



## **Technical Assignment 2:**

### **Cost and Methods Analysis**

# **Capital One Lecture Hall Addition**





## Executive Summary

This technical assignment examines a few of the many management tasks required in every construction project. Even before construction begins, it is very important to have a grasp on cost and work methods to better prepare you for the responsibilities to come. Some of these duties include project schedules, site layout planning, and estimating.

For the Capital One Lecture Hall, we begin with a look into the current project schedule and projected dates of future work. Construction began on 03-May-05 and is to progress up until project closeout on 23-Aug-06. After breaking down the project into five smaller work packages, we find that the base building and interior construction consume pretty much the entire schedule. Base building work began on 03-May-05 and is to conclude 11-Apr-06, while the interior work began on 23-Aug-05 and will finish around 03-Aug-06.

In order to meet all of the project deadlines and efficiently complete tasks at hand, creating a site layout plan is necessary. For the Lecture Hall project, proper coordination of deliveries and construction of the superstructure was imperative. In between 20-Jun-05 and 30-Nov-05, the entire steel and concrete structure was to be complete. For the most part, all work began on the east side of the site and progressed clockwise, finishing on the front west façade.

After creating a mechanical assemblies estimate and a detailed structural estimate, although more time consuming, detailed estimates are more accurate to realistic figures. The generalized systems chosen for the assemblies estimate did not seem to be very precise. The mechanical system was estimated to be around \$1,111,000, while the subcontractor's price was \$1,500,000. The structural system estimate was more accurate with both the steel and concrete. Compared to Southland's concrete bid of \$1,122,817, the detailed was \$1,111,832. For the steel numbers, an estimate of \$509,000 was received, compared to Lynchburg's \$890,000. As given to the owner's representative, the calculated general conditions estimate from DAVIS Construction was around \$820,000.



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## Appendix

**A - Detailed Steel Estimate**

**B - Detailed Concrete Estimate**

**C - Detailed General Conditions Estimate**

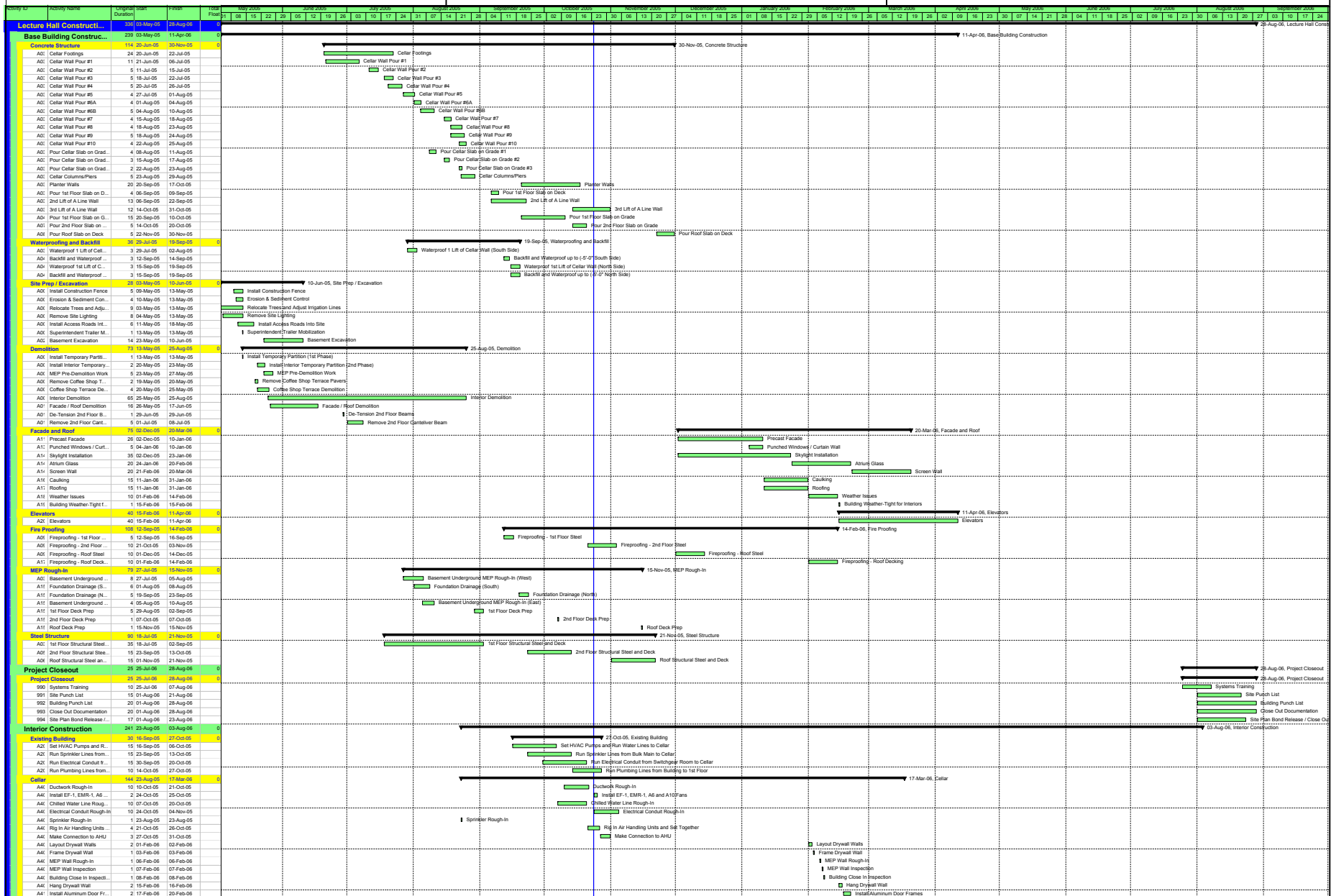


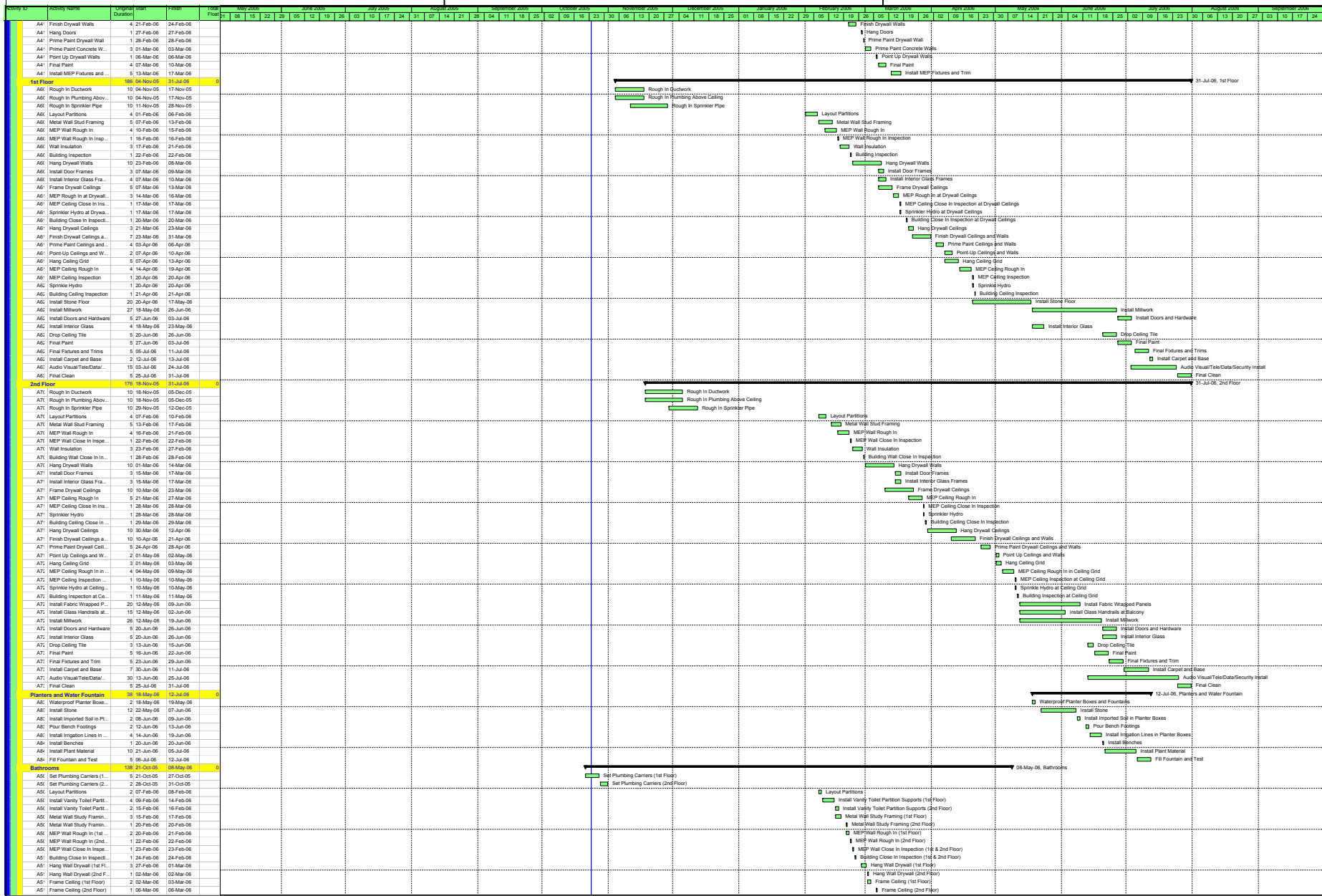
## Detailed Project Schedule

The detailed project schedule to follow contains around 220 activities, each separated into its own respective portion of work. The construction phase of the Capital One Lecture Hall began on 03-May-05 and is projected to continue until 23-Aug-06. Seeing as though the proposed facility is only around 20,400 ft<sup>2</sup> and there is not an abundance of repetitive spaces, dividing the subcontracted work into short intervals would not be appropriate.

