
Technical Report 2

Inova Fairfax Hospital South Patient Tower
Falls Church, VA

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Construction Management Option

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Executive Summary

Technical Assignment Two is intended to analyze the key features of the project that affect project execution of the Inova Fairfax Hospital South Patient Tower, which includes the detailed schedule, detailed structural estimate, general condition cost estimate of the building. Some comparisons and analysis is provided in the report as well.

In Technical Assignment two, the uses of LEED Pointe system and the Building Information Modeling (BIM) are also evaluated and analyzed. LEED scorecard is developed in order to help analyze the appropriateness of the goal pursued by the project. A thorough summary of the pursuing points is provided to help understand the point system. For BIM evaluation, both BIM use list and BIM Process Map are developed based on the project type.

For detailed project schedule, it reflects how the project was built, including phasing and structural sequences, MEP rough-in, and finishes. Major milestones of the project are also pointed out in the detailed project schedule.

In the detailed structural systems estimate, square foot method is used to provide an estimate of labor, material, equipment costs for the entire system. The calculation is complete by providing the cubic yards of concrete and/or tons of steel, etc. which includes the foundation, columns, beams slab on grades, flatwork and so on.

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Detailed Project Schedule

The Inova Fairfax Hospital South Patient Tower started the permits & site development on November 3rd 2009 and started the construction on July 8th, 2010. And the expected finish date is June 21, 2010. In order to keep the project on schedule, many milestones are set up for the South Patient Tower. Below is the summary of the Milestone of the project:

Milestone	Contract Days	Current Date	INOVA Milestone
Issue NTP			11-Oct-10
Make Ready Work	66	14-Oct-10	16-Dec-10
Concrete Substantially Complete	364	16-Sep-11	10-Oct-11
Building Watertight	446	15-Dec-11	31-Dec-11
P&HVAC Major Components	476	04-Jan-12	30-Jan-12
Electrical Major Components - Perm Power	442	05-Oct-11	27-Dec-11
Conditioned Air	490	18-Jan-12	13-Feb-12
Issue Non RUP	681	21-Jun-12	22-Aug-12
Substantial Completion	681	18-Jun-12	22-Aug-12

See *Appendix A* for **Detailed Project Schedule**

The pre-construction phase has the duration of 110 days, began on March 6th, 2010. It also took 131 days for the BIM coordination by Turner Construction to coordinate the MEP system of the building. The major utilities and site work started on October 7, 2011 with a total 127 days. The structure will finish on March 6th, 2012 with the floor pour completed on August 30th, 2011.

Detailed Structural Estimate

See *Appendix A* for **Detailed Structural Estimate**

The major structure system of the Inova Fairfax Hospital South Patient Tower is the reinforced concrete with shear walls. The foundation of the structure is supported by the 16” diameter auger-cast piles and pile caps on top of the slab on grade. RS Means 2012 was used for this Detailed Structural Estimate. Time modification is not considered in the estimate. Several other factors was considered into the estimate such as location factor and waste factor of the rebar, concrete, and formwork. Comparing to the Square Foot Estimate from Technical Report 1 is the cost of \$2,610,803 more than the estimate \$27,277,696.14. S

Below is the summary of the estimate:

STRUCTURAL COST SUMMARY			
ITEM	QUANTITY	UNIT RATE	COST
BEAM LABOR&MATERIAL			\$ 1,983,441.92
DROP PANEL& PLATE			\$ 940,500.00
REBAR	8052.62	\$ 1,650.00	\$ 13,286,823.00
CONCRETE			\$ 10,923,784.44
FORMWORK	16102	\$ 8.89	\$ 143,146.78
		TOTAL	\$ 27,277,696.14

The concrete slab for basement is 5” reinforced slab and 9 ½” reinforced two way slabs for the upper floors. The typical columns of the tower are 24X24 size with reinforcing goes through.

General Condition Estimate

The General Condition estimate for Inova Fairfax Hospital South Patient Tower is broken into the following categories: Personnel, Construction Facilities & Aids, Temporary utilities and Miscellaneous Costs. *See APPENDIX C for General Condition Estimate.* Due to the availability of the information from Turner Construction, the following Assumptions were made throughout the estimate:

- RS Means 2012 was used for the personnel salaries reference.
- Some of the unit prices are based on the online researching results.
- Labor durations are approximation numbers based on the duration of the whole project, which do not reflect the actual number for the project.

Below is the summarized version of General Condition Estimate. The Total General Condition Cost is \$601,850 - approximately 7.9% of the total building cost of \$76 million, which is reasonable for most general condition cost in United States. The personnel is found as the largest part around 63% of the total estimate. Construction Facilities & Aids costs 20.7% of the total. It includes items such as office trailers, storage trailers and office supplies. Temporary utilities spent around 9.5% of the total and Miscellaneous cost count as 6.7% of the total General Condition Cost. It is difficult to guarantee the accuracy of the temporary utilities since the durations for the items such as temporary toilets, power, scaffoldings are difficult to decide. Some miscellaneous information is from the experience of previous Turner Construction projects for the insurance, bonds and so forth.

Below is the summary of the General Condition Cost Estimate:

General Condition Summary	
DESCRIPTION	COST(\$)
PERSONNEL	378,720
CONSTRUCTION FACILITIES&AIDS	125,180
TEMPORARY UTILITES	57,550
MISCELLANEOUS COSTS	40,400
TOTAL	601,850

LEED Evaluation

LEED certification is the most recognized standard for building sustainability measurement. The design and project team on Inova Fairfax Hospital South Patient Tower are striving to achieve LEED silver certification on this project. According to LEED rating system, the project is rated based on the LEED 2009 new construction standard, which includes 100 base points for variety of sustainable design strategies. 6 possible Innovation in Design and 4 Regional Priority points are provided. The point range for Silver is from 50-59. *See APPENDIX C for LEED Scorecard* for detailed subcategories rating of South Patient Tower.

The point system is distributed as below through the six categories:

Category	Points
Sustainable Sites	13
Water Efficiency	6
Energy&Atmosphere	18
Materials& Resources	6
Indoor Environmental Quality	14
Innovation &Design process	0
Total	57

Summary of LEED Points

Sustainable Sites

Construction Activity Pollution Prevention: In order to reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust generation, control plan during design phase should be created such as mulching and silt fencing.

Site Selection: The South Patient Tower is connected to the existing main hospital building and will enable the master planned expansion of the women's hospital on the east side. So the area is used efficiently without inappropriate site development such as restrictive high-value farmland, high hydrogeologic risk previously undeveloped land, and public parkland. A suitable location and minimal footprint should be designed.

Development Density and Community Connectivity: For this point, there are two options: development density and community connectivity. According to situation of the Inova Fairfax South Patient Tower, option two can be achieved. The site is located on previously developed site with convenient basic services such as bank, restaurant, and convenience grocery and so on.

