ARNE KVINNESLAND | CONSTRUCTION MANAGEMENT

Technical Report #2

Cost and Schedule Analysis

Advisor: Chris Magent

10/28/2009

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Executive Summary

Technical Report #2 contains analysis information which builds on the schedule and cost summary done in Technical Report #1. A detailed schedule is provided which will be cost loaded in the future and used to find cost and time savings for the project. A detailed structural systems estimate and general conditions estimate were done to provide a basis from which to build on in the future to find areas where savings can be found for the project. A site plan for the superstructure phase of construction was done and analyzed to give a better understanding of one of the critical phases of construction for the Army National Guard Readiness Center. Finally, a brief summary of the October 2009 Partnership for Achieving Construction Excellence Conference in State College, PA provides insight into the various sessions and what kind of information was provided and discussed.

The project schedule is an expansion of the brief schedule summary that was done in Technical Report #1. It was expanded to look take a more detailed look at some specific construction phases, in this case Shoring and Excavation, Structural Framing, Interior Fitout, and Exterior Systems. The interior fitout construction sequences are very repetitive throughout the entire building, so if savings can be found in one small area it can be extrapolated across 8 stories and produce significant time and cost savings for the project.

The detailed structural estimate breaks down unit prices for material, labor, and equipment for each piece of the structural system. The takeoffs were done by calculating amounts of each material in a typical pay and extrapolating that bay across the entire building. This produced a resultant $7,026,847.00 for the superstructure.

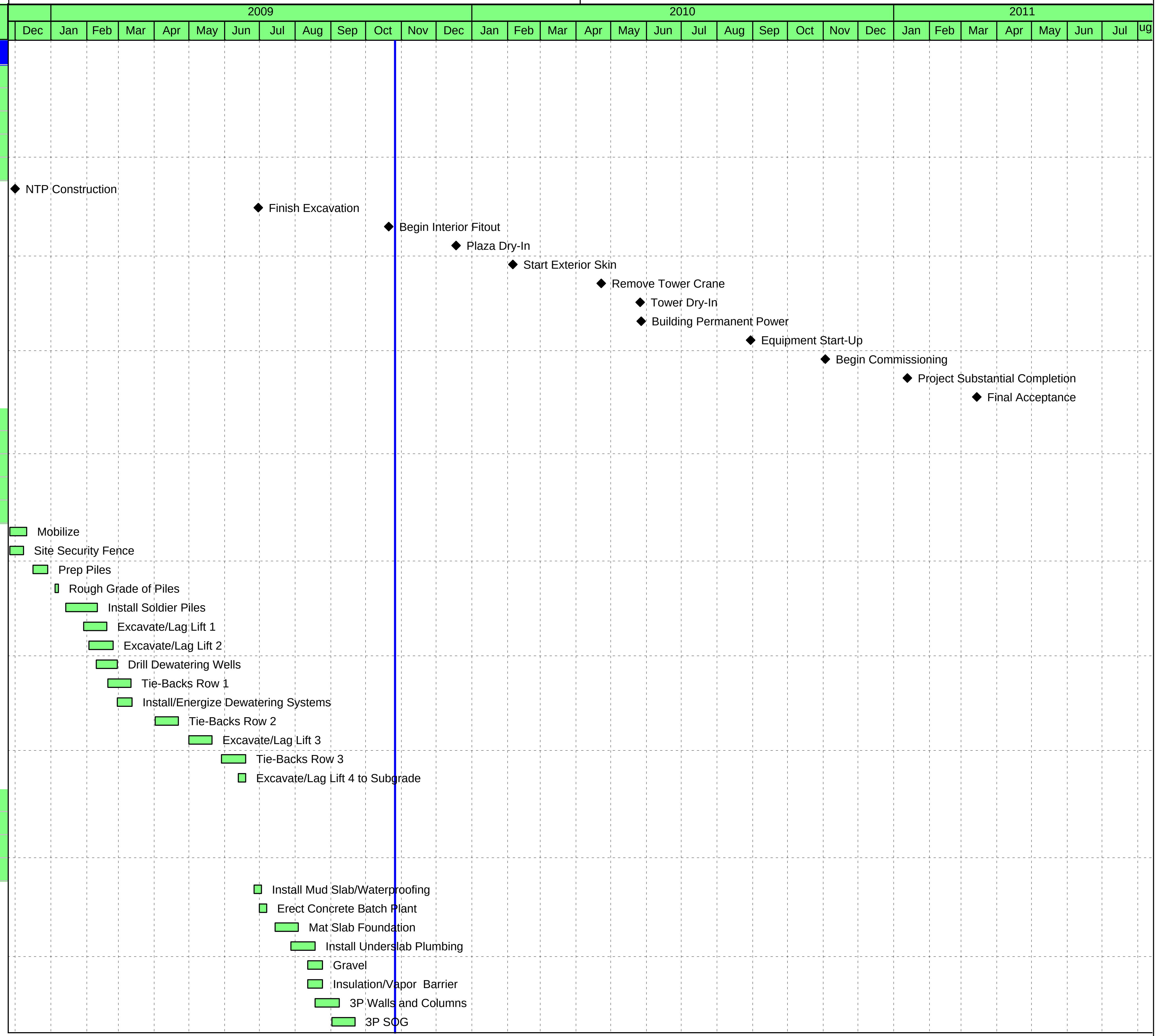
The general conditions estimate shows costs per month of the various general conditions items. Once the schedule becomes cost loaded and time savings are calculated, a change in the general conditions estimate will result from a change in schedule. The overall analysis for general conditions gave $8,219,052.00 total or $293,180.33 per month.

The information sessions at the PACE conference which were of most interest to me were those concerning Building Information Modeling (BIM) and how it is being used in the industry today. The way BIM is taught in the classroom is not the way that it's being used in the industry and trying to discover where the discrepancies lie and why the occur is something that I believe is very important and will become increasingly important as BIM use progresses in the industry.

Detailed Project Schedule

A detailed project schedule was created by expanding on the summary schedule given in Tech Report #1. This schedule with be used for cost loading in an upcoming Technical Report and is intended to analyze specific construction sequences that can be looked at for time and cost saving opportunities. This schedule below, in particular, looks at the repetitive interior fitout sequence throughout all of the floors in the building. If time can be saved anywhere in that sequence it can be extrapolated throughout the entire building and make a significant impact on the schedule.

