New Regional Medical Center
EAST NORRITON, PA

Technical Report
No. 2

October 19

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Department of Architectural Engineering
Construction Management Option

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EXECUTIVE SUMMARY

Technical Report No. 2 focuses on investigation and analysis of the New Regional Medical Center's cost and schedule. This report was developed through exploration of the construction documents and structural model in order to deliver a comprehensive summary on the New Regional Medical Center project execution.

This document includes a detailed schedule and sequence process for the medical center, which is focused on achieving a 553 day construction schedule. Due to extensive Building Information Modeling design coordination by the Architect and Structural Engineer, in addition to trade coordination, mechanical, electrical, and plumbing coordination was able to stay on top of their 114 day schedule, signing-off coordinated models weekly. In conjunction with this effort, trade sequencing was revised, and was redeveloped to include thirty-two trade activities working their way down the patient towers, in-parade, and meeting back on the ground level to assist with the task of closing out the largest and most complex floor of the hospital.

An in-depth study of the building's structural system, in addition to a detailed structural estimate, permits future analysis of alternative structural systems. It was recognized that the structural model was capable of producing an estimate, utilizing *RSMean Facility Construction Cost* data, within 10.5% of the reported structural cost from the project's estimator. The estimate totaled at $18,935,252, and at a $58.94 per square foot.

Project general condition (GC) costs are also evaluated, and are estimated to be $18,222,285, with a monthly cost of $560,094. Personnel costs account for 45.5% of the total GC and temporary facility costs, with miscellaneous costs, including bonds and insurances, accounting for 52%. This investigation enables future discussion regarding cost impacts connected with schedule changes, and potential staffing restructuring.

The New Regional Medical Center's is aiming to achieve a LEED Silver rating (33 credits) based off of the LEED v.2.2 Scorecard. Through analysis and research into Penn State University's *LEED Policy 2011 Update*, recommendations were made to the medical center's scorecard; however, the facility still remains on track for LEED Silver Certification. The owners did not request any BIM deliverable within the Request for Proposal for the project; therefore, minimal BIM applications were applied through the construction programming. Although the Architect and Structural Engineer utilized 3D modeling for the design services of the project, specific BIM uses in the construction phase were at the discretion of Gilbane Building Company, and focused solely on 3D MEP coordination.

Through the completion of this report, and the distribution of the information contained within, focus will be placed on continued research in the sustainable design of the medical center and potential ways to capture usage of the strongly detailed structural model. These items, in addition to others, provide a strong lead into project design intent and constructability concerns. Analysis of the information contained in Technical Report No. 2 permits a comprehensive understanding of the project's execution, the trade schedule, and the opportunities the New Regional Medical Center project team is able to capture in both LEED investigation and BIM development. This knowledge will be the baseline for future developments of Technical Report No. 3, and concurrent thesis research.

THE NEW REGIONAL MEDICAL CENTER

OWNER: THE NEW REGIONAL MEDICAL CENTER, INC.

BUILDING INTRODUCTION

Site Overview

The New Regional Medical Center is located at 559 West Germantown Pike in East Norriton, Pennsylvania (See Figure 1). The selected site is an 84-acre greenfield property, which was previously occupied by an 18-hole golf course, miniature golf course, and auxiliary buildings; this site provides a very accessible and open plan for development. It is located directly off of a main arterial road (Germantown Pike) which bisected half of Montgomery County, and provides access to major roadway systems of neighboring counties. The site design shall preserve over one-third of the property as open green space for patients, visitors, and public walking trails. Along Germantown Pike, on the Southwest and Southeast corners of the property, there are existing establishments that range from restaurants, drugstores, and retail services, as shown in Figure 2.

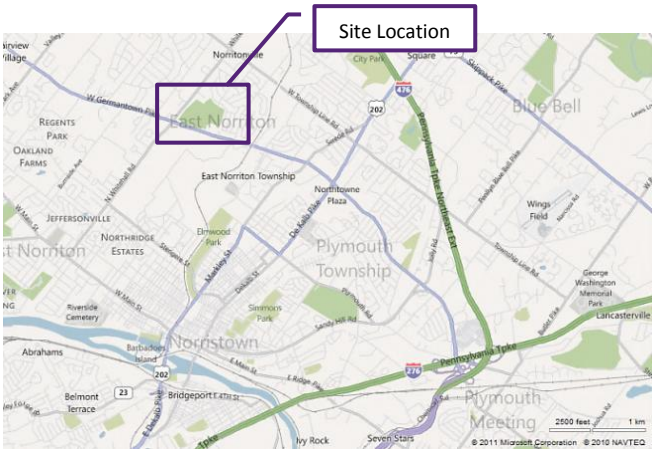

Figure 1: Regional Map | *bing.com*

Architectural Design

The facility's architectural design includes 146 beds: 96-bed medical/surgical, 22-bed intensive care unit, 20-bed obstetrical unit, and an 8-bed neonatal intensive care unit. It also includes a state-of-the-art 24 hour emergency department, advanced cancer care, advanced cardiac services, in addition to cutting-edge catheterization and electro-physiology laboratories (Wooley, 2010). Future campus development plans include direct on-site access to primary care at the adjacent medical office building. The main architectural feature of the project is the five story central patient tower atrium. This atrium serves as the location of the main entrance, and the vertical conveyance systems for the hospital. It also provides a sun-filled space, in which each floor's balcony steps back from the curtain wall to provide an open, large, panoramic view of the surrounding green space and across Germantown Pike onto the preserved lands of the Norristown Farm Park.

Figure 2: Birds-Eye View (Looking North) | *bing.com*

Architectural Materials

The primary building enclosure is a curtain wall system which incorporates precast panels and glazing units, as shown on the following page, in Figure 3. The architectural precast concrete panels are located on the North, South, and East façade of the patient tower, and feature linear windows of consistent size. In order to create aesthetic

variation and texture across the surfaces, sandblasting of varying degree was requested. In addition to this, split-faced concrete masonry units are located on the building at the West, North, and East sections of exterior wall at the Emergency Department and the Central Utility Plant. Metal panel components are located on the building at the West facade of the patient tower in addition to the screen wall surrounding the rooftop mechanical systems for the low roof.

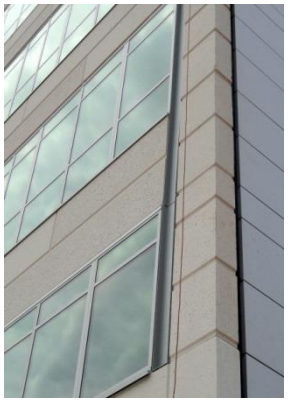

Figure 3: Façade System
Courtesy of Gilbane Building Co.

Sustainability

The New Regional Medical Center is dedicated to implementation of sustainability features within design, construction, and lifecycle of the facility. With consideration for the patients, the community, and the environment, countless steps have been taken by the Einstein-Montgomery Partnership and project team to achieve their goal of a LEED Certified rating for the medical campus. Sustainability features include a land preservation and waste management program, management of solar gain through architectural design and building placement, and design development for implementation of future sustainable technologies.

Construction Programming

The New Regional Medical Center includes 4 stories above grade, with a partial sub-grade ground floor. It will stand at 90'-8" tall, and have a gross building area of approximately 360,000 square feet. The project is being delivered through a construction management at risk contract, under an approximate construction cost of $147 million using a guaranteed maximum price contract.

Construction began on July 6, 2010 and is scheduled to be completed on August 31, 2012.

PROJECT TEAM DIRECTORY

OWNER:	NEW REGIONAL MEDICAL CENTER, INC. [PARTNERSHIP OF ALBERT EINSTEIN HEALTHCARE NETWORK & MONTGOMERY HEALTHCARE SYSTEM]
CONSTRUCTION MANAGER:	GILBANE BUILDING COMPANY
ARCHITECT:	PERKINS + WILL
STRUCTURAL ENIGNEERS:	O'DONNELL & NACCARATO
CIVIL ENGINEER:	BOHLER ENGINEERING
MEP & FIRE PROTECTION ENGINEERS:	PWI ENGINEERING
TRAFFIC ENGINEERS:	TRAFFIC PLANNING & DESIGN, INC
LANDSCAPE ARCHITECT:	WELLS APPEL

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DETAILED PROJECT SCHEDULE

PRIMAVERA SCHEDULE

The project detailed schedule includes approximately 270 activities and milestones associated within the phases of (1) design and preconstruction services, (2) construction activities, and (3) final closeout. The level of detail distinguishes sequencing, rough-in, finishes, and commissioning for trade activity. In addition to this, major phasing activities have been grouped in order to develop summary information concerning this work. Table 1 includes the major components of the Primavera schedule, and provides a summary of the phasing relations.

See **Appendix A** for the New Regional Medical Center's project schedule.

Table 1: Detailed Schedule Phase Summary

Primavera Schedule			
Phase	**Start**	**Finish**	**Duration (days)**
Design & Preconstruction	01-Oct-07	11-May-10	681
Construction	01-Jul-10	31-Aug-12	553
Structure	*29-Nov-10*	*18-Apr-11*	*99*
Enclosure	*22-Mar-11*	*01-Sep-11*	*116*
Ground Level	*11-Mar-11*	*25-May-12*	*310*
Level 1	*08-Apr-11*	*28-Feb-12*	*227*
Level 2	*22-Apr-11*	*28-Feb-12*	*217*
Level 3	*04-May-11*	*28-Feb-12*	*209*
Level 4	*11-May-11*	*28-Feb-12*	*204*
Electrical Room	*28-Dec-10*	*15-Aug-11*	*162*
Mechanical Room	*14-Mar-11*	*07-Jun-12*	*316*
Elevator Machine Room	*25-Oct-11*	*23-Mar-12*	*105*
MEP Coordination	30-Aug-10	09-Feb-11	114
Project Closeout	09-Apr-12	15-Oct-12	133

DESIGN & PRECONSTRUCTION

The design and preconstruction phase consists of 681 days and includes activities from preliminary site investigation / geotechnical testing through the Owner awarding the project to the construction management team. In review of the design and preconstruction sequencing, there are two major activity lapses on the project schedule between the (1) Preliminary Geotechnical Investigation and Supplemental Geotechnical Investigation, and (2) Supplemental Geotechnical Investigation and Civil Design. These lapses occurred due to timely decisions regarding finding a suitable site, and subgrade environment for the intended medical program. Additional influences on this gap can be attributed to coordination of the land purchase and development of project funding. However, once design began on the project, this phase progressed under suitable timing.

CONSTRUCTION

Construction of the New Regional Medical Center consists of 553 days from Notice to Proceed (NTP) to Substantial Completion. This phase includes all major construction activities (outlined in Table 1, above), in addition to

site clearing, driveway and parking lot establishment, and landscape installation around the facility. The construction phase is identified through 10 internal sequences that are additionally detailed within the schedule provided in Appendix A.

STRUCTURE

The structural phase of the construction schedule includes a combination of steel erection, and slab on deck placement. This process is dictated by an overall sequence layout, staged by bays, and is denoted as follows: 1 – 9, 10 – 15, 16 – 21, 22 – 27, 28 – 33, and 34 – 40. The sequence essentially flows from A to D to C & B as noted in Figure 1. In addition to this typical sequence, concrete work for the footings and retaining wall, and the slab-on-grade (SOG) are also included. Items that are not included due to level-of-detail constraints include activities such as in-slab electrical and plumbing rough-in, in addition to steel staging and delivery milestones.

The layout sequences were identified in such a way to permit concurrent activities between steel erection and slab-on-deck (SOD) preparation and placement. Typically each sequence requires 10 – 18 days of work, while each SOD needs 5 – 10 days for placement. In order to efficiently plan work through these spaces, the SOD began construction approximately three sequences behind, permitting a safe working area for the concrete and decking crews, while also keeping an accelerated structural schedule. A key item to note is that the SOG is held until approximately 50% of the structure is in place, in addition to a portion of the slab on deck underway. This strategy is required in order to permit the appropriate electrical and plumbing services within the slab to be roughed-in prior to pouring. Due to the location of the cafeteria on ground level in Section A, this sequencing was essential to keeping this area of the facility on schedule.

ENCLOSURE

Building enclosure for the medical center is scheduled over 116 days, and includes major activities regarding façade and roof enclosure. Due to the various exterior materials on this project, and the internal phasing required to meet the constructability requirements of the curtain wall, this phase includes major activities surrounding the exterior walls, curtain wall pre-cast, and atrium curtain wall.

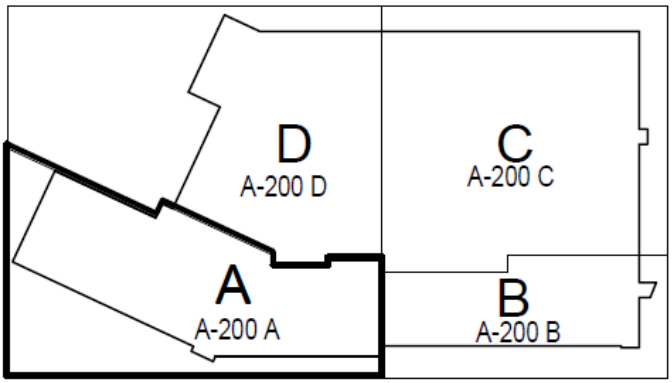


Figure 4: Building Quadrants
Detail from Sheet A-200A | Perkins + Will

The exterior walls are located surrounding the ground level at the emergency room entrance (Section C), and the loading dock area (Section D). This activity was sequenced first due to the longer duration of 95 days to complete. Following this, the curtain wall assembly was developed through the building sector layout. In this work flow, the medical center consists of 4 quadrants in which the trades are sequenced, as shown in Figure 4. Similarly, the roofs are phased by the quadrant method, in addition to designation of “low” or “high”.

Enclosure begins with curtain wall pre-cast placement in section C and D, and progresses into section A and B. The building roof system is phased in a similar pattern, approximately one section behind the curtain wall. In order to

minimize crane and worker overlap, the metal panel installation travels in the same sequence overlapping roof activities. They begin to the north, over sections D and C, and continue counterclockwise into the west façade. Due to constraints along the south façade (activity: curtain wall atrium), the metal panel work flow passes by the frontage of A and B, and continues work on the east façade before returning to fill-in around the atrium curtain wall. The curtain wall atrium activity is the most critical of the enclosure sequencing due to its large size, challenging construction method, and its reliance on progress in both section A and B for tolerance controls.

GROUND LEVEL THROUGH LEVEL 4

Construction on the ground level through level 4 consists of a systematic workflow that is repeating at each level. The only major difference between these five sequences is the overall duration. The ground level consists of 310 working days, while level 4 consists of only 204 days. The floors between these two decrease in duration with the rise in level. The range in variation is due to the overlying fact that the ground floor and level 1 are the two largest floors with the core medical systems, while level 2, 3, and 4 consist of the patient tower with repetitive elements, and a more efficient work flow.

The sequencing on this aspect of the New Regional Medical Center consists of approximately 32 activities which include the major MEP and finishes trades. It details aspects regarding rough-in, distribution, and finishes, in addition to detailing the scheduling differences regarding overhead and in-wall activities. Specialty systems of the medical center, such as the medical gas system and the pneumatic tube system, are also included in the detailed schedule. It is recognized that duration increases with floor size and system complexity. In addition to this, activity items also increase in detail; however, these additional items were excluded from the detailed estimate due to detail constraints.

As described in Technical Report No. 1, the following sequence reflects the flow of work through the New Regional Medical Center:

Finish sequencing is planned for a top-down approach. This method permits the trades to work their way out of the building, and depart the medical center on the first floor. Doing so also permits the completed sections of the facility to be locked out and begin closeout review. However, the programming of the facility, places the Emergency Department and Operating Rooms on the ground floor and first floor, respectively, of the north sector of the medical center. These two areas involve the greatest focus regarding interior systems and finishes; therefore, a second crew will be dedicated to this space. By working down the East and West Towers, the crews will complete three floors (Fourth, Third, Second); in the same amount of time scheduled for the second crew to complete the ground floor. The goal is for the crews to merge on the first floor and work their way north, finishing the operating room support areas and waiting area last (Packer, 2011).

Note however, that the activities in the schedule do not convey the same message. Within Appendix A, and also detailed in Table 1, work began on the ground level first, and additional levels were added approximately every two weeks, working up the structure. All floors are schedule to conclude on February 28th, except for the ground level which will not be completed for another 3 months. This discrepancy is due to a reevaluation of the MEP coordination and workflow process through the building. The included detail schedule reflects initial plans of the trade sequence. After discussion with the subcontractors, and revision of coordination model sequencing, it was recognized that the process described in Technical Report No. 1 is most efficient and meets the schedule and workflow progression.

This new flow of work was applied in the field around the month of April and permits schedule recovery for the ground level and the first level once the patient tower is completed.

ELECTRICAL ROOM

The electrical room detail schedule includes major activities regarding electrical equipment delivery, installation, and start up for generators and switchgear. Key items of focus include the milestone dates of Emergency Power Available (20-Jun-11), and Permanent Power Available (15-Aug-11). Once permanent power is establish, the trades within the facility are permitted to work off of this source.

MECHANICAL ROOM

Construction of the mechanical room systems is heavily dependent on delivery milestones. Five milestones are provided in Appendix A, include (1) cooling tower, (2) AHU, (3) Fire Pump, (4) Boiler, and (5) Chiller deliveries. Once on site, the activities are tightly phased for placement. Due to the size of this equipment, the cooling towers and AHU required use of the same crane being utilized on the building enclosure. Although this may be viewed as a conflict, this permitted a higher level of subcontracts coordination and eliminated the need for additional equipment rentals for servicing these lifts.

Work flow for the mechanical room transition from equipment placement into the Central Utility Plant rough-ins. In order to facilitate coordination in this space, 3D coordination (Figure 5) was utilized and developed well in advance of material deliveries, permitting prefabrication of select components. This also permitted a more efficient work flow in the congested space. The central utility plant is represented in Figure 6.

ELEVATOR MACHINE ROOM

The elevator core is set within the rear of the central atrium. This location permits ease of access, in addition to a large work area, as most of the trades are located within the wings of the medical center. The duration of elevator construction from shaft preparation through testing is 105 days. Within this schedule breakdown, the patient and visitor lifts were combined to permit a higher level-of-detail in other sections. Regarding phasing, the patient lifts precede the visitor lifts by approximately two weeks, although they are shown combined. This allows the high-capacity lifts to be operable to assist in equipment deliveries throughout the medical center once enclosed.

PROJECT CLOSEOUT

Although detailed in Technical Report No. 1, the project closeout has been included in the detailed project schedule located in Appendix A. Project closeout takes 133 days for the New Regional Medical Center and includes activities such as owner move-in, Department of Health (DOH) inspections, and owner training. Workflow for move-in, inspections, and punch list items, will be conducted from the top down – following the trades out of each area, permitting each area to be signed-off and delivered in time for owner and medical staff training.

MEP COORDINATION

Mechanical, electrical, plumbing (MEP) coordination is a key aspect which assisted with constructability on the project. It occurred over 114 days and continues to be incorporated through RFIs and ASIs on the project. The

coordination process consists of fourteen areas of the medical center. For ease of design and subcontractor communication, the same quadrants sections (A-D) were applied throughout the BIM coordination process. Each week, an individual section was assigned for design and revision, with the sign-off of the section occurring on week after the related coordination meeting. The 3D coordination process began approximately one month after NTP, and concluded during structural erection.

Reference the *BIM Use Evaluation* section for additional information regarding workflow and sequencing of MEP Coordination.

Figure 5: Central Utility Plant 3D Coordination
Courtesy of Gilbane Building Co.

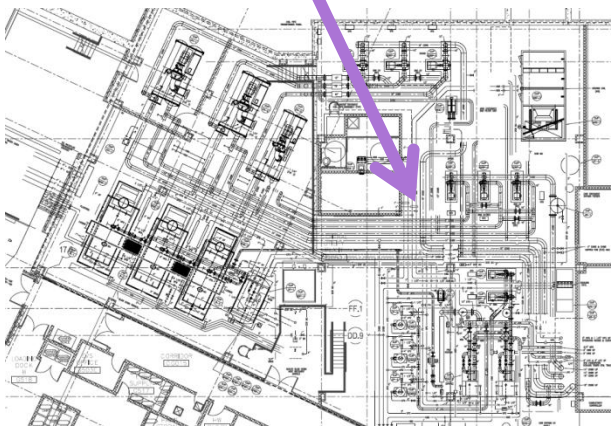


Figure 6: CUP Layout
Detail from Sheet M-505 | Perkins + Will

DETAILED STRUCTURAL SYSTEM ESTIMATE

STRUCTURAL SYSTEM SUMMARY

OVERVIEW

The new Regional Medical Center consists of a steel frame with structural decking and concrete slabs. As shown in Table 2, the major components of the structural system are classified in the CSI Masterformat as 03|Concrete and 05|Metals. Based off of the project data report, developed by a career estimator, the structural system is $19,850,000, with a square footage cost of $58.94. Through the utilization of the Autodesk Revit structural model, material properties, quantities, and means and methods of construction were extracted in order to develop a material quantity takeoff to the level of detail in which the structural engineers modeled with. Due to their efforts, a majority of the key takeoff elements for the structural estimate were included. Leveraging this tool, this report includes a complete structural takeoff by graphical element and component attributes.

