Hakuna Resort

Swift Water, Pennsylvania

Technical Report 3

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Structural Option
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Background Information

- Location: Swiftwater, PA
- Function – Hotel & Retail
- Number of Stories: 8
- Size: 395,938 Gross SF
- Architect: Architectural Design Consultant, Inc.
- Structural: Harwood Engineering Consultants

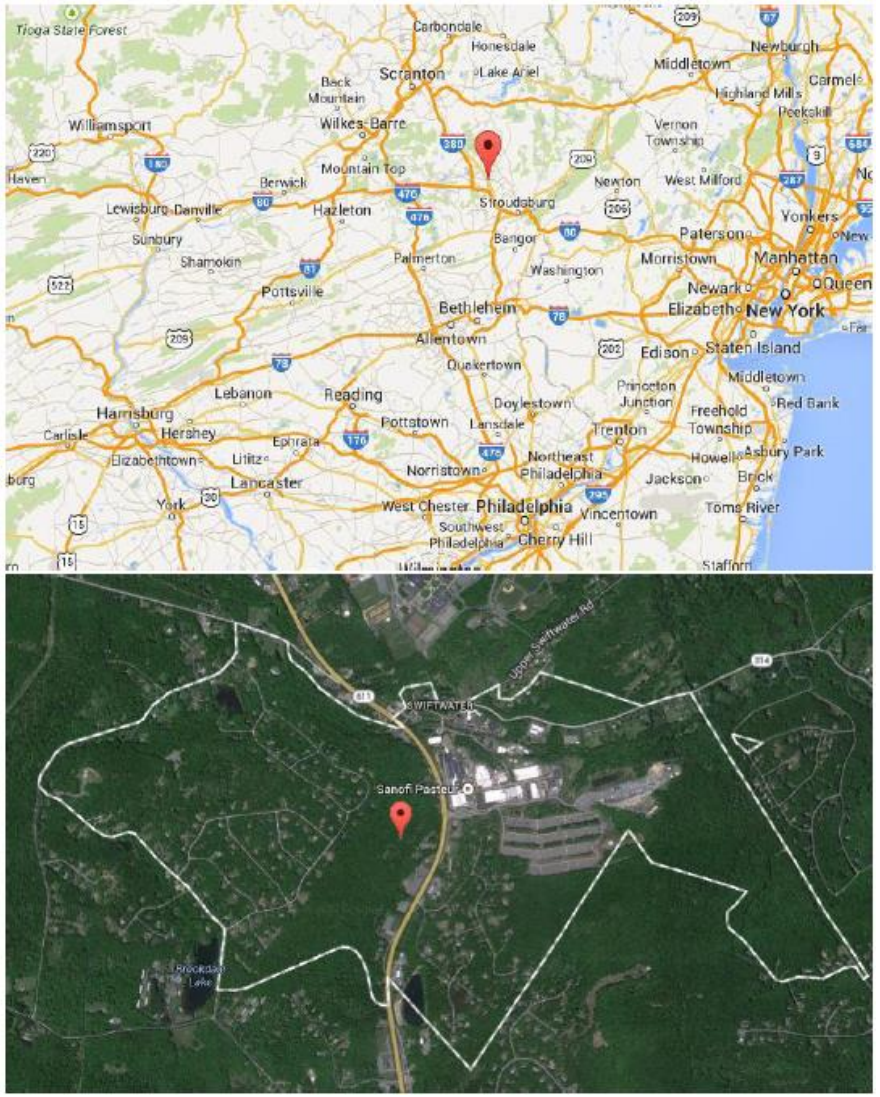


Image source: http://maps.google.com

Existing Structural System

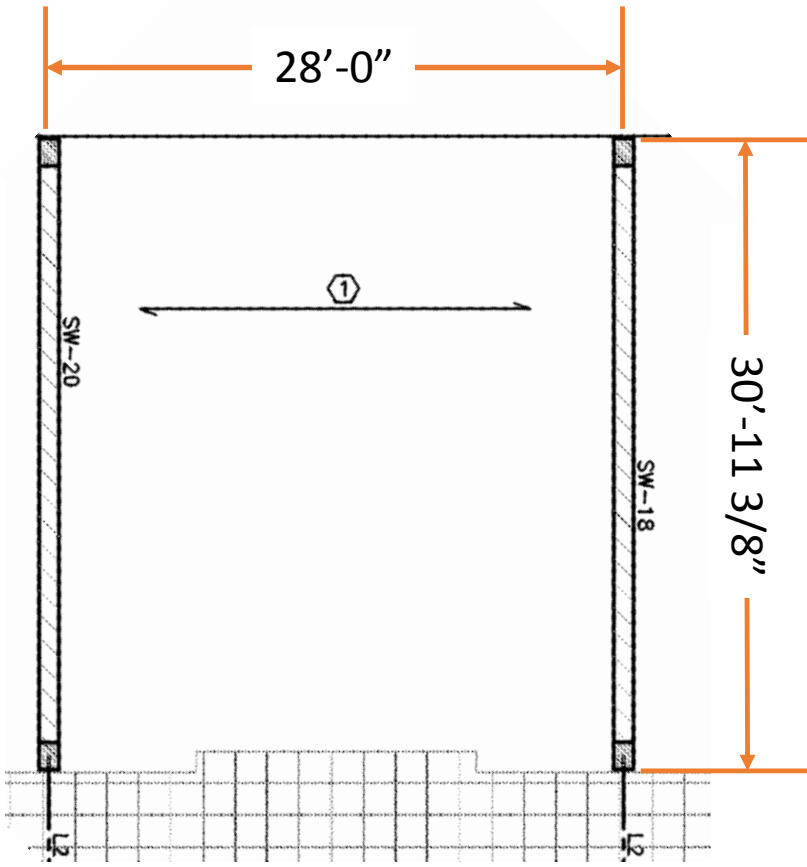
- Prestressed precast hollow core slab
- Masonry wall
- Steel wide flange beams and columns
- Reinforced concrete piers

Image source: http://www.cprestress.com/hollowcore

Typical Bay

Typical Bay

- 10” Hollow core plank w/ 3” topping
- 12” Masonry wall
  - #5 @ 48” o.c. vertical reinforcing
  - Fully grouted
  - 32” masonry pier w/ (4) #5

