conditions of the project were also calculated in the same manner.

The closing section of this report evaluates a critical industry issue as discussed at the 2008 PACE Roundtable held at The Pennsylvania State University on October 16, 2008. Among the topics discussed at the event was 'The Effects of Energy and the Economy On Construction.' This discussion topic focused on how current energy prices and the state of the economy affect the construction industry and the decisions that industry members make in regards to these issues.

Information technology and its integration into the construction industry was also discussed through an industry panel. During this time questions were asked and members of the industry could reply and drive the discussion based on their experiences. One of the most interesting topics was the use of mobile information technology documents in the construction field. These types of documents were utilized on the Passavant project and this topic may provide an excellent research topic for future technical reports and thesis research.

A. Detailed Project Schedule

The duration of the UPMC Passavant Pavilion Addition and Renovation encompasses almost 3 years from the Notice To Proceed date of 16 November 2007 to the Final Completion date of the renovation of 07 July 2010. Throughout this period an 8 story hospital addition, 3 story central plant a facility and the renovation of four existing hospital floors takes place.

The construction of the Pavilion Addition and Renovation is broken down into six phases. Phase 1 began after the Notice to Proceed was issued and the general contractor mobilized to site. During this phase minor renovations and preparations are made to the emergency department on the 1st Floor of the existing hospital. This work prepared the emergency department for the rerouting of patients and staff throughout the construction of the Addition.

Phase 2 of the project begins with site demo of the existing facilities within the footprint of the Pavilion. Much of the demo included removal of paving and curbs, as well as, the removal of the façade along the south elevation of the existing hospital. This phase of construction includes the all of the work that is directly related to the construction of the Pavilion Addition and the new Central Plant.

After the excavation of the footprint of the Pavilion and the installation of the foundation was complete the structural steel erection was able to begin. The erection was broken into four zones within the Pavilion and then one zones for the Central Plant. Each Zone 1 contained an area three bays long by the width of the building while Zones 2 – 4 each was two bays long by the width. These zones were then broken down further into sequences with a sequence generally being either the north or south half of each zone.

For scheduling purposes the durations of the sixteen sequences within each zone, Zone 4 only contained 8 sequences, were combined to create an overall duration for each of the four zones of the Pavilion and the single zone within the Central Plant.

The remaining work on the exterior of the Pavilion consisted of masonry veneer, curtain wall, metal wall panels, and louvers with translucent panels. Durations for each of these activities were sorted based upon the building elevation that they were on.

Once the steel superstructure was progressing past Zone 1 and 2 the concrete slabs on deck and the slab on grade could begin being placed. Each floor from the 1st Floor through 3rd Floor and the slab on grade were broken into three pours while the remaining floors were broken into two pours. Again for scheduling purposes the durations of each of these separate phases was combined to form an overall duration for the entire floor.

Activities within the construction of the building were nearly similar on each floor and the schedule in Figures 1a – 1d reflects this. Each floor listed on the schedule contains the same items; Concrete SOD, Mechanical, Electrical, Plumbing, Partitions/Drywalls/Ceilings, Finishes, Fire Protection, FF&E, Pneumatic Tubing, Punch List, and Final Cleaning.

The durations for these activities were calculated in the same manner as the steel erection and the concrete slabs. While this method may not be the best for showing the overall interaction between the trades and activities, it does show the overall duration of the activities while limiting the number of line items within the schedule. These durations can be slightly misleading because many times only one line item within the overall activity is incomplete and causes the overall duration to be extended by weeks or months.

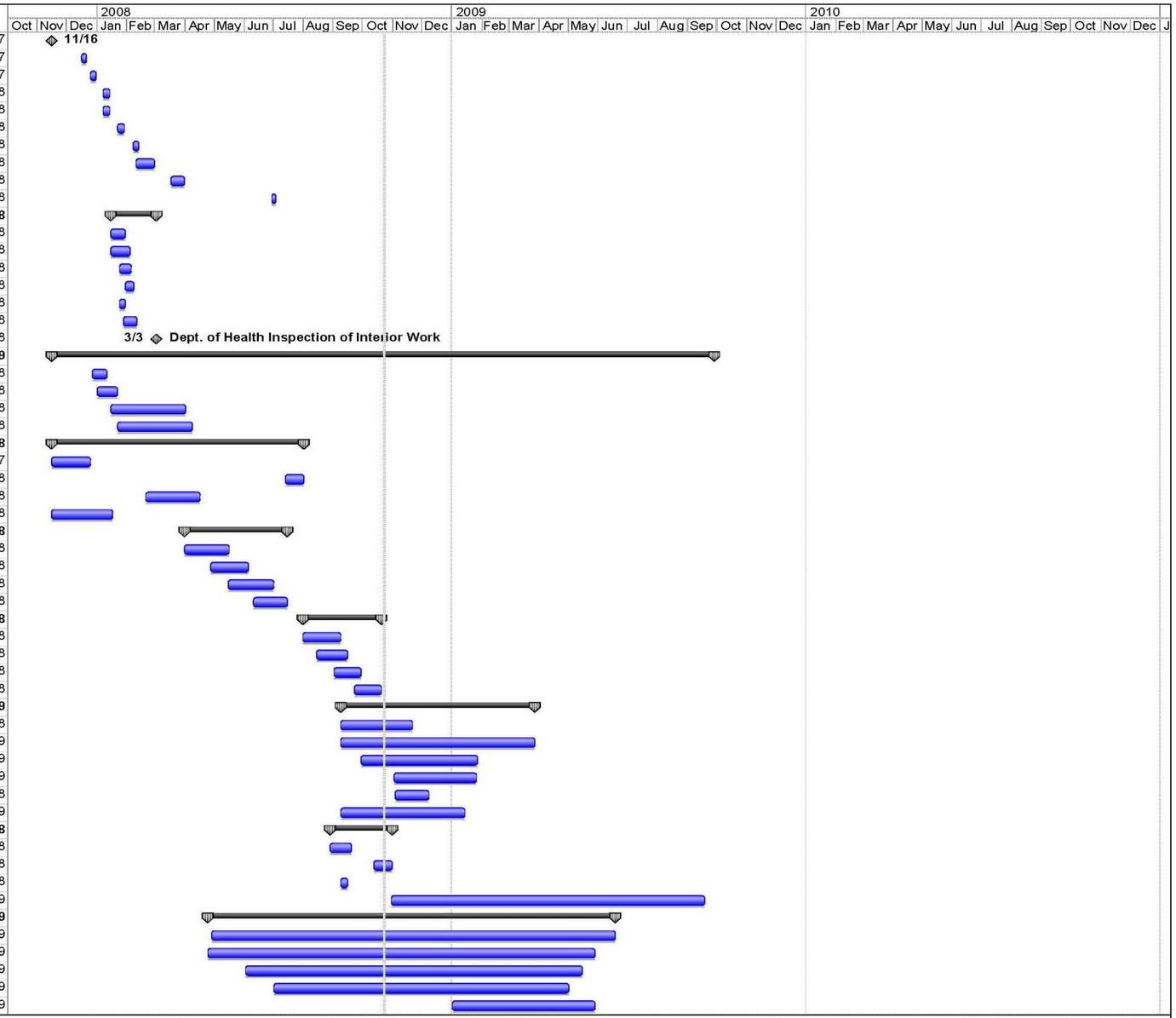
Construction on the interior of the Pavilion, including MEP and interior partitions began on the Ground Floor on 04 April 2008 and concluded on the 7th Floor on 14 July 2009. Throughout this time period many different trades were working in close proximity to one another and the use of the schedule and sequencing was an important part of ensuring the work was completed on time. If the work on one floor were to fall behind the remaining work would need to be accelerated to stay on schedule.

The remaining portion of Phase 2 of the project was the construction of the Central Plant. This construction occurred simultaneously with that of the Pavilion. The work was scheduled to begin on 27 May 2008 with the start of the concrete foundations and footings and be completed on 17 July 2009 when all the mechanical work within the building was complete. The activities within the Central Plant resemble those of the Pavilion with some minor exceptions. There are no drywall partition but rather masonry walls and there are no FF&E or finish items.

The completion of the Pavilion and the Central Plant work marks the end of Phase 2 of the project and the beginning of the renovation phases. Renovation of the existing Passavant Hospital occurs in four phases, Phase 3 – Phase 6. During these renovation phases work occurs on the Ground, 1st, and 2nd Floors. The renovation is broken into four phases because of the nature of the work. Each phase represents a different area of the hospital that is being renovated and each of these areas has its own needs and requirements. UPMC needs to be able to transfer the affected departments to the new Pavilion and into other portions of the existing hospital so that they can maintain constant operations during the renovation process and this facilitates the need for the multiple phases.

After the completion of the renovation phases on 21 May 2010 the building construction portion of the project is complete. The project contract shows a final completion date of 07 July 2010. During the period between the end of building construction and the final completion date miscellaneous site and exterior work will occur.

ID	Task Name	Duration	Start	Finish
1	Notice To Proceed	0 days	Fri 11/16/07	Fri 11/16/07
2	General Contractor Mobilization	5 days	Mon 12/17/07	Fri 12/21/07
3	Excavator Field Mobilization	4 days	Wed 12/26/07	Mon 12/31/07
4	Electrical Field Mobilization	5 days	Tue 1/8/08	Mon 1/14/08
5	Plumbing Field Mobilization	5 days	Tue 1/8/08	Mon 1/14/08
6	Site Utility Field Mobilization	5 days	Wed 1/23/08	Tue 1/29/08
7	Mason Field Mobilization	4 days	Fri 2/8/08	Wed 2/13/08
8	Mechanical Field Mobilization	15 days	Mon 2/11/08	Fri 2/29/08
9	Structural Steel Erector Field Mobilization	10 days	Tue 3/18/08	Mon 3/31/08
10	Fire Protection Field Mobilization	4 days	Mon 6/30/08	Thu 7/3/08
11	**Phase 1 - Renovation/Prep**	**33 days**	**Wed 1/16/08**	**Mon 3/3/08**
12	Mechanical Demo	11 days	Wed 1/16/08	Wed 1/30/08
13	Electrical Demo	14 days	Wed 1/16/08	Mon 2/4/08
14	Electrical Rough In - Power, Lighting, Systems	8 days	Fri 1/25/08	Tue 2/5/08
15	Electrical Trim Out/Fixtures	7 days	Thu 1/31/08	Fri 2/8/08
16	General Contractor Architectural Demo	4 days	Fri 1/25/08	Wed 1/30/08
17	General Contractor Finishes	10 days	Tue 1/29/08	Mon 2/11/08
18	Dept. of Health Inspection of Interior Work	0 days	Mon 3/3/08	Mon 3/3/08
19	**Phase 2 - Pavilion**	**487 days?**	**Fri 11/16/07**	**Tue 9/29/09**
20	Site Demo	11 days?	Fri 12/28/07	Fri 1/11/08
21	Bulk Excavation	15 days	Wed 1/2/08	Tue 1/22/08
22	Building Foundations/Walls	55 days	Wed 1/16/08	Tue 4/1/08
23	Plumbing Under Slab Utilities	55 days	Wed 1/23/08	Tue 4/8/08
24	**Concrete**	**186 days?**	**Fri 11/16/07**	**Fri 8/1/08**
25	Prep/Place SOG	28 days?	Fri 11/16/07	Tue 12/25/07
26	Complete SOG	15 days	Mon 7/14/08	Fri 8/1/08
27	Masonry Foundation Walls	40 days	Thu 2/21/08	Wed 4/16/08
28	Backfill Foundation Walls	45 days	Fri 11/16/07	Thu 1/17/08
29	**Structural Steel**	**76 days?**	**Tue 4/1/08**	**Tue 7/15/08**
30	Structural Steel Erection/Detailing/Decking Zone 1	34 days	Tue 4/1/08	Fri 5/16/08
31	Structural Steel Erection/Detailing/Decking Zone 2	29 days?	Mon 4/28/08	Thu 6/5/08
32	Structural Steel Erection/Detailing/Decking Zone 3	33 days?	Fri 5/16/08	Tue 7/1/08
33	Structural Steel Erection/Detailing/Decking Zone 4	25 days?	Wed 6/11/08	Tue 7/15/08
34	**Masonry**	**57 days?**	**Fri 8/1/08**	**Mon 10/20/08**
35	East Elevation	27 days?	Fri 8/1/08	Mon 9/8/08
36	North Elevation	22 days?	Fri 8/15/08	Mon 9/15/08
37	South Elevation	20 days?	Tue 9/2/08	Mon 9/29/08
38	West Elevation	20 days?	Tue 9/23/08	Mon 10/20/08
39	**Curtain Wall**	**144 days?**	**Tue 9/9/08**	**Fri 3/27/09**
40	East Elevation	54 days?	Tue 9/9/08	Fri 11/21/08
41	South Elevation	144 days?	Tue 9/9/08	Fri 3/27/09
42	North Elevation	86 days?	Tue 9/30/08	Tue 1/27/09
43	West Elevation	61 days?	Mon 11/3/08	Mon 1/26/09
44	Bridge	25 days?	Tue 11/4/08	Mon 12/8/08
45	Translucent Panels	92 days?	Tue 9/9/08	Wed 1/14/09
46	**Metal Wall Panels**	**46 days?**	**Fri 8/29/08**	**Fri 10/31/08**
47	East Elevation	16 days?	Fri 8/29/08	Fri 9/19/08
48	West Elevation	15 days?	Mon 10/13/08	Fri 10/31/08
49	Louvers	5 days?	Tue 9/9/08	Mon 9/15/08
50	Elevators	231 days?	Fri 10/31/08	Fri 9/18/09
51	**Ground Floor**	**300 days?**	**Fri 4/25/08**	**Thu 6/18/09**
52	Mechanical	298 days?	Tue 4/29/08	Thu 6/18/09
53	Electrical	285 days?	Fri 4/25/08	Thu 5/28/09
54	Plumbing	249 days?	Tue 6/3/08	Fri 5/15/09
55	Partitions/Drywall/Ceilings	218 days?	Wed 7/2/08	Fri 5/1/09
56	Finishes	105 days?	Fri 1/2/09	Thu 5/28/09



