ROOSEVELT ISLAND
SOUTHTOWN BUILDING NO. 5

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Roosevelt Island Southtown Building No. 5

- Presentation Overview
  - Introduction
  - Existing Structure
  - Problem Statement/Proposal
  - Structural Redesign
    - Girder-Slab System for Typical Floors
    - Composite Floor System for 1st Floor
    - Gravity Columns
    - Braced Frame Lateral System
  - Cost & Schedule
  - LEED Design and Sustainability
  - Conclusions

Roosevelt Island Southtown Building No. 5

Introduction

- 187' Luxury Condominium in NYC
- Located on Roosevelt Island in the East River
- Number 5 out of 9 new condos being built the Southtown development

Roosevelt Island Southtown Building No. 5

Introduction

- 130,000+ square feet
- $51million to build
- 16 stories with a one story cellar below grade
- 123 – 1,2 and 3 bedroom condominiums
- Additional Amenities:
  - full service health club
  - children's day care center
  - green roof and private terraces

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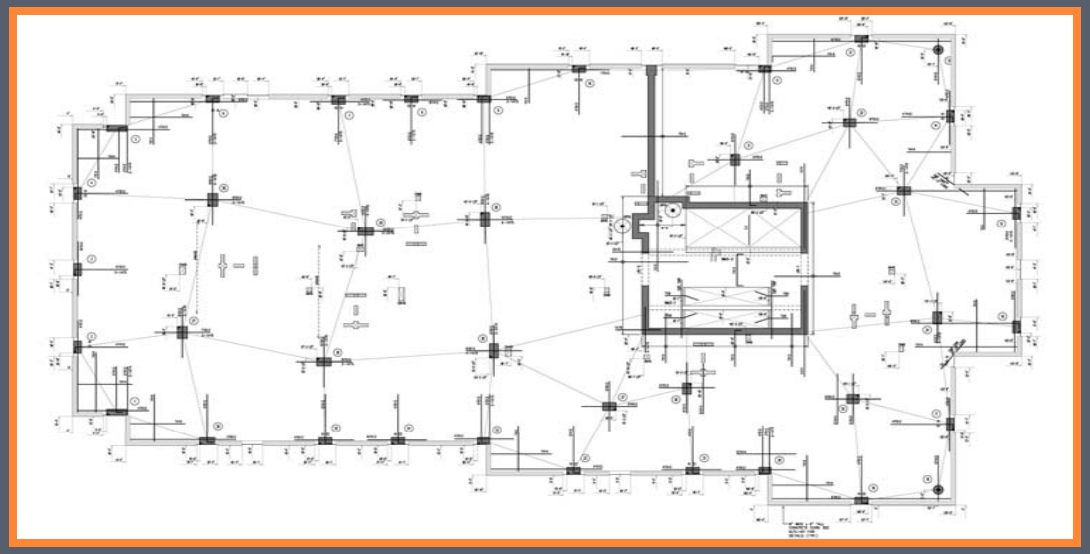
- Existing Structure – Gravity System
  - 9'-4" Floor-to-floor height (typ.)
  - 8" Reinforced Concrete Flat Plate (typ.)
    - f'c = 4ksi
    - Mild steel reinforcement in slabs
  - Staggered Bay Sizes
  - Rectangular Columns, various sizes and orientation



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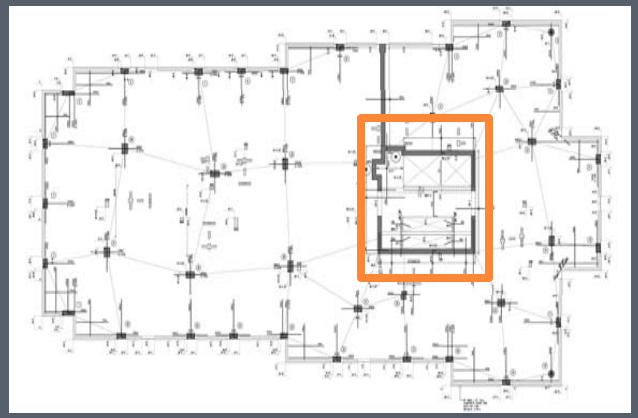
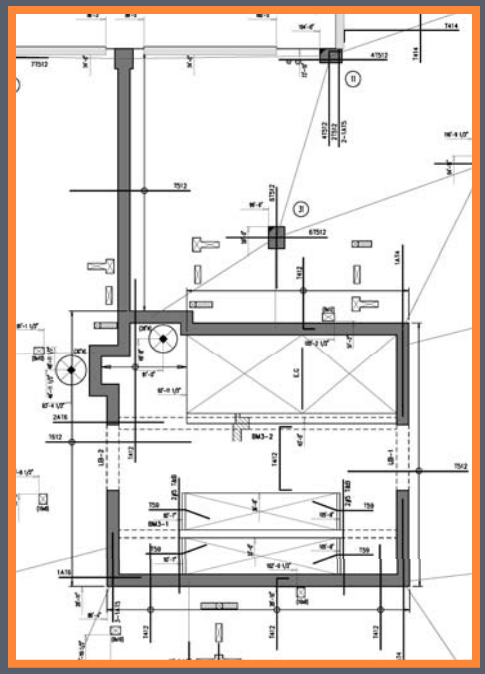
- Existing Structure – Lateral System
  - Reinforced Concrete Shear Walls
    - Located around stairwell and elevator core
  - Typically 12” wide
  - Concrete varies in strength
    - 7ksi at cellar – 5ksi at roof





