Visteon Corporate Headquarters
Village Center

Jamison David Morse
AE 882 – Senior Thesis
Structural Option

Introduction: Project Information

- I. Introduction
- II. Problem Statement
- III. Solution Statement
- VI. Structure
  - A. Gravity Framing
  - B. Lateral System
- V. Architecture
- VI. Overall Benefits
- VII.Conclusions


Image courtesy of SmithGroup

Location: Van Buren, MI
Owner: Visteon Corporation
Arch/Eng/Site: SmithGroup
Type: Design-Build

Cost: $85 Million
Size: 130,000 gsf
Completed December 2004


Image courtesy of Google

Introduction: Existing Structure

Image courtesy of SmithGroup

- Composite steel framing
- Special steel moment frame lateral system
- Deep foundation system with HP shape friction piles and concrete pile caps

Image courtesy of SmithGroup

Introduction: Existing Structure

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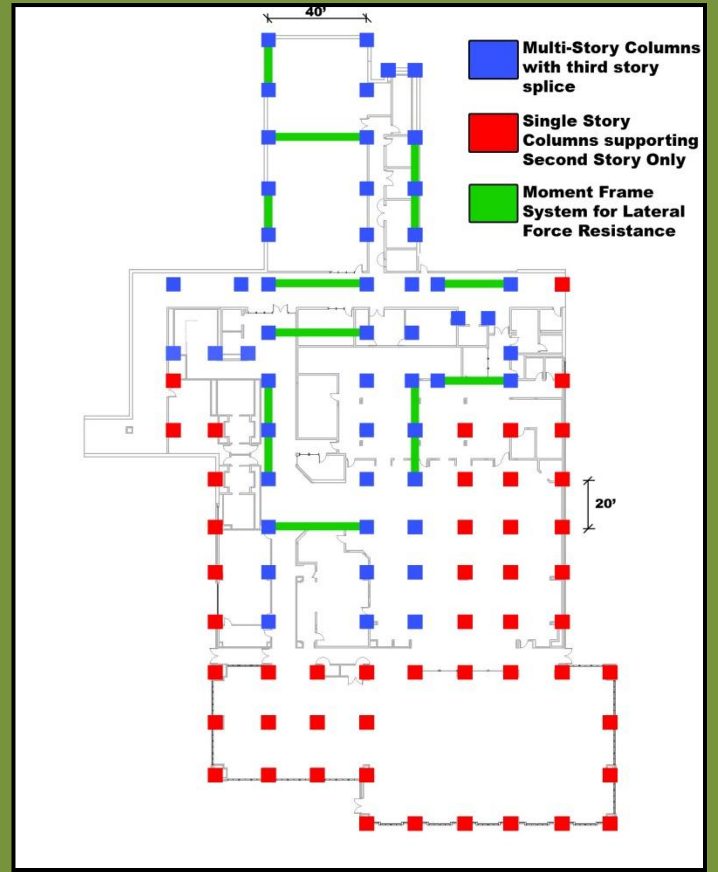

Image courtesy of Jamison Morse

- -Single story columns
- -Multi story columns
- -Six moment frames in E-W
- -Five moment frames in N-S

Thesis Problem Statement

Image courtesy of SmithGroup

-Relocation of the Visteon Village Center to Orinda, CA
- -Increased seismic loading
- -Structural redesign
- -Possible negative effects on architecture

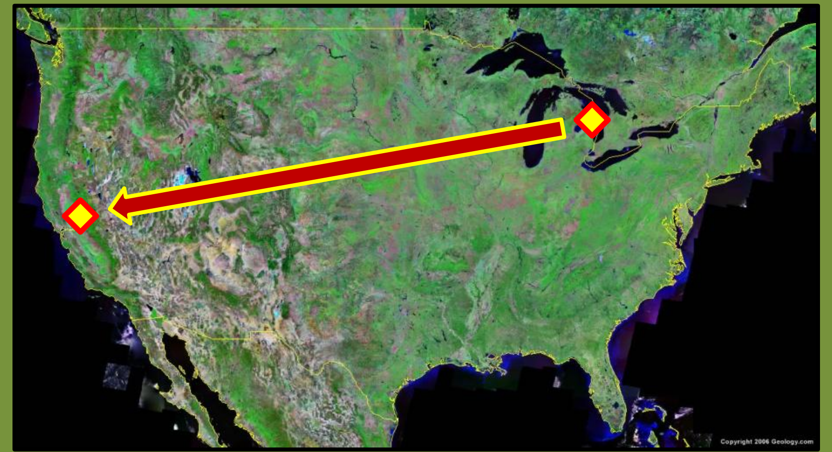

Image courtesy of Geology.com

Thesis Solution Statement

Image courtesy of SmithGroup

Image courtesy of SmithGroup

-Determine critical load case
-Adequacy of current system
-Analysis of different framing schemes
-Integration into architecture
-Benefits of systems

Structural System Analysis

Image courtesy of SmithGroup

- Forty foot spans difficult to maintain under new critical loading
- Column grid optimization
- Different framing systems analyzed
- Braced frame systems determined most efficient to resist the critical seismic load case