Alternative Transportation

- **Public Transportation Access:** Option 2- Bus Stop Proximity can be achieved for the South Patient Tower. The project is located within 1/4 miles walking distance of one or more stops for 2 or more public, campus, or private bus lines usable by building occupants. There three metro bus lines connect the hospital campus with major North Virginia locations, including the Dunn Loring Metro rail Station.
- **Bicycle Storage& Changing Rooms:** bicycle racks and shower/ changing facilities can be adopted into the project to reduce pollution and land development impacts from auto mobile use. As nonresidential project, the South Patient Tower need to provide bicycle racks within 200 yards of the building entrance for 5% or more of building users.
- **Low-Emitting and Fuel-Efficient Vehicles:** The good environmental condition for the is very important for the patients at Inova Fairfax Hospital. Therefore, it is quite necessary to reduce the pollution and land development impacts from the automobile use. The pollution can be reduced or controlled by providing transportation amenities such as alternative fuel refueling stations.

- Parking Capacity:** In order to minimize parking lot/garage size, South Patient can consider sharing parking facilities with adjacent buildings such as number 12 and number 13 existing parking for the hospital show in figure 1 below:

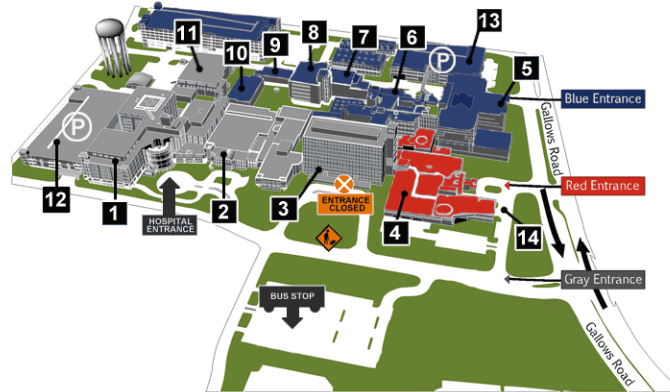


figure1

Storm-water Design, Quantity: is to limit the disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from storm-water runoff and eliminating contaminants. Pervious paving and other measures can be designed to minimize impervious surfaces in order to protect the natural hydrology

Heat Island Effect, Roof: The South Patient Tower did a good job in reducing heat island effect by designing the green roof and white roof to minimize the impacts on human and wildlife habitats.

Light Pollution Reduction: The site lighting is minimized where possible. Computer software should be used to model the site lighting. Light trespass and sky-glow should be minimized.

Water Efficiency

Water Use Reduction: Certain requirement of toilets, urinals, lavatory faucets, showers should be met in order to increase the efficiency of building water uses and also reduce the burden on wastewater systems.

Energy & Atmosphere

Fundamental Refrigerant Management: For new constructed South Patient Tower, specify new HVAC equipment in the base building that uses no CFC-based refrigerants to reduce ozone depletion.

Optimize Energy Performance: The minimum energy cost saving percentage for South Patient Tower is targeting 30% with 10 points rewarded.

On-Site Renewable Energy: Renewable energy such as solar, low-impact hydro can be used instead of fossil fuel energy to reduce both environmental and economic impacts.

Materials & Resources

Construction Waste Management: The goal for the Turner construction is to divert 50% construction and demolition debris from Disposal

Materials Reuse: 10% reuse of refurbished or salvaged materials can earn South Patient Tower 2 points. This helped to reduce the demand for virgin materials and reduce the waste.

Recycled Content: Project goal should be established to use 10 % of materials with recycled content. Only the materials permanently installed in the project will be counted.

Regional Materials, 20% Extracted: This means the materials needed for the building are processed & manufactured regionally from VA. The environmental impacts will be reduced from transportation.

Indoor Environmental Quality

Outdoor Air Delivery Monitoring: CO2 and airflow measurement equipment need to be installed for South Patient Tower to ensure the quality of air and promote occupant comfort.

Increased Ventilation: Natural ventilation systems for occupied spaces should be put into design to meet the recommendation set forth in the CIBSE.

Construction IAQ Management Plan: An IAQ management plan for both during construction and before occupancy should be generated to reduce in-door air quality problems to promote the comfort of construction workers and the patients.

Low-emitting material: Many sustainable features such as adhesives & sealants, paints & coatings, Carpet systems, composite wood, low or no-VOC buildings materials and furniture are attributed to South Patient Tower to guarantee the health and comfort of the occupants.

Indoor Chemical & Pollutant Source Control: Potential entry of pollutants into building should be controlled to minimize the building occupant exposure to the hazardous particulates and chemical pollutants.

Controllability of Systems for Lighting and Thermal Comfort: The patient tower should provide a high level of individual or groups control of lighting and thermal comfort system to make it as convenient as possible for patients to get access to them.

Daylight & Views, Daylight 75% of spaces: The natural daylight and view are very important for the patients in South Patient Tower. So a goal to achieve day lighting in 75% of regularly occupied spaces is needed to provide patients with a connection between indoor spaces and the outdoors.

BIM USE EVALUATION

Building Information Modeling (BIM) was used on the Inova Fairfax Hospital South Patient Tower, to help generating and managing building data during the construction. The project team has developed the BIM Execution Plan to achieve several goals they are pursuing.

See *Appendix E* for **BIM Analysis Chart**

Major BIM Goals/Objectives

Priority	Goal Description	Potential BIM Uses
HIGH	Engineering Analysis	3D Coordination
MED	Increase effectiveness of Building Design	Design Authoring, Design Reviews, 3D Coordination
HIGH	Optimize building sustainability Goals	LEED Evaluation
MED	Eliminate field conflicts	3D Coordination
LOW	Increase field efficiency	3D Coordination
LOW	Cost concerns associated with design changes	Cost Estimation
LOW	Track Construction Progress	4D Modeling

BIM has been employed to this high performance Inova Fairfax Hospital South Patient Tower. 3D Coordination are used during the both the design and construction phase to coordinate the architect and engineering design. Since the MEP System is very complicated for the Patient Tower due to some special requirement of medical air and medical vacuum, Turner construction is in charge to use the 3D Coordination to finalize the MEP System such as low-flow plumbing system and highly efficient mechanical system for the building to eliminate the design conflict and also minimize the field conflicts. BIM also helped to optimize the building sustainability goals to achieve LEED Silver. The priority of BIM use in tracking construction progress is relatively low since the complexity of the project is low.

SEE *Appendix F* for **BIM Process Map**.

A completed BIM project plan should define the appropriate uses for BIM on a project. The process map includes the tasks and information exchanges of the project. The connections between processes define the dependency between processes. The whole map contains the planning, schematic design, design development, construction document, and operation phases of the project. It also shows the responsible parties of each task.