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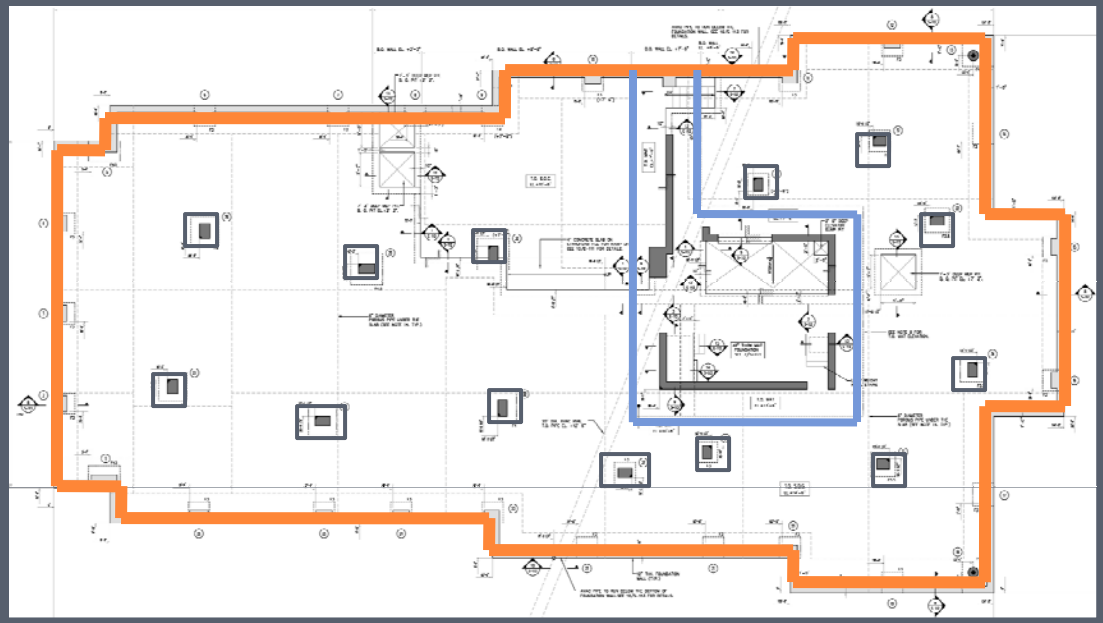
- Existing Structure – Foundation
  - Spread Footings under Gravity Columns
  - 42” Mat Foundation used under Shear Walls
  - 12” Foundation Wall used around the perimeter



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Problem Statement

- Strict Height Restriction
  - New York City Zoning Regulations
  - 187’ from the datum

- Keep existing architecture consistent
  - New York State Urban Development Corporation
  - Masterplan developed by Philip Johnson and John Burgee

Roosevelt Island Southtown Building No. 5

- Proposal Goals
  - Redesign Structure using Girder-Slab Floor System and Braced Frame Lateral System
    - Do not exceed 187'
    - Maintain 9'-4" typical floor-to-floor height
    - Stay as close to an 8" floor as possible
  - Design the building as environmentally friendly as possible.
    - Earn LEED certified rating