Activity ID	Activity Name	Original Duration	Start	Finish
Army National Guard Readiness Center		598	26-Nov-08	14-Mar-11
Milestone		595	01-Dec-08	14-Mar-11
Excavation		595	01-Dec-08	14-Mar-11
Concrete Frame		595	01-Dec-08	14-Mar-11
Exterior Curtainwall		595	01-Dec-08	14-Mar-11
3Pb		595	01-Dec-08	14-Mar-11
A1020	NTP Construction	0	01-Dec-08	
A1070	Finish Excavation	0		29-Jun-09
A1110	Begin Interior Fitout	0	21-Oct-09	
A1150	Plaza Dry-In	0		18-Dec-09
A1190	Start Exterior Skin	0	05-Feb-10	
A1810	Remove Tower Crane	0		23-Apr-10
A1200	Tower Dry-In	0		26-May-10
A1210	Building Permanent Power	0	27-May-10	
A1220	Equipment Start-Up	0	30-Aug-10	
A1230	Begin Commissioning	0	03-Nov-10	
A1250	Project Substantial Completion	0		13-Jan-11
A1260	Final Acceptance	0		14-Mar-11
No Project Milestone		568	26-Nov-08	28-Jan-11
Excavation		147	26-Nov-08	18-Jun-09
No Concrete Frame		147	26-Nov-08	18-Jun-09
No Exterior		147	26-Nov-08	18-Jun-09
No Interior		147	26-Nov-08	18-Jun-09
A1000	Mobilize	12	26-Nov-08	11-Dec-08
A1010	Site Security Fence	9	26-Nov-08	08-Dec-08
A1030	Prep Piles	10	16-Dec-08	29-Dec-08
A1270	Rough Grade of Piles	3	05-Jan-09	07-Jan-09
A1280	Install Soldier Piles	20	14-Jan-09	10-Feb-09
A1290	Excavate/Lag Lift 1	15	29-Jan-09	18-Feb-09
A1300	Excavate/Lag Lift 2	15	03-Feb-09	23-Feb-09
A1310	Drill Dewatering Wells	15	09-Feb-09	27-Feb-09
A1320	Tie-Backs Row 1	15	19-Feb-09	11-Mar-09
A1330	Install/Energize Dewatering Systems	10	27-Feb-09	12-Mar-09
A1340	Tie-Backs Row 2	15	01-Apr-09	21-Apr-09
A1350	Excavate/Lag Lift 3	15	30-Apr-09	20-May-09
A1360	Tie-Backs Row 3	15	29-May-09	18-Jun-09
A1370	Excavate/Lag Lift 4 to Subgrade	5	12-Jun-09	18-Jun-09
No Shoring and Excavation		416	26-Jun-09	28-Jan-11
Concrete Frame		211	26-Jun-09	16-Apr-10
No Exterior		211	26-Jun-09	16-Apr-10
No Interior		211	26-Jun-09	16-Apr-10
A1380	Install Mud Slab/Waterproofing	5	26-Jun-09	02-Jul-09
A1390	Erect Concrete Batch Plant	5	30-Jun-09	06-Jul-09
A1400	Mat Slab Foundation	15	14-Jul-09	03-Aug-09
A1410	Install Underslab Plumbing	15	28-Jul-09	17-Aug-09
A1420	Gravel	10	11-Aug-09	24-Aug-09
A1430	Insulation/Vapor Barrier	10	11-Aug-09	24-Aug-09
A1440	3P Walls and Columns	15	18-Aug-09	07-Sep-09
A1450	3P SOG	15	01-Sep-09	21-Sep-09



Actual Work | Critical Remaining Work | Remaining Work | ◆ Milestone

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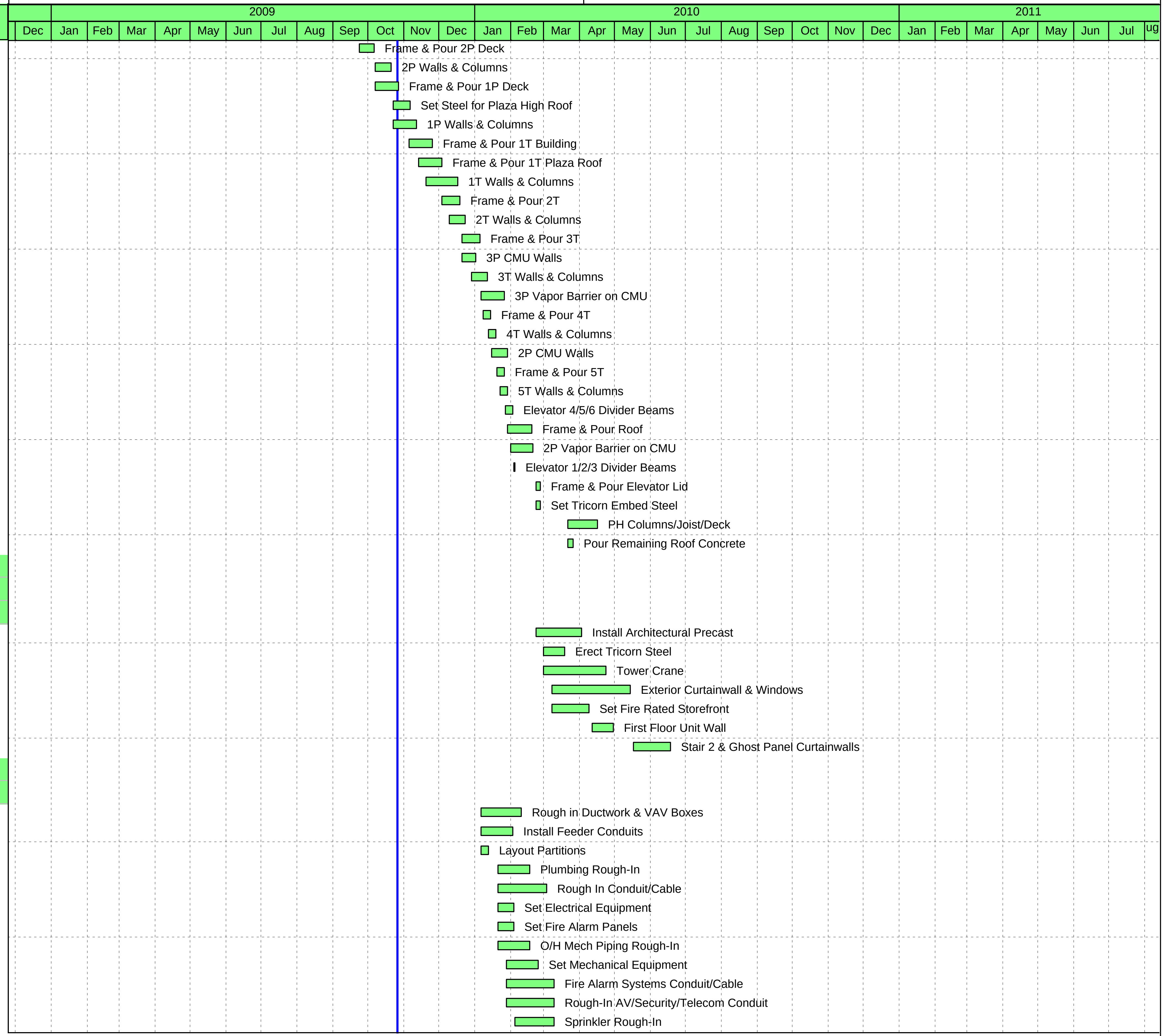
Schedule supplied by Tompkins Builders, Inc. Edited by Arne Kvinnesland

