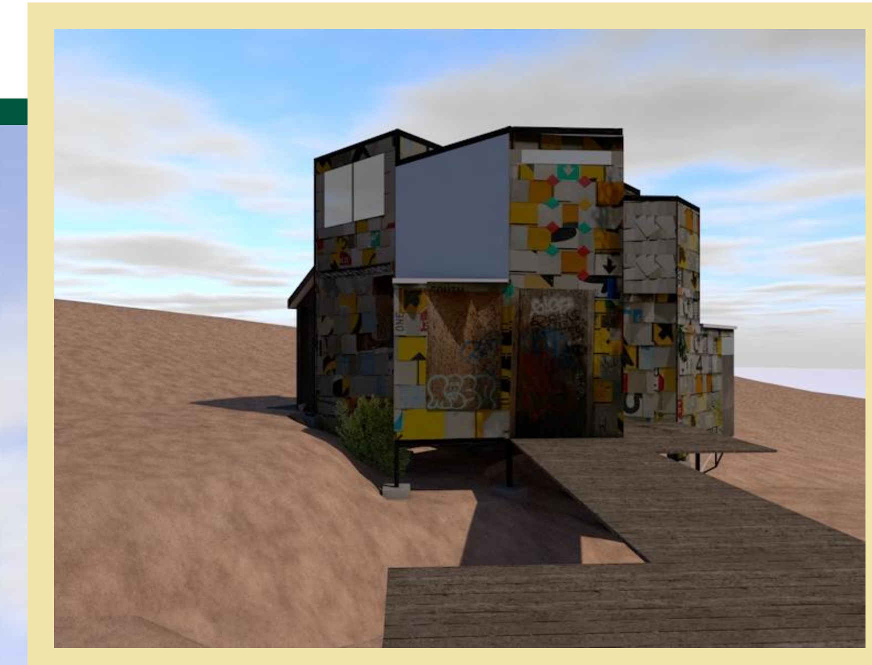
Existing Conditions - March 2017



MODULAR HOUSE
SENIOR PROJECT

MOD SQUAD

ARCE
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BUILDING 21 - 122E
CALIFORNIA POLYTECHNIC
STATE UNIVERSITY
1 GRAND AVE.
SAN LUIS OBISPO, 93401

STAMP:

REGISTERED PROFESSIONAL ENGINEER
KEVIN JON DONG
No. S4072
Exp. 6/30/2017
STRUCTURAL
STATE OF CALIFORNIA

DRAWN BY:

Chris Martinez

Date:

5/2/17

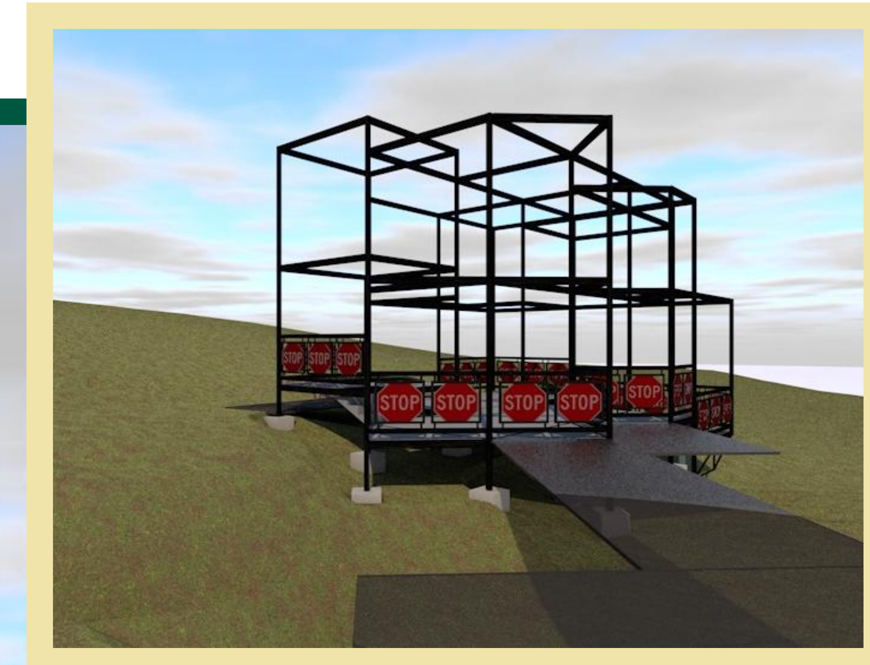
DRAWING TITLE:

Existing Conditions
Rendering

SCALE:

SHEET NUMBER:

T.0.01



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STATE OF CALIFORNIA

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Chris Martinez

Date:

5/2/17

DRAWING TITLE:

Phase 1 Rendering

SCALE:

SHEET NUMBER:

T.0.02

Phase II Construction - December 2017

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KEVIN JON DONG
No. S4072
Exp. 6/30/2017
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STATE OF CALIFORNIA

DRAWN BY:

Chris Martinez

Date:

5/2/17

DRAWING TITLE:

Phase II Rendering

SCALE:

SHEET NUMBER:

T.0.03

Modular House Project Narrative

Senior Project - Spring 2017

Completed by:
Kevin Chiang · Spencer Dilley · Sarah Dowthwaite
Trevor Houghton · Ryan Lefebvre · Michele Leung
Cameron Lober · Chris Martinez · Katie Mayer

February 24, 2017

Project Summary

The Modular House, located in Poly Canyon, has seen extensive damage since the last caretaker left nearly ten years ago. To prevent further damage and improve the safety and appeal of the structure, we are proposing a renovation of the existing building that removes the existing cladding and partitions. By the end of Spring Quarter 2017, the Modular House will have a guardrail system replacing the wood paneling on the walls and a new steel composite deck to replace the current flooring system. The structural steel framing system will remain as is.

Purpose

The Modular House has been subject to the most damage due to vandalism in Poly Canyon. After the last caretaker left in 2010, steps were taken to preserve the structures. The Modular House used to be a symbol of livelihood in the area and was once used as housing for the caretaker of the canyon. Now, it is a boarded up house. We hope to revive this structure by improving its structural and aesthetic qualities, thereby creating a safe and welcoming space for the Cal Poly community to utilize and enjoy.

Our focus is a remodel of the Modular House which emphasizes the unique structural and architectural aspects of the house. In terms of architectural design, what makes the house unique are the road signs that act as the building's skin. In terms of structural design, the house was built using 8'0" cubes with a few forty-five degree offsets around the perimeter of the house. Our goal is to highlight the frames and utilize them in the design of a new guardrail system.

The new design will remove all of the walls from the structure, revealing the cubic modules, and will replace the perimeter walls with a guardrail that integrates the road signs into the design. This will effectively transform the structure from a closed off house into an open observation deck (overlooks a creek) to be used by the public.

Multi-Phase Project

***With this being such a large project to finish in 10 weeks, the construction will be split into two phases. We propose to complete Phase I, which will offer a new usable space, while Phase II will bring the addition of a 2nd level and the connecting stairs.*

Phase I: A complete demolition of the walls, roof, and floor will be performed. The new floor (LW concrete over steel decking) and guardrails for the first level will be installed.

Phase II: The second level guardrails and floor will be added, as well as the linking stairs and structural components necessary for the stairs (footings and columns). Since the design of the guardrails and floor will have been completed in Phase I, the design focus of Phase II will be the stairs.

Scope of Work (Phase I)

Design: This project will include the design of a new guardrail system, connections between the rails and the existing frame, and a new steel deck with concrete fill. The Modular House will have a new guardrail system surrounding every exterior side on both the lower and upper levels. We will be incorporating the existing road signs from the south wall of the structure into the design to maintain the unique charm they currently give to the Modular house. The guardrail will be made of steel for ease of connection to the frame through welds. These connections will be designed to ensure adequate strength. Additionally, a steel deck with concrete fill will be designed to replace the existing deck on both floors. A seismic analysis will be performed on the structure to ensure that the proposed solution will be adequate for the canyon. Analysis will also be performed on the existing structure to confirm that the structure is adequate for continuation of proposed design.

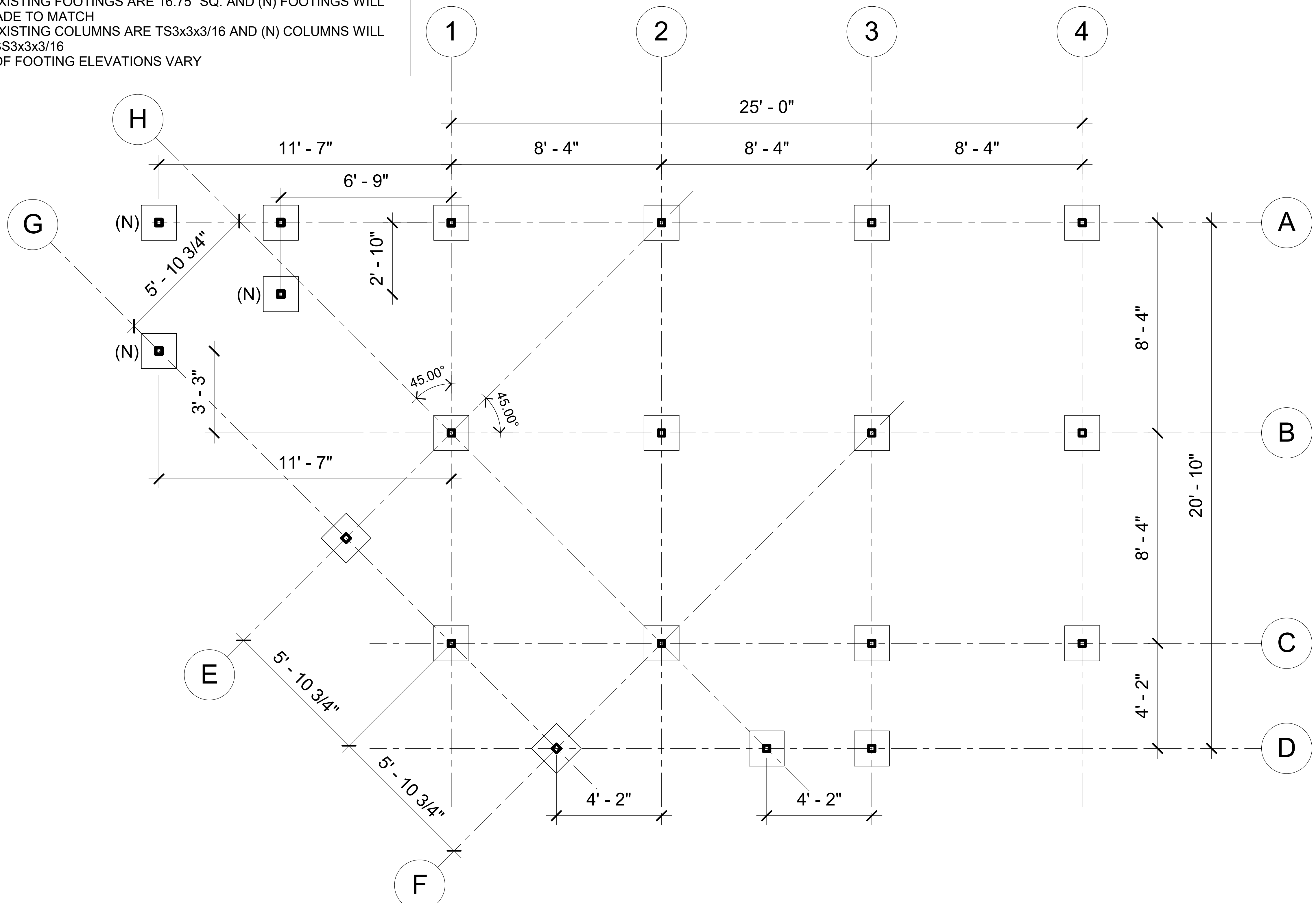
Demolition/Construction**:** For the repair and remodel for the Modular House, the following is a deconstruction and construction phase as proposed. The goal is to deconstruct the original modular house while maintaining the structural frame. For demolition, the interior and non-structural components (cabinets, furniture and other design aspects) are to be removed from the structure first. Following the removal of non-structural components will be the removal of the exterior walls whilst preserving the original signs. The signs will be reused for use of the handrail design. All waste will be disposed and removed from the premise to begin construction. The tentative construction phase proposal shall consist of the finalised design as described in the section above. All construction pertaining to the structural aspect of the building shall be completed first. Following the completion of the structural portion of construction will be the architectural finishes as proposed.

Existing Repairs**:** The floors will be removed and replaced with a new steel deck with concrete fill. Any decking that is damaged should also be replaced with new materials. For all other components of the Modular House, anything that is damaged, either by natural weathering or intentional mischief, shall be replaced and repaired. After all demolition is complete, a survey and analysis of the existing frame will be done, and then construction of the remodel will begin.

Timeline**:** The timeline below shows a tentative schedule of this project.

