

Langford Building A

Case Study

ARCH 631 Applied Structures

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Overview

- Fun Facts
- Brief History
- Design Concept
- Building Layout
- Structural Features
- Building Components & Systems
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 - Lateral Load Resistance
 - Visual Analysis
 - Foundation and Soil
- Bibliography

The Ernest Langford Architecture Center

Designed by: Jack R. Yardley '58

Price: <\$7 million

Architect/Engineering Firm: HKS, Dallas

Dedication Year: 1976

Location: Texas A&M University, College Station, Texas.

Construction: 1975-1978



Brief History



- Dedicated and named after Ernest Langford
 - Head of Architecture department for 27 years (1929-1956)
- Building was designed to accommodate 1,500 students.
- The Langford Architecture Center was built in two phases.
 - Phase 1: renovation of “Building C” from 1961 to 1963.
 - Phase 2: Addition of “Building A”



Design Concept

- Style: Brutalism
 - Characterized by its massive, monolithic, rigid geometry
- From “HKS: Selected and Current Works”:
 - Designed to:
 - express primary building systems
 - Utilize climatic elements for energy conservation
 - Precast reinforced concrete structure used to highlight design concept.
- Special features:
 - Bridge connection to all buildings (A, B and C)
 - Deep recesses on east and west side of the building



Building Layout

- Floors: 4
 - Penthouse + Roof Garden
- Total square footage: 116,000 sqft.
- Orthogonal grid system
 - 40 ft. bays
 - 10 ft. service modules
- Area tabulations

AREA TABULATIONS:
BUILDING 'A'

FLOOR	ADDITIONABLE	UNADDITIONABLE	TOTAL
FIRST	13,641 ^{sq}	10,191 ^{sq}	23,832 ^{sq}
SECOND	13,527 ^{sq}	10,756 ^{sq}	24,283 ^{sq}
THIRD	21,954 ^{sq}	5,570 ^{sq}	27,524 ^{sq}
FOURTH	16,243 ^{sq}	4,061 ^{sq}	20,304 ^{sq}
ROOF	800 ^{sq}	2,362 ^{sq}	3,162 ^{sq}
TOTAL	66,165 ^{sq}	35,940 ^{sq}	102,105 ^{sq}

- Program:
 - Building A currently houses
 - Offices
 - departments (Architecture, Landscape Architecture and Urban Planning, Visualization)
 - Staff + faculty
 - Education
 - Studio spaces, study rooms
 - Design/print labs (Makerspace, ITS, Photroom)
 - Mixed-use open areas
 - Gallery space
 - Cafe

Building Layout - Building A



Green: Educational (Studios, study rooms/classrooms)