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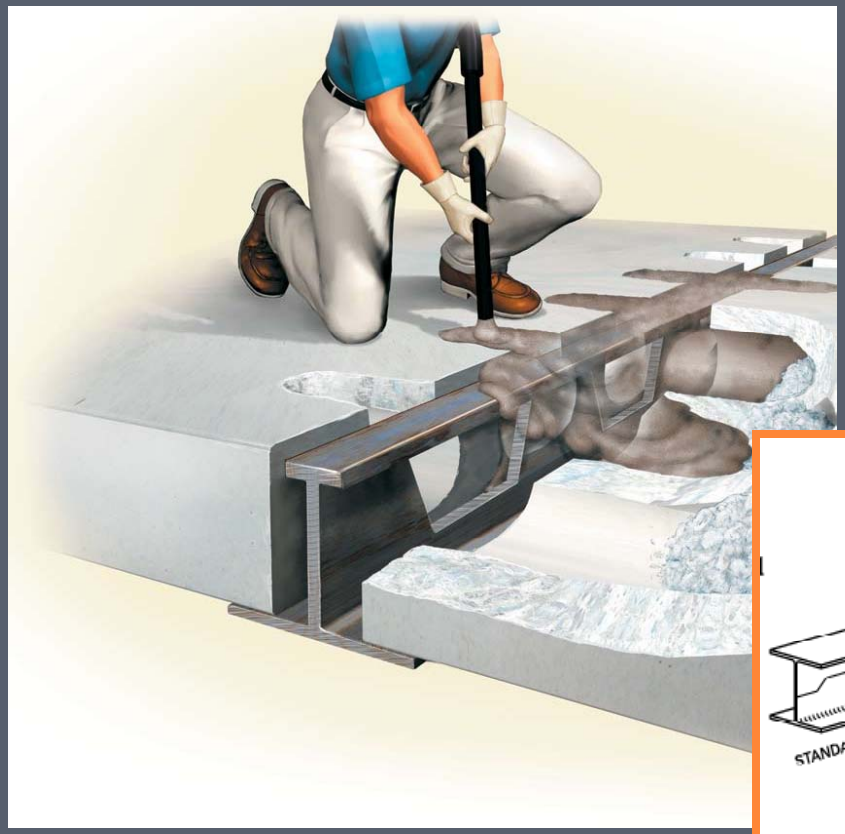
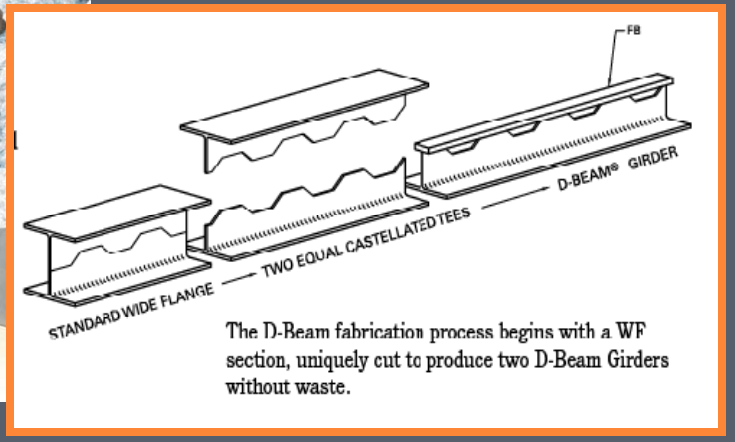
Girder-Slab System for Typical Floors 2-16



- Floor System develops composite action through grouting



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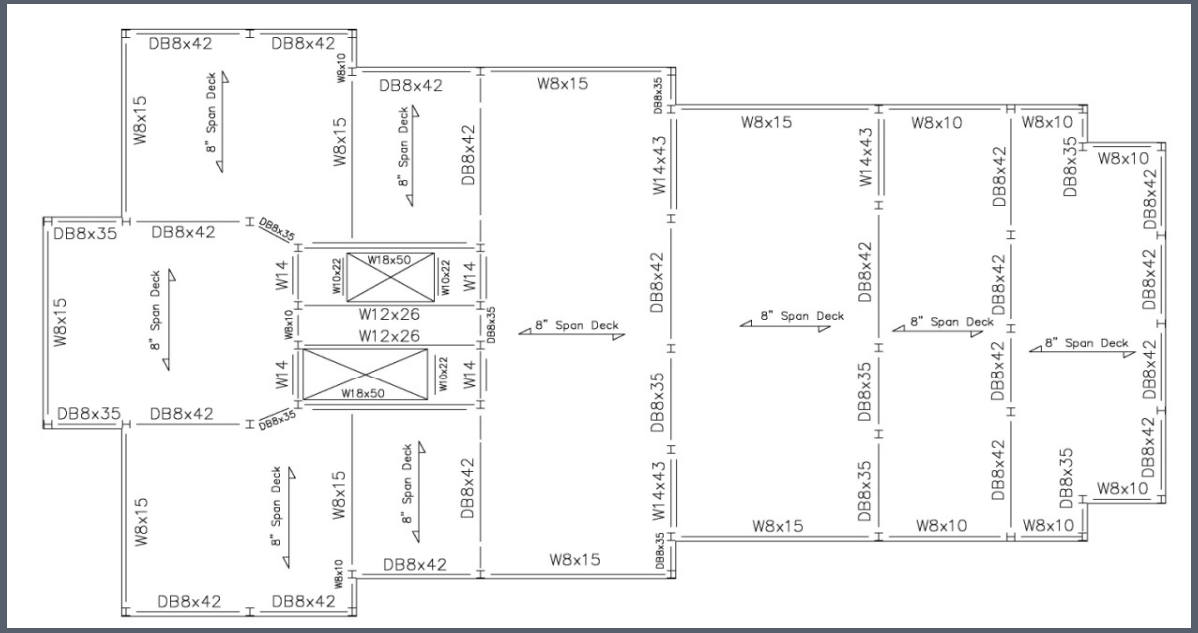

- Typical Floor with 8" Hollow Core Floor Planks
  - ¾" topping to level floor surfaces
- Comprised of DB8x35 and DB8x42