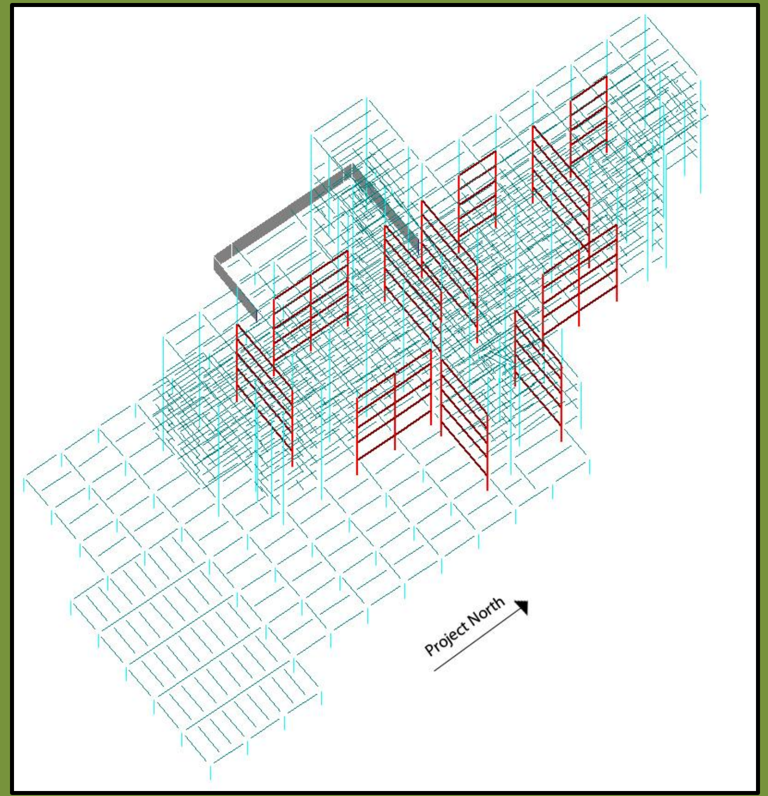

Image courtesy of Jamison Morse

Gravity Framing Changes

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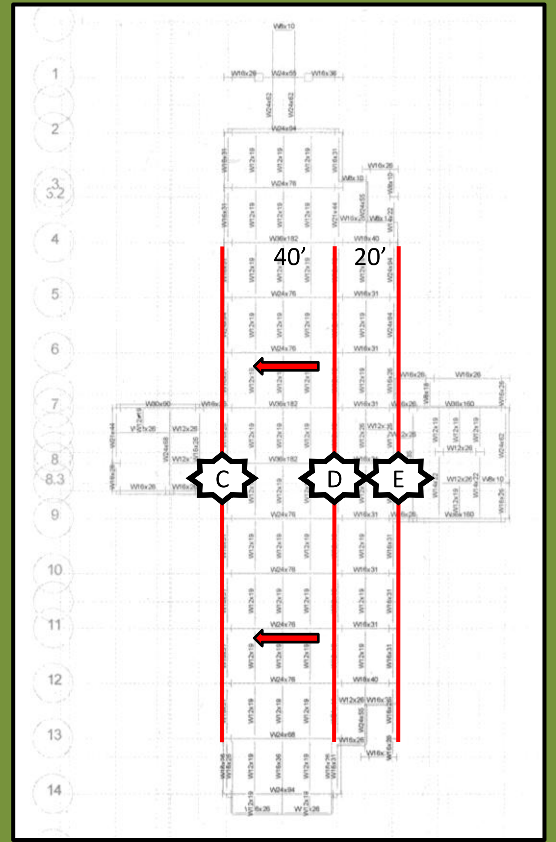

Image courtesy of Jamison Morse

-Column grid line spacing was originally 40’ between C and D and 20’ between D and E

-It was decided to move grid line D 10’ west to create two equally spaced column grids of 30’ each between column lines 4 and 13

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Advisor: Dr. Andres Lepage

Gravity Framing Changes

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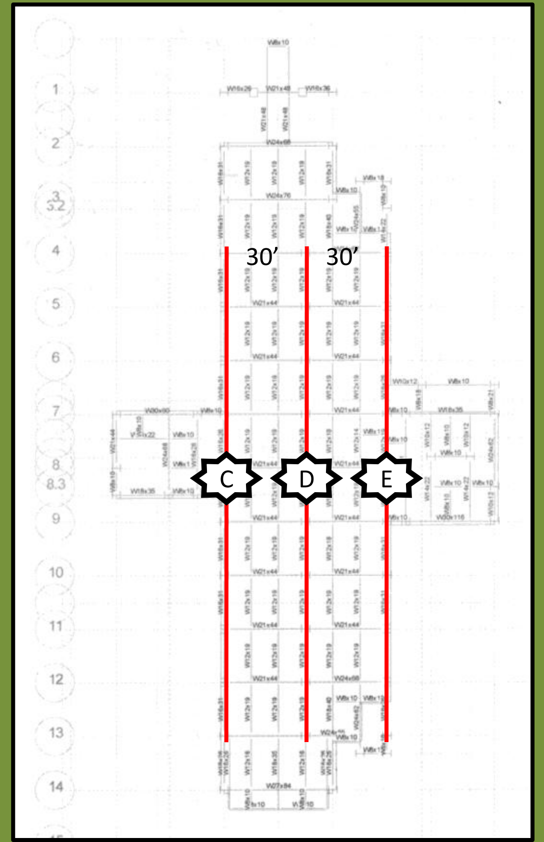

Image courtesy of Jamison Morse

- Much more efficient spacing to utilize for lateral framing system
- Symmetric bays and framing members improves efficiency

New Column Grid Impact

Image courtesy of SmithGroup

- Architectural implications
- Special moment frame drift issues
- Braced frames
  - Eccentrically braced frames
  - Concentrically braced frames
  - Architectural impact

Image courtesy of SmithGroup

Lateral System Layout

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Image courtesy of SmithGroup

-Frames could be integrated architecturally
-Placed to minimize conflicts
-Three 30’ wide frames in E-W
-Four 20’ wide frames in N-S