Date	**Objective**
Late February 2017	Conduct Site Investigation
Mid March 2017	Complete Structural Analysis and Design
Late April 2017	Complete Permit to Send Off for Approval
Early May 2017	Begin Demolition
Late May 2017	Begin Panel Prefabrication
Early June 2017	Complete Phase I

NOTES:
1. ALL FOOTINGS AND COLUMNS CURRENTLY EXIST UNLESS LABELED (N)
2. (N) COLUMNS AND FOOTINGS ARE PART OF PHASE 2
3. ALL EXISTING FOOTINGS ARE 16.75" SQ. AND (N) FOOTINGS WILL BE MADE TO MATCH
4. ALL EXISTING COLUMNS ARE TS3x3x3/16 AND (N) COLUMNS WILL BE HSS3x3x3/16
5. TOP OF FOOTING ELEVATIONS VARY



1 FOUNDATION
1/4" = 1'-0"

MODULAR HOUSE SENIOR PROJECT

MOD SQUAD

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KEVIN JON DONG
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Exp. 6/30/2017
STRUCTURAL
STATE OF CALIFORNIA

DRAWN BY:
RYAN LEFEBVRE

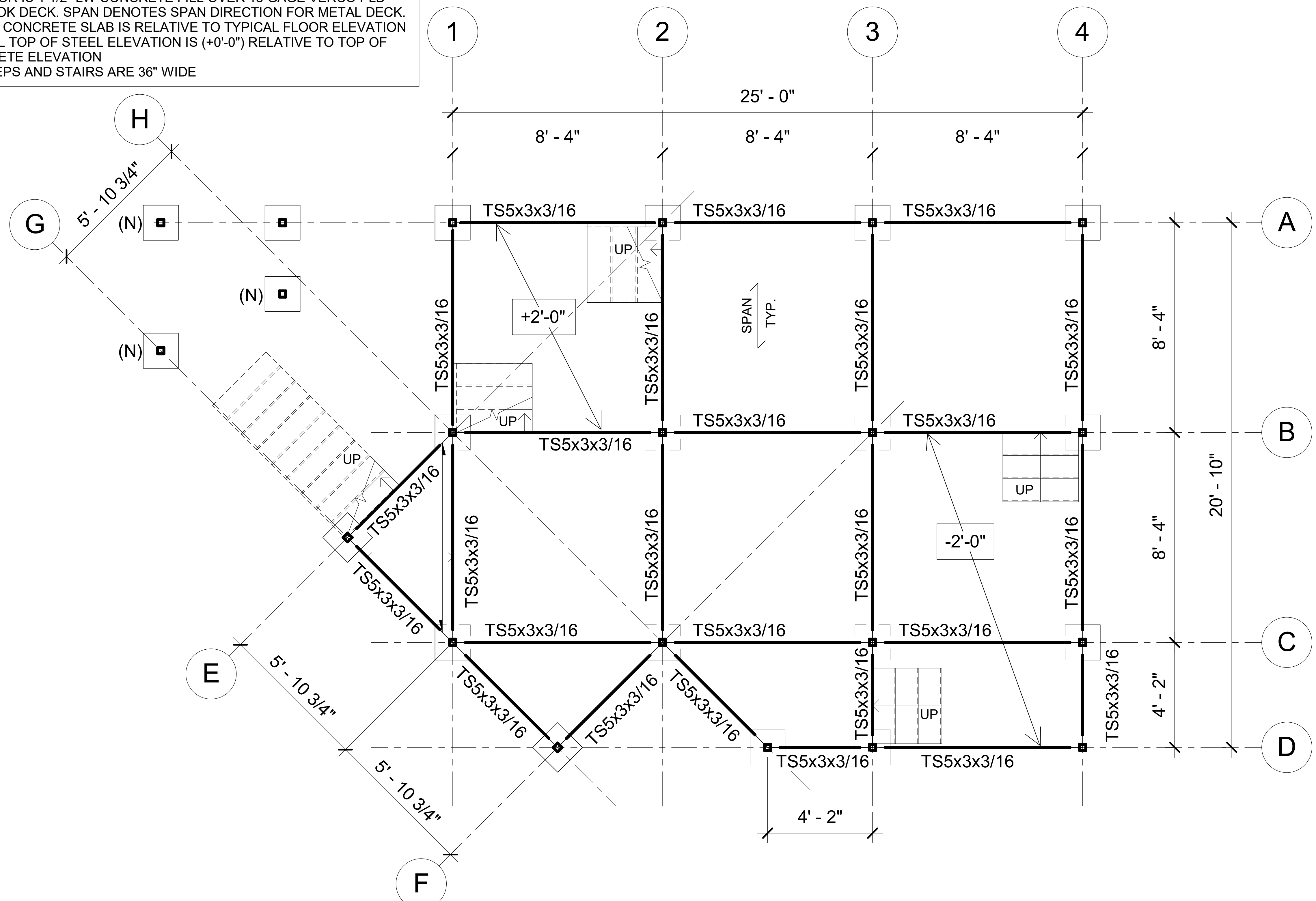
Date:
5/2/17

DRAWING TITLE:
FOUNDATION PLAN

SCALE:
1/4" = 1'-0"

SHEET NUMBER:
S.3.1

NOTES:
1. TYP. ELEVATION: 0'-0" (ELEVATION DATUM IS TOP OF FIRST FLOOR)
2. ALL BEAMS & COLUMNS ARE EXISTING UNLESS LABLED (N)
3. ALL EXISTING COLUMNS ARE TS3x3x3/16
4. (N) FLOOR IS 1 1/2" LW CONCRETE FILL OVER 18 GAGE VERCO PLB FORMLOK DECK. SPAN DENOTES SPAN DIRECTION FOR METAL DECK.
5. TOP OF CONCRETE SLAB IS RELATIVE TO TYPICAL FLOOR ELEVATION
6. TYPICAL TOP OF STEEL ELEVATION IS (+0'-0") RELATIVE TO TOP OF CONCRETE ELEVATION
7. ALL STEPS AND STAIRS ARE 36" WIDE



1 LEVEL 1 FRAMING
1/4" = 1'-0"

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DRAWN BY:

RYAN LEFEBVRE

Date:

5/2/17

DRAWING TITLE:

1ST FLOOR PLAN

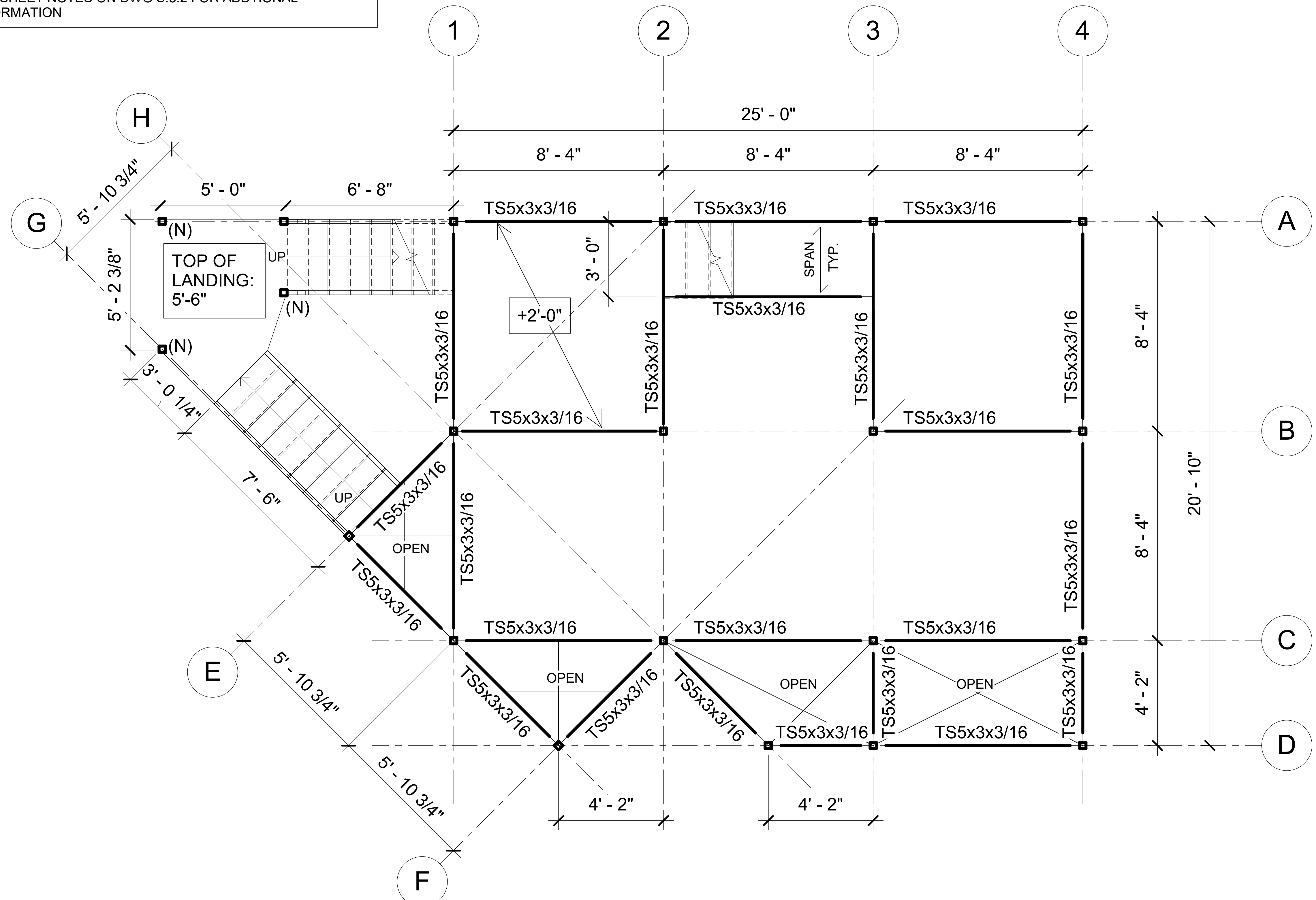
SCALE:

1/4" = 1'-0"

SHEET NUMBER:

S.3.2

NOTES:
1. SECOND FLOOR SLAB AND STAIRS ARE PART OF PHASE 2
2. TYP. ELEVATION: 8'-4" (TOP OF FLOOR)
3. ALL BEAMS & COLUMNS ARE EXISTING UNLESS LABLED (N)
4. SEE SHEET NOTES ON DWG S.3.2 FOR ADDTIONAL INFORMATION



1 LEVEL 2 FRAMING
1/4" = 1'-0"

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DRAWN BY:
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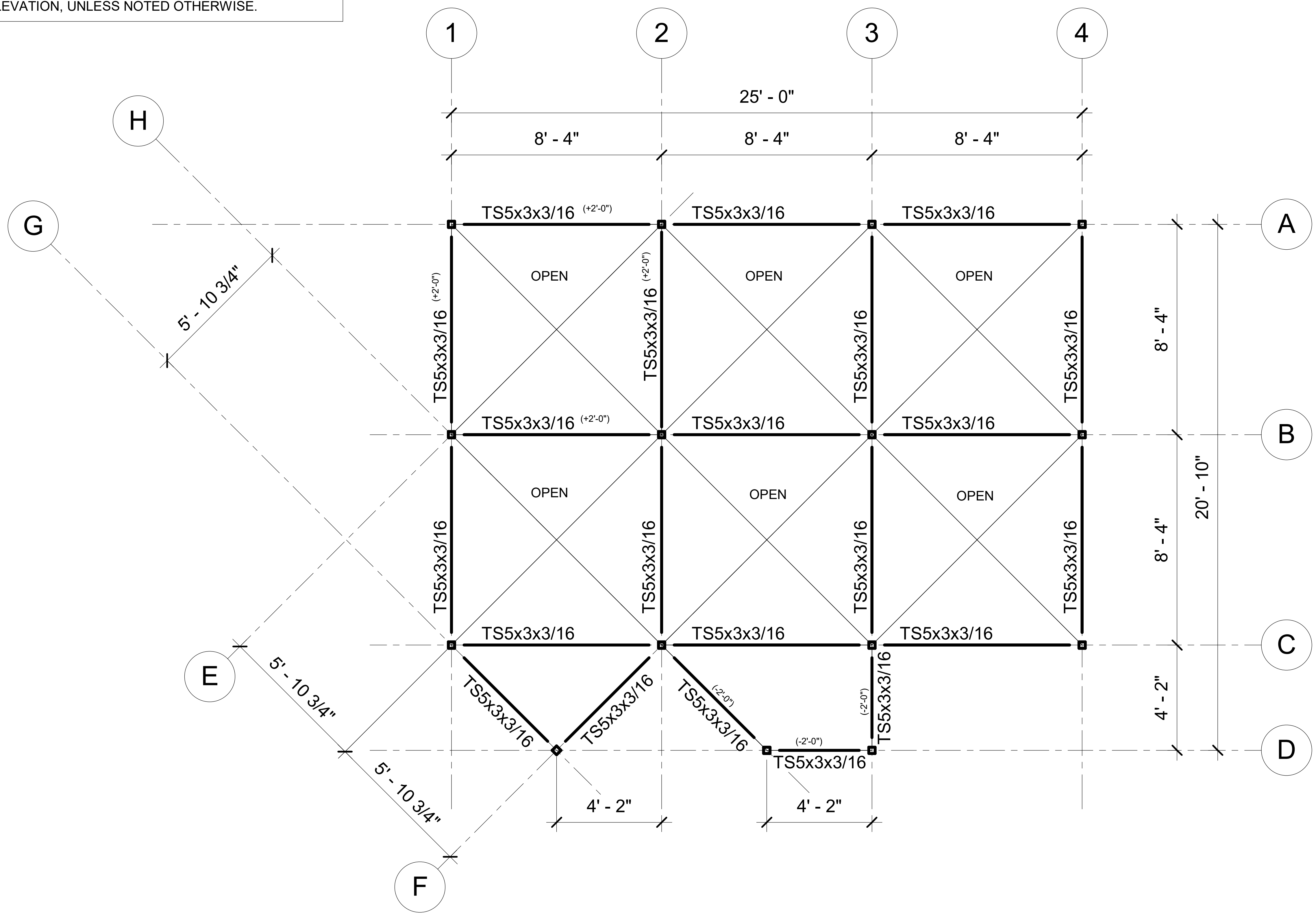
Date:
5/2/17

DRAWING TITLE:
2ND FLOOR PLAN

SCALE:
1/4" = 1'-0"

SHEET NUMBER:
S.3.3

NOTES:
1. TYP. ELEVATION: 16'-8" (TOP OF BEAM)
2. TYPICAL TOP OF STEEL IS (+0-0") RELATIVE TO TYP. ELEVATION, UNLESS NOTED OTHERWISE.



