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Construction Management

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Tech

Main & Gervais
Columbia, South Carolina

October 24, 2008

Dr. Riley

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I. Executive Summary

The objective of this technical assignment is to examine Main & Gervais in terms of construction management details more extensively. Some of the information found in the first technical assignment was improved upon and implemented in this assignment. This report includes a further detailed project schedule, two separate site plans for the foundation and super structure phases, general conditions estimate, detailed structural estimate, and an analysis of the critical issues currently impacting the construction industry.

The project schedule included in this report has been expanded with more line items to get a better understanding of the activities scheduled for Main & Gervais. For construction of the super structure, the parking garage is estimated to take on average, 16 days a floor and for the office levels, 10 days a floor. The curtain wall façade installation is estimated at 50 days a floor. Finally, the schedule allows 13 months of interior construction for the three future tenants and their respective architect's designs.

Two site plans were created to get an idea of the two major phases during construction. Both site plans display the location of material storage/equipment, entrance/exit to the site, fencing, and trees that must remain per the City of Columbia. The excavation site plan indicates where demolition took place and the equipment required for the foundation. The super structure site plan reveals where the tower crane is to be place with its reach indentified as well.

The general conditions estimate performed concluded that it would cost **$4,302,266.24**. This is 10% of the actual contract value cost of **$41,151,000.**

For the detailed estimate of the cast-in-place concrete structural system, the final cost came to **$10,172,474.31.**

The final portion of the report includes a recap of the Annual Pace Roundtable Meeting. With the current economy's conditions and the advancement of technology in the construction industry, it was necessary to discuss how people will take on these new challenges. One particular finding from the meeting that is in relation to Main & Gervais is that speculative offices are not popular buildings to construct during an economic downturn. Main & Gervais is set on a site in a prime location that is in high demand. The site is located in downtown Columbia, South Carolina, next to the State Capital Building so it had no trouble obtaining three tenants to occupy all the office space.

II. Detailed Project Schedule

Key Project Dates

Notice to Proceed	9/15/2007
Substructure Construction Begins	8/18/2008
Excavation Complete	10/10/2008
Superstructure Construction Begins	10/6/2008
Interior Construction Begins	1/5/2009
Curtain Wall Construction Begins	3/31/2009
Superstructure Construction Completion	6/4/2009
Tenant Upfit – Edens & Advant	6/1/2009
Tenant Upfit – NBSC	8/3/2009
Tenant Upfit – McNair	11/16/2009
Final Completion	12/31/2009

Structural Construction

There are three main sections to the building. These include the lobby, the parking garage, and the office portion. Each of these sections has different concrete placement sequences. The lobby requires MEP rough in and storm line installation on the south side before the slab on grade can be placed. The lobby is scheduled for 22 days. The parking garage levels are broken into four separate subsections of formwork, rebar, and concrete placement. Each parking garage level is scheduled to take on average 16 days. There is one exception with the parking garage and that is the first level in which it has three larger subsections and will take 24 days. Lastly, the office space has two separate subsections of formwork, rebar, and placement that will take on average, ten days a level.

Façade Construction

The curtain wall is scheduled to begin on March 31, 2008, and will take approximately 135 days to complete. Installing the vertical and horizontal mullions and inserting the glass will take approximately 50 days for every floor. The level next in line will be able to start as soon as the layout and clips are complete for the concurrent level. This will allow the schedule to shrink down to 135 days for the aluminum glazed curtain wall.

Interior Construction

Shell finishes will begin in January of 2009 and continue until October of the same year. Activities within this section include MEP rough in, drywall, and masonry walls. The interior finishes will begin 6 months later in June 2009 just after the shell construction finishes for level 12 of the office portion. Interior finishes have a long schedule due to the fact that there are three separate tenants moving into the building. The three tenants have their own architect designing the interior portions of the office building. Because of the complexity of all the coordination required, the schedule allows 13 months for interior finishes.

Schedule Notes

When observing the schedule attached to this report, keep in mind the following information. Certain portions of the schedule are repetitive so some of the schedule items are hidden. For example, the concrete pours for each of garage levels closed up except for the first level. This gives the observer a chance to understand the pour sequence but does not overburden the reader with unnecessary detail.

A project schedule with more detail can be found in **Appendix A**.

III. Site Layout Planning

The construction site is rather constrained in terms of space. The site is right at the corner of Main Street and Gervais Street with the National Bank of South Carolina north and Capital Center west of the building. There is an alley way in between the site and the Capital Center Building, but is not available for construction use. The trees on site must remain per the City of Columbia's request. This leaves construction to take place on a very slim site with just the exterior plaza for temporary storage until that is eventually constructed.