Orange: Mixed-use

Yellow: Offices

Blue: Design/Print labs

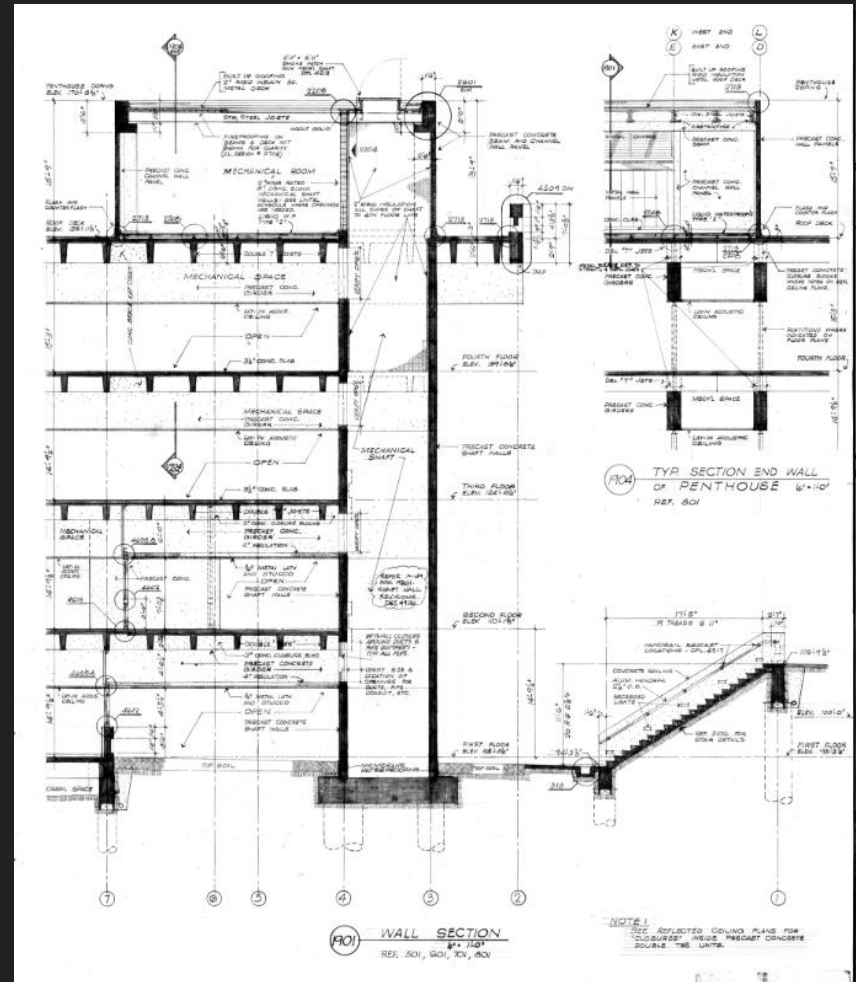
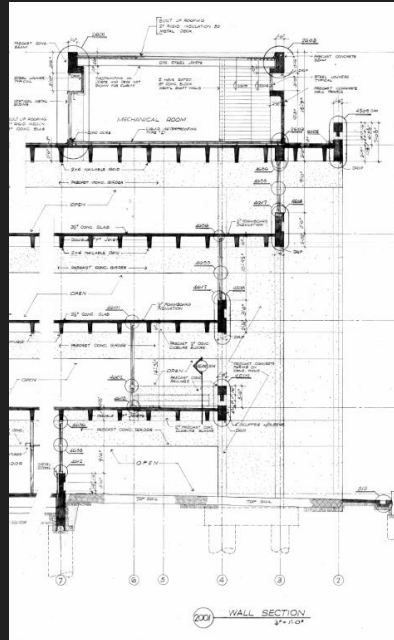
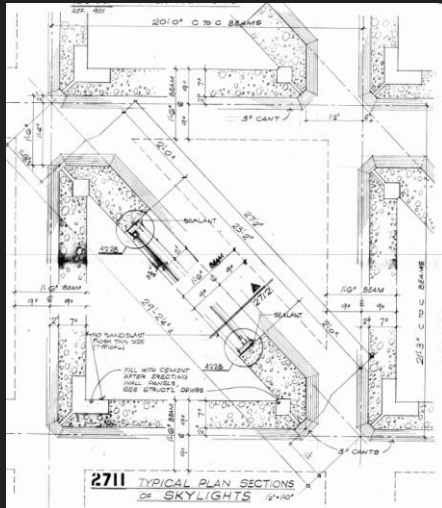
Purple: Services

Red: Cafe

Pink: Gallery/Lecture space

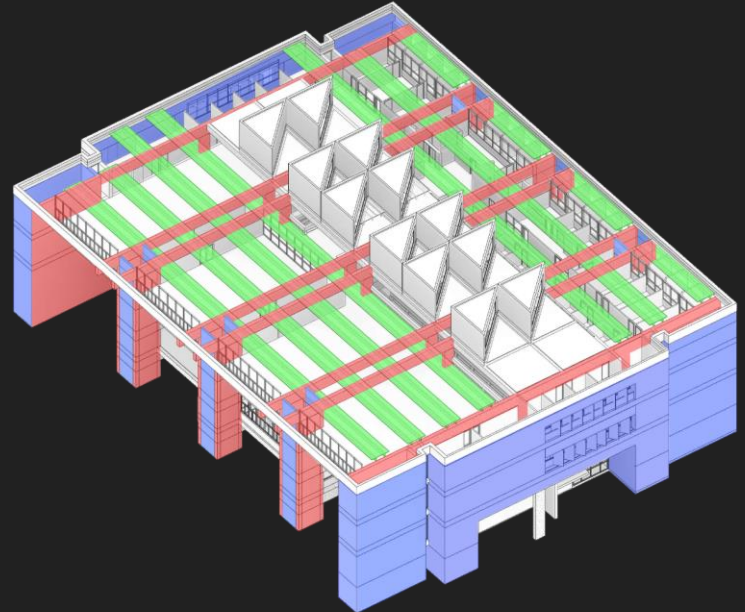
Structural Features

- Skylights at 45 degrees due North
- Columns = shafts that encase the mechanical systems that service the building
- Double Tee Joists
- Precast beams
- Handrail beams