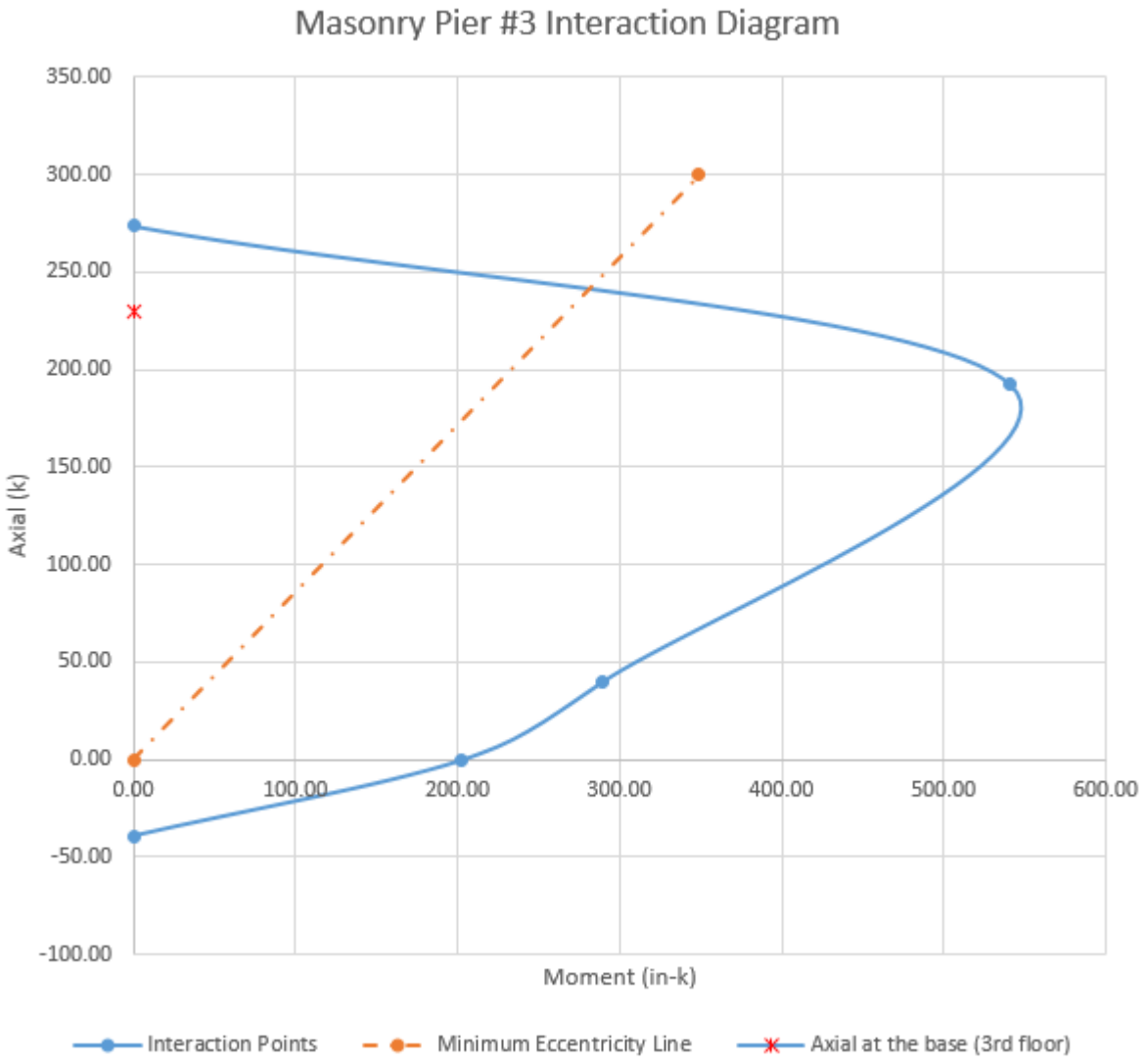


Gravity Spot Checks

- Hollow Core Plank
  - Strength
    - 192.4 ft-kip > 122.0 ft-kip
  - Horizontal Shear
    - 34 kips > 12.1 kips
  - Deflection
    - Initial camber: 0.132”
    - Long-term camber: 0.233”