Activity ID	Activity Name	Original Duration	Start	Finish
A1460	Frame & Pour 2P Deck	10	23-Sep-09	06-Oct-09
A1470	2P Walls & Columns	10	07-Oct-09	20-Oct-09
A1490	Frame & Pour 1P Deck	15	07-Oct-09	27-Oct-09
A1480	Set Steel for Plaza High Roof	12	22-Oct-09	06-Nov-09
A1500	1P Walls & Columns	15	22-Oct-09	11-Nov-09
A1510	Frame & Pour 1T Building	15	05-Nov-09	25-Nov-09
A1520	Frame & Pour 1T Plaza Roof	15	13-Nov-09	03-Dec-09
A1530	1T Walls & Columns	20	20-Nov-09	17-Dec-09
A1540	Frame & Pour 2T	12	03-Dec-09	18-Dec-09
A1550	2T Walls & Columns	10	10-Dec-09	23-Dec-09
A1560	Frame & Pour 3T	12	21-Dec-09	05-Jan-10
A1570	3P CMU Walls	10	21-Dec-09	01-Jan-10
A1580	3T Walls & Columns	10	29-Dec-09	11-Jan-10
A1590	3P Vapor Barrier on CMU	15	06-Jan-10	26-Jan-10
A1600	Frame & Pour 4T	5	08-Jan-10	14-Jan-10
A1610	4T Walls & Columns	5	12-Jan-10	18-Jan-10
A1620	2P CMU Walls	10	15-Jan-10	28-Jan-10
A1630	Frame & Pour 5T	5	20-Jan-10	26-Jan-10
A1640	5T Walls & Columns	5	22-Jan-10	28-Jan-10
A1650	Elevator 4/5/6 Divider Beams	5	27-Jan-10	02-Feb-10
A1660	Frame & Pour Roof	15	29-Jan-10	18-Feb-10
A1670	2P Vapor Barrier on CMU	15	01-Feb-10	19-Feb-10
A1680	Elevator 1/2/3 Divider Beams	2	03-Feb-10	04-Feb-10
A1690	Frame & Pour Elevator Lid	5	22-Feb-10	26-Feb-10
A1700	Set Tricorn Embed Steel	5	22-Feb-10	26-Feb-10
A1720	PH Columns/Joist/Deck	20	22-Mar-10	16-Apr-10
A1730	Pour Remaining Roof Concrete	5	22-Mar-10	26-Mar-10
No Concrete Frame		278	06-Jan-10	28-Jan-11
Exterior Curtainwall		85	22-Feb-10	18-Jun-10
No Interior		85	22-Feb-10	18-Jun-10
A1740	Install Architectural Precast	30	22-Feb-10*	02-Apr-10
A1710	Erect Tricorn Steel	15	01-Mar-10	19-Mar-10
A1750	Tower Crane	40	01-Mar-10*	23-Apr-10
A1760	Exterior Curtainwall & Windows	50	08-Mar-10	14-May-10
A1770	Set Fire Rated Storefront	25	08-Mar-10	09-Apr-10
A1780	First Floor Unit Wall	15	12-Apr-10	30-Apr-10
A1800	Stair 2 & Ghost Panel Curtainwalls	25	17-May-10	18-Jun-10
No Exterior		278	06-Jan-10	28-Jan-11
3Pb		205	06-Jan-10	19-Oct-10
A1790	Rough in Ductwork & VAV Boxes	25	06-Jan-10	09-Feb-10
A1820	Install Feeder Conduits	20	06-Jan-10	02-Feb-10
A1830	Layout Partitions	5	06-Jan-10	12-Jan-10
A1840	Plumbing Rough-In	20	21-Jan-10	17-Feb-10
A1850	Rough In Conduit/Cable	30	21-Jan-10	03-Mar-10
A1860	Set Electrical Equipment	10	21-Jan-10	03-Feb-10
A1870	Set Fire Alarm Panels	10	21-Jan-10	03-Feb-10
A1880	O/H Mech Piping Rough-In	20	21-Jan-10	17-Feb-10
A1890	Set Mechanical Equipment	20	28-Jan-10	24-Feb-10
A1900	Fire Alarm Systems Conduit/Cable	30	28-Jan-10	10-Mar-10
A1910	Rough-In AV/Security/Telecom Con...	30	28-Jan-10	10-Mar-10
A1920	Sprinkler Rough-In	25	04-Feb-10	10-Mar-10



