SAINT VINCENT HEALTH CENTER

Tyler Jaggi
CM Option

Technical Assignment 2

Advisor: Dr. David Riley

October 27th, 2010

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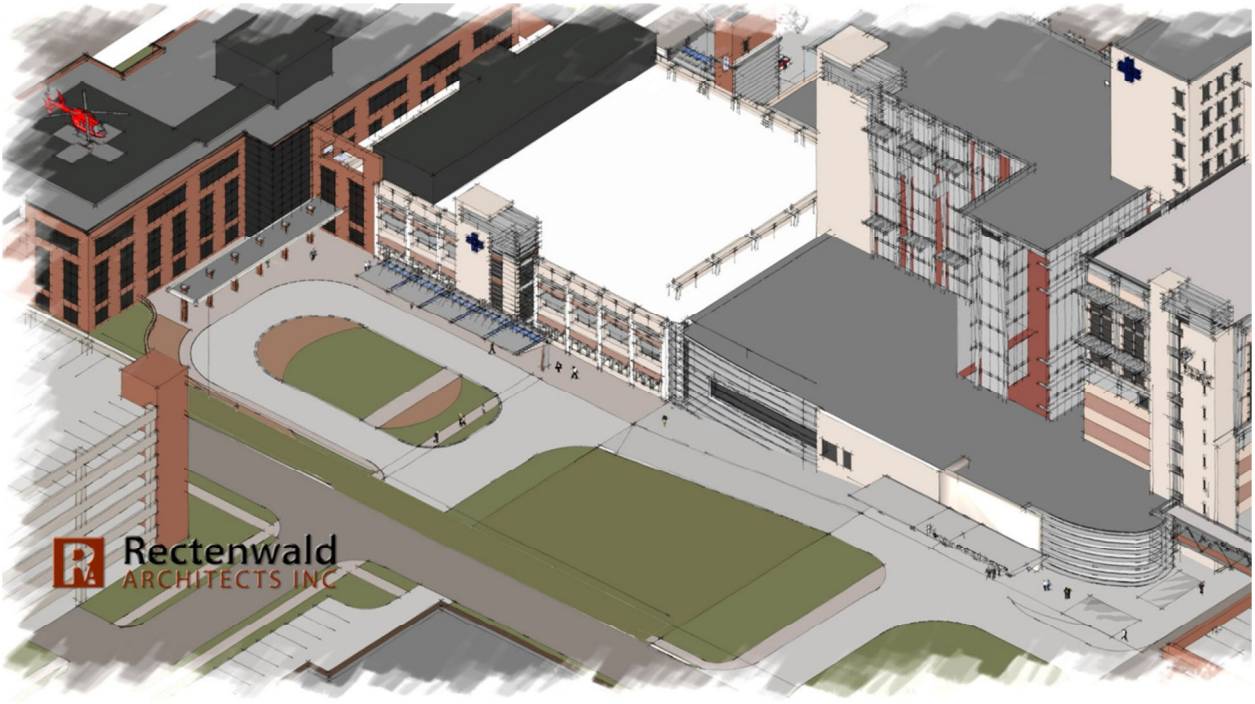
SAINT VINCENT
INFILL BUILDING



Executive Summary

Technical Assignment Two is intended to analyze the key features and parameters that influence project execution of the Saint Vincent Health Center new In-fill Building addition. This project includes a new Central MEP Plant for the Hospital Complex as well as new operating room and patient rooms. There is a detailed project summary schedule that gives a descriptive of the major project activities and milestones that take place during the design and construction of Saint Vincent Health Center Infill Building in Erie, PA located on the Saint Vincent Health Center complex. The largest challenge associated with this project is that the proposed site is located in between two existing structures (both of which are Saint Vincent's existing buildings) on an active private hospital complex.

Information regarding the complex phasing/turnover milestones of the new construction and renovation work is shown within the report and a ***detailed project schedule*** is presented to depict the sequencing of trades as work progresses from the new addition. This is a three phase project: Phase I is new Ambulance Entrance Addition. Phase II is Temporary connector corridor along the west side of the site so the existing connector can be removed to allow for access to the new building. Phase III is the new inlet building itself. With three phases, a lot of coordination must be done to not fall behind schedule. A critical sequencing issue is not to interrupt flow of hospital operations at ED and movement between the existing hospital and the MOB (Medical Office Building / Hardner Building) to the North.

Individual ***site layout plans*** are included for each phase to convey proposed locations of the key features of the site. A ***detailed estimate*** was performed for the structural system of the new addition. The estimate produced nearly 1475 CY of concrete for the project. The total costs of $1.69 million for the above ground structural system, which includes steel (columns, beams and girders), metal decking and concrete floor slabs. The foundations system which includes the nearly 4700 cased caissons, the concrete grade beams and the slab on grade estimated cost is approximately $1.267 million. A ***general conditions estimate*** is included to show projected costs for supervision/personnel, construction facilities/equipment, temporary utilities and miscellaneous project costs. At an amount of $1.1 million, the general conditions accounts for approximately 3% of the total project cost.

After analyzing the information contained within this report and the findings from Technical Assignment One, a major focus for upcoming thesis research will be directed towards schedule acceleration techniques and potential re-sequencing of work to better meet the critical turnover dates and phased occupancies set by Saint Vincent.

Overall, this report has given a more detailed understanding of the project and how the project is being constructed. It will be beneficial to know this information for the following technical reports and the proposal that will be submitted later in the semester.

Detailed Project Schedule

The project summary schedule is in **Appendix C**

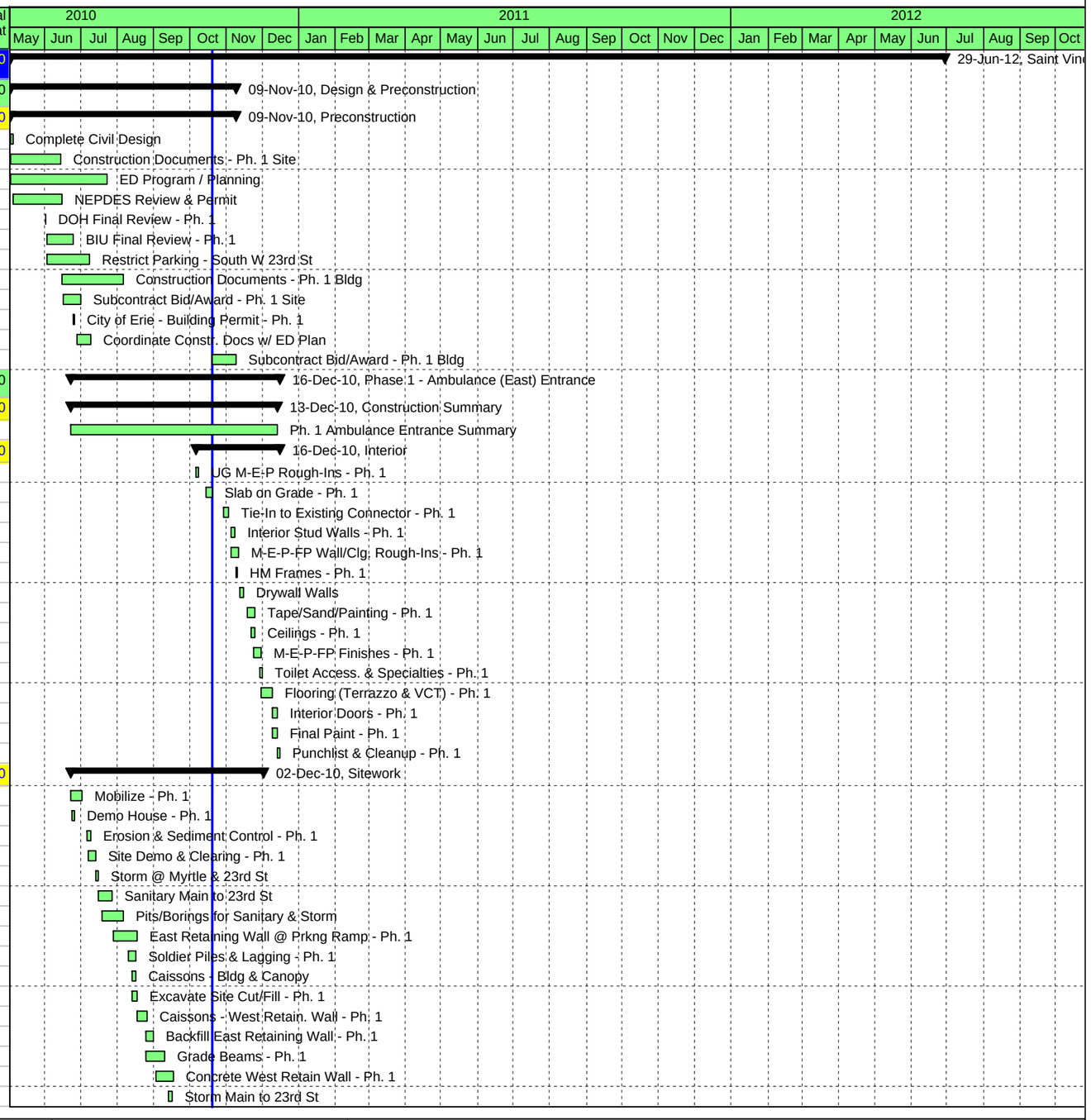
The following Detailed Project schedule is based off a detailed schedule provided by EE Austin & Son, Inc., the construction manager on the project, although I have made a few changes and completed the schedule past the enclosure stage. The site work consists of demolishing the existing connecting corridor (Phase I) and then constructing the new emergency entrance. There is also civil work done during this time dealing with sanitary and storm lines. Following Phase I work is the construction of the temporary connecting corridor (Phase II).

After Phase II is complete, starts the substructure which includes excavation and constructing the foundations along the existing hospital buildings (phase III). The superstructure is a steel frame with composite metal decking and follows the substructure of the building. Since actual construction on this project is only starting Phase 1, this schedule isn't 100% certain. The start of Phase III (the main Infill Building itself) won't be started until next May. The interior design of this space is not even developed yet so the actual project finish date is unknown. I had to estimate on the schedule of the interior work and finishes for Phase III which I guessed would end around the start of July, 2012.