Building Systems

- Hybrid
 - Pre-tensioned and post-tensioned precast reinforced concrete components.
- Reinforced Concrete Shear Walls
- One-way Precast Reinforced Concrete Double Tee Beams
- Reinforced Concrete Rigid Moment Frames

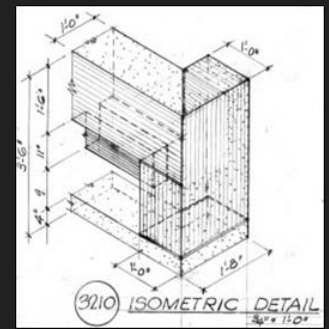
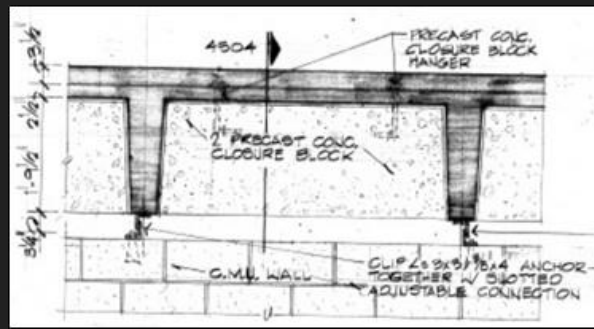
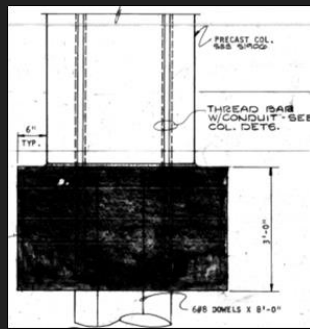
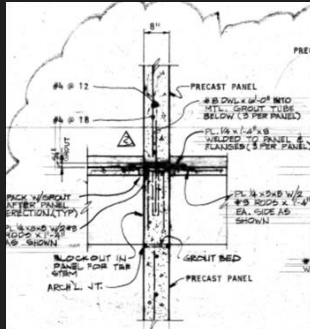
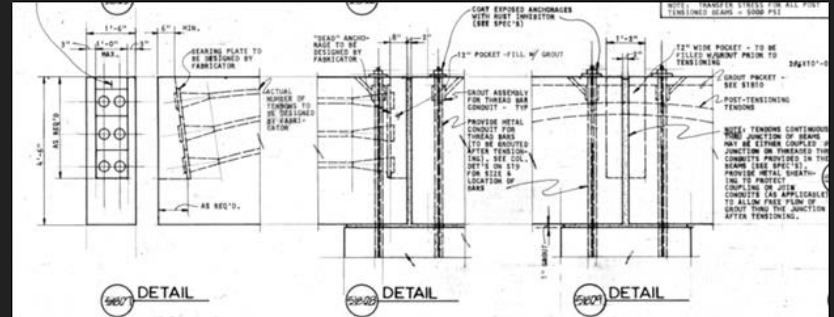


Building Components Overview

- Precast reinforced concrete components
 - Columns
 - Shear Walls
 - Post-tensioned Beams
 - Double Tee Beams
 - Spandrel beams
 - Handrail girders
- Cast-in-place reinforced concrete components
 - Belled Piers
 - Pier Caps
 - Retaining Walls
 - Topping Slabs
 - Grade Beams

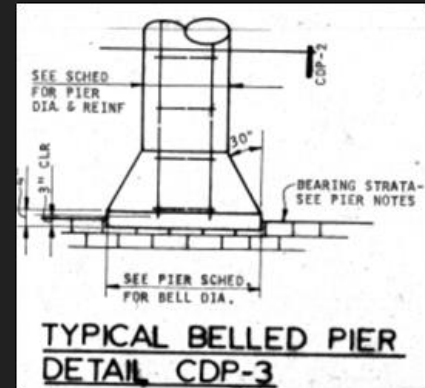
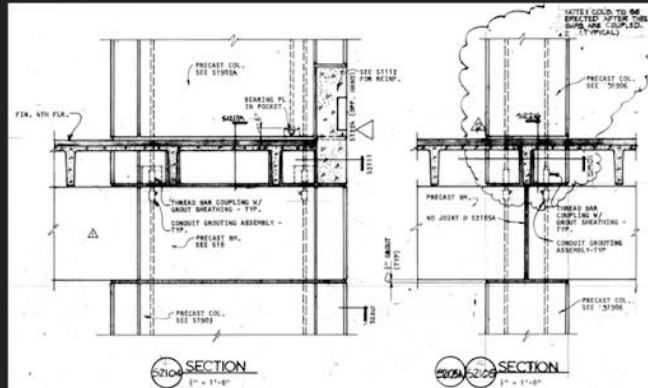
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Building Components