Excavation Site Plan

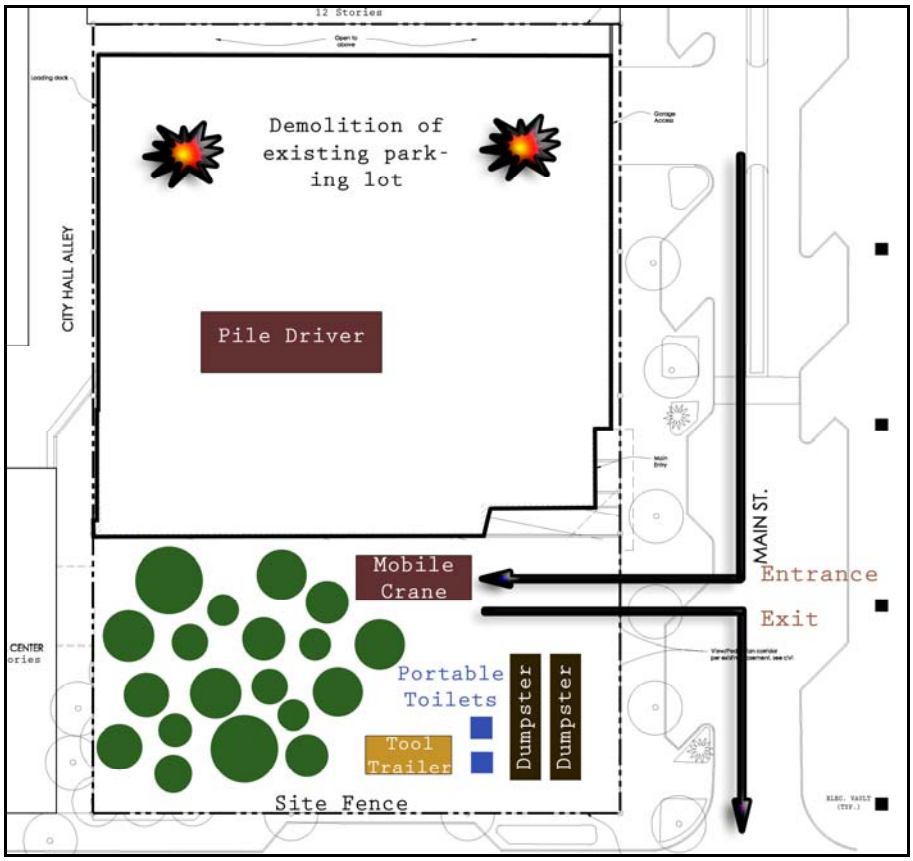


Figure 3.1 – Excavation Site Plan (not original size)

A parking lot remained on the site before Main & Gervais was set to be constructed. Demolition of the parking lot was necessary before any excavation could take place. There was no excavation support necessary since they did not go that deep. After excavating the site, the piles could be driven into the ground to complete the foundation. **Figure 3.1** displays the setup during demolition and excavation. There is not enough space for trailers, therefore the office personnel had to stay in an office nearby and rent out the space. A mobile crane had to be rented for installing the columns on top of the pile caps since the tower crane had not been installed yet. Also, the mobile crane helps when installing the tower crane.