APPENDIX A

Detailed Project Schedule

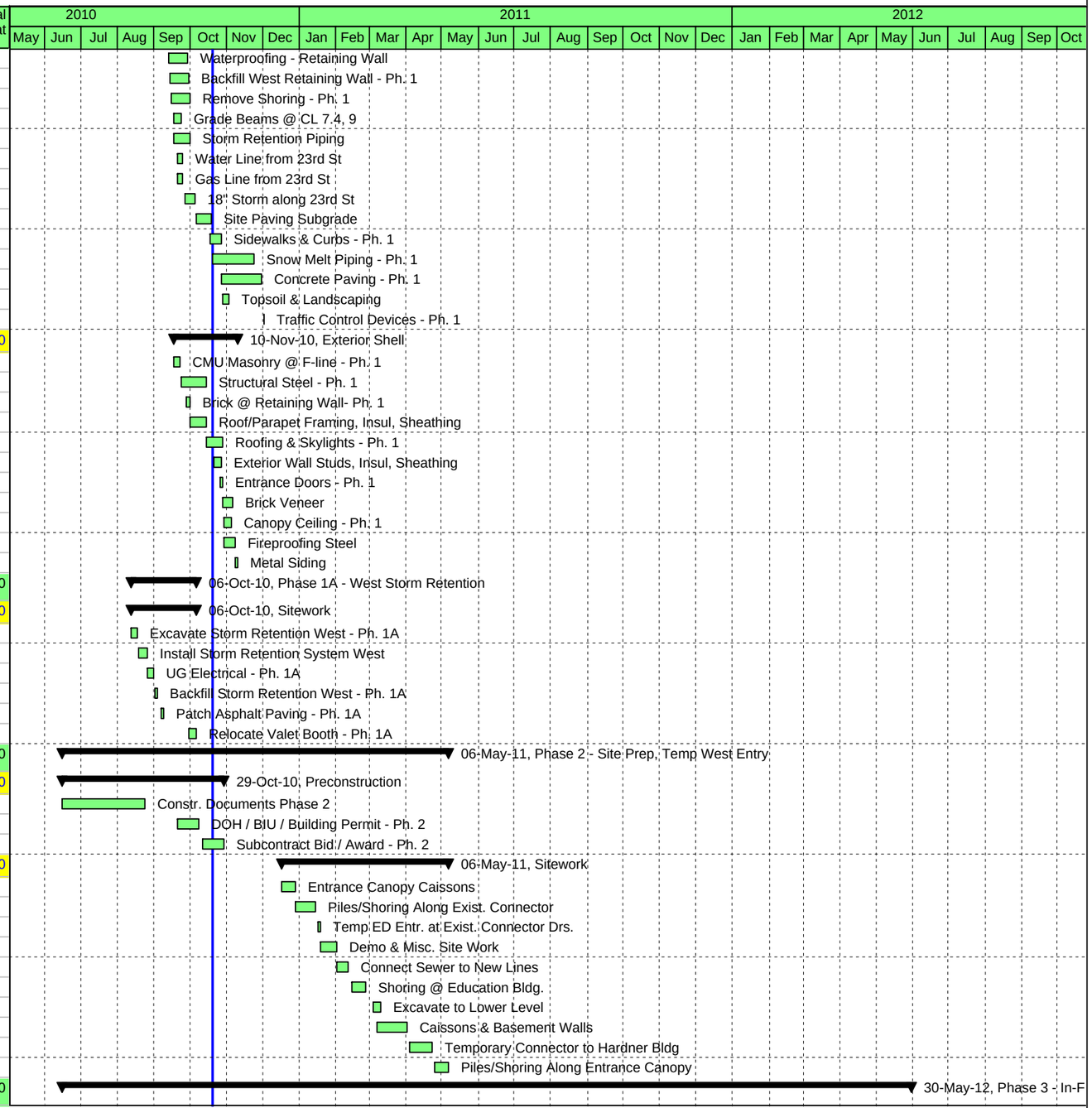
Activity ID	Original Duration	Activity Name	Remaining Duration	Start	Finish	Total Float
Saint Vincent Hea	565		565	03-May-10	29-Jun-12	0
Design & Precon	137		137	03-May-10	09-Nov-10	0
Preconstruction	137		137	03-May-10	09-Nov-10	0
A1010	2	Complete Civil Design	2	03-May-10	04-May-10	
A1020	31	Construction Documents - Ph. 1 Site	31	03-May-10	14-Jun-10	
A1030	60	ED Program / Planning	60	03-May-10	23-Jul-10	
A1040	30	NEPDES Review & Permit	30	05-May-10	15-Jun-10	
A1050	1	DOH Final Review - Ph. 1	1	01-Jun-10	01-Jun-10	
A1060	17	BIU Final Review - Ph. 1	17	02-Jun-10	24-Jun-10	
A1070	27	Restrict Parking - South W 23rd St	27	02-Jun-10	08-Jul-10	
A1080	39	Construction Documents - Ph. 1 Bldg	39	15-Jun-10	06-Aug-10	
A1090	12	Subcontract Bid/Award - Ph. 1 Site	12	16-Jun-10	01-Jul-10	
A1100	1	City of Erie - Building Permit - Ph. 1	1	25-Jun-10	25-Jun-10	
A1110	10	Coordinate Constr. Docs w/ ED Plan	10	28-Jun-10	09-Jul-10	
A1120	15	Subcontract Bid/Award - Ph. 1 Bldg	15	20-Oct-10	09-Nov-10	
Phase 1 - Ambula	127		127	23-Jun-10	16-Dec-10	0
Construction Summ	124		124	23-Jun-10	13-Dec-10	0
A1130	124	Ph. 1 Ambulance Entrance Summary	124	23-Jun-10	13-Dec-10	
Interior	52		52	06-Oct-10	16-Dec-10	0
A1550	3	UG M-E-P Rough-Ins - Ph. 1	3	06-Oct-10	08-Oct-10	
A1560	4	Slab on Grade - Ph. 1	4	15-Oct-10	20-Oct-10	
A1570	3	Tie-In to Existing Connector - Ph. 1	3	29-Oct-10	02-Nov-10	
A1580	2	Interior Stud Walls - Ph. 1	2	05-Nov-10	08-Nov-10	
A1590	5	M-E-P-FP Wall/Clg. Rough-Ins - Ph. 1	5	05-Nov-10	11-Nov-10	
A1600	2	HM Frames - Ph. 1	2	09-Nov-10	10-Nov-10	
A1610	2	Drywall Walls	2	12-Nov-10	15-Nov-10	
A1620	6	Tape/Sand/Painting - Ph. 1	6	18-Nov-10	25-Nov-10	
A1630	4	Ceilings - Ph. 1	4	22-Nov-10	25-Nov-10	
A1640	5	M-E-P-FP Finishes - Ph. 1	5	24-Nov-10	30-Nov-10	
A1650	3	Toilet Access. & Specialties - Ph. 1	3	29-Nov-10	01-Dec-10	
A1660	8	Flooring (Terrazzo & VCT) - Ph. 1	8	30-Nov-10	09-Dec-10	
A1670	2	Interior Doors - Ph. 1	2	10-Dec-10	13-Dec-10	
A1680	2	Final Paint - Ph. 1	2	10-Dec-10	13-Dec-10	
A1690	3	Punchlist & Cleanup - Ph. 1	3	14-Dec-10	16-Dec-10	
Sitework	117		117	23-Jun-10	02-Dec-10	0
A1140	8	Mobilize - Ph. 1	8	23-Jun-10	02-Jul-10	
A1150	2	Demo House - Ph. 1	2	24-Jun-10	25-Jun-10	
A1160	4	Erosion & Sediment Control - Ph. 1	4	06-Jul-10	09-Jul-10	
A1170	5	Site Demo & Clearing - Ph. 1	5	07-Jul-10	13-Jul-10	
A1180	2	Storm @ Myrtle & 23rd St	2	14-Jul-10	15-Jul-10	
A1190	8	Sanitary Main to 23rd St	8	16-Jul-10	27-Jul-10	
A1200	15	Pits/Borings for Sanitary & Storm	15	19-Jul-10	06-Aug-10	
A1210	15	East Retaining Wall @ Prkng Ramp - Ph. 1	15	28-Jul-10	17-Aug-10	
A1220	5	Soldier Piles & Lagging - Ph. 1	5	10-Aug-10	16-Aug-10	
A1230	2	Caissons - Bldg & Canopy	2	13-Aug-10	16-Aug-10	
A1240	3	Excavate Site Cut/Fill - Ph. 1	3	13-Aug-10	17-Aug-10	
A1250	7	Caissons - West Retain. Wall - Ph. 1	7	18-Aug-10	26-Aug-10	
A1260	5	Backfill East Retaining Wall - Ph. 1	5	25-Aug-10	31-Aug-10	
A1270	12	Grade Beams - Ph. 1	12	25-Aug-10	09-Sep-10	
A1280	12	Concrete West Retain Wall - Ph. 1	12	02-Sep-10	17-Sep-10	
A1290	4	Storm Main to 23rd St	4	13-Sep-10	16-Sep-10	



