




RUTGERS UNIVERSITY
LAW SCHOOL BUILDING ADDITION AND RENOVATION

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STRUCTURAL OPTION
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THE PENNSYLVANIA STATE UNIVERSITY
ARCHITECTURAL ENGINEERING

The Presentation

- Building Overview
- Thesis Proposal
- Structural Analysis
 - The Floor System
 - The Lateral System
- Architectural Breadth
- CM Breadth
- Conclusions



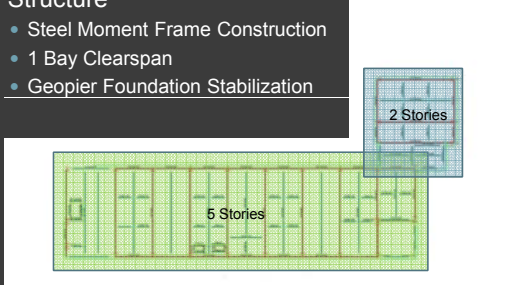
The Building

- Architecture
 - 1970's Era Law School
 - 90,000 SF Addition
 - Classroom Space
 - Office Space
- Construction
 - 4 Phases
 - Minimal Interruption
 - 2 Year Construction



The Building

- Structure
 - Steel Moment Frame Construction
 - 1 Bay Clearspan
 - Geopier Foundation Stabilization



The Proposal

- Structural Study
 - Floor System Analysis
 - Composite Steel Joists (CJ-Series)
 - Lateral System Analysis
 - Braced Frame or Shear Wall Design

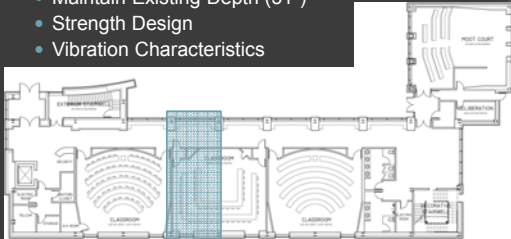
The Proposal

- Breadth Studies
 - Architecture
 - Floor Plans
 - Elevations
 - Construction Management
 - Cost Estimate
 - Project Schedule



The Structure

- Floor System Considerations
 - Large Open Spans
 - Maintain Existing Depth (31")
 - Strength Design
 - Vibration Characteristics



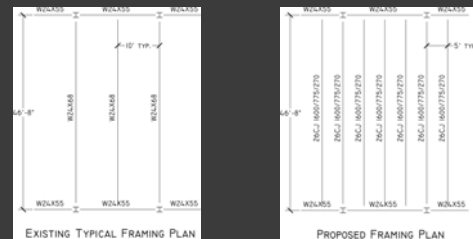
The Structure

- Strength Analysis
 - Designed using SJI Standard Specs
 - Spacing: 5' O.C.
 - Non-Composite Dead Load: 270 PLF
 - Live Load: 600 PLF
 - Total Load: 1150 PLF
 - Preliminary Design: 26CJ 1150/600/270

The Structure

- Vibration Analysis
 - Spacing: 5' O.C.
 - Damping Coefficient: 0.03
 - First Floor Classrooms
 - Natural Frequency: 3.96 Hz
 - Peak Acceleration: $0.0041g < 0.005g$
 - Final Design: 26CJ 1600/775/270
 - (46) $\frac{3}{4}$ " Shear Studs
 - Larger than Required by Strength

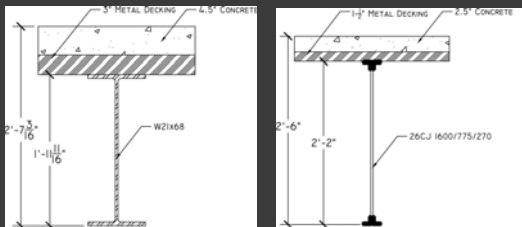
The Structure



Existing Floor System

Proposed Floor System

The Structure

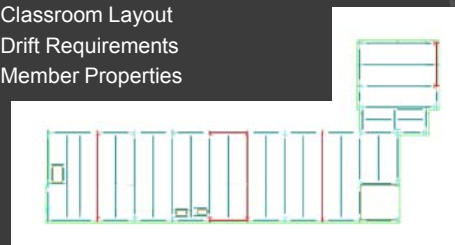


Existing Floor System

Proposed Floor System

The Structure

- Lateral System Considerations
 - Classroom Layout
 - Drift Requirements
 - Member Properties

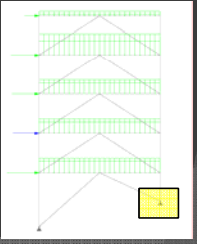


The Structure

- North-South Lateral System
 - Shear Wall
 - Impractical Coordination of Trades
 - Diagonal Bracing
 - Span Length Issues (55 ft)
 - Knee Bracing
 - Excessive First Floor Drift
 - Chevron Bracing
 - Architectural Interruption
 - Classroom Corridor
 - Eccentric Chevron Bracing
 - Minimal Complications

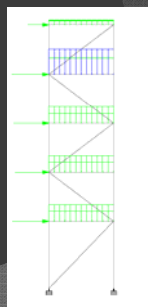
The Structure

- North-South Braced Frame
 - Eccentric Chevron Brace
 - First Floor
 - HSS9x7x1/2"
 - Upper Floors
 - HSS8x6x1/2"
 - 3 Braces Required
 - Increased Column Size
 - W14x109
 - Drift: 0.88 inches

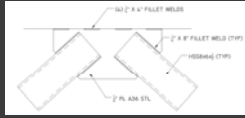
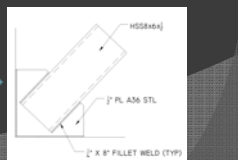


The Structure

- East-West Braced Frame
 - Diagonal Bracing
 - HSS8x6x1/2"
 - Typical Column Size
 - W14x82
 - Drift: 0.43 inches



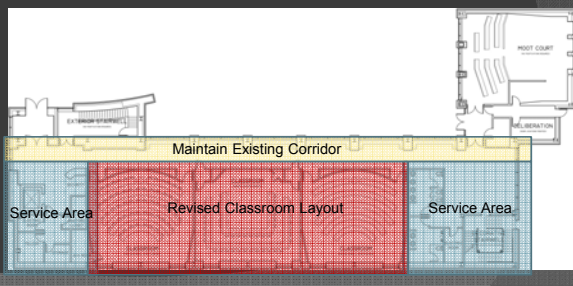
The Structure

- Typical Bracing Connections
 - Typical Chevron Brace
 
 - Typical Diagonal Brace
 

The Structure

- Additional Structural Considerations
 - Foundations
 - Geopier Stabilization Remains Necessary
 - Not Significantly Modified
 - Beams
 - W21x50
 - (44) 3/4" Shear Studs
 - Columns
 - Sized for Gravity Load Only
 - W14x82
 - Existing Design Sized for Drift
 - W14x159

The Architecture

- Revised First Floor Plan
 

The Conclusions

- Proposed Floor System
 - Negligible Effect on Construction Process
- Proposed Lateral System
 - Beneficial to Overall Construction Process
- Proposed Architectural Plan
 - More Aesthetically Pleasing Façade

The Conclusions

- Recommendations
 - Implement Revised Lateral System
 - Structural Engineer Involved in Schematic Design Process
 - Maintain Existing Floor System
 - Less Members, Equal Cost
 - Utilize Revised Architectural Elevations

Questions?