

Piez Hall Extension

Oswego, NY



Piez Hall Extension

■ Building Introduction

- Existing Structural System
- Proposal Overview
- Gravity Re-design
- Lateral Re-design
- ETABS Model
- Construction Management Breadth
- Comparison of Designs
- Questions/Comments

Building Introduction

- Location : Oswego University, New York
- Size : 159,000 SF
- Height : 64 feet up to roof
- Occupancy : Business, A2 and A3 Assembly
- Construction Cost : 40,585,679 USD
- Spring 2011 – Spring 2014
- Design – Bid – Build (Single Prime)
- LEED Gold Certification

Site Map



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Project Team

- Owner: State University College at Oswego
- General Contractor : Whiting Turner
- Architect : Cannon Design
- MEP : Cannon Design
- Structural Engineer : John R. Boekelman
- Landscape Architect : Trowbridge & Wolf

Introduction



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Design Highlights

- Addition to existing Piez Hall
- An atrium walkway connects to Willbur Hall
- Interior spaces includes :
 - Planetarium
 - Greenhouse
 - Meteorology observatory

Introduction

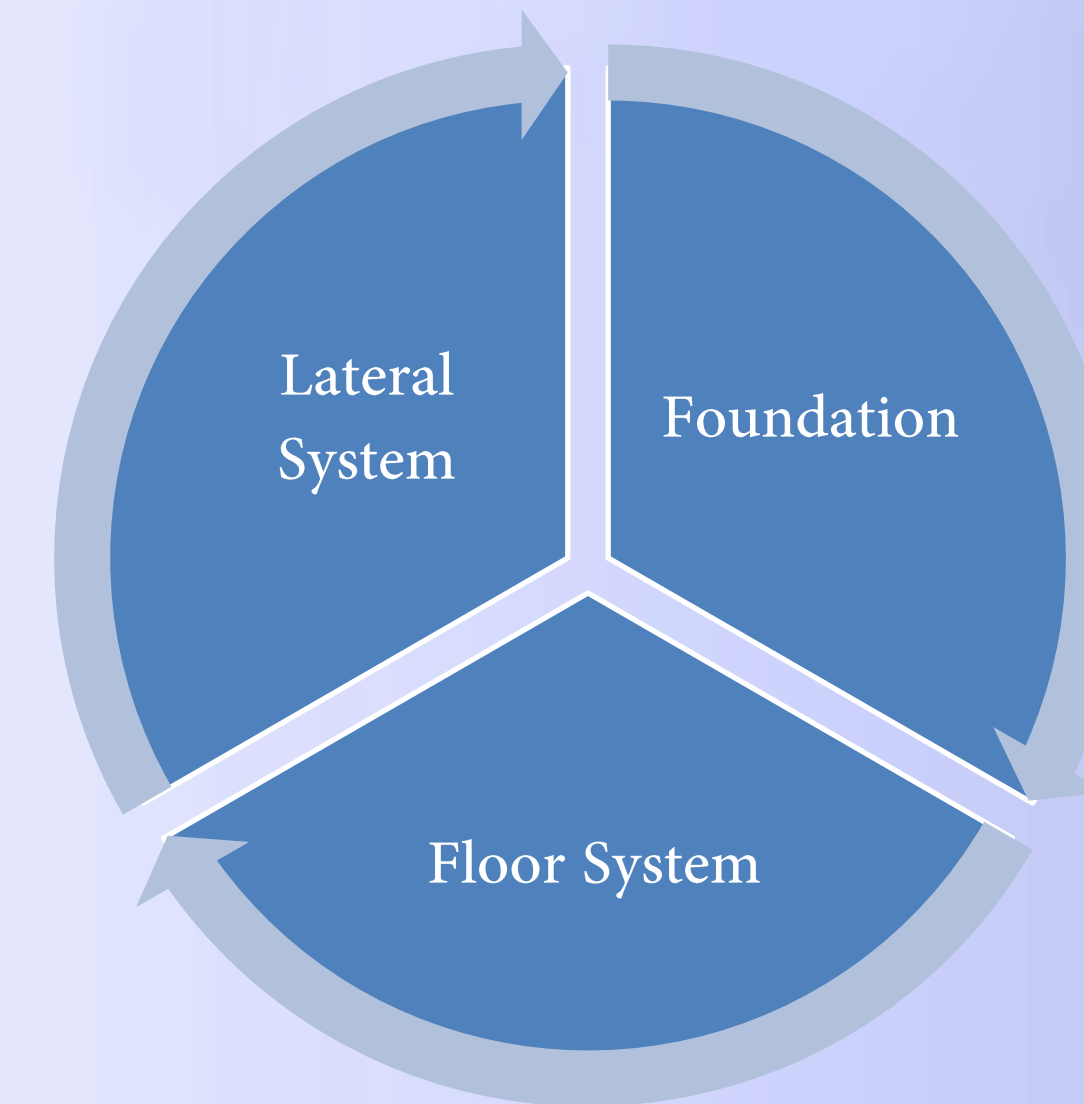


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Existing Structural System

- Foundation
- Floor System
- Lateral System



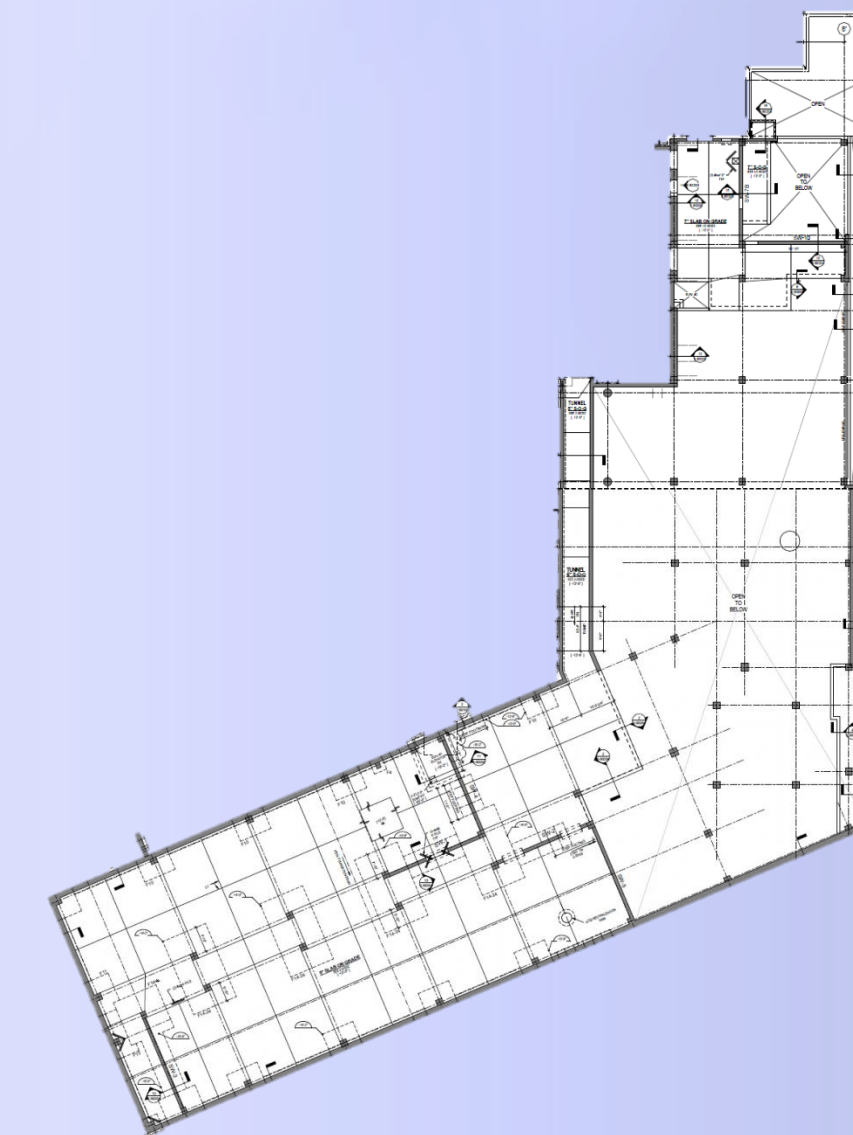
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Existing Structural System