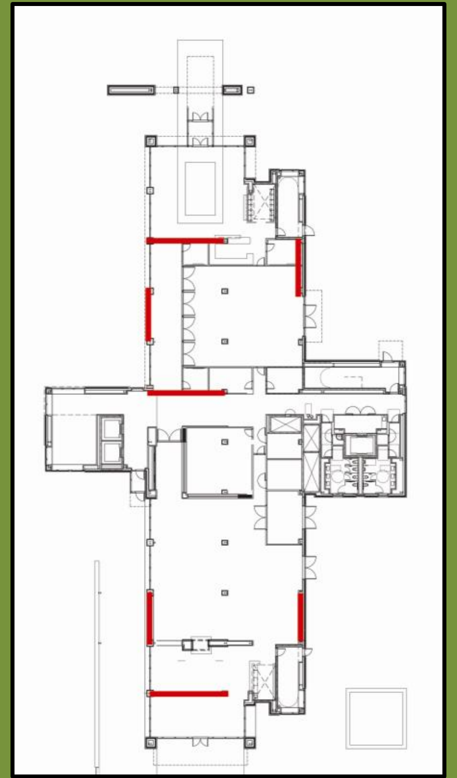
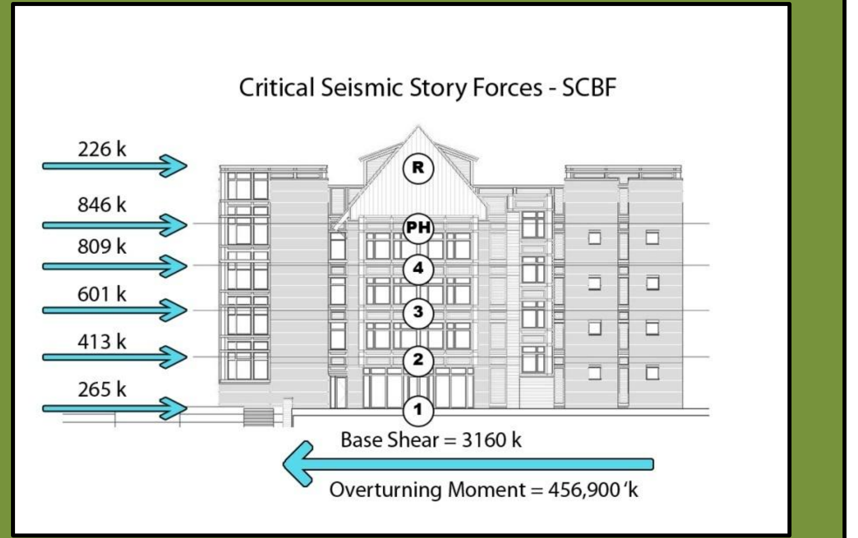


Image courtesy of Jamison Morse

Lateral System Design

Image courtesy of SmithGroup

Using ASCE 7-05:



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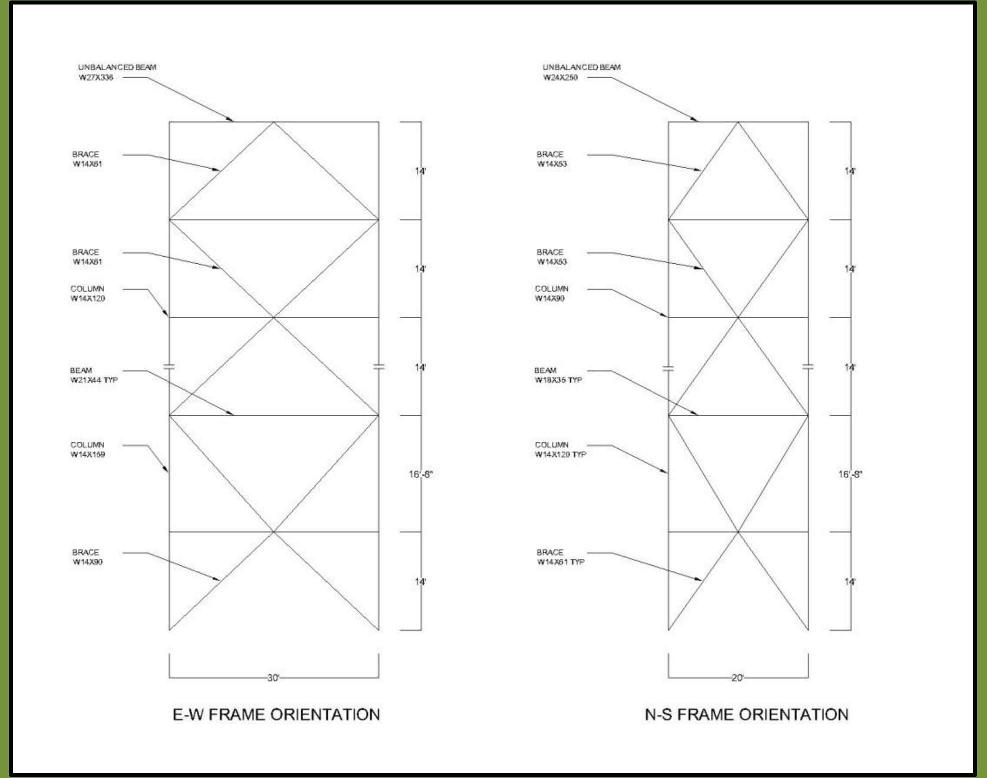

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Lateral System Connection

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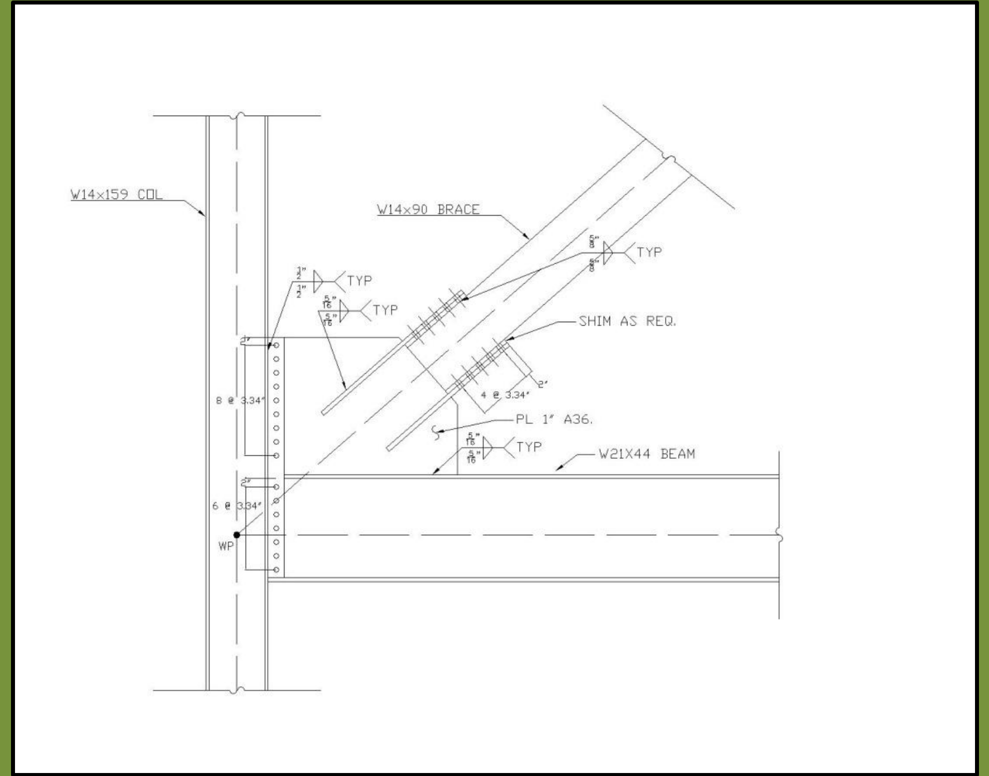