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Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

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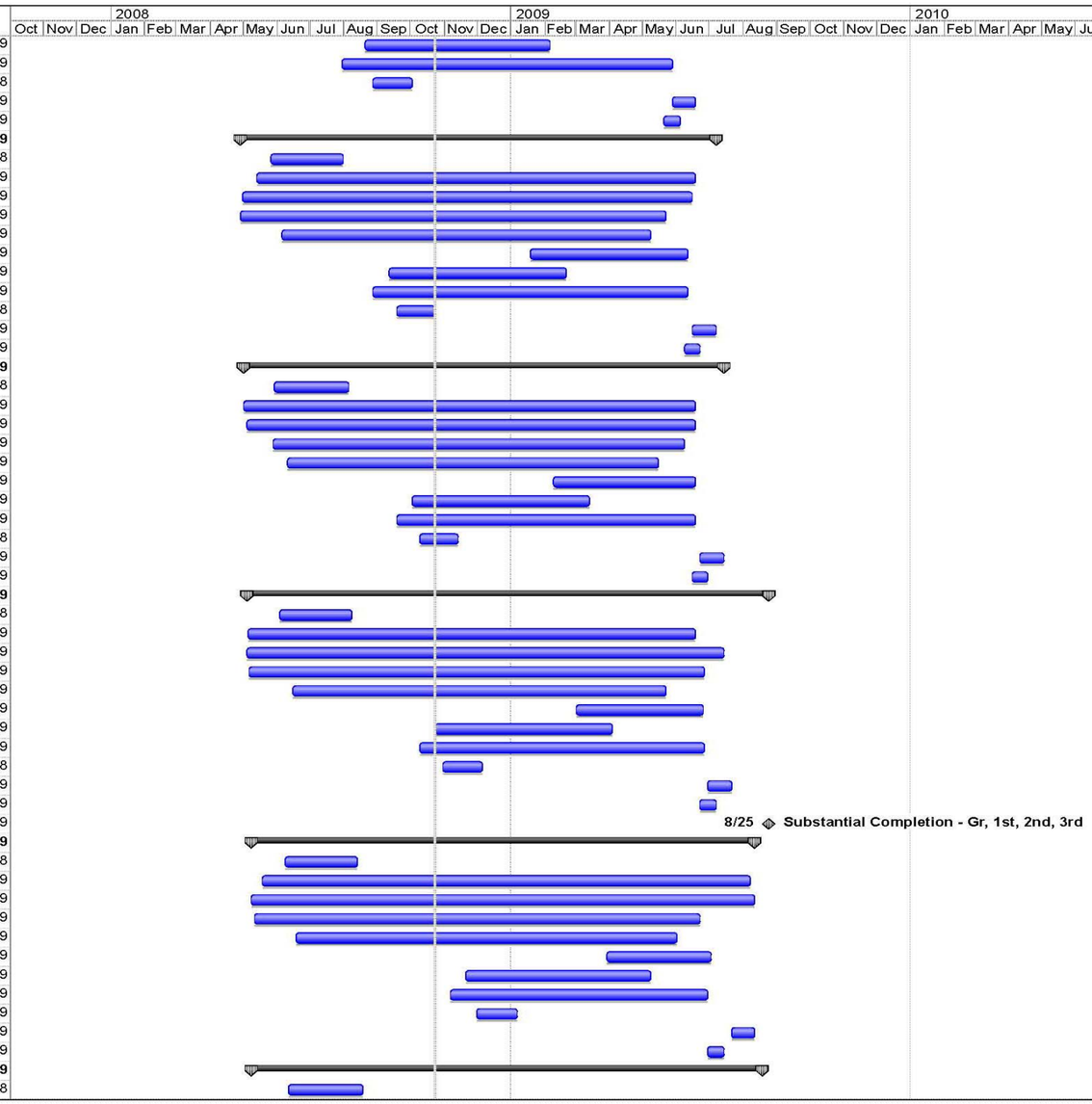
Figure 1a – Detailed Project Schedule

ID	Task Name	Duration	Start	Finish
57	Fire Protection	121 days?	Thu 8/21/08	Thu 2/5/09
58	FF&E	216 days?	Thu 7/31/08	Thu 5/28/09
59	Pneumatic Tubing	26 days?	Thu 8/28/08	Thu 10/2/08
60	Punch List	15 days?	Fri 5/29/09	Thu 6/18/09
61	Final Cleaning	11 days?	Thu 5/21/09	Thu 6/4/09
62	**1st Floor**	**311 days?**	**Tue 4/29/08**	**Tue 7/7/09**
63	Concrete SOD	48 days?	Tue 5/27/08	Thu 7/31/08
64	Mechanical	287 days?	Wed 5/14/08	Thu 6/18/09
65	Electrical	293 days?	Thu 5/1/08	Mon 6/15/09
66	Plumbing	279 days?	Tue 4/29/08	Fri 5/22/09
67	Partitions/Drywall/Ceilings	241 days?	Fri 6/6/08	Fri 5/8/09
68	Finishes	104 days?	Mon 1/19/09	Thu 6/11/09
69	Fire Protection	116 days?	Fri 9/12/08	Fri 2/20/09
70	FF&E	206 days?	Thu 8/28/08	Thu 6/11/09
71	Pneumatic Tubing	25 days?	Fri 9/19/08	Thu 10/23/08
72	Punch List	16 days?	Tue 6/16/09	Tue 7/7/09
73	Final Cleaning	10 days?	Tue 6/9/09	Mon 6/22/09
74	**2nd Floor**	**313 days?**	**Fri 5/2/08**	**Tue 7/14/09**
75	Concrete SOD	48 days?	Fri 5/30/08	Tue 8/5/08
76	Mechanical	295 days?	Fri 5/2/08	Thu 6/18/09
77	Electrical	294 days?	Mon 5/5/08	Thu 6/18/09
78	Plumbing	268 days?	Thu 5/29/08	Mon 6/8/09
79	Partitions/Drywall/Ceilings	243 days?	Wed 6/11/08	Fri 5/15/09
80	Finishes	94 days?	Mon 2/9/09	Thu 6/18/09
81	Fire Protection	116 days?	Fri 10/3/08	Fri 3/13/09
82	FF&E	195 days?	Fri 9/19/08	Thu 6/18/09
83	Pneumatic Tubing	25 days?	Fri 10/10/08	Thu 11/13/08
84	Punch List	16 days?	Tue 6/23/09	Tue 7/14/09
85	Final Cleaning	10 days?	Tue 6/16/09	Mon 6/29/09
86	**3rd Floor**	**341 days?**	**Mon 5/5/08**	**Tue 8/25/09**
87	Concrete SOD	48 days?	Wed 6/4/08	Fri 8/8/08
88	Mechanical	293 days?	Tue 5/6/08	Thu 6/18/09
89	Electrical	312 days?	Mon 5/5/08	Tue 7/14/09
90	Plumbing	298 days?	Wed 5/7/08	Fri 6/26/09
91	Partitions/Drywall/Ceilings	245 days?	Mon 6/16/08	Fri 5/22/09
92	Finishes	84 days?	Mon 3/2/09	Thu 6/25/09
93	Fire Protection	116 days?	Fri 10/24/08	Fri 4/3/09
94	FF&E	186 days?	Fri 10/10/08	Fri 6/26/09
95	Pneumatic Tubing	26 days?	Fri 10/31/08	Fri 12/5/08
96	Punch List	16 days?	Tue 6/30/09	Tue 7/21/09
97	Final Cleaning	11 days?	Tue 6/23/09	Tue 7/7/09
98	Substantial Completion - Gr, 1st, 2nd, 3rd	0 days	Tue 8/25/09	Tue 8/25/09
99	**4th Floor**	**328 days?**	**Fri 5/9/08**	**Tue 8/11/09**
100	Concrete SOD	48 days	Mon 6/9/08	Wed 8/13/08
101	Mechanical	320 days?	Mon 5/19/08	Fri 8/7/09
102	Electrical	328 days?	Fri 5/9/08	Tue 8/11/09
103	Plumbing	291 days?	Mon 5/12/08	Mon 6/22/09
104	Partitions/Drywall/Ceilings	248 days?	Thu 6/19/08	Mon 6/1/09
105	Finishes	69 days?	Mon 3/30/09	Thu 7/2/09
106	Fire Protection	121 days?	Fri 11/21/08	Fri 5/8/09
107	FF&E	167 days?	Fri 11/7/08	Mon 6/29/09
108	Pneumatic Tubing	27 days?	Mon 12/1/08	Tue 1/6/09
109	Punch List	15 days?	Wed 7/22/09	Tue 8/11/09
110	Final Cleaning	11 days?	Tue 6/30/09	Tue 7/14/09
111	**5th Floor**	**333 days?**	**Fri 5/9/08**	**Tue 8/18/09**
112	Concrete SOD	48 days?	Thu 6/12/08	Mon 8/18/08



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Task | Split | Progress | Milestone | Summary | External Tasks | Deadline