Super Structure Site Plan

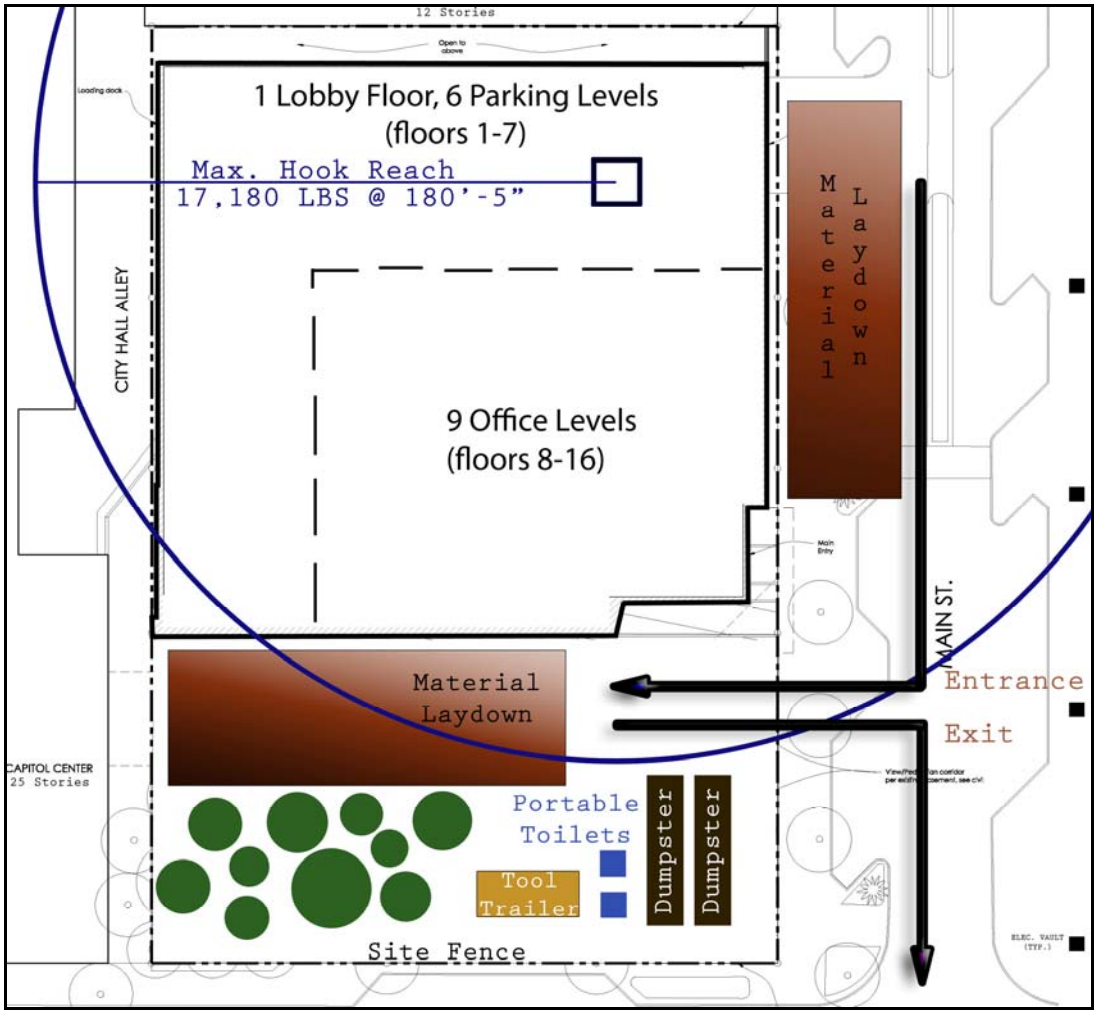


Figure 3.2 – Superstructure Site Plan (not original size)

For the superstructure, a tower crane is necessary considering the building will reach 230 feet in the air with its 16 floors. The tower crane is setup in the northeast portion of the building, where there is just the parking garage, and will remain throughout the duration of construction. The office portion has a smaller footprint than the parking garage; therefore, the office building will not interfere with the tower crane. Since the building is primarily cast-in-place concrete, the tower crane will assist with the bucket for placing the concrete. Also, the crane will assist with the installation of the curtain wall by lifting the panels of glass to the appropriate location so that a crew can tie them into the structure safely. The material lay down area for the building is to be conveniently placed in reach of the tower crane just east of the building where the trucks can pull right up on Main Street. There is more for material storage mixed between the trees just south of the building. In the case of removing waste, the dumpsters are placed near the entrance/exit for easy access for truck drivers.

The original excavation and superstructure site plan can be seen in **Appendix B**.

IV. Detailed Structural Systems Estimate

Structural Estimate Summary				
Description	**Quantity**	**Unit**	**Cost/Unit**	**Total**
03 11 13 Forms In Place	857232	SFCA	$ 4.07	$ 3,484,808.47
03 21 10 Reinforcing In Place	2032	tons	$ 1,192.75	$ 2,423,672.60
03 23 05 Prestressing Tendons	242	tons	$ 2,970.40	$ 718,836.80
03 31 05 Placing Concrete	19317	CY	$ 36.37	$ 702,560.27
03 31 05 Normal Weight Concrete	19317	CY	$ 102.24	$ 1,974,913.10
31 62 13 Concrete Piles	25650	VLF	$ 33.83	$ 867,683.07
Total				**$ 10,172,474.31**

Table 4.1 – Structural Estimate Summary

Table 4.1 outlines the cost for each of the categories in the detailed structural estimate, which can be found in **Appendix D.** The estimate was done utilizing R.S. Means 2008. There were several assumptions made during the estimate and they can be found in the following paragraphs. The final cost for the structural portion of the building came to **$10,172,474.31.** Due to the restrictions preventing the release of cost information about the project, there is no comparison between the estimated and actual cost.