Table 2: Specification Section Cost Data

Project Cost Data				
New Regional Medical Center | 336,780 SF				
CSI Masterformat		**Structural Element**	**Cost**	**Cost/SF**
03	--	Concrete	$8,600,000	$25.54
05	--	Metals	$11,250,000	$33.40
		Total:	**$19,850,000**	**$58.94**

Although a detailed takeoff of a typical bay was recommended, and through application of a square foot extrapolation the cost values would have applied to the system as a whole, the availability of this model permitted the investigating into the consistency between traditions estimate takeoffs versus a building information modeling approach. As the industry develops into a more virtual approach to construction and document management, it is an essential time to challenge the capabilities of the software and investigate the level of modeling required to match up with the knowledge and the processes of a career estimator.

Although cost values were not embedded into the model, all attributes were extracted and costs were applied though the use of the *RSMeans Facility Construction Cost Data* book from 2011. Figure 7 details the proximity of the New Regional Medical Center in relation to the city center of Norristown, PA. This location was selected as the project's location factor since it is 2 miles away, and shares similar characteristics and traits of East Norriton.

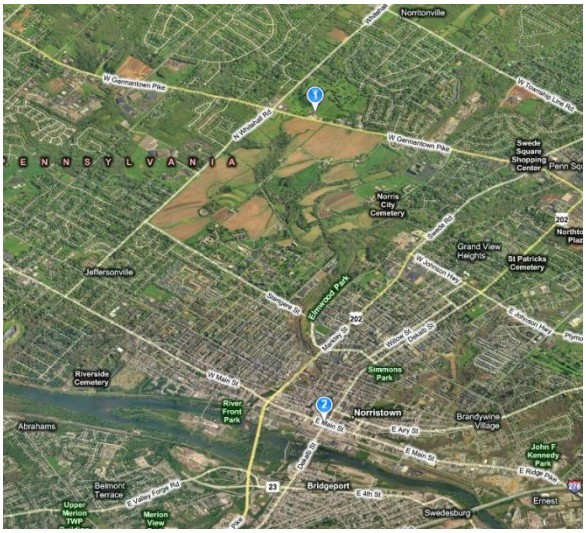


Figure 7: Map of East Norriton (1) & Norristown (2)
Courtesy of Bing.com

RESULTS

Through the use of the BIM model developed through the design, fabrication, and installation of the structural system in the medical center, an accurate structural estimate was procured for the entire structure. With a single pass through the model, multiple material schedules were developed and exported into Excel for data management and cost incorporation. The detailed estimate, through the utilization of modeled components, resulted in a cost of $17,012,805. Once the location factor was applied, a more appropriate estimate of $18,935,252 was achieved, as shown in Table 3. This value is within 10.5% of the actual project cost, as identified through hand and on-screen quantity takeoffs of construction drawings.

Shortcomings on costs are most recognizable in the Concrete section, as a major element on site, the retaining wall and loading dock area, were excluded from the estimate. Although these exclusions do not account for $6 million of concrete work, it puts into perspective the capabilities of Autodesk Revit Structural. Notably it showcases the capabilities of components and families to create a strong interface between modeled components and project estimations. For example, structural steel and other metals within a project mainly rely on square footage and linear foot, while concrete relies on volumes and more advanced takeoff processes including reinforcing and miscellaneous metals. Although there is current deviation from the actual value, the amount of time saved in utilizing a model for takeoffs permits a greater level of attention to the details and the constructability of the project. In addition to this, cost savings due to a more efficient estimate process can assist in development of cost estimation modeling training.

Table 3: Structural System Overview

Project Estimate Summary			
New Regional Medical Center | 336,780 SF			
CSI Masterformat	**Cost**	**Cost/SF**	**Structural Component**
03 --	$1,972,962	$5.86	Concrete
05 --	$15,039,843	$44.65	Metals
Subtotal:	**$17,012,805**	**$50.52**	
Location Factor #194 | Norristown, PA | Total = 111.3			
[$17,012,805 x 111.3] / 100			
[$50.52 x 111.3] / 100			
Detailed Structural Estimate Total:			
$18,935,252 | $56.23/SF			

Location factor #194 is applied to the RSMeans data in order to produce a more accurate estimate to the geographic location of the project. Within the appendix of the RSMean catalog, location factors by city and state are listed. The value obtain for Norristown, PA is 111.3, and is the multiplier for the total cost and cost per square foot. This value is then divided by 100 per RSMeans directions in order to adjust the costs back to the baseline factor of 100/100.

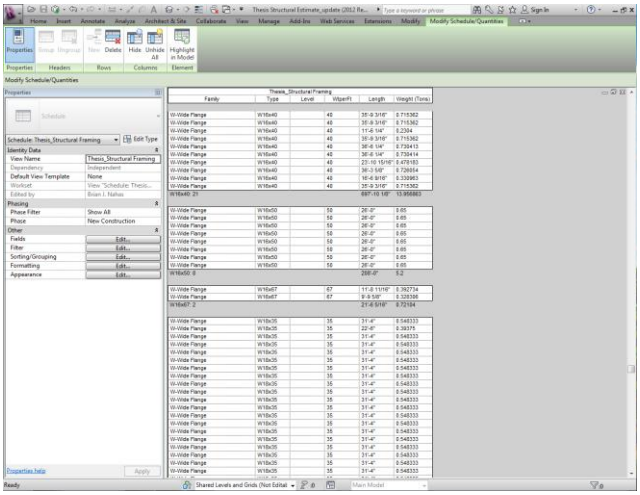


Figure 8: Structural Model Material Schedule
Courtesy of Gilbane Building Company

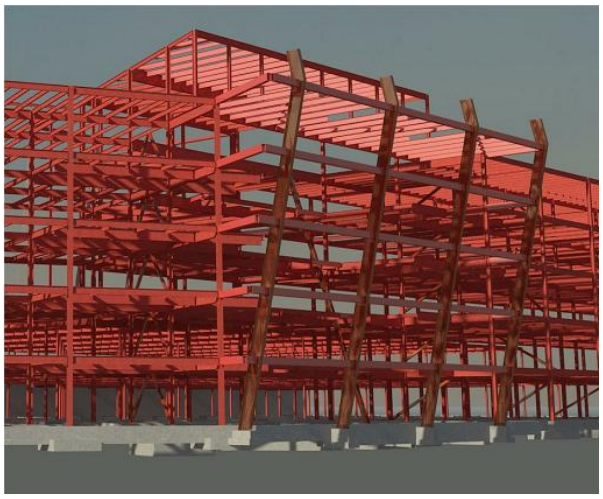


Figure 9: Structural Rendering
Courtesy of Gilbane Building Company

Table 4: Higher Detail of Structural Estimate

ESTIMATE SUMMARY				
Location Factor of 111.3 is included				
CSI Masterformat		**Cost**	**Cost/SF**	**Structural Component**
03	21	$14,800	$0.04	Reinforced Steel
03	22	$345,293	$0.92	Welded Wire Fabric Reinforcing
03	30	$639,583	$1.90	Cast In-Place Concrete
03	31	$1,009,846	$3.00	Structural Concrete Elements
05	12	$13,466,339	$39.99	Structural Steel Framing
05	31	$1,573,504	$4.67	Steel Decking

See **Appendix B** for the summation of each common model attribute associated with the structural detail.

For additional information, and the complete detailed quantity take off, please follow this link:

[Online Detailed Quantity Take Off for the New Regional Medical Center's Structural System]

GENERAL CONDITIONS ESTIMATE

GENERAL CONDITIONS SUMMARY

The general conditions (GC) estimate for this project is based off of a 33 month construction schedule. It is comprised of personnel costs, construction management reimbursements and facility, temporary utilities, and miscellaneous costs, including bonding and insurances. Excluded items from Gilbane's general condition costs are also included in this section; however, they are also excluded from the table below. Table 5 includes summary information regarding the major components of general condition costs. This estimate was developed by using data provided by Gilbane Building Company, with supplement from RSMeans. Quantities and durations were provided by Gilbane's proposal and updated according to the summary schedule provided in Technical Report No. 1.

The New Regional Medical Center's general conditions estimate is $18,222,285, with a monthly cost of $560,094. Notable factors in the estimate are the personnel costs, in addition to the miscellaneous, bonds, and insurances on the project. Personnel costs account for 45.5% of the total GC cost, and miscellaneous, bonds, and insurances account for 52%.

Table 6 includes detailing on personnel costs. The major expenses within this component are due to a large site staff, in addition to a highly involved office staff. With 25 Gilbane employees involved in the project, and most of them working full-time on this project, a great deal of expense is transferred towards payroll. Miscellaneous, bonds, and insurances are detailed in Table 10. This component is a high value due to the single expense of the Contractor Controlled Insurance Program (CCIP), which is over $8 million.

Cost concerns for the general condition revolve around scheduling and billing overruns since any minor delay on the project schedule risks extending this large expense beyond the scope of the GMP. In order to mitigate this, close monitoring must be made regarding construction progress, and personnel billing. The project team must monitor the construction schedule daily, and ensure their personnel costs are within the budget. Although miscellaneous, bonds, and insurances costs constitute the highest percentage of the New Regional Medical Center's general conditions, very few of these can be controlled internally by the project team.

Table 5: General Conditions Summary

GENERAL CONDITIONS SUMMARY			
	Cost/Unit	**Units**	**Total Cost**
Personnel	$251,661	Month	$8,304,803
CM Reimbursable	$11,102	Month	$336,375
		Single Expense	$369,175
Temporary Utilities	$10,087	Month	$332,874
Misc., Bonds, Insurance	$287,244	Month	$9,479,058
Monthly Total:	***$560,094***	**Project Total:**	***$18,222,285***

PERSONNEL COSTS

Table 6: Personnel Costs | Detailed Schedule of Values

Staffing Plan	Hours	Rate/Hr	Weeks	Rate/Week	Month	Rate/Month	Cost	Personnel
Field Office								
Project Executive								Kriebel
Executive Admin Support								Aguirre
Project Superintendent								Baird
Regional Quality Manager								Mulligan
Project Engineer								McCammit
Area Superintendent								Hedlund
Project Engineer # 1								Marshall
Project Engineer # 2								Waszilycsak
Project Engineer # 3								Gutherman
Project Engineer # 4								Esfahani
Asst. Project Engineer								Murzynski
Office Engineer								Packer
Assc. Office Engineer								Landa
MEP Superintendent								Markovic
MEP Engineer								Abdallah
Safety Supervisor								Plefka
						Field Support	**$ 6,415,217**	
Regional Office								
Principal								O'Connor
Project Accountant								Hunter
Senior Office Engineer								Morgan
Estimating Executive								Debruyn
Purchasing Agent								Miller
Project Engineer (BIM)								Horn
MEP Coordinator								Ankers
LEED Engineer								Reed
Management Trainee/Intern								Nahas
						Office Support	**$ 1,889,585**	
						Total Support	**$ 8,304,803**	

Information withheld in digital copy of Technical Report No. 2

Information withheld in digital copy of Technical Report No. 2

CM REIMBURSABLE

Table 7: CM Reimbursable | Monthly Values

CM Reimbursable	Unit Rate	Unit(s)	Cost	Cost/Month
Janitorial/Maintenance	$ 1,500	33 Mo.	$ 49,500	$ 1,500
Stationary/Supplies	$ 1,000	33 Mo.	$ 33,000	$ 1,000
Postage/Overnight	$ 750	33 Mo.	$ 24,750	$ 750
Site Vehicle				
Senior PM	$ 850	33 Mo.	$ 28,050	$ 850
Project Superintendent	$ 850	33 Mo.	$ 28,050	$ 850
Senior PE	$ 850	33 Mo.	$ 28,050	$ 850
Radio Cell				
Monthly	$ 150	270 Mo.	$ 40,500	$ 1,227
Prolog Manager	$ 200	33 Mo.	$ 6,600	$ 200
Router				
Monthly	$ 600	33 Mo.	$ 19,800	$ 600
Water/Coffee	$ 125	33 Mo.	$ 4,125	$ 125
Copier Lease (Quantity 2)	$ 700	66 Mo.	$ 46,200	$ 1,400
Petty Cash	$ 150	33 Mo.	$ 4,950	$ 150
Digital Camera				
Printing of Photographs	$ 100	33 Mo.	$ 3,300	$ 100
Travel (local)	$ 1,000	33 Mo.	$ 33,000	$ 1,000
Safety Incentives	$ 500	33 Mo.	$ 16,500	$ 500
			$ 366,375	**$ 11,102**

Table 8: CM Reimbursable | Single Expense Value

CM Reimbursable	Unit Rate	Unit(s)	Cost
Field Office & Furniture	$240,000	1 allowed	$ 240,000
Fax Machine	$ 400	2 each	$ 800
Telephone			
Setup	$ 3,000	1 each	$ 3,000
Purchase	$ 300	9 each	$ 2,700
Computers & IT			
Laptop	$ 2,000	9 each	$ 18,000
Desktop	$ 1,400	3 each	$ 4,200
Server	$ 7,000	1 each	$ 7,000
Printer	$ 1,900	2 each	$ 3,800
Color Printer	$ 600	1 each	$ 600
Switch	$ 125	1 each	$ 125
SureTrack	$ 450	1 each	$ 450
Router			
Purchase	$ 3,000	1 each	$ 3,000
Record Storage	$ 50	300 Boxes	$ 15,000
Project Signage	$ 1,000	2 each	$ 2,000
First Aid	$ 3,000	1 each	$ 3,000
Digital Camera			
Purchase	$ 500	1 each	$ 500
Temporary Secretary	$ 5,000	1 each	$ 5,000
Small Tools	$ 5,000	1 each	$ 5,000
Subsistence Allowance	$ 50,000	1 each	$ 50,000
Parterning Session	$ 5,000	1 each	$ 5,000
			$ 369,175

TEMPORARY UTILITIES

Table 9: Temporary Utilities | Detailed Schedule of Monthly Value

Item	Unit Rate	Unit(s)	Cost	Cost/Month
Temporary Power	$ 660	33 Months	$ 21,780	$ 660
Telephone	$ 1,350	33 Months	$ 44,550	$ 1,350
Data Processing	$ 3.60	74,040 Hours	$ 266,544	$ 8,077
			$ 332,874	**$ 10,087**

MISCELLANEOUS COSTS

Table 10: Miscellaneous Costs, Bonds, Insurance

Item	Unit Rate	Unit(s)	Cost
Traffic Control - Police Officer	$ 3,938	33 Months	$ 129,938
CCIP Fee	$ 8,116,120	1 Lump Sum	$ 8,116,120
CM Payment & Performance Bond	$ 1,233,000	1 Lump Sum	$ 1,233,000
Insurance			
General Liability			Included in Fee
Automobile			Included in Fee
Liability			Included in Fee
General Excess Liability	$ 7.47	$ 1,000.00 of Revenue	Unknown
Pollution			Not Included
Worker's Compensation			Included in Fee
Builders Risk			Owner Carries

EXCLUDED COSTS

Table 11: Excluded General Condition Costs

Item	Unit Rate	Unit(s)	Cost	Trade
Tire Cleaner & Wash Station	$161,677	1 Lump Sum	$ 161,677	Sitework
Temporary Construction Crossings	$ 13,138	3 each	$ 39,414	Sitework
Temporary Fencing	$ 55,326	1 Lump Sum	$ 55,326	Sitework
Snow Removal	$ 25,275	1 Lump Sum	$ 25,275	Sitework
Temporary Toilets (Quantity 15)	$ 3,450	33 Month	$ 113,850	Sitework

LEED EVALUATION

ANALYSIS

The New Regional Medical Center's is aiming to achieve a LEED Silver rating based off of the LEED v.2.2 Scorecard. In Table 12, each of the six categories are reviewed with the corresponding point values as decided upon by the project team. Successful approaches are made within the *Water Efficiency* and *Innovation & Design Process* categories, helping capture 9 points. Due to the energy intensive nature of a medical facility, only 4 of 17 potential points were attainable in the *Energy & Atmosphere* category. Through careful design intent, points were attained in the *Sustainable Sites* and *Materials & Resources* categories, helping to overcome some of the LEED challenges in a greenfield development. Finally, with a high focus for Indoor Air Quality (IAQ) in the medical center, it was both reasonable and attainable to quality for over 65% of the *Indoor Environmental Quality* credits.

In reviewing the "?" column on the project's LEED objective sheet (recreated in Table 12) it is recognized that the project has the potential to achieve upwards of 40 points, placing their rating as high as Gold, upon review and certification. However, this pursuit may not necessarily fit the intentions of the project, in addition to the budget.

LEED SCORECARD

Table 12: Project Team Scorecard Summary

Project Score LEED V.2.2				
33	***7***	***29***	***New Regional Medical Center***	***Silver***
Y	***?***	***N***	***Point Category***	***Possible Points (69)***
6	1	7	Sustainable Sites	14
4	0	1	Water Efficiency	5
4	3	10	Energy & Atmosphere	17
4	2	7	Materials & Resources	13
10	1	4	Indoor Environmental Quality	15
5	0	0	Innovation & Design Process	5

See **Appendix C** for the complete *LEED* Scorecard for the New Regional Medical Center.

CRITICAL EVALUATION

The New Regional Medical Center, Inc. strives for an environmentally friendly design and operation of the facility. "From the earliest planning stages of the new medical center Montgomery County residents have expressed how much they revered their community's natural landscape" (Environmentally Friendly Design, 2010). Through this goal, they were able to apply multiple strategies to ensure an appropriate LEED certification level. In many aspects, LEED credit decision making was done following a similar thought process to Penn State's *Credit Classification* (PSU LEED Policy, 2011).

Therefore, for evaluation purposes of an appropriate LEED Certification, the New Regional Medical Center's LEED credits will be classified according to Penn State's philosophy. Penn State identifies an appropriate effort level per credit opportunity, and provides a recommendation on how to capture, or yield each credit. This process will be

applied to the New Regional Medical Center to evaluate the depth of LEED program development for the "obtained" and "potential" credits shown above, in Table 12.

The rubric for classification from Penn State's *2011 LEED Policy Update* includes 4 classification types.

Mandatory: Credit compliance required. If not already present, achievement must be made prior to completion.

Significant Effort: Proof of serious investigation must be completed and proven. If compliance is not achieved, documentation must detail failure through design professional demonstration.

Minimal Effort: Investigation of compliance must be completed and approved. If beyond program requirements, documentation must detail such, and no additional efforts will be dedicated towards its compliance.

Not Pursued: Credits will not be pursued, and no documentation is required.

*This classification process assumed that all category prerequisite credits are obtained.

The following details include the obtained and potential points within the New Regional Medical Center's LEED V.2.2 Scorecard, and highlight the classification type in which Penn State pursues these opportunities (in University Park applications). Items which provide significant contrast include a brief narrative regarding its positive application to the medical center. Note that the Penn State classification types are based off of LEED V.3.0, and some items are not applicable.

OBTAINED POINTS:

Sustainable Sites

Credit 4.2: Alternative Transportation, Bicycle Storage & Changing Rooms **SIGNIFICANT EFFORT**

Credit 5.1: Site Development, Protect or Restore Habitat **MINIMAL EFFORT**

Due to the nature of greenfield development, all members of the medical center project team agreed on the importance of protection of the property and conservation of the landscape. This credit is easily obtained due to the site disturbance requirements outlined in the LEED V.2.2 Rating System relative to the property size.

Credit 5.2: Site Development, Maximize Open Space **SIGNIFICANT EFFORT**

Credit 6.1: Stormwater Design, Quantity Control **MANDATORY**

Credit 6.2: Stormwater Design, Quality Control **SIGNIFICANT EFFORT**

Credit 8: Light Pollution Reduction **NOT PURSUED**

Due to the nature of Penn State's campus, safety and zoning requirements require finite light levels around campus which typically exceed the credit levels. The medical center campus will be able to pursue this credit due to the large property size and centrally located facilities, which is possible due to minimize light trespass into the surrounding residential areas.

Water Efficiency

Credit 1.1: Water Efficient Landscaping, Reduce by 50% **MINIMAL EFFORT**

With new development for an entire medical campus, it is feasible to adopt the policy of efficient landscaping. Penn State has dictated efforts to attain this goal; however, campus landscape design criteria influence this credit, minimizing the importance in facility design.

Credit 1.2: Water Efficient Landscaping, No Potable Use or No Irrigation ***not applicable***

Credit 3.1: Water Use Reduction, 20% Reduction ***not applicable***

Credit 3.2: Water Use Reduction, 30% Reduction **SIGNIFICANT EFFORT**

Energy & Atmosphere

Credit 1: Optimize Energy Performance, 14% New Building **NOT PURSUED**

The New Regional Medical Center has been designed to achieve an appropriate energy reduction for the services included in the facility. Due to the high energy loading of equipment and continuous operation, the effort placed into achieving 14% reduction is appropriate. University Park operates off of a different energy model; therefore, the systems are not comparable.

Credit 4: Enhanced Refrigerant Management **MANDATORY**

Credit 5: Measurement & Verification **NOT PURSUED**

The New Regional Medical Center is capable of meeting the staffing requirements and strategies required to meet this credit. Although Penn State is capable of tracking building energy consumption, their strategy does not qualify with the rating system.

