

Bayhealth Medical Center



Technical Assignment two

**The Pennsylvania State
University**

**AE Faculty Advisor: Chimay
Anumba**

**Architectural engineering
senior thesis**

10/27/2010

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Construction Management

I. Executive Summary

Technical assignment two is an examination into the key scheduling and cost of the bayhealth medical center expansion. Areas that are examined include a detailed project schedule, the site layout plan of the steel erection phase of construction, a detailed super structure estimate, a general conditions estimate, and a look into a current critical issue in the construction industry.

A detailed project schedule for this technical report was generated from the projects actual schedule provided by Whiting-Turner. It shows their approach that was taken to efficiently phase the workflow throughout the building. The project start date is December 24, 2007 with and expected completion date of December 8, 2011.

The critical phase of construction that is shown in the site layout plan is the Steel erection phase. The site layout plan shows a visual representation of key features of construction such as crane placement, job trailer location, etc. Because of the large size of the site, there is adequate space available for not only parking, but also for material storage. Even with plenty of space on site, whiting-Turner made the decision to purchase a house less than two blocks from the site to use as there on site office.

The estimated cost for the superstructure that was calculated was 3.33 million dollars, which was significantly lower than the provided amount of \$5,243,966.00. The calculated superstructure estimate was comprised by estimating the linear feet of steel beams, steel columns, the cubic yards of concrete of the slab on grade, elevated slabs, pile caps, and grade beams. Because of the lack of a typical bay, the entire structural steel system needed to be estimated for the bayhealth medical center.

The estimated cost of the general conditions was estimated to be 8.7 million dollars. This estimate was found to be very close to the given estimate of \$8,982,501.00. The estimate was broken down into 3 categories supervision/personnel, equipment, and miscellaneous costs. The largest cost to the general conditions estimate was a five million dollar contingency By Whiting-Turner.

In the last section of this technical report, a summarization of the October 28, 2010 PACE roundtable is discussed. The PACE roundtable is a yearly event that brings together 5th year architectural engineering students with a focus in construction management, industry leaders, and architectural engineering faculty to discuss important issues in the industry today.

Dover, Delaware

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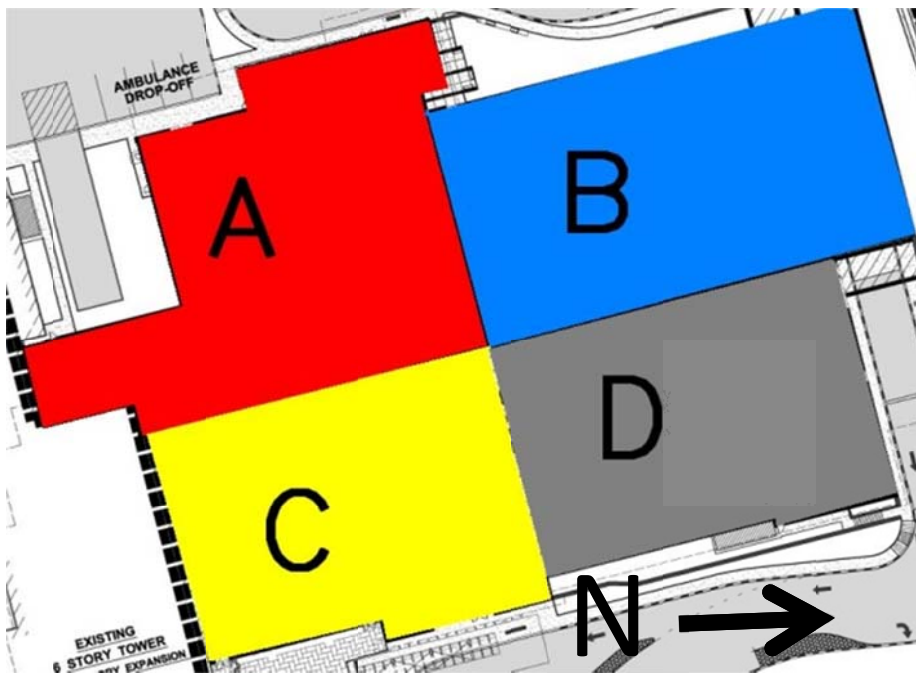
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III. Detailed Project Schedule

The bayhealth medical center's schedule is driven by the two main things that are most important to the owner, cost and quality. The schedule starts on December 24, 2007 with the foundation work and relocation of existing utilities. As the foundation and superstructure is completed and the building is made watertight, the rough-in work for the buildings systems will be started. The building is broken apart into four areas A, B, C, and D, with area B being the already constructed parking garage. The rough-in sequenced is shown in the schedule to be from the basement up to the third floor. Each area begins with the layout of the partition walls, then each of the building systems are installed into the walls and ceilings. After all testing and inspections are completed, the area is finished. The project duration is a total of 35 months, with an estimated completion date of December 8, 2011.



The detailed project schedule is located in Appendix A.

IV. Site Layout Planning

The site layout plan shows the steel erection phase of construction. There are three possible crane locations around the foot print of the building. Because of such a large site, there are large amounts of room for storage on site or shake out areas. There is also a large volume of parking available directly north of the site in an existing parking lot. Access to the site is provided by gates at the north and west sides of the construction site.

The site plan layout is located in Appendix B

V. Detailed Structural Estimate

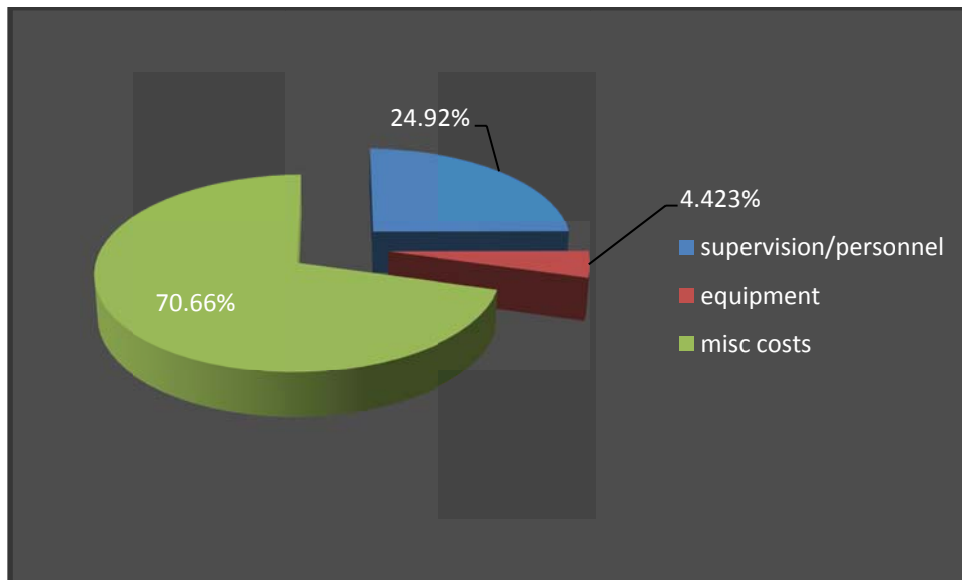
A detailed structural estimate including the steel beams, steel columns, pilecaps, grade beams, slab on grade, and elevated slabs was performed on the bayhealth medical center using 2009 RS Means data. The superstructure estimate was considerably lower than provided numbers, roughly 64%. This could be due to several factors such as what components were included in the given structural estimate, and different prices for the cost of material. Because of the lack of a typical bay, the entire steel structure needed to be estimated for the building. As shown in the figure below, the largest cost of the superstructure estimate comes from the steel beams. Because of an abnormally high water table a complex foundation was also used. There is a mix of pilecaps that sit atop of 16" diameter reinforced auger piles embedded 20'-30' into the ground, and a system of grade beams of varying lengths, depths, and reinforcement between column lines.

	Summary
Cost of Beams	\$1,622,152.76
Cost of Columns	\$651,970.05
Cost Of Pilecaps	\$234,311.93
Cost of Grade Beams	\$162,779.16
Cost of Slabs	\$661,388.00
TOTAL	\$3,332,601.90

Tables of the structural takeoff and calculations can be found in Appendix C

VI. General Conditions Estimate

The general conditions estimate was comprised using 2009 RS Means data. The estimate was broken down into 3 categories supervision/personnel, equipment, and miscellaneous costs. A time frame of 35 months was used as the duration of the project. The major cost of the general conditions estimate was a contingency of over 5 million dollars. It is unknown why such a large contingency was required on this project. Many of the usual general condition costs of construction are being paid by the owner.



A table of the general conditions can be found in Appendix D

VII. Critical Industry Issues

The 19th annual PACE roundtable was a great opportunity to sit down with industry leaders, architectural engineering faculty, and other 5th year students and discuss current issues and relevant technology in the construction industry. The conference kicked off with an update of what PACE and the architectural engineering department has been doing over the last year by Professor Riley, Messner, and Leicht. After some of the bigger events in the architectural engineering department were talked about, such as the 129 million dollar grant from the DOE (Department of Energy), the group was dismissed to breakout session one.

Although each of the three topics of break out session one sounded very interesting, I chose the lecture held by Dr. Messner about current innovations that are transforming our industry. I choose this break out session because it had the highest amount of personal interest to me, and also thought it would give me the greatest amount of ideas that I could use for my thesis. During the break out session the overall theme was the general lack of the construction industry to keep pace with today's innovative technology. There were some interesting innovative technologies discussed, that are being implemented in the field today. One of these technologies was combining BIM software and mechanized machines to do layout of building systems such as ductwork hanger locations. It was discussed that renewable energy sources should be examined more for the feasibility of implementing them into new construction. Another existing technology that is being looked at by the industry is using gaming engines to simulate not only buildings themselves, but how they actually go together. Game engines are light years ahead of the current software used by the construction industry, according to Dr. Messner. He explained how it allows users to truly interact with their virtual surroundings. This idea of using game engine software really brought out the biggest issue with technology in construction today. I think that looking at implementing BIM and these ideas into my thesis would be a great idea, but possibly hard to show. I do however think that I could take some of the sustainability topics from this lecture and implement them into my thesis. The overall consensus of the group was that the industry needs to look outwards at other industries and how they use technology, and find ways that it could also pertain to construction. A good point that was raised by one of the students, is that there should be a national organization that promotes the use of technology in the construction industry. It really surprised me that the construction industry hasn't taken the initiative to create any such organization.