Foundations

For this particular foundation, there were 270 concrete piles with an 18" diameter that reached a depth of 95' into the ground. On average, the pile caps resting on these piles were 11'x11'. The size was obtained by averaging the values shown for each of the pile caps on the drawings. The pile caps were assumed to have #9 top and bottom bars placed in each direction.

Slab on Grade/Elevated Slabs

Each slab was typically 7" thick and had #4 top and bottom reinforcing bars at 12" on center. The elevated slabs were taken off as flat plate slabs in square feet.

Girders/Joists/Beams

These structural items were each common sized to 24"x24" and 30' in length due to the limitations of R.S. Means. The parking garage had a larger quantity considering it has a larger footprint than the office levels so there was a separate average taken for each portion of the building. The post-tensioning was calculated using pricing guidelines outline in the drawings. The girders, joists, and beams were assumed to have 0.30, 0.35, and 0.55 pounds per square foot of overall building area respectively.

Columns

A typical column was assumed to have dimensions of 36"x36" and 12' in height. There was assumed to be 16 #10 bars running vertical to reinforce each of the columns.

Concrete Placement

For the most part, concrete placement was assumed it would be done by bucket with the tower crane. Although with slab on grade, it was assumed the concrete would be pumped into place.

V. General Conditions Estimate

Cost Breakdown			
Category	**Unit (month)**	**Monthly Cost**	**Total Cost**
Equipment	18	$ 34,045.83	$ 612,825.00
Material	18	$ 15,747.86	$ 283,461.42
Labor	18	$ 35,201.76	$ 633,631.62
Project	18	$ 231,029.02	$ 2,772,348.20
Totals		**$ 316,024.46**	**$ 4,302,266.24**

Table 5.1 – Cost Breakdown

The values generated in the general conditions estimate were obtained by utilizing R.S. Means Building Cost Data 2008, pages 10-22. The above table, **Table 5.1**, displays the breakdown of costs for labor, material, equipment, and project items (fee, insurance, etc.) for the project as a whole. The chosen unit is months so that the observer can get an idea of the monthly cash flow for general conditions. It can also be understood what potential costs might be added/subtracted in case the project schedule changes.

The total general conditions estimate of **$4,302,266.24** represents approximately 10% of the total contract value of **$41,151,000.00**. A more detailed breakdown of the general conditions estimate can be found in **Appendix C**.

VI. Critical Industry Issues

Kick-Off and Plenary Address

The roundtable meeting began with a presentation on the current progress the graduate students are making in their respective studies. Learning about what each of the graduate students are studying allowed the industry members to pick up on the upcoming technology in construction. It also allowed the students to understand what technologies are taking hold of the construction industry and thus giving the students a possible avenue to pursue in the technology realm of construction.

Breakout Session I

The first breakout session involved the discussion of a possible mentorship program between students and industry members during the course of a college career. Although the idea sounds appealing at first, following through would be rather difficult. It was found that it would be difficult to establish a contact in the industry and maintain that relationship. Several solutions were proposed including setting up a relationship between a student interested in a specific sector and matching them with a corresponding industry member early on in the college career. This is a step in the right direction, though it will require many adjustments during implementation.

Breakout Session II

The second breakout session included three separate options to choose from including: LEED Evolution, BIM Strategies, and Energy/Economy. The specific session I attended was the Energy/Economy discussion. Due to the excessive consumption of raw materials and the struggling economy America is currently in, there are concerns related to the construction industry that require investigation. One such concern is the rising energy costs that have caught the attention of the construction industry. This has motivated them to reduce the consumption of electricity by increasing design/construction of efficient MEP systems. Another concern to be wary about is the economy's condition. The current situation has limited companies to certain markets such as government work and healthcare projects. This could possibly affect companies if they rely mostly on unstable markets including residential and speculative offices. The building I am researching is a speculative office which falls under one of the categories listed. The developer was still able to occupy the building with three tenants because of the site's prominent location in downtown Columbia, South Carolina, next to the State Capital Building. Lastly, the economy could impact the availability of jobs in the construction market. This will require potential employees to enhance their resumes and be more flexible with job locations.