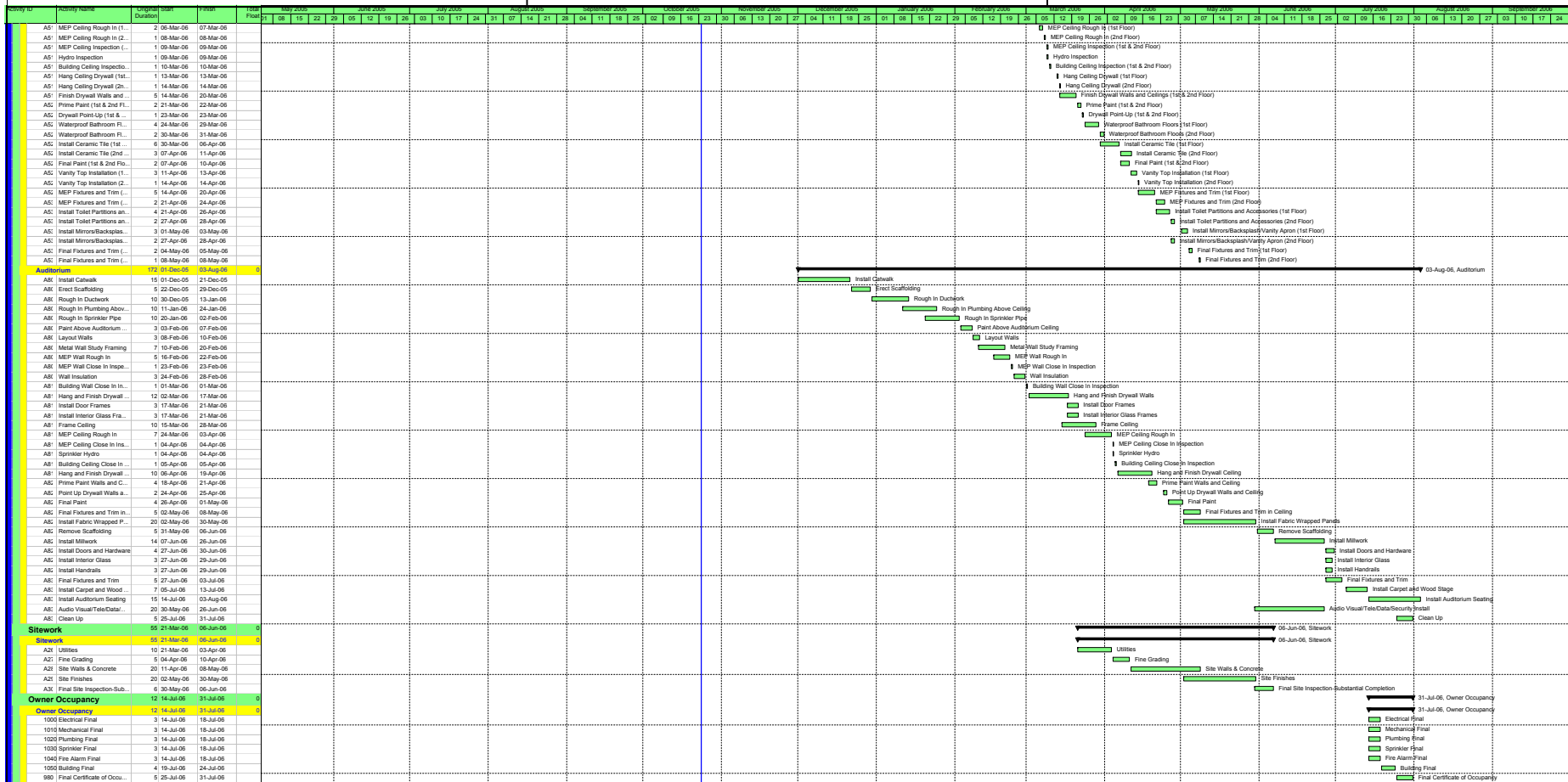
The breakdown in this schedule presented to Capital One and Jones Lang LaSalle consists of three major activities. These include base building construction from 5/3/05-4/11/06, site work from 3/21/06-6/6/06, interior construction from 8/23/05-8/3/06, owner occupancy between 7/14/06-7/31/06, and project closeout from 7/25/06-8/23/06. Since base building and interior construction are very large portions of this project, each of these activities is further broke down into smaller subdivisions.

Base building construction is separated into site preparation, demolition, concrete structure, waterproofing and backfill, steel structure, fire proofing, MEP rough-in, façade and roof, and elevators. Interiors are broken down into existing building, cellar, bathrooms, auditorium, 1<sup>st</sup> floor, 2<sup>nd</sup> floor, and planters and water fountain. Although not in chronological order, it is easier to track the work in each of these larger, non-repetitive spaces.





Actual Work    
  Critical Remaining Work    
  Summary  
 Remaining Work    
 ◆ Milestone



  Actual Work    
   Critical Remaining Work    
 ▶▶ Summary  
  Remaining Work    
 ◆ Milestone





## Site Layout Plan - Superstructure

The planning for site layout can be one of the most important aspects of any construction project. The plans to follow will depict how the Capital One Lecture Hall site was and is to be configured throughout the course of superstructure construction. For the most part, there is only one major access route to the site from Scott's Crossing to the north. This access road is wide enough for two-way travel. Once delivery and concrete trucks arrive on the site, they have the option of going into the staging area to drop off materials, or turn around and back up to an appropriate location.

Site layout plan #1 of 4 displays the pouring of the basement slab-on-grade and exterior walls. The multiple wall pours can be viewed in the *Concrete Structure* section included with the detailed project schedule previously shown. The work for this phase of the project occurred between 20-Jun-05 and 17-Aug-05. Initially, a crane and bucket (1.5 cy) was used to pour the basement's exterior walls. Starting at the west side of the building and continuing clockwise to the east, 7 of the 10 wall pours were completed. Once this was done, a concrete pump was brought to the site to pour the slab-on grade and placed in the same manner as the crane for the walls.

Site layout plan #2 of 4 shows the remaining basement slab-on-grade work and the 1<sup>st</sup> floor steel being erected. This work was performed between 18-Aug-05 and 29-Aug-05. As shown in the first plan, the concrete pump was completing its work on the east while a larger mobile crane for began to erect on the west.



Figure 1. Crane on auditorium nose pulling formwork

Once the 1<sup>st</sup> floor steel was erected, the slab-on-deck and walls could be poured. Beginning around 6-Sep-05, the concrete pump circled back around to the west portion of the building to pour the slab and continued clockwise like previously discussed. Following suite was the crane and bucket to complete the exterior walls along the west end. This work was completed fairly quickly because a smaller portion of the skin on the remaining levels is cast-in-place. A majority of the skin is pre-cast panels that have no structural bearing on the building. Once the walls on the 1<sup>st</sup> floor





were poured and curing, a larger crane began to erect the 2<sup>nd</sup> floor steel. At this point in construction, the subcontractors were still able to utilize the soils below the nose of the auditorium to stage the crane. The work for this stage of construction wrapped up around 13-Oct-05.