APPENDIX A

DETAILED PROJECT SCHEDULE

APPENDIX B

DETAILED STRUCTURAL ESTIMATE

COLUMN	QUANTITY	WIDTH	DEPTH	HEIGHT	CONCRETE CY	FORMWORK	
ID			1.5	1.5	13	6.5	78
B-2	24X24		1.5	1.5	13	6.4	78
D-2	24X24		1.5	1.5	13	5.5	78
E-2	24X24		1.5	1.5	13	2.6	78
B-5	24X25		1.5	1.5	13	6.7	78
D-5	24X26		1.5	1.5	13	8.5	78
E-3	24X27		1.5	1.5	13	6.3	78
E-4	24X28		1.5	1.5	13	3.1	78
E-5	24X29		1.5	1.5	13	3.7	78
C-2	24X30		1.5	1.5	13	5.1	78
F-2	24X31		1.5	1.5	13	7.5	78
G-2	24X32		1.5	1.5	13	7.63	78
H-2	24X33		1.5	1.5	13	5.58	78
C-3	24X34		1.5	1.5	13	9.9	78
C-4	24X35		1.5	1.5	13	6.1	78
C-5	24X36		1.5	1.5	13	5.5	78
D-4	24X37		1.5	1.5	13	6.8	78
D-3	24X38		1.5	1.5	13	6.6	78
F-3	24X39		1.5	1.5	13	7.2	78
H-5	24X40		1.5	1.5	13	5.4	78
H-4	24X41		1.5	1.5	15	5.98	90
H-3	24X42		1.5	1.5	15	6.9	90
F-4	24X43		1.5	1.5	15	5.2	90
F-5	24X44		1.5	1.5	15	2.5	90
G-5	24X45		1.5	1.5	15	3.52	90
G-3	24X46		1.5	1.5	13	5.5	78
G-4	24X47		1.5	1.5	13	6.4	78
COL-1	12X18		1.5	1.5	13	5.2	78
COL-2	18X12		1.5	1.5	13	4.2	78
COL-3	12X18		1.5	1.5	13	4.3	78
COL-4	18X12		1.5	1.5	13	3.8	78
COL-5	12X18		1.5	1.5	13	3.4	78
COL-6	18X12		1.5	1.5	13	6.7	78
COL-7	12X18		1.5	1.5	13	5.5	78
COL-8	18X12		1.5	1.5	13	6.8	78
COL-9	12X18		1.5	1.5	13	6.6	78
COL-10	18X12		1.5	1.5	13	7.2	78
COL-12	12X18		1.5	1.5	13	5.2	78
COL-	18X12		1.5	1.5	13	8.4	78
					225.91	3102	

GRADE BEAM								
ID	WIDTH(IN)	DEPTH(IN)	LENGTH(FT)	REINFORCING		QUANTITY	WEIGHT(LB/FT)	LBS
GB1	24	24		860	BOT BARS			
GB2	24	36		980	3#7	3#7	148	2.06 304.88
GB3	18	36		550	3#9	3#9	124	3.4 421.6
GB4	30	36		100	2#7	2#7	250	2.06 515
GB5	36	24		305	4#9	4#9	280	3.4 952
GB6	42	36		246	4#10	4#10	176	4.303 757.328
				357	4#11	4#11	248	5.313 1317.624
							TOTAL	4268.432

ELEVATED SLABS	AREA	REBAR	WEGITH
S1	5690	0.77 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S2	2356	0.77 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S3	64770	0.77 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S4	2368	0.77 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S5	4789	0.77 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S6	3478	0.4 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S7	2352	0.4 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S8	89767	0.5 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6
S9	1225	0.5 (4) #5 TOP(4)#5 BOT @18"O.C.	2.6

CONCRETE BEAM SCHEDULE ID	SIZE		REINFORCING		STIRRUPS SIZE	SPACING(IN)
	W	D	BOT BARS	TOP BARS		
TB1	12"	24"	2#8	2#8	#4	1@3",BAL @10"
TB2	12"	60"	6#9	6#9	#4	1@3",BAL @12"
TB3	24"	28"	4#9	4#9	#4	1@3",BAL @12"
TB4	8"	36"	2#9	2#9	#3	1@3",BAL @12"
TB5	24"/32"	32"	6#9	4#9	#4	1@3",BAL @12"
1B1	24"	46"	6#9	4#9	#5	1@3",BAL@16"
1B2	24"	33.5"	5#9	3#9	#5	1@3",BAL@16"
1B3	32"	33.5"	5#9	3#9	#5	1@3",BAL@16"
1B4	84"	24"	8#8	8#8	#4	3@3",BAL@12"
1B5	12"	33.5"	3#9	3#9	#4	1@3",BAL@12"
1B6	12"	18"	2#9	2#9	#3	1@3",BAL@7"
1B7	18"	33.5"	6#9	4#9	#4	1@3", BAL @ 12"
1B8	24"	FOLD	3#8	3#8	#4	1@3", BAL @ 12"
1B9	32"	33.5"	6#9	4#9	#5	1@3",6@5,BAL@10"
1B10	12"	36"	3#9	2#9	#4	1@3",BAL@12"
1B11	12"	36"	3#9	2#9	#4	1@3",BAL@12"
1B12	24"	45.5"/21.5"	6#9	3#9	#5	1@3",BAL@12"
1B13	18"	33.5"	5#9	2#9	#4	1@3",BAL@12"
1B14	24"	33.5"	5#9	4#9	#5	1@3",BAL@12"

WALL THICKNESS	BAR SIZE& SPACING EACH MAT	
	HORIZONTAL	VERTIAL
6"TO 8"	#4 @12"	#4 @ 12"
8 1/2" TO 10"	#4 @18"	#4 @ 18"
10 1/2" TO 12"	#4 @ 12"	#4 @ 12"
12 1/2" TO 14"	#5 @ 14"	#4 @ 12"

	fc'=3,000PSI				
	TOP BARS		OTHER BARS		
BAR SIZE	CASE1	CASE2	CASE1	CASE2	
#3	1'-5"	1'-11"	1'-4"	1'-6"	6.17
#4	1'-11"	3'-2"	1'-6"	2'-5"	9
#5	2'-4"	4'-6"	1'-10"	3'-6"	12.17
#6	2'-10"	6'-0"	2'-2"	4'-7"	15.58
#7	4'-7"	9'-6"	3'-7"	7'-4"	25.83
#8	5'-10"	11'-7"	4'-6"	8'-11"	30.58
#9	7'-2"	13'-1"	5'-6"	10'-1"	35.833
#10	8'-9"	14'-9"	6'-9"	11'-4"	41.58
#11	10'-6"	16'-4"	8'-1"	12'-7"	47.5
				TOTAL	224.243
	fc'=4000PSI				
	TOP BARS		OTHER BARS		
BAR SIZE	CASE1	CASE2	CASE1	CASE2	
#3	1'-4"	1'-8"	1'-4"	1'-4"	5.67
#4	1'-8"	2'-9"	1'-4"	2'-1"	7.83
#5	2'-1"	3'-11"	1'-7"	3'-0"	10.6
#6	2'-5"	5'-2"	1'-11"	4'-0"	13.5
#7	4'-0"	8'-3"	3'-1"	6'-4"	21.67
#8	5'-1"	10'-1"	3'-11"	7'-9"	26.83
#9	6'-3"	11'-4"	4'-10"	8'-9"	31.17