Industry Panel

In the first panel discussion, the industry members talked about changing roles in the industry. The main idea behind changing roles in the industry was identified as project integration. Collaboration between all parties (CM/A/E/Subs) involved, project delivery with an emphasis in design build, and the implementation of BIM are all crucial in increasing the integration of projects. Eventually, the industry will have to utilize more prefabrication on projects. Another route is potentially going global to expand work opportunities. The latter option is not as practical as raising the amount of prefabrication projects in the industry.

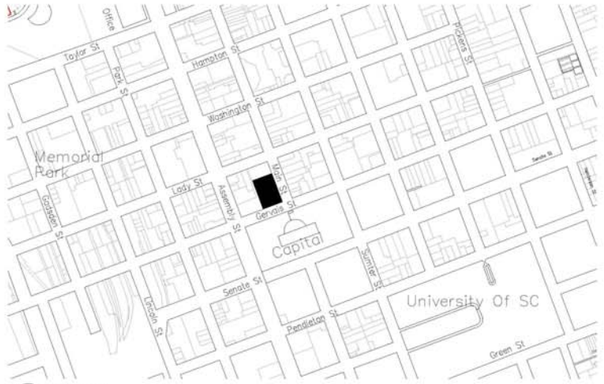
Student Panel

The second panel discussion involved the students talking about balancing work and life. The students discussed their current situations in school with respect to class, athletic team involvement, club affiliations, outside work responsibilities, etc. With these activities in mind, the students explained how they handle their schedules and remain productive. While being a student brings some challenges, I believe having more responsibilities with the consistent long weekly schedule that goes along with work will bring on more difficult challenges. I feel that it is relative to the difficult transition from high school to college. It was a change of pace for most students and everyone had to adapt to their new situations or drop out. In the case for work, everyone has to adapt to his/her new responsibilities or get fired.