    - Final downward deflection: 0.251” < 0.93”

Gravity Spot Checks

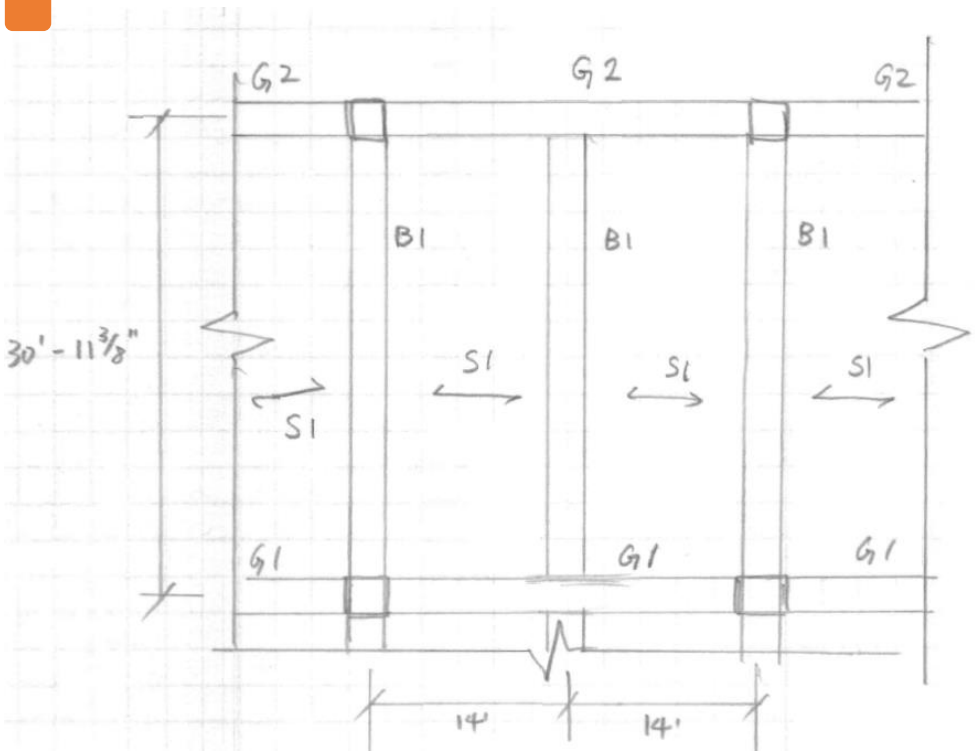
- Masonry Pier



Alternative Systems Considerations

- Floor depths
- Maintain existing bay dimensions
  - Avoiding any additional columns
- Cost per square foot
- Weight per square foot