Figure 2. Steel crane setting up while concrete pulling forms



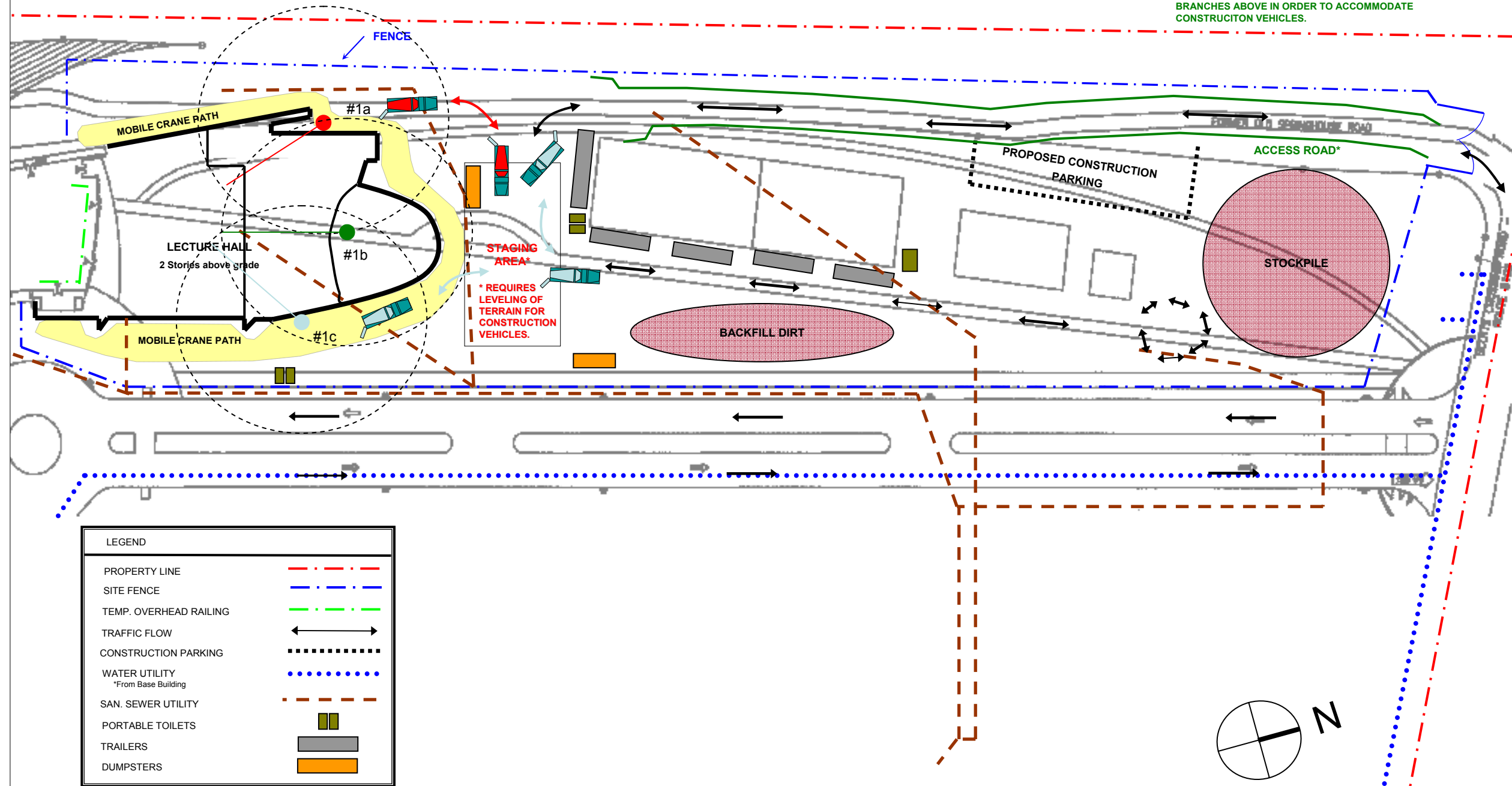
The final site layout plan shows the 2<sup>nd</sup> floor slab-on-deck and roof steel being performed. As described in the previous layout plan, a concrete pump came through and completed its work before the crane and bucket finished the exterior walls along the east side. The only difference in this stage of construction was the need for the steel crane to be located outside the nose of the auditorium to complete the steel in that

area. Once the roof steel is completed around 21-Nov-05, topping out will be pretty much complete.

Please view the plans to follow in order to get a better idea of the site's spatial constraints and requirements.

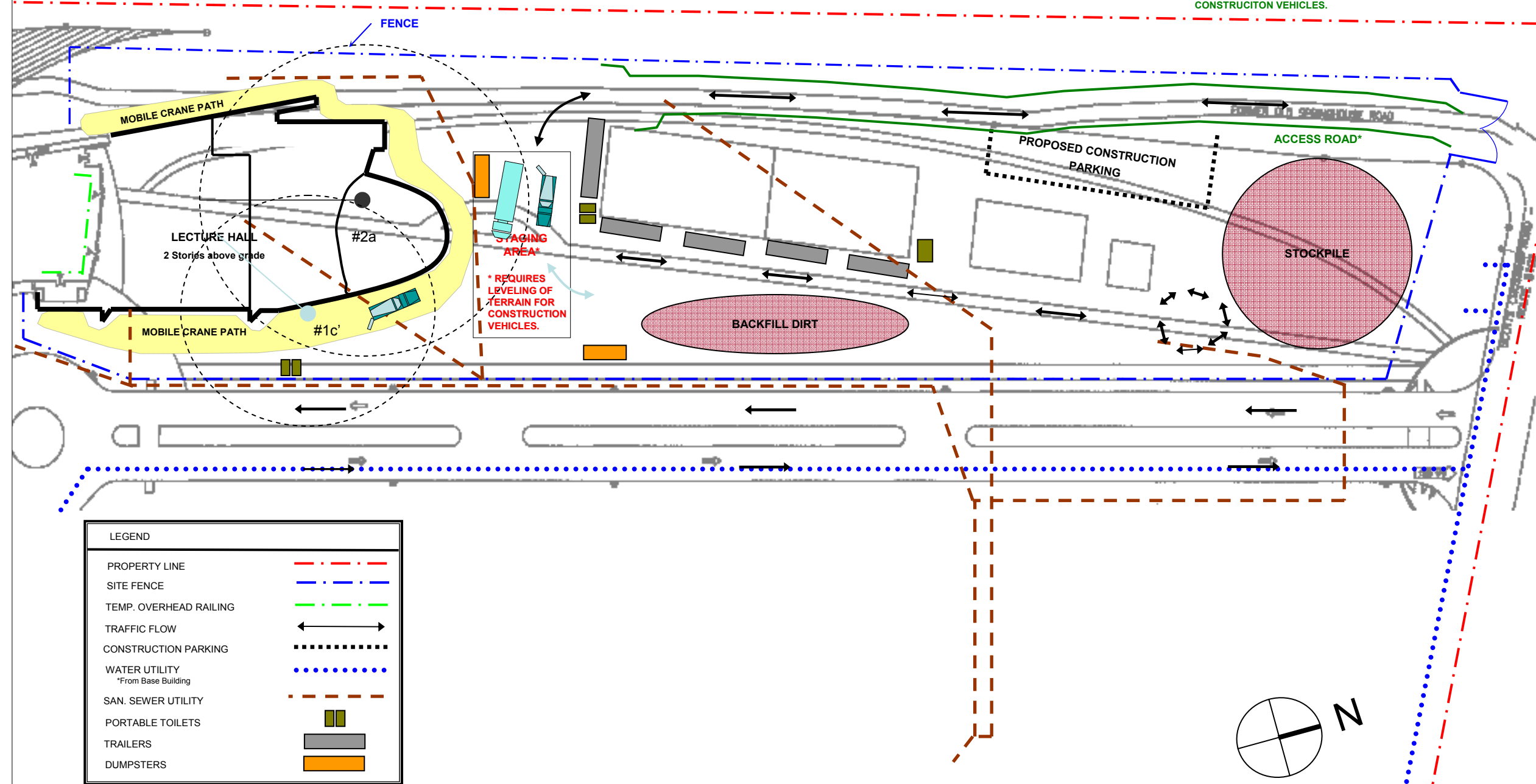


\* ACCESS ROAD TO BE WIDENED. REQUIRES MINOR GRADING AND TRIMMING OF TREE BRANCHES ABOVE IN ORDER TO ACCOMMODATE CONSTRUCTION VEHICLES.