- Shallow spread foundation system
- Maximum net allowable pressure of 4000psf
- Coefficient of friction of 0.32
- 7 in. slab on grade
- Design factor of safety : 1.5

Foundation



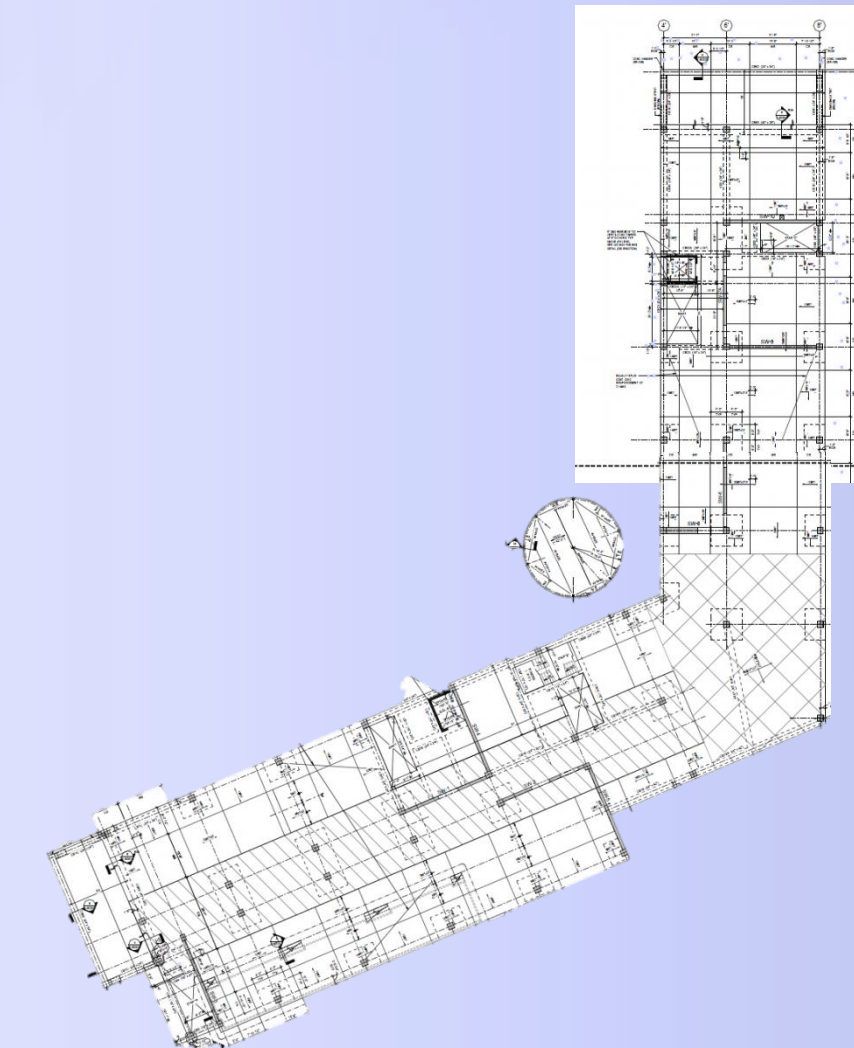
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Existing Structural System

- Typical bay size : 31.5 ft x 31.5 ft
- 12 in. two-way flat plate with 8 in. drop panels
- Typical column: 24 in. x 24 in.
- Weights 170 psf

Floor System



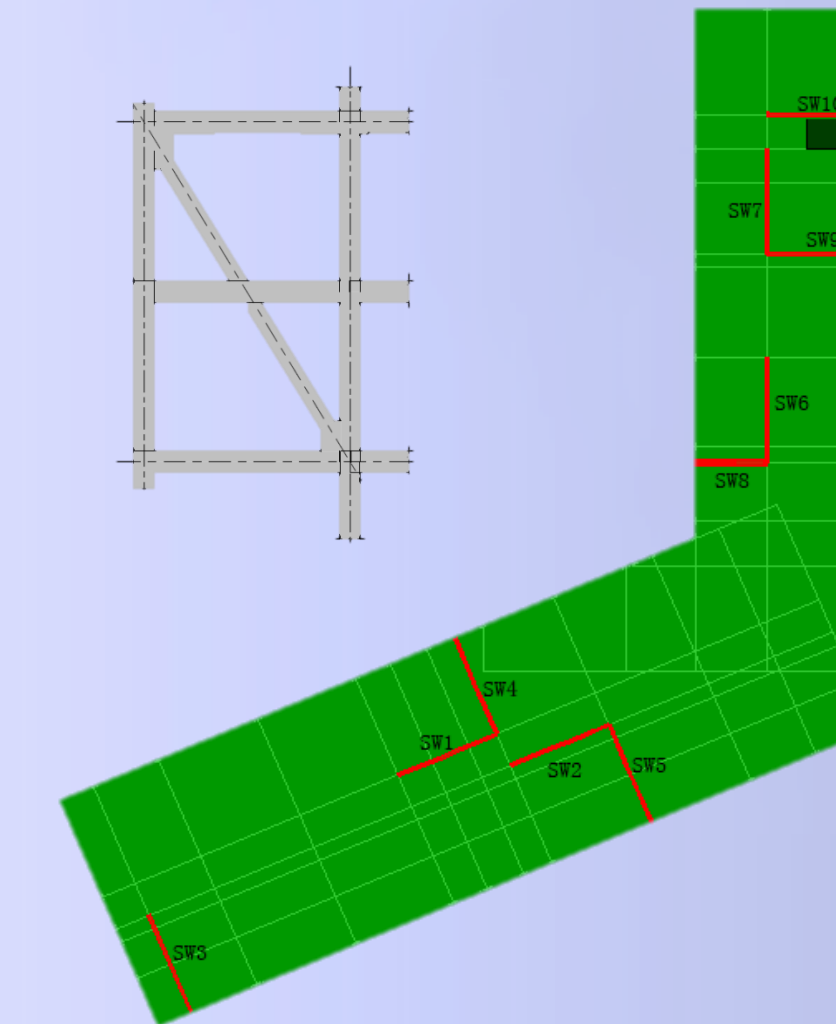
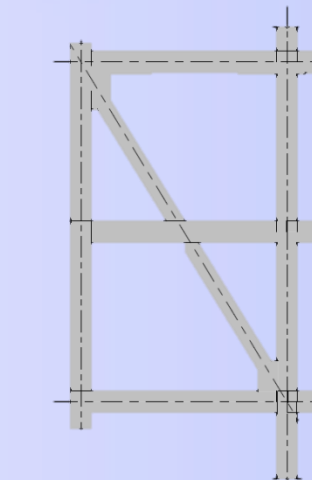
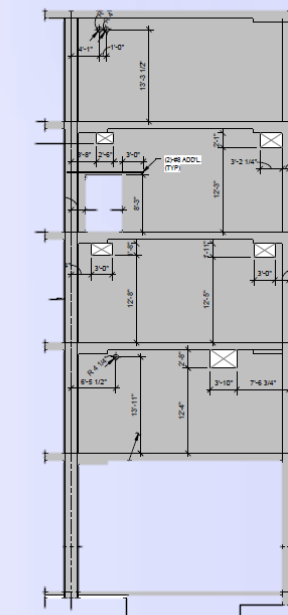
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Existing Structural System