1 ROOF FRAMING
1/4" = 1'-0"

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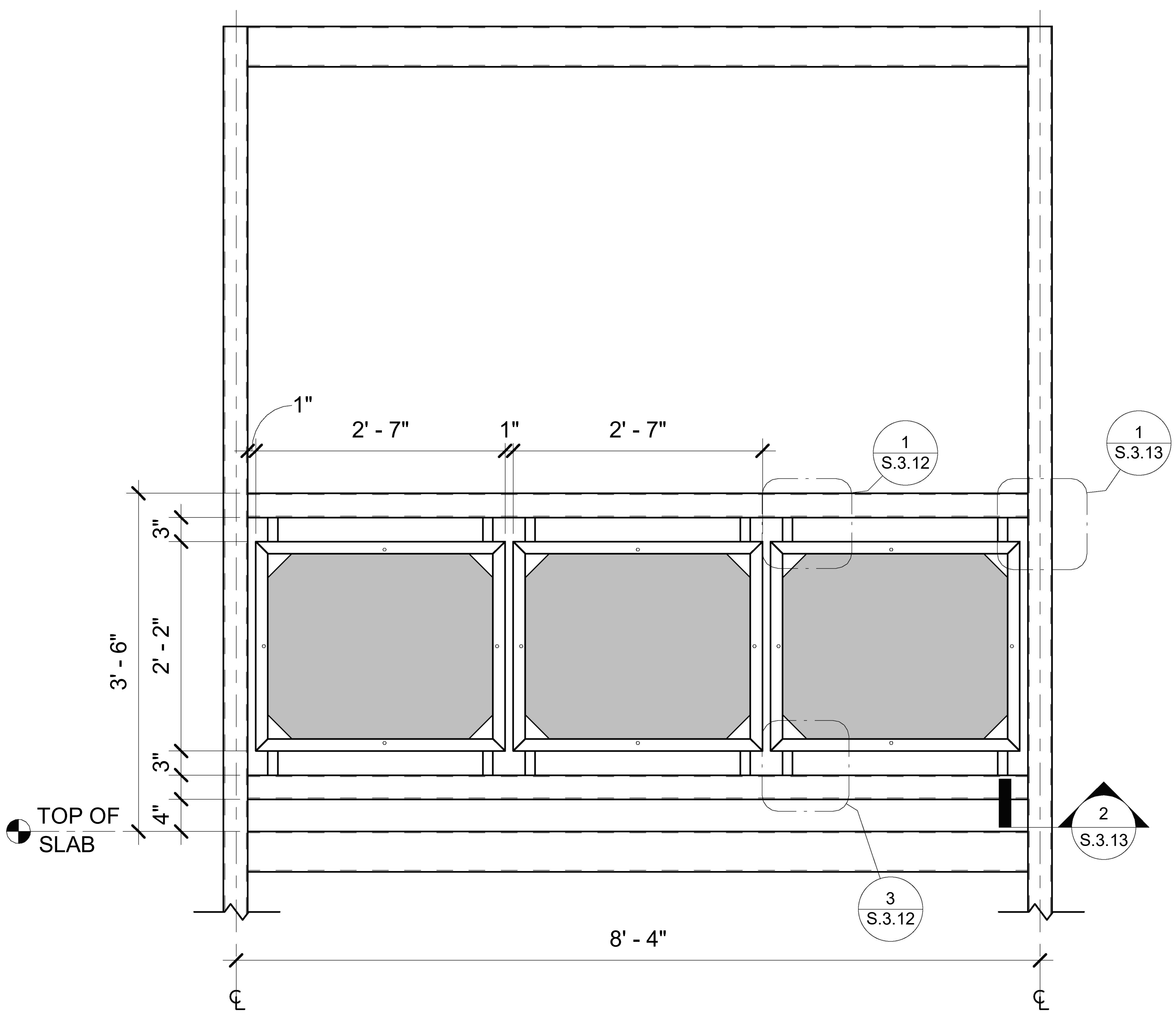
DRAWN BY:
RYAN LEFEBVRE

Date:
5/2/17

DRAWING TITLE:
ROOF PLAN

SCALE:
1/4" = 1'-0"

SHEET NUMBER:
S.3.4



1 GUARD RAIL EXTERIOR TYP.

3/4" = 1'-0"

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No. S4072
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Date:

5/2/17

DRAWING TITLE:

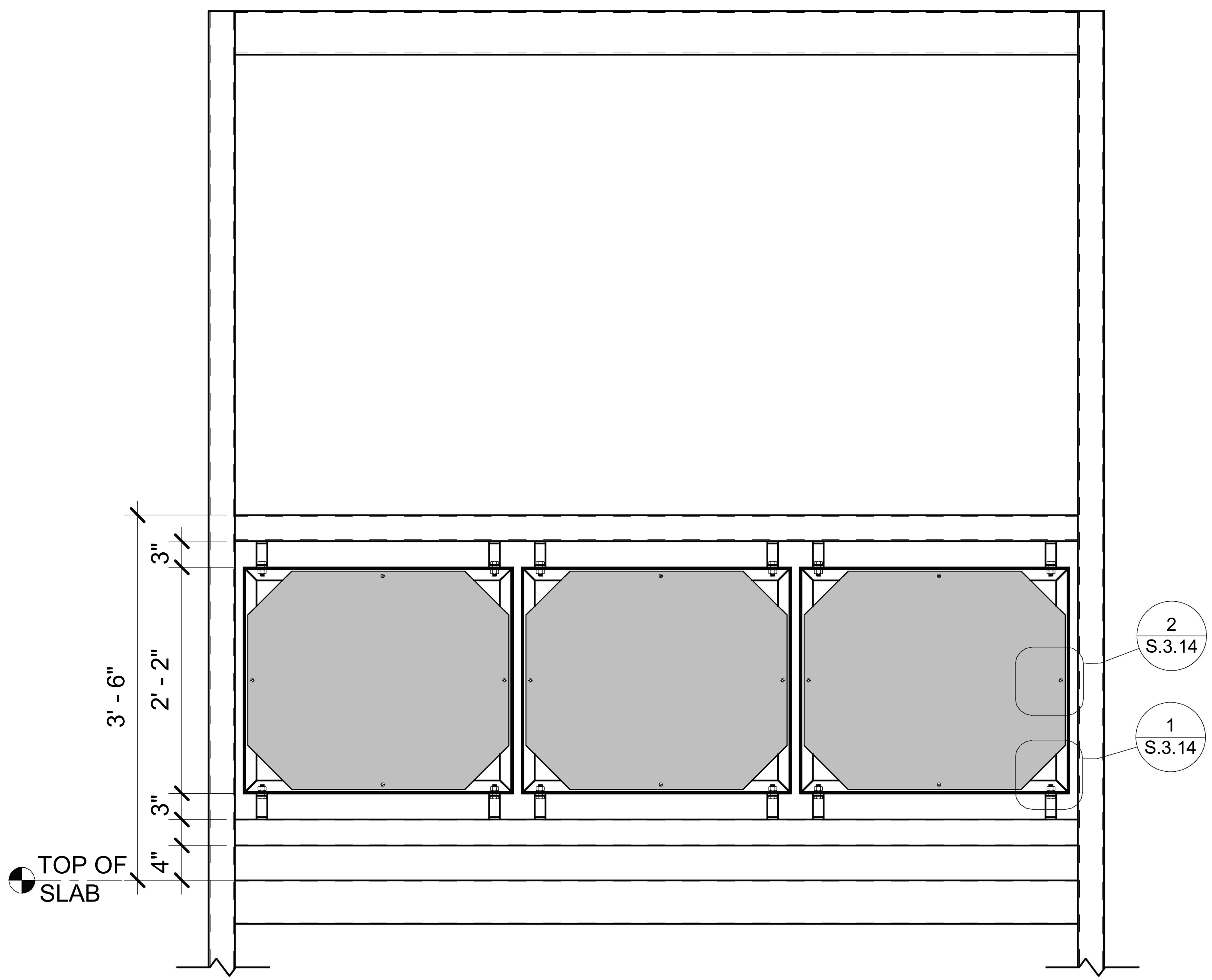
TYPICAL GUARD RAIL DETAILS

SCALE:

3/4" = 1'-0"

SHEET NUMBER:

S.3.10



1 GUARD RAIL INTERIOR TYP.
3/4" = 1'-0"

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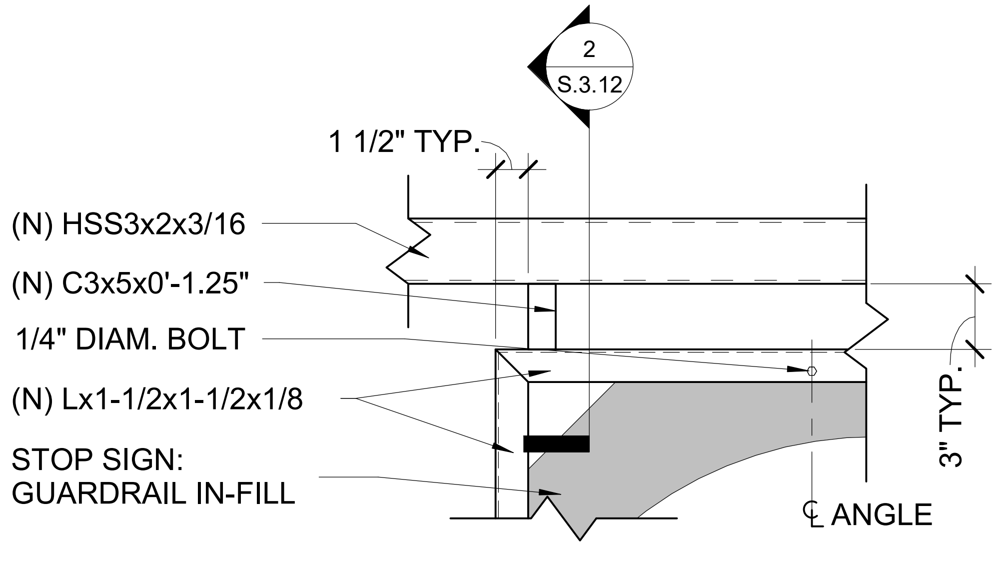
Date:
5/2/17

DRAWING TITLE:
TYPICAL GUARD RAIL DETAILS

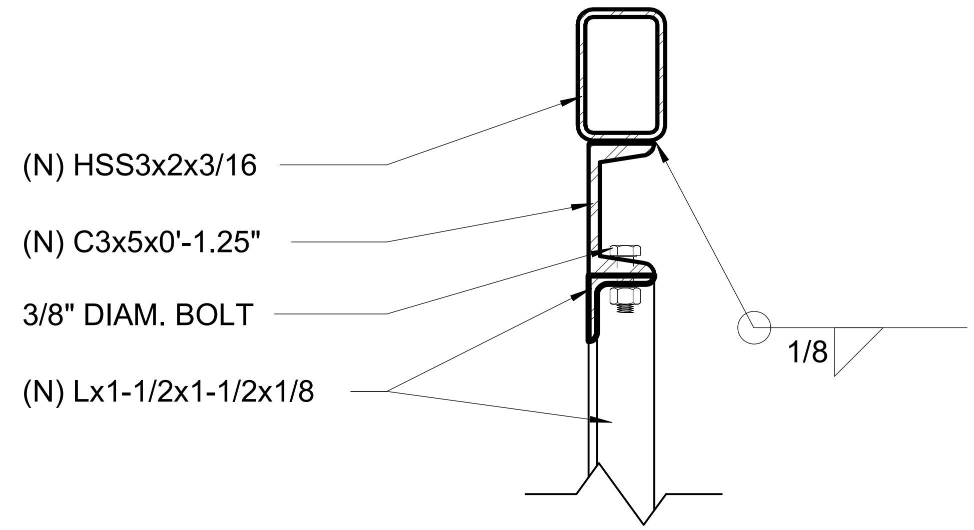
SCALE:
3/4" = 1'-0"

SHEET NUMBER:
S.3.11



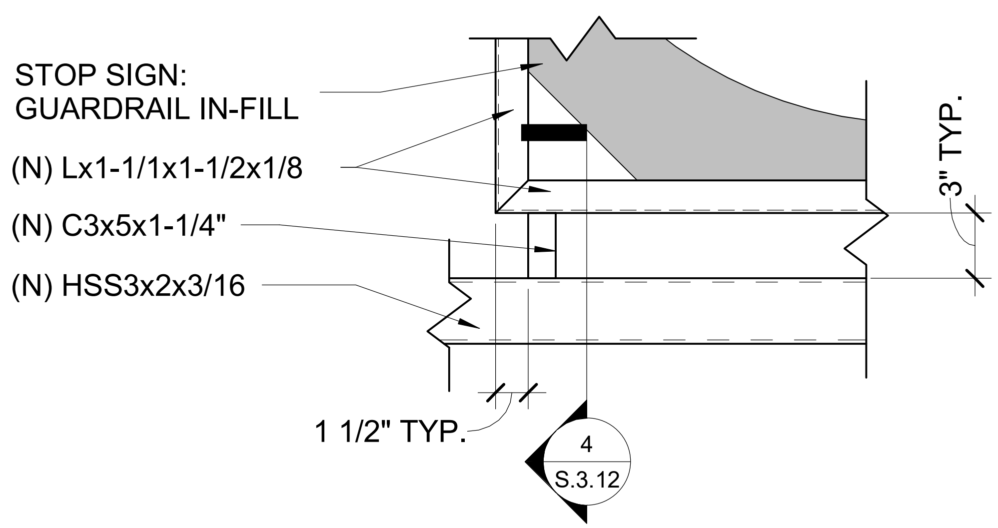
1 PANEL TO GUARD RAIL - TOP

1 1/2" = 1'-0"



