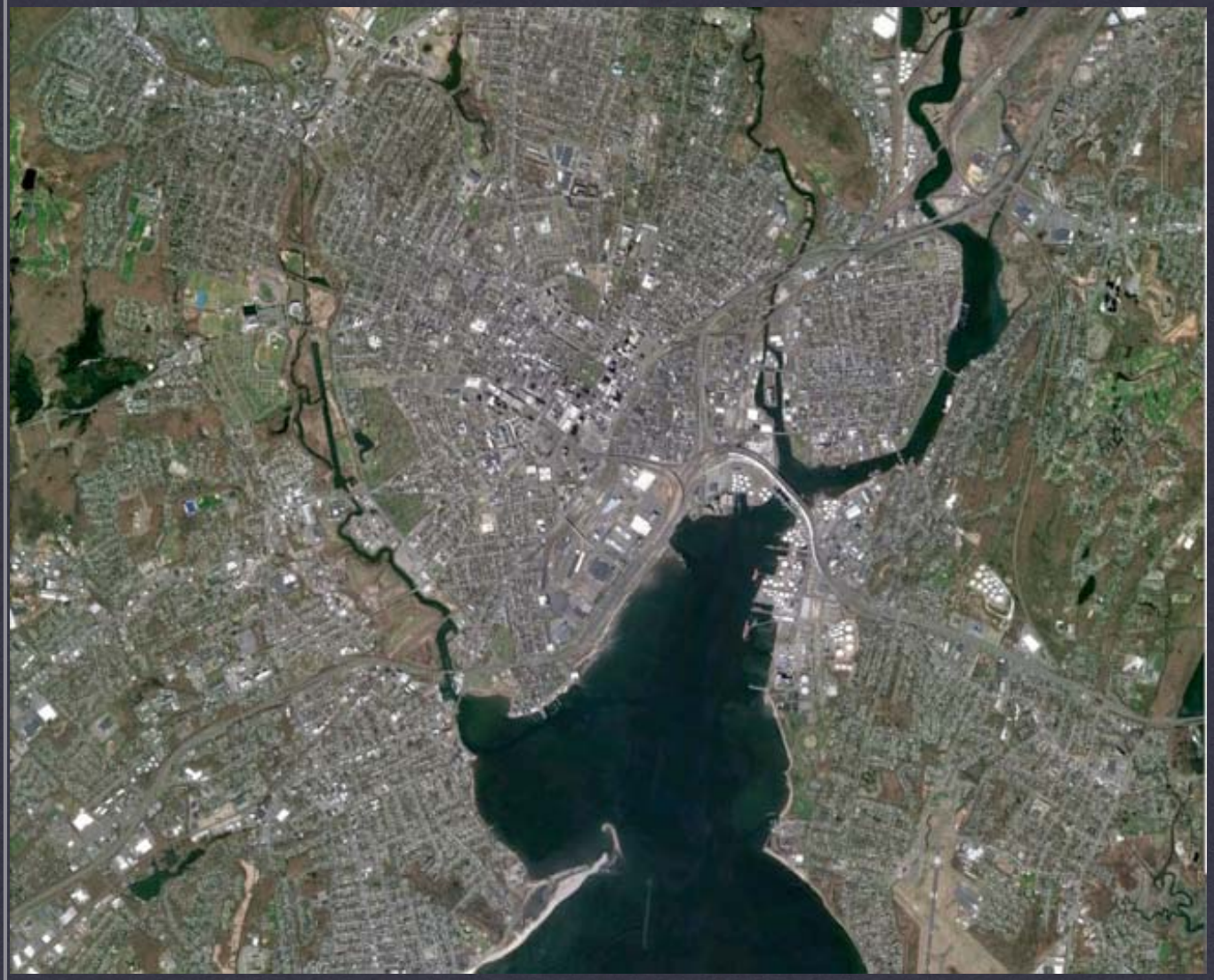
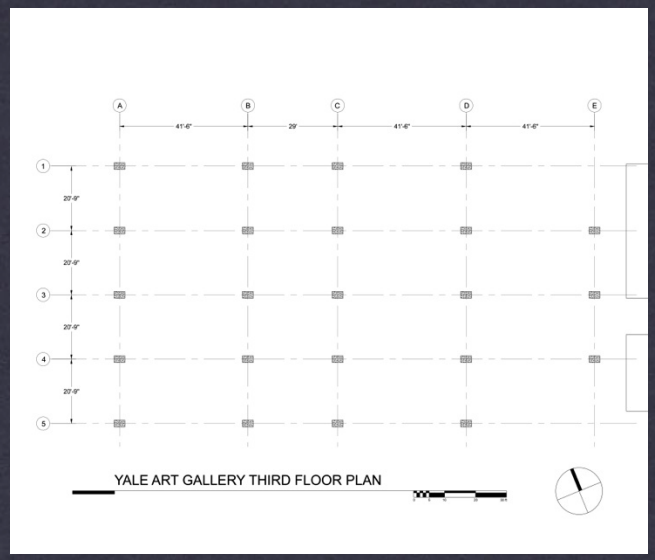
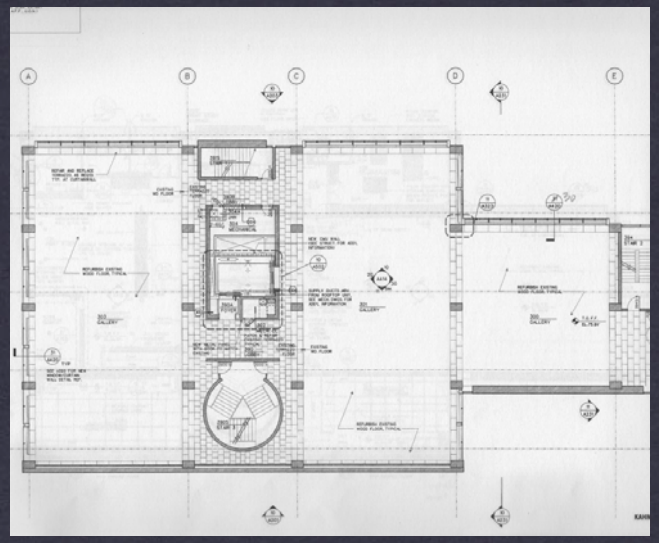