- 10, 5000psi concrete, 12 in. shear walls
- Evenly distributed around elevator/stair case cores
- Very stiff building
(fundamental period of 0.33s)

Lateral System



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Proposal Overview

- To explore an alternative design
- To unify the design
- Design undertaken in steel
- Rearranged column layout
- Eccentric and concentric brace frames
- Composite system with long span trusses

Goals

- To reduce construction confusing
- To reduce construction cost and time
- To reduce overall building weight
- To reduce seismic load
- To reduce building torsion
- To increase interior space

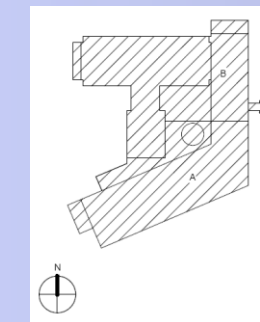
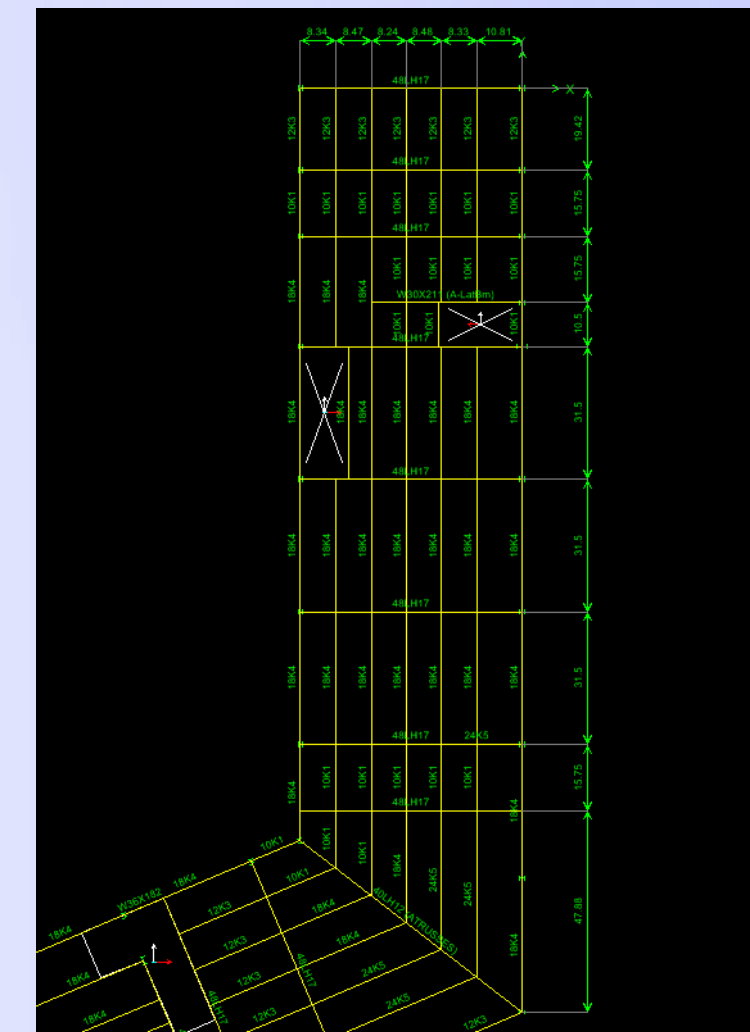
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Gravity System Re-Design

- Schematic design
- Eliminated most interior columns
- Floor decks were 3VLI18 lightweight
- Roof deck was N18
- Trusses were 48LH17 (max span : 60 feet)
- Longest span joists were 24K5
- Overall building height increased from 64ft to 73'