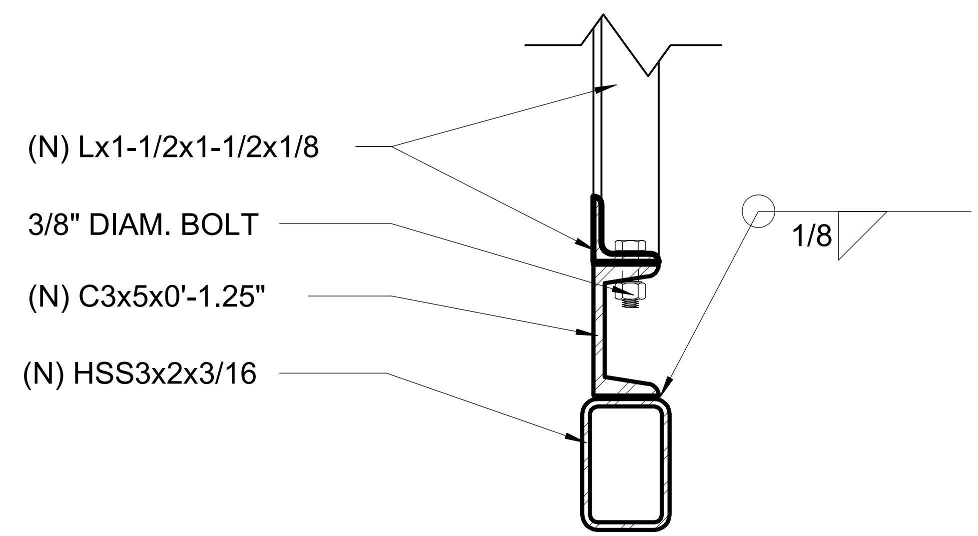
2 PANEL CONNECTION - TOP

3" = 1'-0"



3 PANEL TO GUARD RAIL - BOTTOM

1 1/2" = 1'-0"



4 PANEI CONNECTION - BOTTOM

3" = 1'-0"

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Date:

5/2/17

DRAWING TITLE:

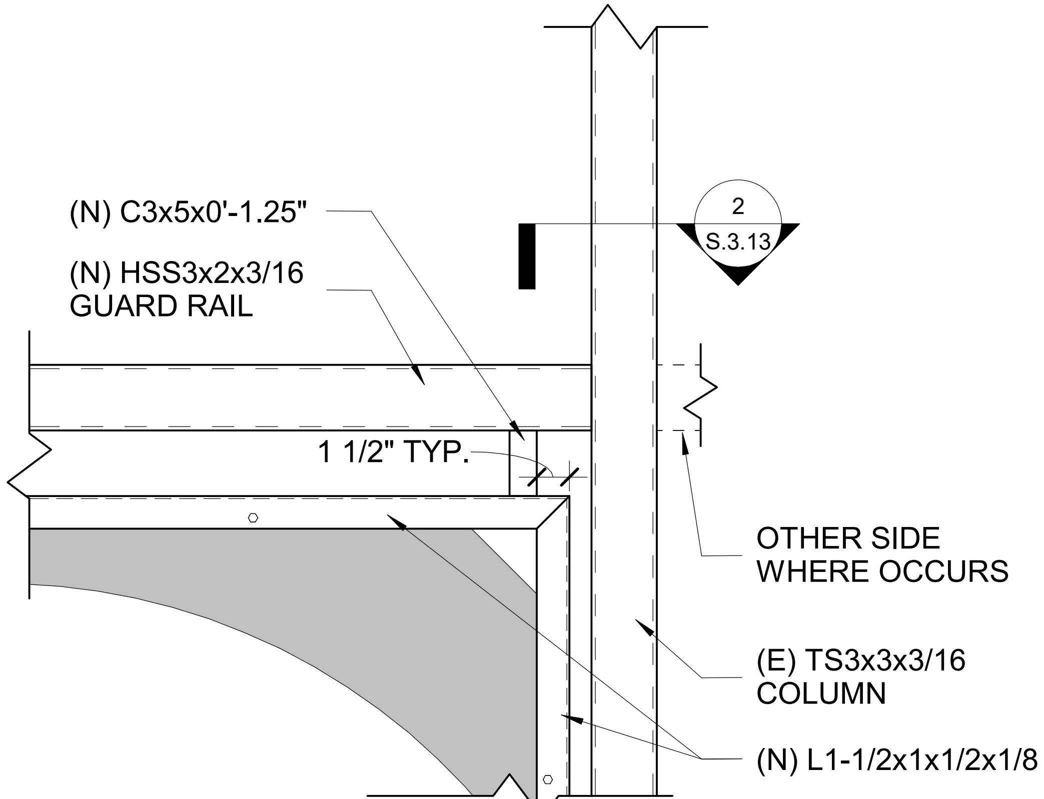
TYPICAL GUARD
RAIL DETAILS

SCALE:

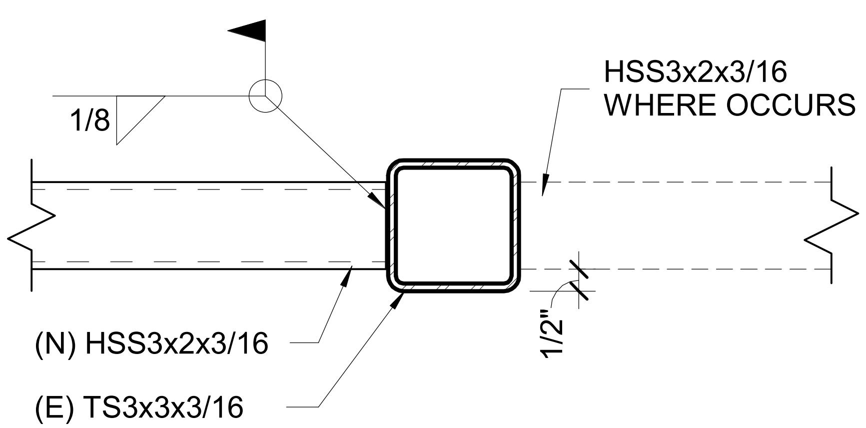
As indicated

SHEET NUMBER:

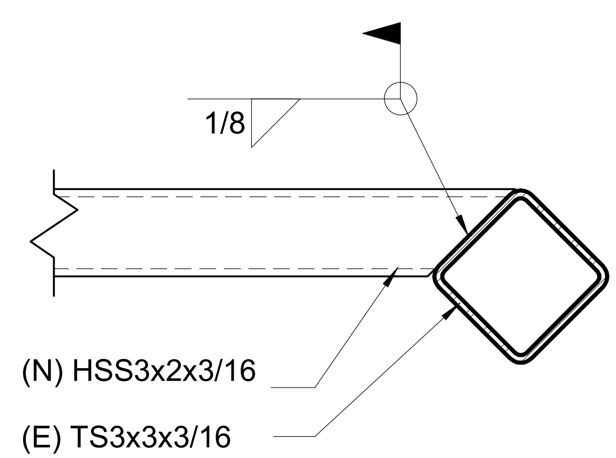
S.3.12



1 UPPER RAIL TO COLUMN CONNECTION
1 1/2" = 1'-0"



2 RAIL TO COLUMN - TOP & BOTTOM
3" = 1'-0"



3 RAIL TO ANGLED COLUMN - TOP & BOTTOM
3" = 1'-0"

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DRAWING TITLE:

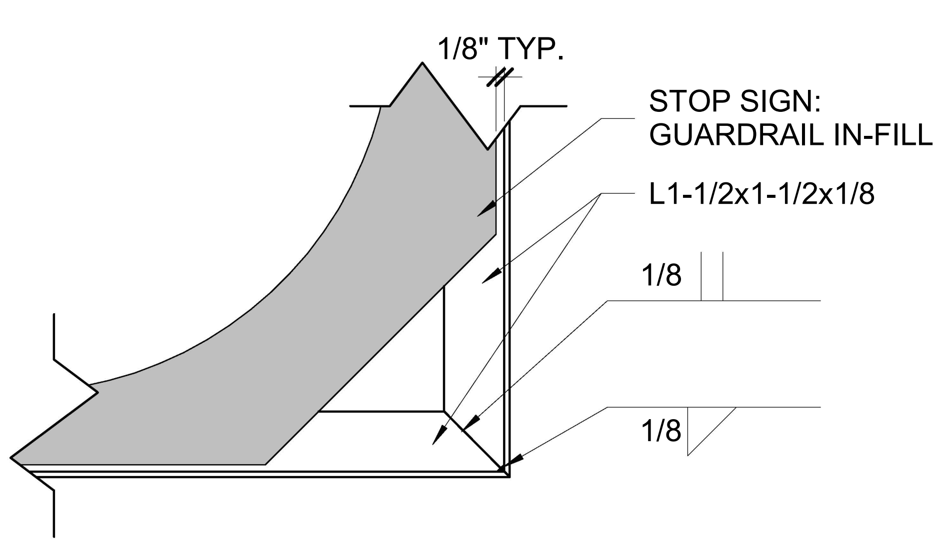
TYPICAL GUARD RAIL DETAILS

SCALE:

As indicated

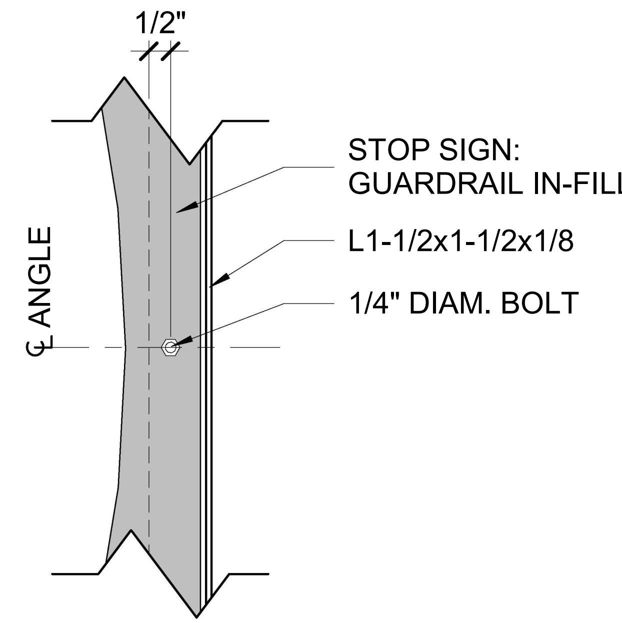
SHEET NUMBER:

S.3.13



1 PANEL CONNECTION TYP.

3" = 1'-0"



2 SIGN CONNECTION

3" = 1'-0"

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DRAWING TITLE:

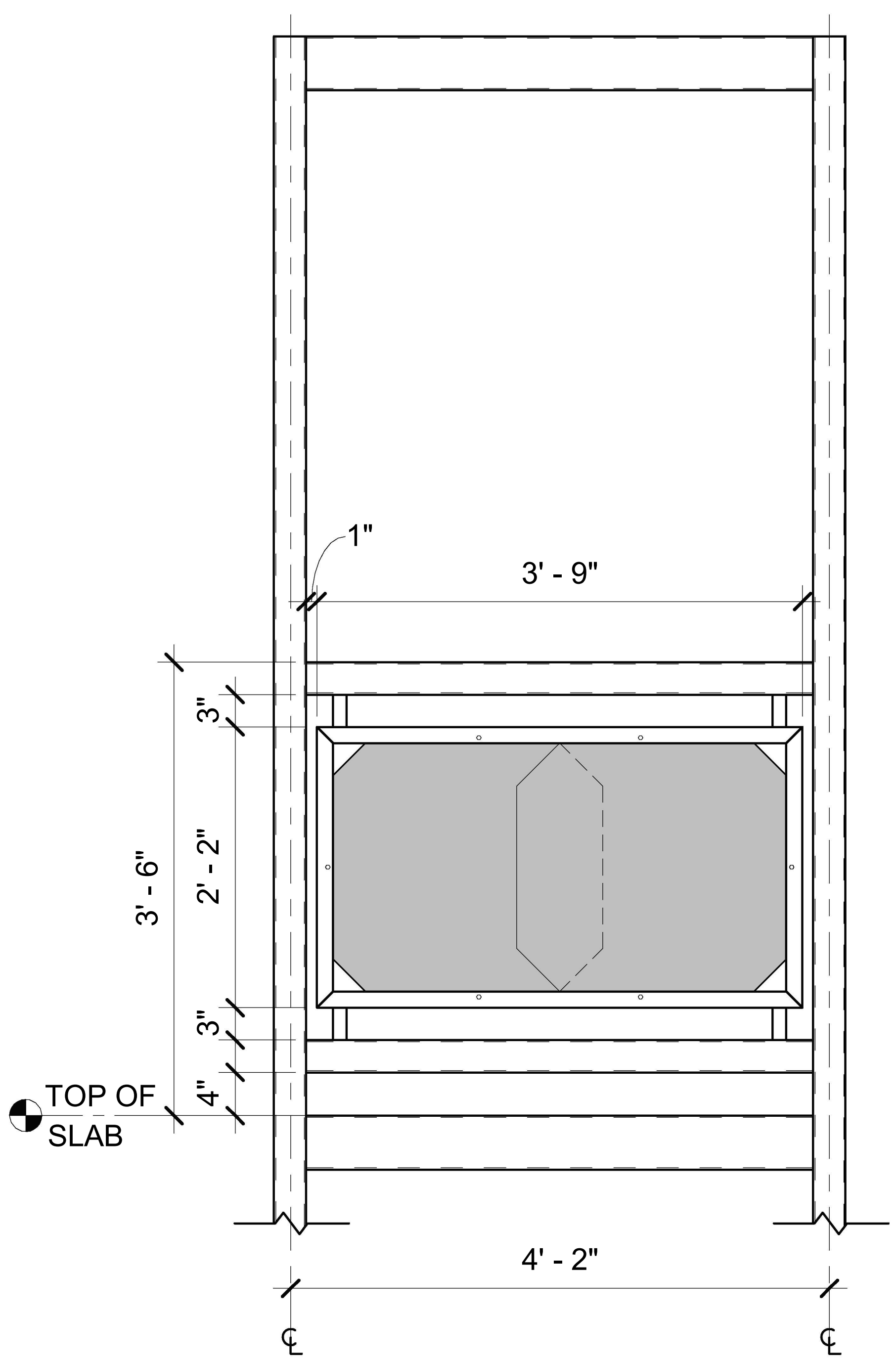
TYPICAL GUARD RAIL DETAILS

SCALE:

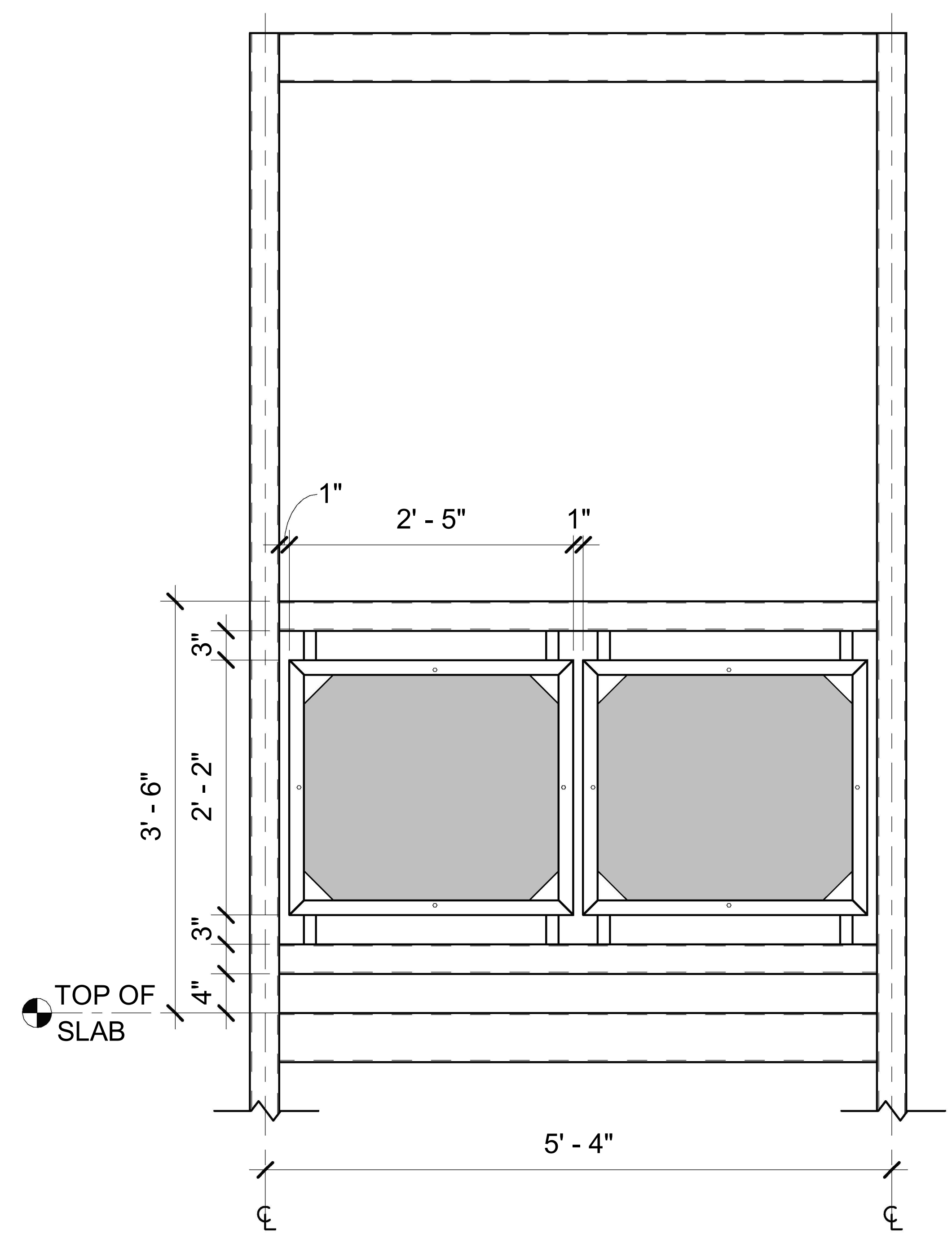
3" = 1'-0"

SHEET NUMBER:

S.3.14



1 GUARD RAIL EXTERIOR 4'-2"
3/4" = 1'-0"



2 GUARD RAIL EXTERIOR 5'-4"
3/4" = 1'-0"

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DRAWING TITLE:

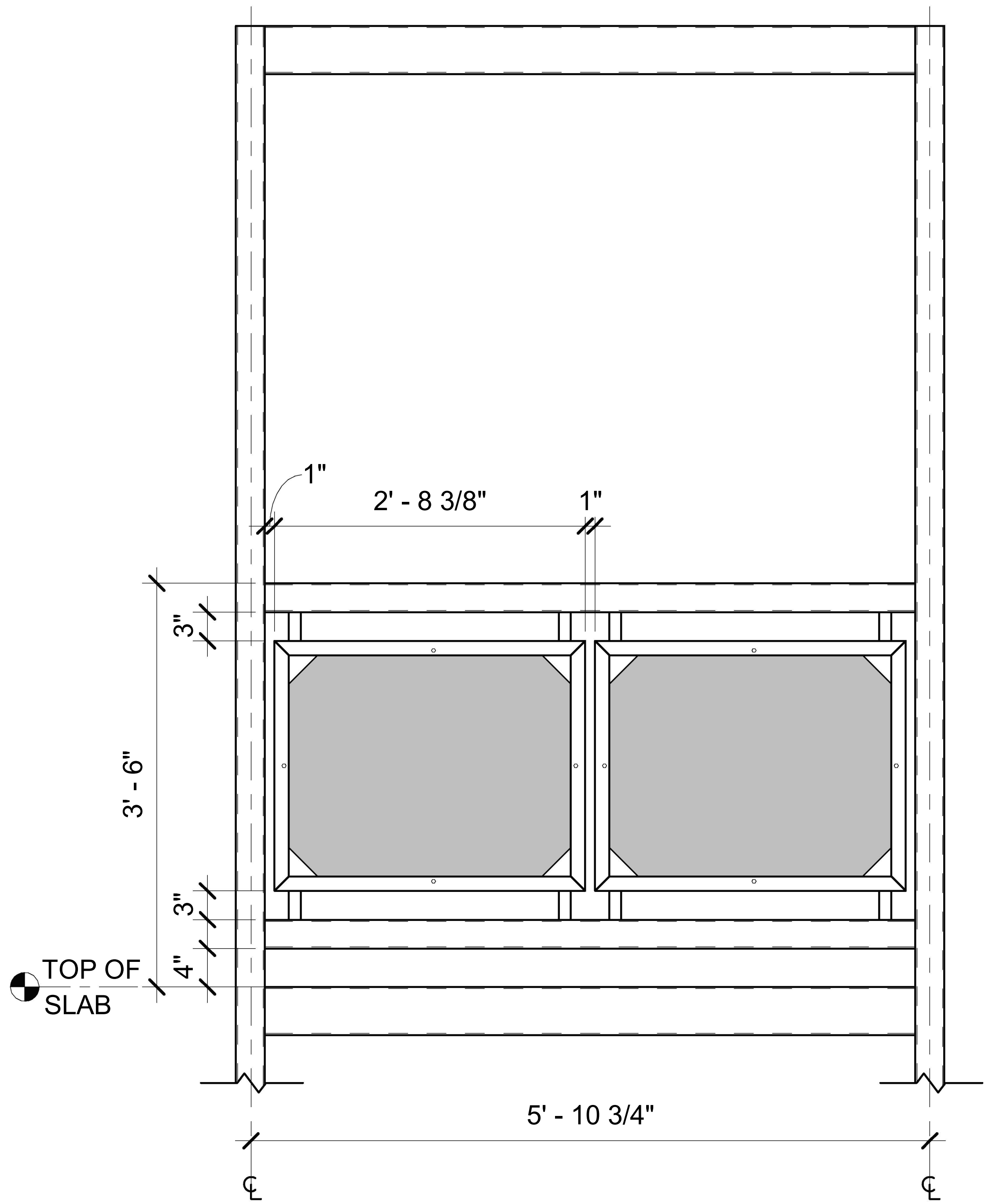
ATYPICAL GUARD RAILS

SCALE:

3/4" = 1'-0"

SHEET NUMBER:

S.3.15



1 GUARD RAIL EXTERIOR 5'-10 3/4"
3/4" = 1'-0"

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DRAWING TITLE:

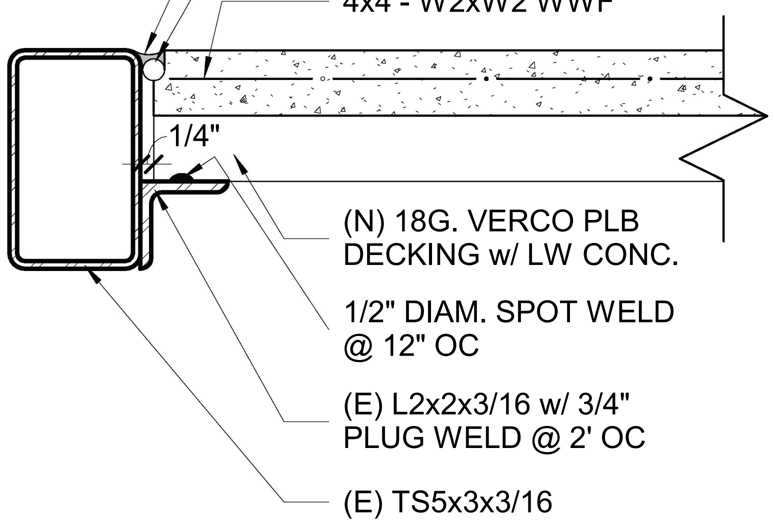
ATYPICAL GUARD RAILS

SCALE:

3/4" = 1'-0"

SHEET NUMBER:

S.3.16



1 DECKING CONNECTION
3" = 1'-0"

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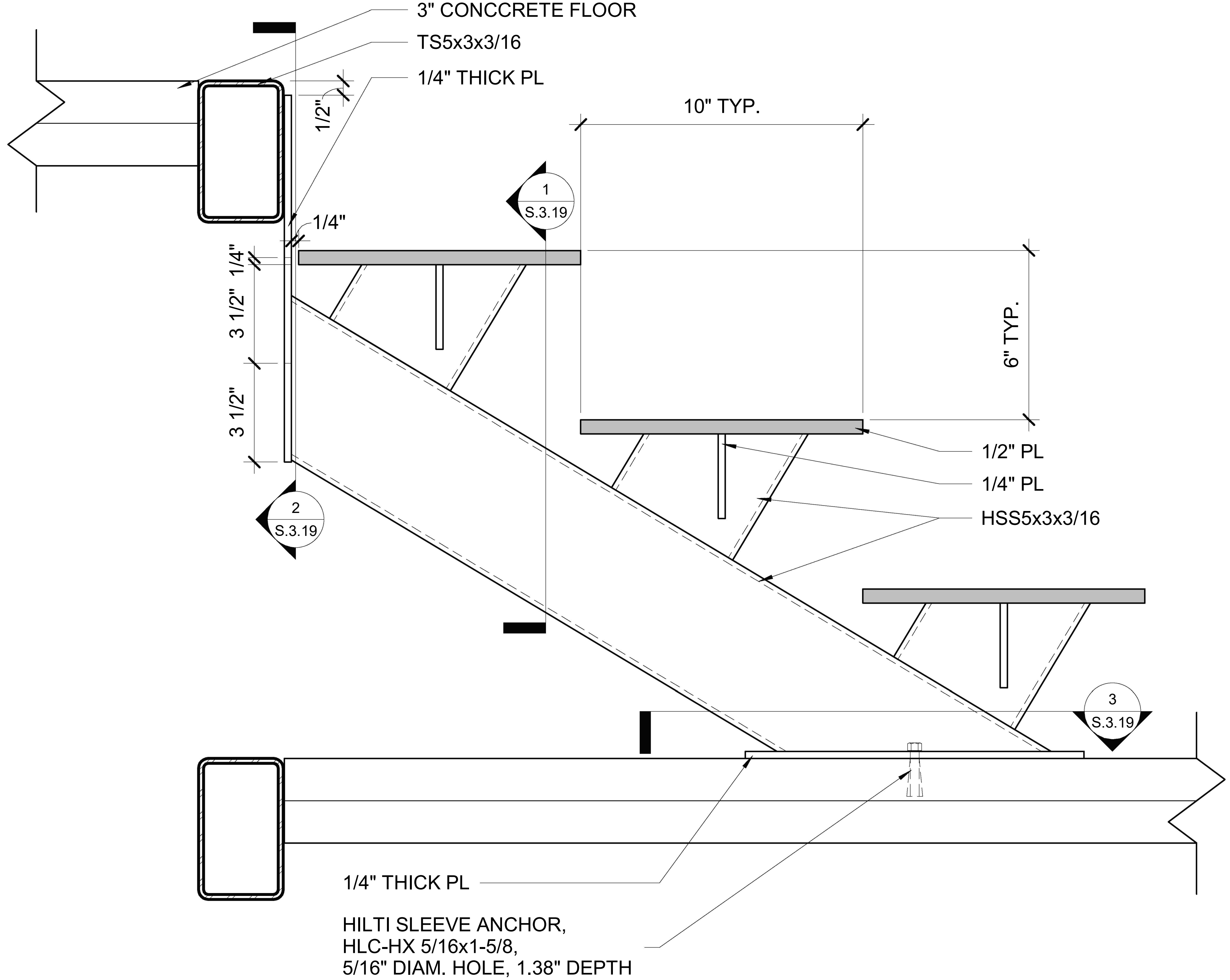
DECKING DETAILS