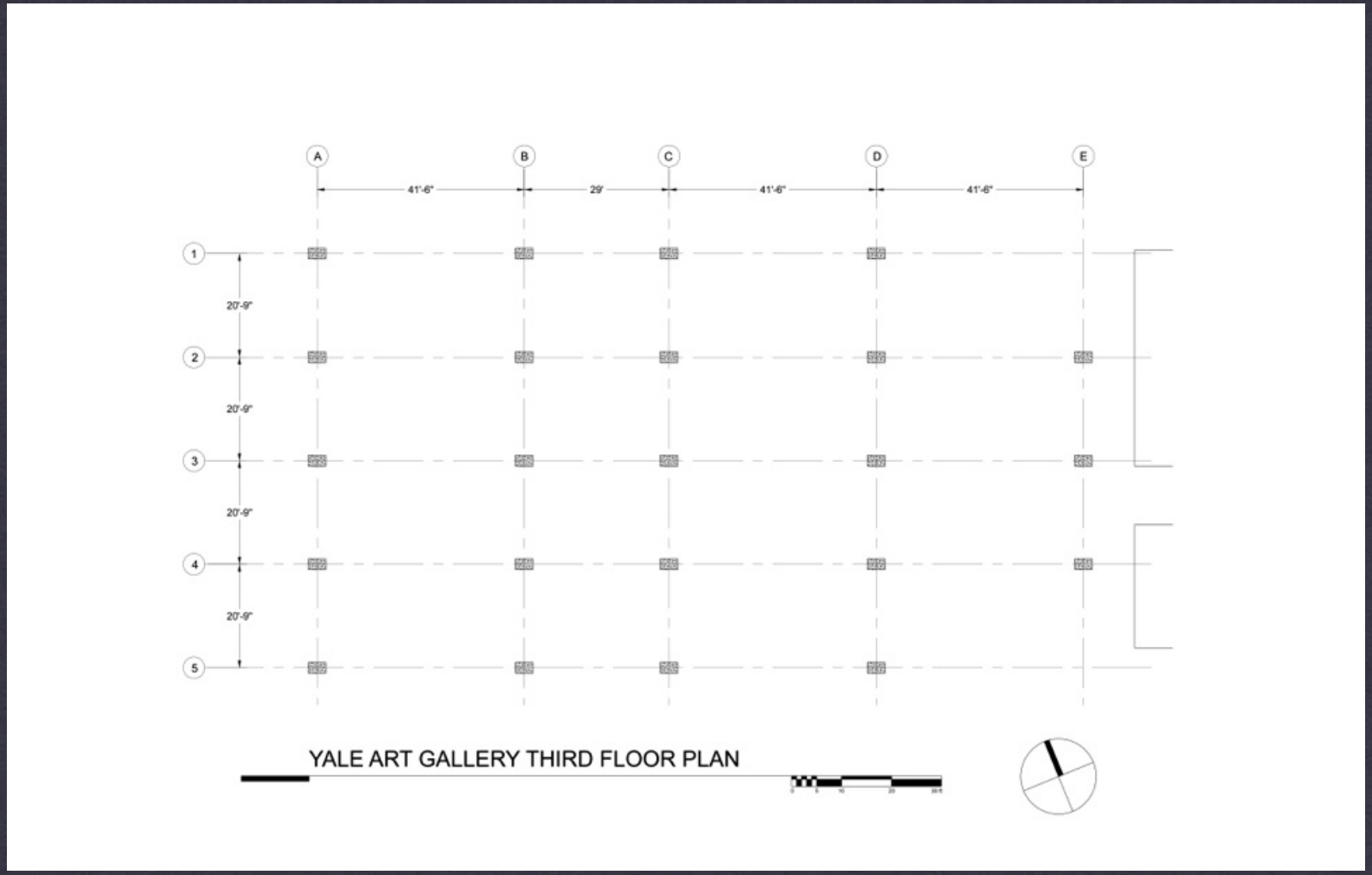
SUBJECT

Building Technology II

Assignment B- Foundation Design

DATE	PROFESSOR
FALL 2012	Friedman

We are going to build off of Assignment A and take our 2D columns and extend