Image courtesy of Jamison Morse

-AISC Seismic Design Manual
-Detailed R=6 connection
-Wide flange brace

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Lateral System Design


Image courtesy of SmithGroup

Buckling Restrained Braced Frames
- -Braces designed to have compression strength equal to yield stress
- -Connection of R=8
- -More expensive braces
- -Smaller column sizes
- -Cheaper connections
- -No greater architectural impact

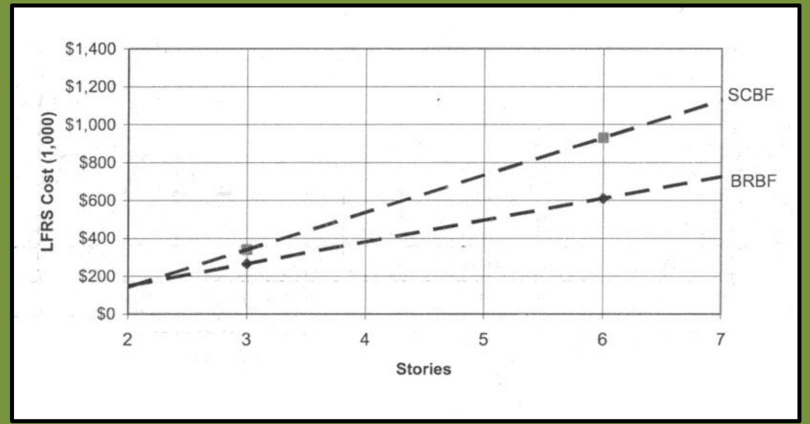

Image courtesy of Thornton Tomasetti

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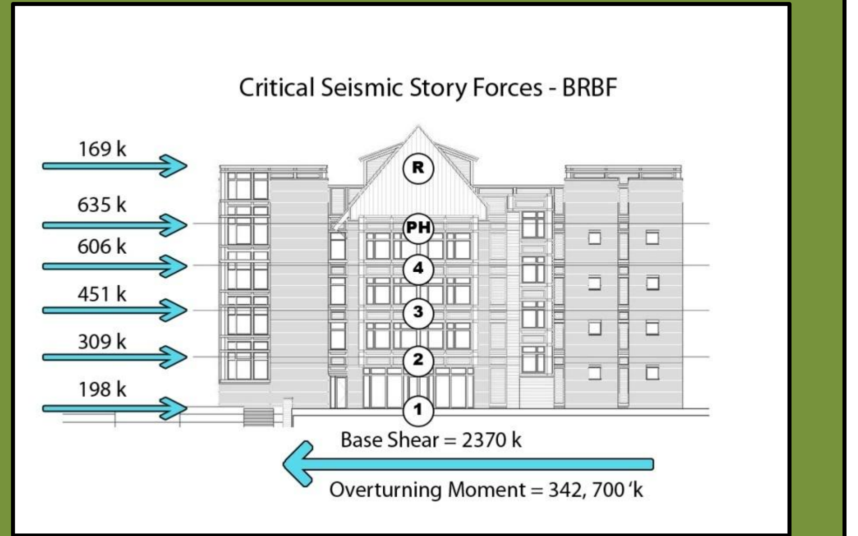

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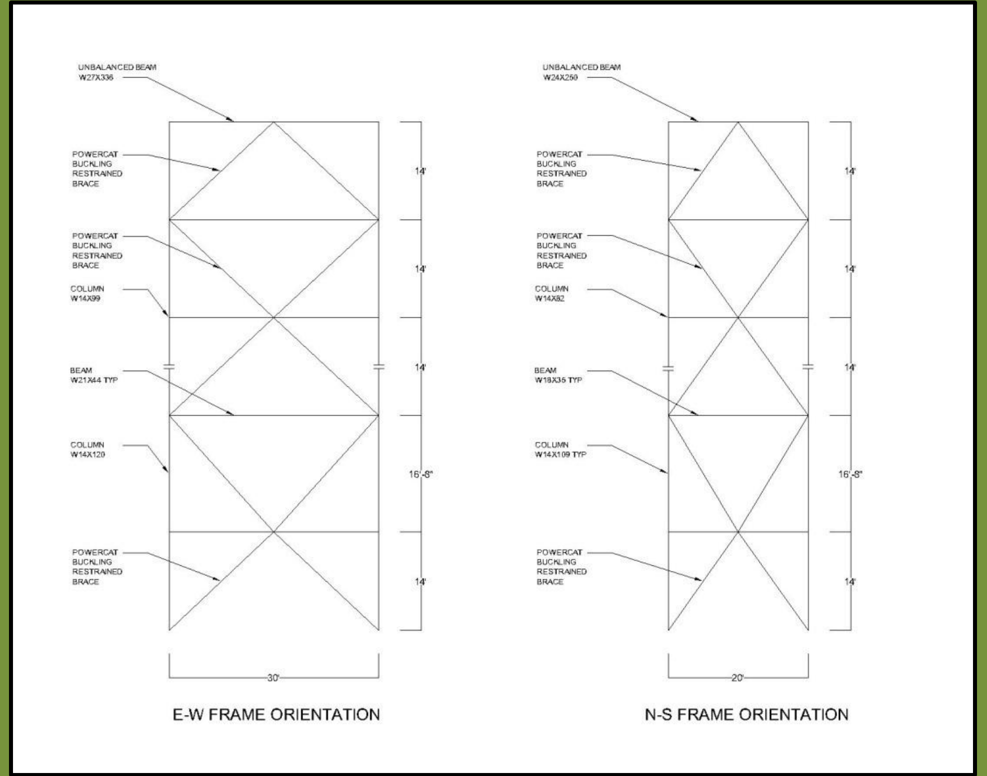