Figure 1b – Detailed Project Schedule

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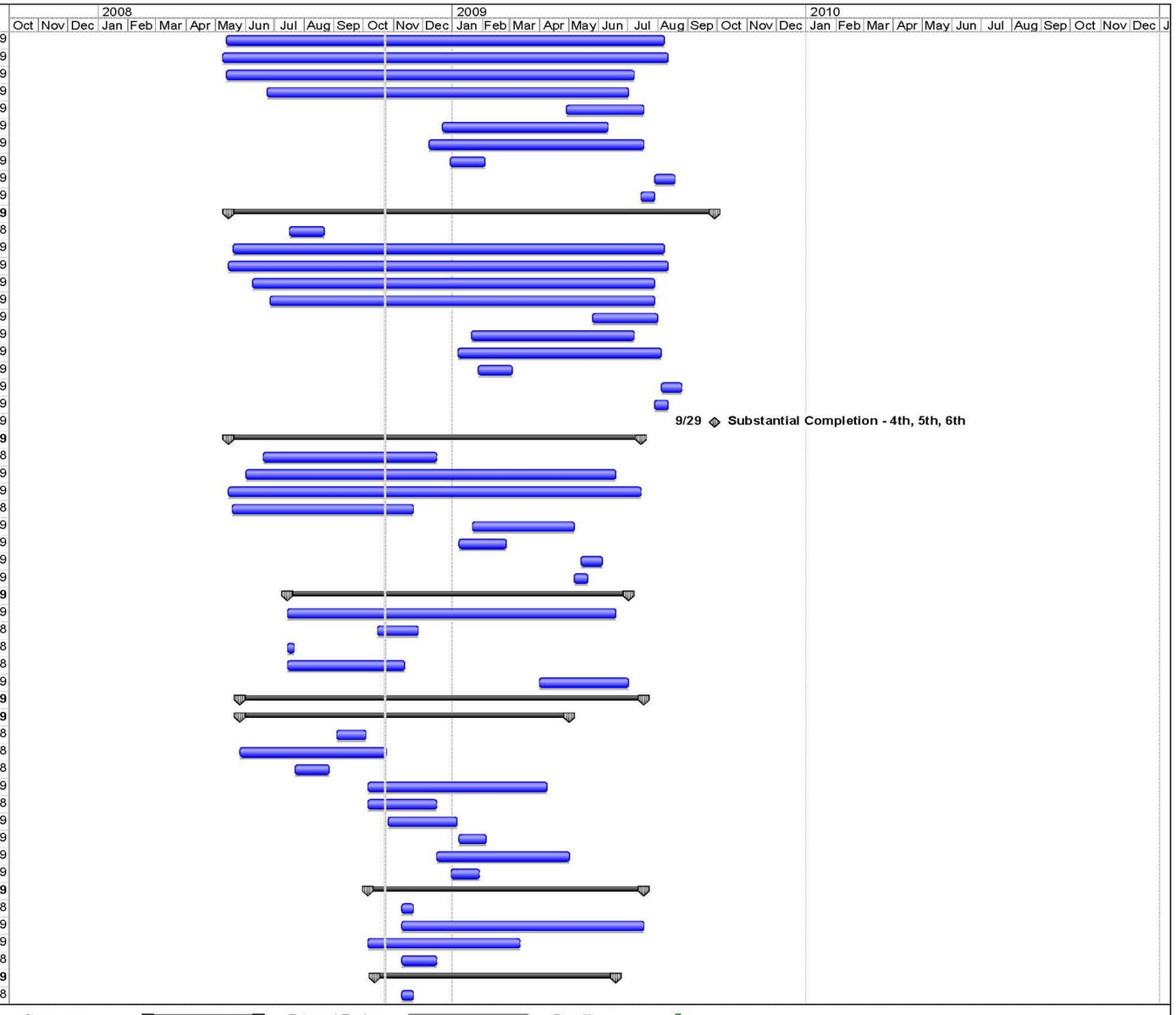
ID	Task Name	Duration	Start	Finish
113	Mechanical	324 days?	Tue 5/13/08	Fri 8/7/09
114	Electrical	328 days?	Fri 5/9/08	Tue 8/11/09
115	Plumbing	301 days?	Tue 5/13/08	Tue 7/7/09
116	Partitions/Drywall/Ceilings	267 days?	Tue 6/24/08	Wed 7/1/09
117	Finishes	58 days?	Wed 4/29/09	Fri 7/17/09
118	Fire Protection	123 days?	Mon 12/22/08	Wed 6/10/09
119	FF&E	160 days?	Mon 12/8/08	Fri 7/17/09
120	Pneumatic Tubing	26 days?	Tue 12/30/08	Tue 2/3/09
121	Punch List	15 days?	Wed 7/29/09	Tue 8/18/09
122	Final Cleaning	10 days?	Wed 7/15/09	Tue 7/28/09
123	**6th Floor**	**358 days?**	**Thu 5/15/08**	**Tue 9/29/09**
124	Concrete SOD	26 days?	Thu 7/17/08	Thu 8/21/08
125	Mechanical	319 days?	Tue 5/20/08	Fri 8/7/09
126	Electrical	324 days?	Thu 5/15/08	Tue 8/11/09
127	Plumbing	297 days?	Mon 6/9/08	Tue 7/28/09
128	Partitions/Drywall/Ceilings	283 days?	Fri 6/27/08	Tue 7/28/09
129	Finishes	49 days?	Tue 5/26/09	Fri 7/31/09
130	Fire Protection	120 days?	Wed 1/21/09	Tue 7/7/09
131	FF&E	150 days?	Wed 1/7/09	Tue 8/4/09
132	Pneumatic Tubing	25 days?	Wed 1/28/09	Tue 3/3/09
133	Punch List	15 days?	Wed 8/5/09	Tue 8/25/09
134	Final Cleaning	10 days?	Wed 7/29/09	Tue 8/11/09
135	Substantial Completion - 4th, 5th, 6th	0 days	Tue 9/29/09	Tue 9/29/09
136	**7th Floor**	**304 days?**	**Thu 5/15/08**	**Tue 7/14/09**
137	Concrete SOD	127 days?	Fri 6/20/08	Mon 12/15/08
138	Mechanical	274 days?	Mon 6/2/08	Thu 6/18/09
139	Electrical	304 days?	Thu 5/15/08	Tue 7/14/09
140	Plumbing	135 days?	Mon 5/19/08	Fri 11/21/08
141	Finishes	75 days?	Thu 1/22/09	Wed 5/6/09
142	Fire Protection	35 days?	Thu 1/8/09	Wed 2/25/09
143	Punch List	16 days?	Thu 5/14/09	Thu 6/4/09
144	Final Cleaning	10 days?	Thu 5/7/09	Wed 5/20/09
145	**Roof**	**252 days?**	**Tue 7/15/08**	**Wed 7/1/09**
146	Mechanical	243 days?	Tue 7/15/08	Thu 6/18/09
147	Electrical	30 days?	Thu 10/16/08	Wed 11/26/08
148	Plumbing	5 days?	Tue 7/15/08	Mon 7/21/08
149	Roofing	87 days?	Tue 7/15/08	Wed 11/12/08
150	Roof Garden	66 days?	Wed 4/1/09	Wed 7/1/09
151	**Phase 2 - Central Plant**	**299 days?**	**Tue 5/27/08**	**Fri 7/17/09**
152	**Structure**	**244 days?**	**Tue 5/27/08**	**Fri 5/1/09**
153	Structural Steel Erection/Detailing/Decking - Zone 5	22 days?	Thu 9/4/08	Fri 10/3/08
154	Concrete	109 days?	Tue 5/27/08	Fri 10/24/08
155	Plumbing - subgrade	25 days?	Wed 7/23/08	Tue 8/26/08
156	Electrical - subgrade	133 days?	Mon 10/6/08	Wed 4/8/09
157	Masonry	51 days?	Mon 10/6/08	Mon 12/15/08
158	Roofing	51 days?	Mon 10/27/08	Mon 1/5/09
159	Fire Protection - Stand pipe	20 days?	Thu 1/8/09	Wed 2/4/09
160	Mechanical	99 days?	Tue 12/16/08	Fri 5/1/09
161	Louvers	21 days?	Wed 12/31/08	Wed 1/28/09
162	**Ground Floor**	**205 days?**	**Mon 10/6/08**	**Fri 7/17/09**
163	Concrete - Pads	10 days?	Mon 11/10/08	Fri 11/21/08
164	Mechanical	180 days?	Mon 11/10/08	Fri 7/17/09
165	Electrical	113 days?	Mon 10/6/08	Wed 3/11/09
166	Plumbing	26 days?	Mon 11/10/08	Mon 12/15/08
167	**1st Floor**	**179 days?**	**Mon 10/13/08**	**Thu 6/18/09**
168	Concrete - Pads	10 days?	Mon 11/10/08	Fri 11/21/08



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Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

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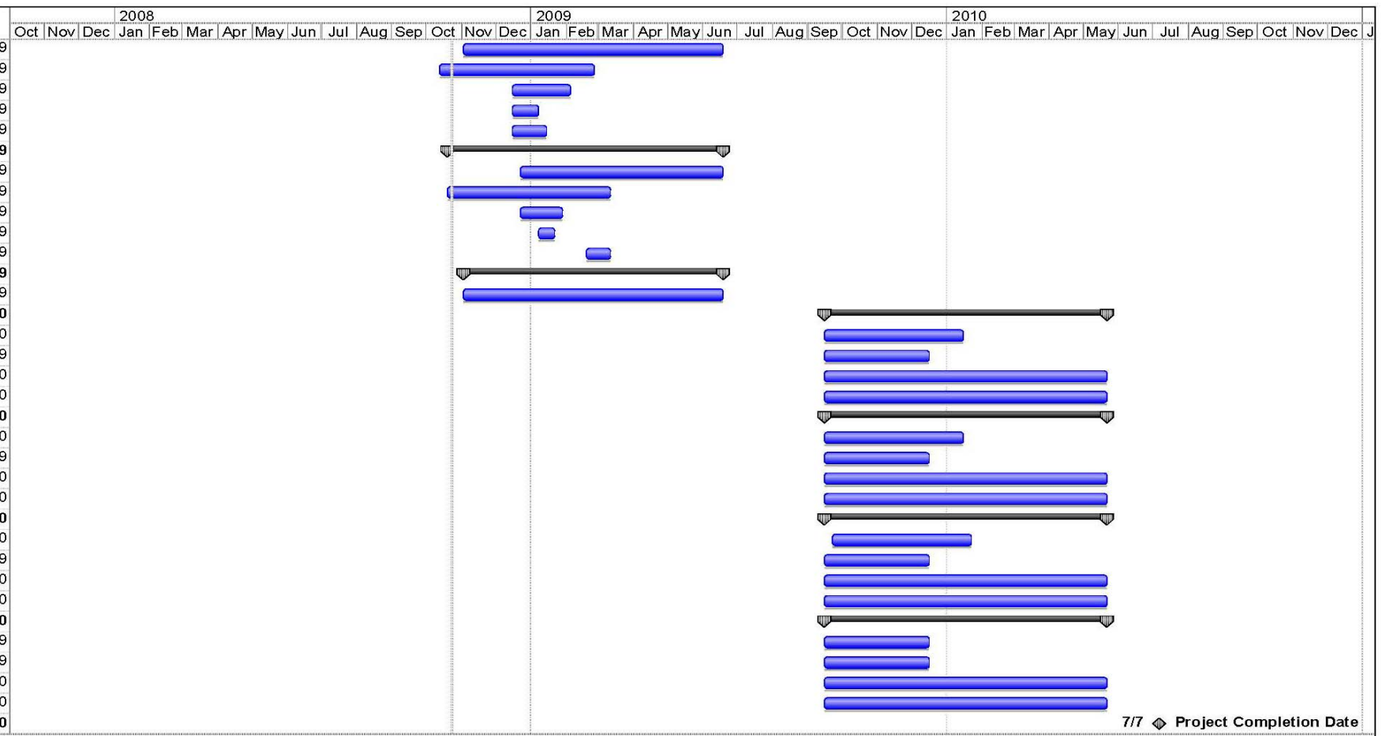
Figure 1c – Detailed Project Schedule

ID	Task Name	Duration	Start	Finish
169	Mechanical	164 days?	Mon 11/3/08	Thu 6/18/09
170	Electrical	98 days?	Mon 10/13/08	Wed 2/25/09
171	Plumbing	37 days?	Tue 12/16/08	Wed 2/4/09
172	Masonry	17 days?	Tue 12/16/08	Wed 1/7/09
173	Fire Protection	22 days?	Tue 12/16/08	Wed 1/14/09
174	**2nd Floor**	**174 days?**	**Mon 10/20/08**	**Thu 6/18/09**
175	Mechanical	128 days?	Tue 12/23/08	Thu 6/18/09
176	Electrical	103 days?	Mon 10/20/08	Wed 3/11/09
177	Plumbing	27 days?	Tue 12/23/08	Wed 1/28/09
178	Masonry	10 days?	Thu 1/8/09	Wed 1/21/09
179	Fire Protection	15 days?	Thu 2/19/09	Wed 3/11/09
180	**Roof**	**164 days?**	**Mon 11/3/08**	**Thu 6/18/09**
181	Mechanical	164 days?	Mon 11/3/08	Thu 6/18/09
182	**Phase 3 - Renovation**	**178 days?**	**Wed 9/16/09**	**Fri 5/21/10**
183	Mechanical	88 days?	Wed 9/16/09	Fri 1/15/10
184	Demo - Gr., 1st, 2nd Floors	66 days?	Wed 9/16/09	Wed 12/16/09
185	Renovation - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
186	Electrical - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
187	**Phase 4 - Renovation**	**178 days?**	**Wed 9/16/09**	**Fri 5/21/10**
188	Mechanical	88 days?	Wed 9/16/09	Fri 1/15/10
189	Demo - Gr., 1st, 2nd Floors	66 days?	Wed 9/16/09	Wed 12/16/09
190	Renovation - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
191	Electrical - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
192	**Phase 5 - Renovation**	**178 days?**	**Wed 9/16/09**	**Fri 5/21/10**
193	Mechanical	88 days?	Wed 9/23/09	Fri 1/22/10
194	Demo - Gr., 1st, 2nd Floors	66 days?	Wed 9/16/09	Wed 12/16/09
195	Renovation - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
196	Electrical - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
197	**Phase 6 - Renovation**	**178 days?**	**Wed 9/16/09**	**Fri 5/21/10**
198	Mechanical	66 days?	Wed 9/16/09	Wed 12/16/09
199	Demo - Gr., 1st, 2nd Floors	66 days?	Wed 9/16/09	Wed 12/16/09
200	Renovation - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
201	Electrical - Gr., 1st, 2nd Floors	178 days?	Wed 9/16/09	Fri 5/21/10
202	**Project Completion Date**	**0 days**	**Wed 7/7/10**	**Wed 7/7/10**



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Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone

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Figure 1d – Detailed Project Schedule

B. Site Layout Planning

Due to the tight constraints of the UPMC Passavant Pavilion construction site it is important to use thorough site planning when sequencing and planning the many different activities that need to be completed. The major phases of construction are steel erection and concrete slab on deck placement because they generally consume the most real estate within the construction site. Deliveries also play an important role in the site planning because while Cumberland Road, the main road to the south of the project, is a private UPMC owned road it cannot not be restricted to one lane of travel. This requires that all trucks and equipment be located within the confines of the site fencing at all times.