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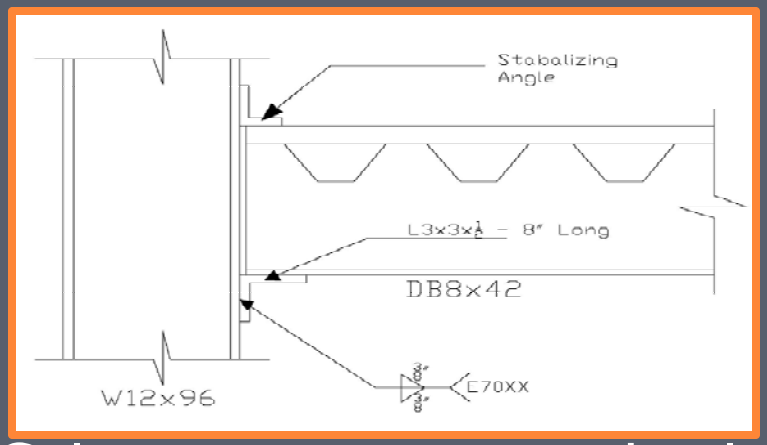
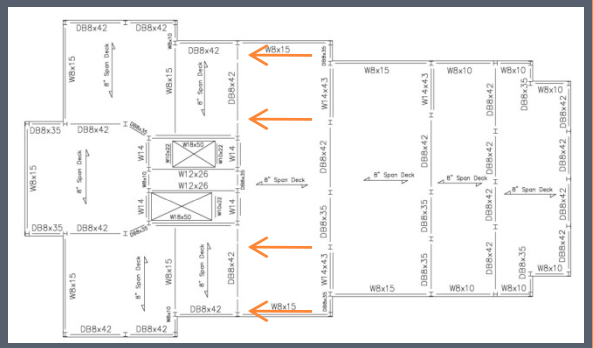
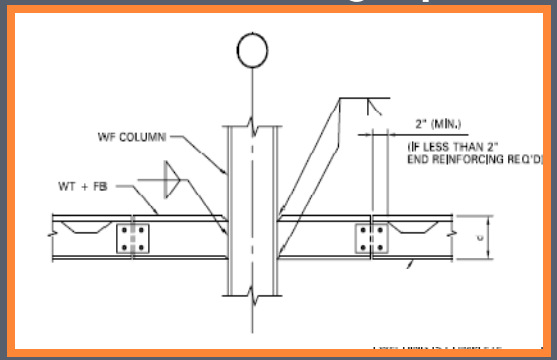
Girder-Slab System for Typical Floors 2-16

- Unstiffened Seat Connection used in most areas



- "Tree" Column connection used in long spans





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- Composite Floor System for 1st Floor
  - Design Considerations
    - Maintain same column grid
    - Resist increased Live Load of 100psf
    - Limit floor deflections to within L/360
  - Design Method
    - Allowable Stress Design Method
    - RAM Structural System

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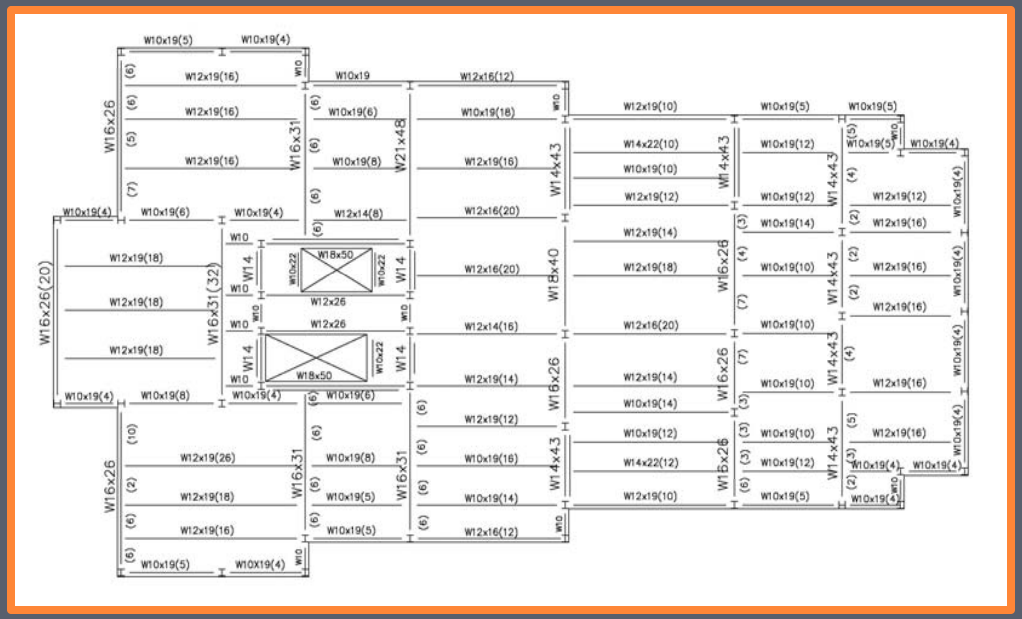
Composite Floor System for 1st Floor

First Floor Framing Plan

- 20 gauge USD 2" Lok-Floor Metal Deck
- 3" normal weight concrete slab above
- 3/4 " shear studs



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Composite Floor System for 1st Floor