#10	7'-7"	12'-9"	5'-10"	9'-10"	36
#11	9'-1"	14'-2"	7'-0"	10'-9"	41
				TOTAL	194.27
	fc'=5000PSI				
	TOP BARS		OTHER BARS		
BAR SIZE	CASE1	CASE2	CASE1	CASE2	
#3	1'-4"	1'-6"	1'-4"	1'-4"	5.5
#4	1'-6"	2'-5"	1'-4"	1'-11"	7.17
#5	1'-10"	3'-6"	1'-5"	2'-8"	9.42
#6	2'-2"	4'-8"	1'-8"	3'-7"	12.1
#7	3'-7"	7'-4"	2'-9"	5'-8"	19.33
#8	4'-6"	9'-0"	3'-6"	6'-11"	23.97
#9	5'-7"	10'-2"	4'-4"	7'-10"	27.92
#10	6'-10"	11'-5"	5'-3"	8'-9"	32.25
#11	8'-1"	12'-8"	6'-3"	9'-9"	36.75
				TOTAL	174.41
	fc'=6000PSI				
	TOP BARS		OTHER BARS		
BAR SIZE	CASE1	CASE2	CASE1	CASE2	
#3	1'-4"	1'-5"	1'-4"	1'-4"	5.41
#4	1'-4"	2'-3"	1'-4"	1'-9"	6.67
#5	1'-8"	3'-2"	1'-4"	2'-6"	8.67
#6	2'-0"	4'-3"	1'-7"	3'-3"	11.08
#7	3'-3"	6'-9"	2'-6"	5'-2"	17.67
#8	4'-2"	8'-2"	3'-2"	6'-4"	21.83
#9	5'-1"	9'-3"	3'-11"	7'-1"	25.33
#10	6'-3"	10'-5"	4'-10"	8'-0"	29.5
#11	7'-5"	11'-7"	5'-9"	8'-11"	33.67
				TOTAL	159.83
	fc'=7000PSI				
	TOP BARS		OTHER BARS		
BAR SIZE	CASE1	CASE2	CASE1	CASE2	
#3	1'-4"	1'-4"	1'-4"	1'-4"	5
#4	1'-4"	2'-1"	1'-4"	1'-7"	6.33
#5	1'-7"	2'-11"	1'-4"	2'-3"	8.17
#6	1'-10"	3'-11"	1'-5"	3'-0"	10.17
#7	3'-0"	6'-3"	2'-4"	4'-10"	16.42
#8	3'-10"	7'-6"	2'-11"	5'-10"	20.1
#9	4'-9"	8'-7"	3'-8"	6'-7"	23.58
#10	5'-9"	9'-8"	4'-5"	7'-5"	26.83
#11	6'-10"	10'-9"	5'-4"	8'-3"	31.17
				TOTAL	147.77
	fc'=8000PSI				
	TOP BARS		OTHER BARS		
BAR SIZE	CASE1	CASE2	CASE1	CASE2	
#3	1'-4"	1'-4"	1'-4"	1'-4"	5
#4	1'-4"	1'-11"	1'-4"	1'-6"	6.1

#5	1'-6"	1'-11"	1'-4"	2'-2"	6.92
#6	1'-9"	3'-8"	1'-4"	2'-10"	9.6
#7	2'-10"	5'-10"	2'-2"	4'-6"	15.33
#8	3'-7"	7'-2"	2'-9"	5'-6"	19
#9	4'-5"	8'-0"	3'-5"	6'-2"	22
#10	5'-5"	9'-0"	4'-2"	7'-0"	25.58
#11	6'-5"	10'-0"	4'-11"	7'-9"	29.08
				TOTAL	138.61
	fc'=10000P				
	SI				
	TOP BARS		OTHER BARS		
BAR SIZE	CASE1	CASE2	CASE2	CASE1	
#3	1'-4"	1'-4"	1'-4"	1'-4"	5
#4	1'-4"	1'-9"	1'-4"	1'-4"	5.42
#5	1'-4"	2'-6"	1'-4"	1'-11"	7.1
#6	1'-7"	3'-4"	1'-4"	2'-7"	8.83
#7	2'-7"	5'-3"	2'-0"	4'-0"	13.83
#8	3'-3"	6'-5"	2'-6"	4'-11"	16.92
#9	3'-11"	7'-2"	3'-1"	5'-6"	19.67
#10	4'-10"	8'-1"	3'-9"	6'-3"	22.92
#11	5'-9"	9'-0"	4'-5"	6'-11"	26.1
				TOTAL	125.79
	LF	LBS/FT	LBS		
#3	37.75	0.376	14.194		
#4	48.52	0.67	32.5084		
#5	63.05	1.04	65.572		
#6	80.86	1.5	121.29		
#7	130.08	2.06	267.9648		
#8	159.23	2.67	425.1441		
#9	185.503	3.4	630.7102		
#10	214.66	4.303	923.68198		
#11	245.27	5.313	1303.11951		
		TOTAL	3784.18499		

ITEM	QUANTITY	Thickness"	IN	PRICE	COST		
COLUMN BASE PLATE	3124	9 1/2"	14X20	150	468600		
DROP PANEL	2860	6"	10X10	165	471900	TOTAL	\$ 940,500.00

FOUNTATION WALLS						
WIDTH	LENGTH	HEIGHT	BAR	WEGITH	CONCRETE CY	REBAR TOTAL(LBS)
1.33	85	13	5	1.5	521	1520
1.33	300	14	5	1.5	376	1854
				TOTAL	897	3374

BEAM	LEIGHT	MATERIAL	LABOR	EQUIPMENT	TOTAL	TOTAL O& P	COST
W8X15	570	\$ 14.60	\$ 4.06	\$ 2.90	\$ 21.56	\$ 26.07	\$ 14,859.90
W8X18	620	\$ 16.50	\$ 4.06	\$ 2.90	\$ 23.46	\$ 27.12	\$ 16,814.40
W8X24	280	\$ 39.50	\$ 4.06	\$ 3.17	\$ 46.73	\$ 52.50	\$ 14,700.00
W10X12	168	\$ 19.80	\$ 4.06	\$ 2.90	\$ 26.76	\$ 29.63	\$ 4,977.84
W12X14	246	\$ 42.00	\$ 2.77	\$ 1.98	\$ 46.75	\$ 56.74	\$ 13,958.04
W16X26	375	\$ 200.00	\$ 2.44	\$ 1.74	\$ 204.18	\$ 235.51	\$ 88,316.25
W18X50	365	\$ 60.00	\$ 3.67	\$ 1.90	\$ 65.57	\$ 76.06	\$ 27,761.90
W21X50	232	\$ 50.00	\$ 3.32	\$ 1.76	\$ 55.08	\$ 65.49	\$ 15,193.68
W24X55	545	\$ 260.00	\$ 3.18	\$ 1.69	\$ 264.87	\$ 300.31	\$ 163,668.95
W10X54	4850	\$ 42.00	\$ 3.42	\$ 1.69	\$ 47.11	\$ 56.62	\$ 274,607.00
W30X99	4850	\$ 58.00	\$ 3.20	\$ 1.56	\$ 62.76	\$ 73.58	\$ 356,863.00
HSS7/7 1/2	6790	\$ 410.00	\$ 45.00	\$ 43.00	\$ 498.00	\$ 568.49	\$ 991,720.96
						TOTAL	\$ 1,983,441.92