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

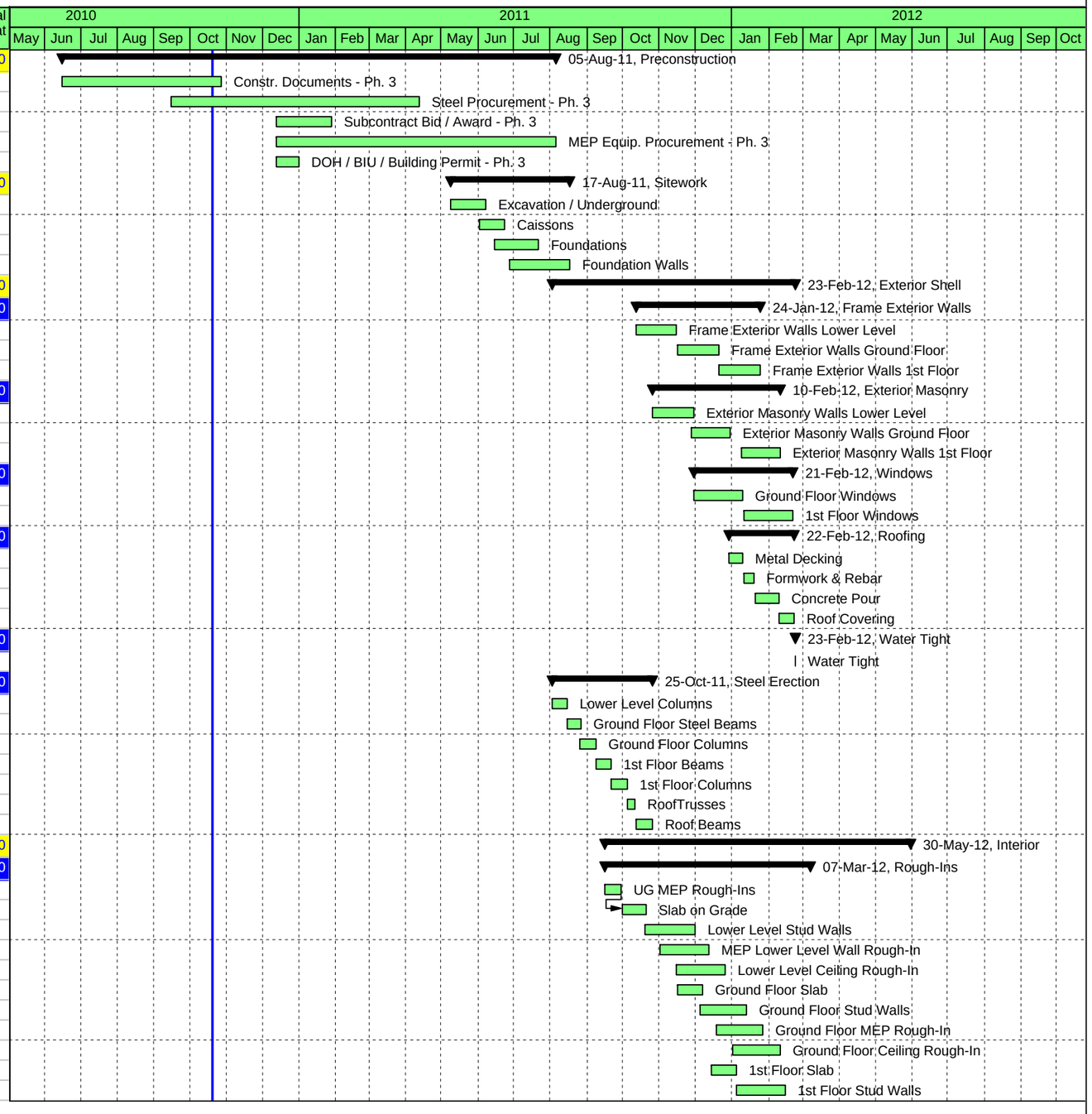
Activity ID	Original Duration	Activity Name	Remaining Duration	Start	Finish	Total Float
A1300	12	Waterproofing - Retaining Wall	12	13-Sep-10	28-Sep-10	
A1310	12	Backfill West Retaining Wall - Ph. 1	12	14-Sep-10	29-Sep-10	
A1320	12	Remove Shoring - Ph. 1	12	15-Sep-10	30-Sep-10	
A1330	5	Grade Beams @ CL 7.4, 9	5	17-Sep-10	23-Sep-10	
A1340	10	Storm Retention Piping	10	17-Sep-10	30-Sep-10	
A1350	5	Water Line from 23rd St	5	20-Sep-10	24-Sep-10	
A1360	5	Gas Line from 23rd St	5	20-Sep-10	24-Sep-10	
A1370	7	18" Storm along 23rd St	7	27-Sep-10	05-Oct-10	
A1380	10	Site Paving Subgrade	10	06-Oct-10	19-Oct-10	
A1390	8	Sidewalks & Curbs - Ph. 1	8	18-Oct-10	27-Oct-10	
A1400	25	Snow Melt Piping - Ph. 1	25	20-Oct-10	23-Nov-10	
A1410	25	Concrete Paving - Ph. 1	25	27-Oct-10	30-Nov-10	
A1420	4	Topsoil & Landscaping	4	28-Oct-10	02-Nov-10	
A1430	1	Traffic Control Devices - Ph. 1	1	02-Dec-10	02-Dec-10	
Exterior Shell	39		39	17-Sep-10	10-Nov-10	0
A1440	4	CMU Masonry @ F-line - Ph. 1	4	17-Sep-10	22-Sep-10	
A1450	15	Structural Steel - Ph. 1	15	24-Sep-10	14-Oct-10	
A1460	4	Brick @ Retaining Wall- Ph. 1	4	28-Sep-10	01-Oct-10	
A1470	10	Roof/Parapet Framing, Insul, Sheathing	10	01-Oct-10	14-Oct-10	
A1480	10	Roofing & Skylights - Ph. 1	10	15-Oct-10	28-Oct-10	
A1490	5	Exterior Wall Studs, Insul, Sheathing	5	21-Oct-10	27-Oct-10	
A1500	3	Entrance Doors - Ph. 1	3	26-Oct-10	28-Oct-10	
A1510	7	Brick Veneer	7	28-Oct-10	05-Nov-10	
A1520	5	Canopy Ceiling - Ph. 1	5	29-Oct-10	04-Nov-10	
A1530	7	Fireproofing Steel	7	29-Oct-10	08-Nov-10	
A1540	3	Metal Siding	3	08-Nov-10	10-Nov-10	
Phase 1A - West	40		40	12-Aug-10	06-Oct-10	0
Sitework	40		40	12-Aug-10	06-Oct-10	0
A1700	4	Excavate Storm Retention West - Ph. 1A	4	12-Aug-10	17-Aug-10	
A1710	6	Install Storm Retention System West	6	19-Aug-10	26-Aug-10	
A1720	4	UG Electrical - Ph. 1A	4	26-Aug-10	31-Aug-10	
A1730	3	Backfill Storm Retention West - Ph. 1A	3	01-Sep-10	03-Sep-10	
A1740	2	Patch Asphalt Paving - Ph. 1A	2	07-Sep-10	08-Sep-10	
A1750	5	Relocate Valet Booth - Ph. 1A	5	30-Sep-10	06-Oct-10	
Phase 2 - Site Pre	234		234	15-Jun-10	06-May-11	0
Preconstruction	99		99	15-Jun-10	29-Oct-10	0
A1760	50	Constr. Documents Phase 2	50	15-Jun-10	23-Aug-10	
A1770	15	DOH / BIU / Building Permit - Ph. 2	15	20-Sep-10	08-Oct-10	
A1780	15	Subcontract Bid / Award - Ph. 2	15	11-Oct-10	29-Oct-10	
Sitework	101		101	17-Dec-10	06-May-11	0
A1800	8	Entrance Canopy Caissons	8	17-Dec-10	28-Dec-10	
A1810	13	Piles/Shoring Along Exist. Connector	13	29-Dec-10	14-Jan-11	
A1820	2	Temp ED Entr. at Exist. Connector Drs.	2	17-Jan-11	18-Jan-11	
A1830	10	Demo & Misc. Site Work	10	19-Jan-11	01-Feb-11	
A1840	8	Connect Sewer to New Lines	8	02-Feb-11	11-Feb-11	
A1850	10	Shoring @ Education Bldg.	10	14-Feb-11	25-Feb-11	
A1860	5	Excavate to Lower Level	5	04-Mar-11	10-Mar-11	
A1870	20	Caissons & Basement Walls	20	07-Mar-11	01-Apr-11	
A1880	15	Temporary Connector to Hardner Bldg	15	04-Apr-11	22-Apr-11	
A1890	10	Piles/Shoring Along Entrance Canopy	10	25-Apr-11	06-May-11	
Phase 3 - In-Fill E	512		512	15-Jun-10	30-May-12	0



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

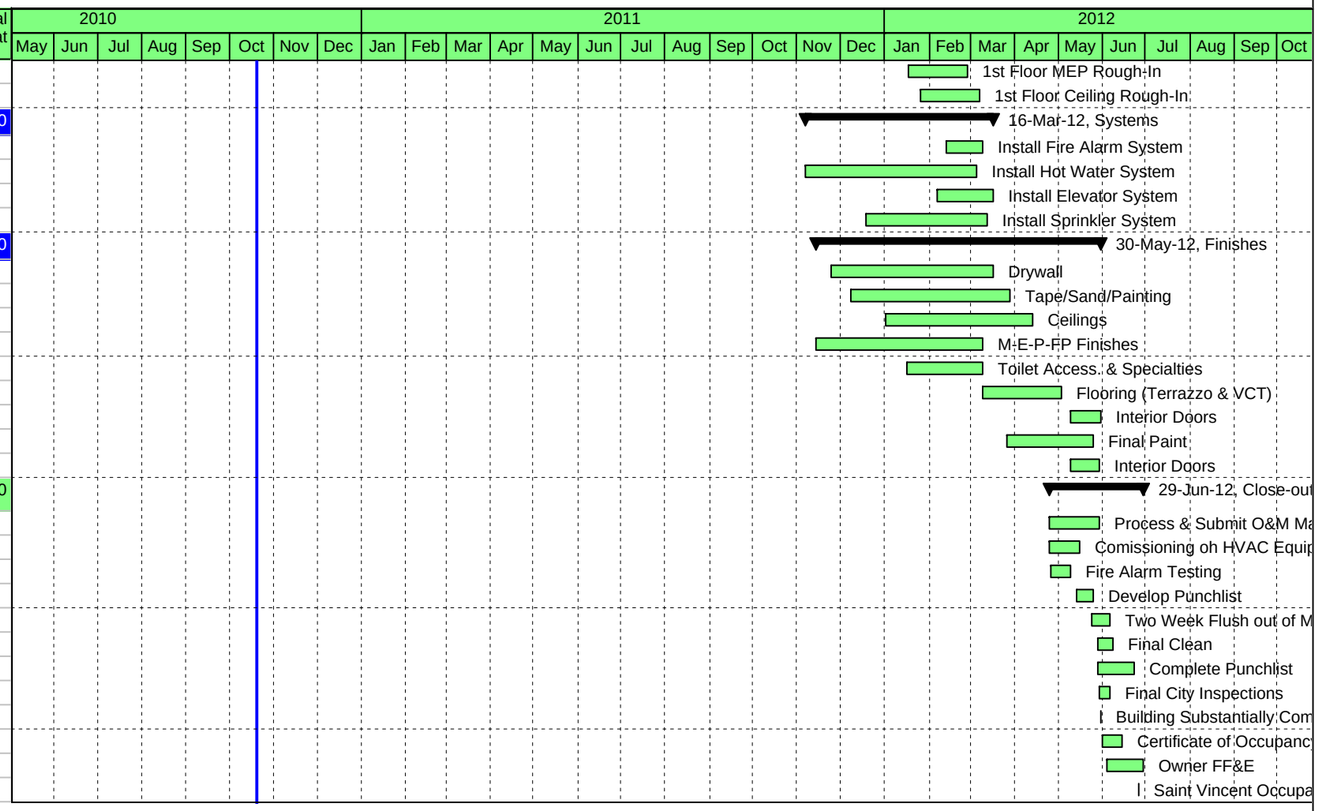
Activity ID	Original Duration	Activity Name	Remaining Duration	Start	Finish	Total Float
Preconstruction	299		299	15-Jun-10	05-Aug-11	0
A1900	97	Constr. Documents - Ph. 3	97	15-Jun-10	27-Oct-10	
A1910	150	Steel Procurement - Ph. 3	150	15-Sep-10	12-Apr-11	
A1930	35	Subcontract Bid / Award - Ph. 3	35	13-Dec-10	28-Jan-11	
A1940	170	MEP Equip. Procurement - Ph. 3	170	13-Dec-10	05-Aug-11	
A1920	15	DOH / BIU / Building Permit - Ph. 3	15	13-Dec-10	31-Dec-10	
Sitework	73		73	09-May-11	17-Aug-11	0
A1950	22	Excavation / Underground	22	09-May-11	07-Jun-11	
A1960	16	Caissons	16	02-Jun-11	23-Jun-11	
A1970	27	Foundations	27	15-Jun-11	21-Jul-11	
A1980	38	Foundation Walls	38	27-Jun-11	17-Aug-11	
Exterior Shell	147		147	02-Aug-11	23-Feb-12	0
Frame Exterior Wa	75		75	12-Oct-11	24-Jan-12	0
A2060	25	Frame Exterior Walls Lower Level	25	12-Oct-11	15-Nov-11	
A2070	25	Frame Exterior Walls Ground Floor	25	16-Nov-11	20-Dec-11	
A2080	25	Frame Exterior Walls 1st Floor	25	21-Dec-11	24-Jan-12	
Exterior Masonry	78		78	26-Oct-11	10-Feb-12	0
A2090	25	Exterior Masonry Walls Lower Level	25	26-Oct-11	29-Nov-11	
A2100	25	Exterior Masonry Walls Ground Floor	25	28-Nov-11	30-Dec-11	
A2110	25	Exterior Masonry Walls 1st Floor	25	09-Jan-12	10-Feb-12	
Windows	60		60	30-Nov-11	21-Feb-12	0
A2120	30	Ground Floor Windows	30	30-Nov-11	10-Jan-12	
A2130	30	1st Floor Windows	30	11-Jan-12	21-Feb-12	
Roofing	40		40	29-Dec-11	22-Feb-12	0
A2140	9	Metal Decking	9	29-Dec-11	10-Jan-12	
A2150	7	Formwork & Rebar	7	11-Jan-12	19-Jan-12	
A2160	15	Concrete Pour	15	20-Jan-12	09-Feb-12	
A2170	9	Roof Covering	9	10-Feb-12	22-Feb-12	
Water Tight	0		0	23-Feb-12	23-Feb-12	0
A2180	0	Water Tight	0	23-Feb-12	23-Feb-12	
Steel Erection	61		61	02-Aug-11	25-Oct-11	0
A1990	10	Lower Level Columns	10	02-Aug-11	15-Aug-11	
A2000	10	Ground Floor Steel Beams	10	15-Aug-11	26-Aug-11	
A2010	10	Ground Floor Columns	10	26-Aug-11	08-Sep-11	
A2020	10	1st Floor Beams	10	08-Sep-11	21-Sep-11	
A2030	10	1st Floor Columns	10	21-Sep-11	04-Oct-11	
A2040	5	RoofTrusses	5	05-Oct-11	11-Oct-11	
A2050	10	Roof Beams	10	12-Oct-11	25-Oct-11	
Interior	184		184	16-Sep-11	30-May-12	0
Rough-Ins	124		124	16-Sep-11	07-Mar-12	0
A2190	10	UG MEP Rough-Ins	10	16-Sep-11	29-Sep-11	
A2200	15	Slab on Grade	15	30-Sep-11	20-Oct-11	
A2210	30	Lower Level Stud Walls	30	20-Oct-11	30-Nov-11	
A2220	30	MEP Lower Level Wall Rough-In	30	01-Nov-11	12-Dec-11	
A2230	30	Lower Level Ceiling Rough-In	30	15-Nov-11	26-Dec-11	
A2240	15	Ground Floor Slab	15	16-Nov-11	07-Dec-11	
A2250	30	Ground Floor Stud Walls	30	05-Dec-11	13-Jan-12	
A2260	30	Ground Floor MEP Rough-In	30	19-Dec-11	27-Jan-12	
A2270	30	Ground Floor Ceiling Rough-In	30	02-Jan-12	10-Feb-12	
A2280	15	1st Floor Slab	15	14-Dec-11	04-Jan-12	
A2290	30	1st Floor Stud Walls	30	05-Jan-12	15-Feb-12	