this information into 3D space.



Building off Assignment A

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the grid

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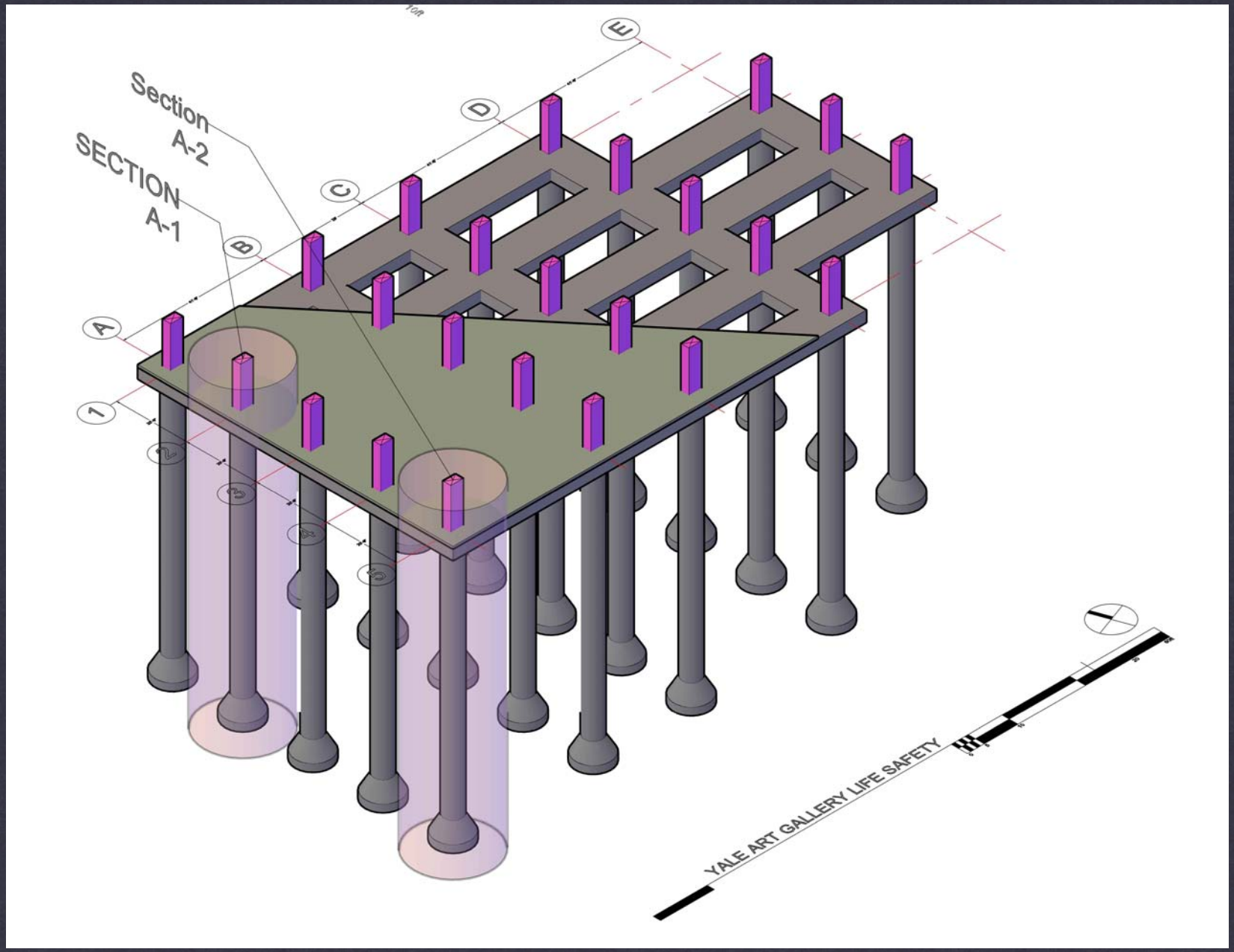