After a short break, break-out session two was started. Once again I decided to choose Dr. Messner's session on carrying BIM into the field. First, we started with discussing some ways that BIM is already being carried into the field. Companies said they are already using tablet PC's to track materials. An example was given that by using barcodes to track pieces of precast the GC or CM can know at any time all information pertaining to a specific piece. Another interesting use of BIM in the field that is currently being implemented is using the model to track the punch list in each specific room or area of a building. We then started to discuss how BIM in the field was a way that information can be streamlined for people in the field. I believe that BIM would be a great advantage on my thesis building. I think even the "low fruits" of BIM would be a huge advantage and cost savings on my thesis.

Overall I thought the PACE roundtable was a great learning experience. I think that after the discussions on prefabrication, it is something that I would like to explore further, and see what benefits it could bring to my thesis. Also some of the sustainability topics like geothermal or PV cell systems are ideas I would like to pursue further. I met some great people from the industry, and gained some valuable knowledge on specific ideas I am going to research for me thesis.

VIII. Appendix A - Detailed Project Schedule

ID	Task Mode	Task Name	Duration	Start	Finish	2008				
						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
1		Foundations	873 days	Mon 12/24/07	Wed 4/27/11					
2		Project Start	0 days	Mon 12/24/07	Mon 12/24/07					
3		Site Utilities Relocation	181 days	Mon 4/14/08	Mon 12/22/08					
4		Bulk Excavation	480 days	Tue 10/7/08	Mon 8/9/10					
5		Auger Cast Piles	92 days	Thu 11/13/08	Fri 3/20/09					
6		Sections C/A Elevator Pits	10 days	Tue 9/29/09	Mon 10/12/09					
7		Section A Sump Pits	7 days	Mon 10/5/09	Tue 10/13/09					
8		Section A Spread Footings	40 days	Mon 10/26/09	Fri 12/18/09					
9		Section D Foundation Walls	64 days	Mon 10/26/09	Thu 1/21/10					
10		Section A Foundation Walls	31 days	Mon 11/2/09	Mon 12/14/09					
11		Section C Foundation Walls	25 days	Mon 12/21/09	Fri 1/22/10					
12		Storm/Sanitary Lines	409 days	Mon 1/12/09	Thu 8/5/10					
13		Structure	264 days	Mon 10/5/09	Thu 10/7/10					
14		SOG	176 days	Mon 10/5/09	Mon 6/7/10					
15		Structural Steel	151 days	Mon 2/15/10	Mon 9/13/10					
16		BackFill	129 days	Fri 4/9/10	Wed 10/6/10					
17		Slab On Deck Area D	90 days	Mon 4/26/10	Fri 8/27/10					
18		Slab On Deck Area C	102 days	Tue 6/22/10	Wed 11/10/10					
19		Slab On Deck Area A	21 days	Fri 3/19/10	Fri 4/16/10					
20		Spray On Fireproofing Section A	37 days	Mon 5/10/10	Tue 6/29/10					
21		SprayOn Fireproofing Section D	107 days	Mon 5/24/10	Tue 10/19/10					

Project: Project schedule.mpp Date: Wed 10/27/10	Task		External Milestone		Manual Summary Rollup	
	Split		Inactive Task		Manual Summary	
	Milestone		Inactive Milestone		Start-only	
	Summary		Inactive Summary		Finish-only	
	Project Summary		Manual Task		Deadline	
	External Tasks		Duration-only		Progress	

ID	Task Mode	Task Name	Duration	Start	Finish	2008				
						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
22		Spray On FireProofing Section C	65 days	Sat 7/10/10	Thu 10/7/10					
23		Building Enclosure	163 days	Mon 9/13/10	Wed 4/27/11					
24		Enclosure Area D	108 days	Mon 9/13/10	Wed 2/9/11					
25		Enclosure Area C	187 days	Tue 8/10/10	Wed 4/27/11					
26		Enclosure Area A	164 days	Mon 5/10/10	Thu 12/23/10					
27		Area C/D Roofing	146 days	Mon 6/21/10	Mon 1/10/11					
28		Area C Low Roofing	101 days	Mon 6/21/10	Mon 11/8/10					
29		Area A Roofing	102 days	Tue 6/1/10	Wed 10/20/10					
30		Basement Permanent Power	197 days	Mon 6/28/10	Tue 3/29/11					
31		Pavilion Emergency Power	0 days	Thu 4/7/11	Thu 4/7/11					
32		Area A Basement	386 days	Tue 4/20/10	Tue 10/11/11					
33		Partition Layout	33 days	Mon 3/29/10	Wed 5/12/10					
34		Stormwater Rough-In	62 days	Tue 4/20/10	Wed 7/14/10					
35		HVAC Rough-In	137 days	Tue 4/20/10	Wed 10/27/10					
36		Sprinkler Rough-In	3 days	Mon 6/7/10	Wed 6/9/10					
37		Ductwork Branches	100 days	Thu 6/10/10	Wed 10/27/10					
38		Plumbing In Wall / Testing	61 days	Wed 7/14/10	Wed 10/6/10					
39		Electrical Rough-In	15 days	Thu 9/30/10	Wed 10/20/10					
40		Punch List	13 days	Fri 9/23/11	Tue 10/11/11					
41		Fitout Of Mech Room BU12	334 days?	Mon 6/7/10	Thu 9/15/11					
42		Sanitary/storm Water Pipping	132 days	Tue 4/20/10	Wed 10/20/10					

Project: Project schedule.mpp
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Task		External Milestone		Manual Summary Rollup	
Split		Inactive Task		Manual Summary	
Milestone		Inactive Milestone		Start-only	
Summary		Inactive Summary		Finish-only	
Project Summary		Manual Task		Deadline	
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ID	Task Mode	Task Name	Duration	Start	Finish	2008				
						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
43		sprinkler Systems	108 days	Mon 6/7/10	Wed 11/3/10					
44		Ductwork Install	128 days	Tue 6/8/10	Thu 12/2/10					
45		House Keeping Pads	53 days	Thu 6/17/10	Mon 8/30/10					
46		Medical Gas Rough-In	153 days	Thu 9/30/10	Mon 5/2/11					
47		Set HVAC Equip	153 days	Thu 9/30/10	Mon 5/2/11					
48		Fitout HVAC Piping	153 days	Thu 9/30/10	Mon 5/2/11					
49		Fitout of Fire Alarm System	76 days	Tue 3/8/11	Tue 6/21/11					
50		Punch List	41 days	Thu 7/21/11	Thu 9/15/11					
51		Basement Fitout Mech Room BU002	249 days	Thu 6/24/10	Tue 6/7/11					
52		house Keeping Pads	75 days	Thu 6/24/10	Wed 10/6/10					
53		Duct Work	98 days	Mon 6/28/10	Wed 11/10/10					
54		Sprinkler System	93 days	Mon 6/28/10	Wed 11/3/10					
55		AHU set	70 days	Thu 7/1/10	Wed 10/6/10					
56		In wall MEP Rough-In	15 days	Thu 9/30/10	Wed 10/20/10					
57		Fire Alarm System	56 days	Tue 3/22/11	Tue 6/7/11					
58		Punchlist	10 days	Thu 7/14/11	Wed 7/27/11					
59		Area C/D/A Basement Corridor Fitout	304 days	Mon 8/16/10	Thu 10/13/11					
60		Ductwork	65 days	Mon 8/16/10	Fri 11/12/10					
61		Sprinkler System Rough-In	55 days	Mon 8/23/10	Fri 11/5/10					
62		Mech Equip Pipe/Duct	83 days	Thu 9/30/10	Mon 1/24/11					
63		Above Ceiling Rough-In	27 days	Fri 12/3/10	Mon 1/10/11					
64		Fitout Fire Alarm	56 days	Tue 3/29/11	Tue 6/14/11					
65		Punchlist	20 days	Fri 9/16/11	Thu 10/13/11					

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	Project Summary		Manual Task		Deadline	
	External Tasks		Duration-only		Progress	

ID	Task Mode	Task Name	Duration	Start	Finish	2008				
						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
66		1st Floor Fitout Section A	565 days	Thu 10/8/09	Thu 12/8/11					
67		Ductwork	85 days	Thu 7/1/10	Wed 10/27/10					
68		Sprinkler Rough-In	73 days	Mon 8/9/10	Wed 11/17/10					
69		Elect Power/ Light Fixtures	56 days	Tue 3/29/11	Tue 6/14/11					
70		Casework rooms	30 days	Thu 4/7/11	Wed 5/18/11					
71		Device Fitout	20 days	Tue 4/12/11	Mon 5/9/11					
72		Inspection/ Close Up	26 days	Tue 5/10/11	Tue 6/14/11					
73		Plumbing	52 days	Tue 5/10/11	Wed 7/20/11					
74		Fitout Finishes	82 days	Wed 6/1/11	Thu 9/22/11					
75		Punchlist	71 days	Thu 7/28/11	Thu 11/3/11					
76		1st Floor Section C	565 days	Thu 10/8/09	Thu 12/8/11					
77		Ductwork Install	95 days	Thu 7/1/10	Wed 11/10/10					
78		Partition Layout	20 days	Mon 8/9/10	Fri 9/3/10					
79		Sprinkler Rough-In	73 days	Mon 8/9/10	Wed 11/17/10					
80		Power/Lighting Above ceiling Rough-In	68 days	Mon 8/16/10	Wed 11/17/10					
81		Punchlist	49 days	Thu 8/4/11	Tue 10/11/11					
82		1st Floor Fitout Diagnostic Imaging Suite	565 days	Thu 10/8/09	Thu 12/8/11					
83		CT Scan Equip	265 days	Thu 10/8/09	Wed 10/13/10					
84		X-Ray Equip	265 days	Thu 10/8/09	Wed 10/13/10					
85		Partiton Layout	4 days	Sat 10/9/10	Wed 10/13/10					