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**SITE LAYOUT PLANNING**

Basement Slab on Grade and 1<sup>st</sup> Floor Steel (18-Aug-05 to 29-Aug-05)

Scale: NTS

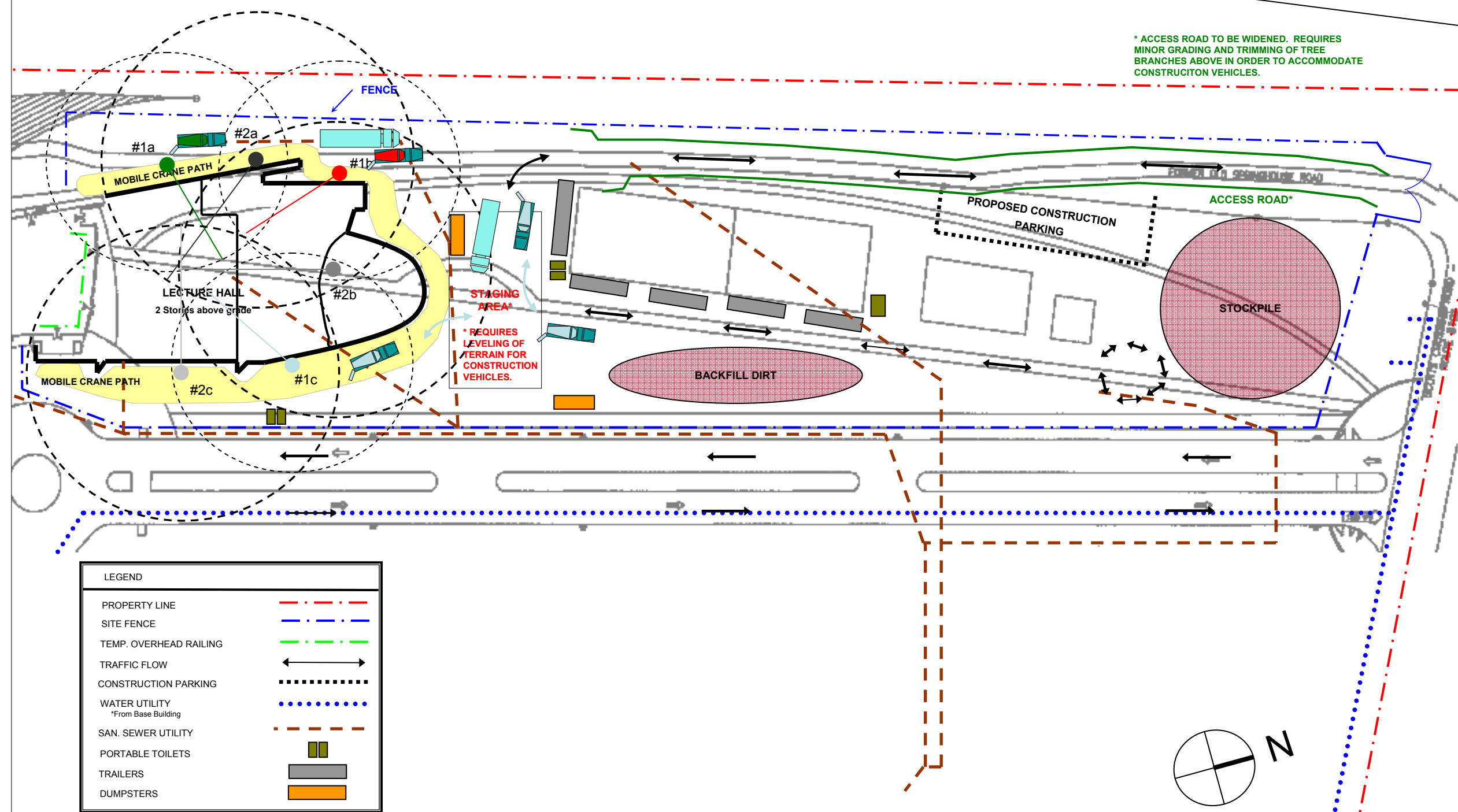
Prepared by  
**Sean C. Ehlers**  
Construction Management

Date  
**October 31, 2005**

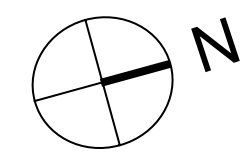
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\* ACCESS ROAD TO BE WIDENED. REQUIRES MINOR GRADING AND TRIMMING OF TREE BRANCHES ABOVE IN ORDER TO ACCOMMODATE CONSTRUCTION VEHICLES.

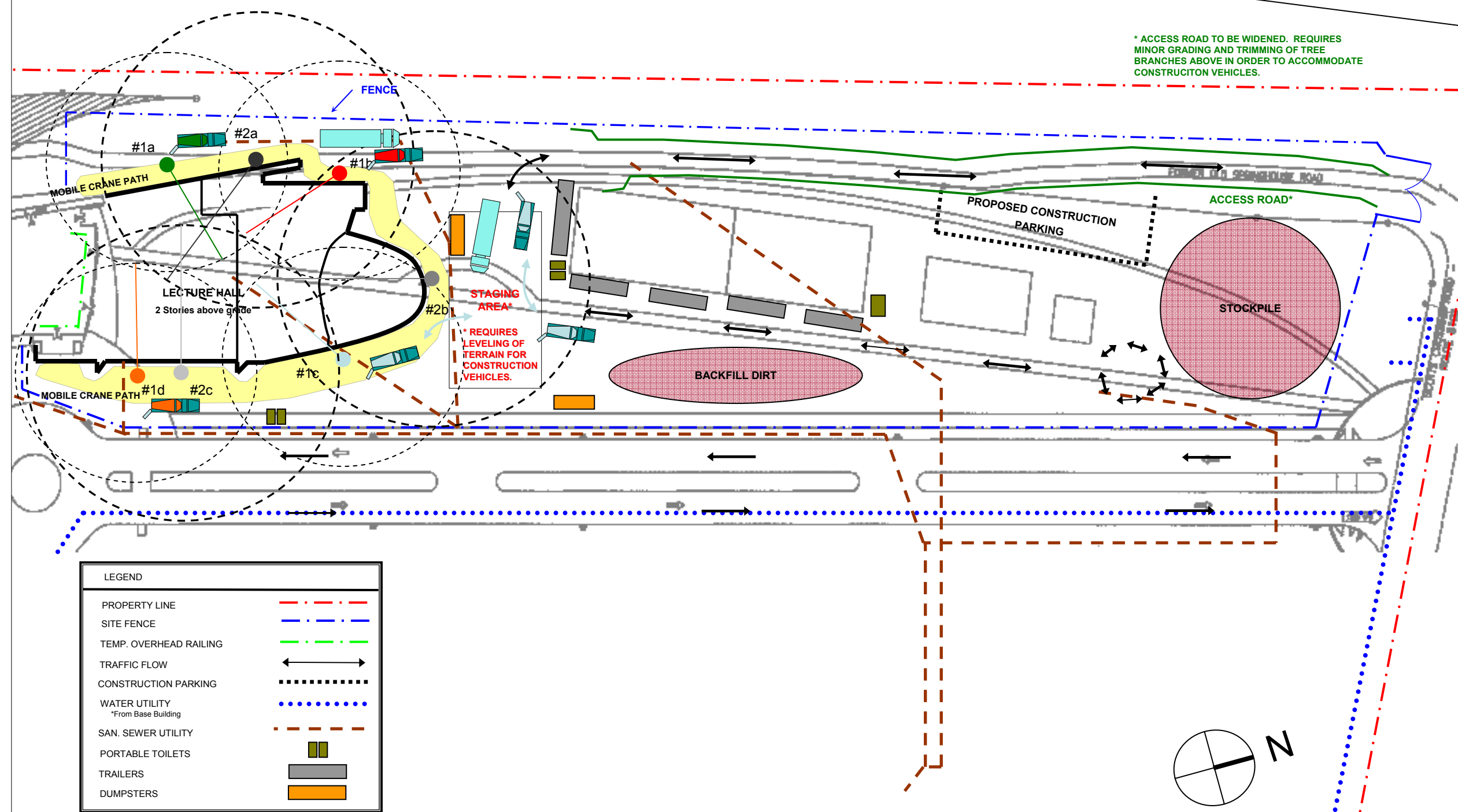


LEGEND	
PROPERTY LINE	— · — · — ·
SITE FENCE	- · - · - ·
TEMP. OVERHEAD RAILING	- · - · - ·
TRAFFIC FLOW	↔
CONSTRUCTION PARKING	- · - · - ·
WATER UTILITY *From Base Building	· · · · ·
SAN. SEWER UTILITY	- · - · - ·
PORTABLE TOILETS	■ ■
TRAILERS	■ ■ ■ ■
DUMPSTERS	■ ■

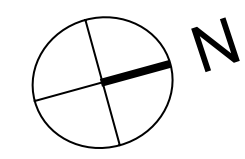




\* ACCESS ROAD TO BE WIDENED. REQUIRES MINOR GRADING AND TRIMMING OF TREE BRANCHES ABOVE IN ORDER TO ACCOMMODATE CONSTRUCTION VEHICLES.