Various construction operations occur simultaneously throughout the Passavant Campus but those that require the most attention and planning are those located in close proximity to the footprint of the new Pavilion Addition. This area is delineated by the outlined box on the overall site plan, Figure 2, below. This area will be the main focus of the logistics plans contained within this report.

The site logistics plans reviewed in this report were chosen due to the critical nature of those activities within the schedule of the project. The activities that will be reviewed are steel erection; both early and late phases, slab on deck placement; with set ups at both the east and the west, and the overall site plan when multiple activities are occurring simultaneously. Each of these logistics plans will be discussed and shown in the related sections and figures below

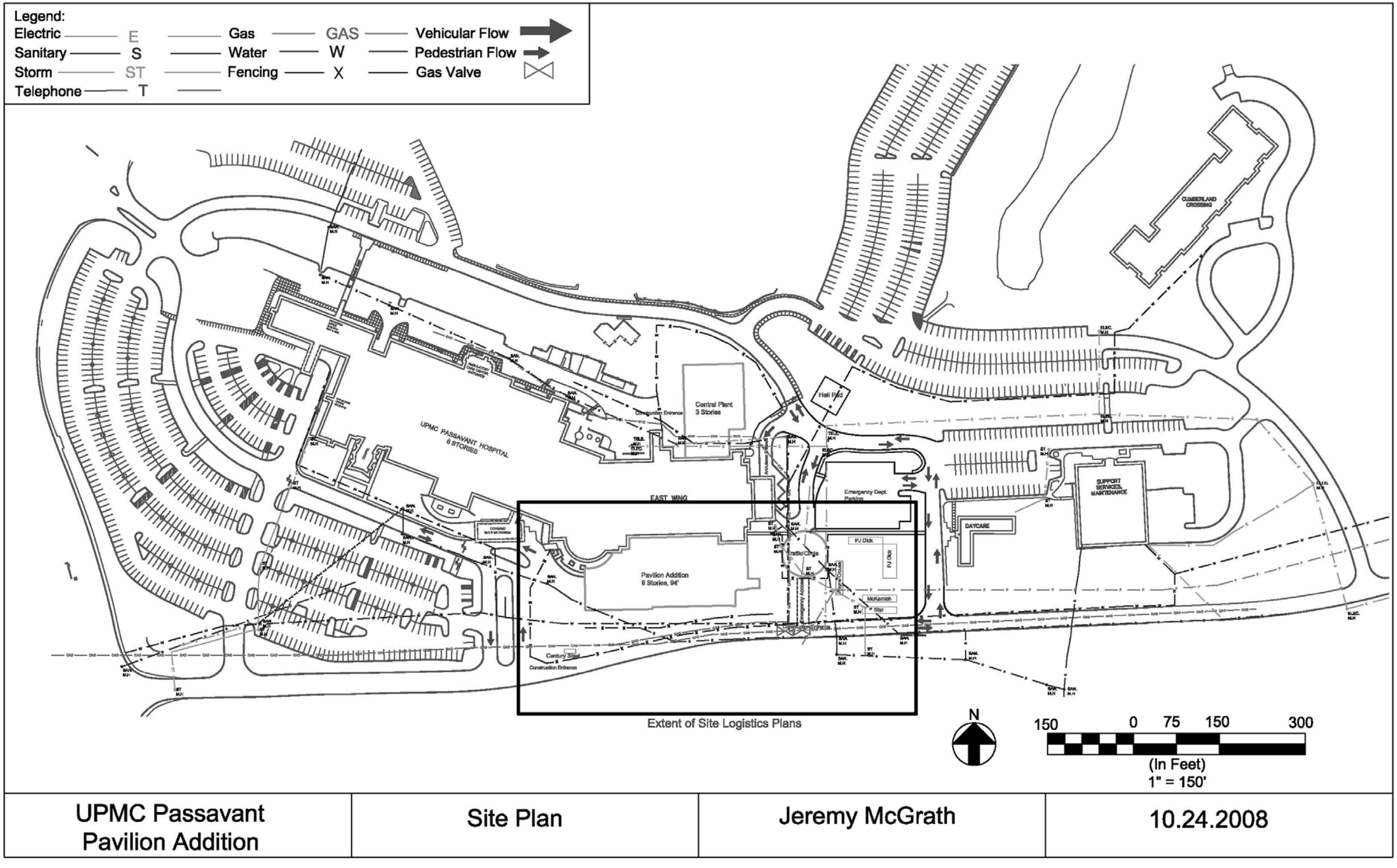


Figure 2. Overall Site Logistics Plan

Steel Erection – Early Phases (Zones 1 and 2)

After the excavation of the subgrade level of the Pavilion was completed the placement of the footings and foundations could commence. These activities were sequenced from the east to the west. This is the same manner in which the steel erection was sequenced after the above mentioned activities were concluded.

Figure 3 , Steel Erection Site Plan – Early Sequences, shows the site logistics of the phases of steel erection that occur at the eastern portion of the building footprint. The driving factor of the layout of the staging and storage areas during this phase of construction is the working radius of the steel erection crane. For this project Century Steel Erectors utilized a Manitowoc 4100w crawler crane with a 160' boom and a 40' jib at a 15^0 offset which allows the crane to have a maximum radius of 125'.

The crane's working radius determined its placement within the footprint of the building. As shown below in Figure 3 the crane was positioned at roughly the location of column line 6 of the Pavilion. This location allows the crane to reach all areas within the footprint to the east of column line 6 during the erection of Zones 1 and 2 and the majority of the footprint to the west. With the crane being able to pick from the majority of the western portion of the Pavilion footprint it allows these areas to be utilized as staging areas for the steel members prior to erection.

Staging areas were placed within the footprint of the building, as well as, along the southern most extent of the construction site along Cumberland Rd. A storage area near the western construction entrance was utilized for the staging of trailer loads of steel that had yet to be unloaded and shook out.

When the steel members were delivered to the site the trucks were to arrive from the east by way of Cumberland Rd. This allowed for the minimal amount of interaction between the heavy truck traffic and the patrons of the hospital. As the deliveries arrived the trucks would back into the site using the western construction entrance and then proceed down the ramp into the subgrade level of the Pavilion. At this time the trucks would be unloaded and the shakeout of the steel would occur. Once unloaded the trucks would then exit in the same direction in which they entered and proceed east on Cumberland Rd.

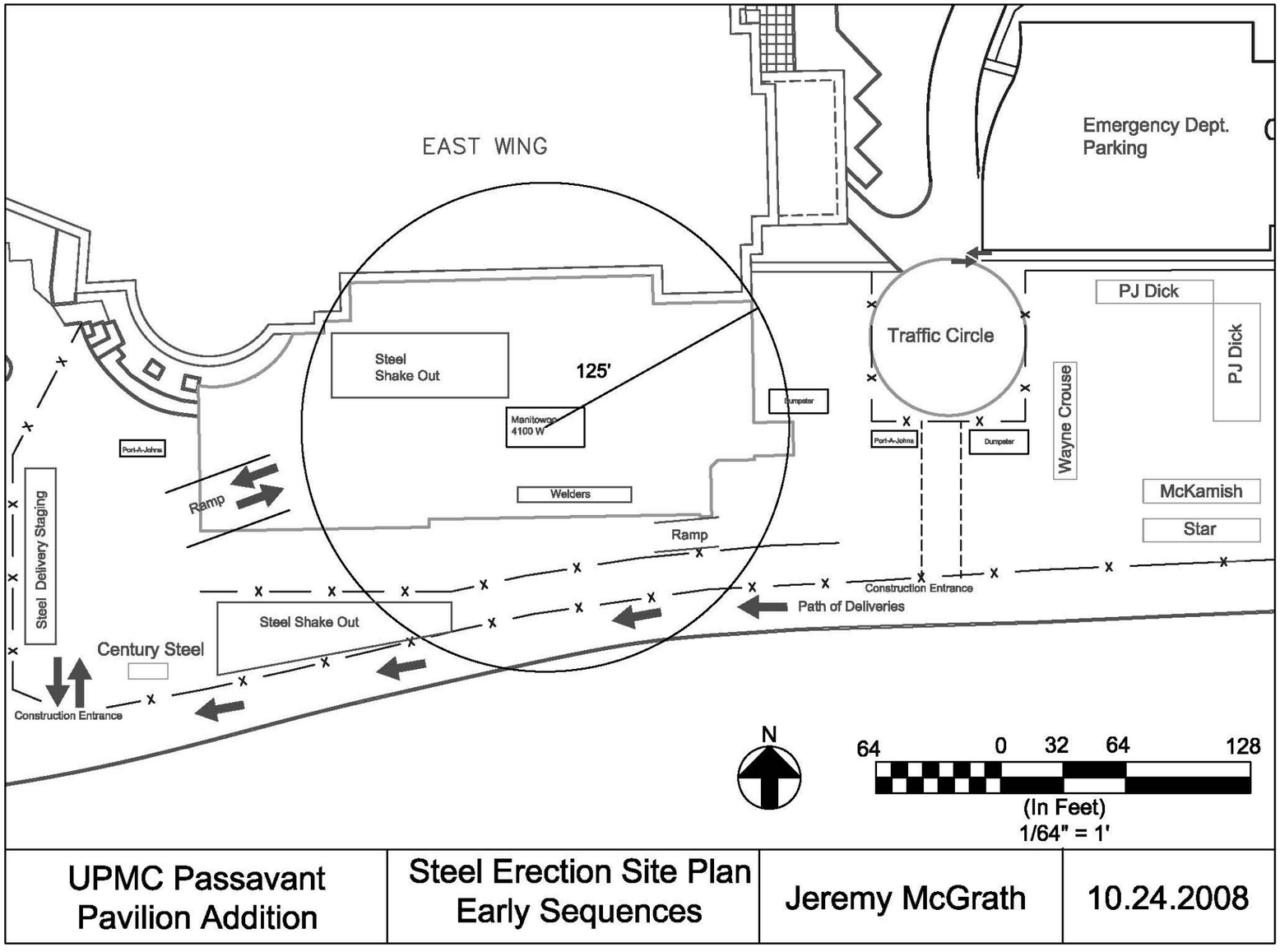


Figure 3. Steel Erection Site Plan – Early Sequences

Steel Erection – Late Phases (Zones 3 and 4)

Once Zones 1 and 2 of the Pavilion Addition were erected it became necessary for the crane to be relocated so that the erection of Zones 3 and 4 could begin. This relocation required the realignment and benching of the ramp entering the excavation so that the crane could be safely during picks.

Since the footprint of the building was now becoming filled with the superstructure of the building the staging areas also needed to be relocated. The optimal locations for the new staging areas were to expand the one located along Cumberland Rd. further to the west and to utilize the area that was previously used as storage area for steel deliveries. These staging areas were well within the picking range of the crane and conveniently located for off loading and shakeout.

The steel deliveries for this phase of the project followed the same path as the earlier phases as they entered and exited the site. This continuity of site access allows for timely deliveries and less confusion among the delivery drivers as they will be familiar with the site and less likely to make wrong turns and enter the site from the wrong direction.

As the steel erection began to near completion and the final pieces were being erected within Zone 4 of the building the crane was working its way out of the excavation. This natural progression out of the hole allowed the crane to be located at its final location on the site. After the erection was complete the crane was laid down along the south staging area near the western construction entrance where it was demobilized and removed from the site.