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Loading and Materials

- Live loads

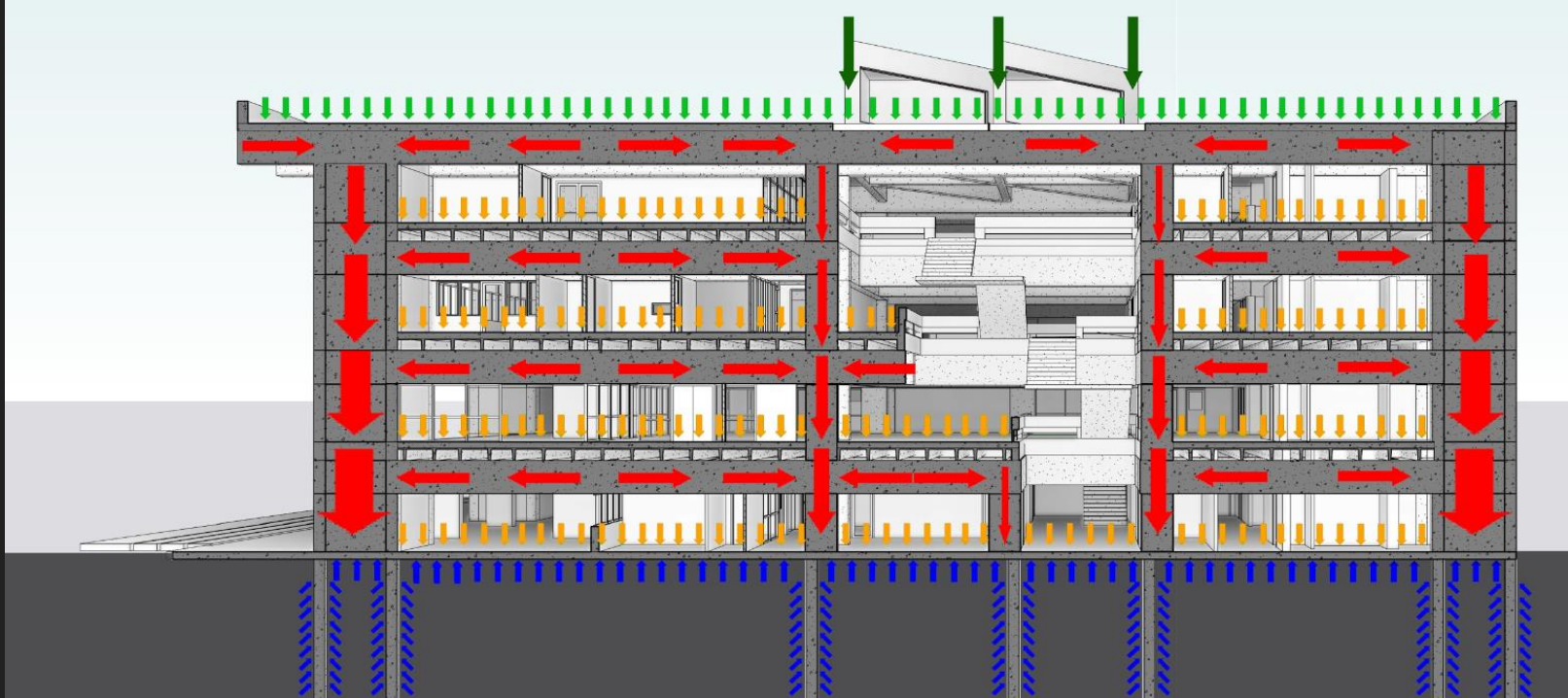
- Lateral Loads

- Material Properties

STRUCTURAL DESIGN CRITERIA			
I. DESIGN LIVE LOADS			
OFFICES	-----	50 PSF	
SCULPTURE STUDIO	-----	100 PSF + H10	
CERAMICS LABORATORY	-----	TRUCK LOAD	
PRINTMAKING STUDIO	-----	AT ENTRY	
RESTROOMS	-----	50 PSF	
CORRIDORS	-----	100 PSF	
STORAGE	-----	100 PSF	
LIBRARY STACKS	-----	125 PSF	
LIBRARY READING ROOMS	-----	75 PSF	
EXHIBIT GALLERY	-----	100 PSF	
DRAWING STUDIOS	-----	75 PSF	
ROOF	-----	20 PSF	
ROOF TOP STUDENT USE AREAS	-----	50 PSF	
BRIDGES	-----	100 PSF	
MECHANICAL ROOMS	-----	150 PSF	
PARTITIONS	-----	20 PSF	
WIND LOADS:			
0' TO 29'	-----	20 PSF	
30' TO 49'	-----	25 PSF	
50' TO 99'	-----	30 PSF	
UPLIFT ON ROOF	-----	25 PSF	
II. MATERIAL STRESSES (CONCRETE DESIGN BASED ON THE ULTIMATE STRENGTH METHOD)			
CONCRETE (AS NOTED ON THE DRAWINGS);			
		$f'_c = 3000 \text{ PSI}$	
		$f'_c = 4000 \text{ PSI}$	
		$f'_c = 5000 \text{ PSI}$	
REINFORCING STEEL;		$f_y = 60,000 \text{ PSI}$	
PRESTRESSING WIRE;		$f_y = 270,000 \text{ PSI}$	
STRUCTURAL STEEL;		$f_y = 36,000 \text{ PSI}$	