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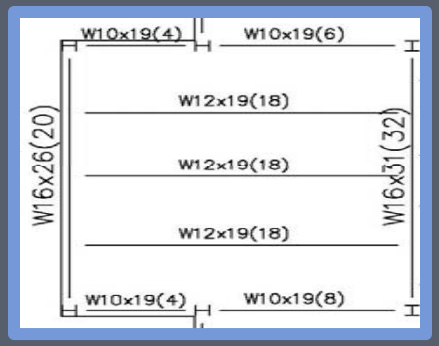
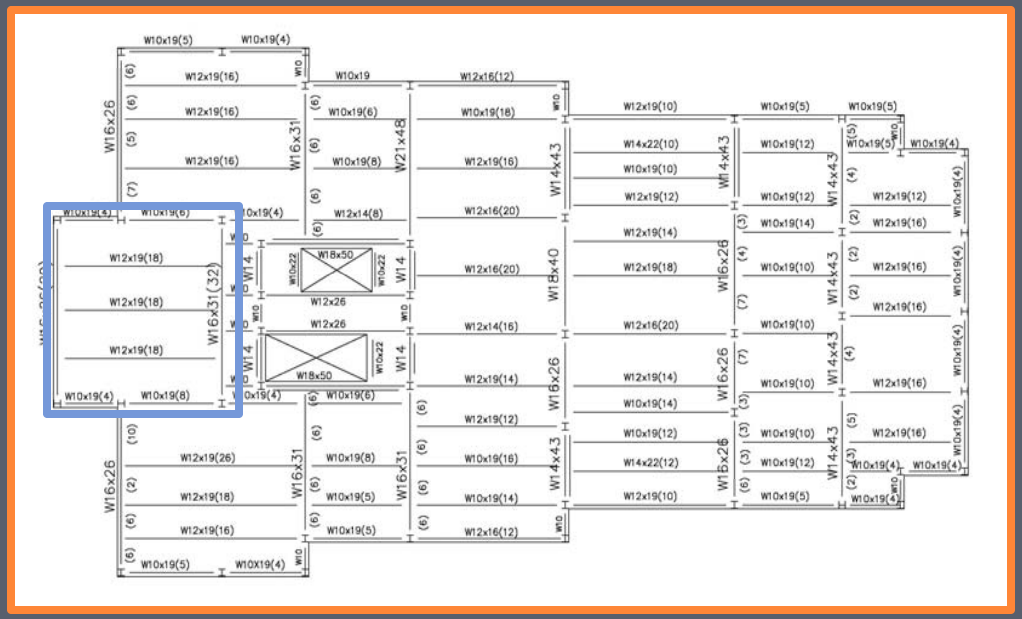
Deflection controlled the design



I_x = 168in^4 for beams
I_x = 497in^4 for girders



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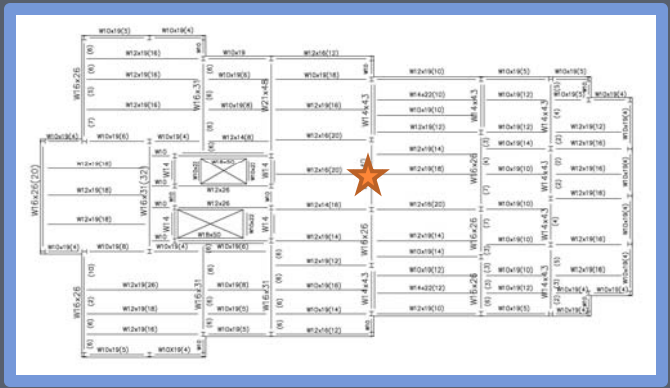
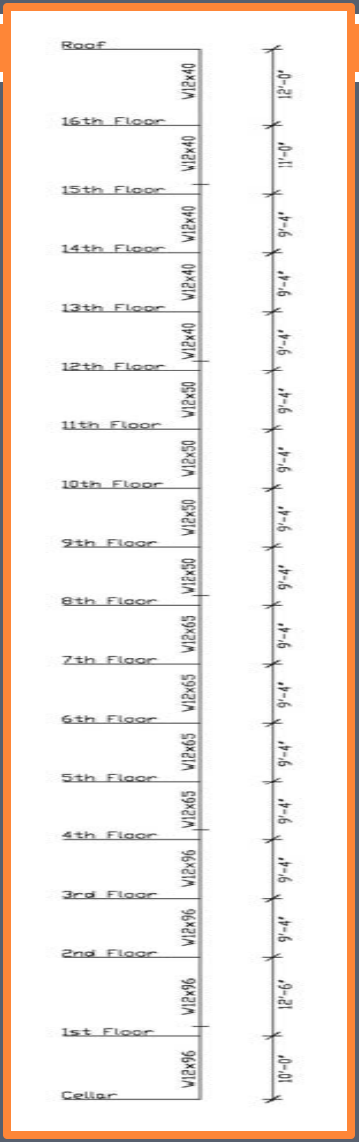
Gravity Columns