LEGEND	
PROPERTY LINE	--- (Red dashed)
SITE FENCE	--- (Blue dashed)
TEMP. OVERHEAD RAILING	--- (Green dashed)
TRAFFIC FLOW	↔ (Black arrow)
CONSTRUCTION PARKING	--- (Black dotted)
WATER UTILITY *From Base Building	... (Blue dotted)
SAN. SEWER UTILITY	--- (Orange dashed)
PORTABLE TOILETS	■ (Green square)
TRAILERS	■ (Grey rectangle)
DUMPSTERS	■ (Orange rectangle)







## Assemblies Estimate – HVAC System

To begin any assemblies estimate, calculate the square and linear footage. For Capital One’s lecture hall, we are able to utilize a 20,400 SF and 450 LF building space. The largest cost to this system was the estimated three 12.66 ton, chilled water air handling units and two 1,088 MBH gas fueled, cast iron boilers. With an estimated cost of \$11.80/SF and \$5.80/SF respectively, the five main pieces of equipment were calculated to be \$958,800. Looking through RS Means Assemblies book, one would be able to find a few numbers dealing with sprinkler systems, piping, and plumbing fixtures. Although relatively less expensive than the air handling units and boilers, these pieces of the mechanical system definitely contribute to the overall cost. The additional cost to the sprinkler system was considered because of the highly occupied, open spaces within the auditorium and garden atrium. The total assemblies estimate for the Lecture Hall’s mechanical system was \$1,138,186, compared to W.E. Bower’s price of \$1,530,581.

Looking at the subcontractor’s price breakdown, you can see that other additional materials such as insulation and ductwork are not included within any section in ‘RS Means Assemblies Cost Data.’ These exclusions are only a few of many materials that can be the cause of such a difference between the estimated and actual costs.

**Table 1. Mechanical Assemblies Estimate**

Description	Qty	Material (\$)	Installation (\$)	Total (\$)	SF	LF	Total Cost
4,000 SF, 12.66 Ton AHU	3	5.70	6.10	11.80	20,400	-	\$722,160.00
1,088MBH, Gas cast iron boiler	2	2.43	3.37	5.80	20,400	-	\$236,640.00
Wet pipe sprinkler, 5,000SF	1	1.03	1.65	2.68	20,400	-	\$54,672.00
+additional floor 5,000SF extra	1	1.49	2.89	4.38	20,400	-	\$89,352.00
Copper piping, 2-1/2" diameter	1	10.95	12.30	23.25	-	450.00	\$10,462.50
Roof Drains, PVC 6" diameter	2	300.00	104.00	404.00	-	-	\$808.00
Roof Drains, PVC 4" diameter	9	220.00	104.00	324.00	-	-	\$2,916.00
Roof Drains, PVC 3" diameter	2	200.00	104.00	304.00	-	-	\$608.00
Water closets, wall hung, one piece	16	442.82	585.15	1,027.97	-	-	\$16,447.52
Urinals, wall hung	4	445.00	585.00	1,030.00	-	-	\$4,120.00
						Mech Total	<b>\$1,138,186.02</b>



## Detailed Structural Estimate

The three tables to follow are a summary of calculations performed to complete a detailed structural estimate of the Capital One Lecture Hall. As provided by DAVIS Construction, the cost of general structural steel was around \$2,000/ton and \$3,500/ton for the trusses. All labor costs accompanying the steel were received from RS Means 2005. Considering the catwalk in the auditorium, which is included in the steel package and does not influence the structural system, this estimate is fairly accurate to the bid (\$890,127) provided to DAVIS from Lynchburg Steel. Also not included within this estimate are base plates, which are only a small portion of the lump sum contract. To receive a more realistic estimate for the steel work, a square foot estimate for 18 gauge metal decking and rental costs for a mobile crane have been included.

Extrapolated from a concrete change order, the price per CY of concrete is provided in the second table. Although not specifically called out, the small costs for the wood formwork have been factored into the concrete material costs. Hourly wages were obtained directly from Southland Concrete, which seemed to more accurately affect the overall estimate for concrete work. An additional price per pound of rebar and price per 100 SF of WWF has been included in the concrete estimate. Compared to Southland's concrete bid of \$1,122,817, the total estimate calculated below is \$1,111,832.

**Table 2. Structural Steel Estimate**

Structural Steel	Cum Weight (lbs)	Cum Tonnage	Material Cost	Labor Cost	Total Cost
Basement Steel	6820.5	3.41	\$6,820.50	\$2,569.80	\$9,390
1st Floor Steel	66966	33.48	\$66,966.20	\$11,348.49	\$78,315
2nd Floor Steel	120551	60.28	\$120,551.30	\$13,111.91	\$133,663
Roof Steel	145002	72.50	\$145,002.40	\$14,047.87	\$159,050
Trusses	71544.03	35.77	\$125,202.05	\$3,747.51	\$128,950
*Metal Decking (18ga)	38000 ft <sup>2</sup>	N/A	\$148,580.00	\$24,700.00	\$173,280
* Mobile Crane	N/A	N/A	\$5,250/wk	14 wks	\$73,500
<b>Steel Total</b>					<b>\$509,368</b>

**Table 3. Structural Concrete Estimate**

Structural Concrete	Cum Volume (ft <sup>3</sup> )	CY	Material (\$/CY)	Material Cost
Basement Walls	11255.70	416.88	225	\$93,798
1st Floor Walls	4317.30	159.90	225	\$35,978





2nd Floor Walls	3018.60	111.80	225	\$25,155
Basement SOG	3119.99	115.56	175	\$20,222
1st Floor SOG	2907.32	107.68	175	\$18,844
1st Floor Comp Slab	3119.99	115.56	175	\$20,222
2nd Flr Comp Slab	2927.34	108.42	175	\$18,974
Auditorium SOG/CS	2818.92	104.40	175	\$18,271
Footings	4672.81	173.07	185	\$32,017
Piers	420.4	15.57	185	\$2,881
* Rebar	148000 lbs	N/A	\$ 0.70/lb	\$103,600
* 6x6 W2.0xW2.0 WWF	380 CSF	N/A	\$9.40/CSF	\$3,572
Tot Mat Cost				<b>\$393,532</b>

**Table 4. Concrete Labor Estimate**

Personnel/Equipment	Qty	Wage (\$/hr)	Hours/Wk	Cost/Wk	Weeks	Labor Cost
Superintendent	1	75	40	\$3,000.00	22	\$66,000
Carpenter Foreman	1	44	40	\$1,760.00	22	\$38,720
Carpenter	2	38	40	\$3,040.00	22	\$66,880
Engineer	1	42	40	\$1,680.00	22	\$36,960
Rodman	3	44	40	\$5,280.00	22	\$116,160
Operator	1	40	40	\$1,600.00	22	\$35,200
Finish Foreman	1	44	40	\$1,760.00	22	\$38,720
Finisher	2	38	40	\$3,040.00	22	\$66,880
Labor Foreman	1	44	40	\$1,760.00	22	\$38,720
Laborer	4	28	40	\$4,480.00	22	\$98,560
Mobile Crane	1	N/A	N/A	\$5,250.00	22	\$115,500
Tot Labor Cost						<b>\$718,300</b>

## General Conditions Estimate

As provided by DAVIS Construction, the general conditions price submitted to Capital One and Jones Lang LaSalle can be seen below. In addition to the normal management, temporary facilities, and permitting costs in general conditions, a breakdown of safety and health costs has also been included. Due to numerous calculations and the manipulation of data, the estimated general conditions cost presented below is \$821,677, compared to the actually \$826,927. To get a better understanding of the source of these numbers, please see *Appendix C – Detailed General Conditions Estimate*.



**Table 5. General Conditions Summary Estimate**

Item #	Description	Job Cost
1.	Management and Supervision	\$464,542
2.	Jobsite Office Costs	\$55,227
3.	Temporary Utilities	\$28,984
4.	Temporary Signage	\$1,575
5.	Insurance	Fringes
6.	Printing Shop Drawings Reproduction	\$15,750
7.	Small Tools, Equipment, and Supplies	\$18,895
8.	Schedules and Reports	GC Fee
9.	Local Travel	\$47,672
10.	Courier / Delivery Service	\$29,033
11.	Progress Photos	\$3,780
12.	Project Management Software	-
13.	Survey and Layout	\$24,546
14.	Access, Staging, and Parking	Job Cost
15.	Fencing and Security	Job Cost
16.	Safety	\$13,802
17.	Drinking Water	\$2,522
18.	Sanitary Facilities	\$29,932
19.	Trash Removal	\$10,393
20.	Street Cleaning	Job Cost
21.	Daily Clean-Up	\$14,220
22.	Final Clean-Up	Job Cost
23.	As-Built Drawings	\$1,575
24.	Permits	\$998
25.	Miscellaneous	\$58,231
<b>General Conditions Total</b>		<b>\$821,677</b>