Schematic Design



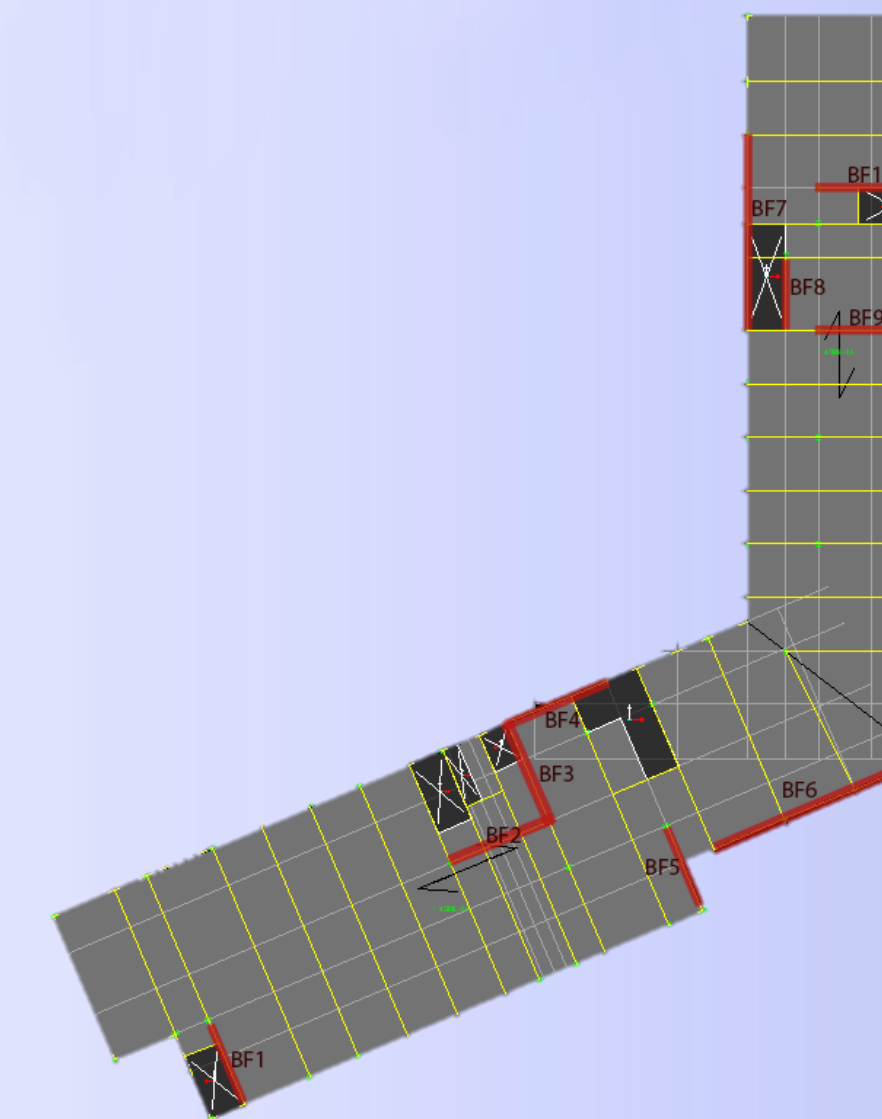
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Lateral System Re-Design

- 10 brace frames (Concentric and Eccentric)
- Locations found by trial and error in ETABS
- Mostly located at elevator and stairwell cores

Floor Plan



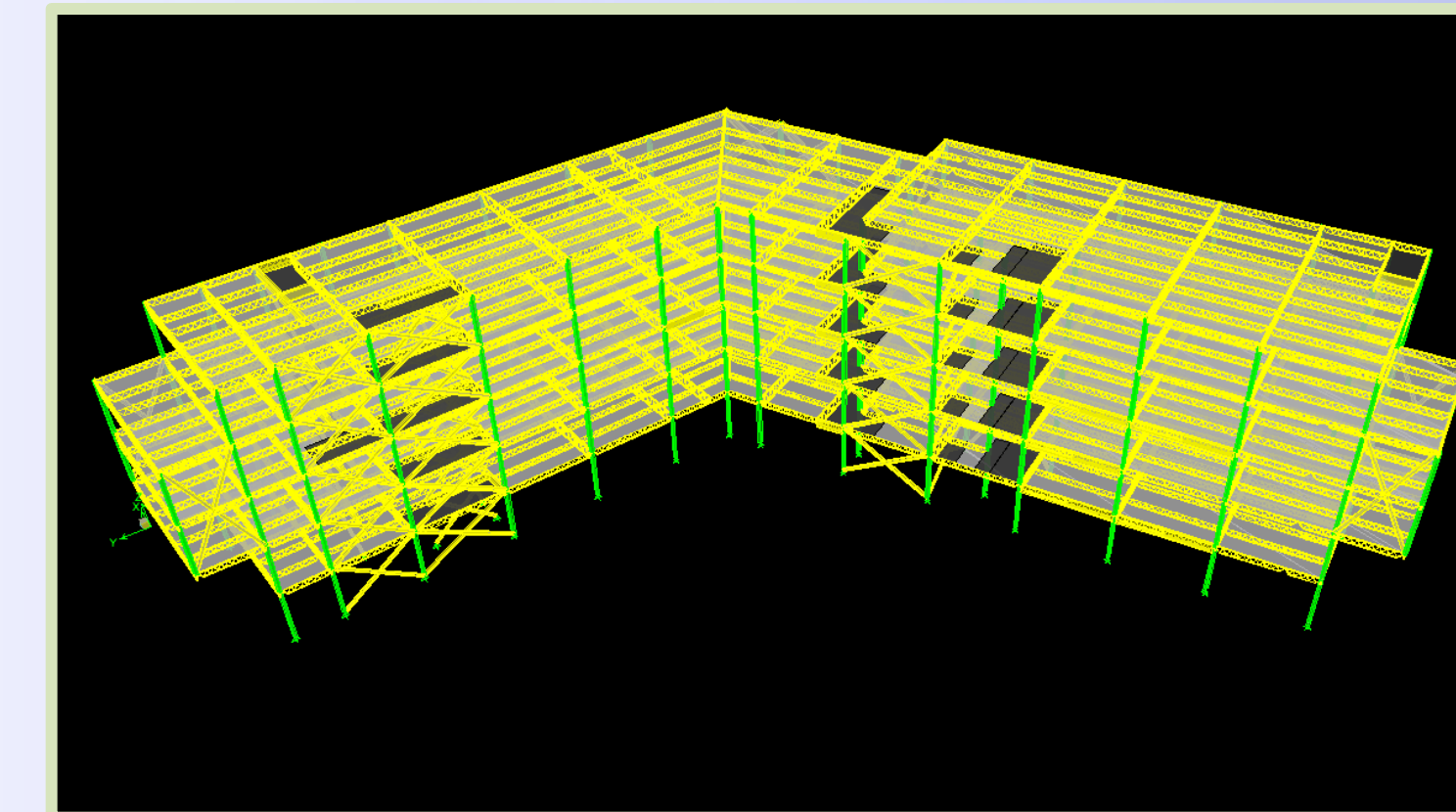
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Lateral System Re-Design

- Increased height also increased wind load
- Building weight estimated based on schematic design
- MWFRS procedure used to find wind load
- Seismic loads determined using Equivalent Lateral Force Procedure in ASCE 7-10