SCALE:
3" = 1'-0"

SHEET NUMBER:
S.3.17



1 MONO-STRINGER STEPS
3" = 1'-0"

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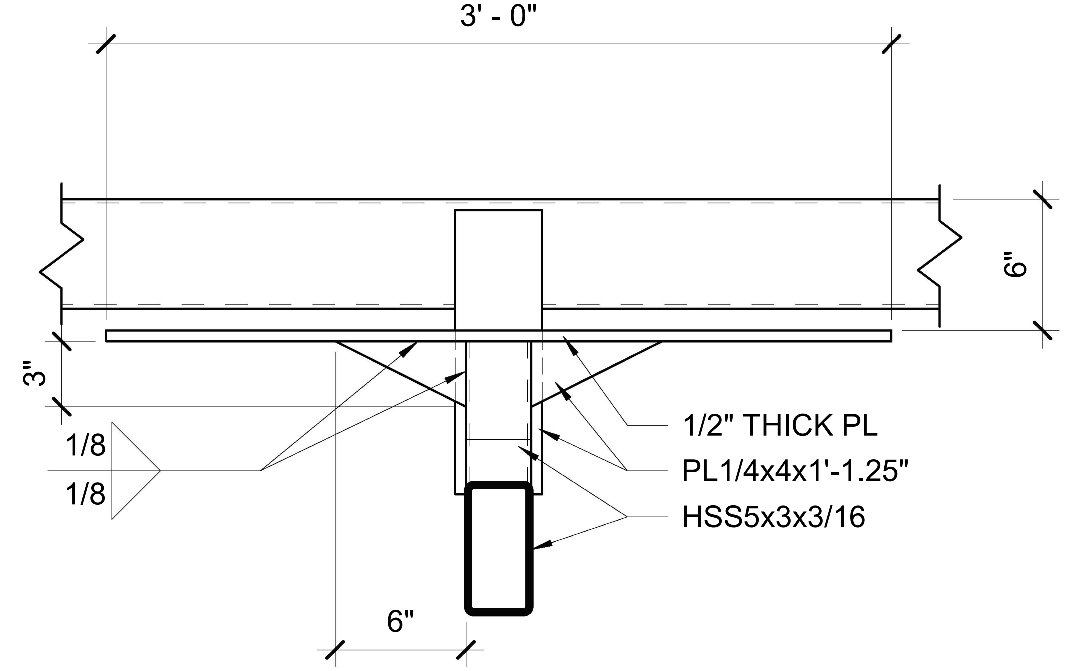
Date:
5/2/17

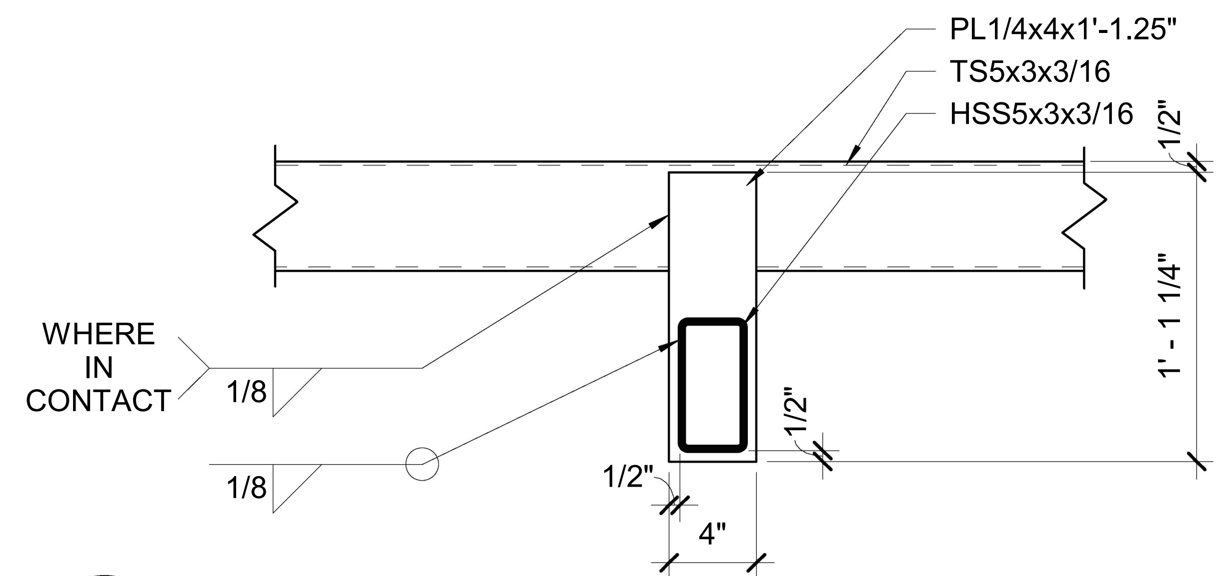
DRAWING TITLE:
STEP DETAILS

SCALE:
3" = 1'-0"

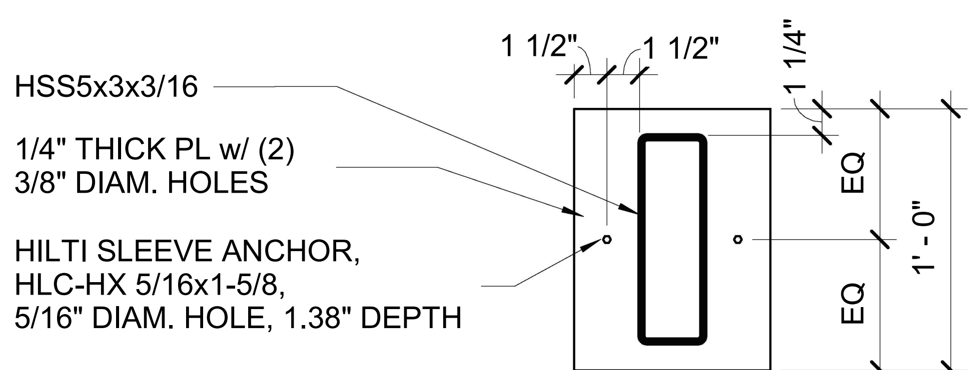
SHEET NUMBER:
S.3.18



1 STEPS SECTION 1
1 1/2" = 1'-0"



2 STEPS SECTION 2
1 1/2" = 1'-0"



3 STEPS SECTION 3
1 1/2" = 1'-0"

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Date:
5/2/17

DRAWING TITLE:
STEP DETAILS

SCALE:
1 1/2" = 1'-0"

SHEET NUMBER:
S.3.19

Project Description

This project will include the design of a new handrail system, connections between the rails and the existing frame, and a new steel deck with concrete fill. The Modular House will have a new handrail system surrounding every exterior side on both the lower and upper levels. The exact design of this handrail is yet to be determined. We will be incorporating the existing road signs from the south wall of the structure into the design to maintain the unique charm they currently give to the Modular house. The handrail will likely be made of steel for ease of connection to both the signs and the frame, either through welds or bolts. These connections will be designed to ensure adequate strength. Additionally, a steel deck with concrete fill will be designed to replace the existing deck on both floors. A seismic analysis will be performed on the structure to ensure that the proposed solution will be adequate for the canyon. Analysis will also be performed on the existing structure to confirm that the structure is adequate for continuation of proposed design.

Design Criteria

Design Code:	IBC 2012 ASCE 7-10 AISC Steel 314 AISC Seismic
Building Type:	Construction Type : Type I No hour fire rating Occupancy Group : Assembly Area A-5 (Assembly Area for viewing outside activities)
Wind Criteria:	N/A, Due to open nature of the stucture
Seismic Criteria:	S_{DS}= 0.789g S_{D1}= 0.450g C_S= .2254
Foundation Criteria:	Use existing Foundation
Allowable loads:	Live Loads: Floor ________ 100 psf Dead Loads: Floor (Fill and Decking)________ 26.1 psf
Controlling Deflections:	Depth of beam shall be great than L/240
GFRS:	HSS Tubing (Beam and Column), Steel Decking and Fill
LFRS:	HSS Tubing Moment Frames

References	System: Project Summary	Comments

The existing weight of the Modular House is 25.7 kips. After all modifications and renovations are complete the building is going to weigh only 17 kips. The renovated building will be 34% lighter than the original building.

Force is defined by mass multiplied by the acceleration. The design acceleration will not change. Therefore a decrease of mass by 34% means that the force the building needs to resist will also be decreased by 34%. The original lateral system was strong enough to resist the original forces with a heavier mass so the lateral system will remain unchanged and will be strong enough to resist the smaller forces that it may experience.

In addition, by getting rid of the complexity of the multiple materials and changing the flooring system will no longer have a mass irregularity caused by the change from wood flooring to tile

References | System: EXISTING LOAD TAKE OFF | Comments

ROOF		
STRESSED SKIN PANEL	10	psf
PARTITION	10	psf
TOTAL	20	psf
AREA	427.5	sf
Load	8.55	k
2ND FLOOR		
1/2" PLYWOOD SHEATHING -FLOOR	1.6	psf
3/8" PLYWOOD SHEATHING -CEILING	1.2	psf
CERAMIC TILE - FLOORING	10	psf
CLADDING		
PARTITION	10	psf
TOTAL	22.8	psf
AREA	153	sf
LOAD	3.5	k
1ST FLOOR		
1/2" PLYWOOD SHEATHING -FLOOR	1.6	psf
3/8" PLYWOOD SHEATHING -CEILING	1.2	psf
CERAMIC TILE - FLOORING	10	psf
CLADDING		
PARTITION	10	psf
TOTAL	22.8	psf
AREA	479.5	sf
LOAD	10.9	k
TUNING		
ROOF	1	k
2ND FLOOR RISE	0.22	k
2ND FLOOR	0.38	k
1ST FLOOR RISE	0.22	k
1ST FLOOR	0.71	k
1ST FLOOR DROP	0.22	k
TOTAL	3	k
TOTAL BUILDING WEIGHT	**25.7**	**k**

References | System: SEISMIC ANALYSIS | Comments

USGS

ASSUMPTIONS: SOIL CLASS : D
RISK CATEGORY I/II

PROVIDED OUTPUT → $S_S = 1.128\,g$ $S_1 = 0.430\,g$
$S_{MS} = 1.183\,g$ $S_{M1} = 0.675\,g$
$S_{DS} = 0.789\,g$ $S_{D1} = 0.450\,g$

- SEISMIC BASE SHEAR

ASCE 7-10

$V = C_s W$ (12.8-1)

→ PERMITTED DUE TO TABLE 12.6-1 w/ RISK CAT. I or II NOT EXCEEDING 2 STORIES

$C_s = \dfrac{S_{DS}}{(R/I_e)}$ (12.8-2) $S_{DS} = 0.789\,g$
$R = 3\frac{1}{2}$ (TAB 12.2-1) OMF
$I_e = 1.00$

$\therefore C_s = .2254$

→ LIMIT (12.8-7) $T_a = C_t h_n^x = 0.028(17')^{0.8}$
$= .2701$ sec

NEED NOT EXCEED. $C_s = \dfrac{S_{D1}}{T(R/I_e)}$ for $T \le T_L$

$= .4760$

SHALL NOT BE LESS THAN $C_s = 0.044 S_{DS} I_e \ge 0.01$
$= .0347$

$\therefore V = .2254\,W$

References	System: Seismic Analysis Cont / Decking	Comments

Decking Requirements

- Minimum 20 gage
- Avoid shoring
- 2 span
- Light weight, no fire rating

B Formlock 18 gage 3 in LW conc.
Single span 8'-0", no shoring req.d

- Allowable super imposed → 166 psf
- Dead
  - Conc → 23.2 psf
  - Deck → 2.9 psf
- Live
  - Assembly / Deck → 100 psf

126.1 psf < 166 psf ✓

Dead Load Take-off

AISC Steel Tab 1-12

2nd Floor Rise → Decking: (23.2 + 2.9 psf)(64 sf) = 1.67^k
Tubing: 6.87 plf (4×8') = $.22^k$

2nd Floor → Decking: (26.1 psf)(64sf + 32sf) = 2.51^k
Tubing: 6.87 plf (7×8') = $.38^k$

1st Floor Rise → Decking: (23.2+2.9 psf)(64 sf) = 1.67^k
Tubing: 6.87 plf (4×8') = $.22^k$

1st Floor → Decking: (23.2+2.9 psf)(256 sf) = 6.68^k
Tubing: 6.87 plf (13×8') = $.71^k$

1st Floor Drop → Decking: (23.2+2.9 psf)(64 sf) = 1.67^k
Tubing: 6.87 plf (4×8) = $.22^k$