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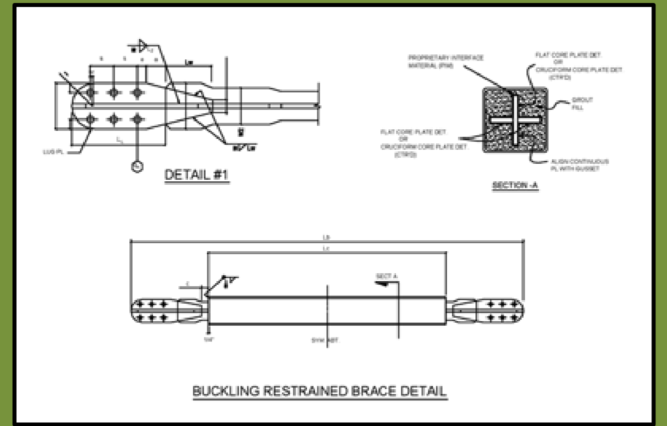

Image courtesy of CoreBrace

Image courtesy of Nippon Steel

Image courtesy of Star Seismic

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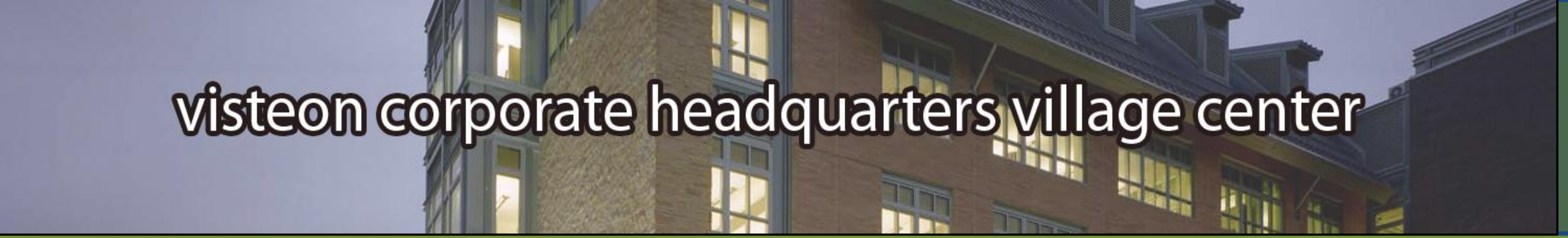

Lateral System Design

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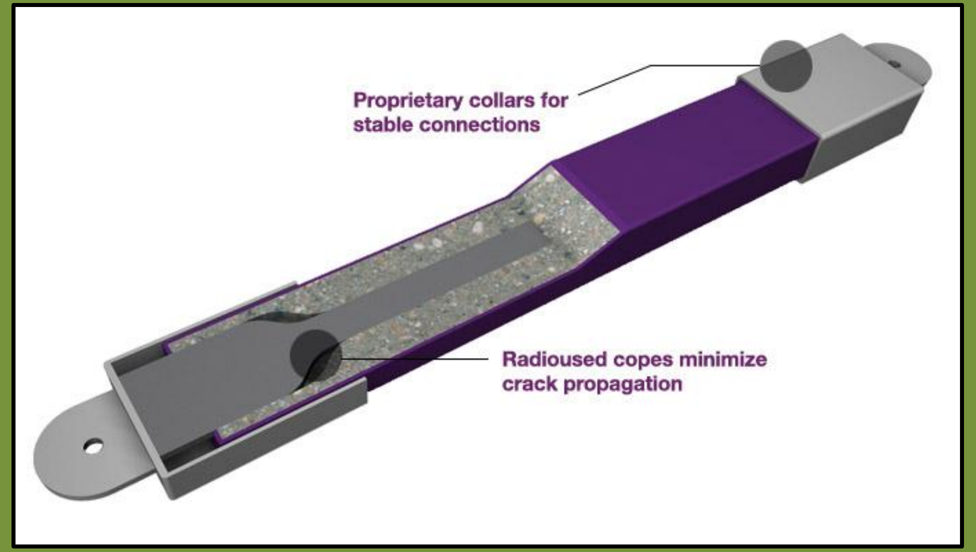


Image courtesy of Star Seismic

Star Seismic brace chosen
- PowerCat Model
- Efficient connections
  - Minimal material
  - No gusset stiffeners
  - Easy erection
- 15% reduction in overall steel cost