APPENDIX C

GENERAL CONDITION ESTIMATE

General Condition Estimate				
DESCRIPTION	UNIT	QTY.	UNIT RATE	COST
Personnel				
Superintendent	WKS	12	\$ 1,050.00	\$ 12,600.00
MEP Superintendent	WKS	20	\$ 1,520.00	\$ 30,400.00
Assis Superintendent	WKS	24	\$ 1,200.00	\$ 28,800.00
Project Manager	WKS	24	\$ 1,275.00	\$ 30,600.00
Field Engineer	WKS	20	\$ 1,000.00	\$ 20,000.00
Project Engineer	WKS	90	\$ 1,800.00	\$ 162,000.00
Project Administrator	WKS	24	\$ 1,480.00	\$ 35,520.00
Safety Manager	WKS	24	\$ 1,200.00	\$ 28,800.00
Accountant	WKS	24	\$ 1,250.00	\$ 30,000.00
Intern	WKS		\$ 400.00	\$ -
total				\$ 378,720.00

Construction Facilities & Aids				
Field Office Trailer Set-up	LS	2	2,000	\$ 4,000.00
Field Office Trailer Removal	LS	2	2,000	\$ 4,000.00
Field Office Trailer	MONTH	24	1,500	\$ 36,000.00
Storage Trailer	MONTH	72	240	\$ 17,280.00
Office Equipment	MONTH	90	200	\$ 18,000.00
Office Supplies	MONTH	90	150	\$ 13,500.00
Fire Extinguisher	MONTH	96	150	\$ 14,400.00
Personal Protective Equipment	MONTH	90	200	\$ 18,000.00
total				\$ 125,180.00

Temporary Utilities				
Temp Fencing	LF	300	29	\$ 8,700.00
Temp Water	LS	1	2500	\$ 2,500.00
Temp Power	MONTH	24	1500	\$ 36,000.00
Weather Protection	MONTH	24	100	\$ 2,400.00
Temp Toilets	MONTH	18	100	\$ 1,800.00
Mobilization	MONTH	20	120	\$ 2,400.00
Scaffolding	EA	500	5.5	\$ 2,750.00
Telephones/Hook-up	LS	1	1000	\$ 1,000.00
total				\$ 57,550.00

Miscellaneous Costs				
Occupancy Permits	LS	1	1000	\$ 1,000.00
Land Permits	LS	1	1000	\$ 1,000.00
Bonds	LS	1	1000	\$ 1,000.00
Clean-up	WEEK	90	100	\$ 9,000.00
System Testing & Certification	EA	10	680	\$ 6,800.00
Delivery/Shipping Expenses	WEEK	96	100	\$ 9,600.00
Travel Expenses	MONTH	24	500	\$ 12,000.00
TOTAL				\$ 40,400.00
FINAL TOTAL				\$ 601,850.00

APPENDIX D

LEED SCORECARD

LEED-NC Version 2.2009 PROJECT CHECKLIST

INOVA FAIRFAX HOSPITAL SOUTH PATIENT TOWER

FALLS CHURCH VIRGINIA

Yes ? No

0	13	0	Sustainable Sites	26 Points
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Y					
x	1		Prereq 1	Construction Activity Pollution Prevention	Required
x	3		Credit 1	Site Selection	1
x	3		Credit 2	Development Density & Community Connectivity	5
		X	Credit 3	Brownfield Redevelopment	1
x			Credit 4.1	Alternative Transportation, Public Transportation Access	6
		X	Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Room:	1
x	3		Credit 4.3	Alternative Transportation, Low-Emitting and Fuel-Efficient Veh	3
x	2		Credit 4.4	Alternative Transportation, Parking Capacity	2
		X	Credit 5.1	Site Development, Protect or Restore Habitat	1
		X	Credit 5.2	Site Development, Maximize Open Space	1
x	1		Credit 6.1	Stormwater Design, Quantity Control	1
x	1		Credit 6.2	Stormwater Design, Quality Control	1
		X	Credit 7.1	Heat Island Effect, Non-Roof	1
x	1		Credit 7.2	Heat Island Effect, Roof	1
x	1		Credit 8	Light Pollution Reduction	1

Yes ? No

0	6	0	Water Efficiency	10 Points
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x					
			Prereq 1	Water Use Reduction	required
			Credit 1	Water Efficient Landscaping	2-4
x	2		Credit 2	Innovative Wastewater Technologies	2
x	4		Credit 3	Water Use Reduction	2-4

Yes ? No

0	18	0	Energy & Atmosphere	35 Points
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Y					
Y			Prereq 1	Fundamental Commissioning of the Building Energy System	Required
Y			Prereq 2	Minimum Energy Performance	Required
Y			Prereq 3	Fundamental Refrigerant Management	Required
x	15		Credit 1	Optimize Energy Performance	1 to 19
x	3		Credit 2	On-Site Renewable Energy	1 to 7
			Credit 3	Enhanced Commissioning	2
			Credit 4	Enhanced Refrigerant Management	2
			Credit 5	Measurement & Verification	3
			Credit 6	Green Power	2

continued...

Yes ? No

0 6 0			Materials & Resources		13 Points
Y			Prereq 1	Storage & Collection of Recyclables	Required
			Credit 1.1	Building Reuse, Maintain Existing Walls, Floors & Roof	1-3
			Credit 1.2	Building Reuse, Maintain Existing Interior Non-Structural Eleme	1
X	1		Credit 2	Construction Waste Management	1-2
X	2		Credit 3	Materials Reuse	1-2
X	1		Credit 4	Recycled Content	1-2
X	2		Credit 5	Regional Materials	1-2
			Credit 6	Rapidly Renewable Materials	1
			Credit 7	Certified Wood	1
Yes	?	No			
0 14 0			Indoor Environmental Quality		15 Points
Y			Prereq 1	Minimum IAQ Performance	Required
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
X	1		Credit 1	Outdoor Air Delivery Monitoring	1
X	1		Credit 2	Increased Ventilation	1
X	1		Credit 3.1	Construction IAQ Management Plan, During Construction	1
X	1		Credit 3.2	Construction IAQ Management Plan, Before Occupancy	1
X	1		Credit 4.1	Low-Emitting Materials, Adhesives & Sealants	1
X	1		Credit 4.2	Low-Emitting Materials, Paints & Coatings	1
X	1		Credit 4.3	Low-Emitting Materials, Carpet Systems	1
X	1		Credit 4.4	Low-Emitting Materials, Composite Wood & Agrifiber Products	1
X	1		Credit 5	Indoor Chemical & Pollutant Source Control	1
X	1		Credit 6.1	Controllability of Systems, Lighting	1
X	1		Credit 6.2	Controllability of Systems, Thermal Comfort	1
X	1		Credit 7.1	Thermal Comfort, Design	1
X	1		Credit 7.2	Thermal Comfort, Verification	1
X	1		Credit 8.1	Daylight & Views, Daylight 75% of Spaces	1
			Credit 8.2	Daylight & Views, Views for 90% of Spaces	1
Yes	?	No			
0 0 0			Innovation in Design and Regional Priority		10Points
	0	X	Credit 1	Innovation in Design	1-5
	0	X	Credit 1.2	LEED Accredited Professional	1
	0	X	Credit 2	Regional Priority	1-4
Yes	?	No			
0 57			Project Totals (pre-certification estimates)		100 Points
Certified 26-32 points Silver 33-38 points Gold 39-51 points Platinum 52-69 points					