Actual Work | Critical Remaining Work | Summary
Remaining Work | Milestone

TASK filter: All Activities

Activity ID	Original Duration	Activity Name	Remaining Duration	Start	Finish	Total Float
A2300	30	1st Floor MEP Rough-In	30	17-Jan-12	27-Feb-12	
A2310	30	1st Floor Ceiling Rough-In	30	26-Jan-12	07-Mar-12	
Systems	95		95	07-Nov-11	16-Mar-12	0
A2320	20	Install Fire Alarm System	20	13-Feb-12	09-Mar-12	
A2330	86	Install Hot Water System	86	07-Nov-11	05-Mar-12	
A2340	30	Install Elevator System	30	06-Feb-12	16-Mar-12	
A2350	61	Install Sprinkler System	61	19-Dec-11	12-Mar-12	
Finishes	143		143	14-Nov-11	30-May-12	0
A2360	81	Drywall	81	24-Nov-11	16-Mar-12	
A2370	80	Tape/Sand/Painting	80	08-Dec-11	28-Mar-12	
A2380	75	Ceilings	75	02-Jan-12	13-Apr-12	
A2390	85	M-E-P-FP Finishes	85	14-Nov-11	09-Mar-12	
A2400	40	Toilet Access. & Specialties	40	16-Jan-12	09-Mar-12	
A2410	40	Flooring (Terrazzo & VCT)	40	09-Mar-12	03-May-12	
A2420	15	Interior Doors	15	09-May-12	30-May-12	
A2430	45	Final Paint	45	26-Mar-12	25-May-12	
A2440	15	Interior Doors	15	09-May-12	29-May-12	
Close-out	48		48	25-Apr-12	29-Jun-12	0
A2450	25	Process & Submit O&M Manuals	25	25-Apr-12	29-May-12	
A2460	15	Comissioning oh HVAC Equipment	15	25-Apr-12	15-May-12	
A2470	10	Fire Alarm Testing	10	26-Apr-12	09-May-12	
A2480	10	Develop Punchlist	10	14-May-12	25-May-12	
A2490	10	Two Week Flush out of Mechanical system	10	24-May-12	06-Jun-12	
A2500	10	Final Clean	10	28-May-12	08-Jun-12	
A2510	20	Complete Punchlist	20	28-May-12	22-Jun-12	
A2520	5	Final City Inspections	5	30-May-12	05-Jun-12	
A2530	0	Building Substantially Compete	0	31-May-12	31-May-12	
A2540	10	Certificate of Occupancy	10	01-Jun-12	14-Jun-12	
A2550	20	Owner FF&E	20	04-Jun-12	29-Jun-12	
A2560	0	Saint Vincent Occupancy	0	26-Jun-12	26-Jun-12	



Site Plan

The site plan along with phasing diagrams for Phases I, II &III are in **Appendix B**

The site for the Saint Vincent Health Center Addition is located between two existing hospital structures. The Hardner Building, located north of the site, is the Medical Office Building for Saint Vincent. The Existing Hospital building is also constricting the site for the new Infill building between the Hardner and existing hospital building. The new addition is designed to connect the two existing buildings, add additional operating and patient rooms along with replacing the central plant for the MEP services for the entire complex.

The property line is the whole block of the Saint Vincent complex. The boundaries of construction are the fenced in area by the site work access on 23th Street. There are no field office trailers on site because of the importance of space to work. Saint Vincent has generously made room for everyone's field office space in the existing Hardner building (electric and utilities included). There are no temporary utilities that are provided by the CM, all is done by Saint Vincent and the existing buildings surrounding the site. There is a dumpster pick-up near the site access on 23rd Street there is little area for material laydown. Materials and equipment are held in warehouses, if possible, until they are needed.

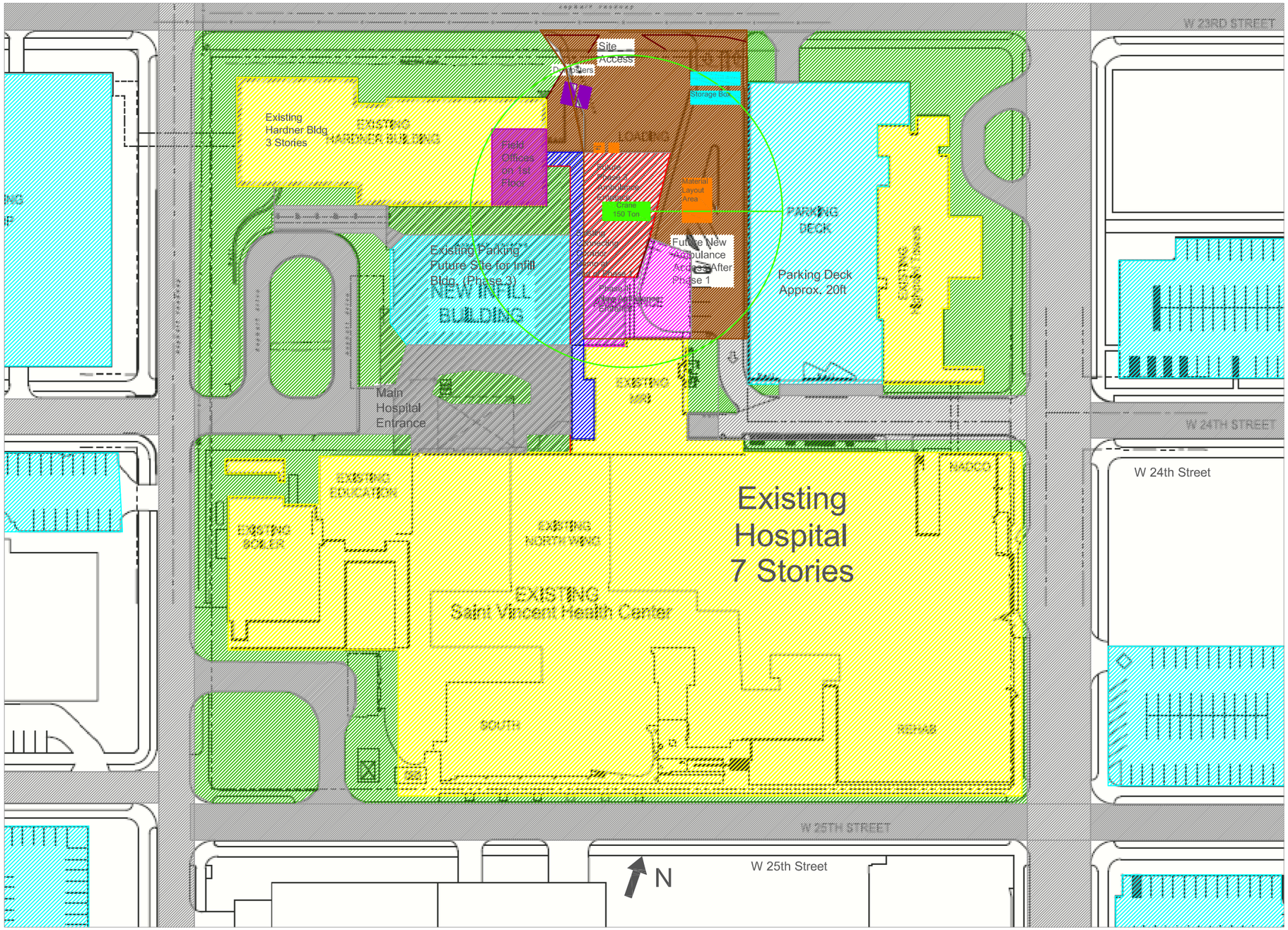
There are multiple places to park all around the complex for worker parking. Patient walk patterns will not be able to be on site because of the new temporary connecting corridor, which will block the front of the hospital from the construction work. The only place where pedestrian patterns could be a concern is on 23rd Street. The site is fenced off from pedestrians, but with trucks and equipment leaving and entering the site will have to watch out for other cars, although this street usually is not busy. Workers need to be cautious of pedestrians walking on the sidewalk.

