PRESENTATION OBJECTIVES

- Introduction
- Proposal
- Structural Depth
- Architecture Breadth
- Conclusions
- Designed and constructed by HBE
- $220 million bare building
- 600,000 SF
- 722,000 SF with future additions
- 7 stories (97.5 ft tall)
- Constructed: March 12, 2008 to April 22, 2011
NEW BUILDING

GRAVITY SYSTEM
- Composite steel beams
  Typically W16x26
- Composite 2VLI20 deck
- Columns typically W12's
  Splices at 2nd and 4th stories
- Max Span: 30 ft
  Typical Bay: 26' x 22'

FOUNDATIONS
- Spread Footings

LATERAL SYSTEM
- 48 eccentrically braced frames
- 2 concentrically braced frames
- Shear walls from ground to first floor
Structural Depth

- Determine if concrete flat slab system is less expensive
- Take advantage of moment frames to eliminate significant amount of braced frames
- Perform gravity and lateral analysis to meet strength, drift, and deflection criteria

Proposal

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Architecture Breadth

- Address occupant concerns
  Rearrange medical departments
  Remove structural braces from windows
- Continue hospital's goal of patient comfort
  Relocate healing garden
Structural Depth

- Determine if concrete flat slab system is less expensive
- Take advantage of moment frames to eliminate significant amount of braced frames
- Perform gravity and lateral analysis to meet strength, drift, and deflection criteria

Construction Management Breadth

- Cost Analysis
  - Existing Steel Structure
  - Redesigned Concrete Structure
- Schedule Analysis
  - Concrete construction
  - Comparison to steel

Architecture Breadth

- Address occupant concerns
  - Rearrange medical departments
  - Remove structural braces from windows
- Continue hospital's goal of patient comfort
  - Relocate healing garden

Cost Analysis
- Existing Steel Structure
- Redesigned Concrete Structure

Schedule Analysis
- Concrete construction
- Comparison to steel
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LOADS USED

- Dead: 145 psf
- Live: 100 psf
- Snow: 28 psf

Gravity Design

- Used CRSI Handbook to determine initial sizing
- Hand calculations for pure axial sizing
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LOADS USED
- Dead: 145 psf
- Live: 100 psf
- Snow: 28 psf

Structural Depth

Lateral Design

- Ran portal method for preliminary forces
Ran portal method for preliminary forces
Designed square columns using spColumn

Final sizes entered into spSlab to check slab and design reinforcement

Sizing became an iterative process between ETABS, spColumn, and spot checks by hand
Structural Depth

Lateral Design

- System had to meet acceptable drift values from seismic load (predominant load)
- Column forces had to fall within interaction diagram
- Geometry caused spike in moment forces at second story
- Addition of shear walls was most effective option
Shear Walls

- Shear walls dropped moment under column capacity
- From ASCE-7-10, lateral resistance now defined as dual system
- Drift values fell within criteria
Structural Depth – Final Design

Shear Walls
- Full height, 16” thick, 6,000 psi concrete

Flat Slab and Drop Panels
- 10”, 4,000 psi flat slab
- 10’ wide by 8.25” deep drop panels

Columns
- 30 x 30’s with 16 # 14 bars
- 24 x 24’s with 16 # 6 bars
- 20 x 20’s with 8 # 7 bars

Cost and Schedule Impacts
- Adds $10 million to structure costs
- Adds 6 weeks to construction schedule
PRESENTATION OBJECTIVES

- Introduction
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• Added weight at second story would require upsizing of structure

Architecture Breadth

Healing Garden

- Better views from patient windows
- Easily accessible at new location
Concrete Flat Slab System

Conclusions

PRESENTATION OBJECTIVES

- Introduction
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- Structural Depth
- **Architecture Breadth**
- Conclusions

- Meets all requirements to withstand gravity and lateral loads
- **Overall, could be an effective system**
- Not right for Orange Regional Medical Center
  - Outside of maximum budget
  - Longer construction
Thank You
### Existing Steel Costs

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### Concrete System Costs

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### Concrete Flat Slab Costs

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