APPENDIX E

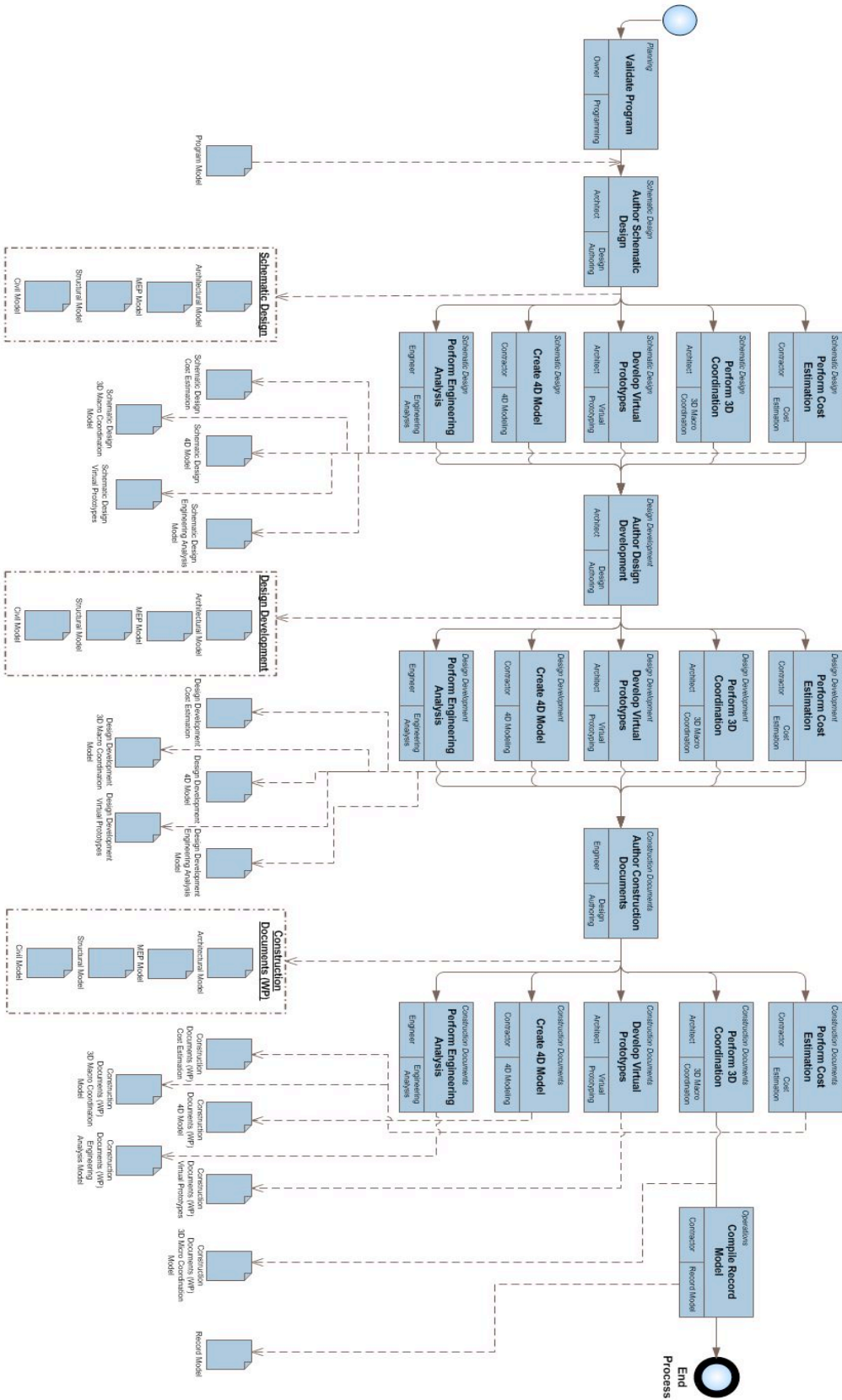
BIM USE ANALYSIS CHART

BIM Use*	Value to Project	Responsible Party	Value to Resp Party	Capability Rating			Proceed with Use
				Scale 1-3 (1 = Low)			
	High / Med / Low		High / Med / Low	Resources	Competency	Experience	YES / NO / MAYBE
Record Modeling	HIGH	Contractor	MED	2	2	2	NO
		Facility Manager	HIGH	1	2	1	
		Designer	MED	3	3	3	
Cost Estimation	MED	Contractor	MED	2	1	1	YES
4D Modeling	HIGH	Contractor	HIGH	3	2	2	YES
3D Co. (Cons.)	HIGH	Contractor	HIGH	3	3	3	YES
		Subcontractors	HIGH	1	3	3	
		Designer	LOW	2	3	3	
Engineering Analysis	HIGH	MEP Engr	HIGH	2	2	2	YES
		Architect	LOW	2	2	2	
Design Reviews	MED	Arch	LOW	1	2	1	YES
3D Co.(Design)	HIGH	Architect	HIGH	2	2	2	YES
		MEP Engr	MED	2	2	1	
		Structural Engr	HIGH	2	2	1	
Design Authoring	HIGH	Architect	HIGH	3	3	3	YES
		MEP Engr	MED	3	3	3	
		Structural Engr	HIGH	3	3	3	
		Civil Engr	LOW	2	1	1	
Programming	MED						NO