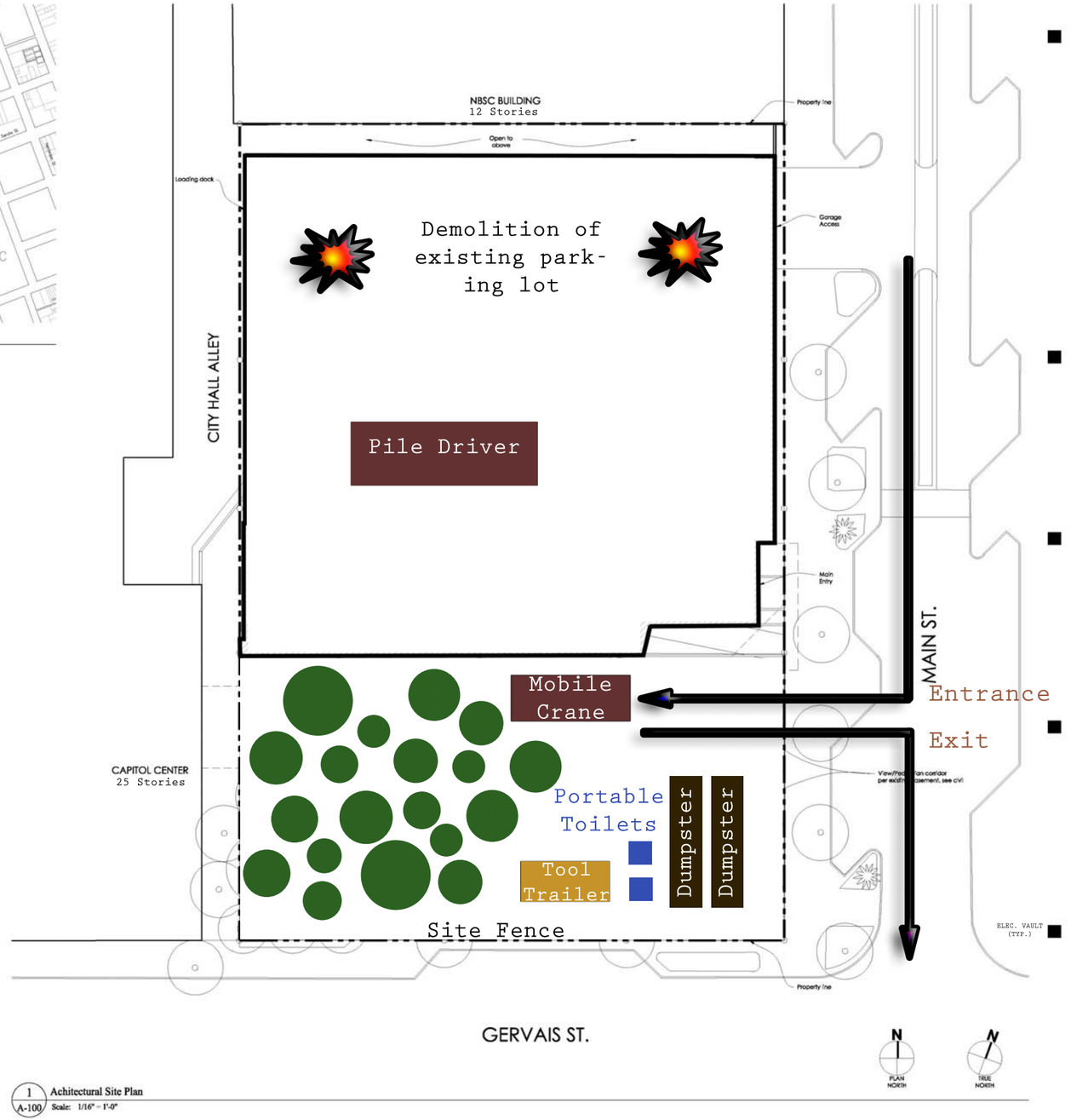
Overall Observations

I felt that the overall idea of exchanging ideas through this type of medium between students and industry members is an excellent method. I noticed that while industry members may have expertise in their particular area they can also be limited to receiving new information. By this I mean the students are able to bring in new ideas related to technology and so forth for the industry members that they would otherwise overlook. The benefit for the students is ability to network with potential employers or future contacts for industry information. The overall objective of the Annual PACE Roundtable Meeting is to bridge the gap between students and industry members and I feel that was achieved greatly.

Appendix A: Detailed Schedule



2 / 100 SITE MAP
Scale: Not to Scale



1 / A-100 Achitectural Site Plan
Scale: 1/16" = 1'-0"