3D View



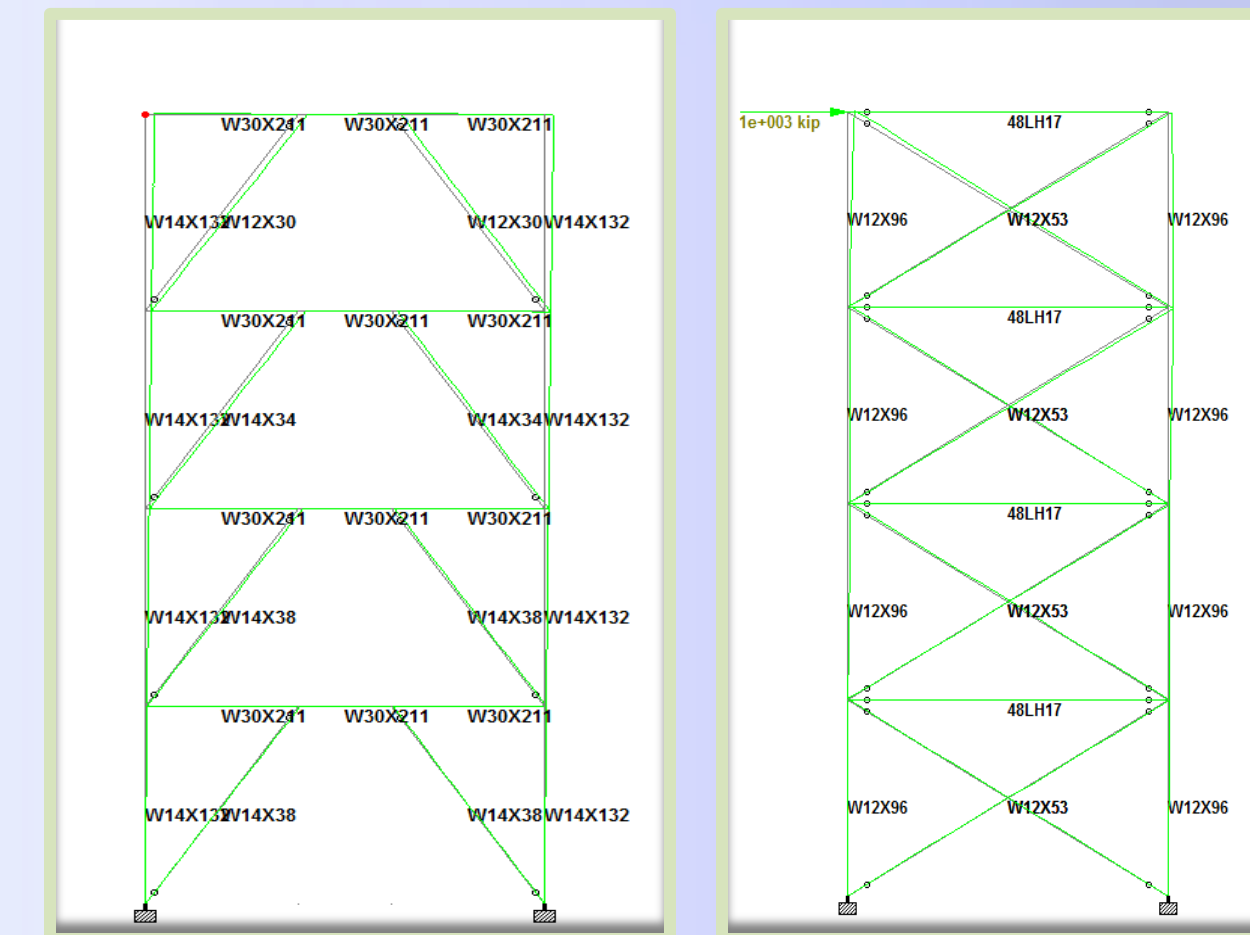
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Lateral System Re-Design

- 1.6 W and 1.0E were inputted into ETABS
- ETABS optimizes the member sizes
- Member sizes were checked manually

Elevation View



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ETABS Model

- Center of mass/rigidity checked manually
- The stiffness of brace frames checked in STAAD
- Relative error : 2%
- ETABS satisfied horizontal irregularity type 5
- ETABS output used to check allowable story drift (drift limit : : $0.02h_x$)

Design Check

Center of Mass and Center of Rigidity				
Story	Center of Mass X (in)	Center of Mass Y (in)	Center of Rigidity X (in)	Center of Rigidity Y (in)
2	1071.106	2304.073	1088.461	2257.057
3	1097.344	2300.094	1070.254	2268.762
4	1090.824	2290.011	1068.785	2262.289
Roof	1055.822	2341.231	1056.866	2233.891

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Construction Management Breadth

- R.S Means 2012
- 1300 tons of steel : 7,042,970 USD
- Connection weight : assumed 15% of steel
- Studs weight : assumed 10% of steel weight
- Accounted for spray fire proofing

Cost

Cost Estimation for Proposed Design		
MF-2004	Description	Cost
01-00-00	General Requirements	715500
03-00-00	Concrete	2237584
04-00-00	Masonry	1760130
05-00-00	Metals	7042970
06-00-00	Wood, Plastics & Composites	863072
07-00-00	Thermal & Moisture Protection	1064621
08-00-00	Openings	2787579
09-00-00	Finishes	4002883
10-00-00	Specialties	277095
11-00-00	Equipment	3281909
12-00-00	Furnishings	264626
13-00-00	Special Construction	136842
14-00-00	Conveying Equipment	516183
21-00-00	Fire Suppression	1188286
22-00-00	Plumbing	1724745
23-00-00	HVAC	8209311
26-00-00	Electrical	3968507
27-00-00	Communications	117659
28-00-00	Electrician Safety & Security	420906
31-00-00	Earthwork	591027
	Total	41171435

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Construction Management Breadth

- R.S Means 2012
- Time to erect and install steel : approximately
4 months

Duration

Schedule for Proposed Design					
Member Size	Number of Members	Lengths (ft)	Weight (lb)	Labor Hour / Crew(s)/L.F	Total Hours
12x14	7	18.7	1832.6	0.064	8.3776
12x26	18	18.7	8751.6	0.064	21.5424
12x40	61	28	68320	0.069	117.852
12x96	21	16	32256	0.088	29.568
12x106	3	16	5088	0.088	4.224
14x68	210	16	228480	0.07	235.2
14x132	57	16	120384	0.078	71.136
14x159	5	16	12720	0.08	6.4
14x193	2	16	6176	0.083	2.656
14x283	1	16	4528	0.087	1.392
27x336	4	16	21504	0.075	4.8
33x130	25	11	35750	0.071	19.525
33x201	62	15.75	196276.5	0.073	71.2845
40x593	74	20	877640	0.09	133.2
48LH17	136	53	302736	0.036	259.488
24K5	684	22	331056	0.026	391.248
				Total	1406 hours
					176 days