Actual Work | Critical Remaining Work
Remaining Work ◆ | ◆ Milestone

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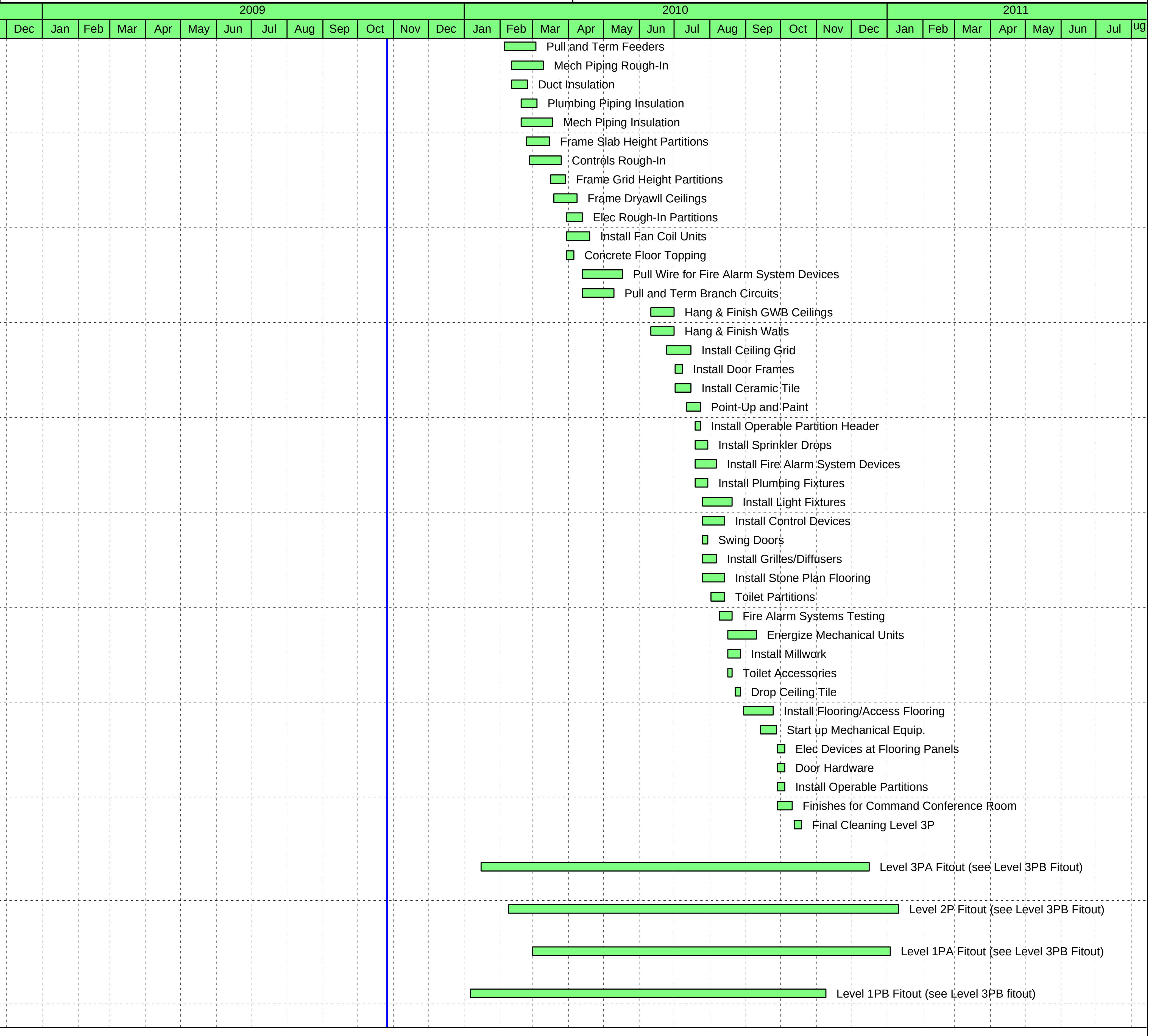
Schedule supplied by Tompkins Builders, Inc. Edited by Arne Kvinnesland

Activity ID	Activity Name	Original Duration	Start	Finish
A1930	Pull and Term Feeders	20	04-Feb-10	03-Mar-10
A1940	Mech Piping Rough-In	20	11-Feb-10	10-Mar-10
A1950	Duct Insulation	10	11-Feb-10	24-Feb-10
A1960	Plumbing Piping Insulation	10	19-Feb-10	04-Mar-10
A1970	Mech Piping Insulation	20	19-Feb-10	18-Mar-10
A1980	Frame Slab Height Partitions	15	23-Feb-10	15-Mar-10
A1990	Controls Rough-In	20	26-Feb-10	25-Mar-10
A2000	Frame Grid Height Partitions	10	16-Mar-10	29-Mar-10
A2010	Frame Drywall Ceilings	15	19-Mar-10	08-Apr-10
A2020	Elec Rough-In Partitions	10	30-Mar-10	12-Apr-10
A2030	Install Fan Coil Units	15	30-Mar-10	19-Apr-10
A2040	Concrete Floor Topping	5	30-Mar-10	05-Apr-10
A2050	Pull Wire for Fire Alarm System De...	25	13-Apr-10	17-May-10
A2060	Pull and Term Branch Circuits	20	13-Apr-10	10-May-10
A2070	Hang & Finish GWB Ceilings	15	11-Jun-10	01-Jul-10
A2080	Hang & Finish Walls	15	11-Jun-10	01-Jul-10
A2090	Install Ceiling Grid	15	25-Jun-10	15-Jul-10
A2100	Install Door Frames	5	02-Jul-10	08-Jul-10
A2110	Install Ceramic Tile	10	02-Jul-10	15-Jul-10
A2120	Point-Up and Paint	10	12-Jul-10	23-Jul-10
A2130	Install Operable Partition Header	5	19-Jul-10	23-Jul-10
A2140	Install Sprinkler Drops	10	19-Jul-10	30-Jul-10
A2150	Install Fire Alarm System Devices	15	19-Jul-10	06-Aug-10
A2160	Install Plumbing Fixtures	10	19-Jul-10	30-Jul-10
A2170	Install Light Fixtures	20	26-Jul-10	20-Aug-10
A2180	Install Control Devices	15	26-Jul-10	13-Aug-10
A2190	Swing Doors	5	26-Jul-10	30-Jul-10
A2200	Install Grilles/Diffusers	10	26-Jul-10	06-Aug-10
A2210	Install Stone Plan Flooring	15	26-Jul-10	13-Aug-10
A2220	Toilet Partitions	10	02-Aug-10	13-Aug-10
A2230	Fire Alarm Systems Testing	10	09-Aug-10	20-Aug-10
A2240	Energize Mechanical Units	20	16-Aug-10	10-Sep-10
A2250	Install Millwork	10	16-Aug-10	27-Aug-10
A2260	Toilet Accessories	5	16-Aug-10	20-Aug-10
A2270	Drop Ceiling Tile	5	23-Aug-10	27-Aug-10
A2280	Install Flooring/Access Flooring	20	30-Aug-10	24-Sep-10
A2290	Start up Mechanical Equip.	10	14-Sep-10	27-Sep-10
A2300	Elec Devices at Flooring Panels	5	28-Sep-10	04-Oct-10
A2310	Door Hardware	5	28-Sep-10	04-Oct-10
A2320	Install Operable Partitions	5	28-Sep-10	04-Oct-10
A2330	Finishes for Command Conference ...	10	28-Sep-10	11-Oct-10
A2340	Final Cleaning Level 3P	5	13-Oct-10	19-Oct-10
3Pa		240	15-Jan-10	16-Dec-10
A2350	Level 3PA Fitout (see Level 3PB Fit...	240	15-Jan-10	16-Dec-10
2P		242	08-Feb-10	11-Jan-11
A2360	Level 2P Fitout (see Level 3PB Fitout)	242	08-Feb-10	11-Jan-11
1Pa		221	01-Mar-10	03-Jan-11
A2380	Level 1PA Fitout (see Level 3PB Fit...	221	01-Mar-10	03-Jan-11
1Pb		220	06-Jan-10	09-Nov-10
A2370	Level 1PB Fitout (see Level 3PB fit...	220	06-Jan-10	09-Nov-10
1T		206	29-Mar-10	10-Jan-11