Material & Resources

Credit 2.1: Construction Waste Management, Divert 50% from Disposal **MANDATORY**

Credit 2.2: Construction Waste Management, Divert 75% from Disposal **MANDATORY**

Credit 4.1: Recycled Content, 10% **MANDATORY**

Credit 5.1: Regional Materials, 10% **MANDATORY**

Indoor Environmental Quality

Credit 1: Outdoor Air Delivery Method **MANDATORY**

Credit 3.1: Construction IAQ Management Plan, During Construction **MANDATORY**

Credit 3.2: Construction IAQ Management Plan, Before Occupancy **MANDATORY**

Credit 4.1: Low-Emitting Materials, Adhesives & Sealants **MANDATORY**

Credit 4.2: Low-Emitting Materials, Paints & Coatings	**MANDATORY**
Credit 4.3: Low-Emitting Materials, Carpet Systems	**MANDATORY**
Credit 6.1: Controllability of System, Lighting	**MANDATORY**
Credit 6.2: Controllability of System, Thermal Comfort	**SIGNIFICANT EFFORT**
Credit 7.1: Thermal Comfort, Design	**SIGNIFICANT EFFORT**
Credit 7.2: Thermal Comfort, Verification	**MANDATORY**

Innovation & Design Process

Credit 1.0: Innovation in Design	**SIGNIFICANT EFFORT**
Credit 2.0: LEED Accredited Professional	**MANDATORY**

POTENTIAL POINTS:

Sustainable Sites

Credit 2: Development Density & Community Connectivity	**MINIMAL EFFORT**

Energy & Atmosphere

Credit 6: Green Power	**MANDATORY**

With recent development in green power and sustainable energy, Penn State is dedicated to their use of renewable energy in the form of Renewable Energy Certificates (2011 LEED Policy Update, 2011). Similarly, the New Regional Medical Center recognizes the importance of green power; however, they have not finalized their investigating into solar photovoltaic or other alternate energy sources for this facility.

Material & Resources

Credit 4.1: Recycled Content, 20%	**SIGNIFICANT EFFORT**
Credit 5.1: Regional Materials, 20%	**MANDATORY**

Due to the strict specifications on materials and requirements for a medical center, it is unknown if the project will be able to meet the 20% Regional Materials credit. With a requirement of 10%, the project team is actively pursuing its potential; however, it cannot confirm the 20% initial standard in which Penn State pursues.

Indoor Environmental Quality

Credit 5: Indoor Chemical & Pollutant Source Control **MANDATORY**

With Penn State's OPP Environmental, Health, and Safety Division strategy for indoor environmental quality as a key aspect of student, staff, and visitor's safety, this requirement is easy to address (2011 LEED Policy Update, 2011). The management staff has not been identified yet for the medical center facility, and this team details the required strategy. Once assigned, stronger effort will be placed in pursuit of the indoor chemical and pollutant source control.

POTENTIAL

Table 13 revisits the application of credits in the LEED V.2.2 system and restructures some of the point levels in each classification in order to review additional credits for this project. A majority of the points reclaimed through analysis reflect the misaligned classifications guided by Penn State University's *LEED Policy 2011 Update*. Below are brief summaries regarding the addition of credits to the LEED Scorecard. A major concept arises regarding added value without added recognition, as the facility still remain on track for LEED Silver Certification. One assistive aspect of Penn State's classification system is the incorporation of higher effort levels, and stronger potential to achieve LEED Gold on the project due to a larger classification of potential points.

LEED SCORECARD

Table 13: Thesis Analysis Scorecard Summary

Thesis Score LEED V.2.2				
New Regional Medical Center				
Y	***?***	***N***	***Point Category***	***Possible Points***
7	1	6	Sustainable Sites	14
4	1	0	Water Efficiency	5
5	4	8	Energy & Atmosphere	17
4	3	6	Materials & Resources	13
11	1	3	Indoor Environmental Quality	15
5	0	0	Innovation & Design Process	5
36	***10***	***23***	***Silver***	**66**

See **Appendix D** for the complete Thesis Analysis *LEED* Scorecard for the New Regional Medical Center.

SUSTAINABLE SITES

SS Credit 7.2: Heat Island Effect: Roof

This credit has changed from "No" to "Yes" due to interests in implementation of vegetated roofs or a high Solar Reflectance Index (SRI) roof. Penn State recommends a pursuit of **SIGNIFICANT EFFORT** due to current roofing technology development. Caution is provided for an in-depth life-cycle analysis before commitment.

WATER EFFICIENCY

WE Credit 2.0: Innovative Wastewater Technologies

This credit has changed from "No" to "Potential" due to concerns for high operation costs. The large facility would easily benefit from reduction initiatives as recommended by Penn State; however, innovative systems such as grey water may provide lifecycle cost savings. Penn State recommends a pursuit of **MINIMAL EFFORT**.

ENERGY & ATMOSPHERE

EA Credit 2.0: On-Site Renewable Energy

This credit has changed from "No" to "Yes" due to growing interest in technological advances. Interest has been voiced for reduction in the consumption of fossil fuels if possible. Penn State recommends a pursuit of **SIGNIFICANT EFFORT** due to the current pace in renewable energy applications. A percentage target has not been recommended, however the LEED scorecard has options from 2.5% to 12.5%.

MATERIALS & RESOURCES

MR Credit 7.0: Certified Wood

This credit has changed from "No" to "Potential" due to the availability of appropriate wood materials. Interest has been voiced for ability to review wood components of construction finishes to meet this requirement and provide a product of higher value. Penn State recommends a **MANDATORY** pursuit since application of certified wood products is typical for university construction, and the surrounding area.

INDOOR ENVIRONMENTAL QUALITY

IEQ Credit 4.4: Low-Emitting, Composite Wood & Agrifiber Products

This credit has changed from "No" to "Potential" due to growing industry trends and standards of products, which make this easily attainable. Concern on attainment is factored since the quantity of these products within the medical center is unknown. Penn State recommends a **MANDATORY** pursuit since it addresses the health and well-being of occupants.

IEQ Credit 5.0: Indoor Chemical & Pollutant Source Control

This credit has changed from "Potential" to "Yes" due to need for a safe and comfortable facility. Interest should be placed on the location and potential hazards of these sources, and the process in which to control their impact. Penn State recommends a **MANDATORY** pursuit since they have strategies previously implemented to achieve this requirement.

INNOVATION & DESIGN PROCESS

No Change

BUILDING INFORMATION MODELING USE EVALUATION

BIM USE LIST

The New Regional Medical Center, Inc. did not request any BIM deliverable within the Request for Proposal for the project. Although the Architect and Structural Engineer utilized 3D modeling for the design services of the project, specific BIM uses in the construction phase were at the discretion of Gilbane Building Company. Through project experience, Gilbane decided that 3D coordination of (1) Mechanical, (2) Electrical, (3) Plumbing, and (4) Fire Protection (MEPF) trades are essential in eliminate field conflicts and trade rework, and necessary for this project. In addition to this, the coordination process brought together the MEP subcontractors into a collaborative environment to work through design revisions and value engineering opportunities with Gilbane. 3D coordination and a BIM Manager were included within the proposal response; however, additional BIM services were excluded from construction services.

Table 14 highlights the related BIM uses that were considered, in addition to ones utilized on the project. As stated above, the Architect, Structural Engineer, and MEPF trades produced models to develop the construction documents. Major goals of the project related to (1) elimination of field MEPF conflicts, (2) coordination of curtain wall and structural connection details, (3) structural detailing for fabrication, and (4) visual graphic (effectiveness) of architectural design. These four goals of priority HIGH and MEDIUM are based off of inclusion of constructability modeling. Low priority goals include potential BIM uses that are beyond the scope of the GMP package from Gilbane, and were not requested by the owner. Low priority uses focus on record modeling, facility management modeling, and cost and schedule modeling. Although beneficial to the project, they have been excluded from project development and execution, as BIM was not requested by the New Regional Medical Center, Inc. beyond the design phase.

Table 14: Project Team BIM Use
Template obtained from BIM Project Execution Planning Guide - Version 2.0.

Priority (HIGH, MED, LOW)	Goal Description	Potential BIM Use
HIGH	Eliminate field conflicts	3D Coordination (const.)
HIGH	Identify potential concerns between structural and architectural design	3D Coordination (design) Design Reviews Design Authoring Engineering Analysis
MED	Increased effectiveness of architectural design	3D Coordination (design) Design Reviews Design Authoring
MED	Increased field staff efficiency	Design Reviews
MED	Accurate structural model	3D Coordination (design) Design Reviews Design Authoring
LOW	Accurate 3D Record Model	Design Authoring Record Model
LOW	Increased office productivity	Cost Estimating 4D Modeling
LOW	Accurate FM Model for owner	Maintenance Scheduling Record Modeling

Table 15 has been developed through the completion of the BIM Use Analysis spreadsheet located in Appendix E. Each identified use was developed in the analysis chart and items which concluded with a "Yes" proceed, or a "maybe" proceed have been explored in more depth.

Table 15: BIM Use Matrix

Template obtained from BIM Project Execution Planning Guide - Version 2.0.

X	PLAN	X	DESIGN	X	CONSTRUCT	X	OPERATE
	Programming	X	Design Authoring		Site Utilization Planning		Building Maintenance Scheduling
	Site Analysis	X	Design Reviews	X	Construction System Design		Building System Analysis
		X	3D Coordination	X	3D Coordination		Asset Management
			Structural Analysis		Digital Fabrication		Space Management / Tracking
			Lighting Analysis		3D Control and Planning		Disaster Planning
			Energy Analysis	X	Record Modeling		Record Modeling
			Mechanical Analysis				
			Other Eng. Analysis				
			Sustainability (LEED) Evaluation				
			Code Validation				
	Phase Planning (4D Modeling)		Phase Planning (4D Modeling)		Phase Planning (4D Modeling)		Phase Planning (4D Modeling)
	Cost Estimation		Cost Estimation		Cost Estimation		Cost Estimation
	Existing Conditions Modeling		Existing Conditions Modeling		Existing Conditions Modeling		Existing Conditions Modeling

DESIGN AUTHORING

Design Authoring is the process in which computer software is used to develop 3D models for enrichment through a database of attributes. These attributes can include element properties, quantities, and cost information, to name a few. Designing Authoring consists of the modeling tool to begin BIM programming.

Value to Project: High

Role Players:

Architect	High
MEP Engineer	Medium
Structural Engineer	High
Civil Engineer	Low

Project Differences:

MEP Engineer	Excluded (modeling developed by subcontractor)
Civil Engineer	Excluded (limited software experience)

DESIGN REVIEWS

Design Review is the process in which 3D models are reviewed and validated for continued design development. Typically this review consists of the architect and the owner, or project investors. Design Reviews consists of component analysis and design alternative assessments to enhance the design and construction delivery process.

Value to Project: High

Role Players:		
	Architect	High
	Owner	High

Project Differences: Design alternatives were reviewed first in the model through renderings
Physical mock-ups were still constructed once alternative was selected

3D COORDINATION

3D Coordination is the process in which 3D models are merged into a common file for Clash Detection software analysis. Use of clash reports permits review of conflicts, and design resubmission prior to fabrication and field installation.

Value to Project: High

Role Players:		
	Construction Manager	High
	Subcontractor	High
	Architect	Low

RECORD MODELING*

Record Modeling is the process in which the main elements of the structural, architectural, and MEPF models are updated during the design and construction process. The record model includes accurate construction components and conditions and represents the finalized BIM model for the project. They are utilized as As-Built models with the inclusion of operation and maintenance data for components of major building systems. Additional asset management may also be incorporated depending on the owner and facility management team's preference.

Value to Project: High

Role Players:		
	Architect	High
	MEP Engineer	Medium
	Structural Engineer	High
	Civil Engineer	Low

Project Differences:		
	MEP Engineer	Excluded (modeling developed by subcontractor)
	Civil Engineer	Excluded (limited software experience)

*Excluded due to additional costs not included in GMP Contract

See **Appendix E** for the complete BIM Use Analysis (Version 2.0) matrix.

LEVEL 1 PROCESS MAP

The Level 1 Process Map for the design, construction, and operation phase of this project consists of a single line diagram reflecting the modeling and coordination process per phase. Due to the "maybe" result of record modeling usage, this item was included to demonstrate the inclusion of this BIM use. A key driver of the BIM use on the project was the inclusion of both an architectural and structural model through design authoring. Within the design process, the architect and structural engineer designed and collaborated on elements of interests, such as façade connection, and steel penetrations. Once design development and façade coordination was completed, the two models were exported to become the construction drawing sheet sets. At this point, Gilbane joined the project team with the subcontractors in order to incorporate the MEPF systems into the model. This process develops a third model on the project, and permits 3D MEPF coordination to take place. Although all models are updated per design revision, clash report, and architect's request for proposal (ARP), the record model will not be delivered at the end of the process.

See **Appendix F** for the Level 1 Process Maps for the New Regional Medical Center's BIM applications.

CRITICAL EVALUATION

Modeling on this project was directed between design and construction. All models used on the project became the contract drawings and details within Autodesk Revit. In addition to this, the structural model was utilized for connection detailing. The architectural model and the structural model were developed in Autodesk Revit Architecture, and Autodesk Revit Structural, respectively. All MEPF models were developed in the trade's software and imported into Autodesk Naviswork weekly, to run coordination reports between each MEPF component, the structure, and the architectural components. 3D coordination was performed by Gilbane's BIM Project Engineer.

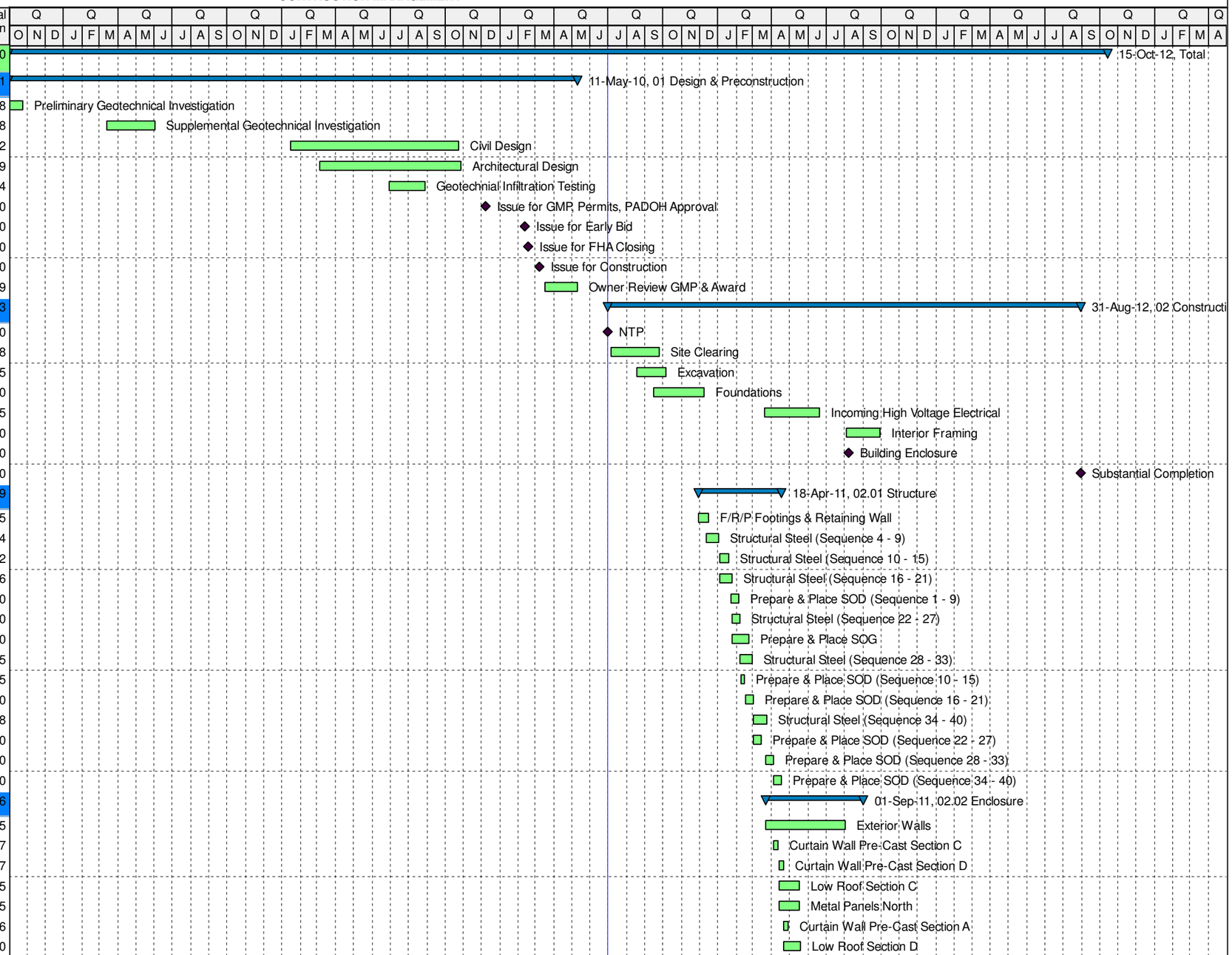
Although the current use of BIM on the project was beneficial to design review and constructability coordination, additional elements of information and database management should have been captured. With 25 BIM uses for the (1) Planning, (2) Design, (3) Construction, (4) and Operation phases of a project, the potential benefits of BIM on The New Regional Medical Center go well beyond design and coordination. Although not requested within the project's RFP or as a project deliverable, construction management productivity uses should have been utilized for personal benefits, at a minimum. As a tradeoff, many of these services rely on additional costs and staffing to operate an active model and database, many of which were not desirable at the time of project development.

In evaluation of the New Regional Medical Center, the level of BIM use was appropriate at the time of project development; however, a stronger interest should have been placed on additional opportunities and uses during design development, as the models produced would have been very symbiotic of additional data integration. Items such as asset management, space management, and building maintenance scheduling would provide efficient facility management for the New Regional Medical Center.

APPENDIX A

PRIMAVERA SCHEDULE

Activity Name	Start	Finish	Original Duration
Total	01-Oct-07	15-Oct-12	1300
01 Design & Preconstruction	01-Oct-07	11-May-10	681
Preliminary Geotechnical Investigation	01-Oct-07	24-Oct-07	18
Supplemental Geotechnical Investigation	13-Mar-08	02-Jun-08	58
Civil Design	15-Jan-09	23-Oct-09	202
Architectural Design	05-Mar-09	28-Oct-09	169
Geotechnial Infiltration Testing	30-Jun-09	28-Aug-09	44
Issue for GMP, Permits, PADOH Approval	09-Dec-09		0
Issue for Early Bid	11-Feb-10		0
Issue for FHA Closing	18-Feb-10		0
Issue for Construction	08-Mar-10		0
Owner Review GMP & Award	18-Mar-10	11-May-10	39
02 Construction	01-Jul-10	31-Aug-12	553
NTP	01-Jul-10		0
Site Clearing	06-Jul-10	24-Sep-10	58
Excavation	18-Aug-10	06-Oct-10	35
Foundations	16-Sep-10	09-Dec-10	60
Incoming High Voltage Electrical	21-Mar-11*	20-Jun-11	65
Interior Framing	04-Aug-11	29-Sep-11	40
Building Enclosure	08-Aug-11		0
Substantial Completion	31-Aug-12		0
02.01 Structure	29-Nov-10	18-Apr-11	99
F/R/P Footings & Retaining Wall	29-Nov-10	17-Dec-10	15
Structural Steel (Sequence 4 - 9)	13-Dec-10	03-Jan-11	14
Structural Steel (Sequence 10 - 15)	04-Jan-11*	19-Jan-11	12
Structural Steel (Sequence 16 - 21)	04-Jan-11*	25-Jan-11	16
Prepare & Place SOD (Sequence 1 - 9)	24-Jan-11*	04-Feb-11	10
Structural Steel (Sequence 22 - 27)	25-Jan-11*	07-Feb-11	10
Prepare & Place SOG	25-Jan-11*	21-Feb-11	20
Structural Steel (Sequence 28 - 33)	08-Feb-11*	28-Feb-11	15
Prepare & Place SOD (Sequence 10 - 15)	09-Feb-11*	15-Feb-11	5
Prepare & Place SOD (Sequence 16 - 21)	16-Feb-11*	01-Mar-11	10
Structural Steel (Sequence 34 - 40)	01-Mar-11*	24-Mar-11	18
Prepare & Place SOD (Sequence 22 - 27)	02-Mar-11*	15-Mar-11	10
Prepare & Place SOD (Sequence 28 - 33)	22-Mar-11*	04-Apr-11	10
Prepare & Place SOD (Sequence 34 - 40)	05-Apr-11*	18-Apr-11	10
02.02 Enclosure	22-Mar-11	01-Sep-11	116
Exterior Walls	22-Mar-11	03-Aug-11	95
Curtain Wall Pre-Cast Section C	04-Apr-11*	12-Apr-11	7
Curtain Wall Pre-Cast Section D	13-Apr-11*	21-Apr-11	7
Low Roof Section C	13-Apr-11*	17-May-11	25
Metal Panels North	14-Apr-11*	18-May-11	25
Curtain Wall Pre-Cast Section A	22-Apr-11*	29-Apr-11	6
Low Roof Section D	22-Apr-11*	19-May-11	20