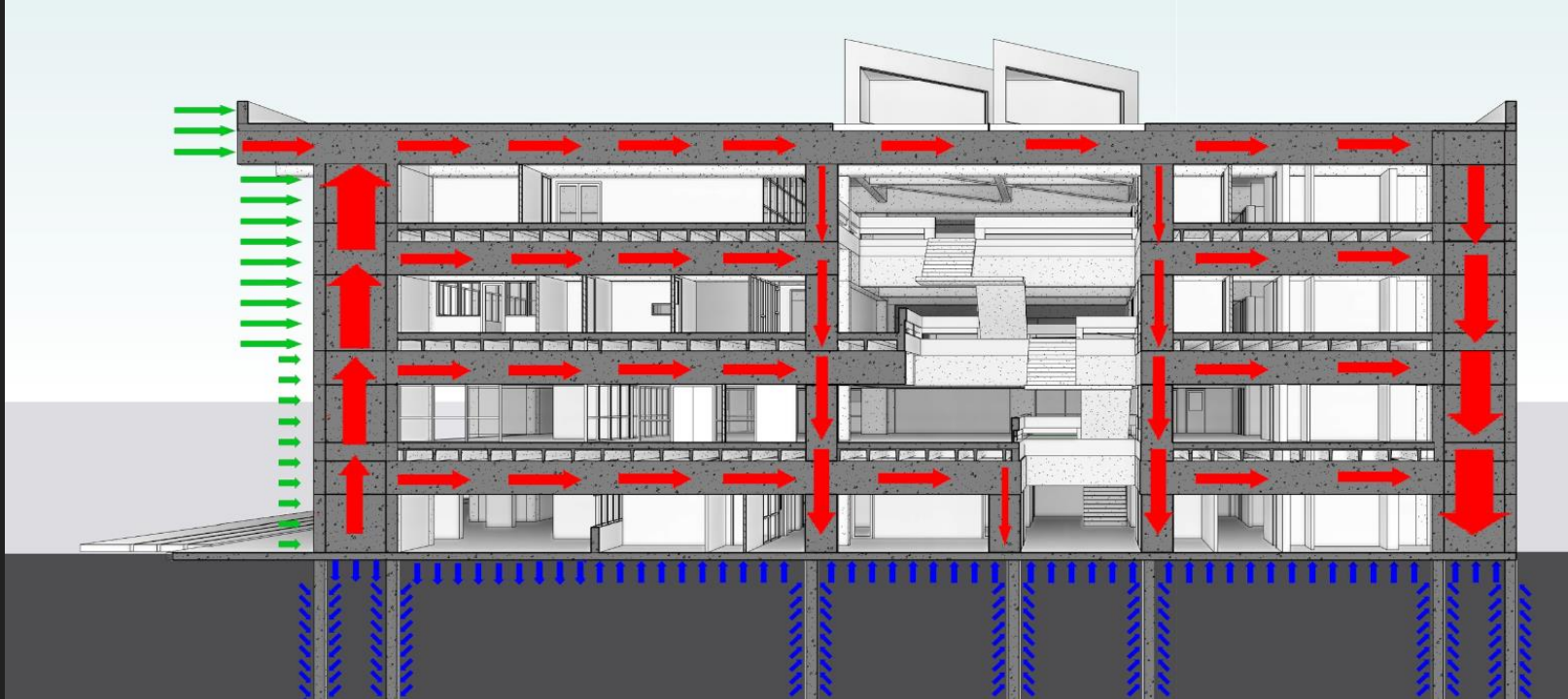
Loading Summary

Gravity Loads

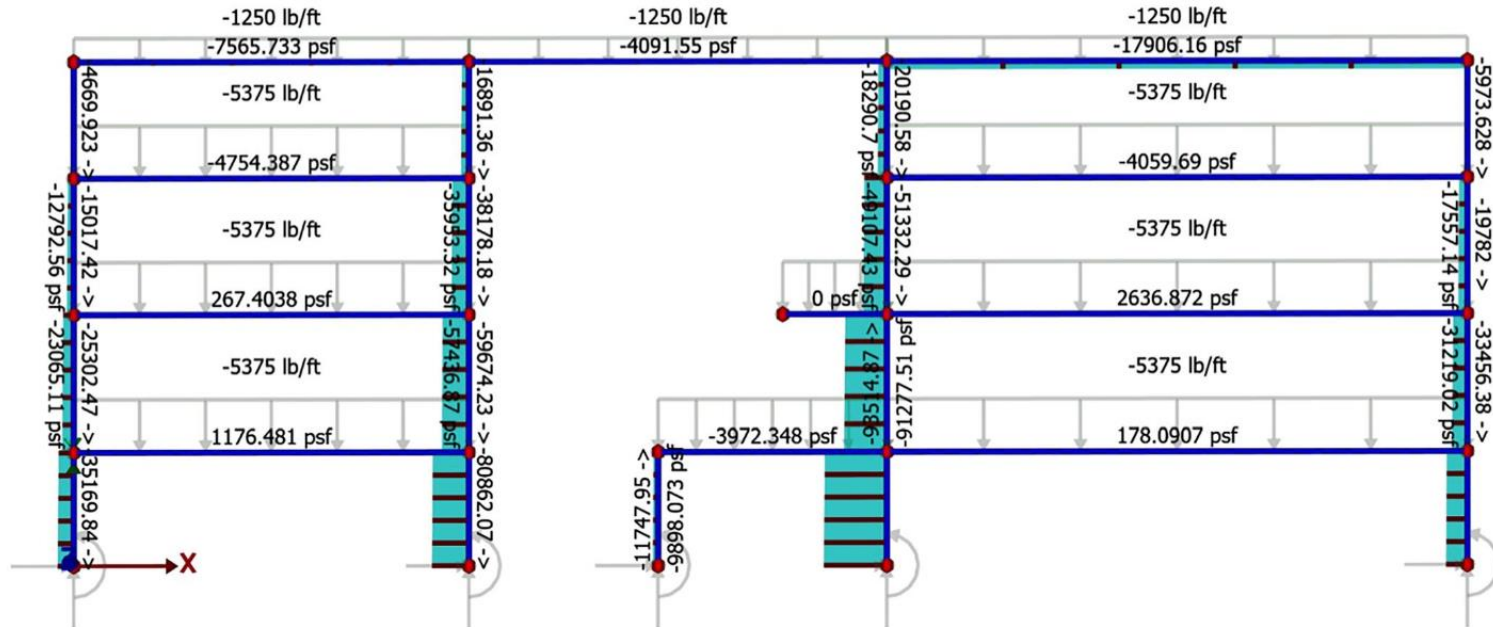