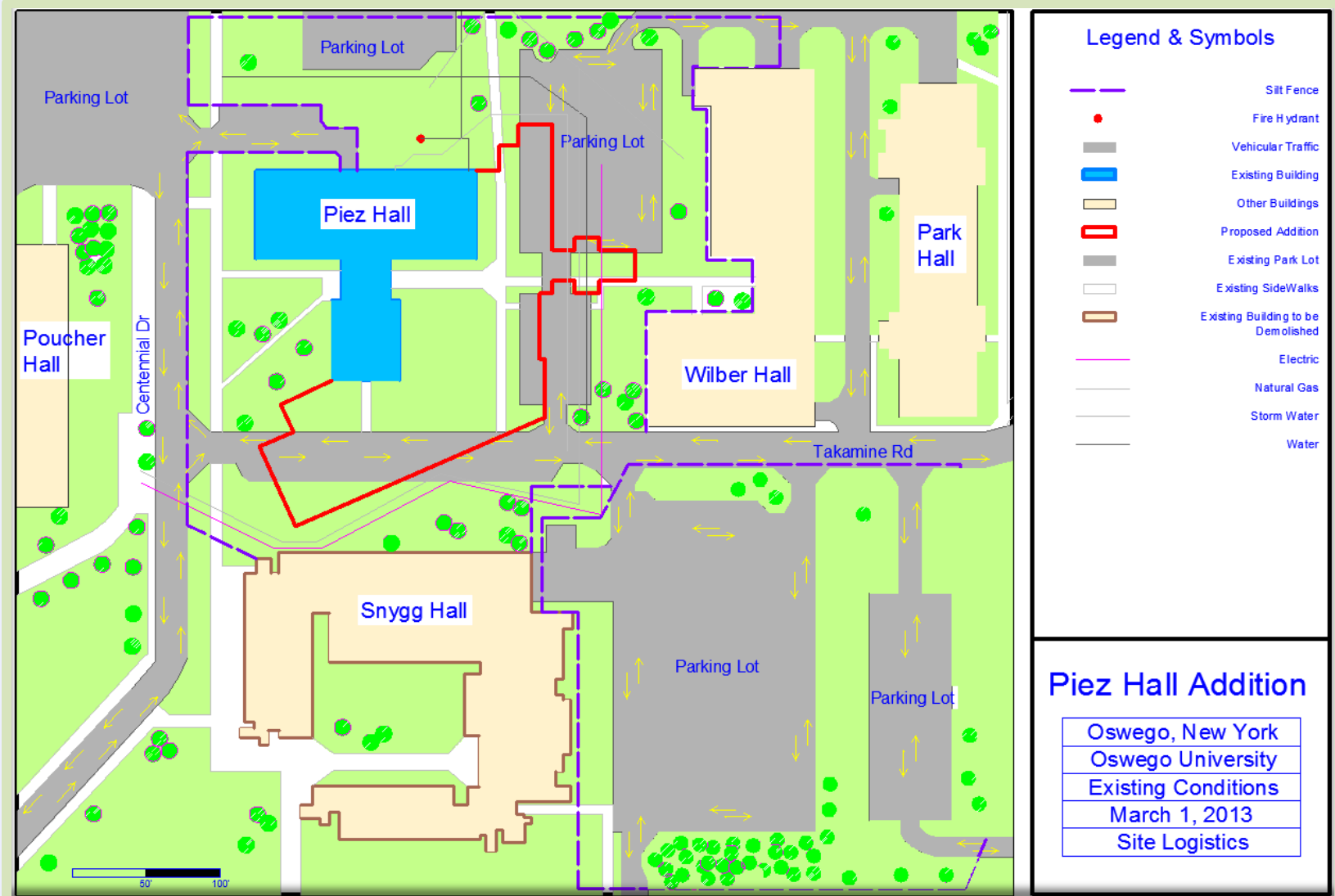
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Construction Management Breadth

- Nearby Oil Plant
- West Seneca St, route 104
- Major access to construction site
- Majority Mid-rise building
- Plenty of parking available

Site Logistics



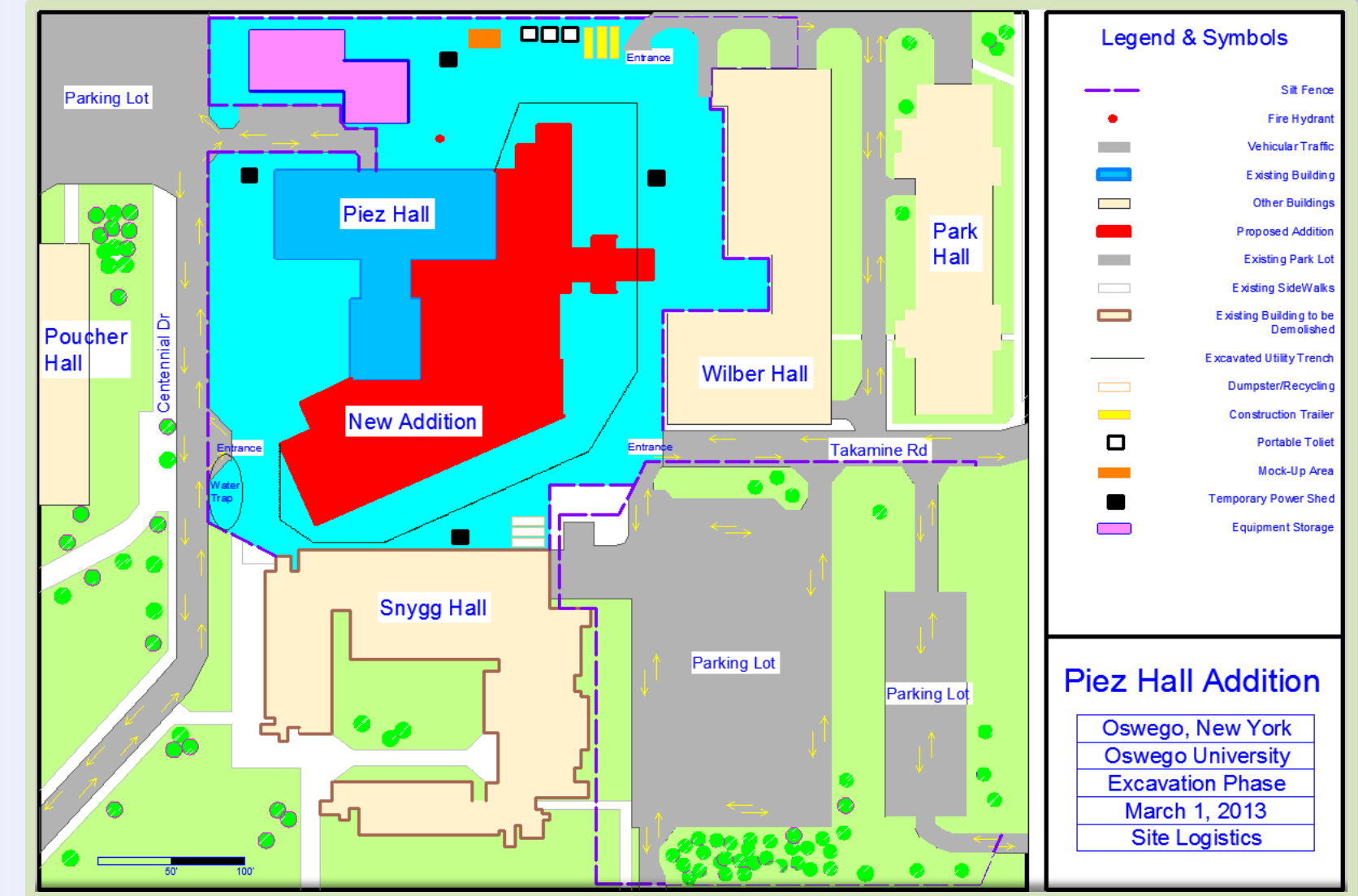
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Construction Management Breadth