Design Method

- Allowable Stress Design
- RAM Structural System
- Spliced at every 4 floors





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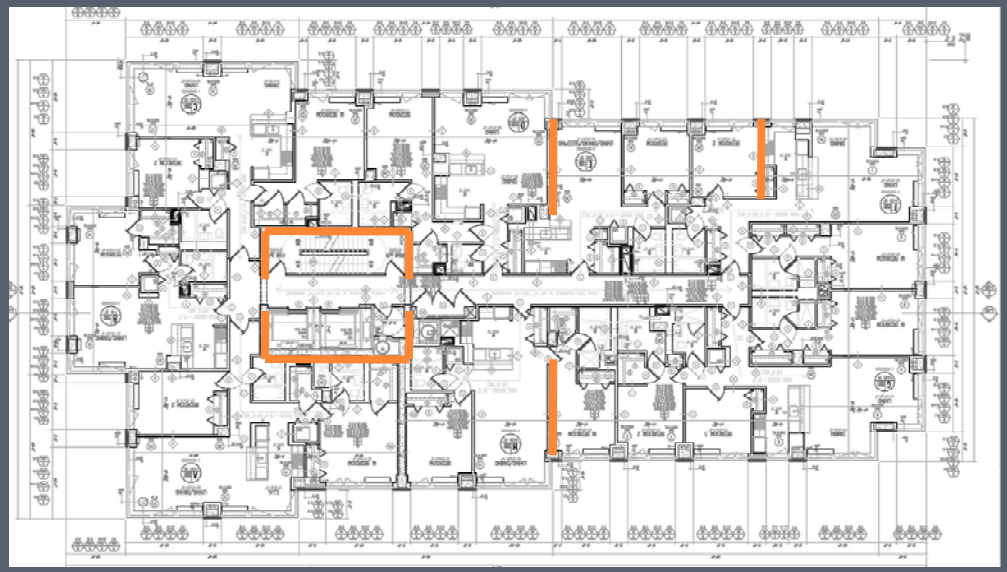
Braced Frame Lateral System

Design Considerations

- Keep consistent framing as gravity columns
- Do not disturb architectural plans
- Least intrusive as possible



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Braced Frame Lateral System

Lateral Loads Obtained from ASCE7-05

Wind Loads

- Classification Category: II
- Basic Wind Speed: 110 mph
- Exposure Category: C

- Base Shear
  - N-S = 908 kips
  - E-W = 454 kips

Seismic Loads

Equivalent Lateral Force Method

- Seismic Design Category: B
- SDS = 0.363 SD1 = 0.112
- R = 3.25, concentric braced frames

- Base Shear = 406 kips

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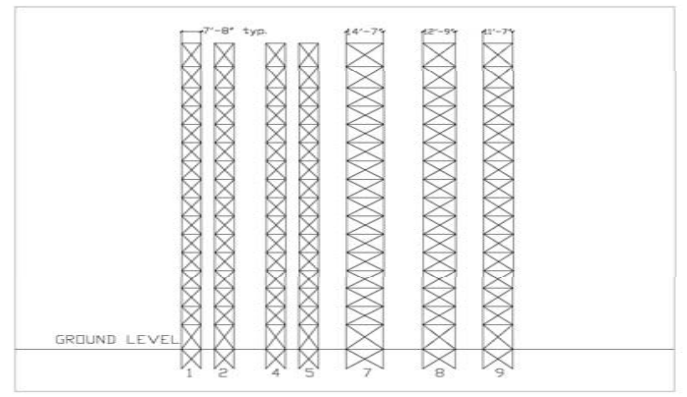
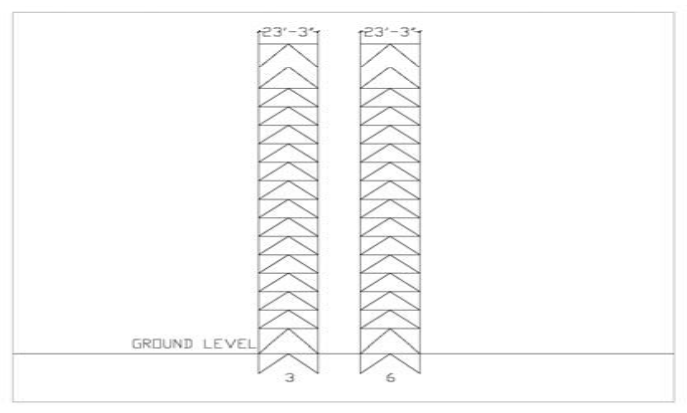
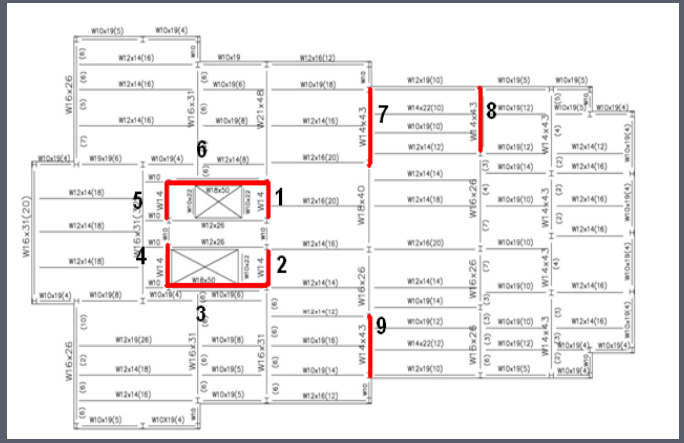
Braced Frame Lateral System

