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*Main & Gervais*  
*Columbia, South Carolina*

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# I. Executive Summary

This technical assignment takes the opportunity to explain some alternative methods analysis that could be implemented on the office building, Main & Gervais. The first half of the report includes information about what is currently happening with construction on the jobsite. This includes topics on constructability challenges, schedule acceleration opportunities, and value engineering possibilities. The second half of the report explains observations made about any problems pertaining to building design and construction process with Main & Gervais. Within those observations are technical analysis methods that could be used to solve the identified problems.

The constructability challenges facing Main & Gervais include site constraints, tower crane limitations, and complications with the Design/Development Review Commission (DDRC). Site constraints on the job site require deliveries before 6:00 am or late in the evening and storage to take place near the site until immediate installation on the project. With the close proximity of adjacent buildings, the tower crane must be downsized and placed where the swing does not interfere. A mobile crane will be required to assist where the tower crane in the new location cannot reach. Extra coordination will be necessary because all designs and any changes must be exchanged with the DDRC before implementation.

The current critical path starts with the cast-in-place concrete structure, followed by elevator installation, and then the curtainwall construction will enclose the building allowing the interior finish construction to begin. If weather does not permit, it could alter the pour sequences thus altering the schedule. If the strict delivery schedule due to the site having limited storage capabilities undergoes interruptions, then the schedule could be impacted. There are areas of schedule acceleration including purchasing high/early strength concrete, which could cost \$10-15 more per cubic yard than normal concrete. Also, starting the curtainwall earlier was a possibility but shop drawings have to be submitted in advance, which would require extra coordination.

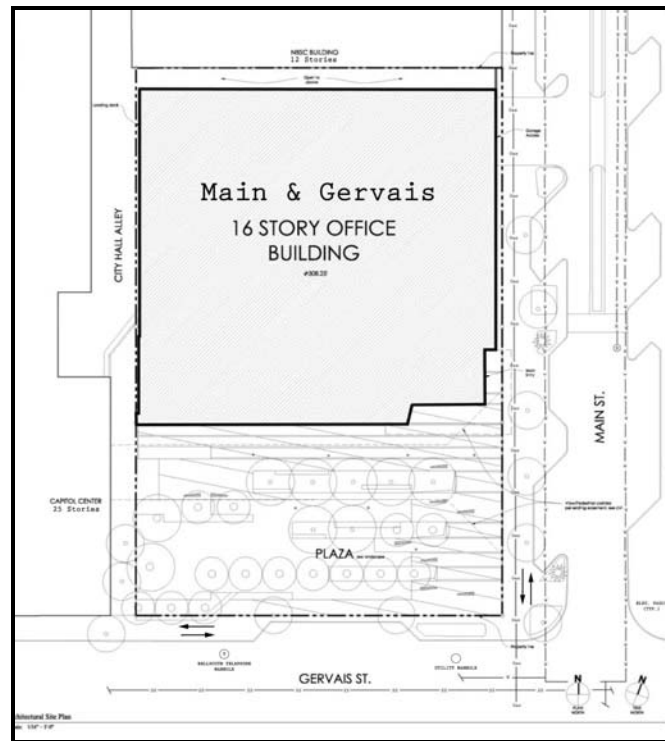
There were value engineering ideas on the project implemented and rejected. The two staircases were replaced with cast-in-place concrete and the handrails were replaced with aluminum instead of steel in both instances. Landscape designs were looked over and more cost effective materials were selected to replace the original choices. The value engineering ideas not accepted were changes to the skin and delaying some common base construction to a later time.

With any construction project, there is always room for improvement. Main & Gervais has some problematic areas that could be adjusted slightly or even corrected. The first idea is the use of building information modeling (BIM), which would increase coordination efficiency when constructing the MEP systems. Secondly, obtaining LEED Credits is certainly a goal to strive for considering the environmental conditions of the planet. A third suggestion brings up the idea of improving the building envelope. Since curtainwalls lend themselves to be less energy efficient, designing for a better window film could provide some energy savings. Lastly, the cast-in-place concrete columns that the structure consists of vary in shape and size. There could be less formwork necessary if the shape of all the columns were designed to be the same throughout the building.

## II. Project Manager Interview

The following topics discuss the issues effecting Main & Gervais currently and address issues that could potentially have an impact on cost, schedule, and value of the building. Following the issues are proposed solutions to eliminate some potential problems.

### *Constructability Challenges*



**Figure 2.1 – Site Plan**

#### **Delivery/Storage**

As shown in **Figure 2.1**, Main & Gervais is located on the corner of two main streets in downtown Columbia, South Carolina. Not only are there two roads sitting against the site but also two buildings. One building is 25 stories high and the other is nine stories high. This reduced the amount of staging area available for construction. Also, the traffic from the two roads limits deliveries and concrete pours to certain times of the day. To solve these problems, sufficient planning and scheduling had to be done in advance. This information was then communicated to the project team to educate them about what the delivery dates were, where the staging would take place, and what the installation schedules were. To get an idea of the planning that took place, the project started in June 2008 and deliveries were scheduled out through the summer of 2009. This planning outlined the major deliveries to take place and the timing for them, which fell before 6 am or late in the evening for each day. Also, materials are being stored off site and delivered just in time for installation.

