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Salisbury, MD
10/5/06



TECHNICAL ASSIGNMENT 1

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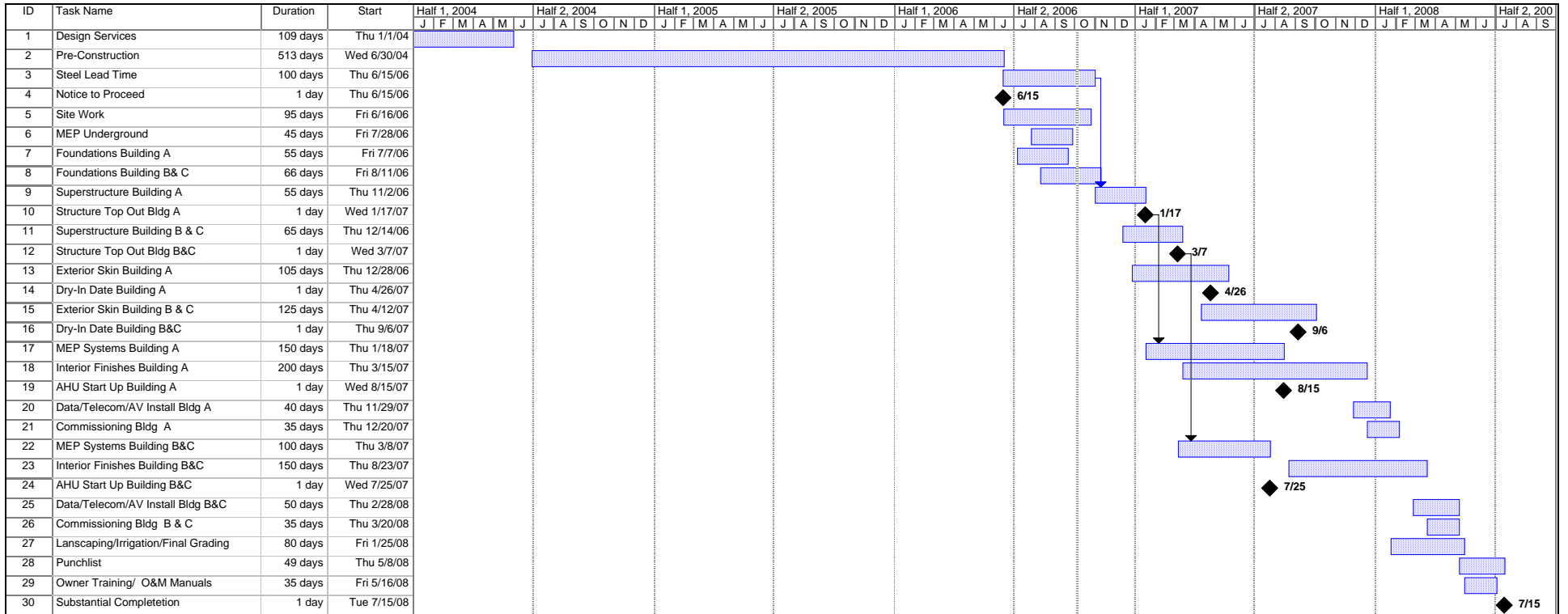
Existing Conditions

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Project Schedule Summary- *See Schedule Next Page (11)*

Schedule Notes - Key Elements to Sequences

- **Foundations**
 - **Drill and Place Concrete for Piles**
 - **Placement of Reinforcing Steel and Formwork for Pile Caps, Piers, Grade Beams to Follow**
 - **4" of Granular Base, Reinforcing Steel, and Formwork Prepped for SOG**
- **Structure**
 - **Structural Steel Columns, Beams, and Roof Trusses**
 - **Metal Floor and Roof Decking**
 - **Installation of Elevated Concrete Composite Slabs**
- **Finishes**
 - **Drywall**
 - **Paint**
 - **Acoustical and Hardboard Ceilings**
 - **Flooring**
 - **Millwork and Casework**