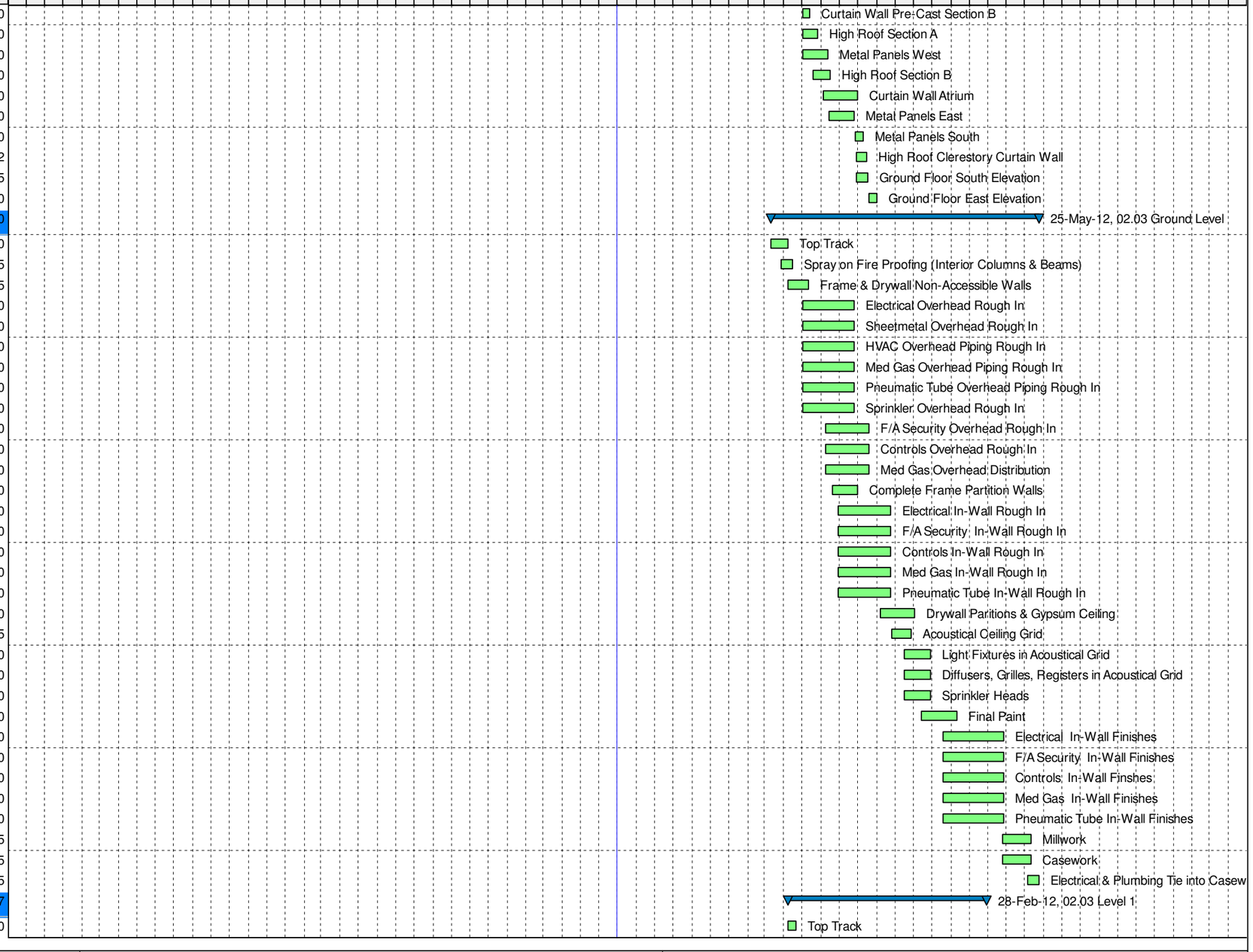
Activity Summary

Milestone

NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

Activity Name	Start	Finish	Original Duration
Curtain Wall Pre-Cast Section B	02-May-1	13-May-11	10
High Roof Section A	02-May-1	27-May-11	20
Metal Panels West	02-May-1	13-Jun-11	30
High Roof Section B	20-May-1	17-Jun-11	20
Curtain Wall Atrium	06-Jun-11*	01-Aug-11	40
Metal Panels East	14-Jun-11*	26-Jul-11	30
Metal Panels South	27-Jul-11*	09-Aug-11	10
High Roof Clerestory Curtain Wall	29-Jul-11*	15-Aug-11	12
Ground Floor South Elevation	29-Jul-11*	18-Aug-11	15
Ground Floor East Elevation	19-Aug-11	01-Sep-11	10
02.03 Ground Level	11-Mar-11	25-May-12	310
Top Track	11-Mar-11*	07-Apr-11	20
Spray on Fire Proofing (Interior Columns & Beam	28-Mar-11*	15-Apr-11	15
Frame & Drywall Non-Accessible Walls	08-Apr-11*	12-May-11	25
Electrical Overhead Rough In	02-May-1	26-Jul-11	60
Sheetmetal Overhead Rough In	02-May-1	26-Jul-11	60
HVAC Overhead Piping Rough In	02-May-1	26-Jul-11	60
Med Gas Overhead Piping Rough In	02-May-1	26-Jul-11	60
Pneumatic Tube Overhead Piping Rough In	02-May-1	26-Jul-11	60
Sprinkler Overhead Rough In	02-May-1	26-Jul-11	60
F/A Security Overhead Rough In	10-Jun-11*	19-Aug-11	50
Controls Overhead Rough In	10-Jun-11*	19-Aug-11	50
Med Gas Overhead Distribution	10-Jun-11*	19-Aug-11	50
Complete Frame Partition Walls	20-Jun-11*	01-Aug-11	30
Electrical In-Wall Rough In	30-Jun-11*	23-Sep-11	60
F/A Security In-Wall Rough In	30-Jun-11*	23-Sep-11	60
Controls In-Wall Rough In	30-Jun-11*	23-Sep-11	60
Med Gas In-Wall Rough In	30-Jun-11*	23-Sep-11	60
Pneumatic Tube In-Wall Rough In	30-Jun-11*	23-Sep-11	60
Drywall Paritions & Gypsum Ceiling	08-Sep-11	02-Nov-11	40
Acoustical Ceiling Grid	26-Sep-11	28-Oct-11	25
Light Fixtures in Acoustical Grid	17-Oct-11*	28-Nov-11	30
Diffusers, Grilles, Registers in Acoustical Grid	17-Oct-11*	28-Nov-11	30
Sprinkler Heads	17-Oct-11*	28-Nov-11	30
Final Paint	14-Nov-11	11-Jan-12	40
Electrical In-Wall Finishes	19-Dec-11	27-Mar-12	70
F/A Security In-Wall Finishes	19-Dec-11	27-Mar-12	70
Controls In-Wall Finshes	19-Dec-11	27-Mar-12	70
Med Gas In-Wall Finishes	19-Dec-11	27-Mar-12	70
Pneumatic Tube In-Wall Finishes	19-Dec-11	27-Mar-12	70
Millwork	26-Mar-12*	11-May-12	35
Casework	26-Mar-12*	11-May-12	35
Electrical & Plumbing Tie into Casework	07-May-1	25-May-12	15
02.03 Level 1	08-Apr-11	28-Feb-12	227
Top Track	08-Apr-11*	21-Apr-11	10



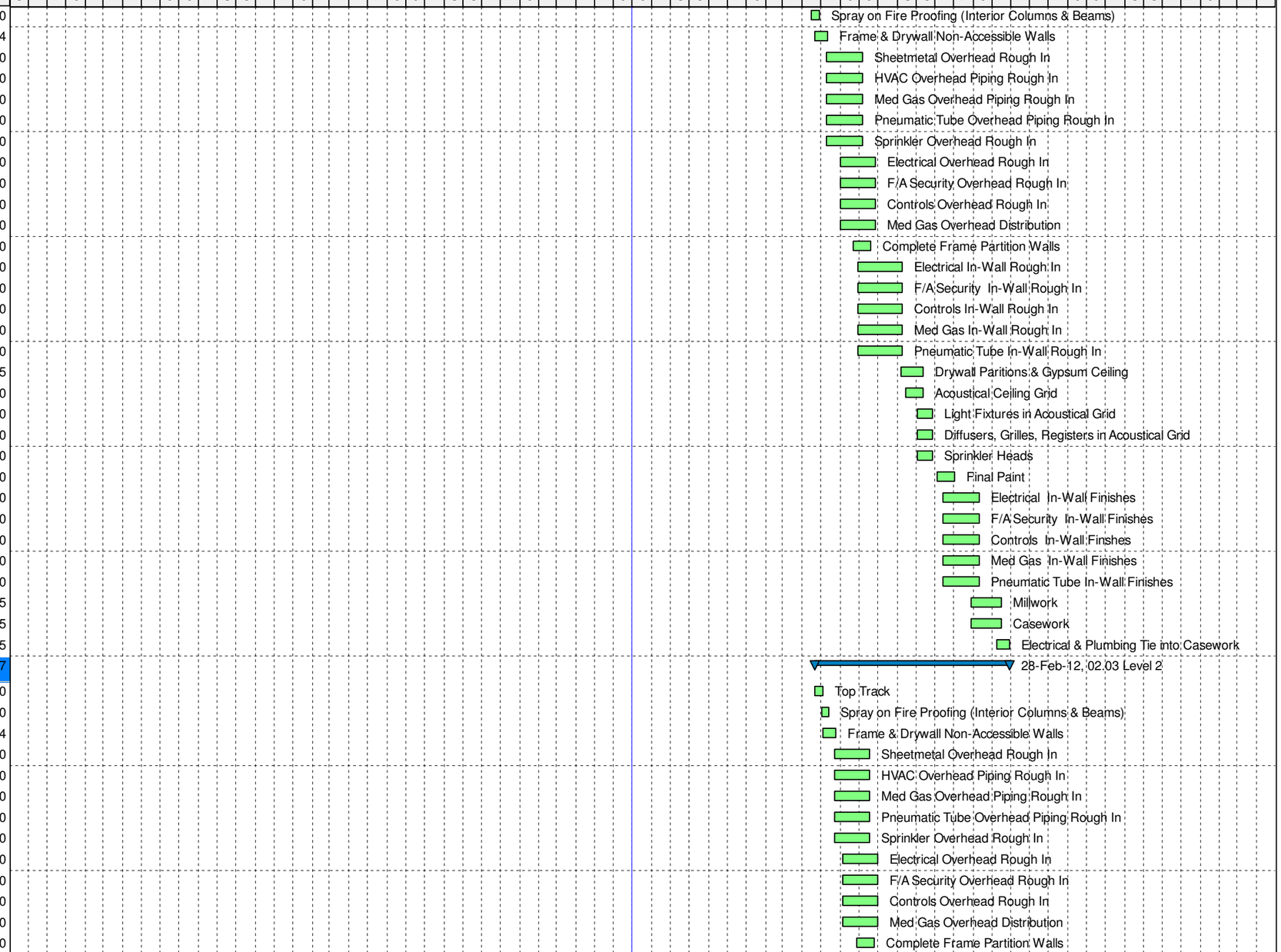
Activity Summary

Milestone

NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

Activity Name	Start	Finish	Original Duration
Spray on Fire Proofing (Interior Columns & Beam	15-Apr-11*	28-Apr-11	10
Frame & Drywall Non-Accessible Walls	22-Apr-11*	11-May-11	14
Sheetmetal Overhead Rough In	10-May-1	06-Jul-11	40
HVAC Overhead Piping Rough In	10-May-1	06-Jul-11	40
Med Gas Overhead Piping Rough In	10-May-1	06-Jul-11	40
Pneumatic Tube Overhead Piping Rough In	10-May-1	06-Jul-11	40
Sprinkler Overhead Rough In	10-May-1	06-Jul-11	40
Electrical Overhead Rough In	01-Jun-11*	27-Jul-11	40
F/A Security Overhead Rough In	01-Jun-11*	27-Jul-11	40
Controls Overhead Rough In	01-Jun-11*	27-Jul-11	40
Med Gas Overhead Distribution	01-Jun-11*	27-Jul-11	40
Complete Frame Partition Walls	22-Jun-11*	20-Jul-11	20
Electrical In-Wall Rough In	30-Jun-11*	09-Sep-11	50
F/A Security In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Controls In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Med Gas In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Pneumatic Tube In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Drywall Paritions & Gypsum Ceiling	08-Sep-11	12-Oct-11	25
Acoustical Ceiling Grid	15-Sep-11	12-Oct-11	20
Light Fixtures in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Diffusers, Grilles, Registers in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Sprinkler Heads	03-Oct-11*	28-Oct-11	20
Final Paint	04-Nov-11	02-Dec-11	20
Electrical In-Wall Finishes	14-Nov-11	11-Jan-12	40
F/A Security In-Wall Finishes	14-Nov-11	11-Jan-12	40
Controls In-Wall Finshes	14-Nov-11	11-Jan-12	40
Med Gas In-Wall Finishes	14-Nov-11	11-Jan-12	40
Pneumatic Tube In-Wall Finishes	14-Nov-11	11-Jan-12	40
Millwork	28-Dec-11	15-Feb-12	35
Casework	28-Dec-11	15-Feb-12	35
Electrical & Plumbing Tie into Casework	08-Feb-12*	28-Feb-12	15
02.03 Level 2	22-Apr-11	28-Feb-12	217
Top Track	22-Apr-11*	05-May-11	10
Spray on Fire Proofing (Interior Columns & Beam	02-May-1	13-May-11	10
Frame & Drywall Non-Accessible Walls	05-May-1	24-May-11	14
Sheetmetal Overhead Rough In	23-May-1	19-Jul-11	40
HVAC Overhead Piping Rough In	23-May-1	19-Jul-11	40
Med Gas Overhead Piping Rough In	23-May-1	19-Jul-11	40
Pneumatic Tube Overhead Piping Rough In	23-May-1	19-Jul-11	40
Sprinkler Overhead Rough In	23-May-1	19-Jul-11	40
Electrical Overhead Rough In	06-Jun-11*	01-Aug-11	40
F/A Security Overhead Rough In	06-Jun-11*	01-Aug-11	40
Controls Overhead Rough In	06-Jun-11*	01-Aug-11	40
Med Gas Overhead Distribution	06-Jun-11*	01-Aug-11	40
Complete Frame Partition Walls	27-Jun-11*	25-Jul-11	20



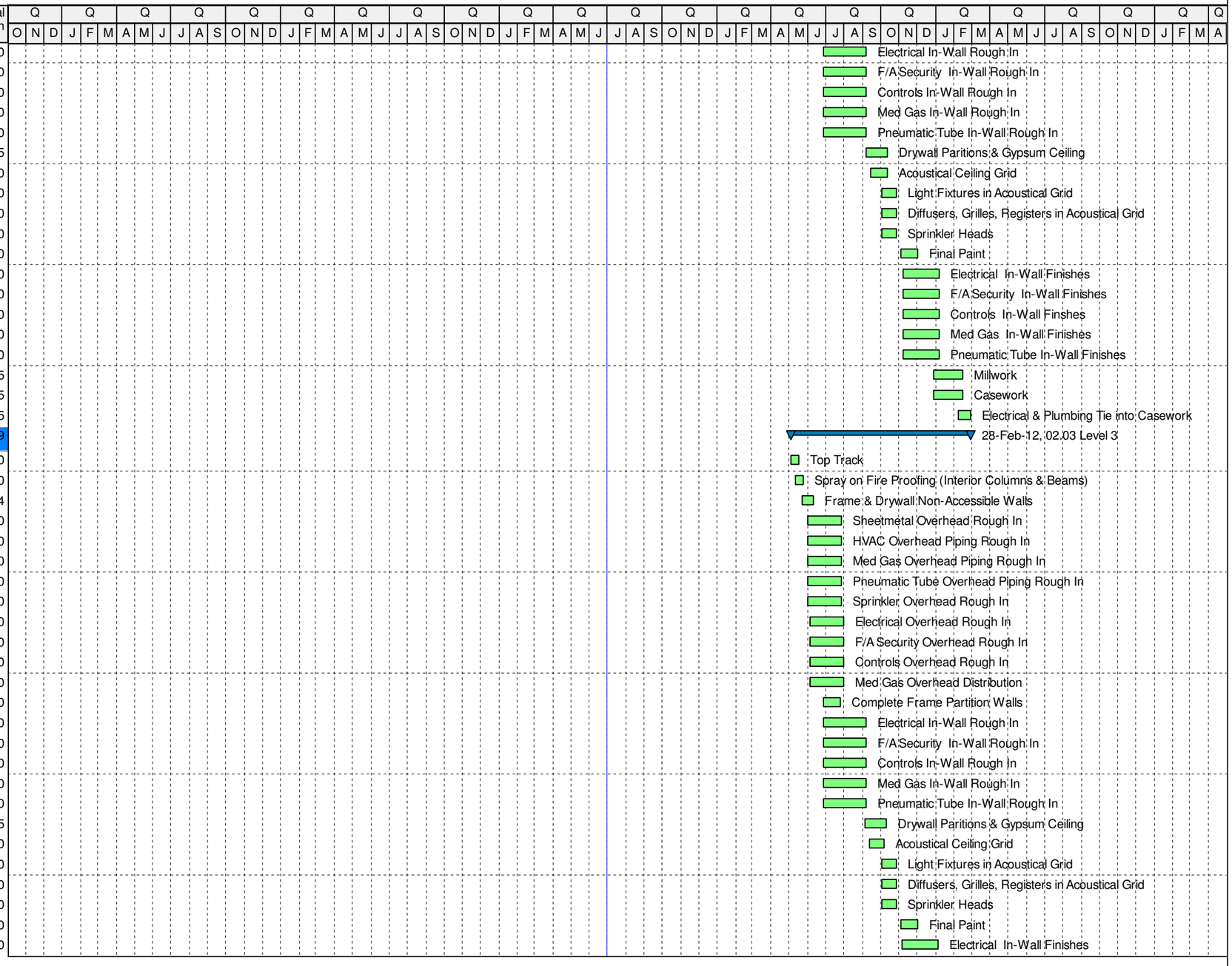
Activity Summary

Milestone

NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

Activity Name	Start	Finish	Original Duration
Electrical In-Wall Rough In	28-Jun-11*	07-Sep-11	50
F/A Security In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Controls In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Med Gas In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Pneumatic Tube In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Drywall Paritions & Gypsum Ceiling	08-Sep-11	12-Oct-11	25
Acoustical Ceiling Grid	15-Sep-11	12-Oct-11	20
Light Fixtures in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Diffusers, Grilles, Registers in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Sprinkler Heads	03-Oct-11*	28-Oct-11	20
Final Paint	04-Nov-11	02-Dec-11	20
Electrical In-Wall Finishes	09-Nov-11	06-Jan-12	40
F/A Security In-Wall Finishes	09-Nov-11	06-Jan-12	40
Controls In-Wall Finshes	09-Nov-11	06-Jan-12	40
Med Gas In-Wall Finishes	09-Nov-11	06-Jan-12	40
Pneumatic Tube In-Wall Finishes	09-Nov-11	06-Jan-12	40
Millwork	28-Dec-11	15-Feb-12	35
Casework	28-Dec-11	15-Feb-12	35
Electrical & Plumbing Tie into Casework	08-Feb-12*	28-Feb-12	15
02.03 Level 3	04-May-11	28-Feb-12	209
Top Track	04-May-11	17-May-11	10
Spray on Fire Proofing (Interior Columns & Beam	11-May-11	24-May-11	10
Frame & Drywall Non-Accessible Walls	23-May-11	10-Jun-11	14
Sheetmetal Overhead Rough In	01-Jun-11*	27-Jul-11	40
HVAC Overhead Piping Rough In	01-Jun-11*	27-Jul-11	40
Med Gas Overhead Piping Rough In	01-Jun-11*	27-Jul-11	40
Pneumatic Tube Overhead Piping Rough In	01-Jun-11*	27-Jul-11	40
Sprinkler Overhead Rough In	01-Jun-11*	27-Jul-11	40
Electrical Overhead Rough In	06-Jun-11*	01-Aug-11	40
F/A Security Overhead Rough In	06-Jun-11*	01-Aug-11	40
Controls Overhead Rough In	06-Jun-11*	01-Aug-11	40
Med Gas Overhead Distribution	06-Jun-11*	01-Aug-11	40
Complete Frame Partition Walls	27-Jun-11*	25-Jul-11	20
Electrical In-Wall Rough In	28-Jun-11*	07-Sep-11	50
F/A Security In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Controls In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Med Gas In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Pneumatic Tube In-Wall Rough In	28-Jun-11*	07-Sep-11	50
Drywall Paritions & Gypsum Ceiling	06-Sep-11	10-Oct-11	25
Acoustical Ceiling Grid	12-Sep-11	07-Oct-11	20
Light Fixtures in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Diffusers, Grilles, Registers in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Sprinkler Heads	03-Oct-11*	28-Oct-11	20
Final Paint	04-Nov-11	02-Dec-11	20
Electrical In-Wall Finishes	07-Nov-11	04-Jan-12	40