Lateral System Design

Image courtesy of SmithGroup

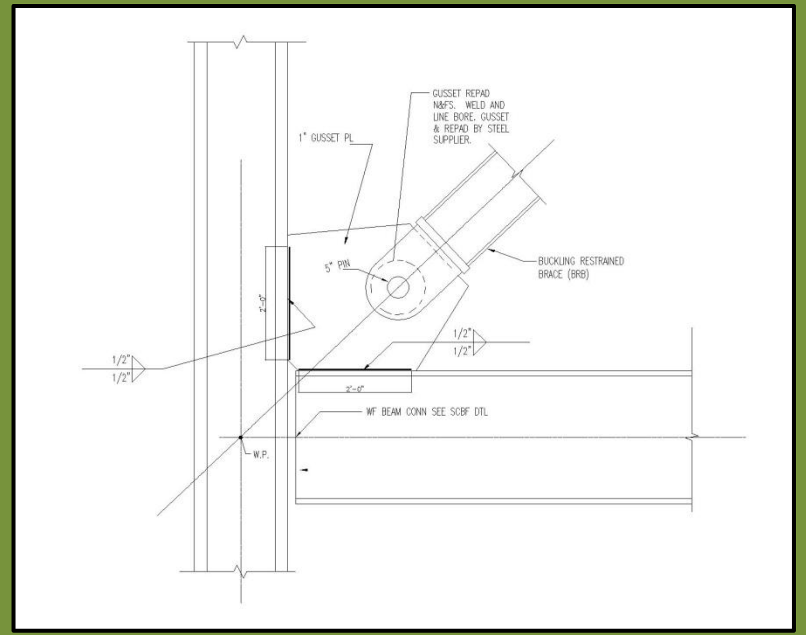


Image courtesy of Star Seismic

- -Connections sized for expected yield
- -RMS analysis done for impact on foundations

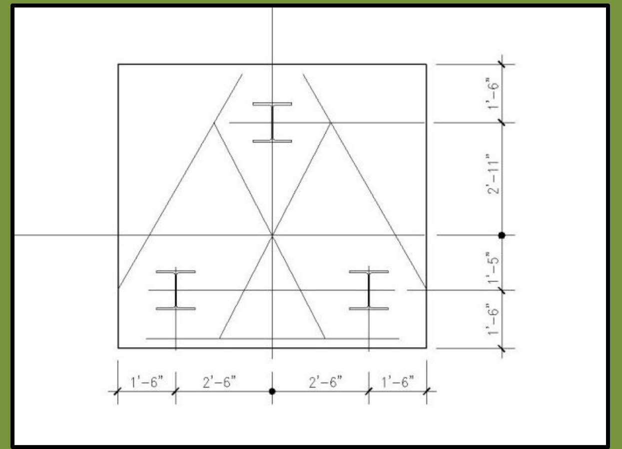
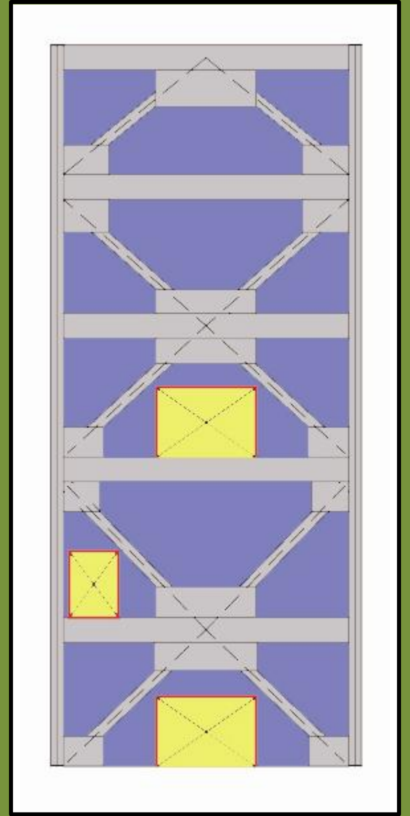


Image courtesy of SmithGroup

Architectural Impact

Image courtesy of SmithGroup

-Concurrent architectural breadth study performed during lateral system design
-Layout conducive to openings
-Small rough openings of 6'wide x 8' tall
-Large rough openings of 12' wide x 8' tall
-Feasibly integrated into building with chosen frame locations



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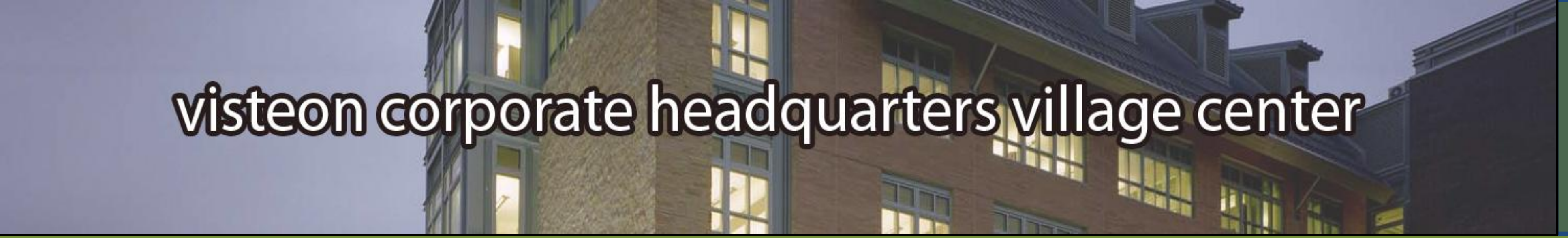
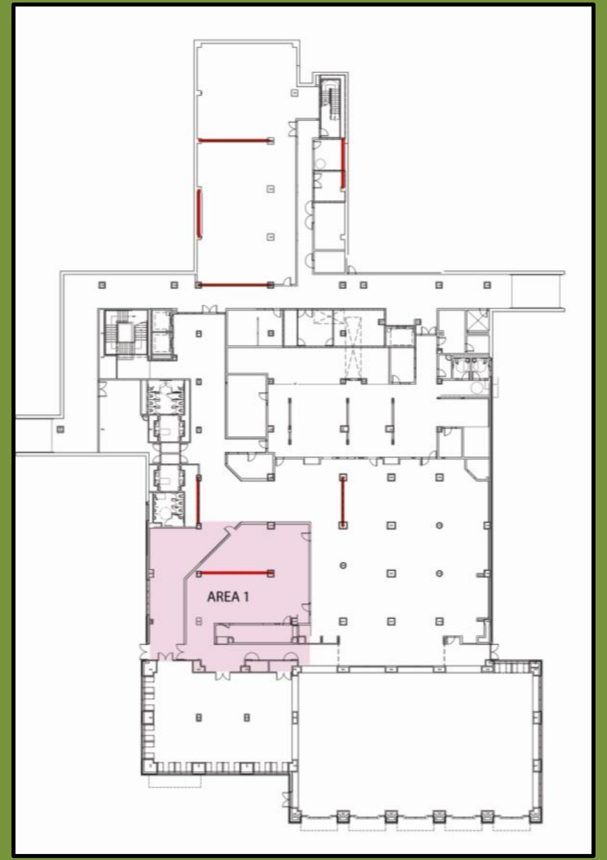
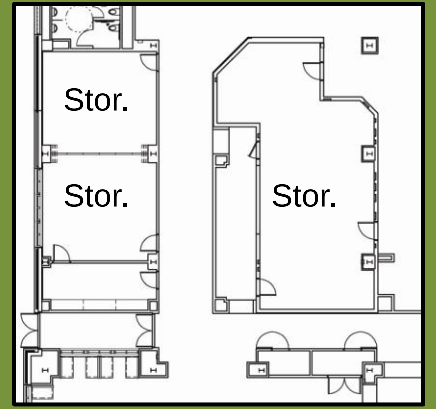