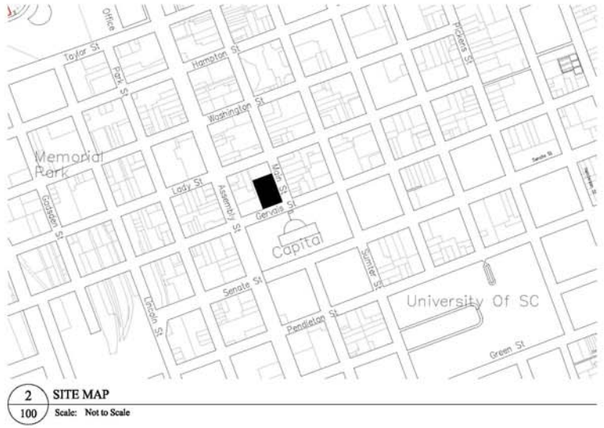
Main & Gervais

MARK	DATE	DESCRIPTION

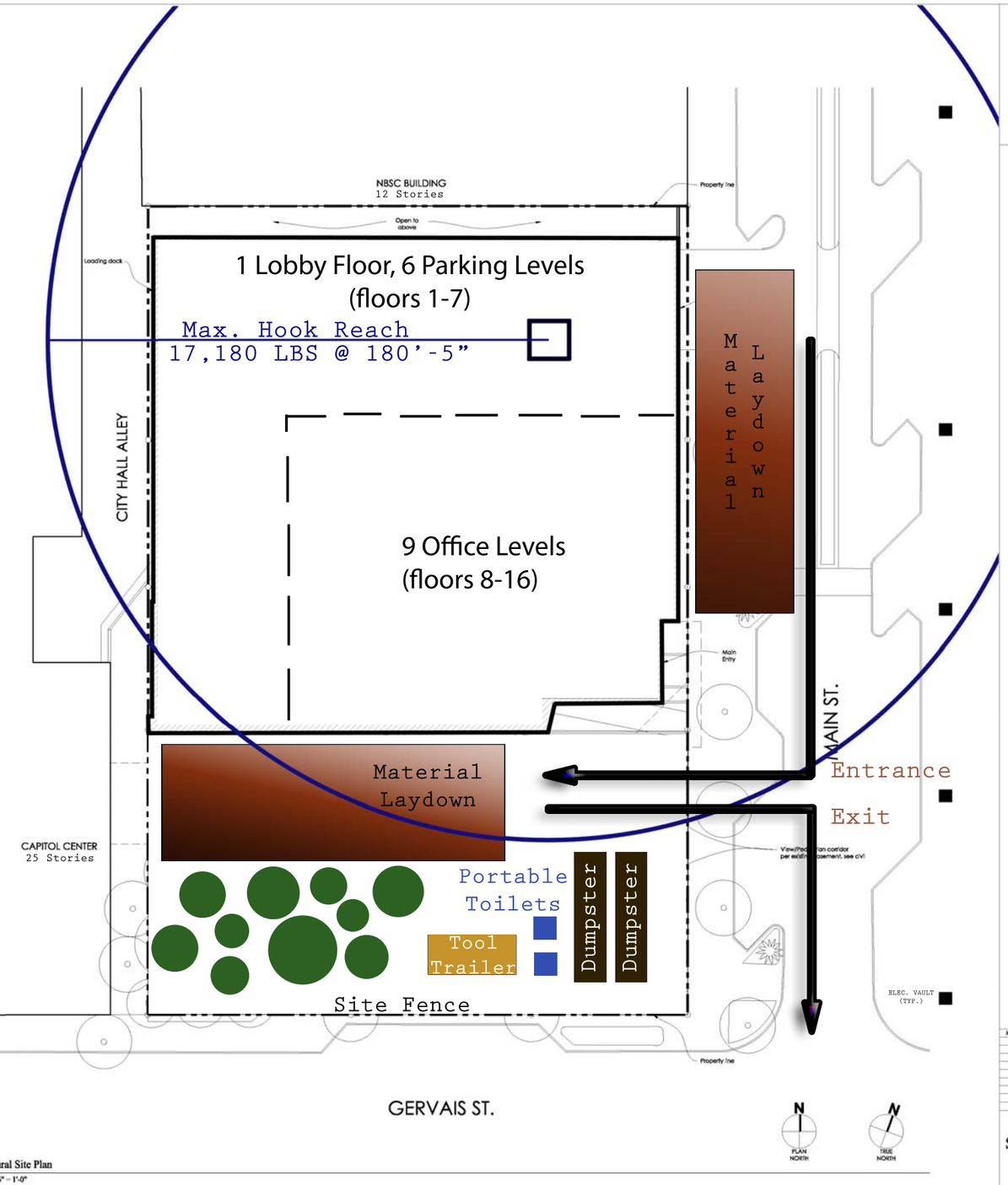
ISSUE DATE:
PROJECT NO:

SITE PLAN
Excava-tion

Adam De Luca
10/22/2008



2 / 100 SITE MAP
Scale: Not to Scale



1 / A-100 Achitectural Site Plan
Scale: 1/16" = 1'-0"

Main & Gervais

MARK	DATE	DESCRIPTION

ISSUE DATE:
PROJECT NO:

SITE PLAN
Super-structure

Adam De Luca
10/22/2008

Appendix C: General Conditions Estimate

Staffing			
Position	**Unit (week)**	**Labor Cost**	**Total Cost**
Project Manager	78	$ 2,100.00	$ 163,800.00
Project Engineer (2)	156	$ 1,005.00	$ 52,260.00
Superintendent	78	$ 1,950.00	$ 101,400.00
Field Engineer (2)	156	$ 1,300.00	$ 67,600.00
Layout Crew	8	$ 4,788.00	$ 38,304.00
Clerk	78	$ 365.00	$ 18,980.00
Total			**$ 442,344.00**

Office Support			
Materials	**Unit (month)**	**Material Cost**	**Total Cost**
Rented Office Space	18	$ 1,565.00	$ 28,170.00
Office Supplies	18	$ 95.00	$ 1,710.00
Telephone	18	$ 210.00	$ 3,780.00
Storage	18	$ 147.00	$ 2,646.00
Office Equipment	18	$ 150.00	$ 2,700.00
Total			**$ 39,006.00**

Material Hoists			
Equipment	**Unit (month)**	**Labor/Equip. Cost**	**Total Cost**
Tower Crane	13	$ 28,800.00	$ 374,400.00
Mobile Crane (100 ton)	3	$ 3,985.00	$ 358,650.00
All-Terrain Forklift	13	$ 3,675.00	$ 47,775.00
Total			**$ 780,825.00**

Temporary Utilities			
Utility	**Time**	**Unit Cost/CSF**	**Total Cost**
Heat (winter months)	5 Months	$ 13.50	$ 54,391.50
Lighting (interior const.)	7 Months	$ 13.33	$ 53,706.57
Power	7 Months	$ 47.00	$ 189,363.00
Total			**$ 297,461.07**