Project: Project schedule.mpp
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Task		External Milestone		Manual Summary Rollup	
Split		Inactive Task		Manual Summary	
Milestone		Inactive Milestone		Start-only	
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Project Summary		Manual Task		Deadline	
External Tasks		Duration-only		Progress	

ID	Task Mode	Task Name	Duration	Start	Finish	2008				
						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
86		HVAC Rough-In	18 days	Mon 9/20/10	Wed 10/13/10					
87		Imaging Equip Rough-In	20 days	Thu 10/7/10	Wed 11/3/10					
88		X-Ray Equip Calibration	46 days	Thu 8/25/11	Thu 10/27/11					
89		Ct Scan Equip Calibration	46 days	Thu 8/25/11	Thu 10/27/11					
90		Punchlist	21 days	Fri 10/28/11	Fri 11/25/11					
91		1st Floor Fitout Public Spaces & D	343 days	Mon 8/16/10	Thu 12/8/11					
92		Partition Layout	14 days	Mon 8/16/10	Thu 9/2/10					
93		Ductwork Rough-In/testing	20 days	Thu 9/30/10	Wed 10/27/10					
94		HVAC Equip/Accessories	25 days	Thu 10/7/10	Wed 11/10/10					
95		Sprinkler Rough-In	25 days	Thu 10/7/10	Wed 11/10/10					
96		HVAC Piping Rough-In/Testing	25 days	Thu 10/7/10	Wed 11/10/10					
97		Plumbing Rough-In	15 days	Thu 10/7/10	Wed 10/27/10					
98		Ductwork Rough-In	15 days	Thu 10/7/10	Wed 10/27/10					
99		Rough-In Inspection	10 days	Thu 10/28/10	Wed 11/10/10					
100		Punchlist	21 days	Wed 6/29/11	Wed 7/27/11					

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ID	Task Mode	Task Name	Duration	Start	Finish	2008				
						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
101		1st Floor Fitout Connector	333 days	Mon 8/30/10	Thu 12/8/11					
102		Demolition Red Bag Building	10 days	Wed 3/30/11	Tue 4/12/11					
103		Demolition Boiler Stack	25 days	Wed 3/30/11	Tue 5/3/11					
104		Earthwork/Bulk Excavation	10 days	Thu 5/5/11	Wed 5/18/11					
105		Remove Chillers	5 days	Thu 5/26/11	Wed 6/1/11					
106		Concrete Foundation/SOG	20 days	Fri 6/3/11	Thu 6/30/11					
107		Steel Erection	15 days	Fri 7/1/11	Thu 7/21/11					
108		Demolition Breakthrough	15 days	Mon 7/25/11	Fri 8/12/11					
109		Fireproofing	10 days	Mon 7/25/11	Fri 8/5/11					
110		Backfill	15 days	Mon 7/25/11	Fri 8/12/11					
111		Partition Layout	15 days	Mon 8/8/11	Fri 8/26/11					
112		Medical Gas Rough-In	15 days	Mon 8/15/11	Fri 9/2/11					
113		Plumbing	15 days	Mon 8/15/11	Fri 9/2/11					
114		Ductwork Rough-In	15 days	Mon 8/15/11	Fri 9/2/11					
115		Sprinkler Rough-in	15 days	Mon 8/15/11	Fri 9/2/11					

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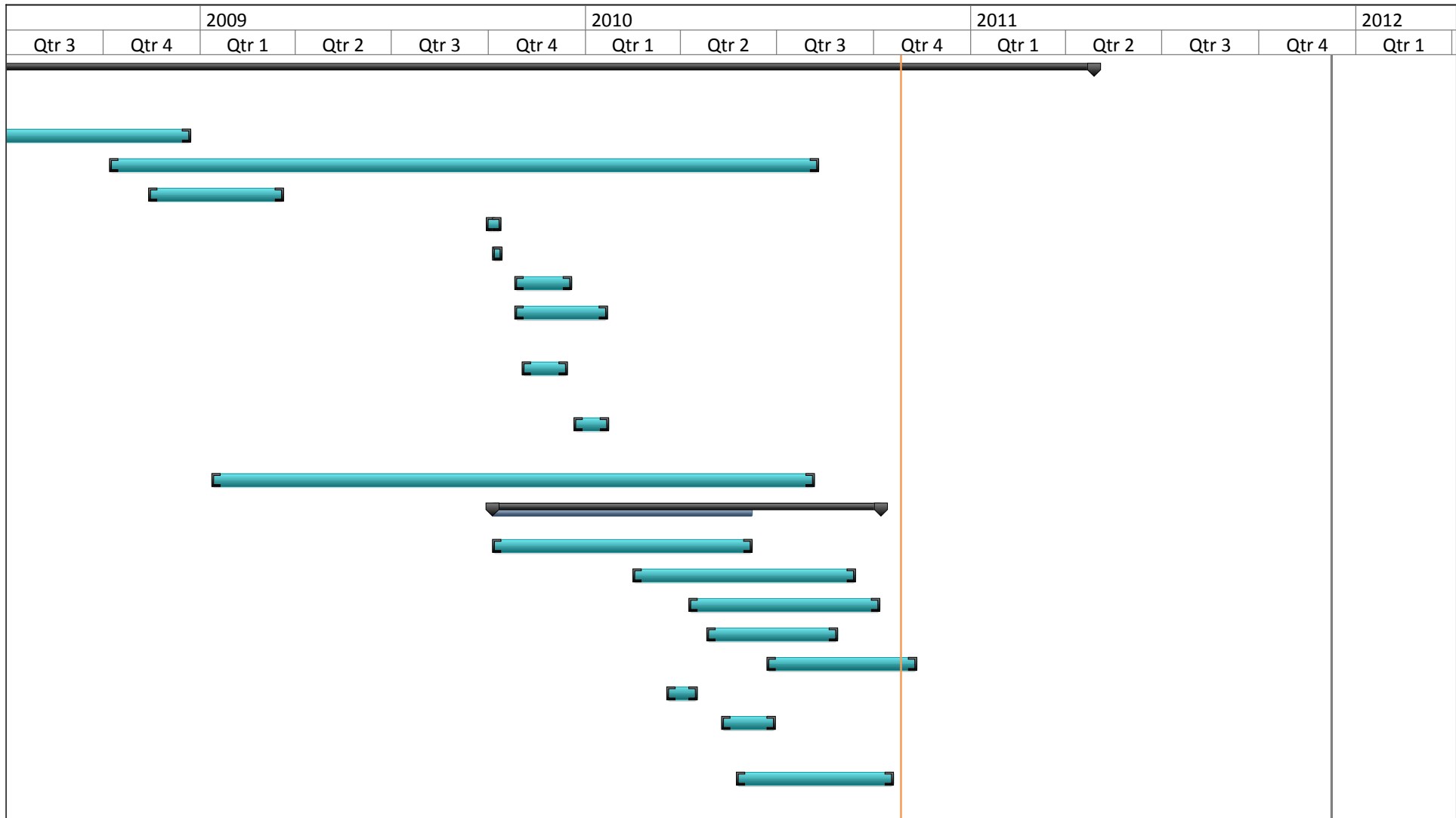
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						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
116		Electrical Power/Lighting Rough-In	15 days	Mon 8/15/11	Fri 9/2/11					
117		Punchlist	10 days	Thu 11/10/11	Wed 11/23/11					
118		2nd Floor fitout C/D	333 days	Mon 8/30/10	Thu 12/8/11					
119		Partiton Layout	17 days	Fri 10/8/10	Mon 11/1/10					
120		Ductwork rough-In/Testing	40 days	Thu 9/30/10	Wed 11/24/10					
121		Mech equip/Accessories	20 days	Thu 9/30/10	Wed 10/27/10					
122		HVAC equip/Accessories	20 days	Thu 9/30/10	Wed 10/27/10					
123		Electric Power/Lighting Rough-In	60 days	Thu 10/14/10	Wed 1/5/11					
124		Medical Gas Rough-In	20 days	Thu 10/21/10	Wed 11/17/10					
125		Sprinkler System Rough-In	35 days	Thu 11/4/10	Wed 12/22/10					
126		Punchlist	31 days	Thu 8/4/11	Thu 9/15/11					
127		3rd Floor Fitout C/D	333 days	Mon 8/30/10	Thu 12/8/11					