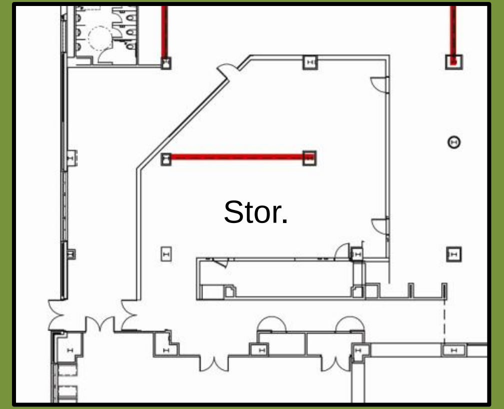
Architectural Impact – Area One


Image courtesy of SmithGroup





Original Design
750 ft^2

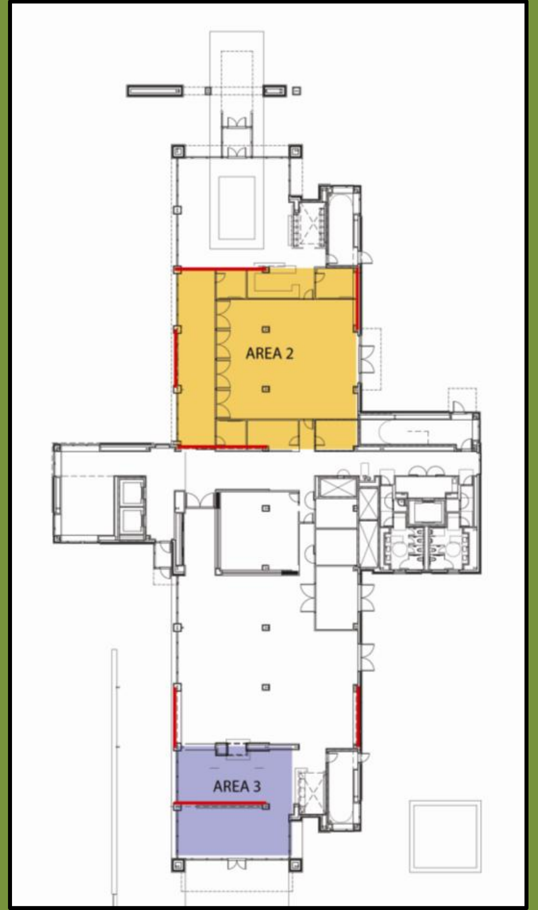


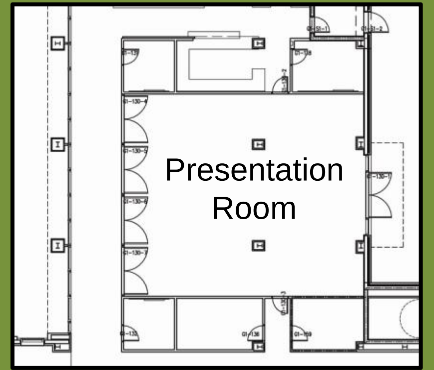
Modified Design
710 ft^2

Images courtesy of Jamison Morse

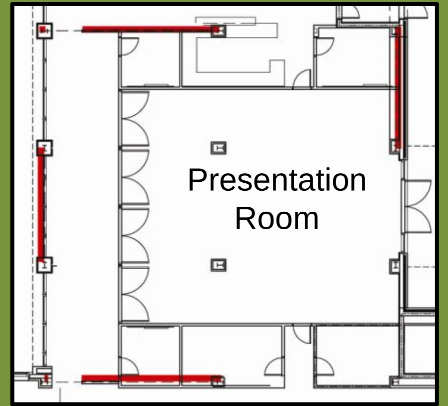
Architectural Impact – Area Two

Image courtesy of SmithGroup





Original Design



Modified Design

Images courtesy of Jamison Morse

Architectural Impact – Area Three

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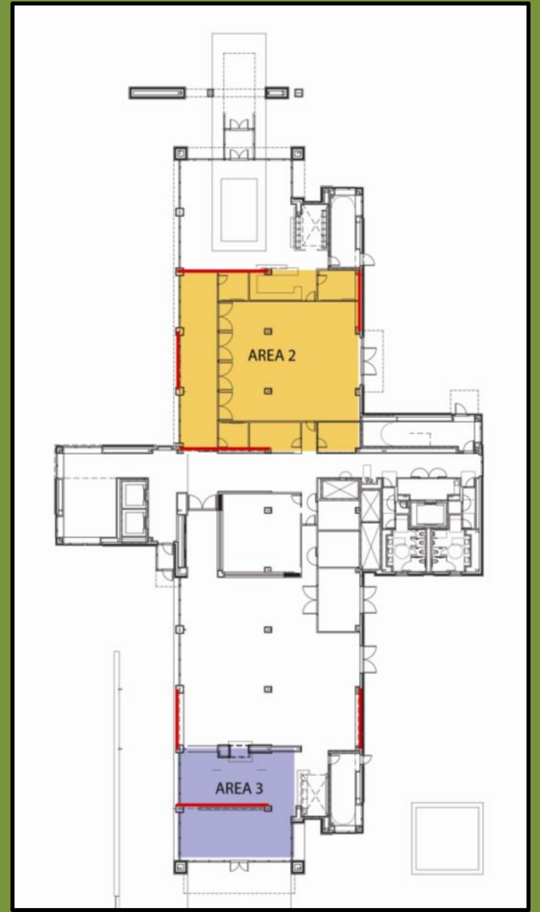