Actual Work | Critical Remaining Work
Remaining Work ◆ | ◆ Milestone

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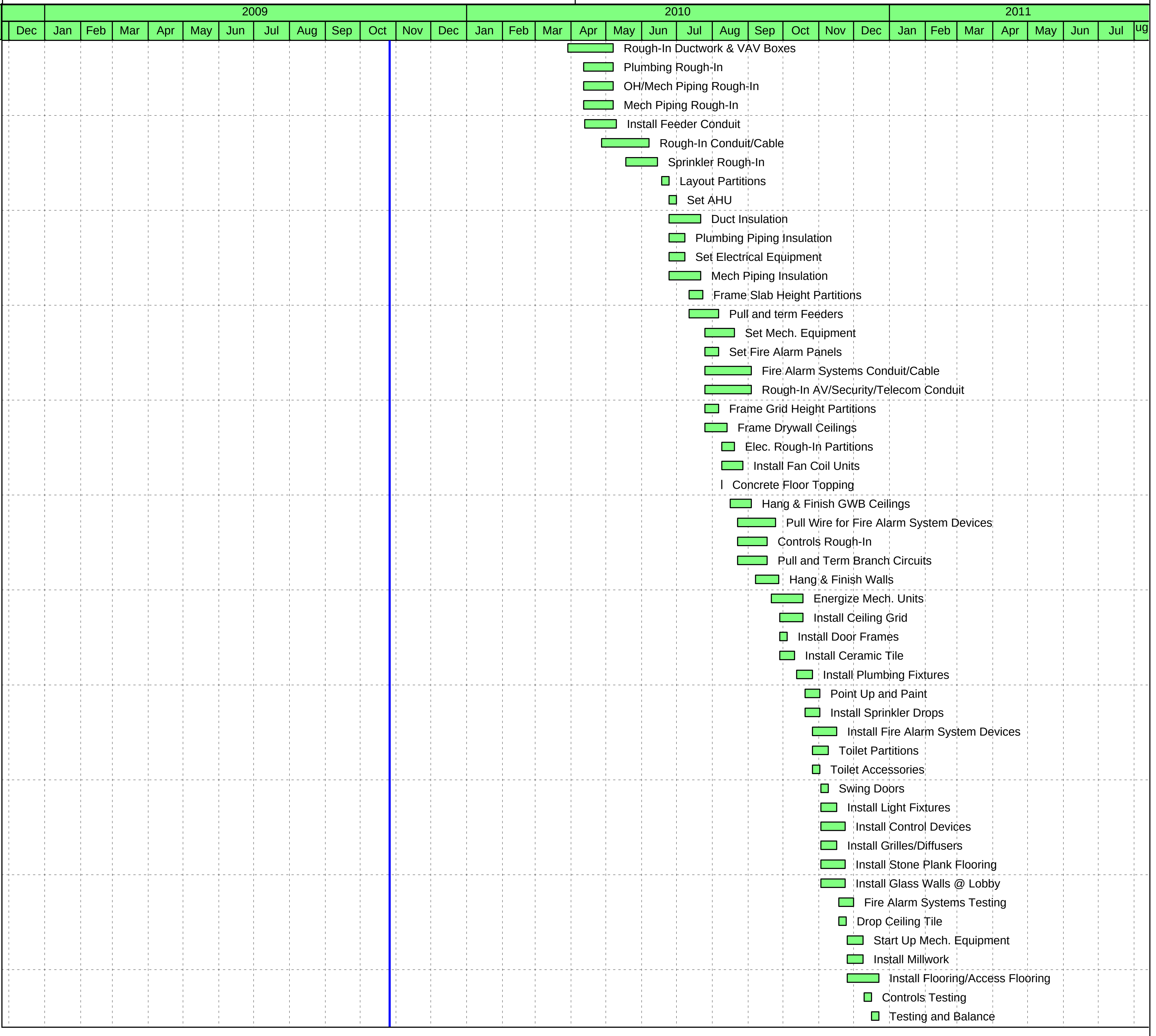
Activity ID	Activity Name	Original Duration	Start	Finish
A2390	Rough-In Ductwork & VAV Boxes	30	29-Mar-10	07-May-10
A2400	Plumbing Rough-In	20	12-Apr-10	07-May-10
A2410	OH/Mech Piping Rough-In	20	12-Apr-10	07-May-10
A2420	Mech Piping Rough-In	20	12-Apr-10	07-May-10
A2430	Install Feeder Conduit	20	13-Apr-10	10-May-10
A2440	Rough-In Conduit/Cable	30	27-Apr-10	07-Jun-10
A2450	Sprinkler Rough-In	20	18-May-10	14-Jun-10
A2460	Layout Partitions	5	18-Jun-10	24-Jun-10
A2470	Set AHU	5	25-Jun-10	01-Jul-10
A2480	Duct Insulation	20	25-Jun-10	22-Jul-10
A2490	Plumbing Piping Insulation	10	25-Jun-10	08-Jul-10
A2500	Set Electrical Equipment	10	25-Jun-10	08-Jul-10
A2510	Mech Piping Insulation	20	25-Jun-10	22-Jul-10
A2520	Frame Slab Height Partitions	10	12-Jul-10	23-Jul-10
A2530	Pull and term Feeders	20	12-Jul-10	06-Aug-10
A2540	Set Mech. Equipment	20	26-Jul-10	20-Aug-10
A2550	Set Fire Alarm Panels	10	26-Jul-10	06-Aug-10
A2560	Fire Alarm Systems Conduit/Cable	30	26-Jul-10	03-Sep-10
A2570	Rough-In AV/Security/Telecom Con...	30	26-Jul-10	03-Sep-10
A2580	Frame Grid Height Partitions	10	26-Jul-10	06-Aug-10
A2590	Frame Drywall Ceilings	15	26-Jul-10	13-Aug-10
A2600	Elec. Rough-In Partitions	10	09-Aug-10	20-Aug-10
A2610	Install Fan Coil Units	15	09-Aug-10	27-Aug-10
A2620	Concrete Floor Topping	1	09-Aug-10	09-Aug-10
A2630	Hang & Finish GWB Ceilings	15	16-Aug-10	03-Sep-10
A2640	Pull Wire for Fire Alarm System De...	25	23-Aug-10	24-Sep-10
A2650	Controls Rough-In	20	23-Aug-10	17-Sep-10
A2660	Pull and Term Branch Circuits	20	23-Aug-10	17-Sep-10
A2670	Hang & Finish Walls	15	07-Sep-10	27-Sep-10
A2680	Energize Mech. Units	20	21-Sep-10	18-Oct-10
A2690	Install Ceiling Grid	15	28-Sep-10	18-Oct-10
A2700	Install Door Frames	5	28-Sep-10	04-Oct-10
A2710	Install Ceramic Tile	10	28-Sep-10	11-Oct-10
A2720	Install Plumbing Fixtures	10	13-Oct-10	26-Oct-10
A2730	Point Up and Paint	10	20-Oct-10	02-Nov-10
A2740	Install Sprinkler Drops	10	20-Oct-10	02-Nov-10
A2750	Install Fire Alarm System Devices	15	27-Oct-10	16-Nov-10
A2760	Toilet Partitions	10	27-Oct-10	09-Nov-10
A2770	Toilet Accessories	5	27-Oct-10	02-Nov-10
A2780	Swing Doors	5	03-Nov-10	09-Nov-10
A2790	Install Light Fixtures	10	03-Nov-10	16-Nov-10
A2800	Install Control Devices	15	03-Nov-10	23-Nov-10
A2810	Install Grilles/Diffusers	10	03-Nov-10	16-Nov-10
A2820	Install Stone Plank Flooring	15	03-Nov-10	23-Nov-10
A2830	Install Glass Walls @ Lobby	15	03-Nov-10	23-Nov-10
A2840	Fire Alarm Systems Testing	10	18-Nov-10	01-Dec-10
A2850	Drop Ceiling Tile	5	18-Nov-10	24-Nov-10
A2860	Start Up Mech. Equipment	10	26-Nov-10	09-Dec-10
A2870	Install Millwork	10	26-Nov-10	09-Dec-10
A2880	Install Flooring/Access Flooring	20	26-Nov-10	23-Dec-10
A2890	Controls Testing	5	10-Dec-10	16-Dec-10
A2900	Testing and Balance	5	17-Dec-10	23-Dec-10