CASE STUDIES

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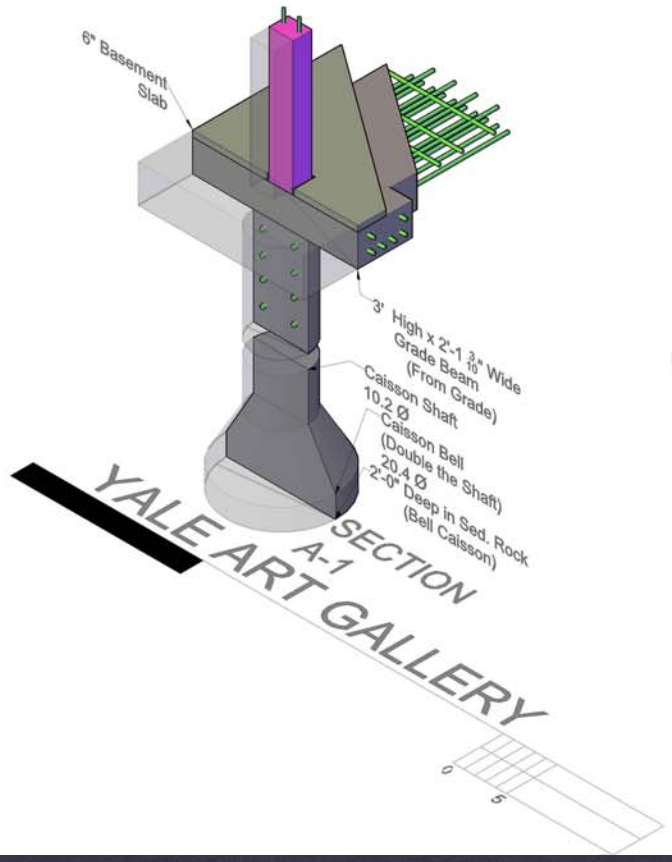


A

TOTAL LOAD: 7.5 MILLION POUNDS

B

STRUCTURE:

Area = Length x Width
23 COLUMNS @ 3'-6" X 2'-2" = 7.58 SQFT/ COLUMN

23 COLUMNS X 7.58 SQFT/COLUMN=174.34SQFT
(GOING INTO FOUNDATION)

A/B:

Total Loads / Structural Area
7.5 MILLION POUNDS / 174.34 SQFT
= 43,019 LBS/SQFT

C:

SEDIMENTARY ROCK ALLOWABLE
FOUNDATION PRESSURE = 4,000 PSFSQ

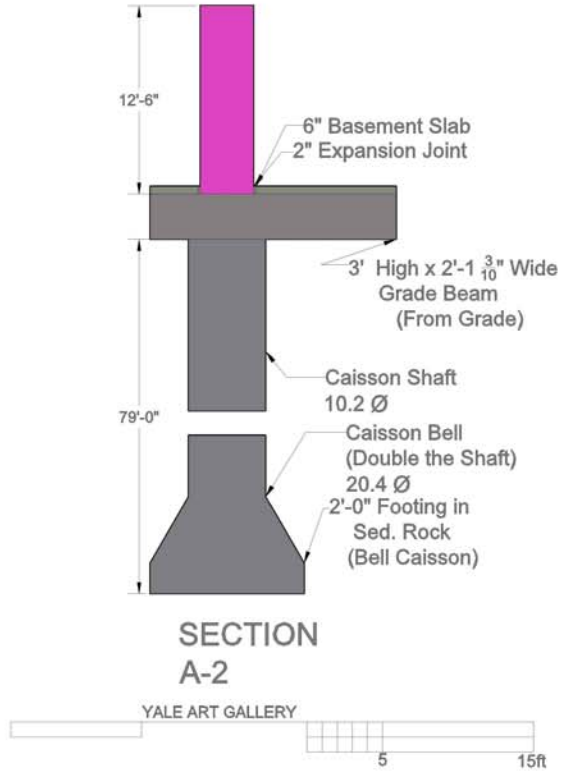
Total Loads / Allowable Foundation Pressure
7.5 MIL LBS / 4000 PSFSQ = 81.52 SQFT