During Phase I, the construction will be restricted to the Entrance for the Emergency department. All hospital traffic will be through the main entrance. A mobile 150 Ton crane will be used when erecting steel for both Phase I & III. When Phase I is complete and the new emergency entrance is ready for use construction for Phase II will began. Phase II deals with the construction of the temporary connecting corridor between main hospital and the Hardner building. Both the main and new emergency entrance will be open for use. Once the new temporary connecting corridor is complete, demolishing of the existing corridor will happen which will allow access to the site of the new In-fill addition building. Starting Phase III will start with demo existing parking lot, and began the deep foundation system. After that and the whole substructure is complete, the project will complete the 3-story building inside and out. The plans for this building are not designed past the exterior enclosure.

APPENDIX B

Site Plans for Phases 1, 2 & 3

Appendix B

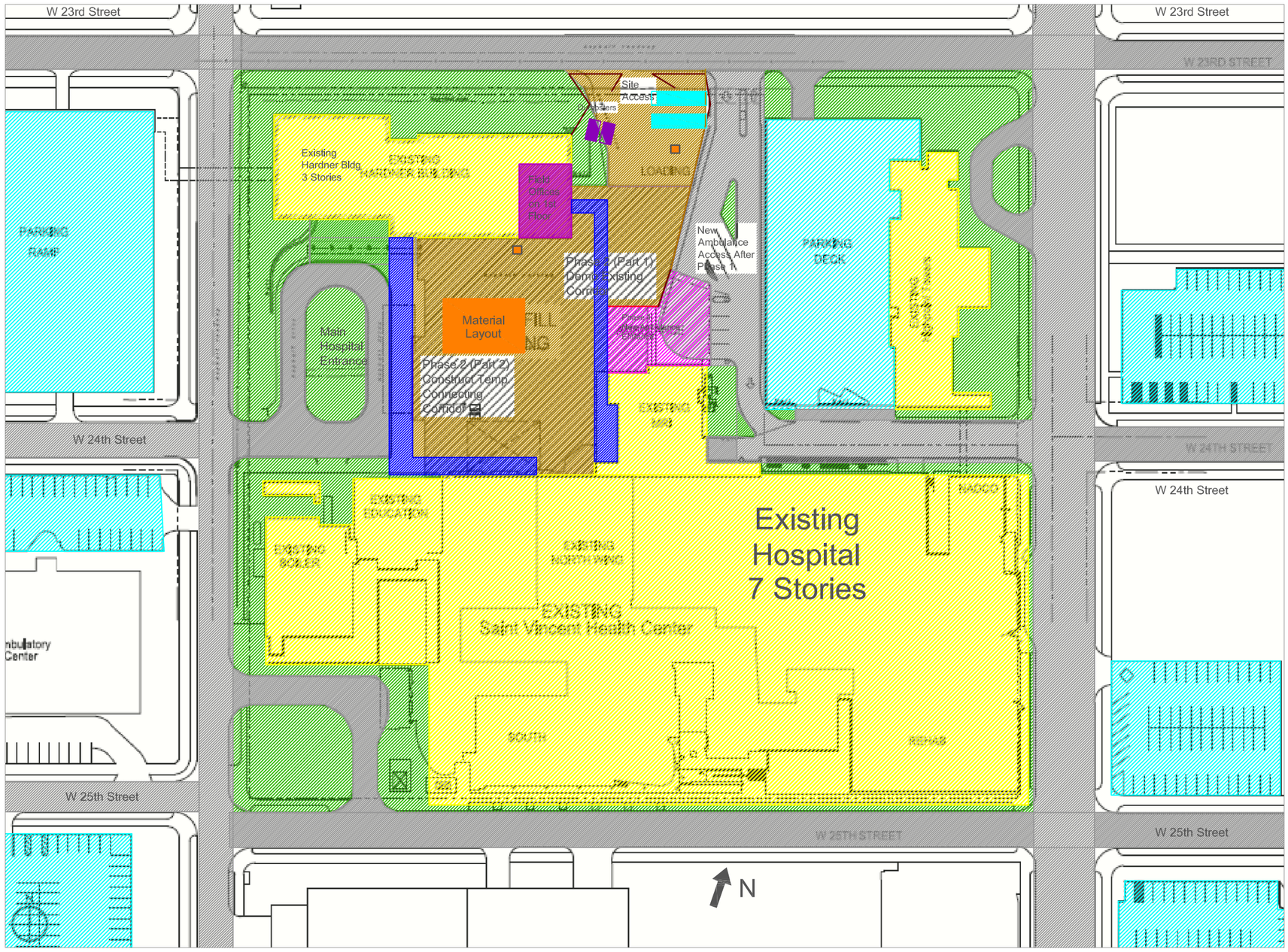


Legend

- Existing Bldgs
- Site Work Area
- Parking
- Grass
- Paving
- Phase 1 Work
- Phase 2 Work (Existing Corridor)
- Phase 3 Future Work
- 150 Ton Crane
- Storage Box/Shed
- Portable Toilets
- Dumpsters

Tyler Jaggi -CM 10/25/10	Phase 1 - Emergency Entrance Saint Vincent Health Center	SP101

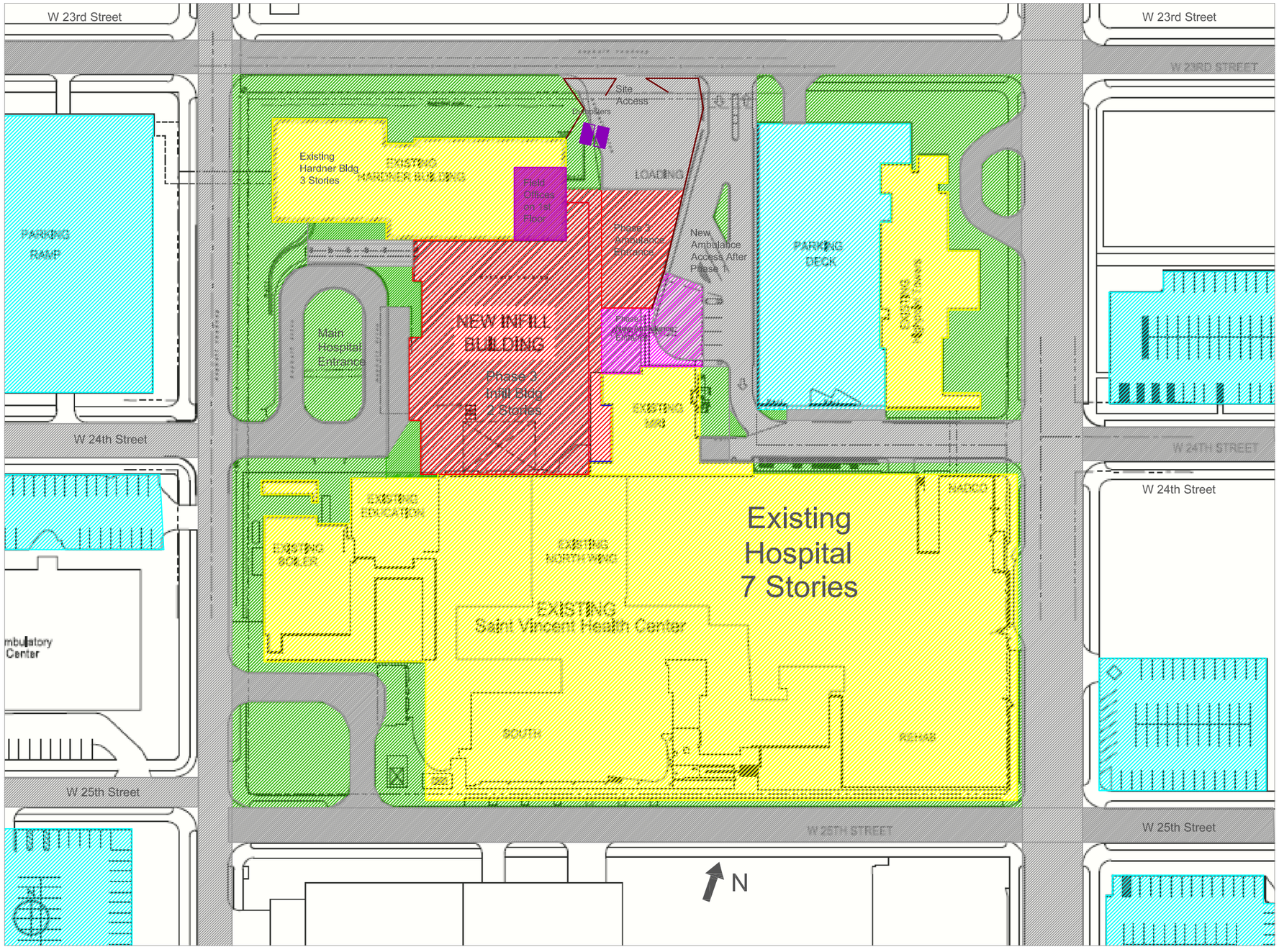
Appendix B



Legend

- Existing Buildings
- Site Work Area
- Parking
- Grass
- Paving
- Phase 1 Work Completed
- Portable Toilets
- Dumpsters
- Storage Box/sheds
- Material Layout
- Phase 2 Work

Tyler Jaggi - CM 10/25/10	Phase 2 - Demo Exist. Corridor/ Constr. New Temporary Corridor Saint Vincent Health Center	SP102