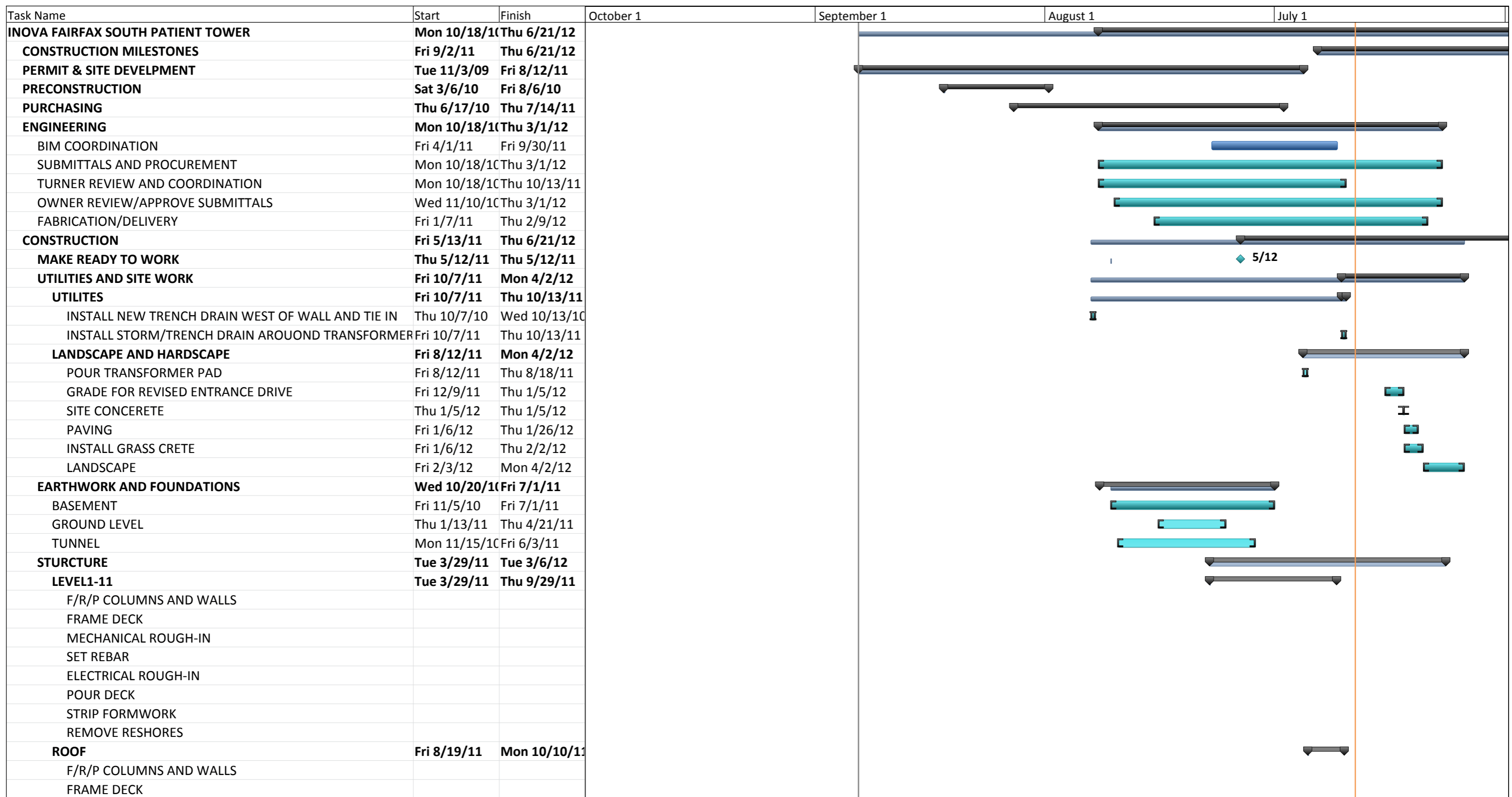
APPENDIX F

BIM PROCESS MAP

Project Title: INOVA FAIRFAX HOSPITAL SOUTH PATIENT TOWER



Developed with the BIM Project Execution Planning Procedure by the Penn State CIO Research Team
<http://www.enr.psu.edu/bim/cep/index>



Project: INOVA FAIRFAX HOSTPITA
Date: Thu 10/27/11

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

Task Name	Start	Finish	October 1	September 1	August 1	July 1
ELECTRICAL ROUGH-IN						
MECHANICAL ROUGH-IN						
SET REBAR						
POUR DECK						
STRIP FORMWORK						
REMOVE RESHORES						
PENTHOUSE	Tue 8/30/11	Tue 9/27/11				
F/R/P COLUMNS AND WALLS						
FRAME WORK						
ELECTRICAL ROUGH-IN						
MECHANICAL ROUGH-IN						
SET REBAR						
POUR DECK						
PH STRUCTURAL STEEL FRAMING	Mon 8/15/11	Fri 9/9/11				
FORM & POUR CONCRETE CURBS AT ETB ROOF						
TEMP WATER PROOFING FOR CURBS AT ETB ROOF						
ERECT STEEL FRAMING						
DETAIL STRUCTURE STEEL						
INSTALL DECK						
POUR SLAB METAL DECK						
HELIPAD	Wed 12/14/11	Tue 3/6/12				
INSTALL POSTS FOR HELIPAD						
INSTALL HELIPAD FRAMING						
INSTALL HELIPAD DECK AND WALKWAY						
INSTALL ICE MELT SYSTEM/DELUGE SYSTEMS						
HELIPAD TRIM AND TEST						
FAÇADE&ROOF	Mon 6/20/11	Tue 12/13/11				
PENTHOUSE	Mon 9/26/11	Fri 11/4/11				
LGMP/LAYOUT	Wed 9/28/11	Fri 11/4/11				
SHEATHING&INSTALL DUROCK	Fri 10/7/11	Tue 11/1/11				
INSTALL METAL PANELS	Wed 10/12/11	Tue 11/1/11				
CAULKING METAL PANELS	Wed 11/2/11	Fri 11/4/11				
ROOF	Thu 6/30/11	Tue 12/13/11				
PARAPET BACKUP, FRAMING& SHEATHING-3RD FLOOR	Thu 6/30/11	Thu 7/7/11				
TEMP IN LOWER ROOF	Fri 7/8/11	Thu 7/21/11				
DEMO PARAPET WALL ON ETB	Fri 8/19/11	Mon 8/29/11				
TEMP IN 11TH FLOOR AT ETB	Mon 8/22/11	Fri 9/2/11				
BUILDING TEMP WATER TIGHT THROUGH 3RD FLOOR						
INSTALL LOWER ROOF	Wed 10/26/11	Fri 11/18/11				

Project: INOVA FAIRFAX HOSTPITA Date: Thu 10/27/11	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only			
	Summary		Inactive Task		Duration-only		Finish-only			