Total Area per Footing
81.52
Square root of Total Area Per footing is 9.28
THE FOOTING SHOULD BE 9'-1" X 9'-1" if "SQUARE"

Used Footing CAISSON

Area = 3.14 $(r)^2$
r^2= Area / 3.14
81.52 = 3.14 (R) SQ

SO, RADIUS OF CAISSON = 5.09'



CASE STUDIES
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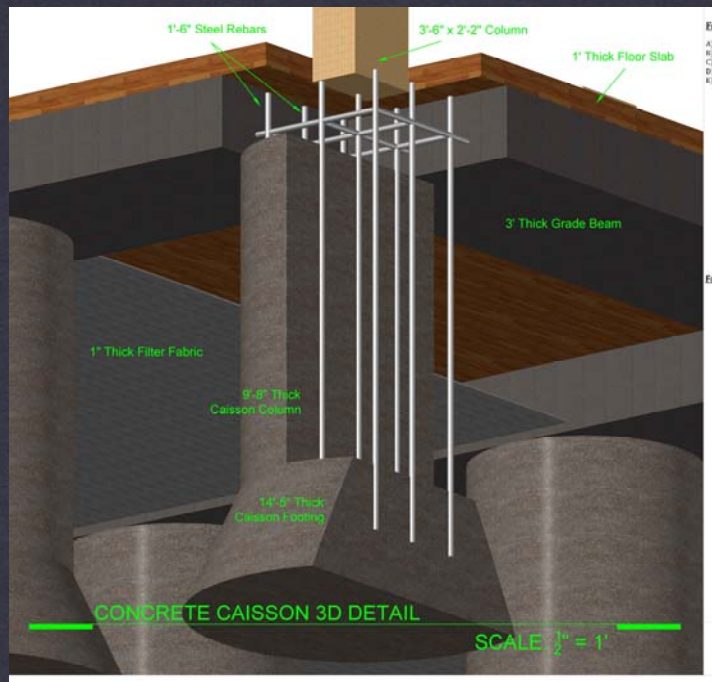


Footing Dimension Analysis

A) Weight of Building = 7,500,000 lbs
B) Soil Strength Capacity = 2,000 psf
C) Column Size: 3'-6" x 2'-2" => 3.5' x 2.167'
D) Number of columns: 23
E) Total area of structural columns: (3.5)*(2.167) x (23) = 174.44 sf

Step 1:

$\frac{A}{a} = \frac{7,500,000}{174.44} = 42,995$ psf > 2,000 psf of soil bearing capacity
no footings are needed

Step 2:

$F = \frac{A}{B} = \frac{7,500,000}{2000} = 3750$ **sf**

Step 3:

$\frac{F}{D} = \frac{3,750}{23} =$ **163 sf per footing**

Step 4:

Shallow Foundation

Dimensions of Footing = $\sqrt{163}$ = **12'- 10" x 12'- 10" x 1'- 0"**

Deep Foundation

Dimensions of Caisson: 163 = πr^2, then radius = 7.2 ft
so diameter = 14.4 ft = **14'-5"**

Foundation Price Analysis

Deep Foundation

Step 1:

Volume of cylindrical caisson = (volume of caisson column) + (volume of caisson footing)
Volume of caisson column = $\pi r^2 h = \pi(4.10')^2(12.11') =$ **948 cf**
Volume of caisson footing = $\pi r^2 h = \pi(7.2')^2(5.2') =$ **834 cf**
Volume of cylindrical caisson = 948 cf + 834 cf = **1, 782 cf per caisson**

Step 2:

Price of concrete for caisson = (volume of cylindrical caisson) x (price of concrete per cf) x (number of caissons)
Price of concrete for caisson = (1,782 cf) • ($311.11 per cf) • (23) = **$456, 000**

Price of drilling = (price of drilling one caisson hole) x (number of caissons)
Price of drilling = ($48,826) • (23) = **$187, 000**

Total price of deep foundation = ($456,000) + ($187, 000) = **$643,000**

Shallow Foundation

Step 1:

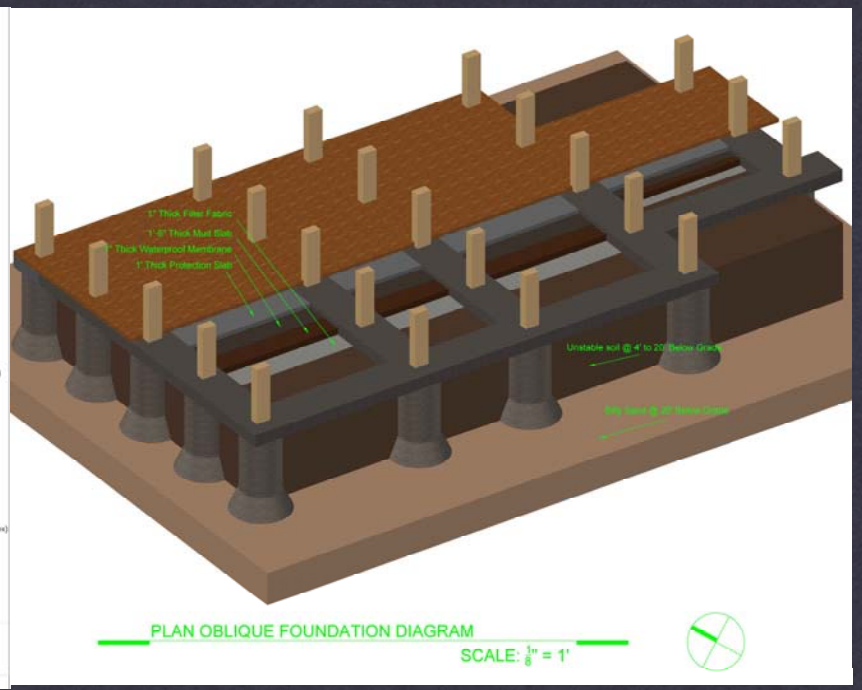
Volume of column footing = (volume of column span) + (volume of column footing)
Volume of column span = (volume of caisson column) = **948 cf**
Volume of column footing = (area per footing) x (footing depth) = (163 sf) • $\frac{1}{2}$ = **163 cf**
Volume of column footing = 948 cf + 163 cf = **1, 111 cf per column footing**

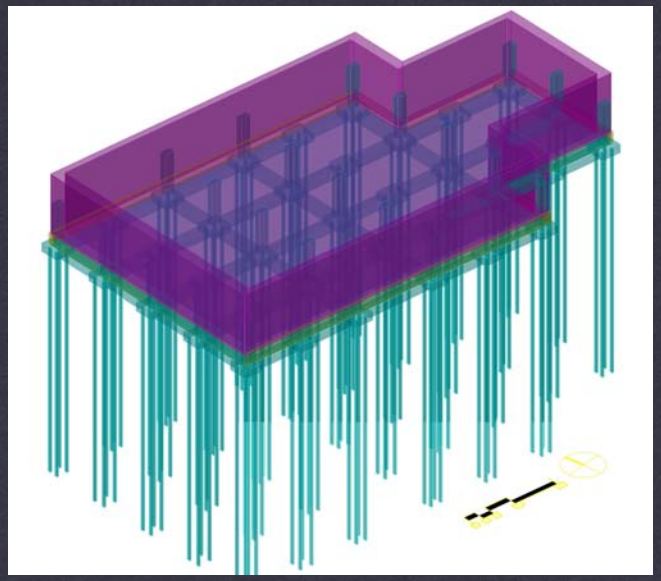
Step 2:

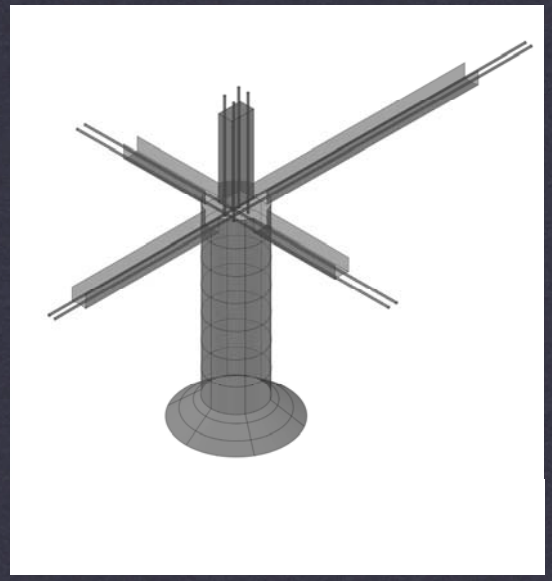
Price of concrete for column footing = (volume of column footing) x (price of concrete per cf) x (number of caissons)
Price of concrete for column footings = (1,111) • ($111.11) • (23) = **$204, 000**