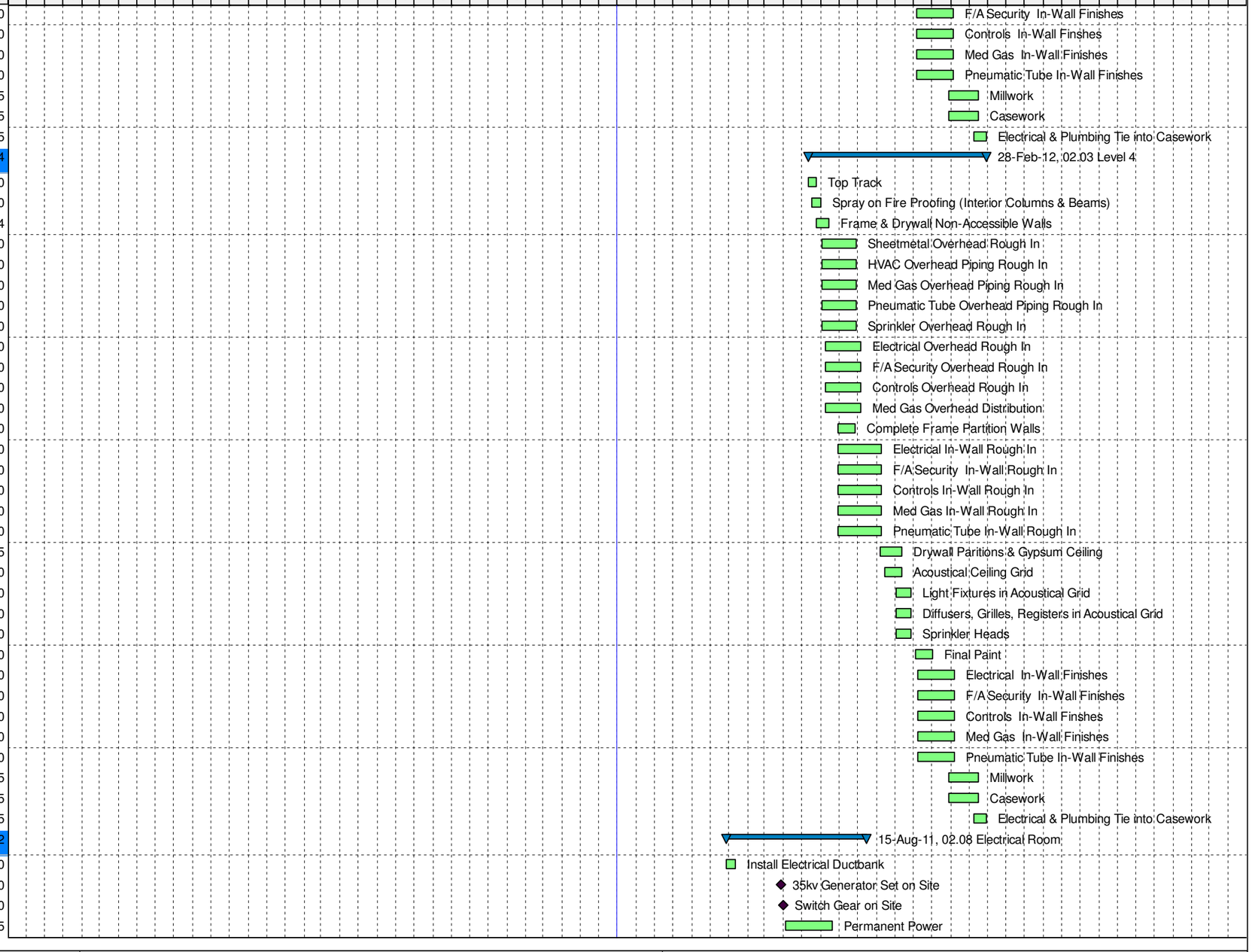
Activity Summary

Milestone

NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

Activity Name	Start	Finish	Original Duration
F/A Security In-Wall Finishes	07-Nov-11	04-Jan-12	40
Controls In-Wall Finshes	07-Nov-11	04-Jan-12	40
Med Gas In-Wall Finishes	07-Nov-11	04-Jan-12	40
Pneumatic Tube In-Wall Finishes	07-Nov-11	04-Jan-12	40
Millwork	28-Dec-11	15-Feb-12	35
Casework	28-Dec-11	15-Feb-12	35
Electrical & Plumbing Tie into Casework	08-Feb-12*	28-Feb-12	15
02.03 Level 4	11-May-11	28-Feb-12	204
Top Track	11-May-11	24-May-11	10
Spray on Fire Proofing (Interior Columns & Beam	18-May-1	01-Jun-11	10
Frame & Drywall Non-Accessible Walls	25-May-1	14-Jun-11	14
Sheetmetal Overhead Rough In	03-Jun-11*	29-Jul-11	40
HVAC Overhead Piping Rough In	03-Jun-11*	29-Jul-11	40
Med Gas Overhead Piping Rough In	03-Jun-11*	29-Jul-11	40
Pneumatic Tube Overhead Piping Rough In	03-Jun-11*	29-Jul-11	40
Sprinkler Overhead Rough In	03-Jun-11*	29-Jul-11	40
Electrical Overhead Rough In	10-Jun-11*	05-Aug-11	40
F/A Security Overhead Rough In	10-Jun-11*	05-Aug-11	40
Controls Overhead Rough In	10-Jun-11*	05-Aug-11	40
Med Gas Overhead Distribution	10-Jun-11*	05-Aug-11	40
Complete Frame Partition Walls	29-Jun-11*	27-Jul-11	20
Electrical In-Wall Rough In	30-Jun-11*	09-Sep-11	50
F/A Security In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Controls In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Med Gas In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Pneumatic Tube In-Wall Rough In	30-Jun-11*	09-Sep-11	50
Drywall Paritions & Gypsum Ceiling	08-Sep-11	12-Oct-11	25
Acoustical Ceiling Grid	15-Sep-11	12-Oct-11	20
Light Fixtures in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Diffusers, Grilles, Registers in Acoustical Grid	03-Oct-11*	28-Oct-11	20
Sprinkler Heads	03-Oct-11*	28-Oct-11	20
Final Paint	04-Nov-11	02-Dec-11	20
Electrical In-Wall Finishes	09-Nov-11	06-Jan-12	40
F/A Security In-Wall Finishes	09-Nov-11	06-Jan-12	40
Controls In-Wall Finshes	09-Nov-11	06-Jan-12	40
Med Gas In-Wall Finishes	09-Nov-11	06-Jan-12	40
Pneumatic Tube In-Wall Finishes	09-Nov-11	06-Jan-12	40
Millwork	28-Dec-11	15-Feb-12	35
Casework	28-Dec-11	15-Feb-12	35
Electrical & Plumbing Tie into Casework	08-Feb-12*	28-Feb-12	15
02.08 Electrical Room	28-Dec-10	15-Aug-11	162
Install Electrical Ductbank	28-Dec-10	11-Jan-11	10
35kv Generator Set on Site		28-Mar-11	0
Switch Gear on Site		01-Apr-11	0
Permanent Power	04-Apr-11*	20-Jun-11	55

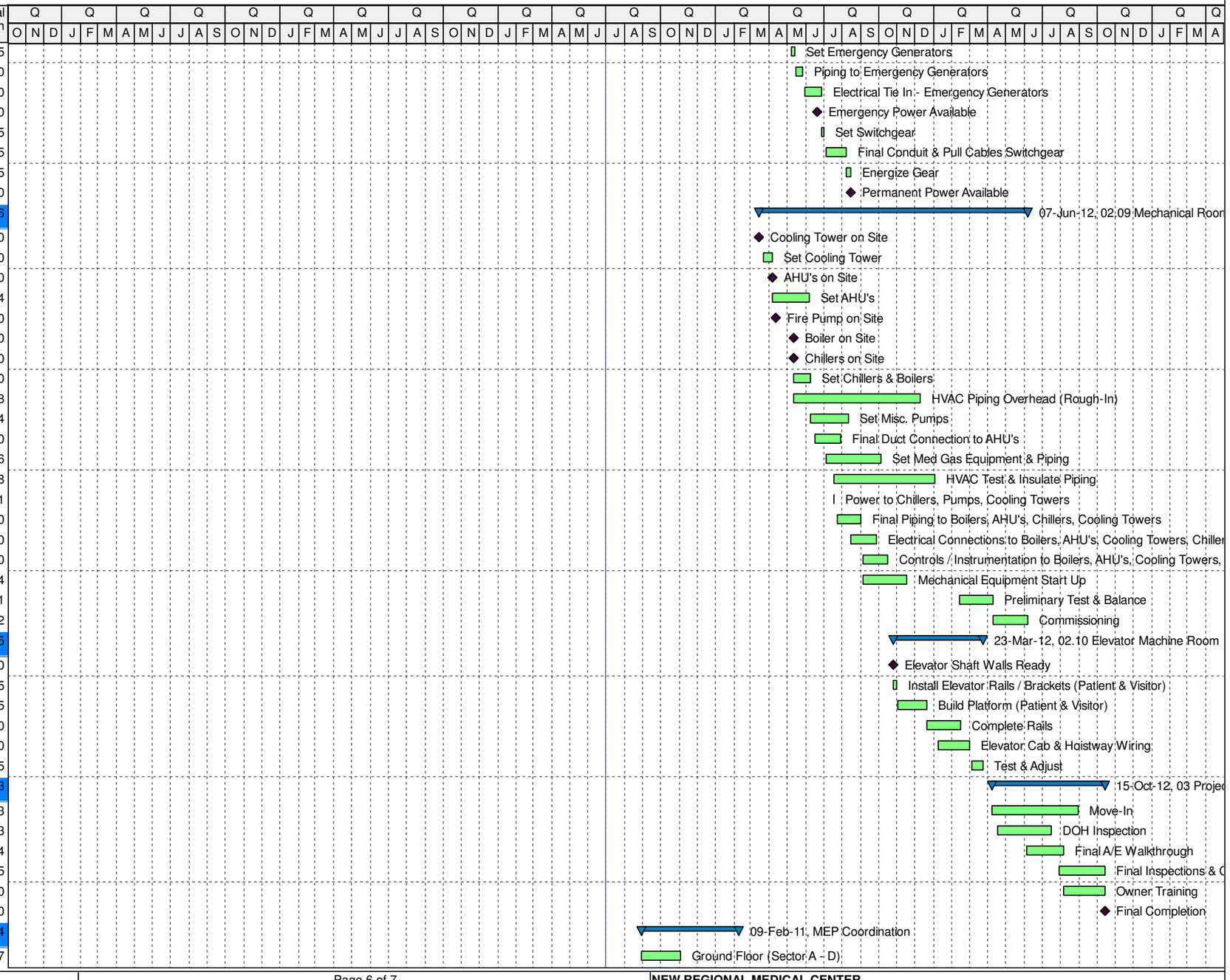


Activity Summary Milestone

NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

Activity Name	Start	Finish	Original Duration
Set Emergency Generators	09-May-1	13-May-11	5
Piping to Emergency Generators	16-May-1	27-May-11	10
Electrical Tie In - Emergency Generators	31-May-1	27-Jun-11	20
Emergency Power Available		20-Jun-11	0
Set Switchgear	27-Jun-11*	01-Jul-11	5
Final Conduit & Pull Cables Switchgear	05-Jul-11*	08-Aug-11	25
Energize Gear	09-Aug-11	15-Aug-11	5
Permanent Power Available		15-Aug-11	0
02.09 Mechanical Room	14-Mar-11	07-Jun-12	316
Cooling Tower on Site		14-Mar-11	0
Set Cooling Tower	23-Mar-11*	05-Apr-11	10
AHU's on Site		05-Apr-11	0
Set AHU's	06-Apr-11*	07-Jun-11	44
Fire Pump on Site		12-Apr-11	0
Boiler on Site		11-May-11	0
Chillers on Site		11-May-11	0
Set Chillers & Boilers	12-May-1	09-Jun-11	20
HVAC Piping Overhead (Rough-In)	12-May-1	09-Dec-11	148
Set Misc. Pumps	10-Jun-11*	11-Aug-11	44
Final Duct Connection to AHU's	17-Jun-11*	29-Jul-11	30
Set Med Gas Equipment & Piping	05-Jul-11*	05-Oct-11	66
HVAC Test & Insulate Piping	18-Jul-11*	03-Jan-12	118
Power to Chillers, Pumps, Cooling Towers	18-Jul-11*	18-Jul-11	1
Final Piping to Boilers, AHU's, Chillers, Cooling To	25-Jul-11*	02-Sep-11	30
Electrical Connections to Boilers, AHU's, Cooling T	16-Aug-11	27-Sep-11	30
Controls / Instrumentation to Boilers, AHU's, Cooli	06-Sep-11	17-Oct-11	30
Mechanical Equipment Start Up	06-Sep-11	18-Nov-11	54
Preliminary Test & Balance	13-Feb-12*	09-Apr-12	41
Commissioning	10-Apr-12*	07-Jun-12	42
02.10 Elevator Machine Room	25-Oct-11	23-Mar-12	105
Elevator Shaft Walls Ready		25-Oct-11	0
Install Elevator Rails / Brackets (Patient & Visitor)	26-Oct-11*	01-Nov-11	5
Build Platform (Patient & Visitor)	02-Nov-11	21-Dec-11	35
Complete Rails	21-Dec-11	16-Feb-12	40
Elevator Cab & Hoistway Wiring	09-Jan-12*	02-Mar-12	40
Test & Adjust	05-Mar-12*	23-Mar-12	15
03 Project Closeout	09-Apr-12	15-Oct-12	133
Move-In	09-Apr-12	31-Aug-12	103
DOH Inspection	17-Apr-12*	16-Jul-12	63
Final A/E Walkthrough	05-Jun-12	06-Aug-12	44
Final Inspections & Certifications	30-Jul-12*	15-Oct-12	55
Owner Training	06-Aug-12	15-Oct-12	50
Final Completion		15-Oct-12	0
MEP Coordination	30-Aug-10	09-Feb-11	114
Ground Floor (Sector A - D)	30-Aug-1(	03-Nov-10	47



Activity Summary Milestone

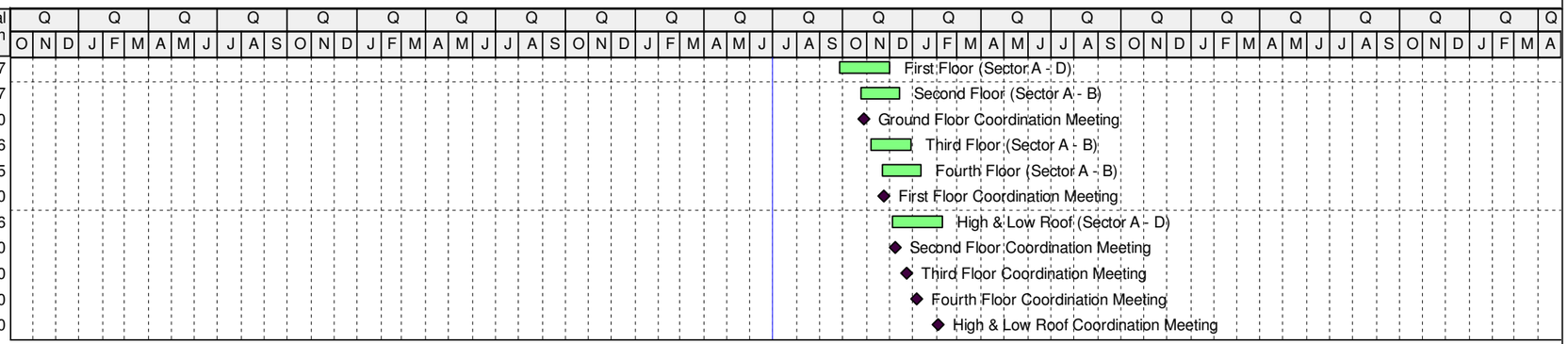
NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

BRIAN NAHAS

CONTRUCTION MANAGEMENT

Activity Name	Start	Finish	Original Duration
First Floor (Sector A - D)	27-Sep-1(	01-Dec-10	47
Second Floor (Sector A - B)	25-Oct-10*	15-Dec-10	37
Ground Floor Coordination Meeting		28-Oct-10	0
Third Floor (Sector A - B)	08-Nov-1(	29-Dec-10	36
Fourth Floor (Sector A - B)	22-Nov-1(	12-Jan-11	35
First Floor Coordination Meeting		24-Nov-10	0
High & Low Roof (Sector A - D)	06-Dec-1(	09-Feb-11	46
Second Floor Coordination Meeting		09-Dec-10	0
Third Floor Coordination Meeting		23-Dec-10	0
Fourth Floor Coordination Meeting		06-Jan-11	0
High & Low Roof Coordination Meeting		03-Feb-11	0



Activity Summary
Milestone

NEW REGIONAL MEDICAL CENTER

EAST NORRITON, PA

APPENDIX B

DETAILED STRUCTURAL SYSTEM ESTIMATE

Structural Foundations

CSI Number	Family and Type	Count	Material: Volume	Reinforcing	Total Units	Material	Labor	Equipmen	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
03 03 53.40	***Concrete In Place***												
	ON-Spread Footing - 4ksf	**204**	**74175.28**		**2747.23**								
3850	Spread Footings (3000psi) over 5 CY				CY	**171**	**61.5**	**0.31**	**232.81**	$ **469,776.33**	$ **168,954.65**	$ **851.64**	$ **639,582.62**
03 03 53.40	***Concrete In Place***									*$ 469,776.33*	*$ 168,954.65*	*$ 851.64*	***$ 639,582.62***
03 21 05	***Reinforcing Steel***												
	Reinforcing Bars	**16**		**#4 EWB**	**16**								
100	#4 Bars				Bars	**4.55**	**6.35**	**0**	**10.9**	$ **72.80**	$ **101.60**	$ -	$ **174.40**
	Reinforcing Bars	**13**		**#5 EWB**	**13**								
105	#5 Bars				Bars	**5.55**	**6.35**	**0**	**11.9**	$ **72.15**	$ **82.55**	$ -	$ **154.70**
	Reinforcing Bars	**27**		**#6 EWB**	**27**								
110	#6 Bars				Bars	**6.4**	**8.05**	**0**	**14.45**	$ **172.80**	$ **217.35**	$ -	$ **390.15**
	Reinforcing Bars	**12**		**#7 EWB**	**12**								
120	#7 Bars				Bars	**7.45**	**9.3**	**0**	**16.75**	$ **89.40**	$ **111.60**	$ -	$ **201.00**
	Reinforcing Bars	**64**		**#8 EWB**	**64**								
300	#8 Bars				Bars	**21.9**	**10.5**	**0**	**32.4**	$ **1,401.60**	$ **672.00**	$ -	$ **2,073.60**
	Reinforcing Bars	**15**		**#9 EW T&B**	**15**								
305	#9 Bars				Bars	**14.1**	**25**	**7.15**	**46.25**	$ **211.50**	$ **375.00**	$ **107.25**	$ **693.75**
	Reinforcing Bars	**13**		**#9 EWB**	**13**								
305	#9 Bars				Bars	**14.1**	**25**	**7.15**	**46.25**	$ **183.30**	$ **325.00**	$ **92.95**	$ **601.25**
	Reinforcing Bars	**24**		**#10 EWB**	**24**								
310	#10 Bars				Bars	**15.7**	**28**	**7.9**	**51.6**	$ **376.80**	$ **672.00**	$ **189.60**	$ **1,238.40**
	Reinforcing Bars	**10**		**#9 LW T&B**	**10**								
305	#9 Bars				Bars	**14.1**	**25**	**7.15**	**46.25**	$ **141.00**	$ **250.00**	$ **71.50**	$ **462.50**
	Reinforcing Bars	**12**		**#7 SW T&B**	**12**								
120	#7 Bars				Bars	**7.45**	**9.3**	**0**	**16.75**	$ **89.40**	$ **111.60**	$ -	$ **201.00**
	Reinforcing Bars	**12**		**#8 LWB**	**12**								
300	#8 Bars				Bars	**21.9**	**10.5**	**0**	**32.4**	$ **262.80**	$ **126.00**	$ -	$ **388.80**
	Reinforcing Bars	**24**		**#8 SWB**	**24**								
300	#8 Bars				Bars	**21.9**	**10.5**	**0**	**32.4**	$ **525.60**	$ **252.00**	$ -	$ **777.60**
	Reinforcing Bars	**20**		**#10 LWB w/ #10@12" SWB**	**20**								
310	#10 Bars				Bars	**15.7**	**28**	**7.9**	**51.6**	$ **314.00**	$ **560.00**	$ **158.00**	$ **1,032.00**
	Reinforcing Bars	**20**		**#10 LWB w/ #10@12" SWB**	**20**								
310	#10 Bars				Bars	**15.7**	**28**	**7.9**	**51.6**	$ **314.00**	$ **560.00**	$ **158.00**	$ **1,032.00**
03 21 05	***Reinforcing Steel***									*$ 4,227.15*	*$ 4,416.70*	*$ 777.30*	***$ 9,421.15***

