

Kenneth G. Langone Athletic and Recreation Center

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Structural Option
Thesis
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Presentation Outline



- Introduction
- Existing Structural System
- Problem Statement
- Problem Solution
- Depth Study
 - Alternative System Design
- Breadth Study
 - LEED Certification
 - Natatorium Duct Redesign
- Conclusion
- Acknowledgements



Introduction

Introduction



Project Team:

Owner: Bucknell University

AE Firm: Ewing Cole Cherry Brott

CM: R.S. Mowery and Sons

Introduction



- Location: Lewisburg, Pa
- Gymnasium and Natatorium Additions to Existing Facilities
- 102,000+ Sqft
- \$27 Million
- Construction: May 2001-Early 2003
- Design-Bid-Build





Existing Structural System

Existing Structural System



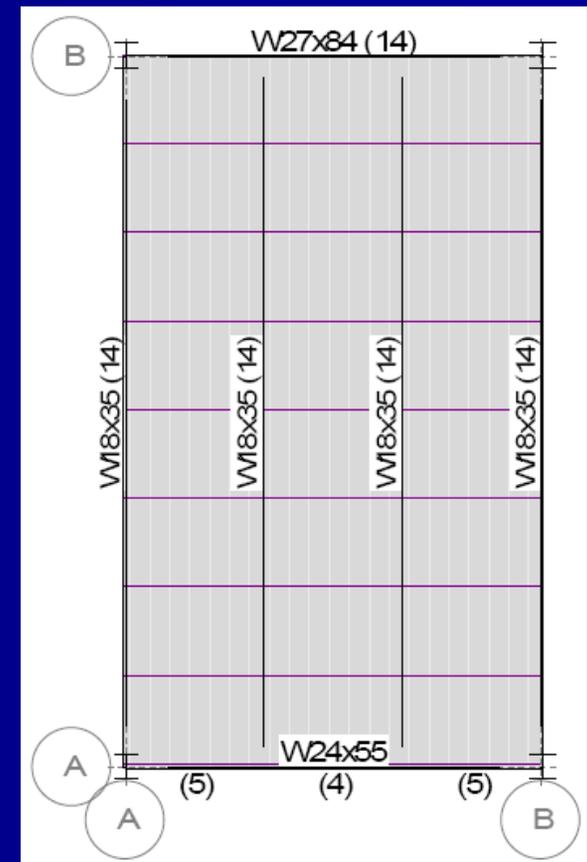
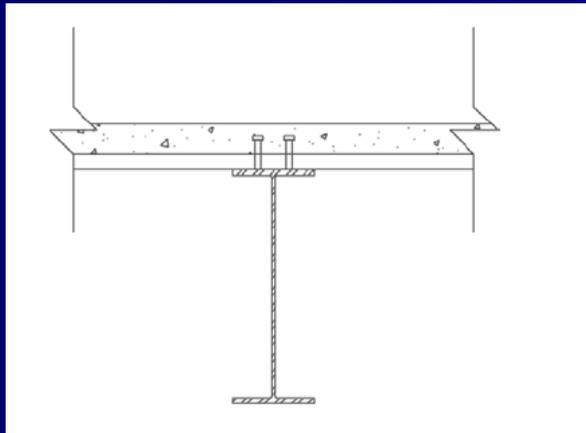
- Foundation: Continuous and Spread Footings
- Gravity Force Resisting System
 - W shaped Columns
 - Prefabricated Structural Steel Roof Trusses

Existing Structural System



■ Floor System

- 2" 20 Gauge Composite Steel Decking
- 4 1/2" Normal Weight Concrete
- 3/4" Diameter 5" Long Shear Studs



Existing Structural System



- Lateral Force Resisting System
 - Cross Braced Frames
 - Extra Strong ASTM 501A Steel Pipe
 - 1/2" Steel Gusset



Problem Statement & Problem Solution

Problem Statement



- Redesign Structural System Using Engineer Wood Products to Better Fit Area's History and Aesthetics
- Compare Cost and Construction Time

Problem Solution



■ New Structural System

- Engineered Lumber Arched Roof Beam
- Engineered Lumber Columns
- Engineered Lumber Floor Girders and Beams
- Poured Concrete Floor on Metal Decking