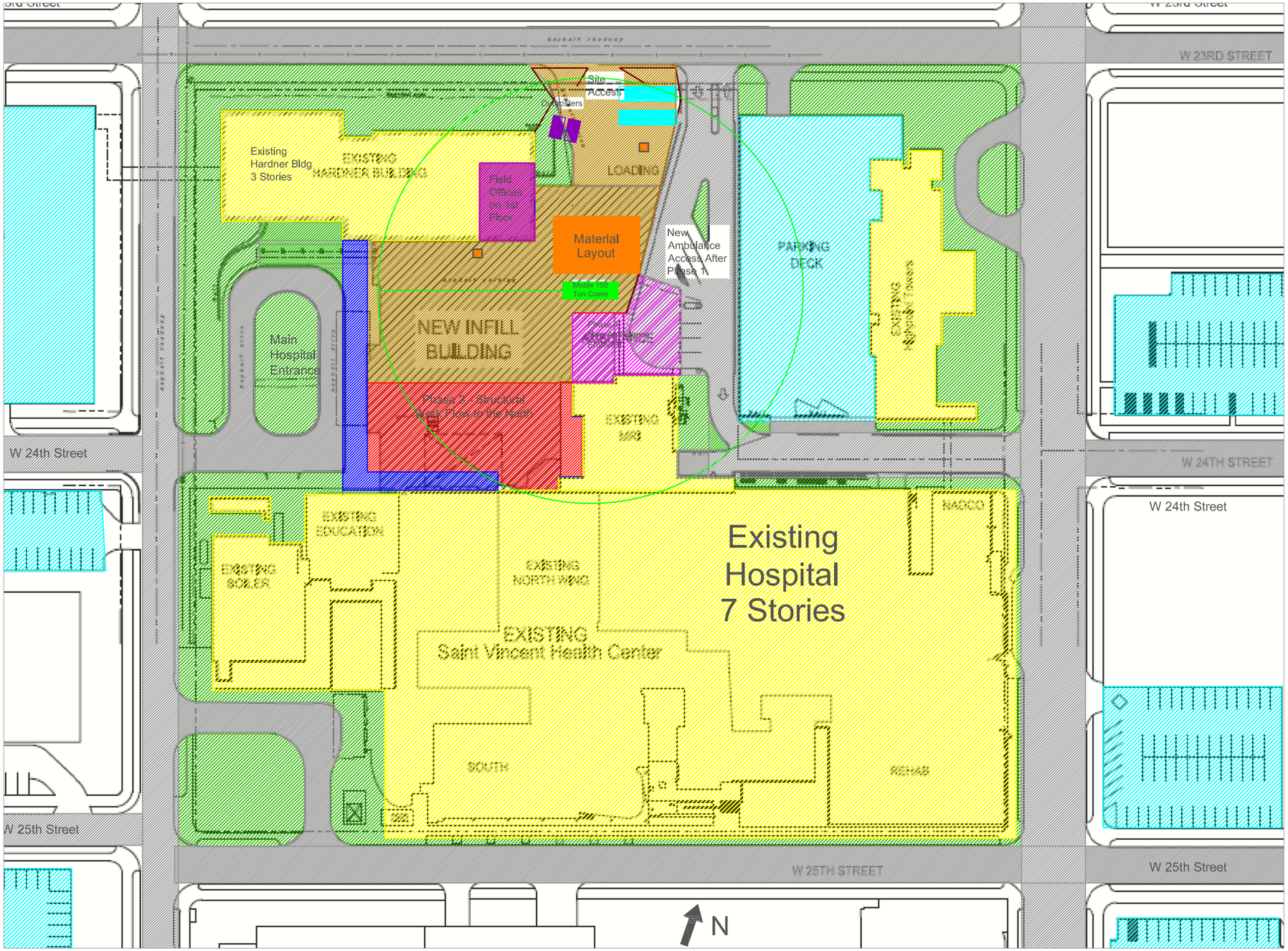


Legend

- Existing Buildings
- Site Work Area
- Parking
- Grass
- Paving
- Phase 1 Work
- Phase 3 Work

Tyler Jaggi - CM 10/25/10	Infill Bldg - Phase 3 Complete Saint Vincent Health Center	SP104

Appendix B



Legend

- Existing Buildings
- Site Work Area
- Parking
- Grass
- Paving
- Phase 1 Work Completed
- Portable Toilets
- Dumpsters
- Storage Box/sheds
- Material Layout
- Phase 2 Temporary Corridor

Tyler Jaggi - CM 10/25/10	Phase 3 - Start of Structural Systems Saint Vincent Health Center	SP103

Detailed Structural Systems Estimate

Saint Vincent Health Center project has a deep foundation system of 48" and 36" cased caissons. On the lower level there are concrete reinforced grade beams under the perimeter and interior walls. The slab on grade is a 4" reinforced mesh concrete slab. The total estimated cost of the Foundation system that I came up with is $1.267 Million. The tables below should the detailed breakdown of the estimate.

Floor Areas

Lower Level – 37,900 SF 12" concrete

Ground Floor – 37,900 SF 18ft x 24ft typical bay

1st Floor – 28,850 SF 18ft x 24ft typical bay

Roof/future 2nd Floor – 36ft x 24ft typical Bay

Foundation Slab & Grade Beams

4" concrete slab on grade

Total Area A = 37,900 SF

Slab Concrete = 1403.7 CY

Grade Beams 18"x42" Below Exterior walls, 16"x36" below Interior walls

Grade Beams Concrete = 238 CY

Deep Foundation Systems:

(2900) 48" cased caissons at unit cost of $245 per, so total of **$710,500**
(1767) 36" cased caissons at $150 per unit = total of **$265,050**

Foundations & Lower Level Estimate					
Foudation System:	**Item Description**	**Quanity**	**Unit**	**Unit Cost**	**Total**
Deep Foundations	48" Cased Caissons	2900	VLF	$245	$710,500
	36" Cased Caissons	1767	VLF	$150	$265,050
Concrete Grade Beams	18" x 42" Perimeter Grade Beams	148	CY	$725	$107,300
	16" x 36" Interior Grade Beams	89	CY	$725	$64,525
Slab on Grade	4" thick slab w/ mesh reinforcing	38100	SF	$3.15	$120,015
				Total	**$1,267,390**

Saint Vincent's new addition can be primarily broken up into 4 types of typical bays. I have labeled them Area A-D. Below is a description of each Area, followed by the estimate of the typical bays:

AREA A

Typical Bay: 18ft x 24ft:

- Beams = (4) W12x19 [24ft]
- Girders = (2) W16x26 [18ft]
- Columns = (4) W10x68

4" concrete slab on 2" compostite steel metal deck

Area = 432 SF

Yards = 180 ft^3 = 6.667 CY

Total Area A = **52,710 ft^2**

AREA A: Ground Floor & 1st Floor Typical Framing

AREA B

Typical Bay: 18ft x 24ft:

- Beams = (3) W14x22 [24ft] & (1) W16x40 [24ft] Exterior wall
- Girders = (2) W16x31 [18ft]
- Columns = (4) W10x54

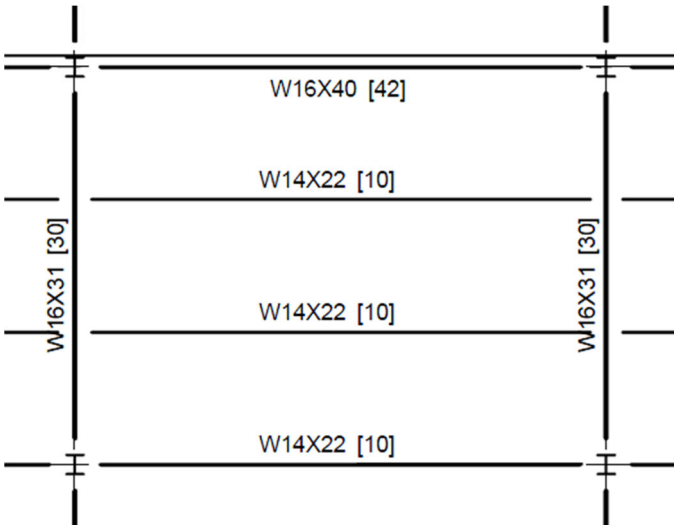
4" concrete slab on 2" compostite steel metal deck

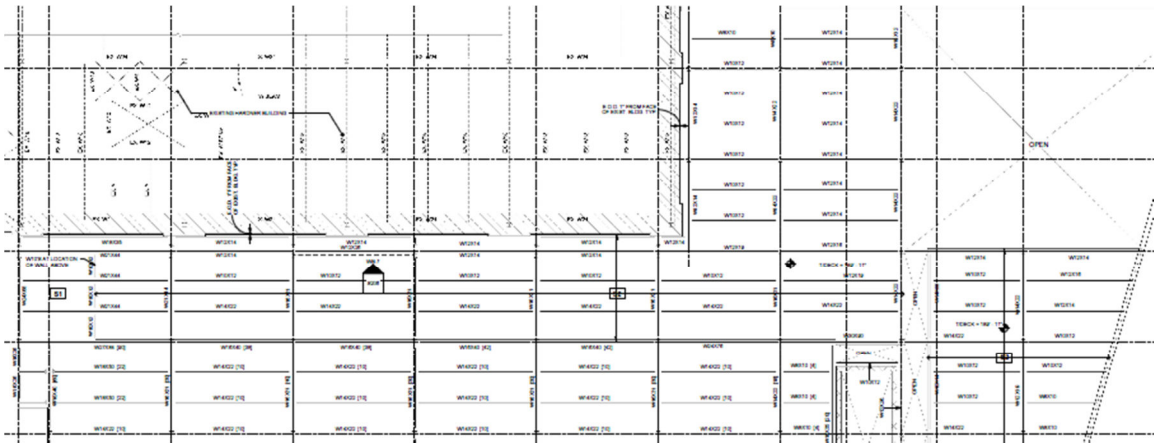
Area = 432 SF

Yards = 180 ft^3 = 6.667 CY

Total Area C = 7128 ft^2 + 5184 ft^2 + 1728 ft^2 = **14040 ft^2**

AREA B: Ground Floor & 1st Floor Typical Edge Framing





AREA C: Roof/ Future 2nd Floor

Typical Bay: 36ft x 24ft:

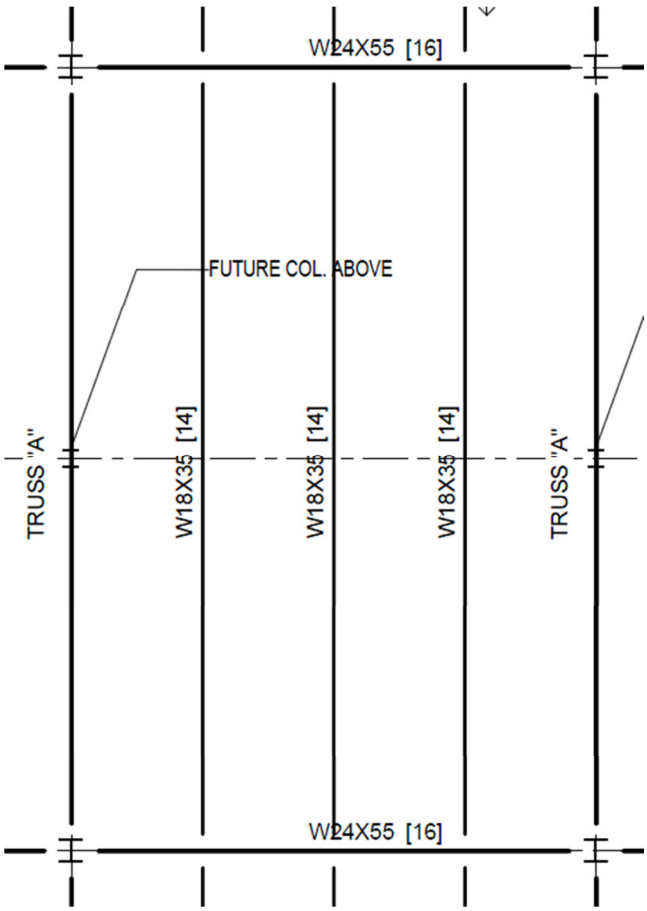
- Beams = (3) W18x35 [36ft]
- Beam/Truss = (2) Truss "A" [36ft]
- Girders = (2) W24x55 [24ft]
- Columns = (4) W12x65