System 1: One-way Slab with Beams



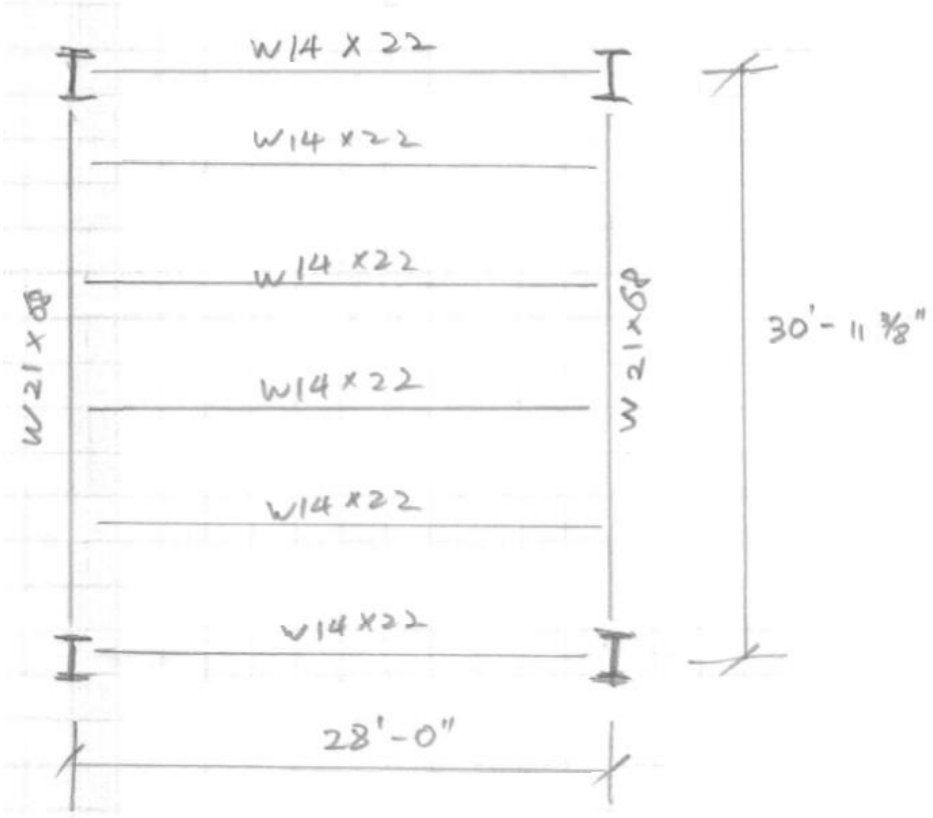
- Slab
  - Thickness: 6”
  - #4 @ 12”
- Beam
  - 12” X 20”
  - Long. Reinf.: (4) #8
  - Transv. Reinf.: (4) #3 stirrups @ 9”
- Girders
  - 17” X 28”
  - Long. Reinf.: (4) #11
  - 16” X 26”
  - Long. Reinf.: (4) # 10

System 1: One-way Slab with Beams

	Alternative System	Original Design
Depth	28”	13”
Weight	177.07 PSF	105.5 PSF
Cost	$19.82	$13.72
Lateral	Concrete Shear Wall / Concrete Moment Frame	Masonry Shear Wall / Steel Moment Frame

- Increased floor depth, weight and cost compared to HC slab. However, no additional fireproofing is required. In conclusion, redesign not feasible.