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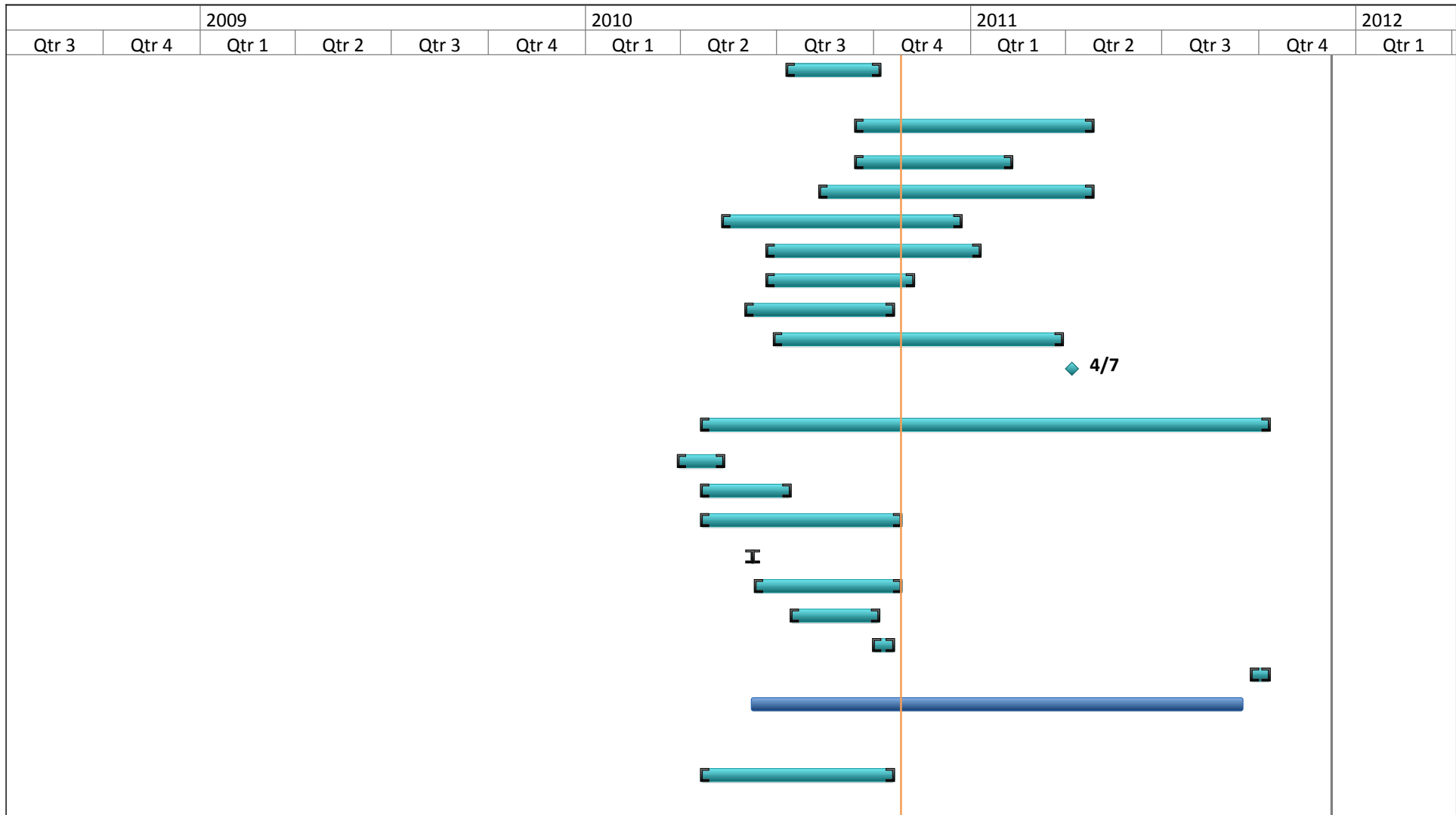
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ID	Task Mode	Task Name	Duration	Start	Finish	2008				
						Qtr 3	Qtr 4	Qtr 1	Qtr 2	Qtr
128		Partiton Layout	22 days	Mon 8/30/10	Tue 9/28/10					
129		Ductwork Rough-In/Testing	40 days	Thu 9/30/10	Wed 11/24/10					
130		Mech p/Accessories	40 days	Thu 9/30/10	Wed 11/24/10					
131		HVAC p/Accessories	40 days	Thu 9/30/10	Wed 11/24/10					
132		Electric ower/Lighting Rough-In	40 days	Thu 9/30/10	Wed 11/24/10					
133		Sprinkler System Rough-In	40 days	Thu 9/30/10	Wed 11/24/10					
134		Punchlist	83 days	Tue 5/24/11	Thu 9/15/11					
135		4th Floor Fitout Elev Room	55 days	Fri 12/3/10	Thu 2/17/11					
136		ommissioning	61 days	Mon 9/12/11	Mon 12/5/11					
137		Punchlist	61 days	Mon 9/12/11	Mon 12/5/11					
138		Substantial Completion	0 days	Thu 12/8/11	Thu 12/8/11					

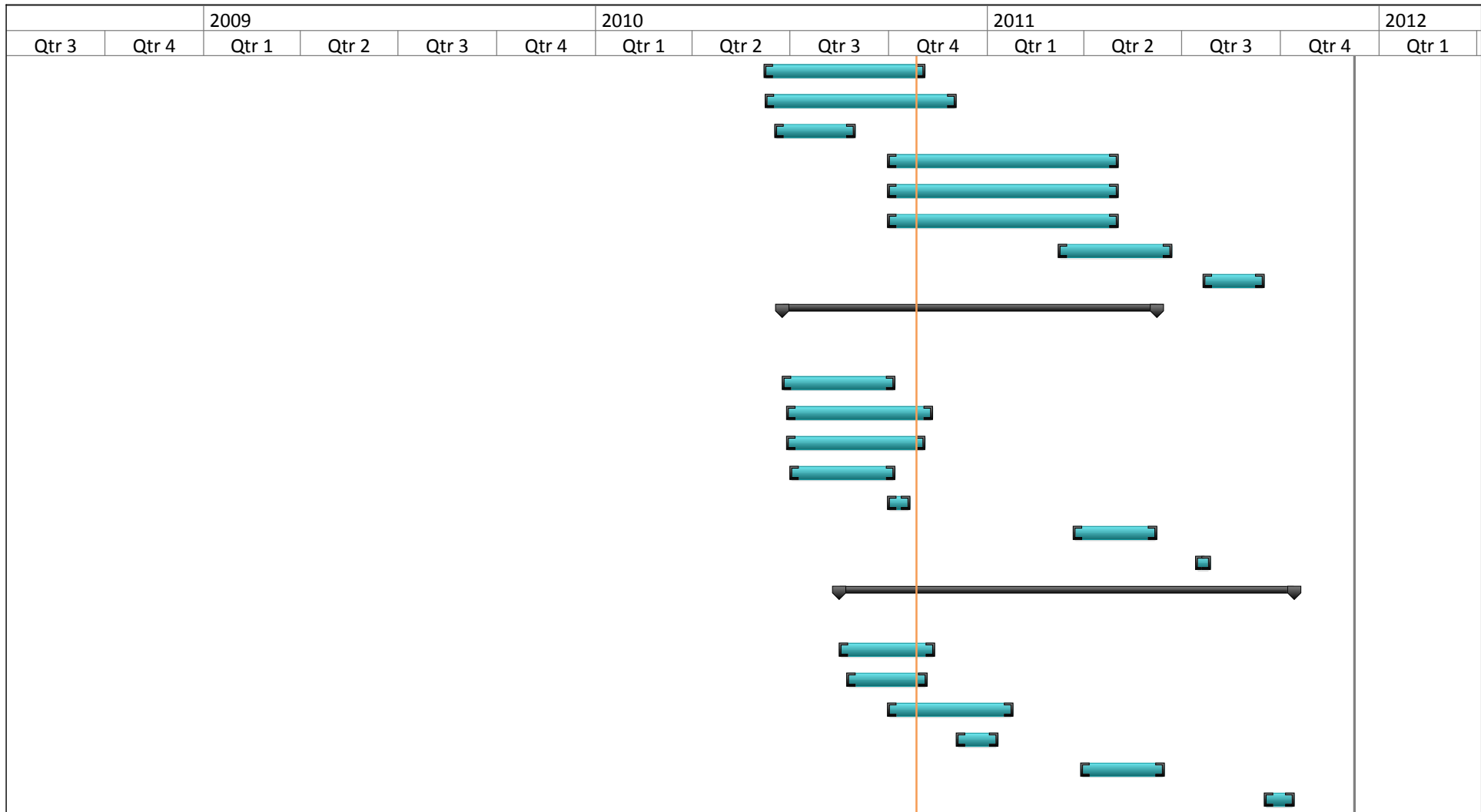
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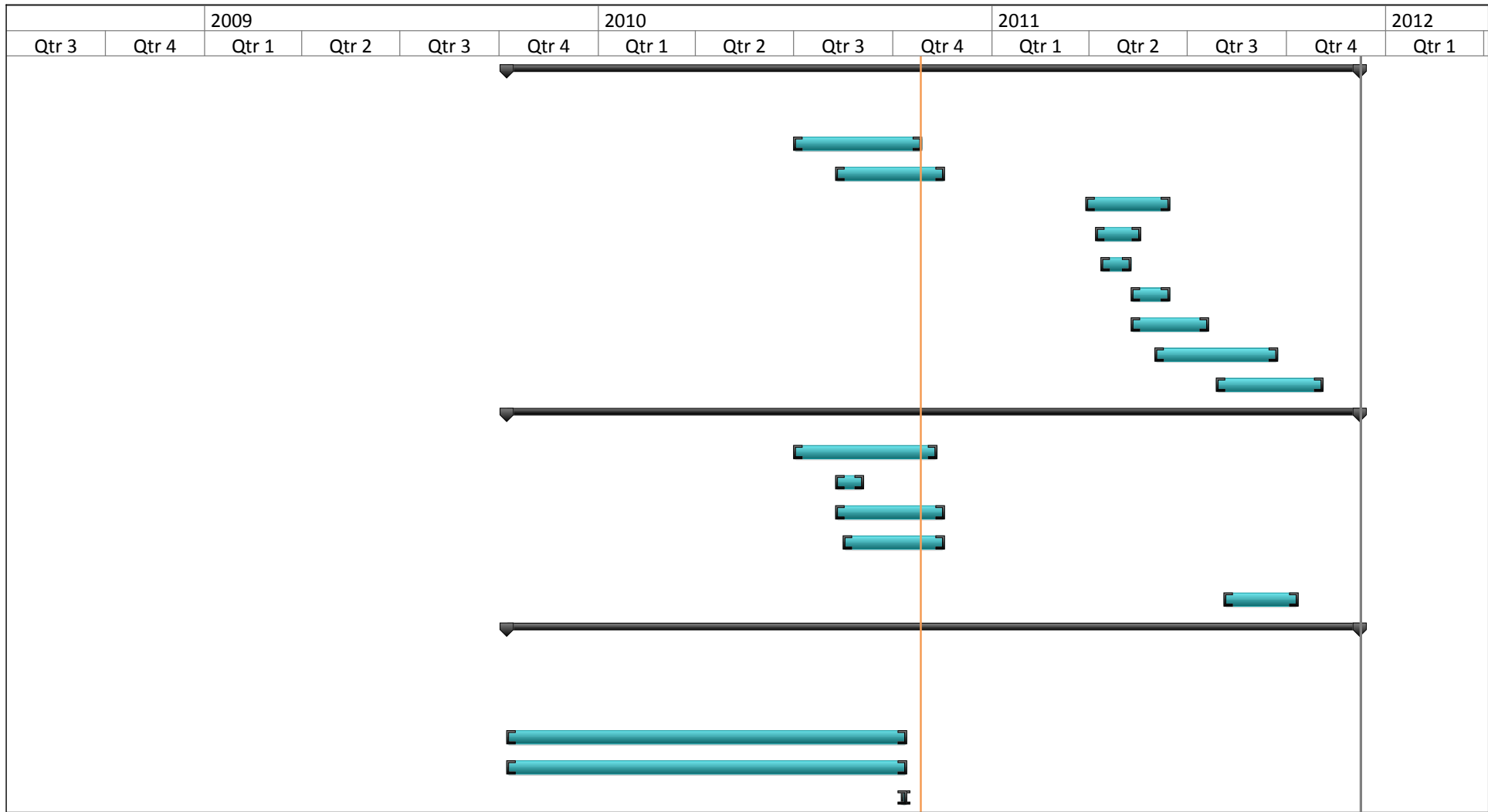
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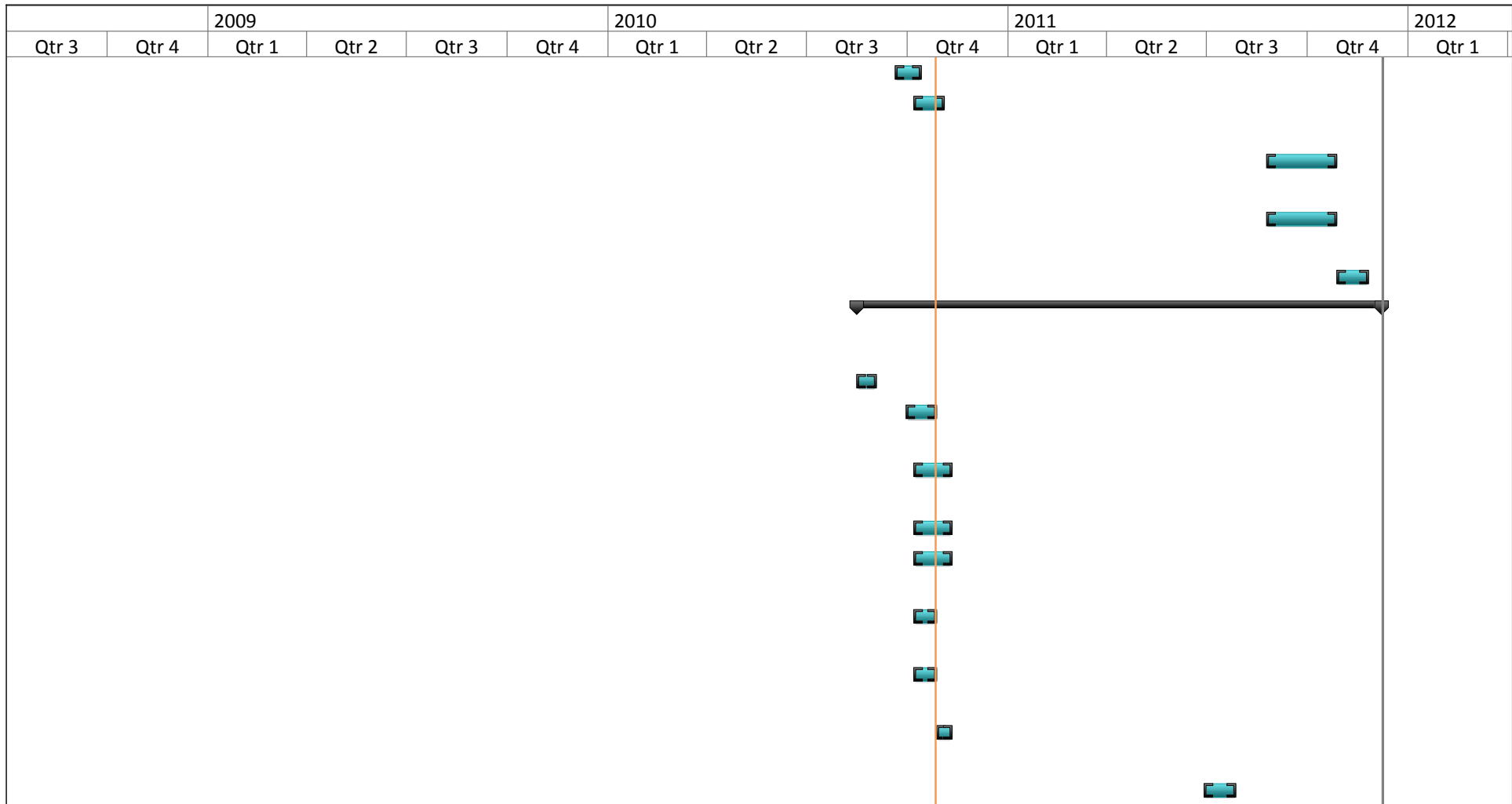