## Appendix A.2 - Basement Steel Estimate

Quantity	Type	Lb/ft	Length (ft)	Weight (lbs)	Total Weight	Labor (\$/LF)	Labor (\$)	Total Labor
3	W 10X49	49	15	735	2205	2.44	36.6	\$109.80
2	HSS 6X6X5/16	23.3	15	349.5	699	25	375	\$750.00
2	HSS 8X8X3/8	37.6	15	564	1128	27	405	\$810.00
1	HSS 12X12X1/2	75.9	15	1138.5	1138.5	30	450	\$450.00
1	HSS 16X12X5/8	110	15	1650	1650	30	450	\$450.00
Cum Weight					6820.5	Labor Cost		\$2,569.80
Cum Tonnage					3.41	Material Cost		\$6,820.50
						Total Cost		<b>\$9,390.30</b>

## Appendix A.2 - 1st Floor Steel Estimate

	Quantity	Type	Lb/ft	Length (ft)	Weight (lbs)	Total Weight	Labor (\$/LF)	Labor (\$)	Total Labor	
Beams	1	W 12X14	14	4	56	56	1.53	6.12	6.12	
	4	W 12X14	14	5	70	280	1.53	7.65	30.60	
	1	W 12X14	14	8	112	112	1.53	12.24	12.24	
	11	W 12X14	14	10	140	1540	1.53	15.30	168.30	
	2	W 12X14	14	16	224	448	1.53	24.48	48.96	
	2	W 12X19	19	22	418	836	1.53	33.66	67.32	
	1	W 14X22	22	4	88	88	1.30	5.20	5.20	
	2	W 16X31	31	24	744	1488	1.49	35.76	71.52	
	1	W 16X31	31	25	775	775	1.49	37.25	37.25	
	3	W 16X31	31	26	806	2418	1.49	38.74	116.22	
	1	W18X35	35	25	875	875	2.10	52.50	52.50	
	1	W 18X35	35	27	945	945	2.10	56.70	56.70	
	1	W 18X35	35	28	980	980	2.10	58.80	58.80	
	1	W 18X40	40	22	880	880	2.10	46.20	46.20	
	1	W 18X40	40	27	1080	1080	2.10	56.70	56.70	
	1	W 18X46	46	23	1058	1058	2.10	48.30	48.30	
	1	W 21X44	44	28	1232	1232	1.89	52.92	52.92	
	1	W 21X44	44	31	1364	1364	1.89	58.59	58.59	
	1	W 21X44	44	34	1496	1496	1.89	64.26	64.26	
	2	W 21X50	50	34	1700	3400	1.89	64.26	128.52	
	1	W 24X55	55	32	1760	1760	1.81	57.92	57.92	
	2	W 24X55	55	33	1815	3630	1.81	59.73	119.46	
	2	W 24X68	68	37	2516	5032	1.81	66.97	133.94	
	1	HSS 12X4X1/2	48.7	10	487	487	30.00	300.00	300.00	
	1	HSS 12X4X1/2	48.7	16	779.2	779.2	30.00	480.00	480.00	
	Girders	1	W 12X14	14	5	70	70	1.53	7.65	7.65
		1	W 12X14	14	13	182	182	1.53	19.89	19.89
		1	W 16X31	31	17	527	527	1.49	25.33	25.33
		1	W 16X31	31	20	620	620	1.49	29.80	29.80
		1	W 18X35	35	12	420	420	2.10	25.20	25.20
		3	W 18X35	35	18	630	1890	2.10	37.80	113.40
		1	W 21X44	44	24	1056	1056	1.89	45.36	45.36
		1	W 24X55	55	24	1320	1320	1.81	43.44	43.44
	Columns	2	HSS 4X4X1/4	12.2	15	183	366	23.00	345.00	690.00
		2	HSS 8X8X3/8	37.6	15	564	1128	27.00	405.00	810.00
3		HSS 8X8X3/8	37.6	15	564	1692	27.00	405.00	1215.00	
1		HSS 12X12X1/2	75.9	15	1138.5	1138.5	30.00	450.00	450.00	
2		HSS 12X12X5/8	93.1	15	1396.5	2793	30.00	450.00	900.00	
5		HSS 16X12X5/8	110	15	1650	8250	30.00	450.00	2250.00	
5		HSS 18X1/2	93.5	15	1402.5	7012.5	30.00	450.00	2250.00	
4		W 10X49	49	15	735	2940	2.44	36.60	146.40	
2		W 14X99	99	15	1485	2970	1.82	27.30	54.60	
Cum Weight						66966	Labor Cost		\$11,348.49	
Cum Tonnage						33.48	Material Cost		\$66,966.20	
							Total Cost		<b>\$78,314.69</b>	

## Appendix A.3 - 2nd Floor Steel Estimate

	Quantity	Type	Lb/ft	Length (ft)	Weight (lbs)	Total Weight	Labor (\$/LF)	Labor (\$)	Total Labor	
Beams	14	W 10X12	12	11	132	1848	2.24	24.64	344.96	
	2	W 10X54	54	14	756	1512	2.44	34.16	68.32	
	2	W 12X14	14	2	28	56	1.53	3.06	6.12	
	4	W 12X14	14	7	98	392	1.53	10.71	42.84	
	4	W 12X14	14	8	112	448	1.53	12.24	48.96	
	9	W 12X14	14	13	182	1638	1.53	19.89	179.01	
	2	W 12X16	16	11	176	352	1.53	16.83	33.66	
	3	W 12X19	19	21	399	1197	1.53	32.13	96.39	
	1	W 12X22	22	20	440	440	1.53	30.60	30.60	
	1	W 12X50	50	22	1100	1100	1.79	39.38	39.38	
	1	W 12X50	50	30	1500	1500	1.79	53.70	53.70	
	1	W 12X50	50	35	1750	1750	1.79	62.65	62.65	
	5	W 14X22	22	15	330	1650	1.30	19.50	97.50	
	4	W 14X22	22	20	440	1760	1.30	26.00	104.00	
	1	W 14X22	22	22	484	484	1.30	28.60	28.60	
	3	W 16X26	26	24	624	1872	1.34	32.16	96.48	
	1	W 16X26	26	32	832	832	1.34	42.88	42.88	
	1	W 16X31	31	23	713	713	1.49	34.27	34.27	
	4	W 18X10	10	5	50	200	1.50	7.50	30.00	
	1	W 18X35	35	20	700	700	2.10	42.00	42.00	
	1	W 18X35	35	24	840	840	2.10	50.40	50.40	
	1	W18X35	35	26	910	910	2.10	54.60	54.60	
	1	W 18X40	40	22	880	880	2.10	46.20	46.20	
	1	W 18X40	40	26	1040	1040	2.10	54.60	54.60	
	1	W 18X40	40	28	1120	1120	2.10	58.80	58.80	
	1	W 18X46	46	23	1058	1058	2.10	48.30	48.30	
	1	W 18X50	50	24	1200	1200	2.21	53.04	53.04	
	1	W 21X44	44	28	1232	1232	1.89	52.92	52.92	
	2	W 24x55	55	10	550	1100	1.81	18.10	36.20	
	1	W 24X55	55	28	1540	1540	1.81	50.68	50.68	
	3	W 24X55	55	32	1760	5280	1.81	57.92	173.76	
	2	W 24X76	76	48	3648	7296	1.97	94.56	189.12	
	1	W 27X84	84	48	4032	4032	1.69	81.12	81.12	
	1	HSS 12X4X1/2	48.7	9	438.3	438.3	30.00	270.00	270.00	
	1	HSS 12X4X1/2	48.7	16	779.2	779.2	30.00	480.00	480.00	
	2	L 4X4X5/16	8.16	2	16.32	32.64	7.00	14.00	28.00	
	1	L 4X4X5/16	8.16	26	212.16	212.16	20.00	520.00	520.00	
	Girders	2	W 12X14	14	7	98	196	1.53	10.71	21.42
		4	W 12X14	14	13	182	728	1.53	19.89	79.56
		1	W 12X60	16	10	160	160	1.82	18.20	18.20
		2	W 14X22	22	12	264	528	1.30	15.60	31.20
		1	W 14X22	22	20	440	440	1.30	26.00	26.00
		1	W 16X26	26	16	416	416	1.34	21.44	21.44
		1	W 16X26	26	23	598	598	1.34	30.82	30.82
		2	W 16X31	31	18	558	1116	1.49	26.82	53.64
1		W 16X31	31	22	682	682	1.49	32.78	32.78	
1		W 18X40	40	27	1080	1080	2.10	56.70	56.70	
1		W 18X40	40	36	1440	1440	2.10	75.60	75.60	
1		W 21X44	44	28	1232	1232	1.89	52.92	52.92	
2		W 21X50	50	15	750	1500	1.89	28.35	56.70	
3		W 24X55	55	25	1375	4125	1.81	45.25	135.75	
1		W 24X62	62	25	1550	1550	1.81	45.25	45.25	
2		W 24X68	68	33	2244	4488	1.81	59.73	119.46	
1		W 27X84	84	20	1680	1680	1.69	33.80	33.80	
2		W 27X84	84	35	2940	5880	1.69	59.15	118.30	
1		W 27X84	84	42	3528	3528	1.69	70.98	70.98	
2		W 27X102	102	34	3468	6936	1.71	58.14	116.28	
Columns		5	HSS 8X8X3/8	37.6	15	564	2820	27.00	405.00	2025.00
		1	HSS 12X12X1/2	75.9	15	1138.5	1138.5	30.00	450.00	450.00
		2	HSS 12X12X5/8	93.1	15	1396.5	2793	30.00	450.00	900.00
		5	HSS 16X12X5/8	110	15	1650	8250	30.00	450.00	2250.00
		5	HSS 18X1/2	93.5	15	1402.5	7012.5	30.00	450.00	2250.00
		4	W 10X49	49	15	735	2940	2.44	36.60	146.40
		2	W 14X99	99	15	1485	2970	1.82	27.30	54.60
		1	W 18X50	50	15	750	750	2.21	33.15	33.15
		1	W 30X90	90	46	4140	4140	1.65	75.90	75.90
		Cum Weight						120551	Labor Cost	
Cum Tonnage						60.28	Material Cost		\$120,551.30	
							Total Cost		<b>\$133,663.21</b>	

