

# Granby Tower

515 Granby Street  
Norfolk Virginia



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Thesis Proposal  
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## Executive Summary

This proposal outlines the issues that will be researched this spring. One of the issues is an industry issue that will be researched. The remaining two issues are technical issues that deal with the structural system and the mechanical system of the building. The industry issue that will be researched is the issue of workforce development in the construction industry.

### Analysis #1 – Structural System

An alternative structural system will be researched and compared to the existing system. First a steel system will be analyzed and compared to the existing cast in place concrete. The costs of each will be analyzed and the effects of both on the schedule will be analyzed. Another analysis will be researched; this analysis will deal with resizing the cast in place concrete system. The three systems will be compared and a decision on which system is the best will be made.

### Analysis #2 – Site Congestion

By changing the structural system from cast in place concrete to structural steel will cause an already congested site to be more congested. Ways to decrease this congestion will be looked into. Options other than on site lay down areas for the steel will be addressed and a site plan will be developed to determine the best possible site layout for this project.

### Analysis #3 – Mechanical System

The current four pipe mechanical system will be compared to a two pipe system. Both systems will be researched; the advantages and disadvantages of each will be weighed and a decision will be made as to which works best for this building.

### Industry Research – Workforce Development

The issue of workforce development in the construction industry will be researched. Reasons as to why people are not entering the workforce will be looked into. A solution to get more people into the workforce will be made.

## Introduction

The Granby Tower is a thirty-one story mixed use high rise building located in Norfolk, Virginia. It consists of retail space, condominiums, and townhouses. It consists of 311 condominiums which use post-tensioned concrete has the predominant structural system and it uses some structural steel elements as well, the retail areas use this system as well. There are some aspects of CMU shear walls located in the lower levels of the tower as well as in the seven story parking garage. The townhouses are located on the lower levels and are to be constructed using standard wood framed construction.

The mechanical system for the project is a four pipe system with individual exchangers in the units. The system includes 1100 GPM cold water pumps, 1650 GPM tempered water pumps, 87 GPM hot water pumps, 87 GPM natural gas boilers, and a 3300 GPM forced draft cooling tower. The mechanical equipment is located on a floor above the penthouse floors.

The owner of this project is 515 Granby, LLC and Marathon Development Group is the developer. The Marathon Development Group has been involved in restoring historic landmarks in the Norfolk area. Not only do they want to restore historic landmarks, but they also want to provide homeowners with a unique living experience. This building is being built to give people a chance to live in a historic neighborhood in what will be the largest building in Norfolk and the second largest in the state of Virginia.

Schedule and cost are the most important factors to the owner for this project. Some of the condominiums have already been sold, so the project being completed on time is very crucial. These people are expecting to be able to move in on a certain date and it is crucial they be able to do so.

## Analysis 1 – Structural Analysis

### Problem:

The current structural system consists of cast in place concrete, structural steel, wood framed construction, and some CMU structural elements. The main problem arising from the cast in place concrete is the differing sizes of columns on the same level. For example the tower level of floor six contains the following column sizes: 30"x30", 36"x36", 18"x18", 72"x18", 48"x27", and 48"x18". These column sizes are very similar to these on each and every floor. This varying size in concrete columns requires multiple formwork sizes as well. Some of the column sizes are only used a few times so you do not get as much use out of the formwork as you could if the columns were sized the same.

### Goal:

This analysis will look into one of two options. Option one will be resizing the existing concrete columns so to reduce the number of column sizes to one or two sizes instead of six sizes. The other analysis will be using a structural steel system.

### Steps:

1. Analyze the loading for the building.
2. Resize the concrete columns or size the structural steel members.
3. Develop a new floor plan layout (structural steel analysis).
4. Analyze the cost of the new system.
5. Develop a schedule for the new system.
6. Compare the new schedule and cost information with the original data.
7. Make suggestion based on comparisons.

### Expected Outcome:

The concrete system will reduce the number of column sizes needed which will reduce the different sizes of formwork. This will reduce the cost of the formwork because the number of different column sizes will be reduced and the formwork will be able to be reused more often.

The structural steel system will allow for larger spans between columns. This will allow for larger community spaces on each floor.

## Analysis 2 – Site Congestion

### Problem:

Currently the site is congested (see figure 1), the building footprint consists of almost the entire site. Using structural steel instead of cast in place concrete as mentioned previously will increase the amount of congestion on site. Currently the Turner office trailer is located on the corner of Granby Street and Brambleton Avenue.