Structural Columns

CSI Number	Family	Measured Units	Total Units	Weight (Tons)	Material	Labor	Equipment	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
05 12 23.40	***Lightweight Framing***											
	ž3x3x3/8: 4	**6'-8 1/8"**	**7**	**NA**								
476	Angle 3"x3"x3/8"		LF		**4.86**	**20.5**	**1.91**	**3.26**	**$ 4.76**	**$ 16.52**	**$ 1.54**	**$ 22.82**
	Screenwall Post 1: 33	**618'-3 3/8"**	**618**	**NA**								
750	Junior Beam, 8"		LF		**12.4**	**22.5**	**2.06**	**36.96**	**$ 7,663.20**	**$ 13,905.00**	**$ 1,273.08**	**$ 22,841.28**
	Screenwall Post 2: 6	**76'-0"**	**76**	**NA**								
750	Junior Beam, 8"		LF		**12.4**	**22.5**	**2.06**	**36.96**	**$ 942.40**	**$ 1,710.00**	**$ 156.56**	**$ 2,808.96**
05 12 23.40	***Lightweight Framing***								*$ 8,610.36*	*$ 15,631.52*	*$ 1,431.18*	***$ 25,673.06***
05 12 23.17	***Columns, Structural***											
	HSS4x4x3/8: 10	**117'-2 3/4"**	**9.75**	**0.867496**								
4500	Structural Tubing, 4"x4"x1/4" x 12'		# of 12' increments		**186**	**45.5**	**28**	**259.5**	**$ 1,813.50**	**$ 443.63**	**$ 273.00**	**$ 2,530.13**
	HSS4x4x5/16: 10	**98'-0 3/8"**	**8.16**	**0.725446**								
4500	Structural Tubing, 4"x4"x1/4" x 12'		# of 12' increments		**186**	**45.5**	**28**	**259.5**	**$ 1,517.76**	**$ 371.28**	**$ 228.48**	**$ 2,117.52**
	HSS5x5x3/8: 1	**15'-8"**	**1.33**	**0.174683**								
4550	Structural Tubing, 6"x6"x1/4" x 12'		# of 12' increments		**305**	**49**	**30**	**384**	**$ 405.65**	**$ 65.17**	**$ 39.90**	**$ 510.72**
	HSS6x6x1/4: 3	**37'-4 13/16"**	**3.08**	**0.355291**								
4550	Structural Tubing, 6"x6"x1/4" x 12'		# of 12' increments		**305**	**49**	**30**	**384**	**$ 939.40**	**$ 150.92**	**$ 92.40**	**$ 1,182.72**
	HSS6x6x3/8: 40	**443'-5 5/16"**	**36.92**	**6.075152**								
4550	Structural Tubing, 6"x6"x1/4" x 12'		# of 12' increments		**305**	**49**	**30**	**384**	**$ 11,260.60**	**$ 1,809.08**	**$ 1,107.60**	**$ 14,177.28**
	HSS6x6x5/16: 19	**204'-7 11/16"**	**17.08**	**2.38404**								
4550	Structural Tubing, 6"x6"x1/4" x 12'		# of 12' increments		**305**	**49**	**30**	**384**	**$ 5,209.40**	**$ 836.92**	**$ 512.40**	**$ 6,558.72**
	HSS8x8x3/8: 3	**33'-0"**	**2.36**	**0.6204**								
4600	Structural Tubing, 8"x8"x3/8" x 14'		# of 14' increments		**660**	**53**	**32.5**	**745.5**	**$ 1,557.60**	**$ 125.08**	**$ 76.70**	**$ 1,759.38**
	HSS12x6x3/8: 4	**8'-8"**	**0.5625**	**0.185033**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 689.06**	**$ 31.22**	**$ 19.13**	**$ 739.41**
	HSS12x6x5/16: 2	**32'-7 3/8"**	**2.06**	**0.587039**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 2,523.50**	**$ 114.33**	**$ 70.04**	**$ 2,707.87**
05 12 23.17	***Columns, Structural***								*$ 25,916.47*	*$ 3,947.62*	*$ 2,419.65*	***$ 32,283.74***
05 12 23.75	***Structural Steel Members***											
	W6x25: 5	**66'-8"**	**67**	**0.833333**								
1502	W12x26		LF		**32**	**3.01**	**1.84**	**360**	**$ 18,827.00**	**$ 3,283.00**	**$ 2,010.00**	**$ 24,120.00**
	W12x87: 1	**56'-10 9/16"**	**57**	**2.474388**								
5702	W24x84		LF		**104**	**3.55**	**1.6**	**745.5**	**$ 37,620.00**	**$ 3,021.00**	**$ 1,852.50**	**$ 42,493.50**
	W14x82: 1	**75'-4"**	**75**	**3.088667**								
5702	W24x84		LF		**104**	**3.55**	**1.6**	**745.5**	**$ 49,500.00**	**$ 3,975.00**	**$ 2,437.50**	**$ 55,912.50**
	W24x306: 4	**299'-0"**	**299**	**45.747**								
8102	W36x302		LF		**375**	**3.7**	**1.67**	**745.5**	**$ 197,340.00**	**$ 15,847.00**	**$ 9,717.50**	**$ 222,904.50**
	W10x49: 1	**53'-4"**	**53**	**NA**								
902	W10x49		LF		**60.5**	**4.82**	**2.95**	**1314.5**	**$ 64,925.00**	**$ 2,941.50**	**$ 1,802.00**	**$ 69,668.50**
	W14x90: 2	**119'-6 3/4"**	**120**	**NA**								
2502	W14x120		LF		**149**	**3.68**	**2.25**	**154.93**	**$ 17,880.00**	**$ 441.60**	**$ 270.00**	**$ 18,591.60**
	W8x24: 10	**144'-8 1/2"**	**145**	**1.736509**								
502	W8x31		LF		**38.5**	**4.82**	**2.95**	**1314.5**	**$ 177,625.00**	**$ 8,047.50**	**$ 4,930.00**	**$ 190,602.50**
	W8x31: 15	**247'-4 7/16"**	**247**	**3.834222**								
502	W8x31		LF		**38.5**	**4.82**	**2.95**	**1314.5**	**$ 302,575.00**	**$ 13,708.50**	**$ 8,398.00**	**$ 324,681.50**
	W8x67: 1	**59'-2 1/4"**	**59**	**1.982781**								
1702	W12x72		LF		**89**	**4.14**	**2.53**	**1314.5**	**$ 72,275.00**	**$ 3,274.50**	**$ 2,006.00**	**$ 77,555.50**
	W10x33: 1	**31'-1"**	**31**	**0.512875**								
2302	W14x34		LF		**42**	**3.27**	**2**	**47.27**	**$ 1,302.00**	**$ 101.37**	**$ 62.00**	**$ 1,465.37**

Structural Columns

CSI Number	Family	Measured Units	Total Units	Weight (Tons)	Material	Labor	Equipment	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
	W10x39: 1	**60'-2 1/4"**	**60**	**1.173656**								
2302	W14x34		LF		**42**	**3.27**	**2**	**47.27**	**$ 2,520.00**	**$ 196.20**	**$ 120.00**	**$ 2,836.20**
	W10x49: 52	**1360'-10 1/2"**	**1361**	**33.341407**								
902	W10x49		LF		**60.5**	**4.82**	**2.95**	**1314.5**	**$ 1,667,225.00**	**$ 75,535.50**	**$ 46,274.00**	**$ 1,789,034.50**
	W10x60: 14	**447'-10"**	**448**	**13.435**								
1702	W12x72		LF		**89**	**4.14**	**2.53**	**1314.5**	**$ 548,800.00**	**$ 24,864.00**	**$ 15,232.00**	**$ 588,896.00**
	W10x68: 1	**32'-9"**	**33**	**1.1135**								
1702	W12x72		LF		**89**	**4.14**	**2.53**	**1314.5**	**$ 40,425.00**	**$ 1,831.50**	**$ 1,122.00**	**$ 43,378.50**
	W12x53: 37	**1051'-4 5/16"**	**1051**	**27.861015**								
3902	W18x55		LF		**68**	**4.2**	**1.9**	**74.1**	**$ 71,468.00**	**$ 4,414.20**	**$ 1,996.90**	**$ 77,879.10**
	W12x65: 15	**471'-4"**	**471**	**15.318333**								
1702	W12x72		LF		**89**	**4.14**	**2.53**	**1314.5**	**$ 576,975.00**	**$ 26,140.50**	**$ 16,014.00**	**$ 619,129.50**
	W12x72: 18	**388'-4"**	**388**	**13.98**								
1702	W12x72		LF		**89**	**4.14**	**2.53**	**1314.5**	**$ 475,300.00**	**$ 21,534.00**	**$ 13,192.00**	**$ 510,026.00**
	W12x79: 29	**907'-7"**	**908**	**35.849542**								
5502	W24x76		LF		**94**	**3.45**	**1.56**	**384**	**$ 276,940.00**	**$ 44,492.00**	**$ 27,240.00**	**$ 348,672.00**
	W12x87: 92	**2305'-6 1/4"**	**2306**	**100.290156**								
5702	W24x84		LF		**104**	**3.55**	**1.6**	**1314.5**	**$ 2,824,850.00**	**$ 127,983.00**	**$ 78,404.00**	**$ 3,031,237.00**
	W12x96: 27	**524'-0"**	**524**	**25.152**								
5902	W27x94		LF		**116**	**3.22**	**1.45**	**120.67**	**$ 60,784.00**	**$ 1,687.28**	**$ 759.80**	**$ 63,231.08**
	W12x106: 4	**117'-4"**	**117**	**6.218667**								
6302	W30x108		LF		**134**	**3.19**	**1.44**	**138.63**	**$ 15,678.00**	**$ 373.23**	**$ 168.48**	**$ 16,219.71**
	W12x120: 17	**473'-11"**	**474**	**28.435**								
2502	W14x120		LF		**149**	**3.68**	**2.25**	**154.93**	**$ 70,626.00**	**$ 1,744.32**	**$ 1,066.50**	**$ 73,436.82**
	W12x136: 2	**31'-4"**	**31**	**2.130667**								
6902	W33x130		LF		**161**	**3.38**	**1.53**	**165.91**	**$ 4,991.00**	**$ 104.78**	**$ 47.43**	**$ 5,143.21**
	W12x152: 1	**29'-4"**	**29**	**2.229333**								
7502	W36x150		LF		**186**	**3.28**	**1.48**	**190.76**	**$ 5,394.00**	**$ 95.12**	**$ 42.92**	**$ 5,532.04**
	W12x170: 15	**324'-5 3/4"**	**324**	**27.580729**								
7702	W36x194		LF		**240**	**3.41**	**1.54**	**244.95**	**$ 77,760.00**	**$ 1,104.84**	**$ 498.96**	**$ 79,363.80**
	W14x90: 2	**119'-10 5/8"**	**120**	**5.394823**								
5902	W27x94		LF		**116**	**3.22**	**1.45**	**120.67**	**$ 13,920.00**	**$ 386.40**	**$ 174.00**	**$ 14,480.40**
	W14x132: 9	**147'-3 9/16"**	**147**	**9.72168**								
6902	W33x130		LF		**161**	**3.38**	**1.53**	**165.91**	**$ 23,667.00**	**$ 496.86**	**$ 224.91**	**$ 24,388.77**
	W14x283: 1	**23'-0"**	**23**	**3.2545**								
8102	W36x302		LF		**375**	**3.7**	**1.67**	**380.37**	**$ 8,625.00**	**$ 85.10**	**$ 38.41**	**$ 8,748.51**
05 12 23.75	***Structural Steel Members***								*$ 7,705,817.00*	*$ 387,709.80*	*$ 236,101.81*	***$ 8,329,628.61***

Structural Framing

CSI Number	Family : Quantity	Measured Units	Total Units	Weight (Tons)	Material	Labor	Equipment	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
05 12 23.40	***Lightweight Framing***											
	C10x25: 64	**837'- 4 9/16"**	**20925**	**10.46727**								
600	Channel framing, 8" and larger	25 lb/lf	LBS		**0.68**	**2.36**	**0.22**	**3.26**	**$ 14,229.00**	**$ 49,383.00**	**$ 4,603.50**	**$ 68,215.50**
	C12x30: 6	**76' 7 11/16"**	**2299.172**	**1.149586**								
600	Channel framing, 8" and larger	30 lb/lf	LBS		**0.68**	**2.36**	**0.22**	**3.26**	**$ 1,563.44**	**$ 5,426.05**	**$ 505.82**	**$ 7,495.30**
	ž3x3x3/8: 29	**131'-0 15/16"**	**131**	**0.471885**								
476	Angle 3"x3"x3/8"		LF		**4.86**	**20.5**	**1.91**	**27.27**	**$ 636.66**	**$ 2,685.50**	**$ 250.21**	**$ 3,572.37**
	ž3x3x5/16: 2	**7'-0 7/8"**	**7**	**0.021213**								
476	Angle 3"x3"x3/8"		LF		**4.86**	**20.5**	**1.91**	**27.27**	**$ 34.02**	**$ 143.50**	**$ 13.37**	**$ 190.89**
	ž4x4x3/8: 21	**188'- 6 9/16"**	**1828.888**	**0.914444**								
400	Angle Framing, 4" and larger	9.7 lbs/lf	LBS		**0.65**	**2.69**	**0.25**	**3.59**	**$ 1,188.78**	**$ 4,919.71**	**$ 457.22**	**$ 6,565.71**
	ž6x4x5/16: 2	**8' - 9 1/2"**	**90.538**	**0.045269**								
400	Angle Framing, 4" and larger	10.3 lbs/lf	LBS		**0.65**	**2.69**	**0.25**	**3.59**	**$ 58.85**	**$ 243.55**	**$ 22.63**	**$ 325.03**
	MC12x31: 10	**249' - 1 7/8"**	**7722**	**3.861886**								
600	Channel framing, 8" and larger	31 lb/lf	LBS		**0.68**	**2.36**	**0.22**	**3.26**	**$ 5,250.96**	**$ 18,223.92**	**$ 1,698.84**	**$ 25,173.72**
05 12 23.40	***Lightweight Framing***								*$ 22,961.70*	*$ 81,025.22*	*$ 7,551.59*	***$ 111,538.52***
03 31 05.70	***Placing Concrete***											
	GB 30"x32": 1	**4.16 CY**	**4.16**	**NA**								
150	3000 psi		CY		**99**			**99**	**$ 411.84**	**$ -**	**$ -**	**$ 411.84**
3200	Grade Beam, direct chute		CY			**11.45**	**0.31**	**11.76**	**$ -**	**$ 47.63**	**$ 1.29**	**$ 48.92**
03 31 05.70	***Placing Concrete***								*$ 411.84*	*$ 47.63*	*$ 1.29*	***$ 460.76***
03 21 10.70	***Glass Fiber Reinfornced Polymer Bars***											
	Round Bar 1": 53	**1531'-9 9/16"**	**1532**	**0**								
350	#8 bar 0.620 lb/lf		LF		**2.32**	**0.21**	**0**	**2.53**	**$ 3,554.24**	**$ 321.72**	**$ -**	**$ 3,875.96**
03 21 10.70	***Glass Fiber Reinfornced Polymer Bars***								*$ 3,554.24*	*$ 321.72*	*$ -*	***$ 3,875.96***
05 12 23.17	***Columns, Structural***											
	HSS6x2x3/8: 16	**51'-9 9/16"**	**4.333**	**0.445468**								
5550	Structural Tubing, 6"x4"x5/16" x 12'		# of 12' increments		**281**	**49**	**30**	**360**	**$ 1,217.67**	**$ 212.33**	**$ 130.00**	**$ 1,560.00**
	HSS6x4x3/8: 1	**1'-10"**	**0.166**	**0.020442**								
5550	Structural Tubing, 6"x4"x5/16" x 12'		# of 12' increments		**281**	**49**	**30**	**360**	**$ 46.65**	**$ 8.13**	**$ 4.98**	**$ 59.76**
	HSS8x6x3/8: 52	**1015'-5 13/16"**	**72.5**	**16.501613**								
4600	Structural Tubing, 8"x8"x3/8" x 14'		# of 14' increments		**660**	**53**	**32.5**	**745.5**	**$ 47,850.00**	**$ 3,842.50**	**$ 2,356.25**	**$ 54,048.75**
	HSS8x6x5/8: 4	**78'-4 3/4"**	**5.57**	**1.983393**								
4600	Structural Tubing, 8"x8"x3/8" x 14'		# of 14' increments		**660**	**53**	**32.5**	**745.5**	**$ 3,676.20**	**$ 295.21**	**$ 181.03**	**$ 4,152.44**
	HSS10x4x3/8: 24	**288'-2 5/8"**	**20.57**	**4.683552**								
5650	Structural Tubing, 10"x6"x3/8" x 14'		# of 14' increments		**660**	**53**	**32.5**	**745.5**	**$ 13,576.20**	**$ 1,090.21**	**$ 668.53**	**$ 15,334.94**
	HSS10x8x1/2: 29	**812'-7"**	**50.81**	**22.54923**								
4650	Structural Tubing, 10"x10"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 62,242.25**	**$ 2,819.96**	**$ 1,727.54**	**$ 66,789.75**
	HSS10x8x5/8: 12	**305'-8 3/8"**	**306**	**10.332524**								
4650	Structural Tubing, 10"x10"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 374,850.00**	**$ 16,983.00**	**$ 10,404.00**	**$ 402,237.00**
	HSS12x4x1/4: 13	**68'-7 3/4"**	**4.3125**	**0.885563**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 5,282.81**	**$ 239.34**	**$ 146.63**	**$ 5,668.78**

Structural Framing

CSI Number	Family : Quantity	Measured Units	Total Units	Weight (Tons)	Material	Labor	Equipment	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
	HSS12x8x5/8: 4	**126'-5 3/16"**	**7.875**	**4.810847**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 9,646.88**	**$ 437.06**	**$ 267.75**	**$ 10,351.69**
	HSS12x8x5/16: 12	**164'-6"**	**10.34**	**10.28**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 12,666.50**	**$ 573.87**	**$ 351.56**	**$ 13,591.93**
	HSS14x6x5/8: 11	**99'-7 3/8"**	**6.25**	**3.790414**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 7,656.25**	**$ 346.88**	**$ 212.50**	**$ 8,215.63**
	HSS14x10x1/2: 4	**82'-2 3/4"**	**5.125**	**3.120661**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 6,278.13**	**$ 284.44**	**$ 174.25**	**$ 6,736.81**
	HSS16x8x1/2: 2	**25'-6"**	**1.59**	**0.967734**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 1,947.75**	**$ 88.25**	**$ 54.06**	**$ 2,090.06**
	HSS16x8x5/16: 14	**356'-2 3/4"**	**22.25**	**8.691968**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 27,256.25**	**$ 1,234.88**	**$ 756.50**	**$ 29,247.63**
	HSS16x12x1/2: 7	**122'-0 13/16"**	**7.626**	**5.468664**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 9,341.85**	**$ 423.24**	**$ 259.28**	**$ 10,024.38**
	HSS16x12x5/8: 25	**637'-1 9/16"**	**39.8**	**35.04203**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 48,755.00**	**$ 2,208.90**	**$ 1,353.20**	**$ 52,317.10**
	HSS20x8x5/16: 6	**148'-2 7/8"**	**9.25**	**4.24701**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 11,331.25**	**$ 513.38**	**$ 314.50**	**$ 12,159.13**
	HSS20x12x1/2: 29	**721'-2 3/16"**	**45.06**	**37.140774**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 55,198.50**	**$ 2,500.83**	**$ 1,532.04**	**$ 59,231.37**
	HSS6x6x5/16: 16	**131'-0 7/16"**	**10.92**	**1.526547**								
4550	Structural Tubing, 6"x6"x1/4" x 12'		# of 12' increments		**305**	**49**	**30**	**384**	**$ 3,330.60**	**$ 535.08**	**$ 327.60**	**$ 4,193.28**
	HSS20x12x1/2 2: 16	**818'-3 13/16"**	**51.125**	**42.143398**								
5700	Structural Tubing, 12"x8"x1/2" x 16'		# of 16' increments		**1225**	**55.5**	**34**	**1314.5**	**$ 62,628.13**	**$ 2,837.44**	**$ 1,738.25**	**$ 67,203.81**
05 12 23.17	***Columns, Structural***								*$ 764,778.85*	*$ 37,474.92*	*$ 22,960.44*	***$ 825,214.21***
05 12 23.75	***Structural Steel Members***											
	W6x9: 1	**1'-0"**	**1**	**0.0045**								
102	W6x9		LF		**11.15**	**4.42**	**2.7**	**18.27**	**$ 11.15**	**$ 4.42**	**$ 2.70**	**$ 18.27**
	W8x15: 24	**137'-4 1/16"**	**137**	**1.030046**								
502	W8x31		LF		**38.5**	**4.82**	**2.95**	**46.27**	**$ 5,274.50**	**$ 660.34**	**$ 404.15**	**$ 6,338.99**
	W8x18: 188	**1085'-8 5/8"**	**1086**	**9.771458**								
502	W8x31		LF		**38.5**	**4.82**	**2.95**	**46.27**	**$ 41,811.00**	**$ 5,234.52**	**$ 3,203.70**	**$ 50,249.22**
	W8x24: 37	**378'-3 3/8"**	**378**	**4.539396**								
502	W8x31		LF		**38.5**	**4.82**	**2.95**	**46.27**	**$ 14,553.00**	**$ 1,821.96**	**$ 1,115.10**	**$ 17,490.06**
	W8x31: 49	**339'-2 9/16"**	**339**	**5.25781**								
502	W8x31		LF		**38.5**	**4.82**	**2.95**	**46.27**	**$ 13,051.50**	**$ 1,633.98**	**$ 1,000.05**	**$ 15,685.53**
	W8x40: 30	**265'-1"**	**265**	**5.301632**								
902	W10x49		LF		**60.5**	**4.82**	**2.95**	**68.27**	**$ 16,032.50**	**$ 1,277.30**	**$ 781.75**	**$ 18,091.55**
	W8x58: 17	**396'-6"**	**396.5**	**11.498529**								
902	W10x49		LF		**60.5**	**4.82**	**2.95**	**68.27**	**$ 23,988.25**	**$ 1,911.13**	**$ 1,169.68**	**$ 27,069.06**
	W10x68: 2	**62'-8"**	**63**	**2.130667**								
1702	W12x72		LF		**89**	**4.14**	**2.53**	**95.67**	**$ 5,607.00**	**$ 260.82**	**$ 159.39**	**$ 6,027.21**
	W12x16: 1	**21'-11 15/16"**	**22**	**0.17596**								
1102	W12x16		LF		**19.8**	**3.01**	**1.84**	**24.65**	**$ 435.60**	**$ 66.22**	**$ 40.48**	**$ 542.30**
	W12x19: 408	**4843'-1 1/2"**	**4843**	**46.009701**								