## Appendix A.4 - Roof Steel Estimate

	Quantity	Type	Lb/ft	Length (ft)	Weight (lbs)	Total Weight	Labor (\$/LF)	Labor (\$)	Total Labor
Truss #1	1	W 16X18	18	90	1620	1620.0	1.30	117.00	117.00
	1	W 14X74	74	90	6660	6660.0	1.77	159.30	159.30
	6	HSS 5X5X1/2	28.3	7.07	200.081	1200.5	1.50	10.61	63.63
	12	HSS 4X4X1/4	12.2	7.07	86.254	1035.0	1.50	10.61	127.26
	11	HSS 4X4X1/4	12.2	5	61	671.0	1.50	7.50	82.50
Truss #2	6	HSS 5X5X1/2	28.3	5	141.5	849.0	1.50	7.50	45.00
	2	W 10X30	30	50	1500	3000.0	2.24	112.00	224.00
	10	HSS 4X4X1/4	12.2	7.07	86.254	862.5	1.50	10.61	106.05
Truss #3	9	HSS 4X4X1/4	12.2	5	61	549.0	1.50	7.50	67.50
	1	W 14X90	90	85	7650	7650.0	1.82	154.70	154.70
Truss #3	1	W 14X82	82	85	6970	6970.0	1.80	153.00	153.00
	6	HSS 5X5X1/2	28.3	7.07	200.081	1200.5	1.50	10.61	63.63
	4	HSS 4X4X1/2	21.5	7.07	152.005	608.0	1.50	10.61	42.42
	7	HSS 4X4X1/4	12.2	7.07	86.254	603.8	1.50	10.61	74.24
	6	HSS 4X4X1/4	12.2	5	61	366.0	1.50	7.50	45.00
	4	HSS 4X4X1/2	21.5	5	107.5	430.0	1.50	7.50	30.00
	6	HSS 5X5X1/2	28.3	5	141.5	849.0	1.50	7.50	45.00
Truss #4	1	W 14X99	99	75	7425	7425.0	1.84	138.00	138.00
	1	W 14X90	90	75	6750	6750.0	1.82	136.50	136.50
	6	HSS 5X5X1/2	28.3	7.07	200.081	1200.5	1.50	10.61	63.63
	4	HSS 4X4X1/2	21.5	7.07	152.005	608.0	1.50	10.61	42.42
	5	HSS 4X4X1/4	12.2	7.07	86.254	431.3	1.50	10.61	53.03
	8	HSS 4X4X1/4	12.2	5	61	488.0	1.50	7.50	60.00
Truss #5	6	HSS 5X5X1/2	28.3	5	141.5	849.0	1.50	7.50	45.00
	1	W 10X60	60	60	3600	3600.0	1.53	91.80	91.80
	1	W 10X54	54	60	3240	3240.0	1.53	91.80	91.80
	4	HSS 5X5X1/2	28.3	7.07	200.081	800.3	1.50	10.61	42.42
	2	HSS 4X4X1/2	21.5	7.07	152.005	304.0	1.50	10.61	21.21
	6	HSS 4X4X1/4	12.2	7.07	86.254	517.5	1.50	10.61	63.63
	4	HSS 5X5X1/2	28.3	5	141.5	566.0	1.50	7.50	30.00
Truss #6 & #7	7	HSS 4X4X1/4	12.2	5	61	427.0	1.50	7.50	52.50
	2	W 8X21	21	75	1575	3150.0	2.24	168.00	336.00
	2	W 8X21	21	65	1365	2730.0	2.24	145.60	291.20
	30	HSS 3X3X1/4	8.78	7.07	62.0746	1862.2	1.50	10.61	318.15
	28	HSS 3X3X1/4	8.78	5	43.9	1229.2	1.50	7.50	210.00
	8	HSS 3X3X5/16	6.04	5	30.2	241.6	1.50	7.50	60.00
Cum Weight						71544.0	Labor Cost		\$3,747.51
Cum Tonnage						35.8	Material Cost		\$125,202.05
							Total Cost		<b>\$128,949.56</b>

## Appendix A.5 - Steel Truss Estimate

	Quantity	Type	Lb/ft	Length (ft)	Weight (lbs)	Total Weight	Labor (\$/LF)	Labor (\$)	Total Labor
Truss #1	1	W 16X18	18	90	1620	1620.0	1.30	117.00	117.00
	1	W 14X74	74	90	6660	6660.0	1.77	159.30	159.30
	6	HSS 5X5X1/2	28.3	7.07	200.081	1200.5	1.50	10.61	63.63
	12	HSS 4X4X1/4	12.2	7.07	86.254	1035.0	1.50	10.61	127.26
	11	HSS 4X4X1/4	12.2	5	61	671.0	1.50	7.50	82.50
Truss #2	6	HSS 5X5X1/2	28.3	5	141.5	849.0	1.50	7.50	45.00
	2	W 10X30	30	50	1500	3000.0	2.24	112.00	224.00
	10	HSS 4X4X1/4	12.2	7.07	86.254	862.5	1.50	10.61	106.05
Truss #3	9	HSS 4X4X1/4	12.2	5	61	549.0	1.50	7.50	67.50
	1	W 14X90	90	85	7650	7650.0	1.82	154.70	154.70
Truss #3	1	W 14X82	82	85	6970	6970.0	1.80	153.00	153.00
	6	HSS 5X5X1/2	28.3	7.07	200.081	1200.5	1.50	10.61	63.63
	4	HSS 4X4X1/2	21.5	7.07	152.005	608.0	1.50	10.61	42.42
	7	HSS 4X4X1/4	12.2	7.07	86.254	603.8	1.50	10.61	74.24
	6	HSS 4X4X1/4	12.2	5	61	366.0	1.50	7.50	45.00
	4	HSS 4X4X1/2	21.5	5	107.5	430.0	1.50	7.50	30.00
	6	HSS 5X5X1/2	28.3	5	141.5	849.0	1.50	7.50	45.00
Truss #4	1	W 14X99	99	75	7425	7425.0	1.84	138.00	138.00
	1	W 14X90	90	75	6750	6750.0	1.82	136.50	136.50
	6	HSS 5X5X1/2	28.3	7.07	200.081	1200.5	1.50	10.61	63.63
	4	HSS 4X4X1/2	21.5	7.07	152.005	608.0	1.50	10.61	42.42
	5	HSS 4X4X1/4	12.2	7.07	86.254	431.3	1.50	10.61	53.03
	8	HSS 4X4X1/4	12.2	5	61	488.0	1.50	7.50	60.00
Truss #5	6	HSS 5X5X1/2	28.3	5	141.5	849.0	1.50	7.50	45.00
	1	W 10X60	60	60	3600	3600.0	1.53	91.80	91.80
	1	W 10X54	54	60	3240	3240.0	1.53	91.80	91.80
	4	HSS 5X5X1/2	28.3	7.07	200.081	800.3	1.50	10.61	42.42
	2	HSS 4X4X1/2	21.5	7.07	152.005	304.0	1.50	10.61	21.21
	6	HSS 4X4X1/4	12.2	7.07	86.254	517.5	1.50	10.61	63.63
	4	HSS 5X5X1/2	28.3	5	141.5	566.0	1.50	7.50	30.00
Truss #6 & #7	7	HSS 4X4X1/4	12.2	5	61	427.0	1.50	7.50	52.50
	2	W 8X21	21	75	1575	3150.0	2.24	168.00	336.00
	2	W 8X21	21	65	1365	2730.0	2.24	145.60	291.20
	30	HSS 3X3X1/4	8.78	7.07	62.0746	1862.2	1.50	10.61	318.15
	28	HSS 3X3X1/4	8.78	5	43.9	1229.2	1.50	7.50	210.00
	8	HSS 3X3X5/16	6.04	5	30.2	241.6	1.50	7.50	60.00
Cum Weight						71544.0	Labor Cost		\$3,747.51
Cum Tonnage						35.8	Material Cost		\$125,202.05
							Total Cost		\$128,949.56