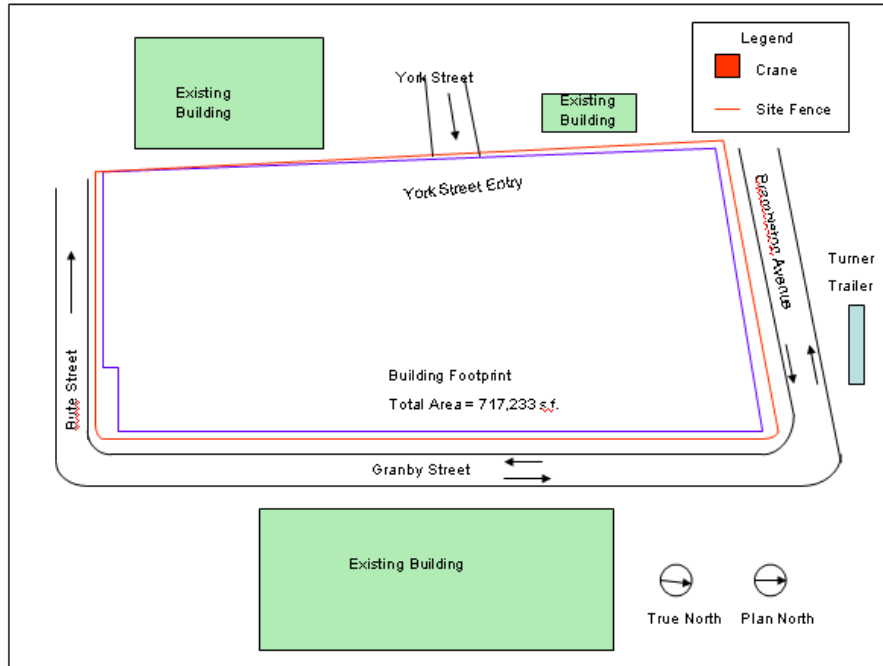


Figure 1

### Goal:

To determine the best alternative for a steel lay down area since the building footprint consists of most nearly the entire site.

### Steps:

1. Look into areas where a possible lay down area could be used.
2. Gather information about closing down a street if necessary.
3. Consult with Turner contact on possible alternatives for lay down areas.
4. Look into trade coordination.
5. Develop new site plan including newly found lay down areas and possible road closures.

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Expected Outcome:

To develop a new site plan that shows a reduction of congestion on site. This will include possible lay down areas for structural steel and indicate possible road closures. The effects of the road closures will be looked into.

## Analysis 3 – Mechanical System

### Problem:

The current mechanical system is a four pipe system. This system allows it so cold water and hot water are always available for heating and cooling purposes. This is beneficial for the condominiums, so the room temperature can be changed to meet the owner's comfort levels.

### Goal:

To design a mechanical system that is more economical and costs less. A two pipe system will be looked into. The main goal will be to determine a system that is more efficient than the current one. Since the mechanical system is located above the penthouse, a system that has a minimal amount of noise and vibration will also be looked for.

### Steps:

1. Contact a mechanical engineer and determine the benefits of a two pipe system compared to a four pipe system.
2. Determine the mechanical loading required for the building.
3. Design a mechanical system for required loading.
4. Talk to a mechanical system provider about availability and efficiency of system.
5. Determine costs of system.
6. Compare newly designed two pipe system with the existing four pipe system.

### Expected Outcome:

The two pipe system will cost less than the existing four pipe system. The four pipe system might be better because hot and cold water are available throughout the entire year, whereas with a two pipe system cold water is usually available in the summer for cooling and hot water is available in the winter for heating. The change in the mechanical system may have an effect on the structural system, if this occurs the structural system will have to be evaluated again.



## Critical Industry Issue Research

### Problem:

Over the years the workforce in the construction industry has been diminishing. People who have been in the industry their whole lives are now retiring and nobody is entering the workforce to fill that void. People have a certain perceived image about construction work and are not entering the workforce. Also the people that are retiring from the industry are telling their family members not to enter the industry. Couple this with labor laws and government regulations and the problem can only get worse. Not only are people not entering the workforce, but now you are being told who you can and can not hire.

### Goal:

The goal of this research will be to figure out why people are not entering the workforce, once that is discovered the objective will be to figure out how to change people's perception of construction so that they want to join the industry. The other objective is to determine what else can be done to get people interested in construction again.

### Proposed Steps:

1. Determine what the negative image people have of construction is through survey.
2. Determine why people have this negative image through survey.
3. Determine why people are telling family members not to enter the workforce.
4. Talk with industry members who have been in the profession for more than ten years about what can be done to change people's perception of the construction industry.
5. Review the suggested methods from industry professionals.
6. Make suggestions on the best way to get people interested in the construction industry.

### Expected Outcome:

To review the main reasons why people are not entering the construction industry, and make suggestions that will persuade them to enter the construction industry. This will involve performing surveys and lots of research to determine the best method for persuading people to enter the industry.

## Summary

From this proposal I would like to develop a better understanding of the labor issues surrounding the construction industry. I would also like to develop my critical thinking skills and overall just get a better understanding of our industry and the issues we deal with everyday.

## Weight Matrix

Description	Research	Value Eng.	Const. Rev.	Sched. Red.	Total
Alternate structural system		5	15	15	35
Site Congestion			10		10
Redesign of mechanical system	5	20	5		30
Labor Shortage Research	25				25
Total	30	25	30	15	100

## Appendix A – Breadth Studies

### Breadth Analysis 1:

Analysis of the proposed structural steel system will be performed. The building load will be calculated and the alternate system will be performed. This system will then be compared to the existing cast in place concrete system. If the mechanical analysis causes for additional loading the system will be redesigned for that as well.

### Breadth Analysis 1-a:

Redesign of the existing cast in place concrete system. The concrete columns will be resized to decrease the amount of different size formwork needed. If the mechanical analysis causes for additional loading the system will be redesigned for that as well.

### Breadth Analysis 2:

Analysis of an alternative two pipe mechanical system compared to the existing four pipe system. Value engineering ideas will be looked into for this analysis.

## Appendix B – Timetable

The chart on the following page represents the proposed schedule to be followed for completing the thesis project in the spring.