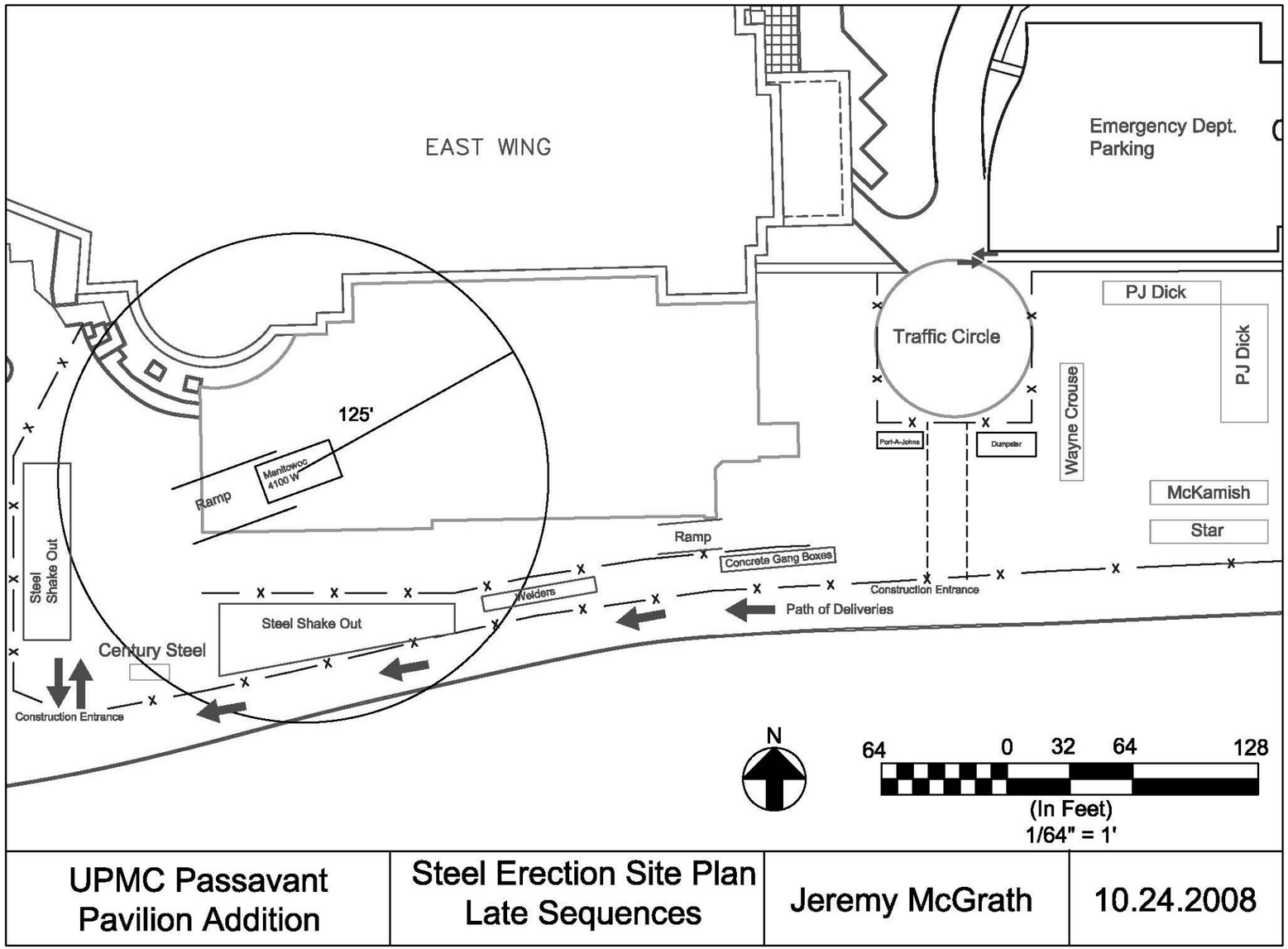


Figure 4. Steel Erection Site Plan – Late Sequences

Overall Site Logistics Plan

As the structural steel frame of the building was progressing towards the east and Zones 1 and 2 were completely decked and detailed the concrete contractor could then begin to place the slabs on deck and the slab on grade in the Pavilion. Again following the general east to west path the concrete placement began at the eastern portion of the building. This allowed the concrete to follow the steel out of the building.

The concrete pump was staged near the ramp which enters the subgrade level of the Pavilion from the east. From this location the pump could easily reach all of the floors of the building. Special care needed to be taken when determining the best place to stage the pump not only for site sequencing reasons but also because of an existing air shaft at the southeast corner of the existing hospital. If the concrete pump was placed too close to the air shaft there was a potential for exhaust fumes to migrate into the shaft and then throughout the hospital.

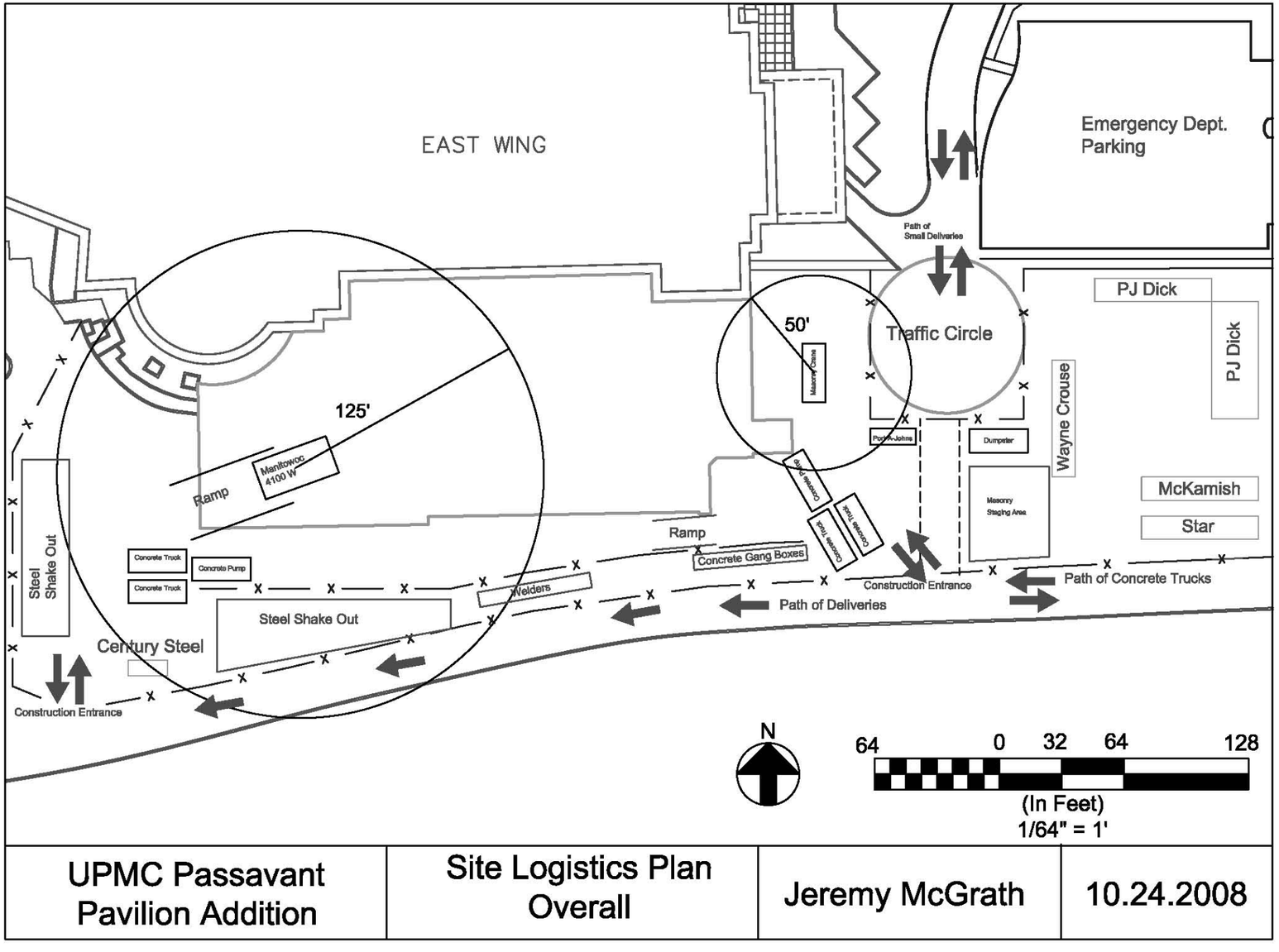
As the concrete progressed up the eastern zones of the building and the steel began to near completion on the western zones of the building, concrete pours were needed to be made in the west. While the crane was still on site the concrete pumping operation was staged near the south steel shakeout area as shown on Figure 5 below. This required coordination between the steel erector and the concrete contractor so that all operations ran smoothly since they were in such close proximity to one another and to ensure the safety of all the workers as steel was still being raised at these locations.

At this time many other trades began to arrive on site as more of the superstructure began to take shape. This necessitated more site logistics planning as the available real estate within the confines of the construction site began to become occupied. The MEP contractors were onsite as the steel and concrete began to work through the building but the majority of their staging occurred within the building on the floors where the materials were needed.

Masonry, on the other hand, required a great deal of space within the site as they needed staging areas for their materials and scaffolding, as well as, the crane which would lift materials up to the floors of the building. The masonry staging area was positioned directly behind the Wayne Crouse field office and between the emergency access road which allowed it to have minimal impact on the other operations. The mason's crane was positioned near the northeast corner of the Pavilion Addition which enabled it to access all floors at the east stair tower where CMU backup walls and brick veneer were being installed.

All concrete deliveries arrived to the site from the east along Cumberland following the same path as the steel deliveries. Once arriving on site they would enter the eastern construction site entrance and back into position behind the concrete pump. This area was wide enough to enable two concrete trucks to be located at the pump so that as one was emptied the next truck could begin to service the pump and keep a continuous flow of concrete moving into the building.

The masonry deliveries to the building followed the same path to the building as described above for the concrete deliveries. Small tools and smaller deliveries were also made to the site and were able to follow the path around the Emergency Department Parking area as shown on Figure 5.



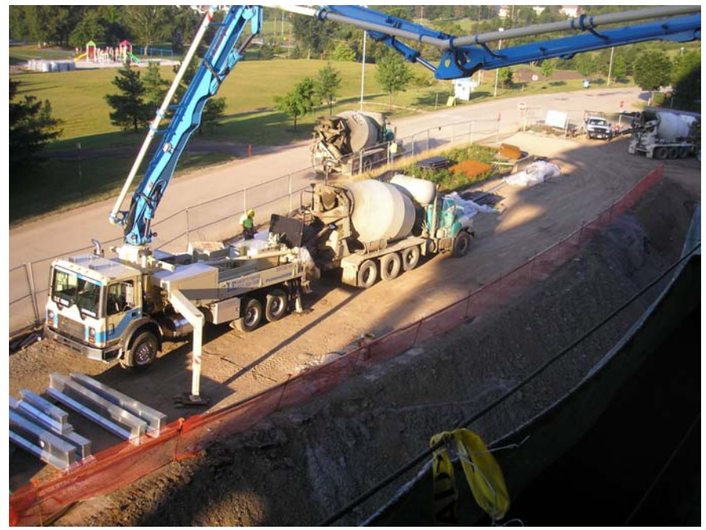


Figure 5. Site Logistics Plan - Overall

Interior and MEP Deliveries Site Plan

As the superstructure was complete and the interior trades began to finish installing hangers and sleeves within the slabs on deck of the Pavilion deliveries of larger materials were needed to be made to the site. While steel erection was still in progress the deliveries were made at the southern portion of the site and the materials placed on the lower floors by a Lull. This process required that a lane of traffic be restricted along Cumberland Rd. as the deliveries were being made. The restriction of traffic along this road was not appealing to the owner and as more and more frequent deliveries began to be made it necessitated the need for a permanent delivery area along the south elevation of the building.

After the steel erection and detailing was complete the south elevation was free from steel shakeout areas and this allowed this area to be utilized as the main site delivery point. Due to the height of the building all materials above the 3rd Floor needed to be lifted with a crane. Lifting platforms were placed on the exterior of the 4th through 7th Floors which enabled the crane to lift the items to the proper floor. The cranes used for this process were operated by the subcontractors responsible for the delivery and were often shared among the different subcontractors. These cranes were placed along the south elevation where they would be able to remove the materials from the trucks and place them on the lifting platforms.