4" concrete slab on 2" compostite steel metal deck

Area = 864 SF

Yards = 360 ft^3 = 13.333 CY

Total Area C = 12,960 ft^2



AREA D: Roof / Future 2nd Floor

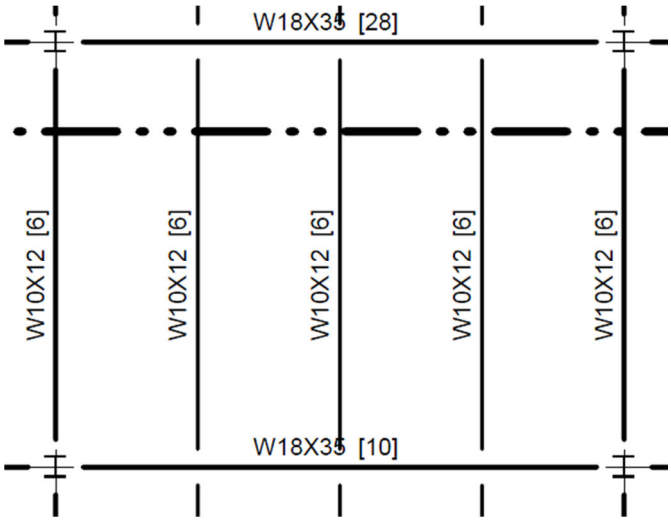
Typical Bay: 18ft x 24ft:

- Beams = (5) W10x12 [18ft]
- Girders = (2) W18x35 [24ft]
- Columns = (4) W10x54

4" concrete slab on 2" compostite steel metal deck

Area = 432 SF

Total Area: 15,890 ft^2



Steel Estimate for Typical Bays									
Typical Bay	Steel Member	# of Members	Member Length (ft)	Unit	Quantity	Unit Cost	Total Cost/Area	Totals Cost/Area	
Area A	W12x19	3	24	L.F.	72	$33.42	$2,406.24	Total Cost Area A	$5,452.58
	W16x26	1	18	L.F.	18	$36.77	$661.86		
	W10x68	2	14	L.F.	28	$85.16	$2,384.48		
Area B	W14x22	2	24	L.F.	48	$36.83	$1,767.84	Total Cost Area B	$6,243.86
	W16x40	1	24	L.F.	24	$54.47	$1,307.28		
	W16x31	1	18	L.F.	18	$43.57	$784.26		
	W10x54	2	14	L.F.	28	$85.16	$2,384.48		
Area C	W18x35	3	36	L.F.	108	$50.01	$5,401.08	Total Cost Area C	$13,028.76
	Truss "A"	1	36	L.F.	36	$73.88	$2,659.68		
	W24x55	1	24	L.F.	24	$97.66	$2,343.84		
	W12x65	2	14	L.F.	28	$93.72	$2,624.16		
Area D	W10x12	4	18	L.F.	72	$25.46	$1,833.12	Total Cost Area D	$5,417.84
	W18x35	1	24	L.F.	24	$50.01	$1,200.24		
	W10x54	2	14	L.F.	28	$85.16	$2,384.48		

Above is the Steel Estimate for the typical bays. This estimate is done based on the steel members used in each bay. The table below is the a detailed typical bay estimate that includes the area of the typical bay, the total area of the bay in the building, the cost of concrete and steel per area type.

Typical Bay Estimate						
Areas			Concrete (CY)/SF			
Typical Bay	Typical Area (SF)	Total Area (SF)	Concrete (CY)/SF	Total Concrete (CY)	Concrete Cost/Typical Area	Total Concrete Cost
Area A	432	52710	0.01543	813.4	$1,054.33	$128,642.90
Area B	432	14040	0.01543	216.7	$1,054.33	$34,265.73
Area C	864	12960	0.01543	200.0	$1,054.33	$15,814.95
Area D	432	15890	0.01543	245.2	$1,054.33	$38,780.80
	Totals:	**95600**		**$1,475.31**		**$217,504.37**

	Metals					
Typical Bay	Steel Cost/SF	Steel Cost/ Typical Area	Total Steel Cost	Metal Decking Cost/SF	Metal Decking Total Cost	**Total Cost**
Area A	$12.62	$5,452.58	$665,290	$2.18	$114,907.80	**$908,841**
Area B	$14.45	$6,243.86	$202,925	$2.18	$30,607.20	**$267,798**
Area C	$15.08	$13,028.76	$195,431	$2.18	$28,252.80	**$239,499**
Area D	$12.54	$5,417.84	$199,281	$2.18	$34,640.20	**$272,702**
			$1,262,929		**$208,408.00**	**$1,688,841**

The Structural System for the above ground structure I estimated will cost $1.69 Million. This price includes the steel members, metal decking and the concrete slabs. Below is the Structural estimate summary that includes the deep foundations, grade beams, slab on grade, and all the typical bays A-D. This total including waste is approximately $3.25 Million.

Structural Estimate Summary		
Structural System	**Cost/Building SF**	**Total Cost**
Deep Foundations	$9.38	$975,550
Grade Beams	$1.65	$171,825
Slab on Grade	$1.15	$120,015
Area A	$8.74	$908,841
Area B	$2.57	$267,798
Area C	$2.30	$239,499
Area D	$2.62	$272,702
TOTAL	**$28.43**	**$2,956,230**
Add Waste 10%	**$2.84**	**$295,623**
GRAND TOTAL	**$31.27**	**$3,251,853**

General Conditions Estimate

My estimated General Conditions for the Saint Vincent Health Center cost would be slightly over $1.1 million. This cost includes Staff, temporary utilities, equipment, and misc. cost. I also included a total savings that the CM is saving because of using Saint Vincent's building and utilities. That savings is approximately $ 162,700.

For the Supervision and personnel estimate, I estimated that the senior superintendent and the project manager will be working on this project full-time whereas the others, vice president, engineer and safety coordinator will be work a portion of the time. The estimated total that I came up with for the CM staff is based on a 100 week project with 10 addition weeks dealing with pre-construction work. The estimated total for the staff will be around $750,000.

Supervision and Personnel				
Line Item	**Quantity**	**Units**	**Unit Price**	**Total**
Vice President	85	Week	$2,225.00	$189,125
Senior Project Manager	110	Week	$2,200.00	$242,000
Project Engineer	50	Week	$1,900.00	$95,000
Senior Superintendent	100	Week	$2,050.00	$205,000
Safety Coordinator	100	Week	$150.00	$15,000
			TOTAL	**$746,125**

Below is my construction facilities and equipment estimate. Saint Vincent is providing the on-site office space in their existing Hardner Building that is adjacent to the site. Because of this there are some savings that normally wouldn't be on a project, such as field office trailer set-up, removal and trailer rental cost. I have made a table of all the cost saving that Saint Vincent is providing. The total cost of the Facilities and Equipment is an estimated $215,000.

Construction Facilities and Equipment				
Line Item	**Quantity**	**Units**	**Unit Price**	**Total**
Field Office Trailer Set-up	-1	LS	$2,000.00	-$2,000
Field Office Trailer Rental	-20	Month	$1,000.00	-$20,000
Field Office Trailer Removal	-1	LS	$2,225.00	-$2,225
Construction Site Fence	20	Month	$325.00	$6,500
Storage Trailers	20	Month	$130.00	$2,600
Survey/Layout (Urban Eng.)	1	LS	$20,000.00	$20,000
Testing & Inspection(Urban)	1	LS	$75,000.00	$75,000
Tools/Equipment	1	LS	$50,000.00	$50,000
Trucking	20	Month	$1,500.00	$30,000
Fire Extinguishers	20	Month	$75.00	$1,500
Field Copier/Fax/Printer	20	Month	$200.00	$4,000
Computer/LAN Equipment	20	Month	$250.00	$5,000
Mobile Phones	20	Month	$75.00	$1,500
Signage	1	LS	$3,000.00	$3,000
Dumpsters	100	EA	$400.00	$40,000
			TOTAL	**$214,875**

The temporary utilities are all provided by Saint Vincent. The offices are in the adjacent Hardner building that saves cost from using trailers and electric cost. Saint Vincent is also providing the temporary power and water for the project. They are just connecting into the existing power and water source of the Hospital Complex. The only cost EE Austin will have in this department is temporary/portable toilets which I estimated will be around $250/month so a total of $5,000. The total cost of temporary utilities compared to a normal project is a savings of $ 133,475.

Temporary Utilities				
Line Item	**Quantity**	**Units**	**Unit Price**	**Total**
Field IT/Network Set-up	-1	LS	$2,225.00	-$2,225
Field Telephone Hook-up	-1	LS	$1,000.00	-$1,000
Field Telephone Service	-20	Month	$100.00	-$2,000
Temporary Power Installation	-1	LS	$10,000.00	-$10,000
Temporary Power Consumption	-20	Month	$6,000.00	-$120,000
Temporary Water	-1	LS	$2,050.00	-$2,050
Temporary Toilets	20	Month	$250.00	$5,000
Potable Water	-20	Month	$60.00	-$1,200
			TOTAL	**-$133,475**

The miscellaneous cost of this project includes insurance, permits, clean-ups and misc. labor. In Erie, you have to estimate for snow removal labor cost; because in Erie, PA they can get multiple feet of snow overnight so there needs to be estimated cost for snow removal. The total estimated cost that I came up with for these miscellaneous costs is approximately $140,250.

Miscellaneous Costs				
Line Item	**Quantity**	**Units**	**Unit Price**	**Total**
Occupancy Permit	1	LS	$1,000.00	$1,000
Trade Permits	1	LS	$1,000.00	$1,000
Progress Photographs	20	Month	$15.00	$300
Document Reproduction	1	LS	$5,000.00	$5,000
Travel Expenses (Staff Vehicles)	20	Month	$500.00	$10,000
Delivery/Shipping Expenses	20	Month	$150.00	$3,000
Clean-up Expenses	100	Week	$100.00	$10,000
Safety Labor	240	HR	$45.00	$10,800
Snow Removal Labor	120	HR	$45.00	$5,400
Health Screenings	10	EA	$175.00	$1,750
Office Furniture	1	LS	$2,000.00	$2,000
Misc. Field Expenses	20	Month	$500.00	$10,000
Insurance	1	Job	$80,000.00	$80,000
			TOTAL	**$140,250**

There are General Conditions Savings that I estimated because of Saint Vincent provided office space and temporary utilities. The offices are in the adjacent Hardner building that saves cost from using trailers and electric cost. Saint Vincent is also providing the temporary power and water for the project. They are just connecting into the existing power and water source of the Hospital Complex. The total estimated saving based on a similar project is approximately $ 162,700.

