


Granby Tower  
Norfolk, Virginia



Justin Pennycoff  
AE Senior Thesis 2008  
Construction Management

Granby Tower  
Norfolk, Virginia

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### Presentation Outline

- Project Overview
- Structural Breadth – Structural System Analysis
- CM Depth – Site Evaluation
- Mechanical Breadth – Mechanical System Analysis
- Research – Workforce Development
- Conclusions
- Q & A

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### Project Overview

- Location  
Norfolk, Virginia
- Total Cost  
\$180 million
- Building Size  
717,233 sq. ft.
- Construction Dates  
July 2, 2007 – November 2009

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### Project Overview

#### Project Team

- Owner – Granby Tower LLC
- General Contractor – Turner Construction
- Architect – Humphrey's and Associates
- Structural Engineer – Abiousness, Cross, and Bradshaw
- MEP Engineer – Jordan and Scala Engineers

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### Project Overview

#### Featured Systems

- Structural – CIP Concrete
- Mechanical – Four Pipe System

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### Structural System Analysis

#### Problem

- Aspects of multiple structural systems
- Multiple formwork sizes

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## Structural System Analysis

**Goals**

- Develop alternate structural system
  - Allow for larger spans and higher floor to floor height
  - Eliminate number of structural elements
  - Reduce schedule
  - Reduce cost

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## Structural System Analysis

**Analysis**

- Structural Loads
  - Total Live load – 80 psf
  - Total Dead Load – 66.25 psf
  - Total Load – 146.25 psf

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## Structural System Analysis

SECTION PROPERTIES		AISC		ASD	
Member	Section	$A_g$	$I_x$	$A_g$	$I_x$
1	W12x14	4.17	143	4.17	143
2	W12x14	4.17	143	4.17	143
3	W12x14	4.17	143	4.17	143
4	W12x14	4.17	143	4.17	143
5	W12x14	4.17	143	4.17	143
6	W12x14	4.17	143	4.17	143
7	W12x14	4.17	143	4.17	143
8	W12x14	4.17	143	4.17	143
9	W12x14	4.17	143	4.17	143
10	W12x14	4.17	143	4.17	143
11	W12x14	4.17	143	4.17	143
12	W12x14	4.17	143	4.17	143
13	W12x14	4.17	143	4.17	143
14	W12x14	4.17	143	4.17	143
15	W12x14	4.17	143	4.17	143
16	W12x14	4.17	143	4.17	143
17	W12x14	4.17	143	4.17	143
18	W12x14	4.17	143	4.17	143
19	W12x14	4.17	143	4.17	143
20	W12x14	4.17	143	4.17	143
21	W12x14	4.17	143	4.17	143
22	W12x14	4.17	143	4.17	143
23	W12x14	4.17	143	4.17	143
24	W12x14	4.17	143	4.17	143
25	W12x14	4.17	143	4.17	143
26	W12x14	4.17	143	4.17	143
27	W12x14	4.17	143	4.17	143
28	W12x14	4.17	143	4.17	143
29	W12x14	4.17	143	4.17	143
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82	W12x14	4.17	143	4.17	143
83	W12x14	4.17	143	4.17	143
84	W12x14	4.17	143	4.17	143
85	W12x14	4.17	143	4.17	143
86	W12x14	4.17	143	4.17	143
87	W12x14	4.17	143	4.17	143
88	W12x14	4.17	143	4.17	143
89	W12x14	4.17	143	4.17	143
90	W12x14	4.17	143	4.17	143
91	W12x14	4.17	143	4.17	143
92	W12x14	4.17	143	4.17	143
93	W12x14	4.17	143	4.17	143
94	W12x14	4.17	143	4.17	143
95	W12x14	4.17	143	4.17	143
96	W12x14	4.17	143	4.17	143
97	W12x14	4.17	143	4.17	143
98	W12x14	4.17	143	4.17	143
99	W12x14	4.17	143	4.17	143
100	W12x14	4.17	143	4.17	143

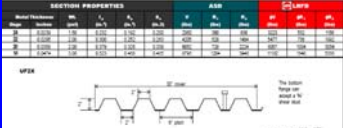


Chart to determine beam spacing

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## Structural System Analysis

**Cost Comparison**

Existing System - \$5,100,744  
New System - \$6,241,850

Item	Cost
Metal Deck	\$87,728
Welded Wire Fabric	\$8,534
Fireproofing	\$68,366
Concrete Floor	\$991,489
Steel	\$5,085,733

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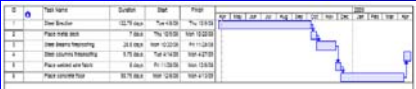
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## Structural System Analysis

**Schedule Impact**

Lose 3 weeks in schedule

Task Name	Duration	Start	Finish
Place concrete	100.00	10/1/07	11/30/07
Place steel deck	7.00	11/1/07	11/8/07
Place concrete	20.00	11/1/07	11/21/07
Place concrete	10.00	11/1/07	11/11/07
Place steel deck	10.00	11/1/07	11/11/07
Place concrete	10.00	11/1/07	11/11/07



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## Structural System Analysis

**Conclusion**

- The cost of the steel system appears to be higher
- The schedule for the steel system appears to be longer
- Recommend existing system

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### Site Analysis

**Problem**

- Site is very congested due to its location
- Certain regulations that must be followed

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### Site Analysis

**Solution**

- Develop site plan for proposed steel structural system with lay down area
- Address other issues related to the site

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### Site Evaluation

**Main Site Issues**

- Project is located in downtown area
- DOT weight regulations on deliveries
- Noise emittance levels
- Necessity to close streets for delivery purposes

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### Site Evaluation

**Problems that arise due to site issues**

- Limited access to the site
- DOT regulations regulate when deliveries can be made
- Noise emittance levels regulate when deliveries can be made
- Street closure process could take a month or longer

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### Site Evaluation

Site Plan – Concrete Superstructure floors 1-7

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### Site Evaluation

Site Plan – Concrete Superstructure floors 7-34

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## Site Evaluation

### Site Plan – Steel Superstructure

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## Site Evaluation

### Site Plan – Alternate Steel Structure

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## Site Evaluation

### Conclusion

- Regulations have an effect on how effective a site plan can be
- Recommend using concrete crane location and picking steel off of truck and place directly from truck
- A site plan can effect the schedule of the project

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## Mechanical System Analysis

### Two Pipe vs. Four Pipe

- Why choose four pipe?
- Why choose two pipe?
- Recommendation

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## Mechanical System Analysis

### Four Pipe

- Hot and cold all year long

### Two Pipe

- Cost less
- Less construction time
- Less construction space

**Recommend two pipe system**

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## Research – Workforce Development

### Problem

- People are either leaving the construction workforce or not entering it at all

### Solution

- Address the issues why this is occurring and develop a solution as to how to improve the industry

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## Research – Workforce Development Issues

- Hard work and long hours
- Safety
- Attitude of people you work with

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## Research – Workforce Development Suggested Improvements

- Integrate safety programs
- Team building exercises
- Improve emotional intelligence
- Show appreciation
- Exercise
- Company activities

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## Conclusion

**Structural Analysis**  
Higher cost, longer schedule

**Site Analysis**  
Site use can have an impact on schedule

**Mechanical Analysis**  
Lower cost, shorter schedule, less on site congestion

**Research**  
There are things that can be done to improve people's perception of the construction industry and the people in it

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# Questions?

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