Actual Work | Critical Remaining Work
Remaining Work | Milestone

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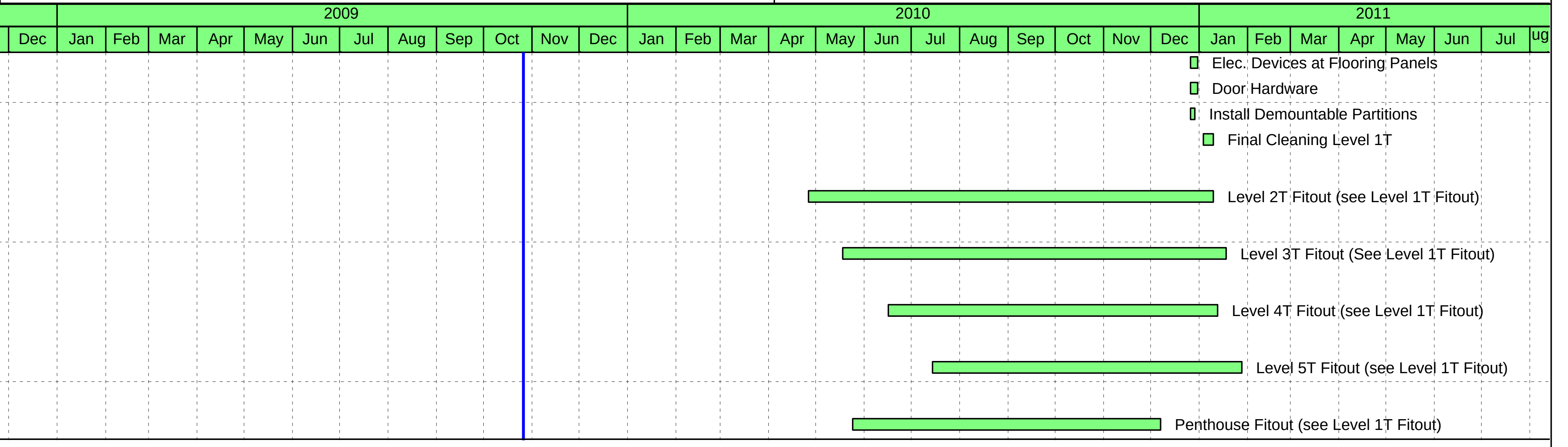
Activity ID	Activity Name	Original Duration	Start	Finish
A2910	Elec. Devices at Flooring Panels	5	27-Dec-10	31-Dec-10
A2920	Door Hardware	5	27-Dec-10	31-Dec-10
A2930	Install Demountable Partitions	3	27-Dec-10	29-Dec-10
A2940	Final Cleaning Level 1T	5	04-Jan-11	10-Jan-11
2T		186	26-Apr-10	10-Jan-11
A2950	Level 2T Fitout (see Level 1T Fitout)	186	26-Apr-10	10-Jan-11
3T		176	18-May-10	18-Jan-11
A2960	Level 3T Fitout (See Level 1T Fitout)	176	18-May-10	18-Jan-11
4T		152	16-Jun-10	13-Jan-11
A2970	Level 4T Fitout (see Level 1T Fitout)	152	16-Jun-10	13-Jan-11
5T		142	15-Jul-10	28-Jan-11
A2980	Level 5T Fitout (see Level 1T Fitout)	142	15-Jul-10	28-Jan-11
Penthouse		141	25-May-10	07-Dec-10
A2990	Penthouse Fitout (see Level 1T Fito...	141	25-May-10	07-Dec-10