- Temporary power
- Temporary water trap
- Temporary equipment
- Mock-up area
- Excavation began from north to south
- Barricaded Takamine street

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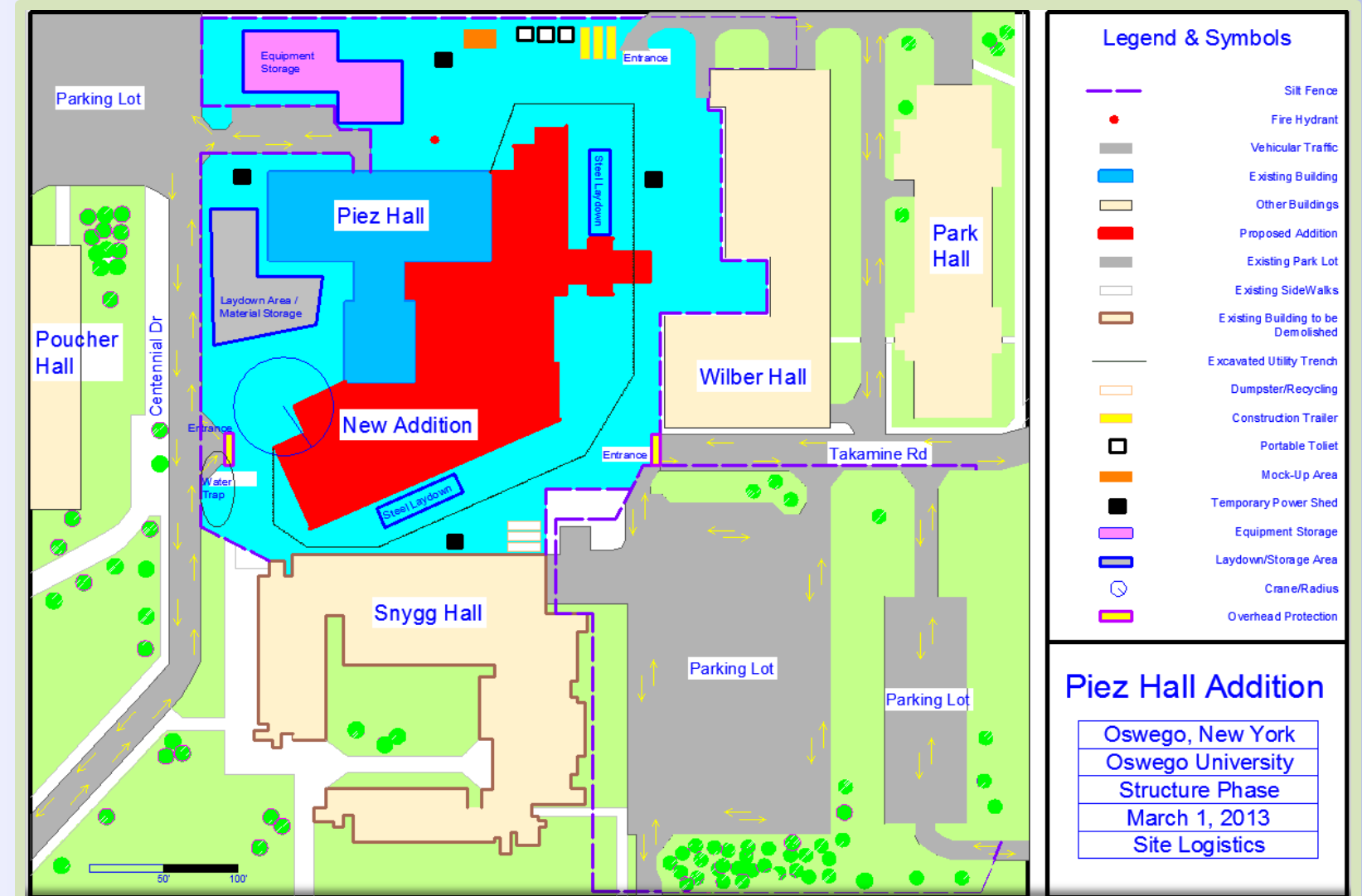
■ Construction Management Breadth

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Construction Management Breadth

- 60 ton crawler crane
- Laydown area for steel
- Temporary bracing
- Overhead protection

Site Logistics



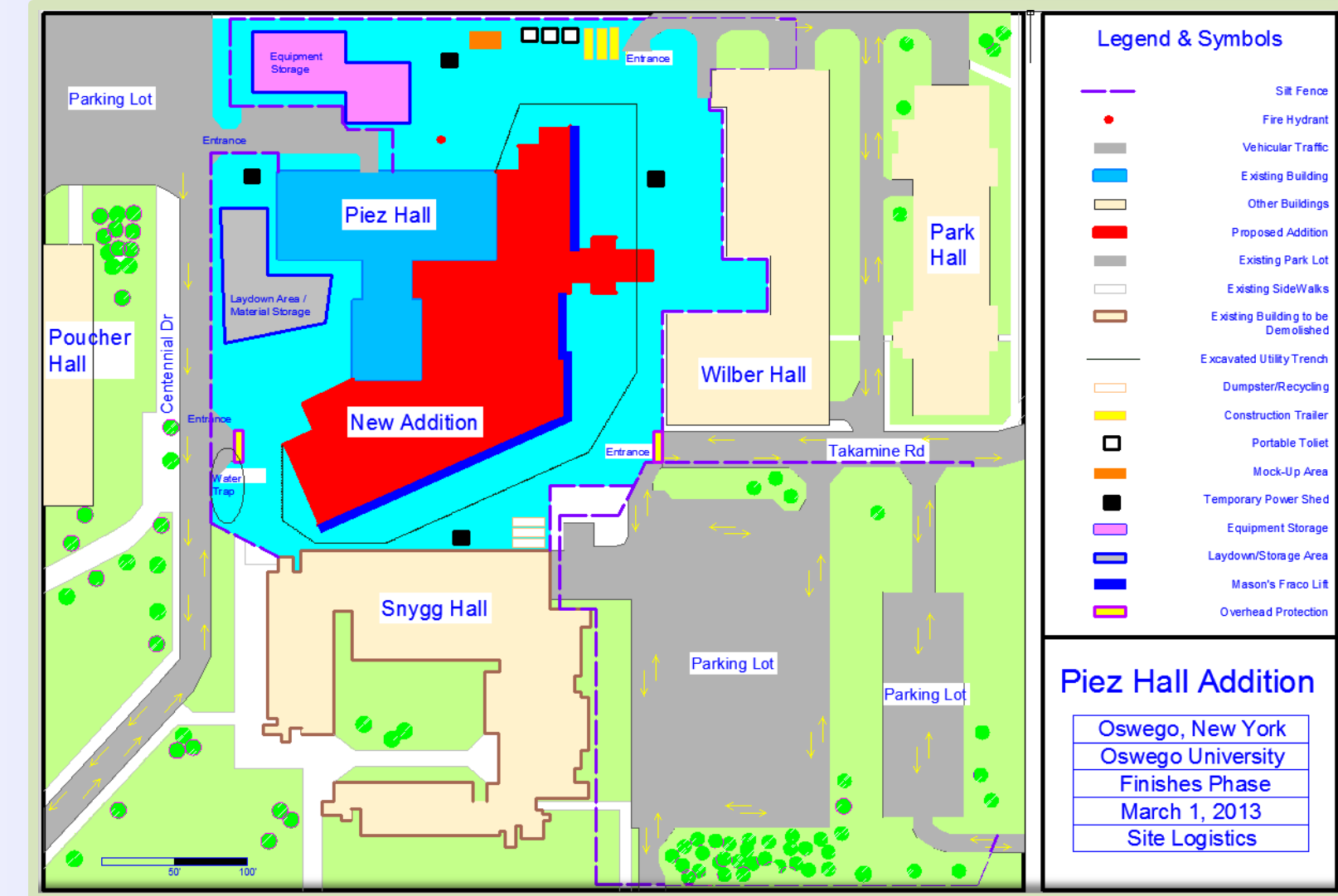
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Construction Management Breadth