Structural Framing

CSI Number	Family : Quantity	Measured Units	Total Units	Weight (Tons)	Material	Labor	Equipment	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
1302	W12x22		LF		27	3.01	1.84	31.85	$ 130,761.00	$ 14,577.43	$ 8,911.12	$ 154,249.55
	W12x26: 132	**1369'-2 15/16"**	**4369**	**17.800207**								
1502	W12x26		LF		32	3.01	1.84	36.85	$ 139,808.00	$ 13,150.69	$ 8,038.96	$ 160,997.65
	W12x35: 1	**8'-8"**	**9**	**0.151637**								
2203	W14x34		LF		42	3.27	2	47.27	$ 378.00	$ 29.43	$ 18.00	$ 425.43
	W12x40: 135	**1122'-6 11/16"**	**1122.5**	**22.451128**								
3102	W16x40		LF		49.5	3.32	2.03	54.85	$ 55,563.75	$ 3,726.70	$ 2,278.68	$ 61,569.13
	W14x22: 524	**13187'-3 9/16"**	**13187**	**145.06028**								
1902	W14x26		LF		32	2.65	1.62	36.27	$ 421,984.00	$ 34,945.55	$ 21,362.94	$ 478,292.49
	W14x26: 18	**504'-0"**	**504**	**6.552**								
1902	W14x26		LF		32	2.65	1.62	36.27	$ 16,128.00	$ 1,335.60	$ 816.48	$ 18,280.08
	W14x30: 15	**411'-9 1/4"**	**412**	**6.176563**								
2102	W14x30		LF		37	2.95	1.8	41.75	$ 15,244.00	$ 1,215.40	$ 741.60	$ 17,201.00
	W14x34: 46	**715'-5 11/16"**	**715.5**	**12.163026**								
2302	W14x34		LF		42	3.27	2	47.27	$ 30,051.00	$ 2,339.69	$ 1,431.00	$ 33,821.69
	W14x38: 27	**755'-9 3/4"**	**756**	**14.360437**								
3102	W16x40		LF		49.5	3.32	2.03	54.85	$ 37,422.00	$ 2,509.92	$ 1,534.68	$ 41,466.60
	W14x43: 99	**1158'-4 7/8"**	**1158**	**24.905694**								
3102	W16x40		LF		49.5	3.32	2.03	54.85	$ 57,321.00	$ 3,844.56	$ 2,350.74	$ 63,516.30
	W14x48: 33	**902'-0 15/16"**	**902**	**21.649861**								
3702	W18x50		LF		62	4.2	1.9	68.1	$ 55,924.00	$ 3,788.40	$ 1,713.80	$ 61,426.20
	W14x53: 22	**501'-9 1/2"**	**502**	**13.297493**								
3902	W18x55		LF		68	4.2	1.9	74.1	$ 34,136.00	$ 2,108.40	$ 953.80	$ 37,198.20
	W14x109: 6	**78'-1 13/16"**	**78**	**4.259258**								
2502	W14x120		LF		149	3.68	2.25	154.93	$ 11,622.00	$ 287.04	$ 175.50	$ 12,084.54
	W16x31: 135	**3972'-9 1/2"**	**3973**	**61.578257**								
2902	W16x31		LF		38.5	2.95	1.8	43.25	$ 152,960.50	$ 11,720.35	$ 7,151.40	$ 171,832.25
	W16x36: 41	**1037'-4 1/2"**	**1037**	**18.672775**								
3102	W16x40		LF		49.5	3.32	2.03	54.85	$ 51,331.50	$ 3,442.84	$ 2,105.11	$ 56,879.45
	W16x40: 21	**697'-10 1/8"**	**698**	**13.956863**								
3102	W16x40		LF		49.5	3.32	2.03	54.85	$ 34,551.00	$ 2,317.36	$ 1,416.94	$ 38,285.30
	W16x50: 8	**208'-0"**	**208**	**5.2**								
3702	W18x50		LF		62	4.2	1.9	68.1	$ 12,896.00	$ 873.60	$ 395.20	$ 14,164.80
	W16x67: 2	**21'-6 5/16"**	**21.5**	**0.72104**								
4702	W21x68		LF		84	3.7	1.67	89.37	$ 1,806.00	$ 79.55	$ 35.91	$ 1,921.46
	W18x35: 217	**5840'-11 1/8"**	**5841**	**102.216269**								
3302	W18x35		LF		43.5	3.99	1.8	49.29	$ 254,083.50	$ 23,305.59	$ 10,513.80	$ 287,902.89
	W18x40: 36	**1078'-0 3/8"**	**1078**	**21.560655**								
3502	W18x40		LF		49.6	3.99	1.8	55.39	$ 53,468.80	$ 4,301.22	$ 1,940.40	$ 59,710.42
	W18x46: 8	**212'-7 1/4"**	**213**	**4.889896**								
3702	W18x50		LF		62	4.2	1.9	68.1	$ 13,206.00	$ 894.60	$ 404.70	$ 14,505.30
	W18x50: 9	**267'-8 5/8"**	**268**	**6.693003**								
3702	W18x50		LF		62	4.2	1.9	68.1	$ 16,616.00	$ 1,125.60	$ 509.20	$ 18,250.80
	W18x60: 2	**54'-0"**	**54**	**1.62**								
4502	W21x62		LF		76.5	3.7	1.67	81.87	$ 4,131.00	$ 199.80	$ 90.18	$ 4,420.98
	W18x65: 1	**32'-5 7/8"**	**32.5**	**1.05598**								

Structural Framing

CSI Number	Family : Quantity	Measured Units	Total Units	Weight (Tons)	Material	Labor	Equipment	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
4702	W21x68		LF		84	3.7	1.67	89.37	$ 2,730.00	$ 120.25	$ 54.28	$ 2,904.53
	W18x76: 4	**77'-7 7/8"**	**78**	**2.951026**								
5502	W24x76		LF		94	3.45	1.56	99.01	$ 7,332.00	$ 269.10	$ 121.68	$ 7,722.78
	W18x86: 2	**66'-6 3/16"**	**66.5**	**2.860098**								
5702	W24x84		LF		104	3.55	1.6	109.15	$ 6,916.00	$ 236.08	$ 106.40	$ 7,258.48
	W18x106: 22	**664'-2 1/2"**	**664**	**35.203054**								
6302	W30x108		LF		134	3.19	1.44	138.63	$ 88,976.00	$ 2,118.16	$ 956.16	$ 92,050.32
	W18x130: 1	**9'-2 1/2"**	**9**	**0.598453**								
6902	W33x130		LF		161	3.38	1.53	165.91	$ 1,449.00	$ 30.42	$ 13.77	$ 1,493.19
	W18x143: 7	**209'-7"**	**210**	**14.985371**								
7102	W33x141		LF		174	3.38	1.53	178.91	$ 36,540.00	$ 709.80	$ 321.30	$ 37,571.10
	W18x234: 5	**114'-8 3/8"**	**115**	**13.419696**								
7902	W36x231		LF		286	3.41	1.54	290.95	$ 32,890.00	$ 392.15	$ 177.10	$ 33,459.25
	W18x258: 3	**156'-7 3/16"**	**157**	**20.201026**								
7902	W36x231		LF		286	3.41	1.54	290.95	$ 44,902.00	$ 535.37	$ 241.78	$ 45,679.15
	W21x44: 243	**7114'-9"**	**7115**	**156.524463**								
4102	W21x44		LF		54.5	3.6	1.63	59.73	$ 387,767.50	$ 25,614.00	$ 11,597.45	$ 424,978.95
	W21x50: 44	**1281'-2 3/16"**	**1281**	**32.029572**								
4302	W21x50		LF		62	3.6	1.63	67.23	$ 79,422.00	$ 4,611.60	$ 2,088.03	$ 86,121.63
	W21x55: 17	**529'-4 1/16"**	**524**	**14.556862**								
4502	W21x62		LF		76.5	3.7	1.67	81.87	$ 40,086.00	$ 1,938.80	$ 875.08	$ 42,899.88
	W21x62: 15	**368'-11 7/16"**	**369**	**11.437557**								
4502	W21x62		LF		76.5	3.7	1.67	81.87	$ 28,228.50	$ 1,365.30	$ 616.23	$ 30,210.03
	W21x68: 3	**89'-4 1/4"**	**89**	**3.037974**								
4702	W21x68		LF		84	3.7	1.67	89.37	$ 7,476.00	$ 329.30	$ 148.63	$ 7,953.93
	W21x83: 2	**62'-8"**	**63**	**2.600667**								
5702	W24x84		LF		104	3.55	1.6	109.15	$ 6,552.00	$ 223.65	$ 100.80	$ 6,876.45
	W21x101: 10	**199'-11 15/16"**	**200**	**10.099633**								
6102	W30x99		LF		123	3.19	1.44	127.63	$ 24,600.00	$ 638.00	$ 288.00	$ 25,526.00
	W21x111: 3	**94'-0 5/16"**	**94**	**5.218304**								
6302	W30x108: 49		LF		134	3.19	1.44	138.63	$ 12,596.00	$ 299.86	$ 135.36	$ 13,031.22
	W21x122: 1	**31'-4"**	**31**	**1.911333**								
6902	W33x130		LF		161	3.38	1.53	165.91	$ 4,991.00	$ 104.78	$ 47.43	$ 5,143.21
	W21x132: 4	**125'-4"**	**125**	**8.272**								
6902	W33x130		LF		161	3.38	1.53	165.91	$ 20,125.00	$ 422.50	$ 191.25	$ 20,738.75
	W21x147: 2	**62'-8"**	**63**	**4.606**								
7502	W26x150		LF		186	3.28	1.48	190.76	$ 11,718.00	$ 206.64	$ 93.24	$ 12,017.88
	W24x55: 138	**4196'-5 1/4"**	**4196.5**	**115.402068**								
4902	W24x55		LF		68	3.45	1.56	73.01	$ 285,362.00	$ 14,477.93	$ 6,546.54	$ 306,386.47
	W24x62: 40	**1062'-0 7/16"**	**1062**	**32.923157**								
5102	W24x62		LF		76.5	3.7	1.67	81.87	$ 81,243.00	$ 3,929.40	$ 1,773.54	$ 86,945.94
	W24x68: 17	**523'-0 15/16"**	**523**	**17.784575**								
5302	W24x68		LF		84	3.45	1.56	89.01	$ 43,932.00	$ 1,804.35	$ 815.88	$ 46,552.23
	W24x76: 21	**671'-1 13/16"**	**671**	**25.503735**								
5502	W24x76		LF		94	3.45	1.56	99.01	$ 63,074.00	$ 2,314.95	$ 1,046.76	$ 66,435.71
	W24x84: 3	**84'-5 3/8"**	**84.5**	**3.546886**								

Structural Framing

CSI Number	Family : Quantity	Measured Units	Total Units	Weight (Tons)	Material	Labor	Equipment	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
5702	W24x84		LF		104	3.55	1.6	109.15	$ 8,788.00	$ 299.98	$ 135.20	$ 9,223.18
	W24x117: 2	**62'-8 3/16"**	**63**	**3.66683**								
6502	W30x116		LF		144	3.31	1.49	148.8	$ 9,072.00	$ 208.53	$ 93.87	$ 9,374.40
	W24x131: 3	**73'-3 3/4"**	**73**	**4.801811**								
6902	W33x130		LF		161	3.38	1.53	165.91	$ 11,753.00	$ 246.74	$ 111.69	$ 12,111.43
	W24x176: 2	**39'-9 3/8"**	**40**	**3.500602**								
7502	W26x150		LF		186	3.28	1.48	190.76	$ 7,440.00	$ 131.20	$ 59.20	$ 7,630.40
	W27x84: 22	**706'-0 5/8"**	**706**	**29.654106**								
5902	W27x94		LF		116	3.22	1.45	120.67	$ 81,896.00	$ 2,273.32	$ 1,023.70	$ 85,193.02
	W30x90: 14	**372'-6 7/16"**	**372.5**	**16.764225**								
6102	W30x99		LF		123	3.19	1.44	127.63	$ 45,817.50	$ 1,188.28	$ 536.40	$ 47,542.18
	W30x99: 7	**124'-10 5/8"**	**125**	**6.181903**								
6102	W30x99		LF		123	3.19	1.44	127.63	$ 15,375.00	$ 398.75	$ 180.00	$ 15,953.75
	W30x108: 49	**1527'-10 5/8"**	**1528**	**82.505812**								
6302	W30x108		LF		134	3.19	1.44	138.63	$ 204,752.00	$ 4,874.32	$ 2,200.32	$ 211,826.64
	W30x124: 2	**34'-1 3/4"**	**34**	**2.117174**								
6902	W33x130		LF		161	3.38	1.53	165.91	$ 5,474.00	$ 114.92	$ 52.02	$ 5,640.94
	W33x118: 28	**745'-8 15/16"**	**746**	**43.999046**								
6702	W33x118		LF		146	3.26	1.47	150.73	$ 108,916.00	$ 2,431.96	$ 1,096.62	$ 112,444.58
	W33x130: 2	**66'-9 3/8"**	**67**	**4.340781**								
6902	W33x130		LF		161	3.38	1.53	165.91	$ 10,787.00	$ 226.46	$ 102.51	$ 11,115.97
	W33x141: 1	**42'-4"**	**42**	**2.9845**								
7102	W33x141		LF		174	3.38	1.53	178.91	$ 7,308.00	$ 141.96	$ 64.26	$ 7,514.22
	W33x152: 1	**56'-9 9/16"**	**57**	**4.316442**								
7502	W36x150		LF		186	3.28	1.48	190.76	$ 10,602.00	$ 186.96	$ 84.36	$ 10,873.32
	W36x135: 5	**170'-8 1/2"**	**171**	**11.522836**								
7302	W36x135		LF		167	3.28	1.48	171.76	$ 28,557.00	$ 560.88	$ 253.08	$ 29,370.96
	W36x150: 1	**32'-6 3/4"**	**32.5**	**2.442318**								
7502	W36x150		LF		186	3.28	1.48	190.76	$ 6,045.00	$ 106.60	$ 48.10	$ 6,199.70
	W36x182: 1	**28'-0"**	**28**	**2.548**								
7702	W36x194		LF		240	3.41	1.54	244.95	$ 6,720.00	$ 95.48	$ 43.12	$ 6,858.60
	W36x231: 1	**72'-0"**	**72**	**8.316**								
7902	W36x231		LF		286	3.41	1.54	290.95	$ 20,592.00	$ 245.52	$ 110.88	$ 20,948.40
	W36x302: 3	**151'-4"**	**151**	**22.851333**								
8102	W36x302		LF		375	3.7	1.67	380.37	$ 56,625.00	$ 558.70	$ 252.17	$ 57,435.87
	W36x487: 2	**144'-0"**	**144**	**35.064**								
8102	W36x302		LF		375	3.7	1.67	380.37	$ 54,000.00	$ 532.80	$ 240.48	$ 54,773.28
	Unistrut P1001: 15	**157'-9 11/16"**	**158**	**0**								
8102	W36x302		LF		375	3.7	1.67	380.37	$ 59,250.00	$ 584.60	$ 263.86	$ 60,098.46
05 12 23.75	***Structural Steel Members***								*$ 3,800,835.05*	*$ 223,090.34*	*$ 118,075.65*	***$ 4,142,001.04***

Structural Slab & Decking

CSI Number	Category	Material: Volume	Material: Area	Total Units	Material	Labor	Equipmen	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
05 31 13.50	***Floor Decking***											
	Floor: 1 1/2" Composite Metal Deck: 4	**167.96 CF**	**1008 SF**	**1008**								
5120	Non-cellular composite decking, galvanized, 1-1/2" deep, 18 gauge			SF	**1.92**	**0.43**	**0.03**	**2.38**	$ **1,935.36**	$ **433.44**	$ **30.24**	$ **2,399.04**
	Floor: 3" Composite Metal Deck: 26	**63151.17 CF**	**189453 SF**	**189453**								
5900	Non-cellular composite decking, galvanized, 3" deep, 18 gauge			SF	**2**	**0.55**	**0.04**	**2.59**	$ **378,906.00**	$ **104,199.15**	$ **7,578.12**	$ **490,683.27**
	Floor: 3" Composite Metal Deck: 26	**91035.16 CF**	**349575 SF**	**349575**								
5900	Non-cellular composite decking, galvanized, 3" deep, 18 gauge			SF	**2**	**0.55**	**0.04**	**2.59**	$ **699,150.00**	$ **192,266.25**	$ **13,983.00**	$ **905,399.25**
	Floor: 3" Composite Metal Deck: 6	**3628.89 CF**	**13935 SF**	**13935**								
5900	Non-cellular composite decking, galvanized, 3" deep, 18 gauge			SF	**2**	**0.55**	**0.04**	**2.59**	$ **27,870.00**	$ **7,664.25**	$ **557.40**	$ **36,091.65**
	Floor: 3" Composite Metal Deck: 4	**123.11 CF**	**422 SF**	**422**								
5900	Non-cellular composite decking, galvanized, 3" deep, 18 gauge			SF	**2**	**0.55**	**0.04**	**2.59**	$ **844.00**	$ **232.10**	$ **16.88**	$ **1,092.98**
05 31 13.50	***Floor Decking***								*$ 1,108,705.36*	*$ 304,795.19*	*$ 22,165.64*	***$ 1,435,666.19***
05 31 23.50	***Roof Decking***											
	Floor: 1 1/2" 22 Ga. Metal Roof Deck: 32	**12353.56 CF**	**98828 SF**	**99828**								
2400	Open Type, 1-1/2" deep, Type B, 22 Ga.			SF	**1.02**	**0.31**	**0.02**	**1.35**	$ **101,824.56**	$ **30,946.68**	$ **1,996.56**	$ **134,767.80**
	Floor: 1 1/2" 22 Ga. Metal Roof Deck: 6	**900.22 CF**	**2274 SF**	**2274**								
2400	Open Type, 1-1/2" deep, Type B, 22 Ga.			SF	**1.02**	**0.31**	**0.02**	**1.35**	$ **2,319.48**	$ **704.94**	$ **45.48**	$ **3,069.90**
05 31 23.50	***Roof Decking***								*$ 104,144.04*	*$ 31,651.62*	*$ 2,042.04*	***$ 137,837.70***
03 31	***Structural Concrete***											
	Foundation Slab: 8" Foundation Slab	**155.41 CF**	**233 SF**	**5.76**								
1500	6" to 10" Thick, Pumped			CY	**0**	**14.7**	**4.92**	**19.62**	$ **-**	$ **84.67**	$ **28.34**	$ **113.01**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **573.12**	$ **-**	$ **-**	$ **573.12**
	Foundation Slab: 12" Foundation Slab	**1039.78 CF**	**1040 SF**	**38.51**								
400	12" Thick, Pumped			CY	**0**	**39**	**13.1**	**52.1**	$ **-**	$ **1,501.89**	$ **504.48**	$ **2,006.37**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **3,831.75**	$ **-**	$ **-**	$ **3,831.75**
	Foundation Slab: 18" Foundation Slab	**25.89 CF**	**17 SF**	**25.89**								
600	18" Thick, Pumped			CY	**0**	**26**	**18.75**	**44.75**	$ **-**	$ **673.14**	$ **485.44**	$ **1,158.58**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **2,576.06**	$ **-**	$ **-**	$ **2,576.06**
	Foundation Slab: 24" Foundation Slab	**501.42 CF**	**251 SF**	**18.57**								
800	24" Thick, Pumped			CY	**0**	**25.5**	**8.55**	**34.05**	$ **-**	$ **473.54**	$ **158.77**	$ **632.31**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **1,847.72**	$ **-**	$ **-**	$ **1,847.72**
	Floor: 2 1/2" NW Concrete	**167.96 CF**	**1008 SF**	**6.22**								
1400	Elevated Slabs, less than 6" thick, pumped			CY	**0**	**16.8**	**5.6**	**22.4**	$ **-**	$ **104.50**	$ **34.83**	$ **139.33**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **618.89**	$ **-**	$ **-**	$ **618.89**
	Floor: 3 1/4" LW Concrete	**91035.16 CF**	**349575 SF**	**3371.67**								
1400	Elevated Slabs, less than 6" thick, pumped			CY	**0**	**16.8**	**5.6**	**22.4**	$ **-**	$ **56,644.06**	$ **18,881.35**	$ **75,525.41**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **335,481.17**	$ **-**	$ **-**	$ **335,481.17**
	Floor: 3 1/4" NW Concrete	**3628.89 CF**	**13935 SF**	**134.4**								
1400	Elevated Slabs, less than 6" thick, pumped			CY	**0**	**16.8**	**5.6**	**22.4**	$ **-**	$ **2,257.92**	$ **752.64**	$ **3,010.56**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **13,372.80**	$ **-**	$ **-**	$ **13,372.80**
	Floor: 4" Concrete	**21173.80 CF**	**63521 SF**	**784.21**								
1400	Elevated Slabs, less than 6" thick, pumped			CY	**0**	**16.8**	**5.6**	**22.4**	$ **-**	$ **13,174.73**	$ **4,391.58**	$ **17,566.30**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **78,028.90**	$ **-**	$ **-**	$ **78,028.90**
	Floor: 4" NW Concrete	**123.11 CF**	**422 SF**	**4.55**								
1400	Elevated Slabs, less than 6" thick, pumped			CY	**0**	**16.8**	**5.6**	**22.4**	$ **-**	$ **76.44**	$ **25.48**	$ **101.92**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **452.73**	$ **-**	$ **-**	$ **452.73**
	Floor: 5" NW Concrete	**63151.17 CF**	**189453 SF**	**2338.93**								
1400	Elevated Slabs, less than 6" thick, pumped			CY	**0**	**16.8**	**5.6**	**22.4**	$ **-**	$ **39,294.02**	$ **13,098.01**	$ **52,392.03**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **232,723.54**	$ **-**	$ **-**	$ **232,723.54**
	Floor: 6" Concrete	**17002.65 CF**	**34027 SF**	**629.73**								
1500	Elevated Slabs, 6" to 8" Pumped			CY	**0**	**14.7**	**4.92**	**19.62**	$ **-**	$ **9,257.03**	$ **3,098.27**	$ **12,355.30**
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ **62,658.14**	$ **-**	$ **-**	$ **62,658.14**