System 2: Non-Composite Steel



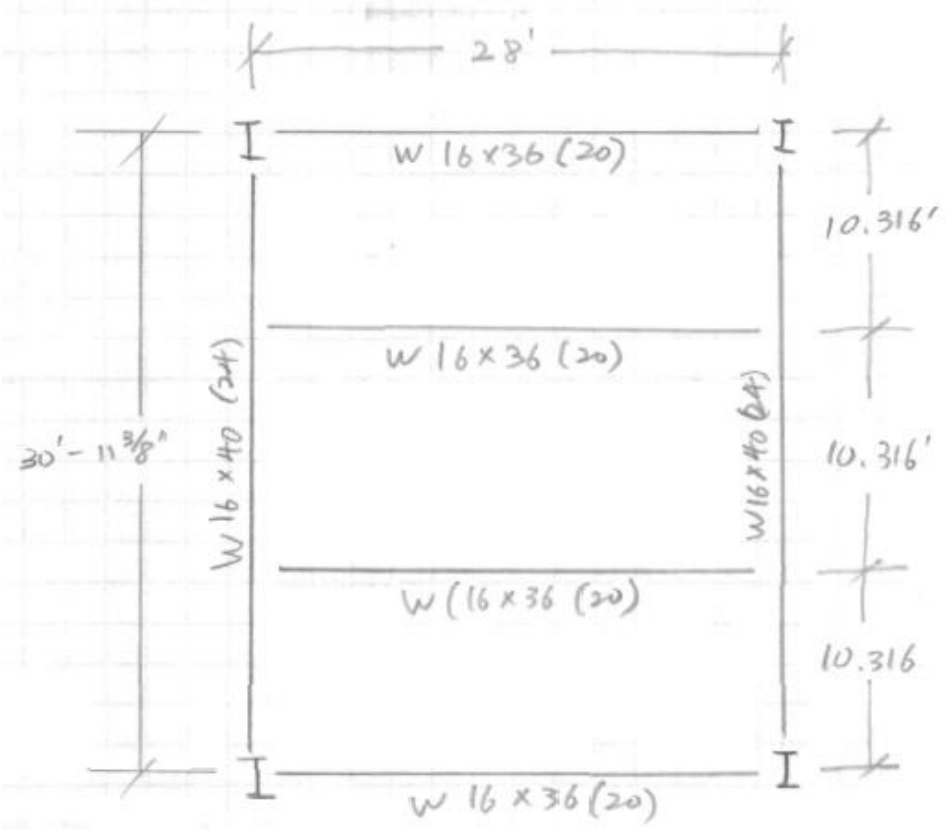
- Decking
  - 1.5 VLR 22
  - 3” topping LWC
  - 2 hr fire rating
- Beam
  - W14 X 22
  - 28’ span, 6’-2” spacing
- Girder
  - W 21 X 68
  - 30’ – 11 3/8” span

System 2: Non-Composite Steel

	Alternative System	Original Design
Depth	25.5”	13”
Weight	59.12 PSF	105.5 PSF
Cost	$28.03	$13.72
Lateral	Concrete Shear Wall / Steel Moment Frame	Masonry Shear Wall / Steel Moment Frame

- Increased floor depth and cost compared to HC slab but reduced weight. Also, additional fire proofing is required. Therefore, redesign may be feasible.

System 3: Composite Steel



- Decking
  - 2 VLI 20
  - 3.25” topping LWC
  - ¾” dia. Shear studs
  - 2 hr fire rating
- Beam
  - W16 X 36 (20)
  - 28’ span, 10.316’ spacing
- Girder
  - W 16 X 40 (24)
  - 30’ – 11 3/8” span

System 3: Composite Steel

	Alternative System	Original Design
Depth	21.25”	13”
Weight	49.5 PSF	105.5 PSF
Cost	$19.56	$13.72
Lateral	Concrete Shear Wall / Steel Moment Frame	Masonry Shear Wall / Steel Moment Frame

- Increased floor depth and cost compared to HC slab but reduced weight. Also, additional fire proofing is required. Therefore, redesign may be feasible.

Final Comparison

	Hollow Core Planks	One-Way Slab with Beams	Non-Composite Steel	Composite Steel
Cost	$13.72	$19.82	$28.03	$19.56
Weight	105.5 PSF	177.07 PSF	59.12 PSF	49.5 PSF
Depth	13”	28”	25.5”	21.25”
Additional Fire Proofing	No	No	Yes	Yes
Vibration	Likely	No	Likely	Likely
Lateral System	Masonry Shear Wall, Steel Moment Frame	Concrete Shear Wall, Concrete Moment Frame	Concrete Shear Wall, Steel Moment Frame	Concrete Shear Wall, Steel Moment Frame
Redesign Feasibility	-	No	Yes	Yes