Project: Salisbury
Date: Wed 10/4/06

Task
Split



Progress
Milestone



Summary
Project Summary



External Tasks
External Milestone



Deadline



Building Systems Summary

Yes	No	Work Scope	Description of Systems/Issues
X		Demolition Required?	<ul style="list-style-type: none"> • Project Site is located on an existing parking lot • Removal of underground utilities required: Storm/Sanitary Sewer, Electrical Underground, Infiltration Trench • Removal of asphalt, concrete sidewalks/curbs, light poles & bases • Iron Fencing with Brick Posts to be removed for construction
X		Structural Steel Frame	<ul style="list-style-type: none"> • Typical steel braced frame with bolted and welded connections • 30' Typical Bay Sizes and Spans for floor framing. • The following column ranges are used: W10x49 to W10x88, W12x58 to W12x96, and W14x74 to W14x109. W8x31's, HSS4's, and HSS6's and, HSS8's are also used. HSS shapes used to support Cooling Towers • Composite metal deck and concrete elevated slabs supported by wide flange beams. Typical floor beam size is a W 21x44 & W 24 x 62 • Steel W8x28 typical roof truss members for Hip style roof. Various "W" shapes used for flat roof framing • Two mobile cranes used to set steel
X		Cast-In-Place Concrete	<ul style="list-style-type: none"> • Deep Foundations: Auger Cast Piles to an average depth of -20' below grade. 4000 PSI Concrete • Pile Caps, Ranging from 36"-46", with 24"x24", 30"x30", and 24"x30" Piers to support steel columns/base plates. Pile caps & Piers formed using ply-wood built forms. 4000 PSI Concrete

			<ul style="list-style-type: none"> • 6'x6' & 8'x8' Spreading Footings, 3'-8" deep to support HSS Columns for Cooling Towers • 5" thick 3500 PSI SOG with 6x6 W2.1 x W2.1 reinforcing on a 4" thick granular sub base. • Grade Beams ranging from 12" to 42" in width and 24" to 36" in depth using 4000 PSI Concrete • 3", 3500 PSI lightweight concrete on metal decking with shear studs & reinforcing steel
X		Masonry/Pre-Cast Concrete	<p>Masonry</p> <ul style="list-style-type: none"> • Standard Modular Brick (3^{5/8} Inch) • 8" Cold formed metal stud back up with 1/2" exterior sheeting board, Air barrier, and rigid board insulation • Brick ties with screws attached to metal studs at 16" O.C. Vertical and Horizontal • Steps in grade beams / footings for brick to rest • Brick installation beginning in December 2006 will require enclosed scaffolding <p>Pre-Cast</p> <ul style="list-style-type: none"> • Panels at roof soffits around the perimeter • Panels to accentuate separation of floors around the perimeter • Panels set using mortar and welded steel anchors during masonry construction. Rest on 6"x"6 x (5/16)" angles • Architectural Pre-Cast Columns at curved corner and at porch in the courtyard area. • Materials hoisted via mobile cranes or material lifts
X		Mechanical System	<ul style="list-style-type: none"> • (8) Attic Area AHU's ranging from 3,000 to 34,000 CFM depending on space served.

			<ul style="list-style-type: none"> • AHU's 1,4, & 5 are responsible for general service to buildings C, B, & A respectively • AHU's 2,3,6,& 8 service specific classroom, video studio, & computer lab areas • (2) 350 Ton Chillers with (1) 467 GPM pump each. (2) 350 Ton Capacity Cooling Towers. Located in ground floor chiller room and service yard • (2) 3000 MBH Boilers with (1) 113 GPM pump each. Located in ground floor boiler room.
X		Electrical System	<ul style="list-style-type: none"> • 4000 amp, 480/277V, 3 Phase Main Feed Consisting of 11 sets of (4) #5 KCMIL • Emergency Generator Located in Ground Floor Service Yard: 3000 KVA, 480Y/277V, 3 Phase, 4 Wire. Fueled by 5,000 gallon exterior buried Fuel Oil Tank with (2) 3 GPM Fuel Oil Pumps • Majority of Lighting powered by 277 with some powered by 120 • 24 Building transformers handling between 9 and 112.5 KVA
X		Conveyance	<ul style="list-style-type: none"> • 3 Hydraulic Elevators in separate locations throughout the building • 1 Hospital/Service Type Elevator and 2 Passenger Type elevators. • Hospital Type: Maximum rated load of 5000 lbs and a rated speed of 100 fpm. Services 4 floors including the Attic floor housing the AHU's • Passenger Type: Maximum rated load of 4000 lbs and a rated speed of 100 fpm. Services 3 floors • 5 Stairwells
	X	Support of Excavation	No Deep Excavation Necessary
	X	Curtain Wall	No Curtain Wall

Project Cost Evaluation

Actual Costs

Below in *Table 1*, the Construction Cost, Total Construction Cost (Including Site work), and Building Systems Cost can be found in both total costs and cost per square foot.