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	Split		Inactive Task		Manual Summary	
	Milestone		Inactive Milestone		Start-only	
	Summary		Inactive Summary		Finish-only	
	Project Summary		Manual Task		Deadline	
	External Tasks		Duration-only		Progress	

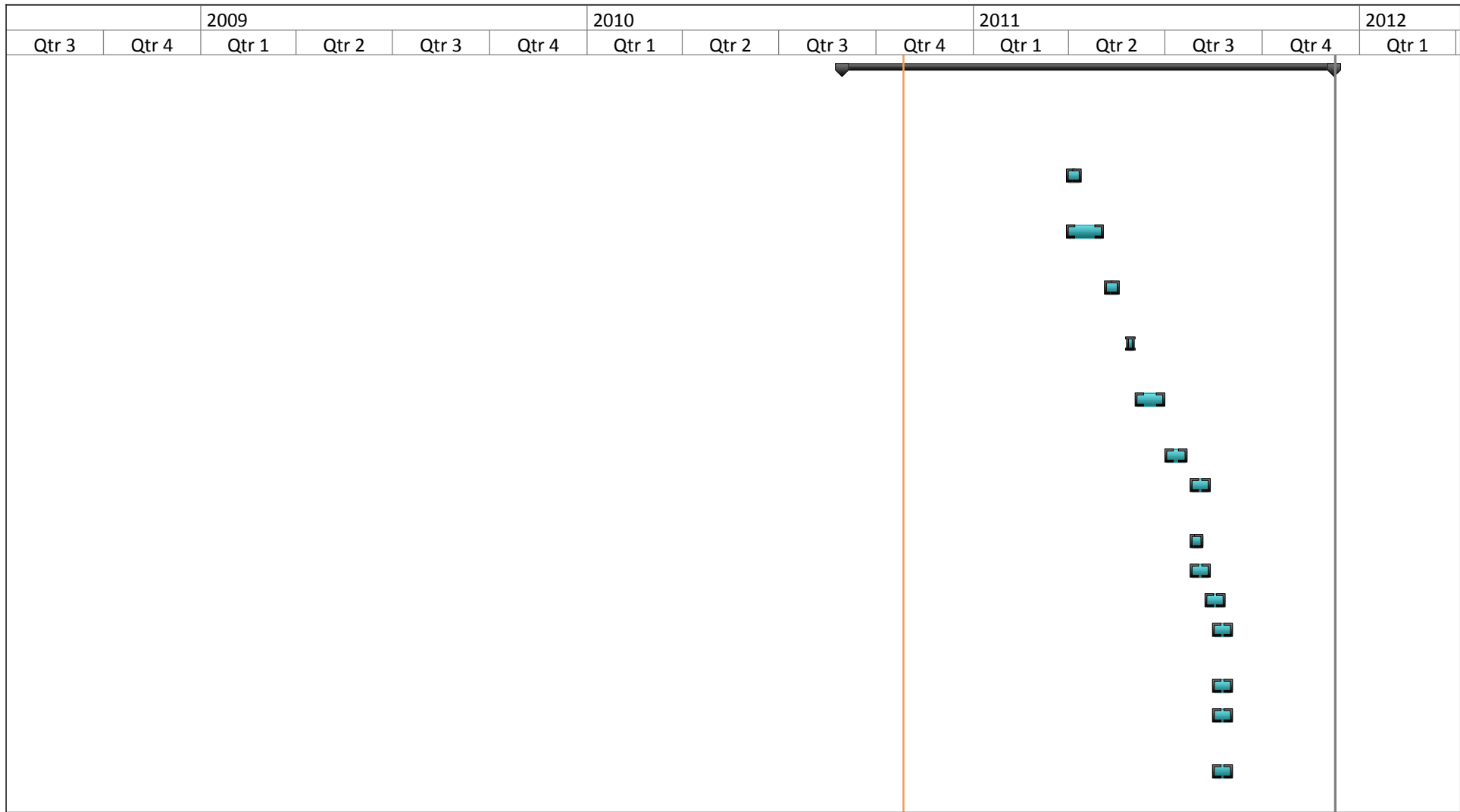


Project: Project schedule.mpp
 Date: Wed 10/27/10

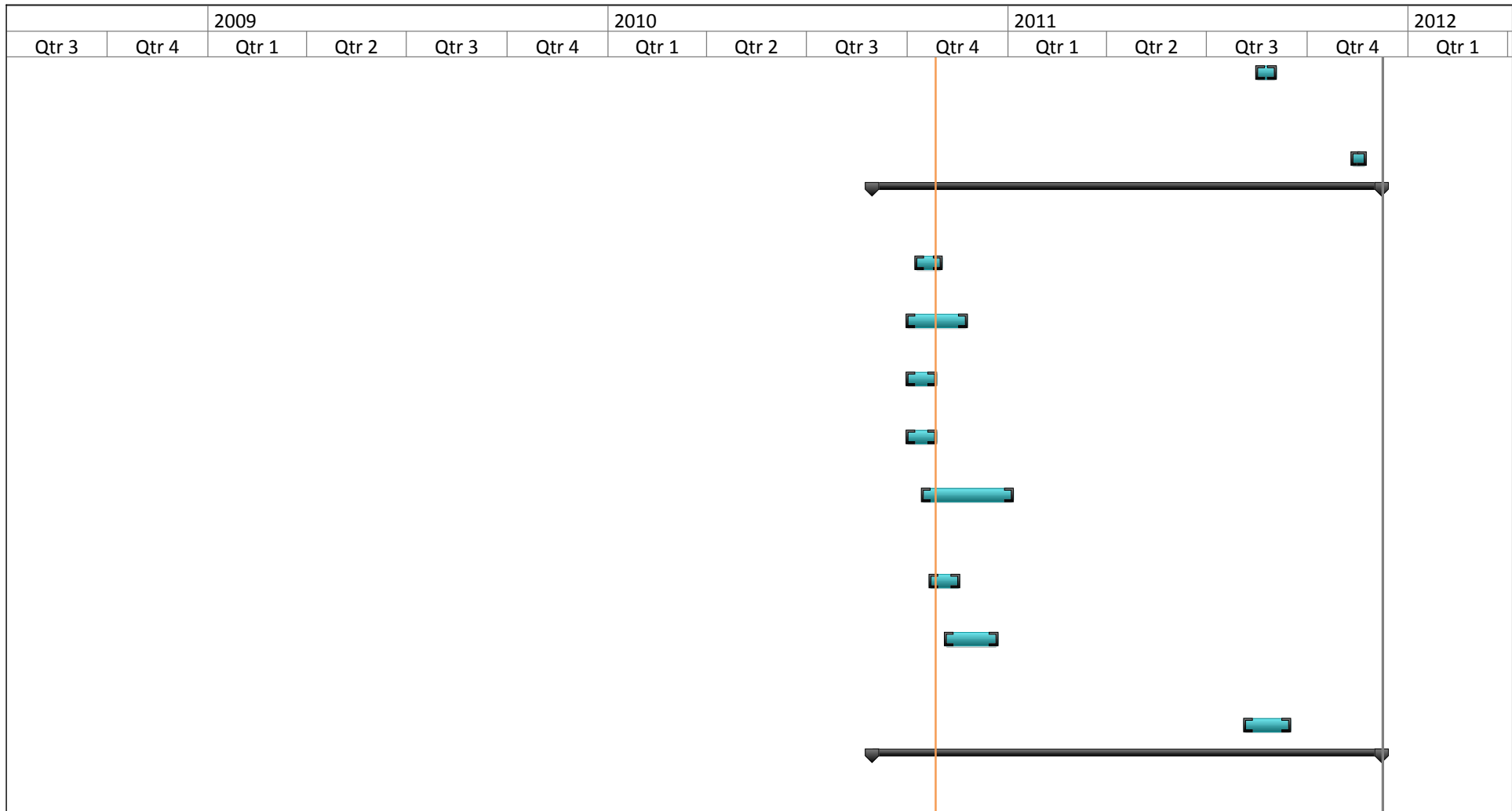
Task		External Milestone		Manual Summary Rollup	
Split		Inactive Task		Manual Summary	
Milestone		Inactive Milestone		Start-only	
Summary		Inactive Summary		Finish-only	
Project Summary		Manual Task		Deadline	
External Tasks		Duration-only		Progress	



Project: Project schedule.mpp Date: Wed 10/27/10	Task		External Milestone		Manual Summary Rollup	