■ Cost Analysis

■ Construction Time Comparison



Depth Study: Alternative Structural System Design

Arched Roof Beams

General



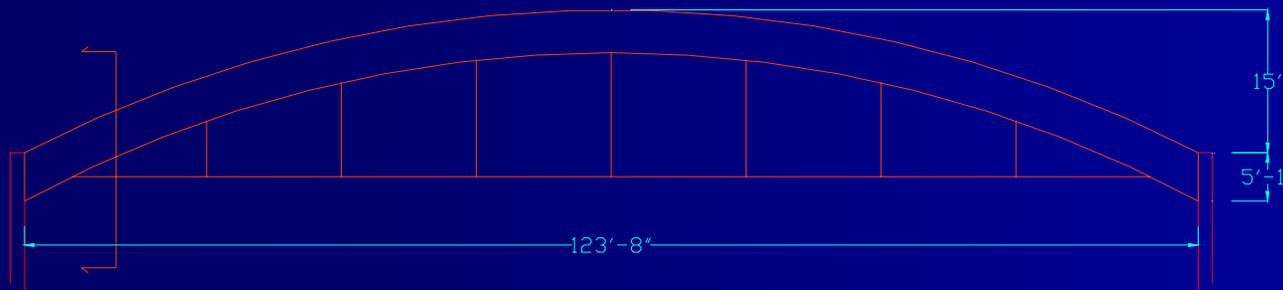
- Natatorium
 - Span: 123' 8"
- Gymnasium
 - Span: 158' 10"
- General Conditions
 - 20 gauge Architectural Metal Sheet Roofing over 5" of Rigid Insulation on 18 gauge Steel Decking
 - Loads (psf)
 - Roofing 13
 - Snow 30
 - Wind 25

Arched Roof Beam

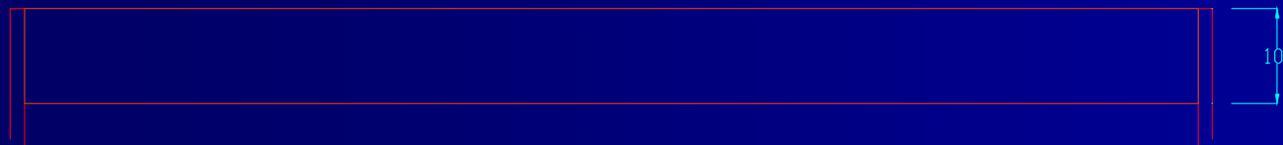
Natatorium



- 12" x 54" Southern Pine 30F-E2
- 7/8" 6 x 7FC Structural Steel Cable



New Natatorium Roof Beam Assembly

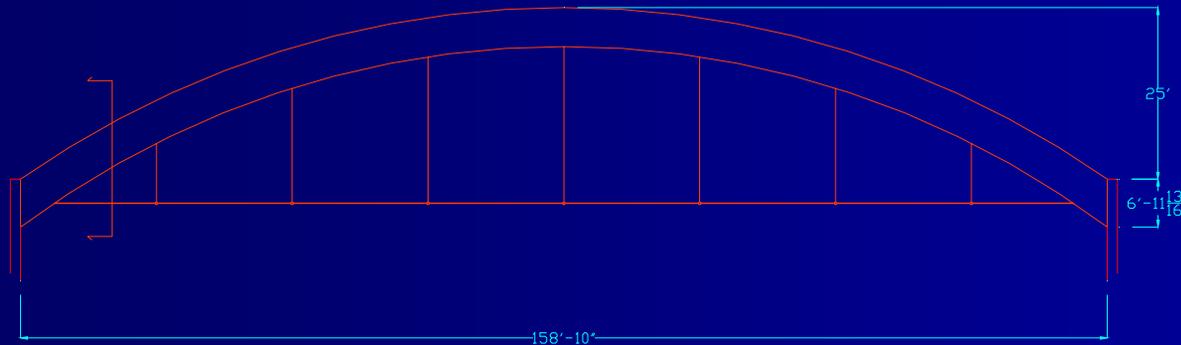


Original Natatorium Truss Outline

Arched Roof Beam Gymnasium



- 12" x 68" Southern Pine 30F-E2
- 7/8" 6 x 7FC Structural Steel Cable



New Gymnasium Roof Beam Assembly

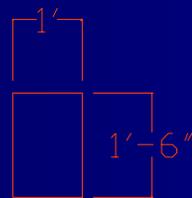


Original Gymnasium Truss Outline

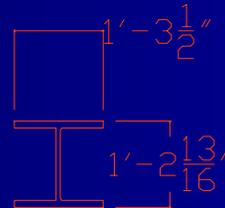
Column



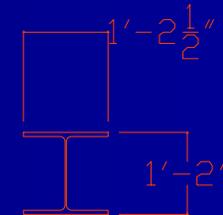
- 12" x 18" Southern Pine Grade N1D14
- Oversized to meet 2 hour fire rating