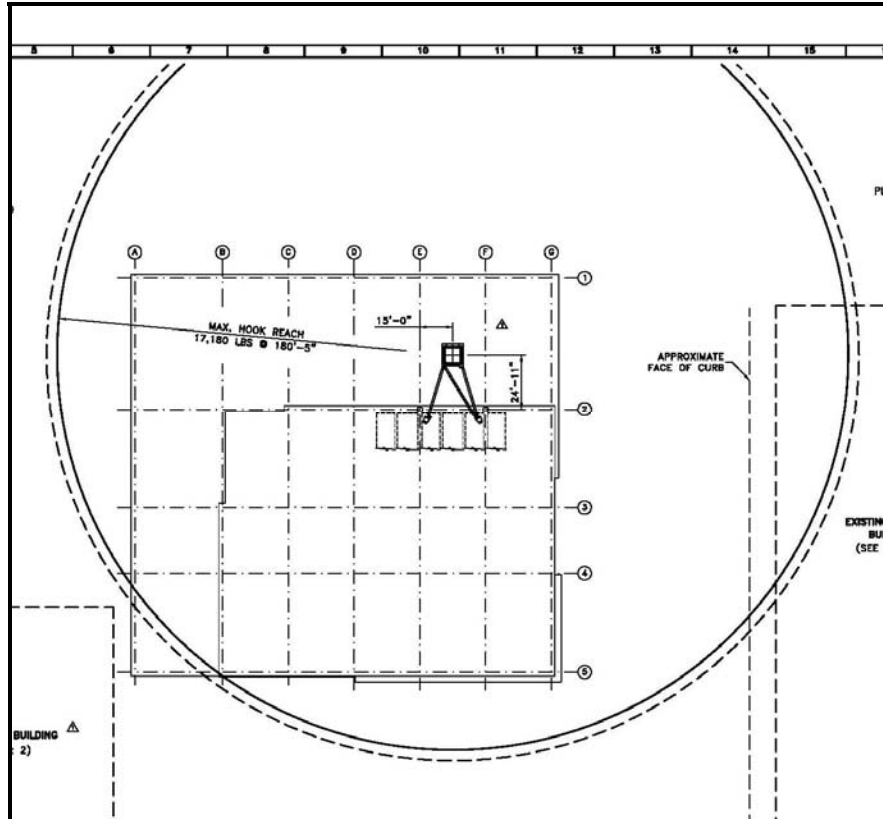


Figure 2.2 – Tower Crane Plan

### Tower Crane

There is a tower crane located on site to assist with the superstructure throughout the construction of the building. The owner of the adjacent building has requested that the tower crane not swing over their building, which can be seen in the bottom left of **Figure 2.2**. This required the relocation of the originally desired spot of the crane to a new spot. The new spot would limit the crane from reaching the corner of the building. This will result in renting a mobile crane to finish off the structure and skin in this particular area. To help cover the cost of the additional mobile crane, the tower crane was downsized.

### Design/Development Review Commission (DDRC)

DDRC reviews and approves site use, building design, hardscape/landscape design, and materials prior to construction. Also, any changes made to the project must be resubmitted prior to moving forward. This brings up some challenges right from the beginning as well as before finalizing design. This can make purchasing trades and beginning construction more difficult. For Main & Gervais, communication was the key for reducing the stress associated with these circumstances. To allow time for review, questions, and answers, the drawings were submitted early and in phases as to not overwhelm the DDRC. Communication is to remain throughout the rest of the project to eliminate the possibility of missing any minute detail.

## ***Schedule Acceleration***

### **Critical Path**

The current critical path begins with the concrete structure. When the concrete structure finishes, the elevator machines setup and elevator installation can take place. Then, to enclose the building, the curtainwall will begin. Enclosing the building will then allow the special interior finishes including the drywall, spandrel glass, wood paneling, etc. to begin.

### **Schedule Risks**

There are a couple areas where the schedule could be impacted and reduce the chances of reaching the completion date on time. If by chance it rains for long periods of time, the schedule/sequence for pouring concrete could be affected. If material deliveries do not arrive on time, the activity requiring these materials could delay the project. For example, support necessary for structure installation including rebar and post tensioning. Another area that could impact the schedule is any delays with shop drawing submittals and/or fabrication with elevators, curtainwall, etc. This delay would in turn delay the material showing up on time to start the installation according to schedule.