	Split		Inactive Task		Manual Summary	
	Milestone		Inactive Milestone		Start-only	
	Summary		Inactive Summary		Finish-only	
	Project Summary		Manual Task		Deadline	
	External Tasks		Duration-only		Progress	

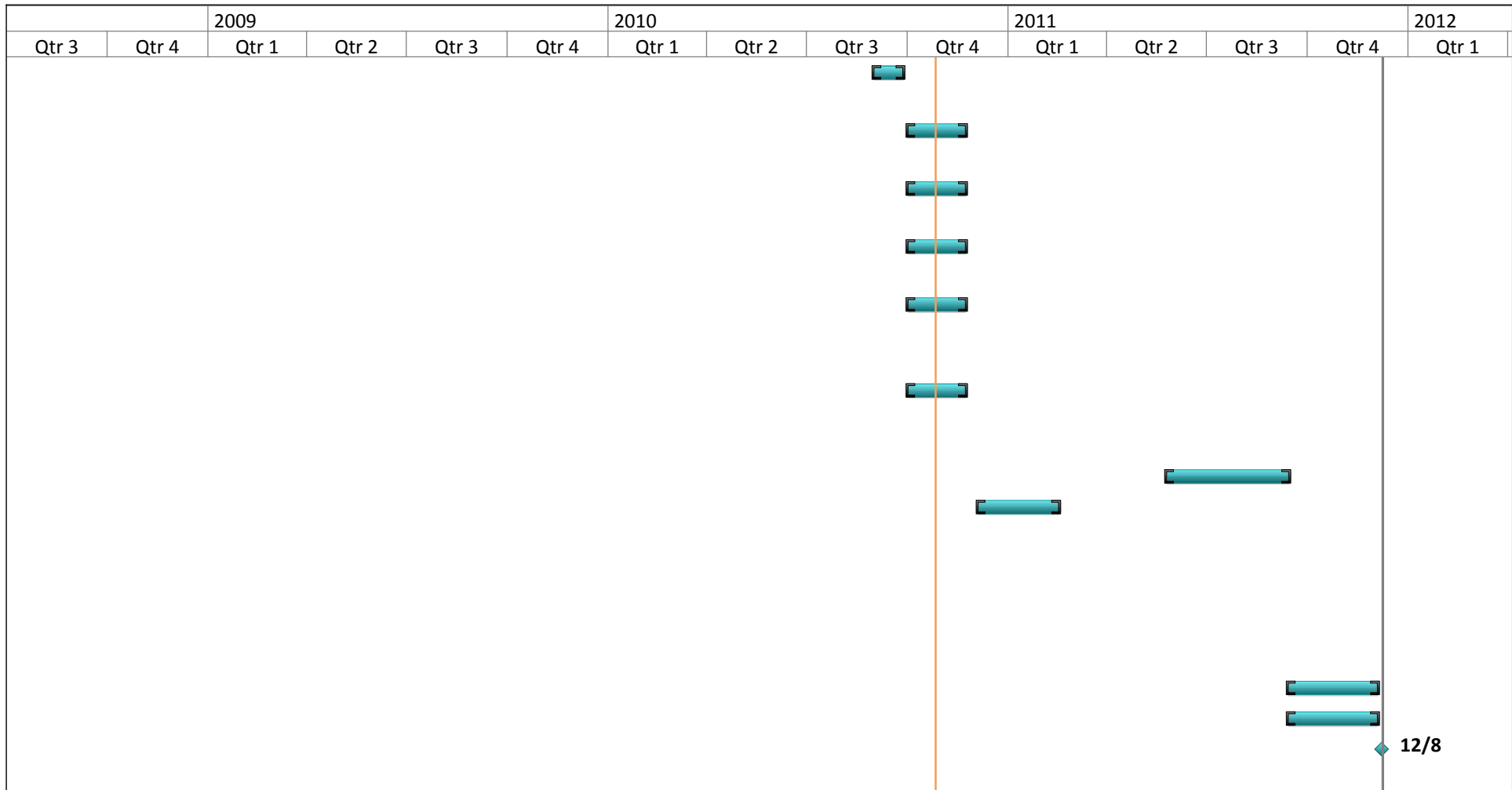




















Project: Project schedule.mpp Date: Wed 10/27/10	Task		External Milestone		Manual Summary Rollup	
	Split		Inactive Task		Manual Summary	
	Milestone		Inactive Milestone		Start-only	
	Summary		Inactive Summary		Finish-only	
	Project Summary		Manual Task		Deadline	
	External Tasks		Duration-only		Progress	



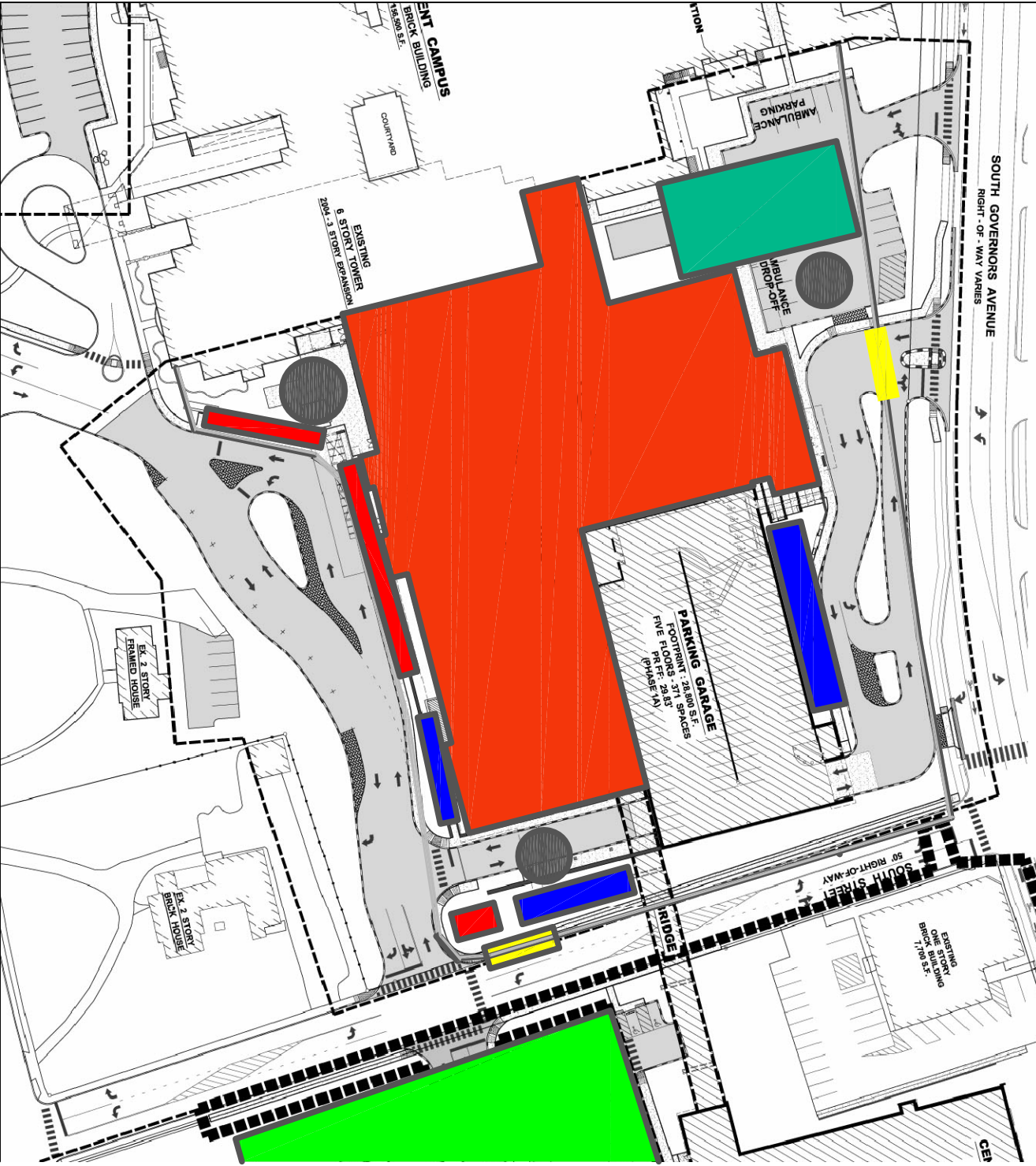
Project: Project schedule.mpp
Date: Wed 10/27/10