Common
Wood Column
Gym and Natatorium



Common Gym
Column

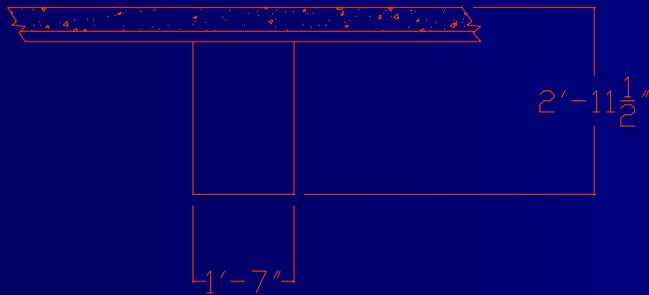


Common Natatorium
Column

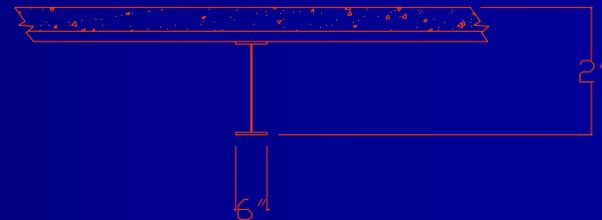
Floor System



- 19" x 29" Southern Pine 30F-E2 Beams
- 18" x 29" Southern Pine 30F-E2 Girders
- Oversized to meet 2 hour fire rating



Common
Wood Flooring System



Common
Steel Flooring System

Lateral Force Resisting System



- 9 1/2" x 12" Southern Pine Grade N1D14
- Design Controlled by Tension Side of Cross
- Oversized to meet 2 hour fire rating

Cost/Construction Time



■ Cost

	Steel	Wood
Beam	\$14500.00	\$15900.00
Column	\$3700.00	\$2100.00

■ Construction Time

- Identical Erection Time
- Wood has a longer production time



Breadth Study:
LEED Certification
HVAC Delivery System

LEED Certification



■ Sustainable Site

– 11 out of 14

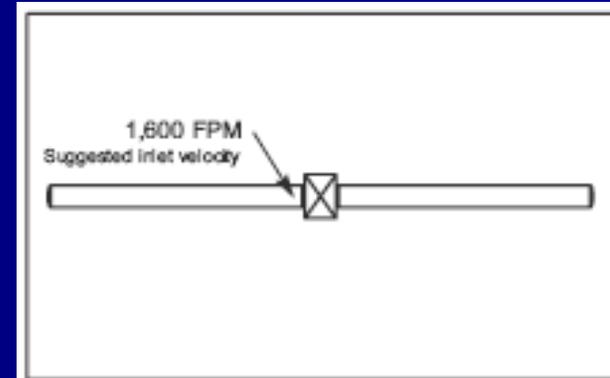
■ Points Earned by Wood System

– 4 points from Materials and Resources Section

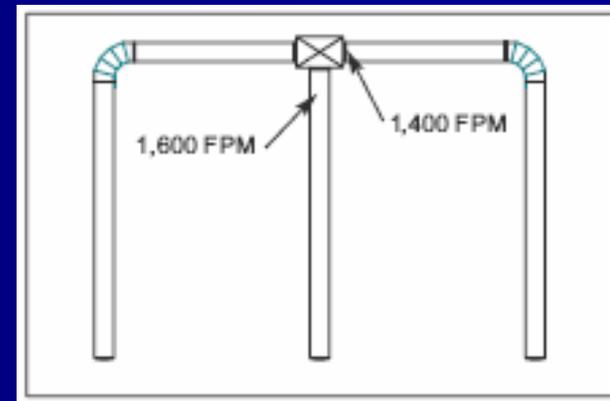
HVAC Delivery System



- Pool Seating
 - 44" Dia. Supply
 - 2" Dia. Holes



- North/South Pool
 - 66" Dia. Supply
 - 2" Dia. Holes





Conclusion

Conclusion



- *New System is a Viable Alternative*
 - Limited Price Increase
 - Approx. Same Construction Time
- **Recommendation**
 - Use Wood Columns and Roof Beams when left exposed.

Acknowledgements



- Bucknell University
- Ewing Cole Cherry Brott
- R.S. Mowery and Sons
- AE Department
- Family
- And the great friends I've made along the way



Questions