Presentation Outline

- Introduction

Base Steel Redesign

Progressive Collapse

- Tie Force
- Alternative Path
- Enhanced Local Resistance

Architectural Breadth

Conclusions

Introduction

120,000 SF

10 Stories (90ft)

$40 Million

Aug. 2010 – Dec.2011

Project Team

Owner: Health Research

Architect & Engineer: EWING COLE

General Contractor: DPR Construction Inc.

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Progressive Collapse

UFC 4-023: Typical Action Classifications

Component	Deformation-Controlled Action	Force- Controlled Action
Moment Frames • Beams • Columns • Joints	 Moment (M) M --	 Shear (V) Axial load (P), V V[1]
Shear Walls	M, V	P
Braced Frames • Braces • Beams • Columns • Shear Link	 P -- -- V	 -- P P P, M
Connections	P, V, M[2]	P, V, M

Alternative Path Analysis

Interaction Equation

Moment Divided by m-factor
Expected Strengths Used
Typical Frames = 6

$$\frac{Pr}{\Omega * Pc} + \frac{\frac{8}{9}\left[\frac{Mrx}{\Omega * Mcx} + \frac{Mry}{\Omega * Mcy}\right]}{m - factor}$$

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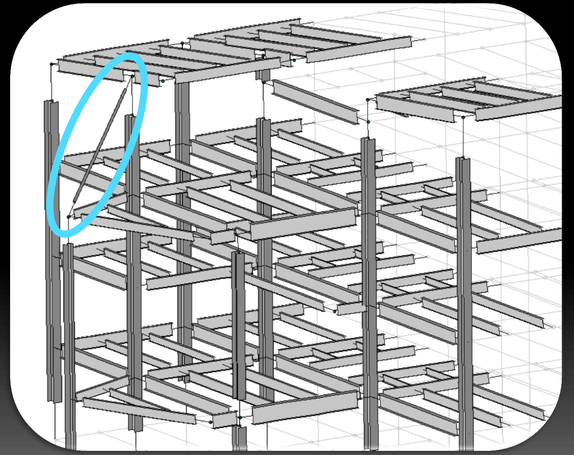
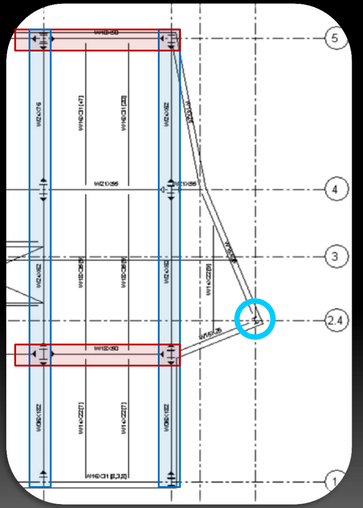
West Façade Column



Alternative Path Analysis



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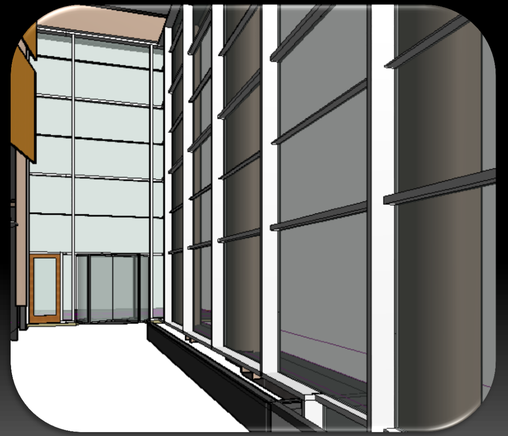
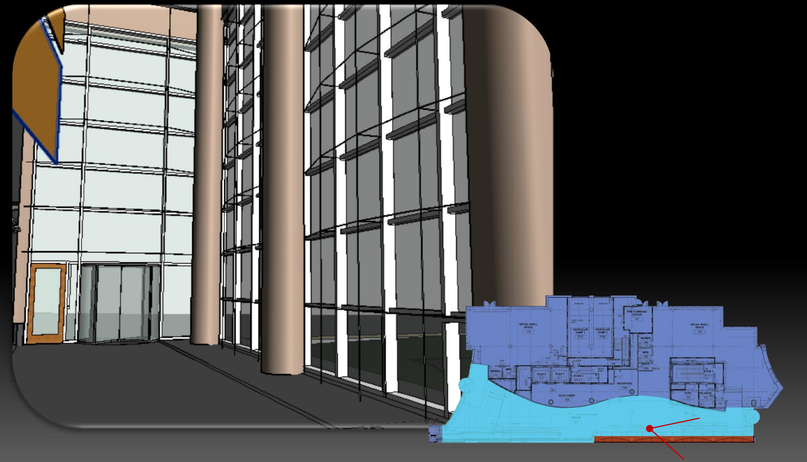
Architecture Breadth

Existing Interior Atrium View



Atrium Curtain Wall

Redesigned Interior Atrium View



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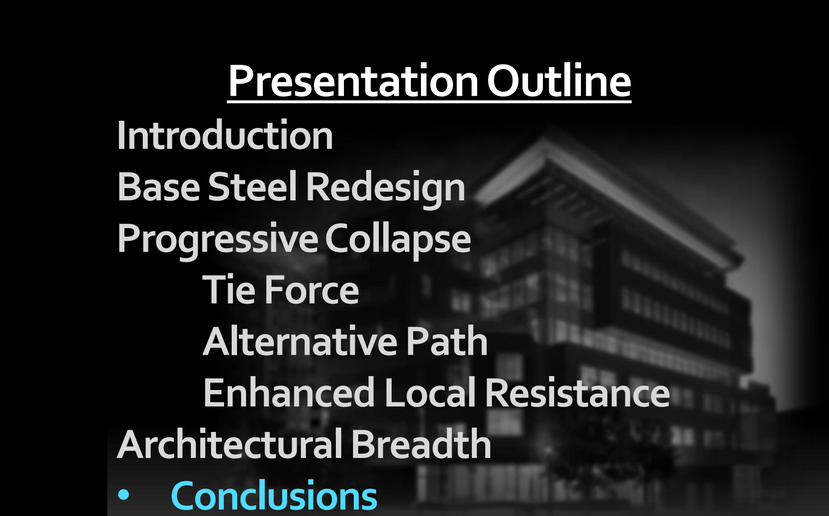

Conclusions

Goals

- ✓ Design to UFC criteria
- ✓ Explore impacts of this analysis
- ✓ Minimal architectural impact

Costs

Progressive Collapse Requirements

Slab Reinforcement: 596% Increase
Columns: 113% Increase
Beams: 9.9% Increase

Total Superstructure: 7.4% Increase