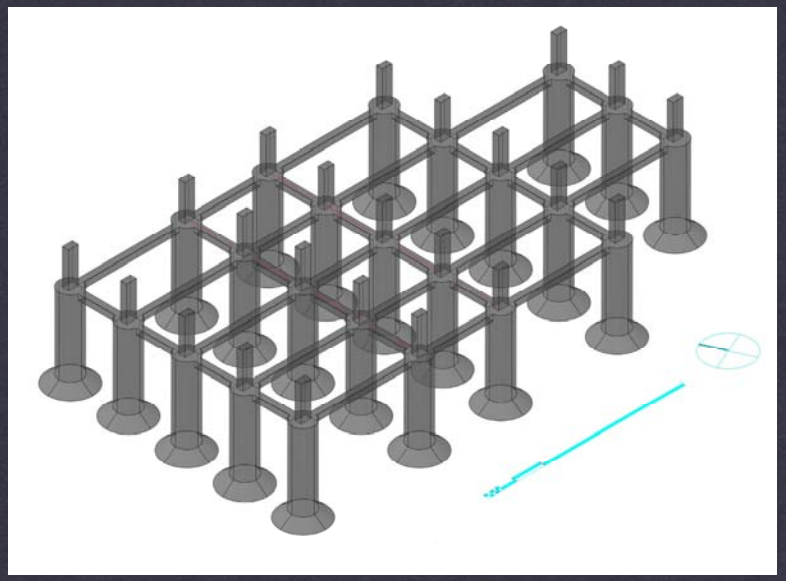
Price of excavation = (gross area of basement floor) x (depth) x (price per cf of excavated soil)
Price of excavation = (12,380 ft) • (20 ft) • ($4) = **$991,000**

Total price of shallow foundation = ($284,000) + ($991,000) = **$1,275,000**









CASE STUDIES

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PAST PROJECTS

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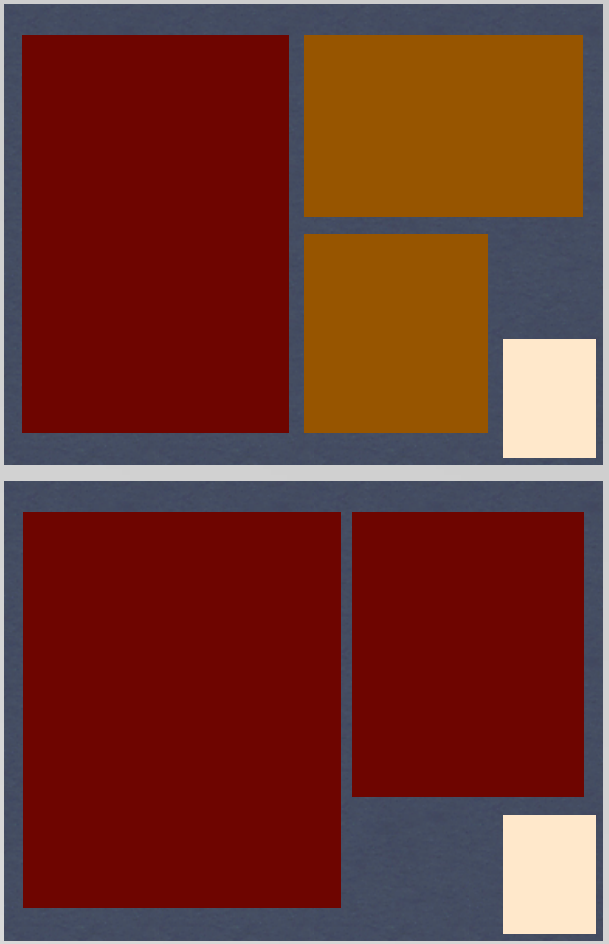
Assignment B

CASE STUDY #1: Foundation Design

DUE: SEPT 21, 2012



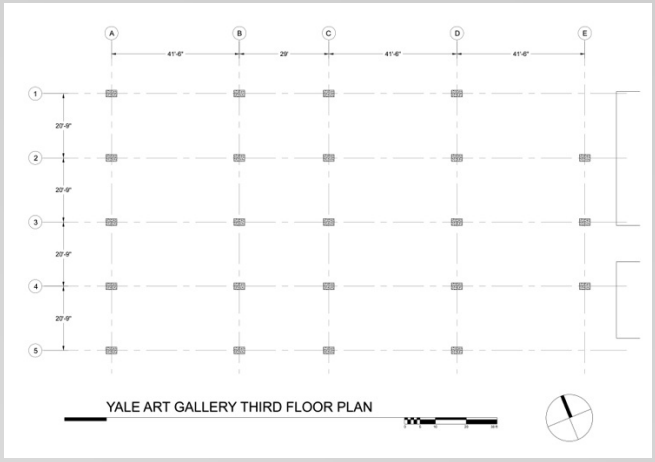
- 2 boards required:
  i. Foundation Plan @ 3/32” = 1’-0”
  ii. Foundation Section @ 1/2”=1’-0”
  iii. 3D Foundation Model @ 3/32”=1’-0”
  iv. 3D Section Model @ 1/2”=1’-0”
  v. Foundation Calculations