Used variety of X-bracing and Chevrons





- HSS members used as braces



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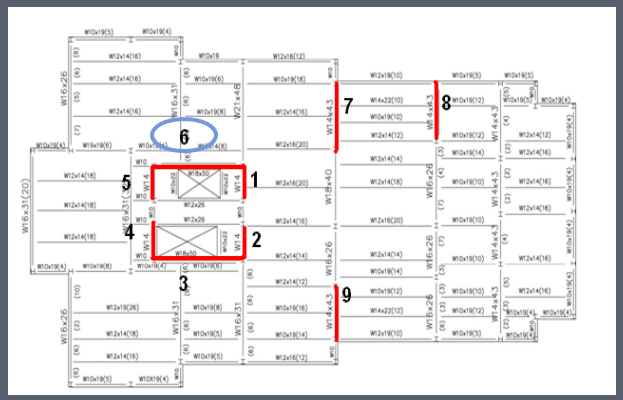
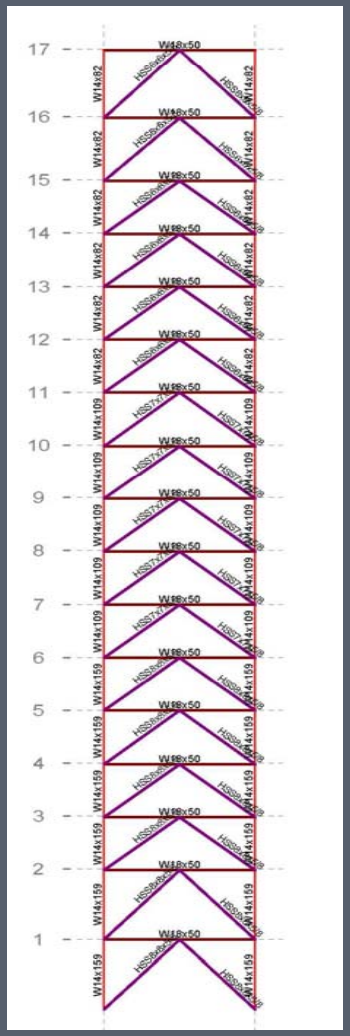
- Braced Frame Lateral System
  - Members checked for Allowable Stress Design Load Combos
    - Member Code Check was performed in RAM
  - Design of Frames controlled by H/400
  - Iterative Process which consisted of increasing column and brace sizing



Frame 6
Member Sizes



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- Structural Recap
  - ☑ Girder-Slab system achieves comparable floor thickness
  - ☑ Composite floor system able to withstand increased live loads
  - ☑ Braced Frames able to resist applied lateral loads

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Cost and Schedule Breadth

- Comparison of material, labor, and erection costs
- RS Means 2007 Construction Cost Data
  - Location Factory of 1.31 for New York City

Existing Concrete System	
Floor Slabs	$2,036,000
Columns	$929,000
Shear Walls	$240,000
Foundation Walls	$76,000
Spread Footings	$10,900
Mat Foundation	$56,000
Total:	$3,347,900

Proposed Girder Slab System	
Braced Frame Lateral System	893,300
Composite Floor 1	140,000
Girder-Slab Floors 2-16	1,928,000
Columns	500,000
Erection Costs	354,600
Spandrel Beams	108,000
Fireproofing	259,000
Foundation Walls	75,500
Spread Footings	10,900
Mat Foundation	56,100
Total:	$4,325,400