The trucks making deliveries to the site again followed Cumberland Rd. from the east and then would enter the site near the crane. There was no permanent entrance at this location so the temporary fencing was needed to be moved and then repositioned so that the entire truck would be within the confines of the site. If the need arose two delivery trucks could be positioned on either side of the crane so that a continuous flow of material to the building could be sustained.

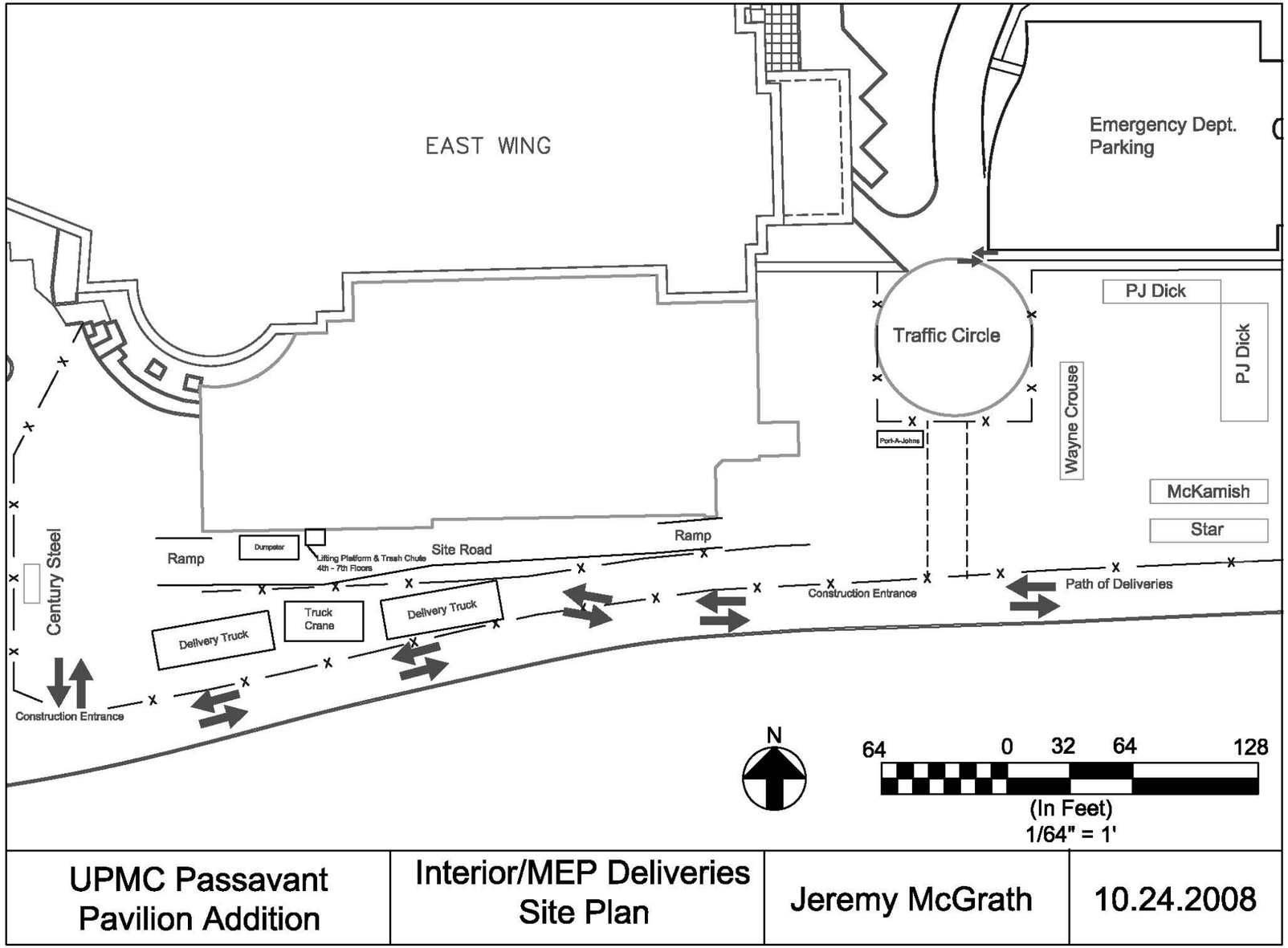


Figure 6. Interior/MEP Deliveries Site Plan

C. Detailed Structural Systems Estimate

System Overview

Structural Steel

Floor members range in size from W10x12 to W36x210.
Columns range in size from W10x33 to W14x99
HSS wind bracing
Number of Quantity and Tons of Members are shown below in Figure 7 and 8

Concrete

4000 psi concrete
6" SOG at the Pavilion and the Central Plant
5 ½" SOD at the Pavilion and the Central Plant
SOD and SOG reinforced with 6x6-w2.1xw2.1
Spread and Strip Footings
Footing reinforcing ranged in size from #3 to #9 bars
Cubic Yards of Concrete shown below in Figure 9

Steel Members		
Floor Members		
Pavilion		
Floor	Quantity	Tons
1st	260	102.19
2nd	247	91.36
3rd	233	101.44
4th	198	104.23
5th	204	81.26
6th	199	76.31
7th	199	82.54
Roof	87	28.29
Total	1627	667.63
Central Plant		
Floor	Quantity	Tons
1st	60	38.99
2nd	111	58.82
Roof	49	21.68
Total	220	119.48

Figure 7 Quantity of Floor Members

Steel Members		
Columns		
Pavilion	Quantity	Tons
Total	151	158.93
Central Plant		
Total	26	18.84

Figure 8. Quantity of Column Members

Concrete	CY
Pavilion	3,666
Central Plant	1,199
Total	4,865

Figure 9. Cubic Yards of Concrete

The detailed structural system estimate is based upon a detailed take off of the steel and concrete superstructure of the Passavant Pavilion. Within this takeoff all steel beams, columns, and joist were accounted for along with the floor and roof decking, concrete slabs on deck and grade, and foundation systems.

When preparing the cost summary of the items the unit prices from RS Means were applied to the quantities. These unit prices were selected based upon the matching of the actual system with that described in RS Means. When the actual system did not match a system within RS Means the next closest compatible match was used. This often occurred when calculating slab costs or costs for some steel member sizes.

It was necessary to calculate an average cost for the structural steel members from the RS Means data. The data provided a cost per linear foot for each of the different sizes of steel members. In order to estimate the cost of steel based on total weight, as is customary in the industry, the cost per linear foot was converted to a cost per pound. An average cost per pound was then calculated from the members listed in RS Means so that the steel could be estimated based upon total weight instead of by each individual member. These costs per pound were then factored in costs per ton as all steel orders are made in tons. The above referenced calculations can be found in Appendix A at the conclusion of this report.

Once the take offs were complete and the proper unit prices found the cost of the system was determined through cost summary sheets that can be found in Appendix A. These sheets were then used to compile the estimate shown in Figure 10 – Structural Systems Estimate. After the total cost was calculated overhead and profit and tax was added to the subtotal. The value for overhead and profit was assumed to be 6% since the range for a typical fee for a general contractor is between 3% and 5%. Since the project is located within Allegheny County in Pennsylvania the sales tax on the material portion of the cost is 7%.

The total cost of the structural system including overhead and profit and tax is estimated to be $4,341,708. 62. The calculations for this estimate can be found below in Figure 10.

Structural Estimate

UPMC Passavant Pavilion Additon						
			Material	Labor	Equipment	Total
Structural Member	Quantity	Unit	Cost	Cost	Cost	Cost
Steel						
Columns & Beams	964.93	Tons	$1,731,063.37	$189,899.02	$122,016.46	$2,042,978.85
HSS Wind Bracing	32.19	Tons	$81,387.74	$9,018.30	$3.01	$90,409.05
Roof Joists	600.00	LF	$3,495.80	$1,039.80	$563.00	$5,098.60
Bearing Plates	398.85	SF	$26,802.53	$0.00	$0.00	$26,802.53
Leveling Plates	110.11	SF	$1,855.37	$0.00	$0.00	$1,855.37
Floor Decking	155973.75	SF	$288,551.44	$57,710.29	$4,679.21	$350,940.94
Roof Decking	32296.5	SF	$59,748.53	$11,949.71	$968.90	$72,667.13
Shear Studs	27000.00	EACH	$17,280.00	$19,170.00	$9,720.00	$46,170.00
Concrete						
Pavilion	3,666.20	CY	$431,479.20	$188,134.22	$42,958.06	$662,571.49
Central Plant	1,198.62	CY	$83,286.20	$42,454.76	$6,141.63	$311,383.78
Reinforcing						
Pavilion Rebar	22.32	Tons	$19,863.06	$13,092.88	$0.00	$32,955.94
Pavilion WWF	1692	CSF	$26,486.96	$37,234.07	$0.00	$63,721.02
Central Plant Rebar	57.08	Tons	$50,714.70	$26,703.41	$0.00	$77,418.11
Central Plant WWF	263	CSF	$4,116.12	$5,786.24	$0.00	$9,902.36
Forms						
Pavilion						
Foundation Walls	7911.463	SF	$6,566.51	$3,694.65	$0.00	$10,261.17
Column Footings	3486.45	SF	$6,798.58	$13,213.65	$0.00	$20,012.22
Slab On Grade	1700	SF	$544.00	$3,281.00	$0.00	$3,825.00
Central Plant						
Foundation Walls	22456.48	SF	$18,638.88	$10,487.18	$0.00	$29,126.05
Column Footings	812.96	SF	$1,585.28	$3,081.13	$0.00	$4,666.41
Grade Beams	805.00	SF	$2,036.65	$2,704.80	$0.00	$4,741.45
Housekeeping Pads	780.00	SF	$249.60	$1,505.40	$0.00	$1,755.00
Slab On Grade	1700.00	SF	$4,590.00	$8,194.00	$0.00	$12,784.00
Truck Crane Rental	10	Days		$3,400.00	$10,500.00	$13,900.00
Masonry						
CMU Foundation Walls	1166.00	SF	$5,212.02	$4,792.26	$0.00	$10,004.28
Reinforcing	0.20	Tons	$175.98	$129.51	$0.00	$305.49
			Material	**Labor**	**Equipment**	**Total**
	SUBTOTAL		$2,872,528.52	$656,676.27	$197,550.27	$3,906,256.25
	O&P	6%	$172,351.71	$39,400.58	$11,853.02	$234,375.38
	Tax	7%	$201,077.00			$201,077.00
	TOTAL		**$3,245,957.22**	**$696,076.85**	**$209,403.29**	**$4,341,708.62**

Figure 10. Structural Systems Estimate

D. General Conditions Estimate

The general conditions for the Passavant Pavilion consist of the salaries of the project staff, site office and associated supplies and equipment, temporary utilities, site facilities, and miscellaneous costs associated with the management of the project. All of the above general conditions items were calculated through the use of RS Means Building Construction Cost Data. The temporary utilities were calculated from a general estimate since the RS Means Data included fuel costs and while the Passavant Project's fuel costs were paid for by the owner.

Staffing
The largest single contributor to the general conditions cost for the project is the salaries of the project management staff. The staff consists of a project executive, project manager, general superintendent, area superintendent, assistant superintendent, interiors superintendent, two project engineers, a safety engineer, secretary, and an engineering intern. When the project is fully staffed the associated cost is $14,305.00/week. Each team member is assigned to the project for different durations since all members do not begin to work on the project at the same time and as such the costs vary throughout the course of the project. Also the project executive and the safety engineer split time between different jobs.