Seismic Weight = $16^k + 1^k$ (Tubing)
= 17^k

∴ $V = .2254(17^k) = \underline{3.83^k}$

References	System: Frame Analysis	Comments

Column Flexural Capacity

Steel Tubing 3×3×3/16

AISC Steel F7-1/Tab 2-4

Yielding $\phi M_n = \phi F_y Z$

$F_y = 46$ ksi

$I = 2.60\ in^4,\ S = 1.73\ in^3,\ r = 1.13$ in

$$Z = \frac{bh^2}{4} - (b-2t)\left(\frac{h}{2}-t\right)^2$$

$$= \frac{3" \times 3"^2}{4} - (3-2(3/16))\left(\frac{3}{2}-3/16\right)^2$$

$$= 2.23\ in^3$$

$\phi M_n = .9(46\ ksi)(2.23\ in^3) = \underline{7.69\ k\text{-}ft}$

Beam Flexural Capacity

F7-1

$\phi M_n = \phi F_y Z$

$F_y = 46$ ksi, $\phi = .9$

$$Z = \frac{bh^2}{4} - (b-2t)(h/2-t)^2$$

$$= \frac{3 \times 5^2}{4} - (3-2(3/16))(5/2-3/16)\ in^3$$

$$= 4.71\ in^3$$

$\phi M_n = .9(46\ ksi)(4.71\ in^3) = \underline{16.24\ k\text{-}ft}$

Beam Shear Capacity

G2-1

$\phi V_n = \phi\ 0.6\ F_y A_w C_v$

$F_y = 46$ ksi

$A_w = d t_w = 4\ 3/16\ (3/16)\ in^2$

$= .7852\ in^2$

$C_v \rightarrow h/t_w = 5'/3/16 = 25.7$

$K_v = 6$

$\sqrt{K_v E/F_y} = 53.85$

$h/t_w \leq 110\sqrt{K_v E/F_y}$

$25.7 \leq 59.2$

∴ $C_v = 1.0$

$\phi V_n = .9(.6)(46\ ksi)(.7852\ in^2)(1.0) = \underline{19.5^k}$

References	System: FRAME ANALYSIS	Comments

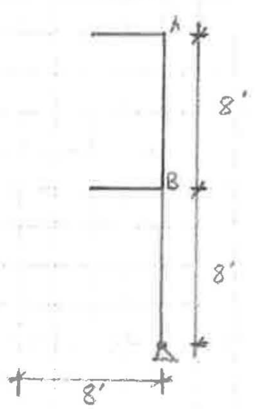
ALLOWABLE BEAM DEFLECTION

$D+L \rightarrow L/240 = 8' \times 12''/, /240 = .4''$

COLUMN SLENDER VALUE

- DETERMINE K

→ CORNER



COL: 3x3x3/16 → $I = 2.60\ in^4$
BEAM: 5x3x3/16 → $I = 9.61\ in^4$

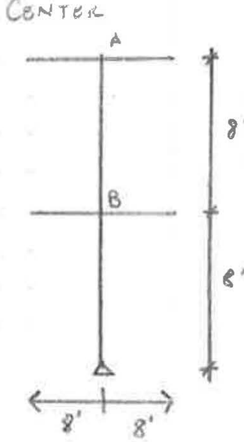
$G_A = \frac{EI_c/L_c}{EI_b/L_b} = \frac{I_c}{I_b} = \frac{2.60}{9.61} = .271$

$G_b = \frac{2(EI_c/L_c)}{EI_b/L_b} = \frac{1570.3}{2903.0} = .541$

AISC STEEL — $K = 0.66$ (FIG C-A-7.1)

SLENDER → $\frac{KL}{r} = \frac{0.66(8 \times 12)''}{1.13 in} = \underline{56.1 < 200}$ ✓

→ CENTER



$G_A = \frac{I_c}{2I_b} = \frac{2.60}{9.61 \times 2} = .136$

$G_b = \frac{I_c}{I_b} = \frac{2.60}{9.61} = .271$

AISC STEEL — $K = 0.59$ (C-A-7.1)

$\frac{KL}{r} = \frac{0.59(8 \times 12)}{1.13} = \underline{50.1 < 200}$ ✓

References	System: FRAME ANALYSIS	Comments

COMPRESSION STRENGTH COLUMN

E3-1 — $P_n = A_g F_{cr}$, $A_g = 1.89\ in^2$

$\frac{KL}{r} = 56.1$, $4.71\sqrt{\frac{E}{F_y}} = 4.71\sqrt{\frac{29000}{46}} = 118.3$

$\therefore F_{cr} = (0.658^{F_y/F_e})F_y$

$F_e = \frac{\pi^2 E}{\left(\frac{KL}{r}\right)^2} = \frac{\pi^2(29000)}{56.1^2} = 90.9$

$\rightarrow F_{cr} = (0.658^{46/90.9})46$
$= 37.2\ ksi$

$P_n = 1.89(37.2\ ksi) = 70.3\ K$

$\phi_c = 0.9 \rightarrow \underline{\phi_c P_n = 63.3^k}$

SHEAR STRENGTH COLUMN

SECTION G5 — → IN ACCORDANCE TO SEC. G2.1 w/ $A_w = 2ht$
TS 3x3x316
$h = 2.66\ in$
$t = 0.93$ (NOM. THICK) $= .174$
$A_w = .9257\ in^2$
$K_v = 5$

G2-1 — $V_n = 0.6 F_y A_w C_v$
→ C_v
- $h/t_w = 14.2$
- $\sqrt{K_v E/F_y} = \sqrt{5(29000)/46} = 56.1$
$1.10 \ldots = 61.8$

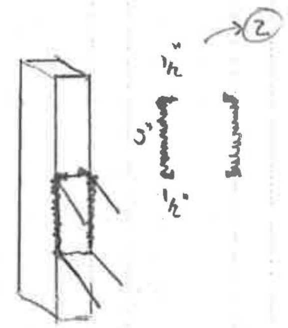
G2-3 — $\therefore C_v' = 1.0$

$V_n = 0.6(46\ ksi)(.9257\ in^2)(1.0)$
$= 25.5^k$
$\phi_v = 0.9$

$\underline{\phi_v V_n = 23^k}$

References	System: FRAME ANALYSIS	Comments

WELD CONNECTION



- BLOCK SHEAR

J4-5
$\phi R_n = \phi [0.6 F_U A_{NV} + U_{bs} F_U A_{NT}]$

$\phi = 0.75$

TAB 2-4
$F_U = 58$ ksi

$A_{NV} = 5'' t \times 2$

$U_{bs} = 1.0$

$A_{NT} = 2.5'' t + \frac{1}{2} t$

$= 3'' t \times 2$ ASSUME 1/8" WELD

$= 0.75 [0.6 (58 \text{ ksi})(10 (1/8)) + 1.0 (58 \text{ ksi})(6 (1/8))]$

$= 65.25^k$

MOMENT CONNECTION

AISC STEEL 16.1-147, K3
HSS TO HSS

ϕM_n IN ACCORDANCE w/ SEC B3.6

→ FULLY RESTRAINED CONNECTION

→ T-CONNECTION

$B = B_b / B = 3 \text{in} / 3 \text{in} = 1.00$

$\beta > 0.85$

K3-10
$M_n = F_y^* t (B - t)(H_b + 5t)$

$F_y^* = 46$ ksi

$B = 3$in

$t = .1744$ in $= 0.93$ (3/16)

$H_b = 5$ in

$\therefore M_n = 46(.1744)(3 - .1744)(5 + 5(.1744))$

$= 133$ K-in

$= 11.1$ K-ft, $\phi = 1.00$

$\underline{\phi M_n = 11.1 \text{ K-ft}}$

References	System: FRAME ANALYSIS	Comments

FRAME SUMMARY

COLUMN:

FLEXURE: 7.69 k-ft

COMPRESSION: 63.3 K

SHEAR : 23^K

SLENDER RATIO : < 200

BEAM:

FLEXURE: 16.24 k-ft

SHEAR : 19.5 K

DEFLECTION: .4"

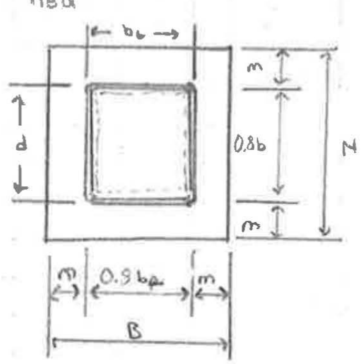
CONNECTION

WELD 65.25

MOM CONN 11.1 K-ft

BASE PLATE

REQ



N + B = 8" (FROM MODULAR HOUSE)

14-2
$\therefore m = \frac{8'' - 0.8(3'')}{2} = 2.8''$

- PLATE THICKNESS
  → 1/2"
- ANCHOR ROD HOLES
  → 3/8" DIA

- PLATE CAPACITY

SHEAR YEILDING

J4-3
$R_n = 0.60 F_y A_{gv}$

$F_y = 36$ ksi

$A_{gv} = \frac{1}{2}'' (8'') = 4 \text{in}^2$

$\phi = 1.00$

$\phi R_n = 0.6 (36 \text{ ksi})(4 \text{in}^2)$

$\underline{= 86.4^K}$

References	System: FRAME ANALYSIS	Comments

BASE PLATE CONT.

- ANCHOR BOLT CAPACITY

AISC STEEL TABLE J3.2

ASSUMING A307
→ TENSILE 45 ksi
→ SHEAR 27 ksi
$A = \frac{\pi}{4}(d^2) = .7854\ in^2$

TEN = 35.3^k
SHEAR = 21.2^k

- PLATE FLEXURAL CAP.

$M_n = F_y Z$
$Z = \frac{bh^2}{4} = \frac{8''(1/2)^2}{4} = .5\ in^3$
$= 36\ ksi\,(.5\ in^3)$
$= 18$ k-in
$= 1.5$ k-ft

$\phi M_n = 1.35$ k-ft

- BEARING STRENGTH ON CONC

J8-1

$P_p = 0.85 f'_c A_1$; ASSUME 4000 psi CONC
$0.85(4000\ psi)(8'' \times 8'' - 4 \times \frac{\pi}{4}(3/8)^2)$

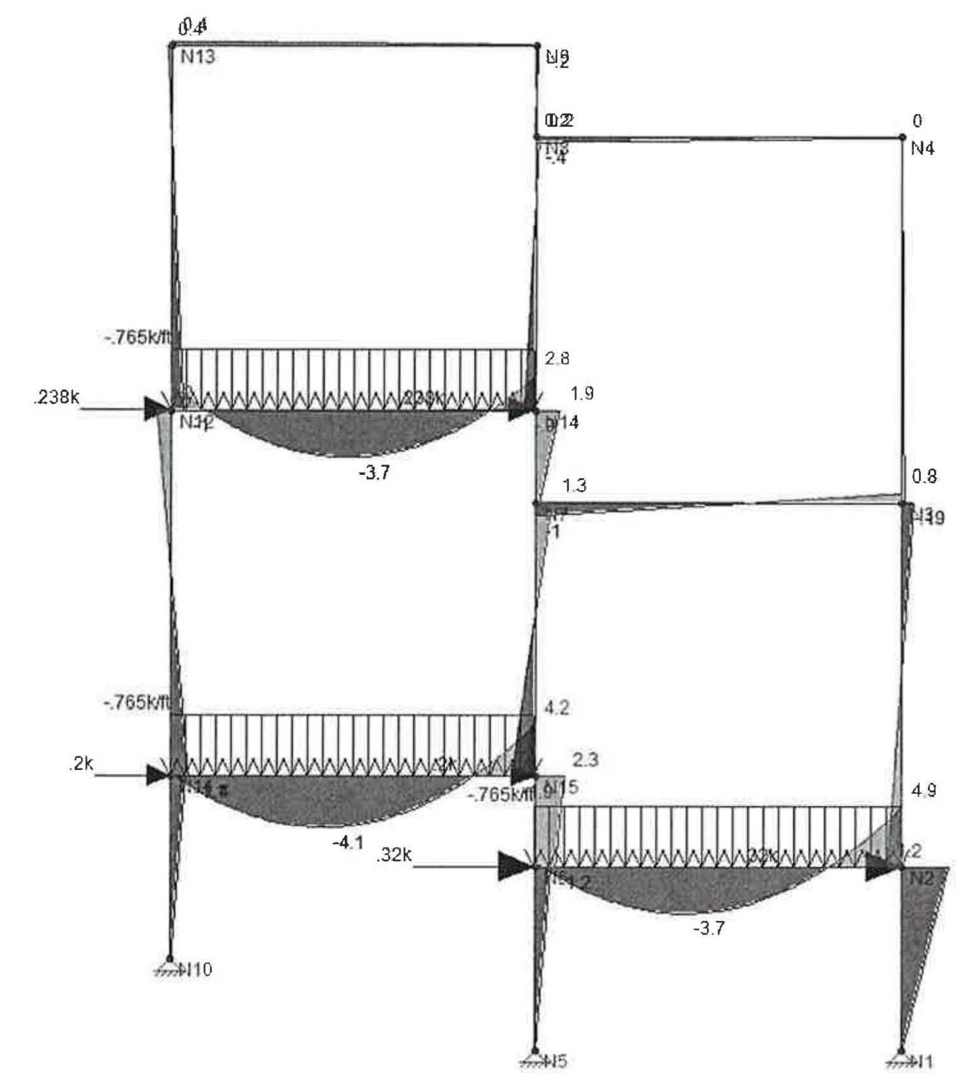
$= 216.1^k$

- BASE PLATE SUMMARY

PLATE THICKNESS : 1/2"
BOLT Ø : 3/8"
PLATE SHEAR CAPACITY = 86.4^k
FLEXURAL CAPACITY = 1.35 k-ft
BOLT TENSIAL : 35.3^k
SHEAR : 21.2^k