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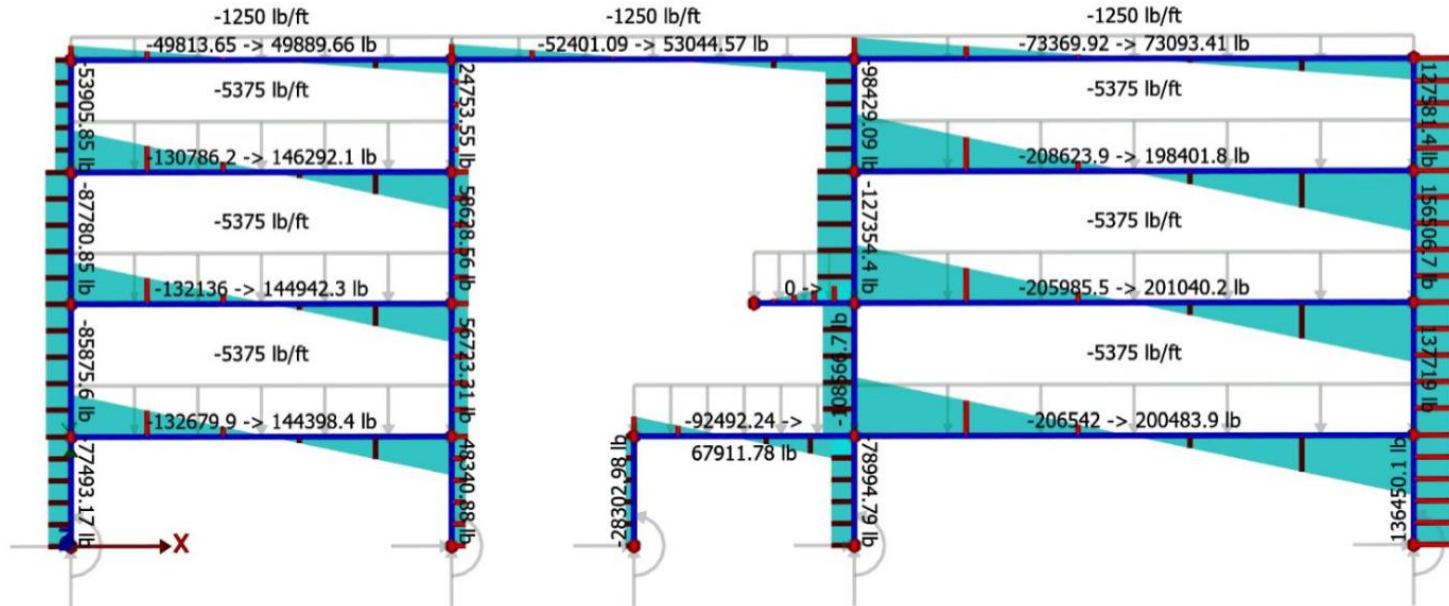
Lateral Load Resistance