- Fraco lifts
- Façade work happening simultaneously with interior work

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Proposed Design

- Building weight : 11,518 kip
- Seismic overturning moment : 25,349 k-ft
- Building torsion : 8,223 k-ft
- Building Height : 73 feet
- Construction cost : 41,171,435 USD
- Construction duration : 2 years and 9 months
- Increased interior spaces

Existing Design

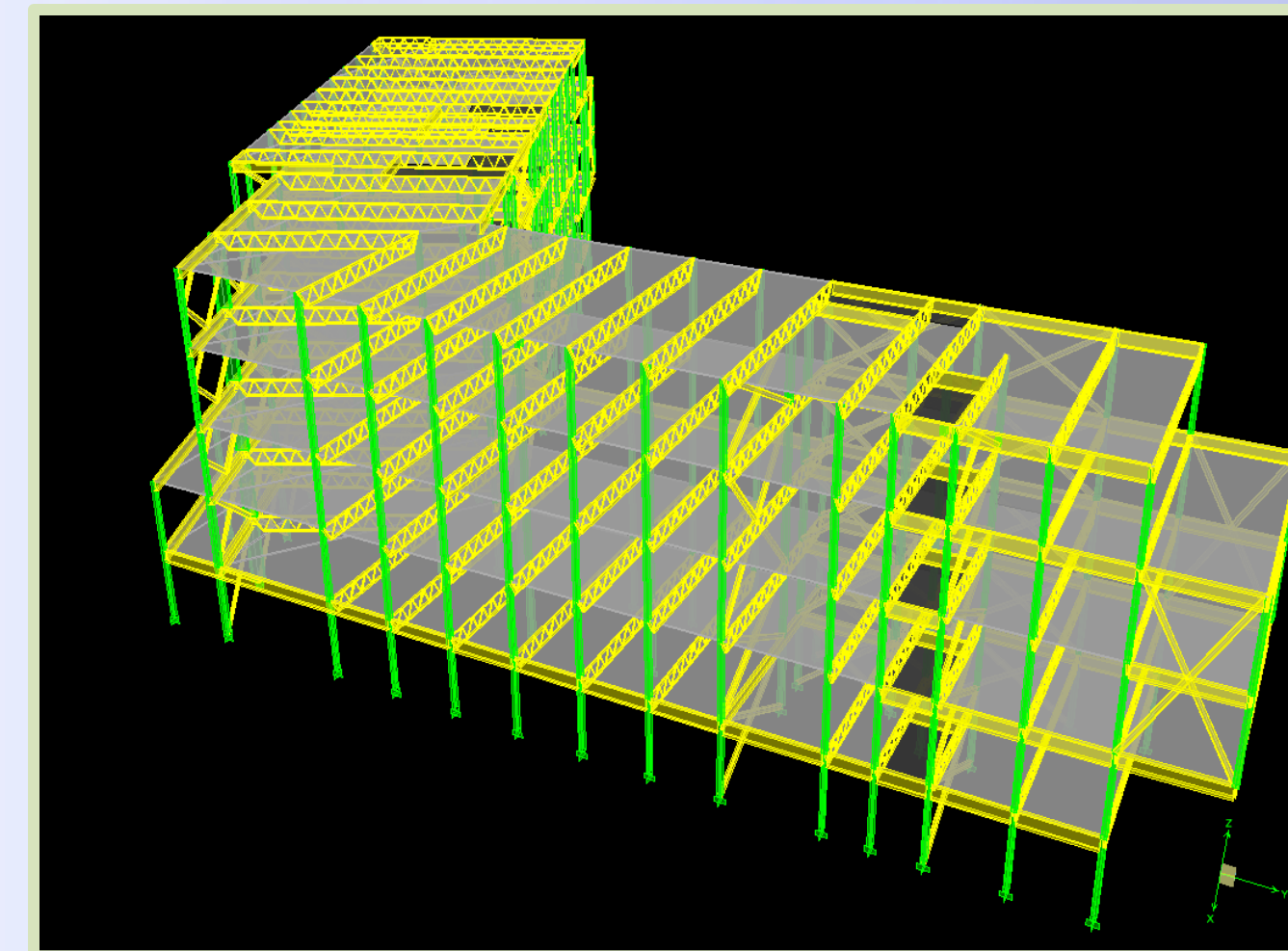
- Building weight : 29,577 kip
- Building Height : 64 feet
- Seismic overturning moment : 47,682 k-ft
- Building torsion : 25,080 k-ft
- Construction cost : 40,585,679 USD
- Construction duration : 3 years

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Conclusion

- The proposed design was a feasible alternative to the Piez Hall extension
- Lots of benefits and some drawbacks
- Unified the design and avoided unnecessary construction confusions
- More things to investigate
 - Foundation
 - Vibration



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Acknowledgement

- Cannon Design
 - Rachel Chicchi
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 - Dr. Thomas Boothby
- AE Student Body
- Family and Friends

Questions?