Task		External Milestone		Manual Summary Rollup	
Split		Inactive Task		Manual Summary	
Milestone		Inactive Milestone		Start-only	
Summary		Inactive Summary		Finish-only	
Project Summary		Manual Task		Deadline	
External Tasks		Duration-only		Progress	



Project: Project schedule.mpp Date: Wed 10/27/10	Task		External Milestone		Manual Summary Rollup	
	Split		Inactive Task		Manual Summary	
	Milestone		Inactive Milestone		Start-only	
	Summary		Inactive Summary		Finish-only	
	Project Summary		Manual Task		Deadline	
	External Tasks		Duration-only		Progress	

IX. Appendix B – Site Layout Plan



Site plan	Bayhealth Medical Center	Christopher Barron	Available Parking	Building Footprint
Bayhealth Medical Center	Dover, Delaware	Teach 2	Job Trailer Locations	Material Laydown
			Site Storage	
			Site Fence	
			Site Access Points	Crane Locations

X. Appendix C – Detailed Structural Estimate

W18X35		W16X26		W12X16		W27X84	
#	length	#	length	#	length	#	length
2	22	74	31	39	10	8	40
2	26	24	30	15	6	1	28
3	18	25	31	64	3	2	34
10	29	8	25	111	8	2	15
3	25	5	27	2	15	1	45
1	17	14	16	3	18	1	30
11	8	2	12	1	13		
1	15	62	29	15	20		
50	31	8	10	2	9		
2	20	2	14.583	29	30		
20	30	9	15	3	25		
5	4	21	18				
		8	6				
		2	23				
		2	17				
TOTAL LF	2845	TOTAL LF	6920.166	TOTAL LF	2920	TOTAL LF	521
Cost per LF	\$54.65	Cost per LF	\$40.27	Cost per LF	\$36.06	Cost per LF	\$118.56
Total Cost	\$155,479.25	Total Cost	\$278,675.08	Total Cost	\$105,295.20	Total Cost	\$61,769.76

W24X76		W12X40		W8X10		W18X40	
#	length	#	length	#	length	#	length
8	32	6	6	1	10	2	32
4	34			15	6	6	26
1	30			14	3	8	27
4	15			8	2	3	30
1	29			2	10	1	40
				5	8		
				3	5		
				2	15		
TOTAL LF	511	TOTAL LF	36	TOTAL LF	263	TOTAL LF	263
Cost per LF	\$108.03	Cost per LF	\$74.20	Cost per LF	\$22.92	Cost per LF	\$61.15
Total Cost	\$55,203.33	Total Cost	\$2,671.20	Total Cost	\$6,027.96	Total Cost	\$16,082.45

W16X31		W16X20		W14X30		W14X68	
#	length	#	length	#	length	#	length
1	27	4	18	4	6	2	31.417
1	31			1	31.417		
1	17						
TOTAL LF	75	TOTAL LF	72	TOTAL LF	55.417	TOTAL LF	62.834
Cost per LF	\$47.92	Cost per LF	\$40.27	Cost per LF	\$46.42	Cost per LF	\$106.12
Total Cost	\$3,594.00	Total Cost	\$2,899.44	Total Cost	\$2,572.46	Total Cost	\$6,667.94

W12X45		W12X26		W14X22		W36X170	
#	length	length	#	length	#	length	#
1	10	5	8	12	10	1	48
		1	9	2	28		
		13	4	3	8		
				33	25		
				2	15		
				5	14		

TOTAL LF	10	TOTAL LF	101	TOTAL LF	1125	TOTAL LF	48
Cost per LF	\$72.00	Cost per LF	\$41.06	Cost per LF	\$36.06	Cost per LF	\$232.78
Total Cost	\$720.00	Total Cost	\$4,147.06	Total Cost	\$40,567.50	Total Cost	\$11,173.44

W18X50		W18X46		W33X130		W40X167	
#	length	length	length	#	length	#	length
1	29	23	22	1	30	1	22
		1	24	1	20		

TOTAL LF	29	TOTAL LF	530	TOTAL LF	50	TOTAL LF	22
Cost per LF	\$75.05	Cost per LF	\$69.15	Cost per LF	\$179.90	Cost per LF	\$264.96
Total Cost	\$2,176.45	Total Cost	\$36,649.50	Total Cost	\$8,995.00	Total Cost	\$5,829.12

W24X55		W42X53		W14X22		W8X18	
#	length	#	length	#	length	#	length
2	32	1	30	11	25	3	8
2	20			2	15		
7	31			6	6		
6	30			1	8		
1	15			8	10		
1	10			2	8		
59	34			1	12		
2	25			1	28		
1	4			2	11		
1	29						
2	42						
1	36						
TOTAL LF	2753	TOTAL LF	30	TOTAL LF	507	TOTAL LF	24
Cost per LF	\$80.03	Cost per LF	\$80.03	Cost per LF	\$40.33	Cost per LF	\$37.62
Total Cost	\$220,322.59	Total Cost	\$2,400.90	Total Cost	\$20,447.31	Total Cost	\$902.88

W30X116		W24X84		HHS10X4X3/8		W18X50	
#	length	#	length	#	length	#	length
1	28	10	34	2	13.67	6	27
1	40	11	25	2	6	1	20
1	30	1	29	1	9	1	22
				8	35	1	30
				1	25	2	29
				1	14		
TOTAL LF	98	TOTAL LF	644	TOTAL LF	367.34	TOTAL LF	292
Cost per LF	\$160.71	Cost per LF	\$119.23	Cost per LF	\$50.00	Cost per LF	\$75.05
Total Cost	\$15,749.58	Total Cost	\$76,784.12	Total Cost	\$18,367.00	Total Cost	\$21,914.60

W24X103		W18X31		W24X104		W24X117	
#	length	#	length	#	length	#	length
1	31.417	8	25.5	1	15	2	15
				1	3		
TOTAL LF	31.417	TOTAL LF	204	TOTAL LF	18	TOTAL LF	30
Cost per LF	\$160.00	Cost per LF	\$52.00	Cost per LF	\$145.43	Cost per LF	\$163.43
Total Cost	\$5,026.72	Total Cost	\$10,608.00	Total Cost	\$2,617.74	Total Cost	\$4,902.90

W33X118		W30X90		W36X135		W21X62	
length	#	length	#	length	#	length	#
1	34	2	34	1	31	4	31
1	4	2	7-Jan			1	34
		2	18				
		2	40				
		2	8				

TOTAL LF	38	TOTAL LF	215	TOTAL LF	31	TOTAL LF	158
Cost per LF	\$163.64	Cost per LF	\$135.00	Cost per LF	\$186.70	Cost per LF	\$90.05
Total Cost	\$6,218.32	Total Cost	\$29,025.00	Total Cost	\$5,787.70	Total Cost	\$14,227.90

W14X43		W21X55		W16X45		W8X13	
#	length	#	length	#	length	#	length
2	30	1	30	1	32	2	18
9	9						

TOTAL LF	141	TOTAL LF	30	TOTAL LF	32	TOTAL LF	36
Cost per LF	\$64.13	Cost per LF	\$88.00	Cost per LF	\$70.00	Cost per LF	\$27.00
Total Cost	\$9,042.33	Total Cost	\$2,640.00	Total Cost	\$2,240.00	Total Cost	\$972.00

W24X62		W21X44		W24X68		W30X99	
#	length	#	length	#	length	#	length
3	31	7	31	1	45	1	45
4	34	10	30	1	55	1	34
1	33	2	13	2	32		
4	8	1	15	6	8		
1	25	2	29	1	2		
1	10	3	10	1	24		
3	40	9	35	1	31		
1	32	2	18	1	42		
		1	36	4	30		
		2	42	2	38		
		5	28	1	40		
		1	16				
		1	27				
		2	20				
TOTAL LF	481	TOTAL LF	1340	TOTAL LF	547	TOTAL LF	90
Cost per LF	\$89.53	Cost per LF	\$65.86	Cost per LF	\$97.53	Cost per LF	\$138.51
Total Cost	\$43,063.93	Total Cost	\$88,252.40	Total Cost	\$53,348.91	Total Cost	\$12,465.90

W12X19		W24X76		W27X84		W21X50	
#	length	#	length	#	length	#	length
1	6	2	34	3	34	10	21
16	3	1	30	1	30	2	25
5	12	1	26			7	29
1	9	1	31			2	34
2	10						
1	2						
1	8						
TOTAL LF	153	TOTAL LF	155	TOTAL LF	132	TOTAL LF	531
Cost per LF	\$36.06	Cost per LF	\$108.03	Cost per LF	\$118.56	Cost per LF	\$73.86
Total Cost	\$5,517.18	Total Cost	\$16,744.65	Total Cost	\$15,649.92	Total Cost	\$39,219.66