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Site Layout Planning

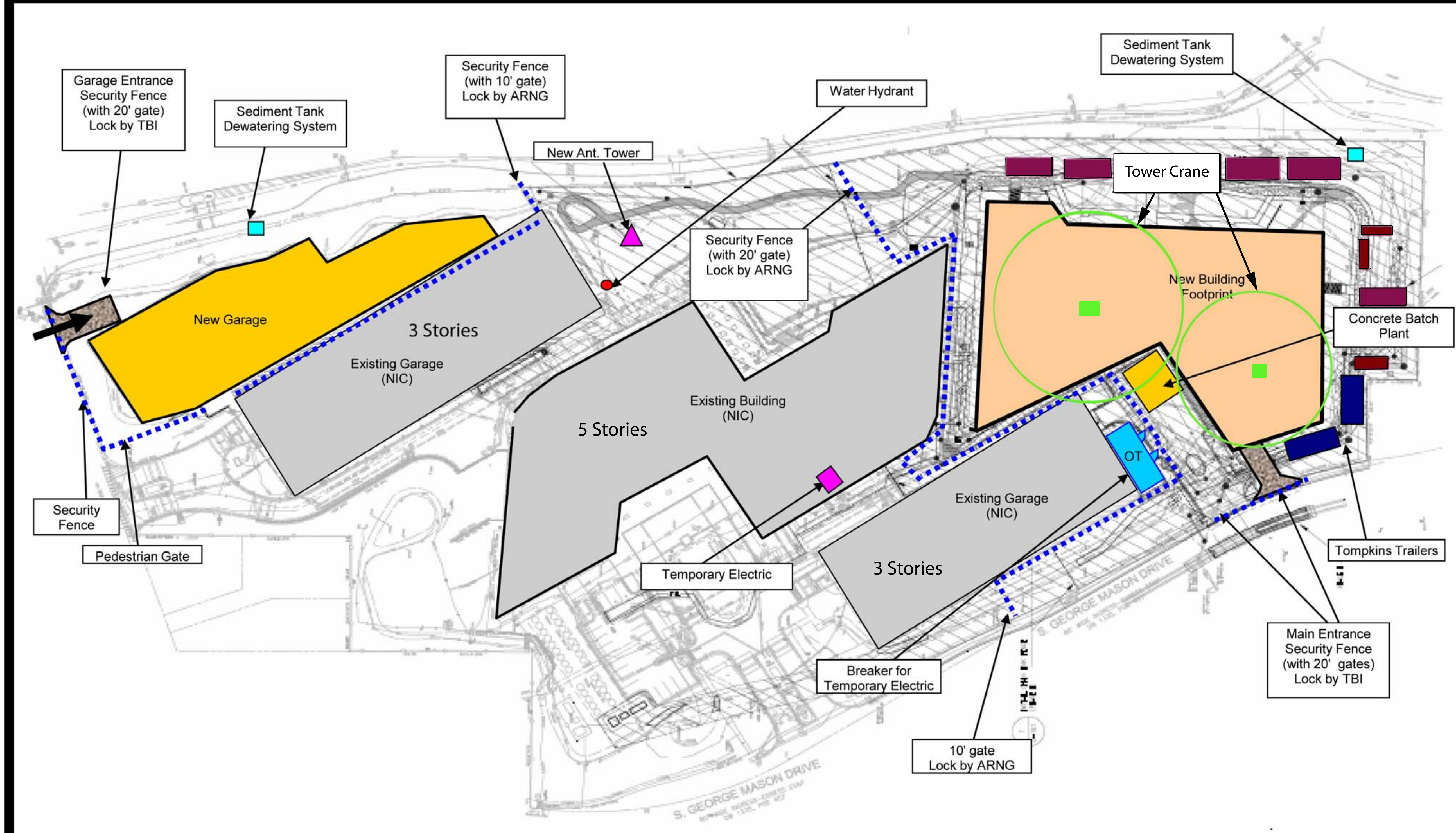
The Army National Guard Readiness Center site is relatively small compared to the size of the building being constructed. The building footprint shown in the site plan below is being excavated to the depth of approximately 50 feet. This limits space for items such as job site trailers and material storage areas to the perimeter of the site. The majority of the material layout is done around the edge of the excavation so that the majority of the items are within reach of the tower cranes on site. The job site trailers are on the outer perimeter near the fence surrounding the project. The general contractor has trailers located closest to the entrance to the site with the subcontractor trailers continuing further into the site.

One key feature of the site plan is the use of a large concrete batch plant located on site. Prior to the batch plant being erected, that space was used as material storage space. Due to the need to keep that area clear and the spaces around it as clear as possible, the site lost a large amount of material storage and layout space.

Due to restrictions of the site and surrounding buildings, the two tower cranes located on site do not cover the entire footprint of the building. The larger tower crane located on the north side of the building will cover the construction of the tower after the bottom three floors have been constructed. The smaller crane located in the southern part of the building will be removed shortly after the lower stories have been completed. Since the tower cranes do not cover the entire building footprint, two mobile cranes are located on site and placed wherever needed on a day to day basis to cover the remaining areas.

ARNG Headquarters Readiness- Center Wing Addition
Army National Guard, Arlington Hall
Arlington, Virginia

SUPERSTRUCTURE PHASE SITE PLAN



LEGEND

- NEW BUILDING FOOTPRINT
- SECURITY FENCE
- EXISTING STRUCTURES TO REMAIN
- TEMPORARY CONSTRUCTION ENTRANCE
- ARNG TRAILER
- TOMPKINS TRAILER
- Material Storage/Dumpsters
- Subcontractor Trailors/Tool Sheds

NOTES

1.) Not to scale.

2.) ARNG to provide connection for pushbutton lock at existing garage.

3.) Security fence will be placed on existing parking garage deck.

TOMPKINS BUILDERS, INC.

Detailed Structural Systems Estimate

Description	Quantity	Cost	Total
Mat Slab Foundation			
6" Crushed Stone	1063 CY	$20.50/CY	**$21,791.50**
Mud Mat Concrete	355 CY	$130.00/CY	**$46,150.00**
Mud Mat Labor	355 CY	$70.00/CY	**$24,850.00**
Mat Foundation Conc.	7616 CY	$130.00/CY	**$990,080.00**
Mat Foundation Labor	7616 CY	$70.00/CY	**$533,120.00**
Mat Foundation Equip.	7616 CY	$0.64/CY	**$4,874.24**
Aggregate Stone	5845 CY	$20.50/CY	**$119,822.50**
SOG Concrete	2126 CY	$130.00/CY	**$276,380.00**
SOG Labor	2126 CY	$40.50/CY	**$86,103.00**
SOG Equipment	2126 CY	$0.61/CY	**$1,296.86**
Reinforcing Steel	713 Tons	$535.00/Ton	**$381,455.00**
Reinforcing Steel Labor	713 Tons	$520.00/Ton	**$370,760**
Elevated Slabs 3P-1P			
Reinforcing Steel	462 Tons	$590/Ton	**$272,580.00**
Reinforcing Steel Labor	462 Tons	$350/Ton	**$161,700.00**
Concrete	4783 CY	$130/CY	**$621,790.00**
Concrete Labor	4783 CY	$70.00/CY	**$334,810.00**
Concrete Equipment	4783 YC	$.82/CY	**$3,922.06**
Elevated Slabs 1T-5T			
Reinforcing Steel	192 Tons	$590/Ton	**$113,280.00**
Reinforcing Steel Labor	192 Tons	$350/Ton	**$67,200.00**
Concrete	2240 CY	$130/CY	**$291,200.00**
Concrete Labor	2240 CY	$70.00/CY	**$156,800.00**
Concrete Equipment	2240 CY	$.82/CY	**$1,836.80**
Elevated Slab Formwork			
4-Use Plywood Forms	48,853 SF	$1.22/SF	**$59,600.66**
Plywood Forms Labor	48,853 SF	$2.43/SF	**$118,712.79**