Girder-Slab system cost roughly $1million more than CIP Concrete System

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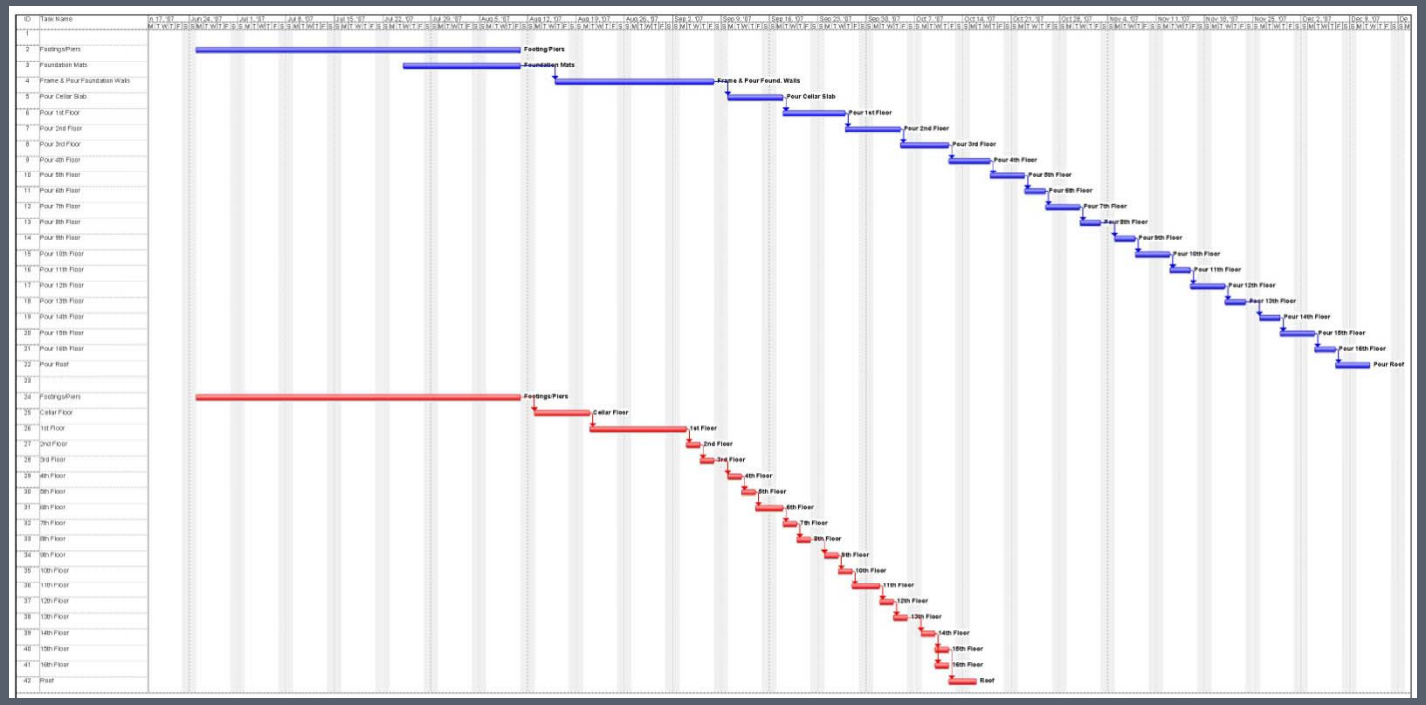
Cost and Schedule Breadth

- Blue represents CIP Concrete System: Typical Floor takes 3 days
- Red represents Girder-Slab System: Typical Floor Takes 1-2 days



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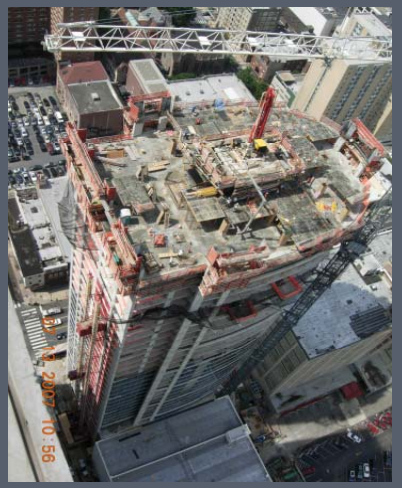
Cost and Schedule Breadth

Erection of Girder-Slab System:
80 Working Days



Erection of Cast-in-Place System:
122 Working Days

Save 42 Working Days =
Over 2 Months Total

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Cost and Schedule Breadth Recap

- Girder-Slab System costs approx. $1 million more than existing CIP Structure
- Girder-Slab System can be erected approx. 2 months quicker than existing CIP Structure
- Owner would generate more revenue by interest gains and less money to pay back in construction loans

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- LEED Design and Sustainability Breadth
  - Sustainable Site – 9 Credits
    - Additional 2000 sq. ft. of vegetative roof
    - Site located only 30 ft. from river
  - Water Efficiency – 5 Credits
    - Wastewater treatment system treats 100% of building wastewater
    - Stormwater storage tank used for irregation needs
    - Low-flow appliances and fixtures
  - Energy and Atmosphere – 3 Credits
    - Energy-10 model created
    - PTAC units vs. Air Source Heat Pump
    - 18% Energy Reduction per floor

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Conclusions and Recommendations

- Use Existing Cast-in-Place Concrete System
  - New York City's concrete workers are very efficient
  - Use of multiple unions for G-S system would be more strenuous
  - Job site could become cluttered with multiple unions
  - Less money to build

Engineer of record	Steven Stein
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Questions?

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- Footing Redesign
  - Original Interior Footing:
    - Large Mat around core
    - 13 interior CIP columns
    - 4'-6" Square Footing, 30" thick, (8) #8 bars each direction
    - 1.9 cubic yards per footing
  - Redesigned Footing:
    - Smaller Mat Around Core + Spread Footings under Lateral Frames
    - 6 interior steel columns
    - 6'-0" Square Footing, 26" thick, (9) #6 bars each direction
    - 2.9 cubic yards per footing

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Footing Redesign