HHS12X4X3/8		W18X16		W12X30		W12X14	
#	length	#	length	#	length	#	length
1	8	1	7	2	10	4	2
2	38					4	10
						3	4
						4	8
						39	3
TOTAL LF	84	TOTAL LF	7	TOTAL LF	20	TOTAL LF	209
Cost per LF	\$52.00	Cost per LF	\$45.00	Cost per LF	\$52.00	Cost per LF	\$25.21
Total Cost	\$4,368.00	Total Cost	\$315.00	Total Cost	\$1,040.00	Total Cost	\$5,268.89

W14X38		W36X135		W21X48		W30X108	
length	#	length	#	#	length	#	length
1	15	1	31	2	30	3	30
				1	8	3	36
						2	45

TOTAL LF	15	TOTAL LF	31	TOTAL LF	68	TOTAL LF	288
Cost per LF	\$53.00	Cost per LF	\$186.70	Cost per LF	\$72.00	Cost per LF	\$150.51
Total Cost	\$795.00	Total Cost	\$5,787.70	Total Cost	\$4,896.00	Total Cost	\$43,346.88

W8X15		W21X68		W14X22	
#	length	#	length	#	length
2	10	1	32	1	25

TOTAL LF	20	TOTAL LF	32	TOTAL LF	25
Cost per LF	\$29.57	Cost per LF	\$98.05	Cost per LF	\$38.00
Total Cost	\$591.40	Total Cost	\$3,137.60	Total Cost	\$950.00

Cloumn #		Designation	Length	Cost Per LF	Total
H	2.7	W10X49	32	66.00	2,112.00
H	3	W10X33	32	60.00	1,920.00
H	4	W10X39	28.4	65.00	1,846.00
H	5	W14X90	63.42	120.00	7,610.40
H	5.8	W14X109	63.42	150.00	9,513.00
H	6.9	W14X120	13.4	166.02	2,224.67
H		W14X109	50	150.00	7,500.00
H	8	W14X120	13.4	166.02	2,224.67
H		W14X109	50	150.00	7,500.00
H	9	W14X120	13.4	166.02	2,224.67
H		W14X109	50	150.00	7,500.00
H	10	W14X120	13.4	166.02	2,224.67
H		W14X109	50	150.00	7,500.00
H	11	W14X120	13.4	166.02	2,224.67
H		W14X109	50	150.00	7,500.00
H	12	W14X120	13.4	166.02	2,224.67
H		W14X109	50	150.00	7,500.00
H	13	W14X120	32	166.02	5,312.64
H	14	W14X120	32	166.02	5,312.64
H	15	W14X120	16	166.02	2,656.32
H		W14X109	50	150.00	7,500.00
J	2.7	W10X49	32	66.00	2,112.00
J	3	W10X45	32	65.59	2,098.88
J	4	W10X54	28.4	72.00	2,044.80
J	5	W14X342	13.4	570.00	7,638.00
J		W14X233	50	320.00	16,000.00
J	5.8	W14X176	63.42	240.33	15,241.73
J	6.9	W14X193	13.4	260.73	3,493.78
J		W14X176	50	240.33	12,016.50
J	8	W14X159	13.4	220.30	2,952.02
J		W14X233	50	320.00	16,000.00
J	9	W14X342	13.4	570.00	7,638.00
J		W14X233	50	320.00	16,000.00
J	10	W14X193	13.4	260.73	3,493.78
J		W14X159	50	220.30	11,015.00
J	11	W14X342	13.4	570.00	7,638.00
J		W14X211	50	314.70	15,735.00
J	12	W14X145	50	215.81	10,790.50
J	13	W14X159	50	233.70	11,685.00
J	14	W14X398	13.4	610.20	8,176.68
J		W14X342	50	570.00	28,500.00
J	15	W14X176	13.4	240.33	3,220.42
J		W14X120	50	166.02	8,301.00
J.4	2.5	W10X23	13.4	52.30	700.82

Cloumn #		Designation	Length	Cost Per LF	Total
K	4	W10X49	28.4	66.00	1,874.40
K	5	W14X342	13.4	570.00	7,638.00
K		W14X233	50	320.00	16,000.00
K	5.8	W14X176	63.42	63.42	4,022.10
K	6.9	W14X176	63.42	63.42	4,022.10
K	8	W14X159	13.4	220.30	2,952.02
K		W14X145	50	215.81	10,790.50
K	9	W14X342	13.4	570.00	7,638.00
K		W14X233	50	320.00	16,000.00
K	10	W14X193	13.4	260.73	3,493.78
K		W14X159	50	220.30	11,015.00
K	11	W14X342	13.4	570.00	7,638.00
K		W14X211	50	314.70	15,735.00
K	12	W14X145	32	215.81	6,905.92
K	13	W14X159	32	220.30	7,049.60
K	14	W14X398	7.40	610.20	4,515.48
K		W14X342	50	570.00	28,500.00
K	15	W14X176	7.4	63.42	469.31
K		W14X120	50	166.02	8,301.00
K.3	2.5	W10X33	13.4	60.00	804.00
K.3	3	W10X33	13.4	60.00	804.00
L	3	W10X33	13.4	60.00	804.00
L	4	W10X49	27	66.00	1,782.00
L	5	W14X90	63.42	63.42	4,022.10
L	5.8	W14X120	13.4	166.02	2,224.67
L		W14w109	50	150.00	7,500.00
L	6.9	W14X176	63.42	240.33	15,241.73
L	8	W14X132	13.4	170.65	2,286.71
L		W14X109	50	150.00	7,500.00
L	9	W14X145	13.4	215.18	2,883.41
L		W14X109	50	150.00	7,500.00
L	10	W14X132	13.4	170.65	2,286.71
L		W14X109	50	150.00	7,500.00
L	11	W14X132	13.4	170.65	2,286.71
L		W14X109	50	150.00	7,500.00
L	12	W14X120	32	166.02	5,312.64
L	13	W14X120	32	166.02	5,312.64
L	14	W14X145	7.4	215.18	1,592.33
L		W14X132	50	170.65	8,532.50
L	15	W14X145	7.4	215.18	1,592.33
L		W14X109	50	150.00	7,500.00
L	15.2	W14X61	57.4	81.53	4,679.82
L.1	2.5	W10W30	13.4	54.32	727.89

Cloumn #		Designation	Length	Cost Per LF	Total
M	2.6	W10X33	13.4	60.00	804.00
M	3	W10X33	13.4	60.00	804.00
M	4	W10X33	13.4	60.00	804.00
M	5	W12X40	28.4	68.58	1,947.67
M	5.8	W12X40	50	68.58	3,429.00
M	6.9	W12X45	50	64.90	3,245.00
M	8	W12X87	33	121.86	4,021.38
M	9	W12X87	33	121.86	4,021.38
M	10	W12X87	33	121.86	4,021.38
M	11	W12X87	33	121.86	4,021.38
M	12	W12X87	33	121.86	4,021.38
M	13	W12X87	33	121.86	4,021.38
M	14	W12X87	43	121.86	5,239.98
N	5	W12X96	38	143.40	5,449.20
N	5.8	W12X96	38	143.40	5,449.20
N	6.9	W12X96	38	143.40	5,449.20
N	8	W12X96	38	143.40	5,449.20
O	5	W10X33	13.4	60.00	804.00
O	5.7	W10X33	13.4	60.00	804.00
O	6.3	W10X33	13.4	60.00	804.00

PILECAPS SCHEDULE						
Type	#	Length (ft)	Width(ft)	Depth(ft)	Volume(CY)	total CY
P1	9	3.00	3.00	3.50	1.17	10.50
P2	22	7.33	4.00	3.50	3.80	83.62
P3	4	7.33	6.92	3.50	6.57	26.29
P3B	1	10.67	3.33	4.00	5.26	5.26
P4	5	7.33	7.33	3.50	6.96	34.82
P5	9	8.75	8.75	4.50	12.76	114.84
P6	9	10.67	7.33	4.50	13.04	117.32
P7	2	10.67	9.83	4.50	17.48	34.96
P8	2	10.67	9.83	5.00	19.42	38.85
P12	2	14.00	10.67	5.00	27.66	55.33
P13	2	15.33	11.33	5.00	32.16	64.33
P21	1	16.50	16.50	6.00	60.50	60.50
P23	3	17.33	16.50	6.00	63.54	190.63
				Total CY	837.25	
				Cost per CY	\$279.86	
				TOTAL COST	\$234,311.93	

XI. Appendix D – General Conditions Estimate

	Unit	Cost	quantity	total
Project Executive	month	2,300.00	1	340,400.00
Construction Manager	month	2,000.00	1	296,000.00
Superintendent	month	1,700.00	1	251,600.00
project Manager	month	1,850.00	3	821,400.00
Project Engineer	month	865.00	2	256,040.00
Scheduler	month	1,005.00	1	148,740.00
Secretary	month	365.00	1	54,020.00
fenceing	month	1,000.00	35	148,000.00
Facilities/Equipment	month	853.00	35	126,244.00
dumpsters	week	750.00	148	111,000.00
Occupancy Permit	LS	paid by owner	1	paid by owner
Geotechnical report	LS	\$3,664.00	1	\$3,664.00
Documents	LS	\$35,000.00	1	\$35,000.00
Clean-up expenses	month	\$600.00	1	\$88,800.00
Bonding	% Contract	\$570,500.00	1	\$570,500.00
temp utilities	N/A	paid by owner	N/A	paid by owner
portable toliets	week	\$150.00	8	\$177,600.00
contingency	% Contract	\$5,273,294.00	1	\$5,273,294.00
Construction Manager Fee	N/A	Included In bid	N/A	Included In bid
Construction Manager Liability Insurance	N/A	Included In bid	N/A	Included In bid
Design Development Contingency	N/A	paid by owner	N/A	paid by owner

TOTAL 8,702,302.00