Columns 3P-1P			
Reinforcing Steel	35 Tons	$560/Ton	**$19,600.00**
Reinforcing Steel Labor	35 Tons	$440/Ton	**$15,400.00**
Columns 1T-5T			
Reinforcing Steel	24 Tons	$560/Ton	**$13,440.00**
Reinforcing Steel Labor	24 Tons	$440/Ton	**$10,560.00**
Rebar Hooks	5 Tons	$500/Ton	**$2,500.00**
Rebar Hooks Labor	5 Tons	$400/Ton	**$2,000.00**
Column Concrete	722 CY	$130/CY	**$93,860.00**
Column Concrete Labor	722 CY	$70.00/CY	**$50,540.00**
Column Concrete Equip.	722 CY	$.82/CY	**$592.00**
Column Formwork			
4-Use Plywood Forms	9968 SF	$1.22/SF	**$12,160.96**
Plywood Forms Labor	9968 SF	$2.42/SF	**$24,122.56**
Concrete Masonry Units	82,192 SF	$1.6/SF	**$131,507.00**
CMU Labor	82,192 SF	$2.94/SF	**$241,644.48**
Stair Tower			
Concrete	1639 CY	$130/CY	**$213,070.00**
Concrete Labor	1639 CY	$70/CY	**$114,740.00**
		Subtotal	**$6,005,852.41**
	Overhead (10%)		**$600,585.24**
	Fee (5%)		**$300,292.62**
	Bonds (2%)		**$120,117.05**
		Total	**$7,026,847.32**

General Conditions Estimate

Below are a summary of the general conditions costs for the Army National Guard Readiness Center Project (figure 1) followed by a more detailed breakdown of the individual items within each of the summary items (figure 2). The information was provided by Tompkins Builders, Inc. adapted for use here by Arne Kvinnesland.

Note: Tompkins Builders, Inc. requested that their staff costs and fees not be released. For the sake of this General Conditions estimate an average value of 3% of the overall cost of the project was used for staff costs. This does NOT reflect Tompkins' staff costs in any way.

General Conditions Item	Total Cost	Cost/Month (Avg)
Temporary Facilities	$ 430,800.00	$ 15,385.71
Hoist Facilities	$ 10,000.00	N/A
Temporary Utilities	$ 468,800.00	$ 16,742.86
Cleaning	$ 257,500.00	$ 9,196.43
Protection & Safety	$ 71,500.00	$ 2,553.57
Fringes/Taxes/Insurance	$ 3,980,452.00	$ 142,159.00
Project Staff	$ 3,000,000.00	$ 107,142.76
Total:	**$ 8,219,052.00**	**$ 293,180.33**

Figure 1: Summary of General Conditions Items

Description	Cost
Temporary Facilities	
Tools & Supplies	$ 5,000.00
Job Office Setup/Removal	$ 78,200.00
Rentals and Equipment	$ 135,500.00
Vehicles/Parking	$ 129,600.00
Temporary Building	$ 10,500.00
Winter Weather/Bldg. Enclosure	$ 72,000.00
Hoist Facilities	
Crane Erect/Dismantle/Jump	$ 10,000.00
Temporary Utilities	
Temp. Light & Power/Install/Remove	$ 333,000.00
Temp. Plumbing & Toilets/Install	$ 117,840.00
Temp. Water	$ 17,960.00
Cleaning	
General Bldg Cleaning/Glass Cleaning	$ 45,000.00
Dirt Chutes/Waste Removal/Recycling	$ 126,000.00
Site & Street Cleaning	$ 5,000.00
Final Cleaning	$ 81,500.00
Protection & Safety	
General Protection & Safety	$ 10,788.00
Barricades/Railings/Toeboards	$ 27,312.00
Safety Program/Watchman/Traffic Cont.	$ 25,000.00
Fire Watch/Rodent Controls/Extinguishers	$ 6,000.00
First Aid Facility	$ 2,400.00

Figure 2: Detailed Breakdown of Figure 1 Summary Items

Critical Industry Issues: PACE

The day started off with an issue at the forefront of everyone's mind: the economy. A panel of industry professionals volunteered to share their experiences and insights about how companies handle economic downturns. Diversification and having a workforce that can handle a wide range of project sizes are key to making it through economic trouble. Two markets were mentioned in particular: health care and energy. The health care industry is always expanding and facilities which produce energy (power plants, nuclear facilities) are always being built and even during economic depressions are always expanding.

The recession is also giving companies an opportunity to go back and do more extensive training on their employees. It's very important to continuously strengthen the "A-Team" within the company and when there is a lack of work, it is the perfect time to invest training into your employees. I see this as a key opportunity for Building Information Modeling to be brought into more companies. With the extra time and training companies are giving their employees, now is the time to invest in BIM.

The second session that I attended dealt with BIM in the industry today. It was a group of industry professionals sharing their experiences, concerns, and successes with BIM within their companies. It was clear from the start that, although a small portion of the companies were seeing some success, there are many challenges that BIM teams face in the industry today. Below are listed some of the most prominent:

- Owner, architect, designers, general contractor, and subcontractors are not always on the same page from Day 1 of the project. The architect and designers put together the models but ways of communicating vital information or just where the models are stored and updated is rarely communicated until there is a problem. Many subcontracts don't have in-house capacity to do 3D modeling for their systems, so that must be picked up by another member in the project team.
- MEP coordination is a key feature of BIM, however having compatible software across the board with all the designers and subcontractors can be an issue if it is not discussed early on in the project. Manufacturers also have not created families of smart objects for key programs such as Revit MEP, so it makes it very challenging or next to impossible to use those programs effectively.

The owner's role in BIM was discussed in the second BIM session of the day. Owner's rarely understand the capabilities of BIM on their projects. They may only understand what was sold to them by the contractor, saying that it's a time and cost saving tool, both of which are true. However, the owner is paying for a tool that has a wide range of possibilities, if they take the time to understand what they are. Owner's need to understand what they want to get out of BIM by the end of the project. Do they have a specific set of deliverables in mind? Is the model going to be turned over to maintenance for future use during normal operation of the building? How does BIM affect the bottom line of the owner's project?

Many of these questions never even occur to the owner early on. Later on, as the project is wrapping up, the owner may realize that they want a specific deliverable. It's possible that it would have been easy to provide that deliverable early on in the project but now it creates a large amount of extra work due to the progress of the project. If these items are identified early and if owners are educated on BIM and what it is capable of, it becomes a much more effective tool.

A possible research topic that was brought up: find out what owner's want out of BIM, general education level and understanding of BIM by owners, what is the general feeling about BIM in the industry from the owner's perspective. The Army National Guard Readiness Center is using BIM as a coordination tool for the building systems. The final model will be turned over to the owner as part of the as-built documents for the project, so it is critical that the model is updated correctly and on a regular basis to accommodate all design changes. However, the project has faced some of the same challenges as mentioned above and if a stronger, more definitive plan had been implemented earlier on in the project, some of those issues could have been avoided.