- All views must have a north arrow
- One graphic scale must be included for each unique scale
- All sheets must use the titleblock from Assignment A (change the label to Assignment B and the Dwg number to A-200 and A-201)
- Site maps to include the following:
  i. Scale
  ii. Altitude
  iii. Latitude and Longitude Coordinates of Case Study Building
  iv. Case Study Building Outlined/Highlighted

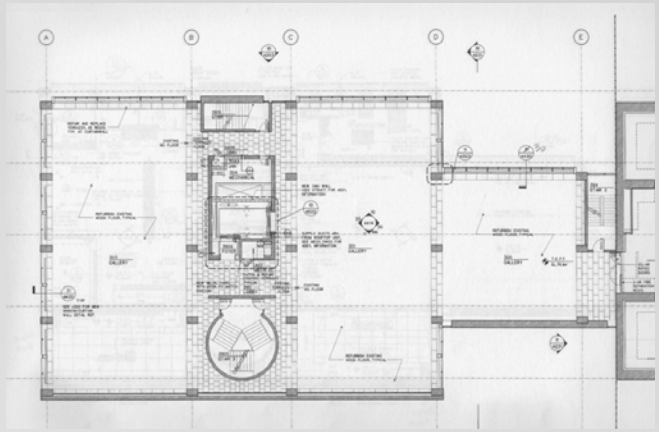
assignment B

CASE STUDY #1: Foundation Design

DUE: SEPT 21, 2012



- 24” x 36” title block that follows studio standards
- emphasis on quality of draftsmanship including:
  - layer management
  - line weights
  - grid dimensions
  - standard notations (doors, elevators, stairs_refer to Arch Graphic Standards)
- column size: 26” x 42”
- submit PDFs and Zip files with all x-refs and rasters included.



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assignment B

CASE STUDY #1: Foundation Design

DUE: SEPT 21, 2012

- Class will be broken up into 4 groups:

- **Group 1:**

- Sandy Clay: 0-30’

- Clay: 30-60’

- **Group 2:**

- Organic Peat: 0- 40’

- Sand: 40-60’

- **Group 3:**

Sandy Gravel: 0-40’

Silty Clay: 40-60’

- **Group 4:**

Organic Peat: 0- 60’

Sedimentary Rock: 60’+

TABLE 1804.2
ALLOWABLE FOUNDATION AND LATERAL PRESSURE

CLASS OF MATERIALS	ALLOWABLE FOUNDATION PRESSURE (psf)[d]	LATERAL BEARING (psf/f below natural grade)[d]	LATERAL SLIDING	
			Coefficient of friction[a]	Resistance (psf)[b]
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and/or gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500[c]	100	—	130

For SI: 1 pound per square foot = 0.0479 kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Lateral sliding resistance value to be multiplied by the contact area, as limited by Section 1804.3.

c. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

d. An increase of one-third is permitted when considering load combinations, including wind or earthquake loads, as permitted by Section 1605.3.2.

FOUNDATION CALCULATIONS

Allowable Pressure

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-Building Height = 5 floors

-Total weight /load of the building (dead + live loads) = 7,500,000 lbs.

-Column size = 3’-6” x 2’-2”

-Frost line of New Haven, Connecticut= 3’-6” down

Foundation Calculations:

Total Load:

1. Calculate the weight of the building loads on the foundation (given = BL)

Structure Area:

1. Calculate the number of columns distributing the load: (count columns = CO)

2. Calculate the area of each column (CA = length x width):

3. Multiply the number of columns x area of each column to find total load distribution area (TLDA = CA x CO)

4. Divide the Total building Loads by the load distribution area to find the amount of load needed to spread per square foot (BL/ TLDA = LS)

Soil Bearing Pressure:

1. Look up the Allowable soil bearing pressure from the chart given (ASBP)

2. If the LS > ASBP, then spread footings are needed.

FOUNDATION CALCULATIONS

Calculations

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Total Bearing Area/ Footing size:

1. Calculate Total Loads (BL) / Allowable soil bearing pressure to find bearing area needed (BA = BL / ASBP)
2. Divide the Bearing Area needed by the # of Columns to get the size needed per footing/ pile/ caisson. (BA / CO = SPF)

3. Calculate the dimensions of the footing/ pile/ caisson (Cylinder: SPF = 3.14 R_2) (Rectangle = Square root of SPF)