## Appendix B.1 - Structural Concrete Estimate

	Height (ft)	Length (ft)	Width (ft)	Volume (ft <sup>3</sup> )	CY	
Basement	Walls	15	493	1.17	8652.15	320.45
	Curved Wall #1	15	83	1.33	1655.85	61.33
	Curved Wall #2	15	54	1.17	947.70	35.10
1st Floor	Walls	15	246	1.17	4317.30	159.90
2nd Floor	Walls	15	172	1.17	3018.60	111.80
<b>Tot Wall Vol</b>					<b>688.58</b>	

	Length (ft)	Width (ft)	Thickness (ft)	Volume (ft <sup>3</sup> )	CY	
Basement	SOG West	134	27	0.417	1508.71	55.88
	SOG East	84	46	0.417	1611.29	59.68
1st Floor	SOG South	84	83	0.417	2907.32	107.68
	Composite Deck	-	-	0.417	3119.99	115.56
2nd Floor	Composite Deck	78	90	0.417	2927.34	108.42
Auditorium	SOG/Comp Deck	104	65	0.417	2818.92	104.40
<b>Tot Flr Vol</b>					<b>551.61</b>	

	Footings	Qty	Width (ft)	Length (ft)	Depth (ft)	Volume (ft <sup>3</sup> )	CY
Basement	#1	4	5	5	1	100.00	3.70
	#2	1	7	7	1.17	57.33	2.12
	#3	1	9	9	1.5	121.50	4.50
	#4	6	10	10	2	1200.00	44.44
	#5	3	13	13	2.17	1100.19	40.75
	#6	1	5	10	1.33	66.50	2.46
	#7	0	6	6	2	0.00	0.00
	#8	2	4	5	1	40.00	1.48
	#9	1	9	20	2.5	450.00	16.67
	#10	0	3	3	1	0.00	0.00
1st Floor	#1	1	5	5	1	25.00	0.93
	#2	1	7	7	1.17	57.33	2.12
	#3	1	9	9	1.5	121.50	4.50
	#4	3	10	10	2	600.00	22.22
	#5	2	13	13	2.17	733.46	27.17
	#6	0	5	10	1.33	0.00	0.00
	#7	0	6	6	2	0.00	0.00
	#8	0	4	5	1	0.00	0.00
	#9	0	9	20	2.5	0.00	0.00
	#10	0	3	3	1	0.00	0.00
<b>Tot Ftng Vol</b>						<b>173.07</b>	

## Appendix B.1 - Structural Concrete Estimate

	Concrete Piers	Qty	Width (ft)	Length (ft)	Height (ft)	Volume (ft <sup>3</sup> )	CY
<b>Basement</b>	#1	2	1.67	1.67	5	27.89	1.03
	#2	2	2	2	5	40.00	1.48
	#3	2	2.5	2.5	5	62.50	2.31
	#4	1	2	1.33	5	13.30	0.49
	#5	1	2	1.17	5	11.70	0.43
	#6	1	2.5	1.75	5	21.88	0.81
	#7	0	1	1.83	5	0.00	0.00
	#8	3	2.17	3.33	5	108.39	4.01
<b>1st Floor</b>	#1	1	1.67	1.67	5	13.94	0.52
	#2	2	2	2	5	40.00	1.48
	#3	2	2.5	2.5	5	62.50	2.31
	#4	0	2	1.33	5	0.00	0.00
	#5	0	2	1.17	5	0.00	0.00
	#6	0	2.5	1.75	5	0.00	0.00
	#7	2	1	1.83	5	18.30	0.68
	#8	0	2.17	3.33	5	0.00	0.00
<b>Tot Pier Vol</b>							<b>15.57</b>

Personnel	Qty	Wage (\$/hr)	Hours/Wk	Cost/Wk
Superintendent	1	75	40	\$3,000.00
Carpenter Foreman	1	44	40	\$1,760.00
Carpenter	3	38	40	\$4,560.00
Engineer	1	42	40	\$1,680.00
Rodman	3	44	40	\$5,280.00
Operator	2	40	40	\$3,200.00
Finish Foreman	1	44	40	\$1,760.00
Finisher	2	38	40	\$3,040.00
Labor Foreman	1	44	40	\$1,760.00
Laborer	6	28	40	\$6,720.00
<b>Total Cost/Wk</b>				<b>\$32,760.00</b>

## Appendix C.1 - General Conditions Estimate

SUPERVISION & PROJECT MANAGEMENT	Quantity	Unit	Material		Labor		Material Total Cost	Labor Total Cost
			Rate	Cost	Rate	Cost		
Vice President		N/A						
Project Executive		N/A						
Project Manager	52	Wks	N/A		\$1,395	\$72,540	\$0	\$72,540
Assistant Project Manager	52	Wks	N/A		\$1,005	\$52,260	\$0	\$52,260
Senior Superintendent	52	Wks	N/A		\$2,117	\$110,084	\$0	\$110,084
Superintendent	44	Wks	N/A		\$1,313	\$57,772	\$0	\$57,772
MEP Coordinator	5	Wks	N/A		\$1,000	\$5,000	\$0	\$5,000
Senior Layout Engineer	26	Wks	N/A		\$791	\$20,566	\$0	\$20,566
Layout Engineer	26	Wks	N/A		\$450	\$11,700	\$0	\$11,700
<b>Total Supervision &amp; Management</b>						<b>\$329,922</b>	<b>\$0</b>	<b>\$329,922</b>

GENERAL CONDITIONS	Quantity	Unit	Material		Labor		Material Total Cost	Labor Total Cost
			Rate	Cost	Rate	Cost		
<b>Permits &amp; Inspections</b>								
Building/Site Permit		N/A						
Occupancy Permits	1	Lump Sum	\$750	\$750	N/A		\$750	\$0
Trade Specific Permits		N/A						
Testing & Inspection		N/A						
Builder's Risk Insurance		N/A						
Field Office Expense	12	Months	\$500	\$6,000	N/A		\$6,000	\$0
<b>Document Reproduction</b>								
Contract Documents		N/A						
Shop Dwgs/As-Builts/Misc.	1	Lump Sum	\$15,000	\$15,000	N/A		\$15,000	\$0
Local Courier Deliveries	12	Months	\$640	\$7,680	N/A		\$7,680	\$0
Shipping & Overnight Deliveries	12	Months	\$750	\$9,000	N/A		\$9,000	\$0
Photographs	12	Months	300	\$3,600	N/A		\$3,600	\$0
Survey & Wall Check	1	Lump Sum	1500	\$1,500	N/A		\$1,500	\$0
Occupancy Permit	1	Lump Sum	200	\$200	N/A		\$200	\$0
Construction Signs	1	Lump Sum	1500	\$1,500	N/A		\$1,500	\$0
Layout Engineer Supplies	26	Wks	\$100	\$2,600	N/A		\$2,600	\$0
Scheduling Consultant	1	Lump Sum	\$5,000	\$5,000	N/A		\$5,000	\$0
Pre-Construction Survey		N/A						
Pumping & Baling		N/A						
Winter Protection		N/A						
Air & Water Balancing		N/A						
Survey/Layout/Grade Sheets		N/A						
Final Cleaning		N/A						
Permit Expediting		N/A						
Miscellaneous Items	52	Wks	\$125	\$6,500	N/A		\$6,500	\$0
<b>Subtotal</b>				<b>\$59,330</b>			<b>\$59,330</b>	<b>\$0</b>
<b>Sales Tax</b>	5	%		\$2,967			\$2,967	\$0
<b>Total General Conditions</b>				<b>\$62,297</b>			<b>\$62,297</b>	<b>\$0</b>

MISCELLANEOUS LABOR	Quantity	Unit	Material		Labor		Material Total Cost	Labor Total Cost
			Rate	Cost	Rate	Cost		
Misc. Labor	52	Wks	N/A		\$697.85	\$36,288	\$0	\$36,288
Courier	52	Wks	N/A		\$110.90	\$5,767	\$0	\$5,767
Dump Truck - Driver	40	Hrs	N/A		\$114.14	\$4,566	\$0	\$4,566
<b>Total Miscellaneous Labor</b>						<b>\$46,621</b>	<b>\$0</b>	<b>\$46,621</b>