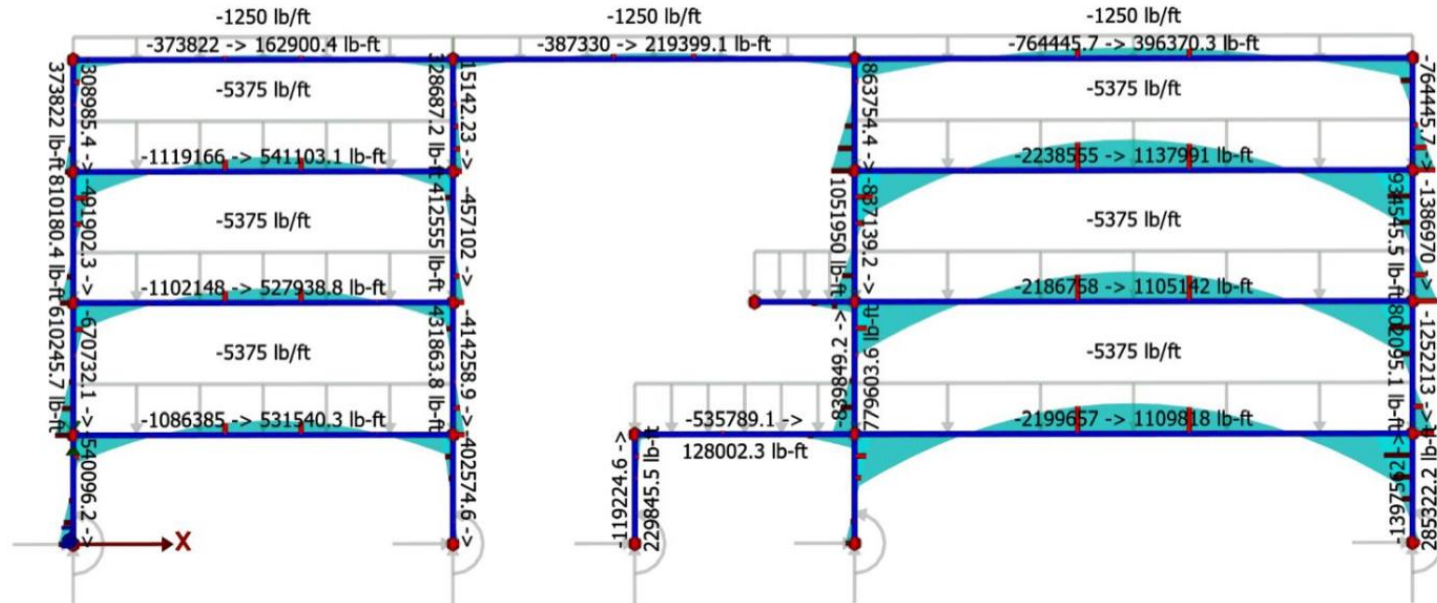
Axial Analysis



Shear Analysis



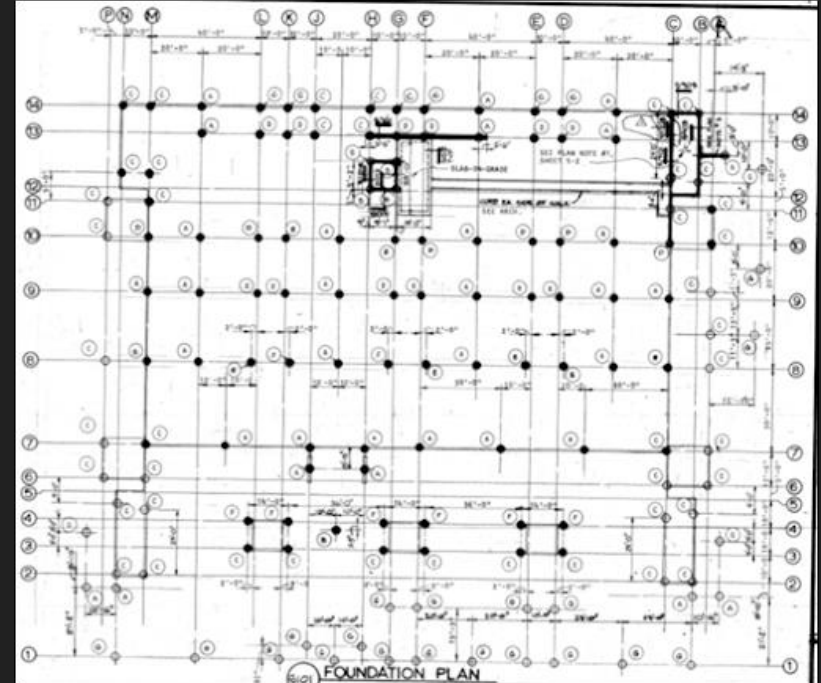
Moment Analysis



Loading Summary

Foundation

- Plan
- Allowable end bearing values
- Soil: Blackland Prairie, Post Oak/Claypan Area
- "Thin, light-colored, acid sandy loam surface layer over dense, mottled red, yellow, and gray claypan subsoils. Some deep, sandy soils with less clayey subsoils exist. Bottomlands are deep, highly fertile, reddish-brown to dark-gray loamy to clayey soils." (texasalmanac.com)



II. FOUNDATION CRITERIA