Task Name	Start	Finish	October 1	September 1	August 1	July 1
PARAPET BACKUP, FRAMING& SHEATHING-12RD FLOOR	Wed 10/26/11	Mon 10/31/11				
BUILDING TEMP WATER TIGHT THROUGH 10TH FLOOR						◆ 6/30
INSTALL UPPER ROOF	Wed 11/23/11	Tue 12/13/11				
BUILDING PERM WATER TIGHT						◆ 6/30
PRECAST	Mon 6/20/11	Tue 10/25/11				
GROUD-2ND LEVEL	Mon 6/20/11	Thu 7/28/11				
3RD-6TH LEVEL	Fri 8/26/11	Thu 9/29/11				
7TH-ROOFLEVEL	Mon 9/19/11	Tue 10/25/11				
GLASS AND GLAZING	Mon 8/22/11	Tue 12/13/11				
GROUND -2ND LEVEL	Thu 8/25/11	Mon 9/19/11				
WATERPROOF SLAB EDGE						
INSTALL PEA GRAVEL FILL						
CAULK PEA GRAVEL						
INSTALL FRAMING/GLASS						
CAULKING						
3RD TO ROOF LEVEL	Mon 10/10/11	Tue 12/13/11				
INSTALL LOUVERS						
EAST ELEVATION						
SOUTH ELEVATION						
WEST ELEVATION						
STUCCO	Mon 8/22/11	Thu 11/3/11				
EAST ELEVATION	Mon 8/22/11	Thu 11/3/11				
LGMF/LAYOUT						
SHEATHING& TAPE JOINTS						
INSTALL DUROCK& TAPE JOINTS						
INSTALL MASONRY PARTITIONS						
CORE CONSTRUCTION	Fri 5/13/11	Thu 4/19/12				
ELEVATORS	Thu 10/27/11	Thu 4/19/12				
INSTALL HYDRAULIC LOBBY ELEVATOR	Thu 10/27/11	Wed 12/21/11				
INSTALL ESCALATOR	Thu 10/27/11	Wed 1/18/12				
SET ELEV MACHINES IN EMR	Fri 11/18/11	Wed 12/14/11				
INSTALL MACHINES/CONTROLLERS	Wed 11/23/11	Tue 12/27/11				
INSTALL ELEVATOR RAILS-PATIENT	Fri 12/16/11	Thu 2/9/12				
INSTALL ELEVATOR RAILS-PUBLIC	Fri 12/16/11	Thu 2/9/12				
SET ELEV DOOR BUCKS-PATIENTS	Fri 2/10/12	Thu 3/1/12				
SET ELEV DOOR BUCKS-PUBLIC	Fri 2/10/12	Mon 2/27/12				
CLOSE UP ELEVATOR FRONTS-PUBLIC	Tue 2/14/12	Wed 2/29/12				
CLOSE UP ELEVATOR FRONTS-PATIENTS	Fri 2/17/12	Thu 3/8/12				
INSTALL CAB-PUBLIC	Thu 3/1/12	Wed 3/21/12				
INSTALL CABS-PATIENT	Fri 3/9/12	Thu 3/29/12				
TEST AND BALANCE-PUBLIC	Thu 3/22/12	Wed 4/11/12				

Project: INOVA FAIRFAX HOSTPITA
Date: Thu 10/27/11

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

Task Name	Start	Finish	October 1	September 1	August 1	July 1
1 PATIENT ELEVATOR READY FOR TEMP USE						10/27
TEST AND BALANCE PATIENT	Fri 3/30/12	Thu 4/19/12				
MEP	Fri 5/13/11	Tue 1/17/12				
ELECTRICAL RISERS	Fri 7/29/11	Tue 1/17/12				
CAFÉ RISER	Fri 7/29/11	Mon 10/24/11				
MOUNT BACK BOSES&TRANSFORMER	Fri 7/29/11	Mon 8/1/11				
INSTALL FEEDER CONDUIT	Tue 9/13/11	Tue 9/20/11				
PIPE IN WIRE PANELS&TRANSFORMERS	Tue 9/27/11	Fri 9/30/11				
TERMINATE FEEDER CABLE	Mon 10/3/11	Mon 10/3/11				
TESTING&INSPECTIONS	Tue 10/4/11	Mon 10/10/11				
ENERGIZE	Mon 10/24/11	Mon 10/24/11				
5TH FLOOR RISER	Wed 9/7/11	Wed 10/26/11				
CRITICAL RISER	Wed 9/7/11	Tue 1/17/12				
GROUNDING SYSTEM						
LIFE SAFETY RISER	Wed 9/7/11	Thu 10/27/11				
PENTHOUSE RISER	Wed 9/7/11	Tue 11/1/11				
MECHANICAL RISERS	Fri 6/3/11	Mon 10/10/11				
DOMESTIC WATER SYSTEM	Tue 7/5/11	Fri 9/16/11				
SANITARY/STORM WATER SYSTEMS	Fri 6/3/11	Thu 9/22/11				
HOT WATER SYSTEM	Tue 7/5/11	Tue 9/20/11				
CHILLED WATER SYSTEM	Tue 7/5/11	Fri 9/23/11				
STEAM RISERS	Tue 7/5/11	Thu 9/22/11				
DUCT RISERS	Thu 6/30/11	Tue 10/4/11				
MED GAS RISERS	Tue 7/12/11	Mon 10/10/11				
CONTROLS	Fri 10/21/11	Thu 11/3/11				
INTERIOR FITOUTS	Mon 4/18/11	Thu 11/3/11				
BASEMENT	Mon 4/18/11	Thu 11/3/11				
ETB	Mon 4/18/11	Thu 11/3/11				
ELECTRICAL SYSTEMS	Fri 5/13/11	Mon 10/31/11				
MECHANICAL SYSTEMS	Mon 4/18/11	Wed 10/26/11				
DOMIESTIC WATER SYSTEM	Fri 5/13/11	Mon 8/1/11				
SANITARY/STORM SYSTEM	Mon 4/18/11	Wed 5/18/11				
HOT WATER HEATING	Fri 7/1/11	Wed 10/26/11				
STEAM SYSTEM	Wed 5/18/11	Mon 8/15/11				
HVAC SYSTEM	Fri 5/13/11	Wed 7/27/11				
MED GAS SYSTEM	Mon 6/20/11	Mon 8/22/11				
PROJECT CLOSEOUT	Tue 1/17/12	Thu 6/21/12				
COMMISSIONING	Tue 1/17/12	Fri 6/8/12				
HVAC EQUIPMENT	Tue 1/17/12	Mon 3/19/12				
ELECTRICAL SERVICE	Wed 3/14/12	Tue 4/24/12				
MEDICAL GAS SYSTEMS	Mon 4/9/12	Fri 5/4/12				

Project: INOVA FAIRFAX HOSTPITA Date: Thu 10/27/11	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only			
	Summary		Inactive Task		Duration-only		Finish-only			

Task Name	Start	Finish	October 1	September 1	August 1	July 1
CHANGE FILTERS	Tue 4/17/12	Mon 4/23/12				
PLUMBING SYSTEMS	Mon 5/7/12	Fri 6/8/12				
SYSTEMS ACCEPTANCE	Fri 6/8/12	Fri 6/8/12				
FINAL INSPECTION	Tue 5/15/12	Thu 6/21/12				
FINAL MECHANICAL INSPECTION	Wed 4/4/12	Wed 4/4/12				
ELEVATOR FINALS	Thu 4/19/12	Wed 5/9/12				
LOW VOLTAGE FINALS	Wed 4/25/12	Tue 5/15/12				
ELECTRICAL FINAL	Wed 4/25/12	Tue 5/15/12				
FINAL PLUMBING INSPECTION	Mon 5/7/12	Tue 5/22/12				
FIRE ALARM FINALS	Mon 5/21/12	Fri 6/15/12				
BUILDING FINAL	Mon 5/28/12	Fri 6/15/12				
SITE FINAL	Tue 6/5/12	Mon 6/18/12				
NON-RUP ISSUED BY COUNTY	Thu 6/21/12	Thu 6/21/12				

Project: INOVA FAIRFAX HOSTPITA Date: Thu 10/27/11	Task		Project Summary		Inactive Milestone		Manual Summary Rollup		Deadline	
	Split		External Tasks		Inactive Summary		Manual Summary		Progress	
	Milestone		External Milestone		Manual Task		Start-only			
	Summary		Inactive Task		Duration-only		Finish-only			