Structural Slab & Decking

CSI Number	Category	Material: Volume	Material: Area	Total Units	Material	Labor	Equipmen	Total	Material Cost	Labor Cost	Equipment Cost	Total Cost
	Floor: 6" Concrete (loading dock)	**25.68 CF**	**51 SF**	**0.95**								
1500	Elevated Slabs, 6" to 8" Pumped			CY	**0**	**14.7**	**4.92**	**19.62**	$ -	$ 13.97	$ 4.67	$ 18.64
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ 94.53	$ -	$ -	$ 94.53
	Floor: 8" Concrete	**18143.23 CF**	**27215 SF**	**671.97**								
1500	Elevated Slabs, 6" to 8" Pumped			CY	**0**	**14.7**	**4.92**	**19.62**	$ -	$ 9,877.96	$ 3,306.09	$ 13,184.05
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ 66,861.02	$ -	$ -	$ 66,861.02
	Floor: 8" Concrete S.O.G.	**810.67 CF**	**1216 SF**	**1216**								
1500	Elevated Slabs, 6" to 8" Pumped			CY	**0**	**14.7**	**4.92**	**19.62**	$ -	$ 17,875.20	$ 5,982.72	$ 23,857.92
4840	SOG (3500psi), no reinforcing			CY	**2.59**	**0.88**	**0.01**	**3.48**	$ 3,149.44	$ 1,070.08	$ 12.16	$ 4,231.68
	Floor: 8" NW Concrete	**900.22 CF**	**2274 SF**	**33.34**								
1500	Elevated Slabs, 6" to 8" Pumped			CY	**0**	**14.7**	**4.92**	**19.62**	$ -	$ 490.10	$ 164.03	$ 654.13
200	3500 psi			CY	**99.5**	**0**	**0**	**99.5**	$ 3,317.33	$ -	$ -	$ 3,317.33
03 31	***Structural Concrete***								*$ 805,587.09*	*$ 152,869.23*	*$ 50,928.87*	***$ 1,009,385.19***
03 22 05.50	***Welded Wire Fabric- ASTM A185***											
	Floor: 2 1/2" NW Concrete	**167.96 CF**	**1008 SF**	**10.08**								
200	W6x6-W2.1xW2.1 WWF			C-SF	**18.9**	**25**	**0**	**43.9**	$ 190.51	$ 252.00	$ -	$ 442.51
	Floor: 3 1/4" LW Concrete	**91035.16 CF**	**349575 SF**	**3495.75**								
200	W6x6-W2.1xW2.1 WWF			C-SF	**18.9**	**25**	**0**	**43.9**	$ 66,069.68	$ 87,393.75	$ -	$ 153,463.43
	Floor: 3 1/4" NW Concrete	**3628.89 CF**	**13935 SF**	**139.35**								
200	W6x6-W2.1xW2.1 WWF			C-SF	**18.9**	**25**	**0**	**43.9**	$ 2,633.72	$ 3,483.75	$ -	$ 6,117.47
	Floor: 4" Concrete	**21173.80 CF**	**63521 SF**	**635.21**								
300	W6x6-W2.9xW2.9 WWF			C-SF	**21.5**	**26.5**	**0**	**48**	$ 13,657.02	$ 16,833.07	$ -	$ 30,490.08
	Floor: 4" NW Concrete	**123.11 CF**	**422 SF**	**4.22**								
300	W6x6-W2.9xW2.9 WWF			C-SF	**21.5**	**26.5**	**0**	**48**	$ 90.73	$ 111.83	$ -	$ 202.56
	Floor: 5" NW Concrete	**63151.17 CF**	**189453 SF**	**1894.53**								
300	W6x6-W2.9xW2.9 WWF			C-SF	**21.5**	**26.5**	**0**	**48**	$ 40,732.40	$ 50,205.05	$ -	$ 90,937.44
	Floor: 6" Concrete	**17002.65 CF**	**34027 SF**	**340.27**								
200	W6x6-W2.1xW2.1 WWF			C-SF	**18.9**	**25**	**0**	**43.9**	$ 6,431.10	$ 8,506.75	$ -	$ 14,937.85
	Floor: 6" Concrete (loading dock)	**25.68 CF**	**51 SF**	**0.51**								
200	W6x6-W2.1xW2.1 WWF			C-SF	**18.9**	**25**	**0**	**43.9**	$ 9.64	$ 12.75	$ -	$ 22.39
	Floor: 8" Concrete	**18143.23 CF**	**27215 SF**	**272.15**								
200	W6x6-W2.1xW2.1 WWF			C-SF	**18.9**	**25**	**0**	**43.9**	$ 5,143.64	$ 6,803.75	$ -	$ 11,947.39
	Floor: 8" Concrete S.O.G.	**810.67 CF**	**1216 SF**	**12.16**								
300	W6x6-W2.9xW2.9 WWF			C-SF	**21.5**	**26.5**	**0**	**48**	$ 261.44	$ 322.24	$ -	$ 583.68
	Floor: 8" NW Concrete	**900.22 CF**	**2274 SF**	**22.74**								
300	W6x6-W2.9xW2.9 WWF			C-SF	**21.5**	**26.5**	**0**	**48**	$ 488.91	$ 602.61	$ -	$ 1,091.52
03 22 05.50	***Welded Wire Fabric- ASTM A185***								*$ 135,708.77*	*$ 174,527.54*	*$ -*	***$ 310,236.31***

APPENDIX C

LEED SCORECARD | PROJECT TEAM

Template obtained from LEED for New Construction V.2.2 Registered Project Checklist

LEED for New Construction v2.2
Registered Project Checklist

Project Name: New Regional Medical Center
Project Address: 559 West Germantown Pike, East Norriton, PA

Yes	?	No			
6	1	7	**Sustainable Sites**		14 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
		1	Credit 1	**Site Selection**	1
	1		Credit 2	**Development Density & Community Connectivity**	1
		1	Credit 3	**Brownfield Redevelopment**	1
		1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	**Alternative Transportation**, Low-Emitting & Fuel-Efficient Vehicles	1
		1	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
1			Credit 5.1	**Site Development,** Protect or Restore Habitat	1
1			Credit 5.2	**Site Development,** Maximize Open Space	1
1			Credit 6.1	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	**Stormwater Design,** Quality Control	1
		1	Credit 7.1	**Heat Island Effect,** Non-Roof	1
		1	Credit 7.2	**Heat Island Effect,** Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
4		1	**Water Efficiency**		5 Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
		1	Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

4	3	10	**Energy & Atmosphere**		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required

***Note for EAc1**: All LEED for New Construction projects registered after June 26th, 2007 are required to achieve at least two (2) points under EAc1.

2	2	6	Credit 1	**Optimize Energy Performance**	1 to 10
				10.5% New Buildings or 3.5% Existing Building Renovations	1
				14% New Buildings or 7% Existing Building Renovations	2
				17.5% New Buildings or 10.5% Existing Building Renovations	3
				21% New Buildings or 14% Existing Building Renovations	4
				24.5% New Buildings or 17.5% Existing Building Renovations	5
				28% New Buildings or 21% Existing Building Renovations	6
				31.5% New Buildings or 24.5% Existing Building Renovations	7
				35% New Buildings or 28% Existing Building Renovations	8
				38.5% New Buildings or 31.5% Existing Building Renovations	9
				42% New Buildings or 35% Existing Building Renovations	10
		3	Credit 2	**On-Site Renewable Energy**	1 to 3
				2.5% Renewable Energy	1
				7.5% Renewable Energy	2
				12.5% Renewable Energy	3
		1	Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
1			Credit 5	**Measurement & Verification**	1
	1		Credit 6	**Green Power**	1

Yes	?	No			
4	2	7	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse**, 5%	1
		1	Credit 3.2	**Materials Reuse**,10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
	1		Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regic	1
	1		Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regic	1
		1	Credit 6	**Rapidly Renewable Materials**	1
		1	Credit 7	**Certified Wood**	1

Yes	?	No			
10	1	4	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
		1	Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
		1	Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
	1		Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
1			Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort**, Design	1
1			Credit 7.2	**Thermal Comfort**, Verification	1
		1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
		1	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
5			**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design**: Green Housekeeping/Operations Program	1
1			Credit 1.2	**Innovation in Design**: Green Education Program	1
1			Credit 1.3	**Innovation in Design**: Demountable Partitions/ss.5.2	1
1			Credit 1.4	**Innovation in Design**: Chemical Free Treatment System	1
1			Credit 2	**LEED® Accredited Professional: Perkins+Will**	1

Yes	?	No		
33	7	29	**Project Totals** (pre-certification estimates)	**69** Points

Certified: 26-32 points, **Silver:** 33-38 points, **Gold:** 39-51 points, **Platinum:** 52-69 points

APPENDIX D

LEED SCORECARD | THESIS ANALYSIS

Template obtained from LEED for New Construction V.2.2 Registered Project Checklist

LEED for New Construction v2.2
Registered Project Checklist

Project Name: New Regional Medical Center
Project Address: 559 West Germantown Pike, East Norriton, PA

Yes	?	No			
7	1	6	**Sustainable Sites**		14 Points
Y			Prereq 1	**Construction Activity Pollution Prevention**	Required
		1	Credit 1	**Site Selection**	1
	1		Credit 2	**Development Density & Community Connectivity**	1
		1	Credit 3	**Brownfield Redevelopment**	1
		1	Credit 4.1	**Alternative Transportation**, Public Transportation Access	1
1			Credit 4.2	**Alternative Transportation**, Bicycle Storage & Changing Rooms	1
		1	Credit 4.3	**Alternative Transportation**, Low-Emitting & Fuel-Efficient Vehicles	1
		1	Credit 4.4	**Alternative Transportation**, Parking Capacity	1
1			Credit 5.1	**Site Development,** Protect or Restore Habitat	1
1			Credit 5.2	**Site Development,** Maximize Open Space	1
1			Credit 6.1	**Stormwater Design,** Quantity Control	1
1			Credit 6.2	**Stormwater Design,** Quality Control	1
		1	Credit 7.1	**Heat Island Effect,** Non-Roof	1
1			Credit 7.2	**Heat Island Effect,** Roof	1
1			Credit 8	**Light Pollution Reduction**	1

Yes	?	No			
4	1		**Water Efficiency**		5 Points
1			Credit 1.1	**Water Efficient Landscaping**, Reduce by 50%	1
1			Credit 1.2	**Water Efficient Landscaping**, No Potable Use or No Irrigation	1
	1		Credit 2	**Innovative Wastewater Technologies**	1
1			Credit 3.1	**Water Use Reduction**, 20% Reduction	1
1			Credit 3.2	**Water Use Reduction**, 30% Reduction	1

5	4	8	**Energy & Atmosphere**		17 Points
Y			Prereq 1	**Fundamental Commissioning of the Building Energy Systems**	Required
Y			Prereq 2	**Minimum Energy Performance**	Required
Y			Prereq 3	**Fundamental Refrigerant Management**	Required

***Note for EAc1**: All LEED for New Construction projects registered after June 26th, 2007 are required to achieve at least two (2) points under EAc1.

2	2	6	Credit 1	**Optimize Energy Performance**	1 to 10
				10.5% New Buildings or 3.5% Existing Building Renovations	1
			2	14% New Buildings or 7% Existing Building Renovations	2
				17.5% New Buildings or 10.5% Existing Building Renovations	3
				21% New Buildings or 14% Existing Building Renovations	4
				24.5% New Buildings or 17.5% Existing Building Renovations	5
				28% New Buildings or 21% Existing Building Renovations	6
				31.5% New Buildings or 24.5% Existing Building Renovations	7
				35% New Buildings or 28% Existing Building Renovations	8
				38.5% New Buildings or 31.5% Existing Building Renovations	9
				42% New Buildings or 35% Existing Building Renovations	10
1	1	1	Credit 2	**On-Site Renewable Energy**	1 to 3
			1	2.5% Renewable Energy	1
				7.5% Renewable Energy	2
				12.5% Renewable Energy	3
		1	Credit 3	**Enhanced Commissioning**	1
1			Credit 4	**Enhanced Refrigerant Management**	1
1			Credit 5	**Measurement & Verification**	1
	1		Credit 6	**Green Power**	1

Yes	?	No			
4	**3**	**6**	**Materials & Resources**		**13** Points
Y			Prereq 1	**Storage & Collection of Recyclables**	Required
		1	Credit 1.1	**Building Reuse**, Maintain 75% of Existing Walls, Floors & Roof	1
		1	Credit 1.2	**Building Reuse**, Maintain 100% of Existing Walls, Floors & Roof	1
		1	Credit 1.3	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	**Construction Waste Management**, Divert 50% from Disposal	1
1			Credit 2.2	**Construction Waste Management**, Divert 75% from Disposal	1
		1	Credit 3.1	**Materials Reuse**, 5%	1
		1	Credit 3.2	**Materials Reuse**,10%	1
1			Credit 4.1	**Recycled Content**, 10% (post-consumer + ½ pre-consumer)	1
	1		Credit 4.2	**Recycled Content**, 20% (post-consumer + ½ pre-consumer)	1
1			Credit 5.1	**Regional Materials**, 10% Extracted, Processed & Manufactured Regic	1
	1		Credit 5.2	**Regional Materials**, 20% Extracted, Processed & Manufactured Regic	1
		1	Credit 6	**Rapidly Renewable Materials**	1
	1		Credit 7	**Certified Wood**	1

Yes	?	No			
11	**1**	**3**	**Indoor Environmental Quality**		**15** Points
Y			Prereq 1	**Minimum IAQ Performance**	Required
Y			Prereq 2	**Environmental Tobacco Smoke** (ETS) **Control**	Required
1			Credit 1	**Outdoor Air Delivery Monitoring**	1
		1	Credit 2	**Increased Ventilation**	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Carpet Systems	1
	1		Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	**Indoor Chemical & Pollutant Source Control**	1
1			Credit 6.1	**Controllability of Systems**, Lighting	1
1			Credit 6.2	**Controllability of Systems**, Thermal Comfort	1
1			Credit 7.1	**Thermal Comfort**, Design	1
1			Credit 7.2	**Thermal Comfort**, Verification	1
		1	Credit 8.1	**Daylight & Views**, Daylight 75% of Spaces	1
		1	Credit 8.2	**Daylight & Views**, Views for 90% of Spaces	1

Yes	?	No			
5			**Innovation & Design Process**		**5** Points
1			Credit 1.1	**Innovation in Design**: Green Housekeeping/Operations Program	1
1			Credit 1.2	**Innovation in Design**: Green Education Program	1
1			Credit 1.3	**Innovation in Design**: Demountable Partitions/ss.5.2	1
1			Credit 1.4	**Innovation in Design**: Chemical Free Treatment System	1
1			Credit 2	**LEED® Accredited Professional: Perkins+Will**	1

Yes	?	No		
36	**10**	**23**	**Project Totals** (pre-certification estimates)	**69** Points

Certified: 26-32 points, **Silver:** 33-38 points, **Gold:** 39-51 points, **Platinum:** 52-69 points

APPENDIX E

BIM USE ANALYSIS

Template obtained from BIM Project Execution Planning Guide - Version 2.0.

BIM Use	Value to Project	Responsible Party	Value to Resp Party	Capability Rating			Additional Resources / Competencies Required to Implement	Notes	Proceed with Use
	High / Med / Low		High / Med / Low	Scale 1-3 (1 = Low)					YES / NO / MAYBE
				Resources	Competency	Experience			
3D Coordination (Construction)	HIGH	Construction Manager	HIGH	3	3	3	On-staff Coordinator, Range of software	Need to be able to accept software utilized in subcontractor's models	**YES**
		Subcontractors	HIGH	2	3	2	On-staff modeler(s), dedicated meeting strategy	Modeling requirement included in bid and contract	
		Architect	LOW	3	3	2			
Design Reviews	HIGH	Architect	HIGH	3	3	2	Review space, high level of model detail	Potential to review façade alternatives	**YES**
		Owner	HIGH	2	1	1		Mock-ups will be constructed	
3D Coordination (Design)	HIGH	Architect	HIGH				Coordination Software	Construction Manager to assist in coordination	**YES**
		MEP Engineer	MED						
		Structural Engineer	HIGH						
Design Authoring	HIGH	Architect	HIGH	3	3	3			**YES**
		MEP Engineer	MED	2	3	2			
		Structural Engineer	HIGH	3	3	3			
		Civil Engineer	LOW	2	1	1	Requires software, large learning curve	Civil Engineer excluded	
Maintenance Scheduling	LOW	Facility Manager	HIGH				Requires training & software	High value to facility's operation	**NO**
		Owner	MED						
Record Modeling	LOW	Facility Manager		1	2	1	Requires training	High value to facility's operation	**MAYBE**
		Construction Manager		2	2	2	Requires training, updated software	Potential Increase in Fee	
		Architect		3	3	2		Potential Increase in Architect Fee	
Cost Estimation	LOW	Construction Manager	MED	2	2	1	Requires training & new software	High value to CM - Utilized in Gilbane's VDC department in Arizona.	**NO**
4D Modeling	LOW	Construction Manager	MED	3	2	1	Requires training & new software	High value to CM - Utilized in Gilbane's VDC department in Arizona.	**NO**

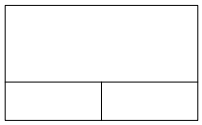
APPENDIX F

BIM PROCESS MAPS

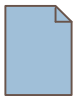
Template obtained from BIM Project Execution Planning Guide - Version 2.0.

BIM Execution Plan Legend:

Begin Level Execution



Level 1 Process Map BIM Use



Model Reference

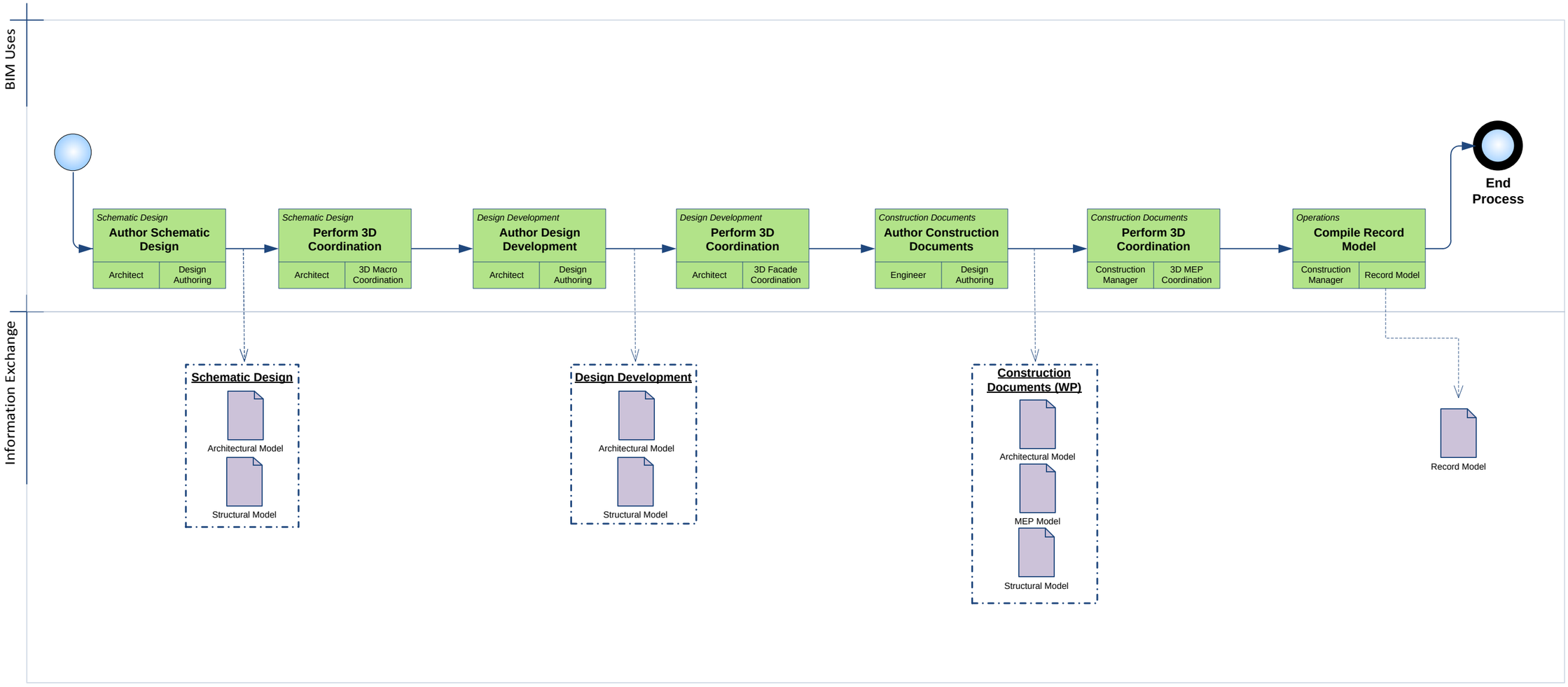
Information Exchange Files

Flow Path

Terminate Level Execution

Level 1 Process Map: New Regional Medical Center

East Norriton, PA



Developed with the BIM Project Execution Planning Procedure by the Penn State CIC Research Team.
http://www.engr/psu.edu/ae/cic/bimex

APPENDIX G

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