### ***Acceleration Opportunities***

Introducing concrete additives could speed up the concrete structure of the building. More specifically, 1 or 2 day high/early strength concrete mix could be used to regain some time. This particular concrete mix would cost \$10-15 more per cubic yard than the current concrete mix of choice. Another potential area to adjust is the curtainwall start date. This date could be moved forward in the schedule, which in turn would enclose the building early allowing the start of interior construction. This idea would not have any costs associated with it but would require earlier coordination in terms of shop drawings and the fabrication process.

## ***Value Engineering***

### ***VE Implementations***

Instead of using steel stairs, cast-in-place concrete stairs will be put in place. Aluminum handrails will accompany these stairs instead of steel handrails. It has been decided that more cost effective finishes will be used for counters, flooring, walls, etc. Hardscape/site furnishings were looked over and decided that more cost saving materials could be used. The value engineering ideas presented to the owner did not detract from any of their goals.

### ***VE Rejections***

It was suggested that the structure/skin could be altered for cost savings. The original curtainwall remained in the construction documents. The idea of delaying some of the common areas from the base building for future construction was brought up for discussion. Each of these ideas was rejected due to misalignment with the owner's original goals for the building.

### **III. My Observations**

The following sections contain observations of potential problems that could arise with Main & Gervais along with technical analysis methods, which provide probable solutions. The problems are outlined in the first section and their respective proposed solutions are in the second section.

#### ***Problem Identification***

##### **MEP Systems**

Main & Gervais is a rather large office building standing 16 stories tall with approximately 200,000 square feet per floor. This will require heavy-duty mechanical systems with many configurations of conduit, piping, ductwork, etc. The office building is primarily post-tensioned cast-in-place concrete, which will require extra coordination when it comes to penetrations, plenum space, and the like. Because of the complexity that accompanies MEP installation, there should be a method of organization proposed for discussion.

##### **Sustainability**

There must be some questioning on how effective new buildings are with where the United States is at in terms of the environmental state of the planet. During the design process, are the architects/engineers coming up with creative ways to achieve LEED credits? During the construction process, is the general contractor ensuring everyone is not wasteful and abiding by LEED suggestions for obtaining credits?

##### **Building Envelope**

The building envelope consists of a curtainwall that contains, for the most part, glass. Glass does not provide much insulation. During the winter months, the heat generated by the mechanical systems will escape more easily through windows due to lack of insulation. And in the summer months, the solar heat generated from the sun can heat the air inside the building requiring heavier output from the air conditioning systems. With technology evolving and the ever-increasing demand for green technology, there could possibly be a better choice than the glass currently chosen.

##### **Structural Elements**

There is an extensive amount of concrete on the project considering the entire building has a cast-in-place structure. The columns made of concrete vary in size and shape. The potential problem lies with the different shapes of the columns that were originally designed for the project. This requires various types of formwork and possibly more labor requirements. Could there be a better design choice that would offer consistency throughout the structure?

## ***Technical Analysis Methods***

### **Building Information Modeling**

As identified above, the problem with complex MEP systems is that coordination between the parties involved increases in difficulty. Therefore, analyzing a way to implement building information modeling (BIM) could be a way to eliminate some unnecessary confusion. By injecting all the information about Main & Gervais into a model, every party involved in the construction process utilizing this model will be more educated about the building. This will have the potential to reduce any conflicts that could eventually occur in the field. It would also provide a virtual database for the owner to keep throughout the lifetime of the building.

### **U.S. Green Building Council**

There is a growing concern with how society is keeping the environment in mind when pursuing everyday activities. Every day, the majority of people spend their times inside buildings; therefore there are many buildings in place and many on their way. There is a limited amount of what can be done with currently built buildings though the approach on how new construction takes place can be changed. By analyzing the U.S. Green Building Council guidelines, better practices can be made to achieve a better standing on this earth and preserve the environment. Applying for practical LEED credits with respect to Main & Gervais, there is a possibility to obtain certification. Some applicable credits could include enhancing the buildings accessibility to public transportation because of the location it has downtown and what types of materials the future tenants use for their interior finishes.

### **Commercial Window Film**

By analyzing a potentially better film for the exterior windows, the curtainwall could provide some energy savings even though there may be a higher cost up front. A film with a lower U-value could prevent less heat from escaping during the winter months. Also, a film that allows less solar transmittance during the summer months would be preferable. Checking out the weather conditions for downtown Columbia, South Carolina, is necessary to understand which film property has a higher priority. After figuring out which film fits appropriately, an analysis of the mechanical load necessary to heat and cool the building with the film in place would determine if there is potential energy savings available.

### **Formwork Consistency**

Main & Gervais has rectangular, square, and circular columns selected for the design of the structure. There is a possibility to switch the circular columns to square columns that would still have a comparable amount of concrete. This would eliminate circular formwork and allow for the reuse of square column formwork, which could provide cost savings. Calculating the strength of a square column in comparison with a similar sized circular column and consulting with a structural engineer could be an analysis worth attempting.