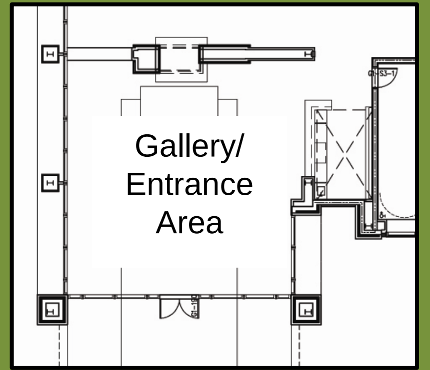

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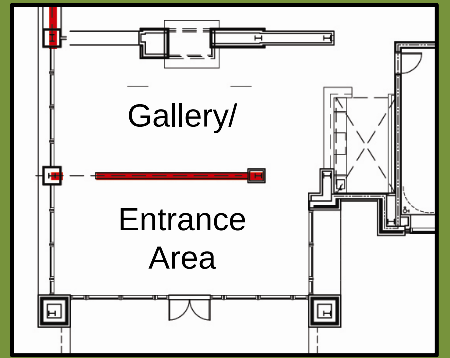

Modified Design

Images courtesy of Jamison Morse

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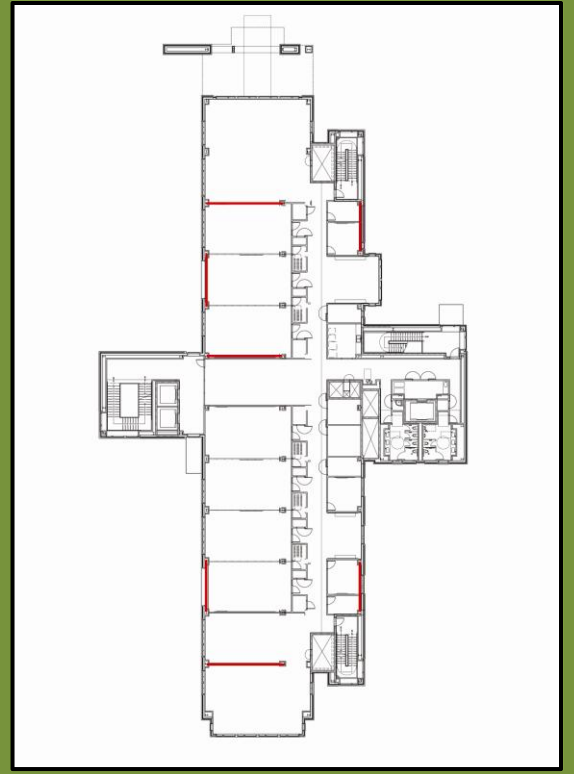
Architectural Impact

Image courtesy of SmithGroup



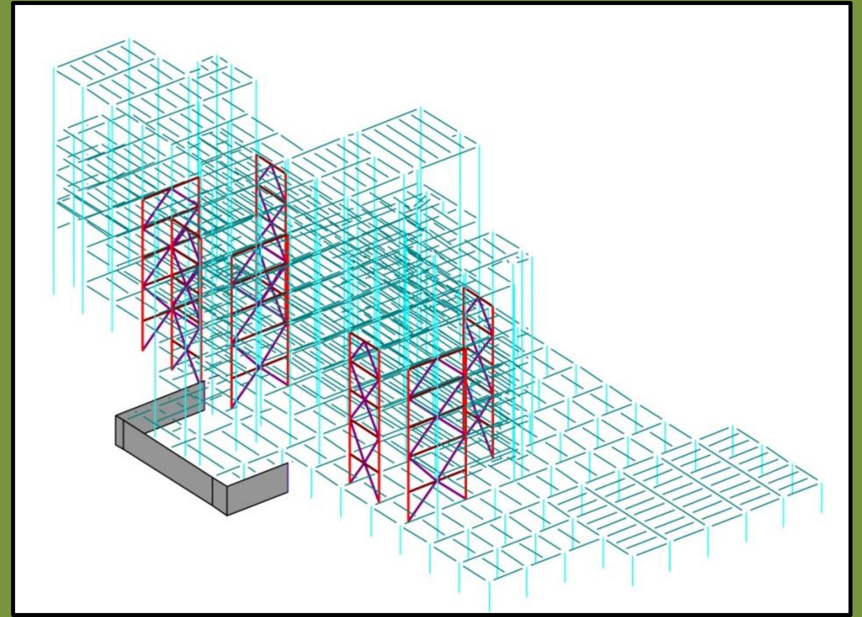
- All braces and columns fit within existing walls and are not obstructive
- Spandrel glass for aesthetics on exterior

Images courtesy of Jamison Morse

Overall Benefits

Image courtesy of SmithGroup

- Cost savings: About $65,000 in steel
  - Connections savings
  - Smaller column sizes
- Efficient handling of loading
- Feasibly integrated into architecture
- Potential cost savings in the future
  - Minimize damage to columns, beams, non-structural elements
  - Easy to uninstall, test, then reuse or replace



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- Prof M. Kevin Parfitt
- Prof Robert Holland
- Dr. Andres Lepage

My friends and family

Images courtesy of SmithGroup

Questions?

Image courtesy of SmithGroup

Question and Answer Session