General Conditions			
Staffing	Duration(Weeks)	Cost/Week	Total Cost
Project Executive	93.1	$2,500.00	$232,750.00
Project Manager	134	$1,850.00	$247,900.00
General Superintendent	108	$1,700.00	$183,600.00
Asst. Superintendent	43	$1,200.00	$51,600.00
Area Superintendent	104	$1,000.00	$104,000.00
Project Engineer	100	$1,125.00	$112,500.00
Project Engineer	117	$1,125.00	$131,625.00
Safety Engineer	32.7	$1,000.00	$32,700.00
Secretary	130	$1,005.00	$130,650.00
Interiors Superintendent	26	$1,000.00	$26,000.00
Engineering Intern	70	$800.00	$56,000.00
		$14,305.00	$1,309,325.00

Figure 11. Project Staffing

General Conditions

General Conditions	Duration (Months)	# of Trailers	Cost/Trailer/Month	Total Cost	Cost/Week
Site Trailers	31	3	$375.00	$34,875.00	$262.22
	Duration (Months)	# of Toilets	Cost/Toilet/Month	Total Cost	Cost/Week
Port-A-Johns	31	6	$171.00	$31,806.00	$239.14
	Duration (Years)	L.F.	$/L.F./Year	Total Cost	Cost/Week
Site Fencing	2.6	1,700	$3.58	$15,823.60	$118.97
	Duration (Weeks)	Pulls/Week	$/Pull	Total Cost	Cost/Week
Waste Management	133	1	$600.00	$79,800.00	$600.00
Field Office Expenses	Duration (Months)	Cost/Month		Total Cost	Cost/Week
Office Equipment	31	$150.00		$4,650.00	$34.96
Office Supplies	31	$95.00		$2,945.00	$22.14
Telephone	31	$210.00		$6,510.00	$48.95
Lights & HVAC	31	$110.00		$3,410.00	$25.64
Temporary Utlilities	Duration (Weeks)	CSF of Building	$/Week/CSF	Total Cost	Cost/Week
Temporary Heating	20	2,094	$3.07	$128,571.60	$966.70
Temporary Electric	64	2,094	$2.39	$320,298.24	$2,408.26
Insurance and Bonds	% of Project Cost	Project Cost		Insurance Cost	Cost/Week
All-Risk Insurance	0.35%	$85,900,000.00		$300,650.00	$2,260.53
Performance Bond	0.70%	$85,900,000.00		$601,300.00	$4,521.05
Misc.				Total Cost	
Signage				$5,000.00	
Mobile IT Documents				$50,000.00	
			Total	$1,585,639.44	

Figure 12. General Conditions Estimate

Overall General Conditions Costs

Overall General Conditions	Total Cost
Project Staffing	$1,309,325.00
General Conditions	$1,585,639.44
Total	$2,894,964.44

Figure 13. Overall General Conditions Costs

The total cost of the overall general conditions amounts to about 3.6% of the Construction Cost of $80,552,617 which was reported in Technical Assignment #1. This percentage is within the appropriate range of general conditions for a project of this type and size since general conditions typically range from 3% to 10% of the cost of the project.

All cost data for the above general conditions estimate was determined using RS Means Building Construction Cost Data. Lines items for signage and the mobile IT were the only items not calculated using RS Means. Costs for signage were assumed to be $5000 since there was signage used on the jobsite but no definitive take off could be performed. The cost of the mobile IT documents was input as $50 000 based upon the actual cost incurred by the contractor since no RS Means data existed for this line item. The durations used to calculate the costs are from the project schedule and were modified into the appropriate units depending upon which general condition items were being calculated.

E. Critical Industry Issues

The PACE Roundtable brought to light many of the critical issues that are affecting the construction industry today. One of the issues that was discussed was 'The Effects of Energy and the Economy On Construction.' The main focus of the energy discussion was the price of materials based on the price of petroleum. Over the past few years the prices of construction materials were volatile due to supply and demand from emerging markets across the globe. When the rising costs of fuel and energy are factored into the already volatile prices the results are unpredictable. This creates a situation in which contractors must try and ascertain the rate at which the prices are going to increase in the time between bidding and buyout.

With the unpredictable nature of these prices it is necessary to begin to change the manner in which projects are bought out. Where many items may have been purchased throughout the course of a project while the markets were stable it is now necessary to purchase these items in the beginning of the process to ensure that the lowest price possible is locked in.

Economic downturns and upswings can also greatly affect the construction industry. When the markets are strong many opportunities exist for project procurement and company expansion. In times such as these, where the state of the economy is in question, companies must begin to find ways to maintain a steady flow of projects and revenue. Often this means that may have to explore new market sectors and projects in which they have minimal experience.

While many market sectors are feeling the effects of the economic downturn there are some sectors which can maintain their strength throughout this crisis. These market sectors include the federal government, health care, higher education, and public private partnerships.

It was interesting to hear how many of the contractors in attendance are dealing with the economic situation and how they are changing their strategies to be able to resist the changing times. These strategies include completing more renovation projects, which many contractors may not normally pursue, and public private partnerships. Public private partnerships are an interesting new development in the United States. In this type of project the contractor funds the project and then leases the space back to the government. When the economy slows down and federally funded projects may not receive the funding that they would under a strong economy these projects seem to be ready to emerge as a greater part of the industry.

Another issue that was raised during the industry panel was the integration of technology and information technology into companies and projects. During the course of the panel session the use of mobile information technology systems was discussed. In particular the use of FASTTAC software on the North Frear renovation here at Penn State. I believe that this will provide a relevant research topic for my thesis project because the same technology was used at UPMC Passavant. In my research I am look into the integration of this technology into the trades level of the construction industry. It seems as if all the innovations that come into the industry are aimed at the project management staff and not towards the field. I would like to review the

issues that would impede the use of this technology in the field and look at ways in which those issues can be alleviated and cause the field workers to become more accepting of technology.

While at the PACE Roundtable I was able to make a key contact that may be able to help me to some length in this issue. John Bechtel from the Pennsylvania State University Office of Physical Plant and I spoke of the use of FASTTAC on the North Frear renovation project and how they are implementing the technology. The University's use of this technology closely mirrors that which was used at Passavant and I believe that this contact will provide me great insight into the uses and the advancements that could be made within the industry.

Appendix A

Structural Take Off Notes

Structural Steel Take Off Notes

Framing									
Pavilion		Material		Labor		Equipment		Total	
Floor	Tons	$/Ton	Cost	$/Ton	Cost	$/Ton	Cost	$/Ton	Cost
1st	102.19	$1,653.09	$168,929.39	$225.54	$23,047.73	$144.51	$14,767.09	$2,023.14	$206,744.20
2nd	91.36	$1,653.09	$151,021.86	$225.54	$20,604.53	$144.51	$13,201.69	$2,023.14	$184,828.08
3rd	101.44	$1,653.09	$167,687.92	$225.54	$22,878.35	$144.51	$14,658.56	$2,023.14	$205,224.83
4th	104.23	$1,653.09	$172,307.89	$225.54	$23,508.67	$144.51	$15,062.42	$2,023.14	$210,878.99
5th	81.26	$1,653.09	$134,330.60	$225.54	$18,327.28	$144.51	$11,742.61	$2,023.14	$164,400.49
6th	76.31	$1,653.09	$126,152.76	$225.54	$17,211.54	$144.51	$11,027.74	$2,023.14	$154,392.04
7th	82.54	$1,653.09	$136,443.67	$225.54	$18,615.57	$144.51	$11,927.32	$2,023.14	$166,986.56
Roof	28.29	$1,653.09	$46,773.39	$225.54	$6,381.49	$144.51	$4,088.73	$2,023.14	$57,243.60
Floor Total	667.63	$1,653.09	$1,103,647.48	$225.54	$150,575.16	$144.51	$96,476.16	$2,023.14	$1,350,698.79
Columns									
Column Total	158.93	$2,417.83	$384,267.20	$69.56	$11,054.58	$46.51	$7,391.13	$2,533.89	$402,712.91
Central Plant									
Floor Total	119.53	$1,653.09	$197,595.89	$225.54	$26,958.82	$144.51	$17,272.99	$2,023.14	$241,827.70
Column Total	18.84	$2,417.83	$45,552.80	$69.56	$1,310.46	$46.51	$876.18	$2,533.89	$47,739.44
Total	964.93		**$1,731,063.37**		**$189,899.02**		**$122,016.46**		**$2,042,978.85**

Roof Joists									
Pavilion		Material		Labor		Equipment		Total	
Roof Joists	LF	$/LF	Cost	$/LF	Cost	$/LF	Cost	$/LF	Cost
16K2	110.00	$4.76	$523.60	$1.88	$206.80	$1.02	$112.20	$7.66	$842.60
18K3	56.00	$5.80	$324.80	$1.70	$95.20	$0.92	$51.52	$8.42	$471.52
20K4	434.00	$6.10	$2,647.40	$1.70	$737.80	$0.92	$399.28	$8.72	$3,784.48
Total	**600.00**		**$3,495.80**		**$1,039.80**		**$563.00**		**$5,098.60**

Wind Bracing									
Pavilion		Material		Labor		Equipment		Total	
HSS Bracing	Tons	$/Ton	Cost	$/Ton	Cost	$/Ton	Cost	$/Ton	Cost
Total	32.19	$2,528.30	$81,387.74	$280.15	$9,018.30	$0.09	$3.01	$2,808.54	**$90,409.05**

Bearing Plates									
		Material		Labor		Equipment		Total	
Plates	SF	$/SF	Cost	$/SF	Cost	$/SF	Cost	$/SF	Cost
	398.85	$67.20	$26,802.53	$0.00	$0.00	$0.00	$0.00	$67.20	**$26,802.53**

Leveling Plates									
		Material		Labor		Equipment		Total	
Plates	SF	$/SF	Cost	$/SF	Cost	$/SF	Cost	$/SF	Cost
	110.11	$16.85	$1,855.37	$0.00	$0.00	$0.00	$0.00	$16.85	**$1,855.37**

Floor Decking										
Pavilion			Material		Labor		Equipment		Total	
Floor	Type	SF	$/SF	Cost	$/SF	Cost	$/SF	Cost	$/SF	Cost
1st	2" 20 Ga. Comp	28066.75	$1.85	$51,923.49	$0.37	$10,384.70	$0.03	$842.00	$2.25	$63,150.19
2nd	2" 20 Ga. Comp	25501	$1.85	$47,176.85	$0.37	$9,435.37	$0.03	$765.03	$2.25	$57,377.25
3rd	2" 20 Ga. Comp	16161	$1.85	$29,897.85	$0.37	$5,979.57	$0.03	$484.83	$2.25	$36,362.25
4th	2" 20 Ga. Comp	17722	$1.85	$32,785.70	$0.37	$6,557.14	$0.03	$531.66	$2.25	$39,874.50
5th	2" 20 Ga. Comp	17118	$1.85	$31,668.30	$0.37	$6,333.66	$0.03	$513.54	$2.25	$38,515.50
6th	2" 20 Ga. Comp	17190	$1.85	$31,801.50	$0.37	$6,360.30	$0.03	$515.70	$2.25	$38,677.50
7th	2" 20 Ga. Comp	17118	$1.85	$31,668.30	$0.37	$6,333.66	$0.03	$513.54	$2.25	$38,515.50
									Total	$312,472.69
Central Plant	Type	SF							$/SF	Total Cost
Floor	2" 20 Ga. Comp	17097	$1.85	$31,629.45	$0.37	$6,325.89	$0.03	$512.91	$2.25	$38,468.25
Total		**155973.75**		**$288,551.44**		**$57,710.29**		**$4,679.21**		**$350,940.94**

Roof Decking										
Pavilion			Material		Labor		Equipment		Total	
Floor	Type	SF	$/SF	Cost	$/SF	Cost	$/SF	Cost	$/SF	Cost
2nd	1 1/2" 20 Ga. Comp	2426	$1.85	$4,488.10	$0.37	$897.62	$0.03	$72.78	$2.25	$5,458.50
3rd	1 1/2" 20 Ga. Comp	6868	$1.85	$12,705.80	$0.37	$2,541.16	$0.03	$206.04	$2.25	$15,453.00
Roof	1 1/2" 20 Ga. Comp	17327.5	$1.85	$32,055.88	$0.37	$6,411.18	$0.03	$519.83	$2.25	$38,986.88
Central Plant	Type	SF							$/SF	Total Cost
Roof	1 1/2" 20 Ga. Comp	5675	$1.85	$10,498.75	$0.37	$2,099.75	$0.03	$170.25	$2.25	$12,768.75
Total		**32296.5**		**$59,748.53**		**$11,949.71**		**$968.90**		**$72,667.13**

		Material		Labor		Equipment		Total	
Shear Studs	Quantity	$/Each	Cost	$/Each	Cost	$/Each	Cost	$/Each	Cost
	27000.00	$0.64	$17,280.00	$0.71	$19,170.00	$0.36	$9,720.00	$1.71	$46,170.00

RS Means Steel Conversions

RS Means			
Steel Costs			
Columns		**Total**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	31	$41.14	$0.75
W8	48	$61.79	$0.78
W8	67	$84.97	$0.79
W12	50	$64.29	$0.78
W12	87	$108.97	$0.80
W12	120	$149.07	$0.80
W14	74	$93.47	$0.79
W14	120	$149.07	$0.80
W14	176	$217.29	$0.81
		Avg. cost/lb	$0.79
		Cost/Ton	$1,579.25