Miscellaneous Items			
Equipment	**Unit**	**Unit Cost**	**Total Cost**
Temporary Fencing	932 LF	$ 3.00	$ 2,796.00
Quality Control Testing	Project	$ 48,182.00	$ 48,182.00
Permits	Project	2.00%	$ 823,020.00
Total			**$ 873,998.00**

Insurance and Fees			
Item	**Unit**	**Unit Cost**	**Total Cost**
Contractors Fee	Project	4.00%	$ 1,646,040.00
All-Risk Insurance	Project	0.62%	$ 255,136.20
Total			**$ 1,901,176.20**

Grand Total	**$ 4,302,266.24**

Appendix D: Detailed Structural Estimate

03 11 13 Forms In Place							
Description	**Quantity**	**Unit**	**Material**	**Labor**	**Equipment**	**Cost/Unit**	**Total**
Pile Caps	7722	SFCA	$ 0.86	$ 3.02		$ 3.88	$ 23,669.47
Joists	124320	SFCA	$ 0.89	$ 4.51		$ 5.40	$ 530,349.12
Beams	137760	SFCA	$ 0.89	$ 4.51		$ 5.40	$ 587,684.16
Girders	114240	SFCA	$ 0.88	$ 5.50		$ 6.38	$ 575,792.45
Columns	69120	SFCA	$ 0.78	$ 4.72		$ 5.50	$ 300,326.40
Slab on Grade	756	LF	$ 0.32	$ 1.93		$ 2.25	$ 1,343.79
Elevated Slabs	403314	SF	$ 1.42	$ 3.18		$ 4.60	$ 1,465,643.08
Total							**$ 3,484,808.47**

03 21 10 Reinforcing In Place							
Description	**Quantity**	**Unit**	**Material**	**Labor**	**Equipment**	**Cost/Unit**	**Total**
Beams & Girders, #8 to #18	1410	tons	$ 980.00	$ 520.00		$ 1,500.00	$ 1,670,850.00
Columns, #8 to #18	198	tons	$ 980.00	$ 600.00		$ 1,580.00	$ 247,143.60
Slab on Grade, #3 to #7	41	tons	$ 940.00	$ 660.00		$ 1,600.00	$ 51,824.00
Elevated Slabs, #4 to #7	383	tons	$ 1,020.00	$ 480.00		$ 1,500.00	$ 453,855.00
Total							**$ 2,423,672.60**

03 23 05 Prestressing Tendons							
Description	**Quantity**	**Unit**	**Material**	**Labor**	**Equipment**	**Cost/Unit**	**Total**
Post-tensioned, 50' span, 300 kip	242	tons	$ 1,820.00	$ 1,860.00	$ 80.00	$ 3,760.00	$ 718,836.80
Total							**$ 718,836.80**

03 31 05 Placing Concrete							
Description	**Quantity**	**Unit**	**Material**	**Labor**	**Equipment**	**Cost/Unit**	**Total**
Pile Caps, pumped	787	CY		$ 12.80	$ 6.40	$ 19.20	$ 11,937.22
Joists, crane & bucket	2302	CY		$ 52.50	$ 26.50	$ 79.00	$ 143,667.82
Beams, "	2551	CY		$ 52.50	$ 26.50	$ 79.00	$ 159,207.91
Girders, "	2116	CY		$ 36.50	$ 18.30	$ 54.80	$ 91,605.87
Columns, "	2296	CY		$ 23.50	$ 11.90	$ 35.40	$ 64,209.94
Slab on Grade, pumped	551	CY		$ 16.00	$ 6.00	$ 22.00	$ 9,576.38
Elevated Slab, crane & bucket	8714	CY		$ 21.50	$ 10.80	$ 32.30	$ 222,355.14
Total							**$ 702,560.27**

03 31 05 Normal Weight Concrete							
Description	**Quantity**	**Unit**	**Material**	**Labor**	**Equipment**	**Cost/Unit**	**Total**
5000 psi	9265	CY	$ 109.00			$ 109.00	$ 797,809.15
6000 psi	6969	CY	$ 124.00			$ 124.00	$ 682,683.24
8000 psi	3083	CY	$ 203.00			$ 203.00	$ 494,420.71
Total							**$ 1,974,913.10**

31 62 13 Concrete Piles							
Description	**Quantity**	**Unit**	**Material**	**Labor**	**Equipment**	**Cost/Unit**	**Total**
Prestressed Concrete Piles, d=18"	25650	V.L.F.	$ 35.00	$ 4.06	$ 3.76	$ 42.82	$ 867,683.07
Total							**$867,683.07**

Grand Total	**$ 10,172,474.31**