General Conditions Savings				
Line Item	**Quantity**	**Units**	**Unit Price**	**Total**
Field IT/Network Set-up	-1	LS	$2,225.00	-$2,225
Field Telephone Hook-up	-1	LS	$1,000.00	-$1,000
Field Telephone Service	-20	Month	$100.00	-$2,000
Temporary Power Installation	-1	LS	$10,000.00	-$10,000
Temporary Power Consumption	-20	Month	$6,000.00	-$120,000
Temporary Water	-1	LS	$2,050.00	-$2,050
Field Office Trailer Removal	-1	LS	$2,225.00	-$2,225
Potable Water	-20	Month	$60.00	-$1,200
Field Office Trailer Set-up	-1	LS	$2,000.00	-$2,000
Field Office Trailer Rental	-20	Month	$1,000.00	-$20,000
			TOTAL SAVINGS	**-$162,700**

Total General condition cost are approximately $1.106 million.

General Conditions Summary				
Line Item	**Quantity**	**Units**	**Unit Price**	**Total**
Supervision and Personnel	100	Week	$7,461.25	$746,125
Constr. Facilities & Equipment	100	Week	$2,148.75	$214,875
Temporary Utilities	100	Week	$50.00	$5,000
Miscellaneous Cost	100	Week	$1,402.50	$140,250
TOTAL	**100**	**Week**	**$11,062.50**	**$1,106,250**

Critical Industry Issues
PACE Meeting Summary

The 19th Annual PACE Roundtable was focused around the theme of "Building a Collaboration Culture". This theme has been especially important to the construction industry during this time of decline in economic movement. The day's discussions were designed to allow both students and industry members the opportunity to express their thoughts regarding the current state of the construction industry and how we can move forward. The three major break-out sessions of the day consisted of: Sustainability/Green Building, Technology Applications and Process Innovation. All three topics are very important at this moment in time. During a respite in the economy is it crucial for individuals and companies alike to expand our knowledge of new innovations and technology and ways to use them to improve construction and energy efficiency. This is the time to educate employees and prepare them for the future. BIM focus is equally important, as it is quickly becoming the industry standard for both design and delivery. However, the industry must develop standards for BIM delivery for it to ultimately be successful for years to come. Finally, the most important topics is a problem not only facing the construction industry but rather facing the world as a whole. Energy consumption may be the single most important issue that will be dealt with in our lifetime. For this reason, I chose to attend the session pertaining to Energy and the Construction Industry.

Introduction

The PACE Roundtable began with a brief introduction, followed by a short presentation on Building Information Modeling (BIM) related topics by Dr. John Messner. He went into detail on the current state of BIM research being conducted at Penn State and the different technologies that are on their way. As you will see, BIM was one of the major topics of discussion during the day's events. Due to the major advances in building information modeling, and its ability to create a much more successful and organized project, BIM is becoming increasingly more popular in the industry. Once this presentation was at its end, Dr. David Riley talked about the research and grants that the Penn State AE Department has received and they are working on. These grants and types of research are listed below.

Penn State AE Research/ Grants:

- Energy efficient building grant - $129 million
- Solar energy, smart grid dept energy grant/research
- Residential energy efficiency grant/research
- HARQ grant for Healthcare improvement

Break Out Sessions – Technology Applications

The topic that I chose to learn more about was that of BIM and Technology Applications. We began the sessions in our breakout room by providing a brief introduction of each of ourselves, our project and our current skill level with BIM Technology. The average skill level in the room was intermediate, leaning

closer to the beginner side. The session then broke out into a discussion of BIM in industry and the problems with implementing it. This continued throughout both of the sessions.

The biggest limitation with BIM is using the software and understanding all the tools. There is so much that can be done with BIM, but many companies don't really understand the possibilities it brings to a project. This also leads to the problem of owners not really knowing what they want when they ask for BIM on a project. One of the solutions that were thought of is the requirement of a BIM implementation plan for the project. By doing this, it is easier to provide a client with exactly what they want, as well as help the client better understand what they are able to do with the software. Another problem with BIM is that many times on a project, the older, less technologically able, project managers push all the modeling on the younger engineers. This can become a problem because of the lower experience level associated with a younger engineer. They may not be able to successfully identify all the problems on a project that an older, more experienced, engineer might be able to. A young draftsman may have no idea how certain members go together, so modeling the connection correctly might be very difficult to do.

A common perception that owners have is that BIM is used to find errors in the construction, and make "a bad building better." They feel that the building should be correct in the first place, and that BIM is completely unnecessary. This idea ignores that fact that clash detection is only a way to help the many different entities on a project work together more efficiently. This will not only save costs on a project due to change orders, but time as well. This will create a much more successful project. Clash detection is not the only thing that BIM can do, either. BIM can be used for putting work into place, such as with surveying or laying pipe on a project. Viewing these objects in a 3-Dimensional view is much more effective that trying to decipher 2-Dimensional drawings. BIM is first and foremost for the builder, so using it for this advantage will make everything much easier.

Finally, the one topic was the possibilities of BIM were discussed. Some possibilities include prefabrication, site layout with total station, 3D gaming simulation and the savings the can come from these things.

A few ideas that were thrown out are:

- Prefabrication (corridor MEP, restroom rough-in)
- The need for collecting more metrics on savings (time & money)
- Laser scanning vs. surveying
- Computer tablets for commissioning/punch-out
- Wireless active RFID
- 3-D gaming interface simulation
- Virtual performance mockups like car industry
- Tablets vs. paper drawings
- Total station from model for layouts
- As-built from total station put back into the model

- Senor technology (bar code)
- Online info exchange

The conclusion of the conference left me with plenty to think about. I now have few ideas for a thesis proposal and a list of professionals willing to help me develop those ideas. I want to look into the improvements and savings that could happen if Saint Vincent and EE Austin would have implemented BIM on this project. I will look at the cost and time savings that could be possible with BIM such as prefabrication. Overall, the 19th Annual PACE Roundtable was a successful at "creating opportunities" for me to gather ideas and meet new people.

Unit Detail Report

Cost Estimate Report CostWorks RSMeans

Erie,

Year 2010 Quarter 3

Date: 24-Oct-10

Saint Vincent Health Center

Prepared By:
Luke Gray
PSU

LineNumber			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
Division 05 Metals							
051223750600			Structural steel member, 100-ton project, 1 to 2 story building, W10x12, A992 steel, shop fabricated, incl shop primer, bolted connections	72.00	L.F.	$25.46	$1,833.12
051223751300			Structural steel member, 100-ton project, 1 to 2 story building, W12x22, A992 steel, shop fabricated, incl shop primer, bolted connections	72.00	L.F.	$33.42	$2,406.24
051223751300			Structural steel member, 100-ton project, 1 to 2 story building, W12x22, A992 steel, shop fabricated, incl shop primer, bolted connections	72.00	L.F.	$33.42	$2,406.24
051223751700			Structural steel member, 100-ton project, 1 to 2 story building, W12x72, A992 steel, shop fabricated, incl shop primer, bolted connections	28.00	L.F.	$93.72	$2,624.16
051223751900			Structural steel member, 100-ton project, 1 to 2 story building, W14x26, A992 steel, shop fabricated, incl shop primer, bolted connections	48.00	L.F.	$36.83	$1,767.84
051223752700			Structural steel member, 100-ton project, 1 to 2 story building, W16x26, A992 steel, shop fabricated, incl shop primer, bolted connections	18.00	L.F.	$36.77	$661.86
051223752900			Structural steel member, 100-ton project, 1 to 2 story building, W16x31, A992 steel, shop fabricated, incl shop primer, bolted connections	18.00	L.F.	$43.57	$784.26
051223753100			Structural steel member, 100-ton project, 1 to 2 story building, W16x40, A992 steel, shop fabricated, incl shop primer, bolted connections	24.00	L.F.	$54.47	$1,307.28
051223753300			Structural steel member, 100-ton project, 1 to 2 story building, W18x35, A992 steel, shop fabricated, incl shop primer, bolted connections	108.00	L.F.	$50.01	$5,401.08
051223753300			Structural steel member, 100-ton project, 1 to 2 story building, W18x35, A992 steel, shop fabricated, incl shop primer, bolted connections	24.00	L.F.	$50.01	$1,200.24
052113504300			Deep longspan joists, SLH Series, 40-ton job lots, 96SLH22, 102 plf, spans to 200', shop fabricated, (shipped in 3 pieces), incl shop primer, bolted cross bridging	36.00	L.F.	$73.88	$2,659.68
052116502280			Longspan joist, LH Series, 40-ton job lots, 24LH05, 13 plf, spans to 96', shop fabricated, incl shop primer, bolted cross bridging	24.00	L.F.	$14.96	$359.04
053113503300			Metal decking, steel, open type, wide rib, galvanized, under 50 Sq, 3" D, 20 ga	432.00	S.F.	$3.61	$1,559.52
053113505800			Metal floor decking, steel, non-cellular, composite, galvanized, 3" D, 20 gauge	432.00	S.F.	$2.72	$1,175.04
Division 05 Subtotal							**$26,145.60**

Unit Detail Report

Cost Estimate Report
CostWorks®
RSMeans

Erie,

Year 2010 Quarter 3

Date: 27-Sep-10

Saint Vincent

Prepared By:
Tyler Jaggi
Penn State

LineNumber			Description	Quantity	Unit	Total Incl. O&P	Ext. Total Incl. O&P
Division 03 Concrete							
031113653000			C.I.P. concrete forms, slab on grade, edge, wood, to 6" high, 4 use, includes erecting, bracing, stripping and cleaning	24.00	L.F.	$3.23	$77.52
033105350300			Structural concrete, ready mix, normal weight, 4000 PSI, includes local aggregate, sand, Portland cement and water, delivered, excludes all additives and treatments	6.67	C.Y.	$103.06	$687.10
033529300300			Concrete finishing, floors, for specified Random Access Floors in ACI Classes 1, 2, 3 and 4, to achieve a Composite Overall Floor Flatness & Levelness value up to F35/F25, power screed, bull float, machine float & steel trowel (walk-behind), excludes plac	432.00	S.F.	$0.55	$237.60
033923130700			Concrete surface treatment, curing compound, 200-400 S.F. per gallon, 55 gal. lots, includes material only	3.00	Gal.	$17.37	$52.11
Division 03 Subtotal							**$1,054.33**
Division 05 Metals							
051223177050			Column, structural, 2-tier, W10x68, A992 steel, incl shop primer, splice plates, bolts	4.00	L.F.	$85.16	$340.64
051223751300			Structural steel member, 100-ton project, 1 to 2 story building, W12x22, A992 steel, shop fabricated, incl shop primer, bolted connections	4.00	L.F.	$33.42	$133.68
051223752700			Structural steel member, 100-ton project, 1 to 2 story building, W16x26, A992 steel, shop fabricated, incl shop primer, bolted connections	2.00	L.F.	$36.77	$73.54
053113505200			Metal floor decking, steel, non-cellular, composite, galvanized, 2" D, 22 gauge	432.00	S.F.	$2.18	$941.76
Division 05 Subtotal							**$1,489.62**