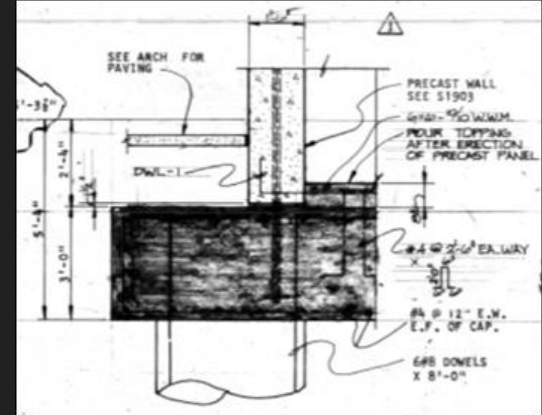
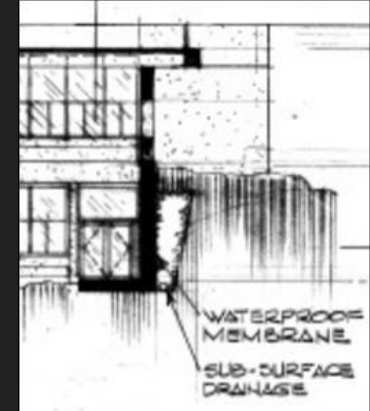
RECOMMENDED BY SPENCER J. BUCHANAN & ASSOC., INC. IN THEIR SOILS INVESTIGATION REPORT DATED JULY 2, 1974, & SUPPLEMENT DATED AUGUST 8, 1974

ALLOWABLE END BEARING VALUES:

SHALLOW PIERS (APPROX. 20' DEEP) $P_b = 9,000$ PSF

DEEP PIERS (APPROX. 50' DEEP) $P_b = 20,100$ PSF

- Belled piers
- Pier caps
- Grade beams
- Retaining walls

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3D model references courtesy of Prof. Marcel Erminy

Interviews with faculty: Prof. Gerald Maffei