Columns		**Labor**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	31	$2.17	$0.07
W8	48	$2.27	$0.05
W8	67	$2.38	$0.04
W12	50	$2.27	$0.05
W12	87	$2.38	$0.03
W12	120	$2.44	$0.02
W14	74	$2.38	$0.03
W14	120	$2.44	$0.02
W14	176	$2.57	$0.01
		Avg. cost/lb	$0.03
		Cost/Ton	$69.56

Columns		**Material**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	31	$37.50	$1.21
W8	48	$58.00	$1.21
W8	67	$81.00	$1.21
W12	50	$60.50	$1.21
W12	87	$105.00	$1.21
W12	120	$145.00	$1.21
W14	74	$89.50	$1.21
W14	120	$145.00	$1.21
W14	176	$213.00	$1.21
		Avg. cost/lb	$1.21
		Cost/Ton	$2,417.83

Columns		**Equipment**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	31	$1.45	$0.05
W8	48	$1.52	$0.03
W8	67	$1.59	$0.02
W12	50	$1.52	$0.03
W12	87	$1.59	$0.02
W12	120	$1.63	$0.01
W14	74	$1.59	$0.02
W14	120	$1.63	$0.01
W14	176	$1.72	$0.01
		Avg. cost/lb	$0.02
		Cost/Ton	$46.51

Floor		**Total**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	10	$18.62	$0.54
W8	21	$32.02	$0.66
W8	48	$65.11	$0.74
W10	12	$21.02	$0.57
W10	22	$33.02	$0.67
W12	14	$21.39	$0.65
W12	35	$47.32	$0.74
W14	26	$35.45	$0.73
W14	53	$68.89	$0.77
W14	90	$114.29	$0.79
W21	44	$57.79	$0.76
W21	50	$65.29	$0.77
W24	55	$71.09	$0.77
W24	62	$79.59	$0.78
W36	170	$210.35	$0.81
W36	194	$239.53	$0.81
W36	230	$282.53	$0.81
		Avg. cost/lb	$0.73
		Cost/Ton	$1,454.55

Floor		**Labor**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	10	$3.91	$0.39
W8	21	$3.91	$0.19
W8	48	$4.26	$0.09
W10	12	$3.91	$0.33
W10	22	$3.91	$0.18
W12	14	$2.66	$0.19
W12	35	$2.89	$0.08
W14	26	$2.37	$0.09
W14	53	$2.93	$0.06
W14	90	$3.17	$0.04
W21	44	$3.19	$0.07
W21	50	$3.19	$0.06
W24	55	$3.39	$0.06
W24	62	$3.06	$0.05
W36	170	$2.95	$0.02
W36	194	$3.02	$0.02
W36	230	$3.02	$0.01
		Avg. cost/lb	$0.11
		Cost/Ton	$225.54

Floor		**Material**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	10	$12.10	$0.83
W8	21	$25.50	$0.82
W8	48	$58.00	$0.83
W10	12	$14.50	$0.83
W10	22	$26.50	$0.83
W12	14	$16.95	$0.83
W12	35	$42.50	$0.82
W14	26	$31.50	$0.83
W14	53	$64.00	$0.83
W14	90	$109.00	$0.83
W21	44	$53.00	$0.83
W21	50	$60.50	$0.83
W24	55	$66.60	$0.83
W24	62	$75.00	$0.83
W36	170	$206.00	$0.83
W36	194	$235.00	$0.83
W36	230	$278.00	$0.83
		Avg. cost/lb	$0.83
		Cost/Ton	$1,653.09

Floor		**Equipment**	
Size	Wt./L.F.	Cost/L.F.	Cost
W8	10	$2.61	$0.26
W8	21	$2.61	$0.12
W8	48	$2.85	$0.06
W10	12	$2.61	$0.22
W10	22	$2.61	$0.12
W12	14	$1.78	$0.13
W12	35	$1.93	$0.06
W14	26	$1.58	$0.06
W14	53	$1.96	$0.04
W14	90	$2.12	$0.02
W21	44	$1.60	$0.04
W21	50	$1.60	$0.03
W24	55	$1.53	$0.03
W24	62	$1.53	$0.02
W36	170	$1.48	$0.01
W36	194	$1.51	$0.01
W36	230	$1.51	$0.01
		Avg. cost/lb	$0.07
		Cost/Ton	$144.51

Concrete Take Off Notes

Concrete									
Pavilion		Material		Labor		Equipment		Total	
	CY	$/CY	Cost	$/CY	Cost	$/CY	Cost	$/CY	Cost
Column Footings	218.56	$192.00	$41,963.52	$95.50	$20,872.48	$0.57	$124.58	$288.07	**$62,960.58**
Strip Footings	CY							$/CY	Cost
	111.84	$115.00	$12,861.71	$62.00	$6,934.14	$0.45	$50.33	$177.45	**$19,846.18**
Grade Beams	CY							$/CY	Cost
		$115.00	$0.00	$62.00	$0.00	$0.45	$0.00	$177.45	**$0.00**
Foundation Walls	CY							$/CY	Cost
	172.67	$175.00	$30,217.10	$155.00	$26,763.71	$15.45	$2,667.74	$345.45	**$59,648.55**
Slab On Grade	SF							$/SF	Cost
	30369.00	$1.95	$59,219.55	$0.75	$22,776.75	$0.01	$303.69	$2.71	**$82,299.99**
Housekeeping Slab	SF							$/SF	Cost
		$192.00	$0.00	$110.50	$0.00	$15.57	$0.00	$318.07	**$0.00**
Piers	CY							$/CY	Cost
	28.94	$231.00	$6,686.29	$325.00	$9,407.11	$32.00	$926.24	$588.00	**$17,019.64**
Slab on Deck	SF							$/SF	Cost
	138876.75	$2.02	$280,531.04	$0.73	$101,380.03	$0.28	$38,885.49	$3.03	**$420,796.55**
Total(CY)	**3,666.20**		**431,479.20**		**188,134.22**		**42,958.06**		**$662,571.49**

Concrete									
Central Plant		Material		Labor		Equipment		Total	
Column Footings	CY	$/CY	Cost	$/CY	Cost	$/CY	Cost	$/CY	Cost
	38.25	$192.00	$7,343.40	$95.50	$3,652.58	$0.57	$21.80	$288.07	**$11,017.78**
Strip Footings	CY							$/CY	Cost
	78.18	$115.00	$8,991.25	$62.00	$4,847.46	$0.45	$35.18	$177.45	**$13,873.89**
Grade Beams	CY							$/CY	Cost
	17.89	$115.00	$2,057.22	$62.00	$1,109.11	$0.45	$8.05	$177.45	**$3,174.38**
Foundation Walls	CY							$/CY	Cost
	518.07							$345.45	**$178,968.06**
Slab On Grade	SF							$/SF	Cost
	11210.00	$1.95	$21,859.50	$0.75	$8,407.50	$0.01	$112.10	$2.71	**$30,379.10**
Housekeeping Slab	SF							$/SF	Cost
	255.09							$2.09	**$533.14**
Piers	CY							$/CY	Cost
	36.79	$231.00	$8,498.88	$325.00	$11,957.30	$32.00	$1,177.33	$588.00	**$21,633.52**
Slab on Deck	SF							$/CY	Cost
	17097	$2.02	$34,535.94	$0.73	$12,480.81	$0.28	$4,787.16	$3.03	**$51,803.91**
Total(CY)	**1,198.62**		$83,286.20		$42,454.76		$6,141.63		**$311,383.78**

Reinforcing									
Pavilion		Material		Labor		Equipment		Total	
	Tons	$/Ton	Cost	$/Ton	Cost	$/CY	Cost	$/Ton	Cost
Column Ftg. Reinforcing									
	8.69	$890.00	$7,737.90	$655.00	$5,694.75			$1,545.00	**$13,432.64**
Strip Ftg. Reinforcing	Tons							$/Ton	Cost
	5.80	$890.00	$5,162.87	$655.00	$3,799.64			$1,545.00	**$8,962.51**
Grade Beams Reinforcing	Tons							$/Ton	Cost
			$0.00		$0.00				
Wall Reinforcing	Tons							$/Ton	Cost
	7.82	$890.00	$6,962.30	$460.00	$3,598.49			$1,350.00	**$10,560.79**
Total Rebar	**22.32**		**$19,863.06**		**$13,092.88**				**32955.94**
SOD Reinforcing	CSF							$/CSF	Cost
	1389	$15.65	$21,734.21	$22.00	$30,552.89			$37.65	**$52,287.10**
Slab On Grade	CSF							$/CSF	Cost
	303.69	$15.65	$4,752.75	$22.00	$6,681.18			$37.65	**$11,433.93**
									$63,721.02
Total WWF	**1692**		**$26,486.96**		**$37,234.07**		**$0.00**	**Total**	**$129,632.90**

Reinforcing									
Central Plant		Material		Labor		Equipment		Total	
	Tons	$/Ton	Cost	$/Ton	Cost	$/CY	Cost	$/Ton	Cost
Column Ftg. Reinforcing									
	1.05	$890.00	$936.17	$655.00	$688.98			$1,545.00	**$1,625.15**
Strip Ftg. Reinforcing	Tons							$/Ton	Cost
	1.95	$890.00	$1,733.95	$655.00	$1,276.11			$1,545.00	**$3,010.06**
Grade Beams Reinforcing	Tons							$/Ton	Cost
	1.73	840	$1,453.35	380	$657.47			$1,220.00	**$2,110.81**
Wall Reinforcing	Tons							$/Ton	Cost
	52.35	$890.00	$46,591.23	$460.00	$24,080.86			$1,350.00	**$70,672.09**
Total Rebar	**57.08**		**$50,714.70**		**$26,703.41**				**$77,418.11**
SOD Reinforcing	CSF							$/CSF	Cost
	170.97	$15.65	$2,675.68	$22.00	$3,761.34			$37.65	**$6,437.02**
Housekeeping Pads	CSF							$/CSF	Cost
	2.55	$15.65	$39.92	$22.00	$56.12			$37.65	**$96.04**
Slab On Grade	CSF							$/CSF	Cost
	89.49	$15.65	$1,400.52	$22.00	$1,968.78			$37.65	**$3,369.30**
Total WWF	**263.01**		**$4,116.12**		**$5,786.24**				**$9,902.36**
								Total	**$164,738.58**

Forms									
		Material		Labor		Equipment		Total	
Pavilion	SF	$/SF	Cost	$/SF	Cost	$/SF	Cost	$/SF	Cost
Foundation Walls	7911.463	$0.83	$6,566.51	$0.47	$3,694.65			$1.30	$10,261.17
Column Footings	3486.45	$1.95	$6,798.58	$3.79	$13,213.65			$5.74	$20,012.22
Slab On Grade	1700	$0.32	$544.00	$1.93	$3,281.00			$2.25	$3,825.00
								Total	**$34,098.39**

Forms									
		Material		Labor		Equipment		Total	
Central Plant	SF	$/SF	Cost	$/SF	Cost	$/SF	Cost	$/SF	Cost
Foundation Walls	22456.48	$0.83	$18,638.88	$0.47	$10,487.18			$1.30	$29,126.05
Column Footings	812.96	$1.95	$1,585.28	$3.79	$3,081.13			$5.74	$4,666.41
Grade Beams	805.00	$2.53	$2,036.65	$3.36	$2,704.80			$5.89	$4,741.45
Housekeeping Pads	780.00	$0.32	$249.60	$1.93	$1,505.40			$2.25	$1,755.00
Slab On Grade	1700	$2.70	$4,590.00	$4.82	$8,194.00			$7.52	$12,784.00
	Days	$/Day	Cost	$/Day	Cost	$/Day	Cost	$/Day	Cost
40 Ton Truck Crane	10			$340.00	$3,400.00	$1,050.00	$10,500.00	$1,390.00	$13,900.00
								Total	**$66,972.92**

Masonry Take Off Notes

Masonry									
Pavilion		Material		Labor		Equipment		Total	
	SF	$/SF	Cost	$/SF	Cost	$/SF	Cost	$/SF	Cost
8" CMU Foundation Wall	583.00	$3.59	$2,092.97	$3.44	$2,005.52			$7.03	$4,098.49
16"CMU Foundation Wall	583.00	$5.35	$3,119.05	$4.78	$2,786.74			$10.13	$5,905.79
Total	**1166.00**		**$5,212.02**		**$4,792.26**				**$10,004.28**

Reinforcing									
Pavilion		Material		Labor		Equipment		Total	
	Tons	$/Ton	Cost	$/Ton	Cost	$/CY	Cost	$/Ton	Cost
Foundation Wall									
	0.20	$890.00	$175.98	$655.00	$129.51			$1,545.00	$305.49
								Total	**$305.49**