Table 1

	Total Cost	Cost per SF (165,000)
Construction Cost	\$45,060,520	\$273.09
Total Construction Cost	\$47,222,372	\$286.20
Building Systems Cost		
<u>Mechanical</u> (HVAC, Plumbing, Fire Protection)	\$11,000,322	\$66.67
<u>Electrical</u> (Including Telecommunications)	\$ 4, 718,350	\$ 28.59
<u>Structural</u>		
• Concrete	\$2,019,110	
• Steel	\$ 5,316,274	
• Total Structure	\$7,335,384	\$44.46
<u>Masonry & Pre-cast</u>	\$4,012,837	\$24.32

D4 Parametric Estimate

Limitations in the types and sizes of projects available in the D4 Cost 2002 Estimating Software restricted the accuracy to which an estimate for The Teachers Education and Technology Center (TETC) could be completed. The TETC combines laboratories, classrooms, lecture rooms, and technology spaces making it difficult to find a similar model. D4 provided a very limited number of buildings with similar square footage and building type that could be used for comparison.

The Daniels College of Business was used as a reference because the square footage of 168,766 is very close to the square footage of 165,000 for the TETC. However, the TETC building has a much more extensive electrical system, mechanical system, and finishes package. The TETC contains many lab spaces not found in The Daniels College of Business. The use of structural steel for the TETC compared to concrete also causes a significant increase.

The cost per square foot for The Daniels College of Business of \$92.86 was almost one third the cost per square foot of the TETC at \$273.09. The D4 model and the actual construction cost showed the following differences in cost for mechanical system, electrical system, finishes, masonry, and structural steel: *See Table 2 & 3 on the following page.*

Table 2

System	D4	Actual Cost	Difference
Mechanical	\$2 million	\$11 million	\$8.9 million
Electrical	\$3.1 million	\$4.7 million	\$1.6 million
Structural	\$0.35 million	\$5.3 million	\$4.9 million
Finishes	\$1.6 million	\$7.7 million	\$6.1 million
Masonry	\$1.6 million	\$4 million	\$3.75 million
Total	\$8.65 million	\$32.7 million	\$24 million

Table 3

	% of Building	SF Cost	Total Cost
General Requirements	7.98	\$7.41	\$1,222,106
Concrete	16.59	\$15.41	\$2,541,981
Masonry	10.21	\$9.48	\$1,564,296
Metals	2.30	\$2.13	\$351,967
Woods & Plastics	5.65	\$5.24	\$865,251
Thermal/Moisture Protection	4.64	\$4.31	\$710,777
Doors & Windows	4.40	\$4.09	\$674,603
Finishes	10.13	\$9.40	\$1,551,586
Specialties	1.39	\$1.29	\$213,135
Equipment	1.05	\$0.97	\$160,340

Furnishings	0.46	\$0.43	\$70,393
Conveying Systems	1.66	\$1.54	\$254,198
Mechanical	13.13	\$12.19	\$2,012,076
Electrical	20.42	\$18.96	\$3,128,592
Total Building Costs	100.00	\$92.86	\$15,321,303
Project Cost	\$15,321,303	Projected Year	2006
Project Name	The Daniels College of Business	Project Month	June
Number of Floors	5	Projected Location	Salisbury, MD
Bid Date	8/1/1997	Use	Education
Project Size	168,766 SF		

R.S. Means Square Foot Estimate

According to R.S. Means 2006 Building Cost Data, a College Building used for Science, Engineering, or Laboratories with a typical size of 45,600 Square Feet should cost approximately \$247/SF. When applying the appropriate size modifier for the 165,000 square foot TETC a cost of \$222.30/SF was obtained. This cost is most likely less than the Actual Building Cost per square foot due to the unique combination of spaces in the TETC. R.S. Means 2006 has College Buildings for Classroom as well those used for Science, Engineering, and Laboratories. The mixture of types of spaces and the overall building size probably increase the actual building cost.