FRAME ON GRID 1

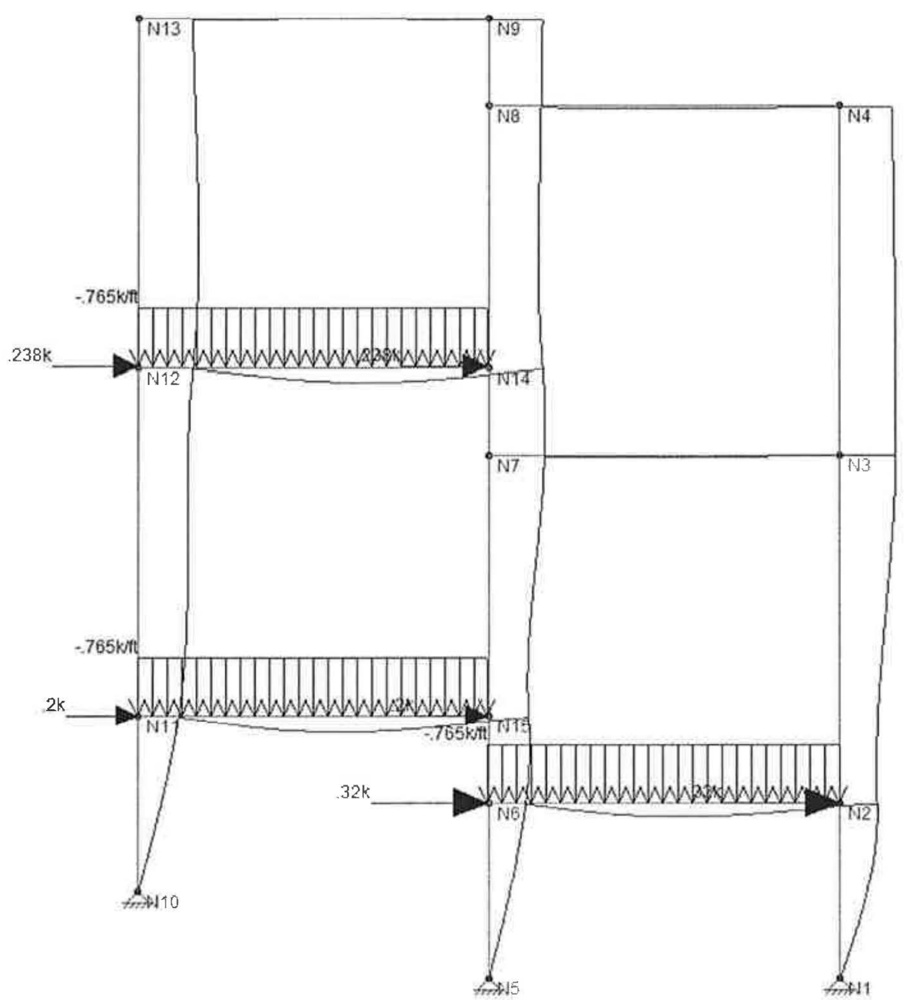
*Modeled w/ Rigid Diaphragm



	M_{max}
BM.	$4.9^{k\text{-}ft}$
COL.	$3.7^{k\text{-}ft}$

MOMENT

Note: $\phi M_n = 7.69^{k\text{-}ft}$ TS3x3 COL
$\phi M_n = 16.24^{k\text{-}ft}$ TS5x3 BMS



Joint Deflections

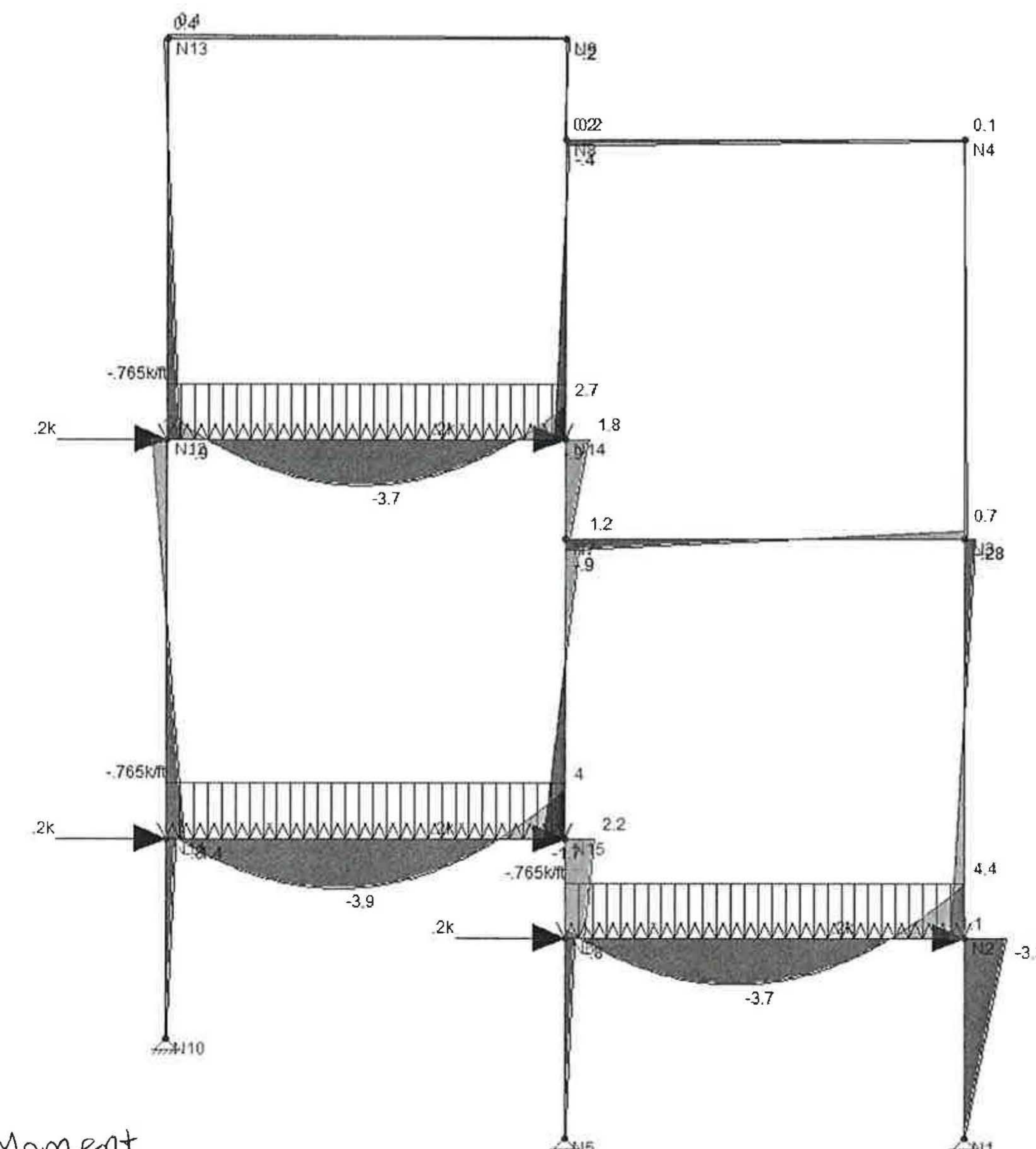
	L...	Joint Label	X [in]
1	1	N1	0
2	1	N2	.502
3	1	N3	.757
4	1	N4	.712
5	1	N5	0
6	1	N6	.503
7	1	N7	.757
8	1	N8	.712
9	1	N9	.732
10	1	N10	0
11	1	N11	.545
12	1	N12	.738
13	1	N13	.733
14	1	N14	.738
15	1	N15	.546

Max Story Drift: .546"

Deflection

FRAME ON GRID 1

* Modded w/ Flexible Diaphragm

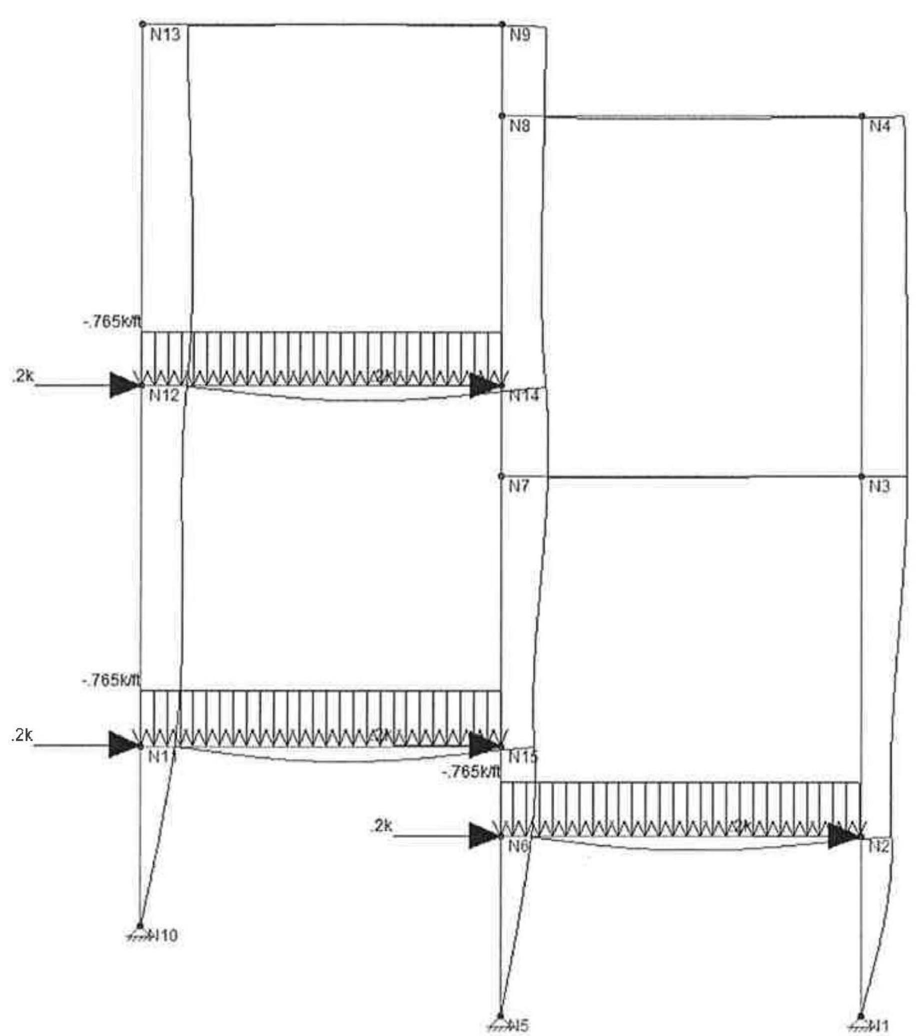


	M_{max}
BM	4.4 k-ft
Col.	3.3 k-ft

Moment

Note: $\phi M_{n\,COL} = 7.69$ k-ft

ϕM_{n} BEAM 16.23 k-ft

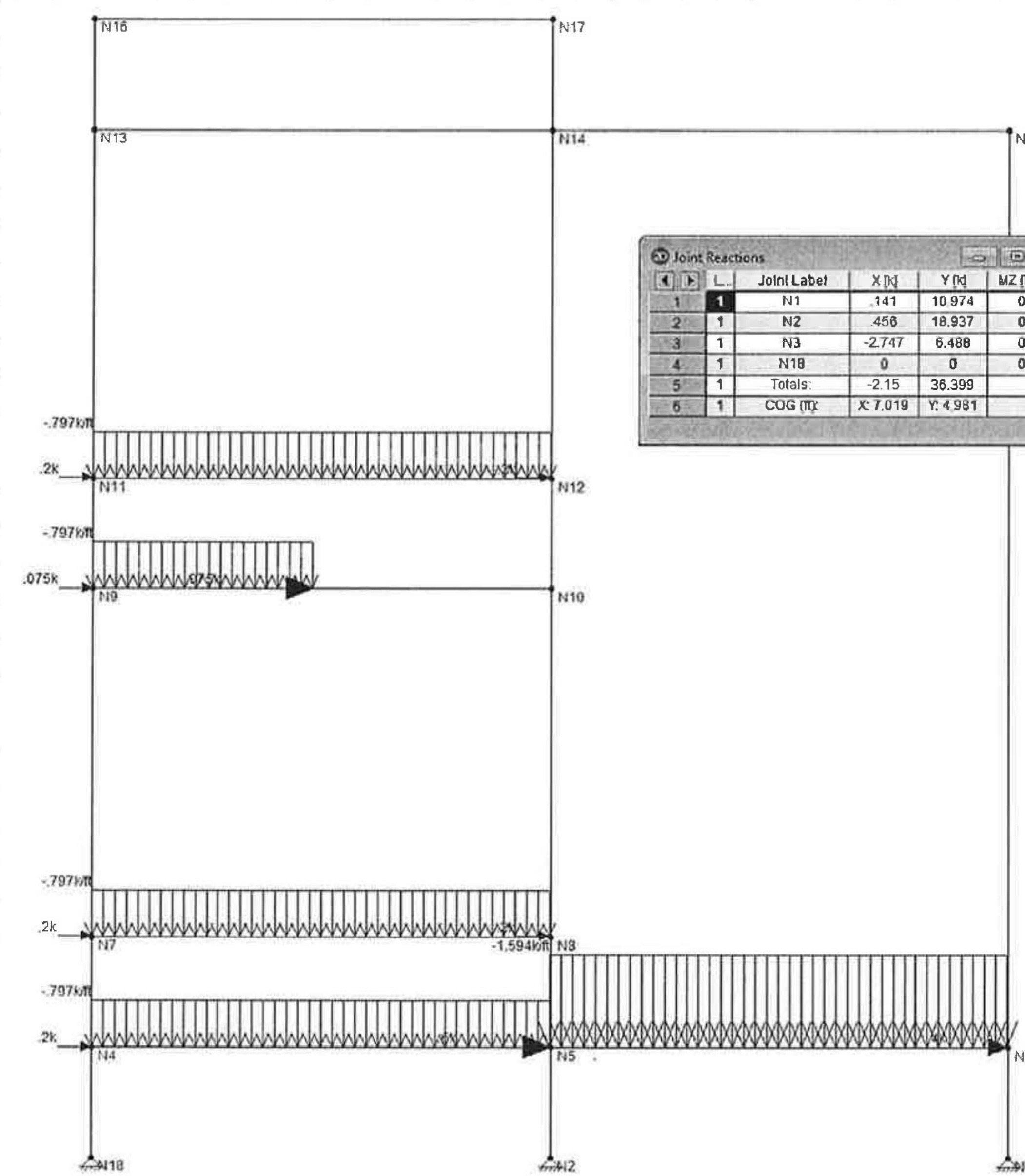


	L..	Joint Label	X [in]
1	1	N1	0
2	1	N2	.412
3	1	N3	.626
4	1	N4	.574
5	1	N5	0
6	1	N6	.413
7	1	N7	.626
8	1	N8	.574
9	1	N9	.594
10	1	N10	0
11	1	N11	.452
12	1	N12	.602
13	1	N13	.595
14	1	N14	.601
15	1	N15	.453

Max Story Drift: .453"

Deflection

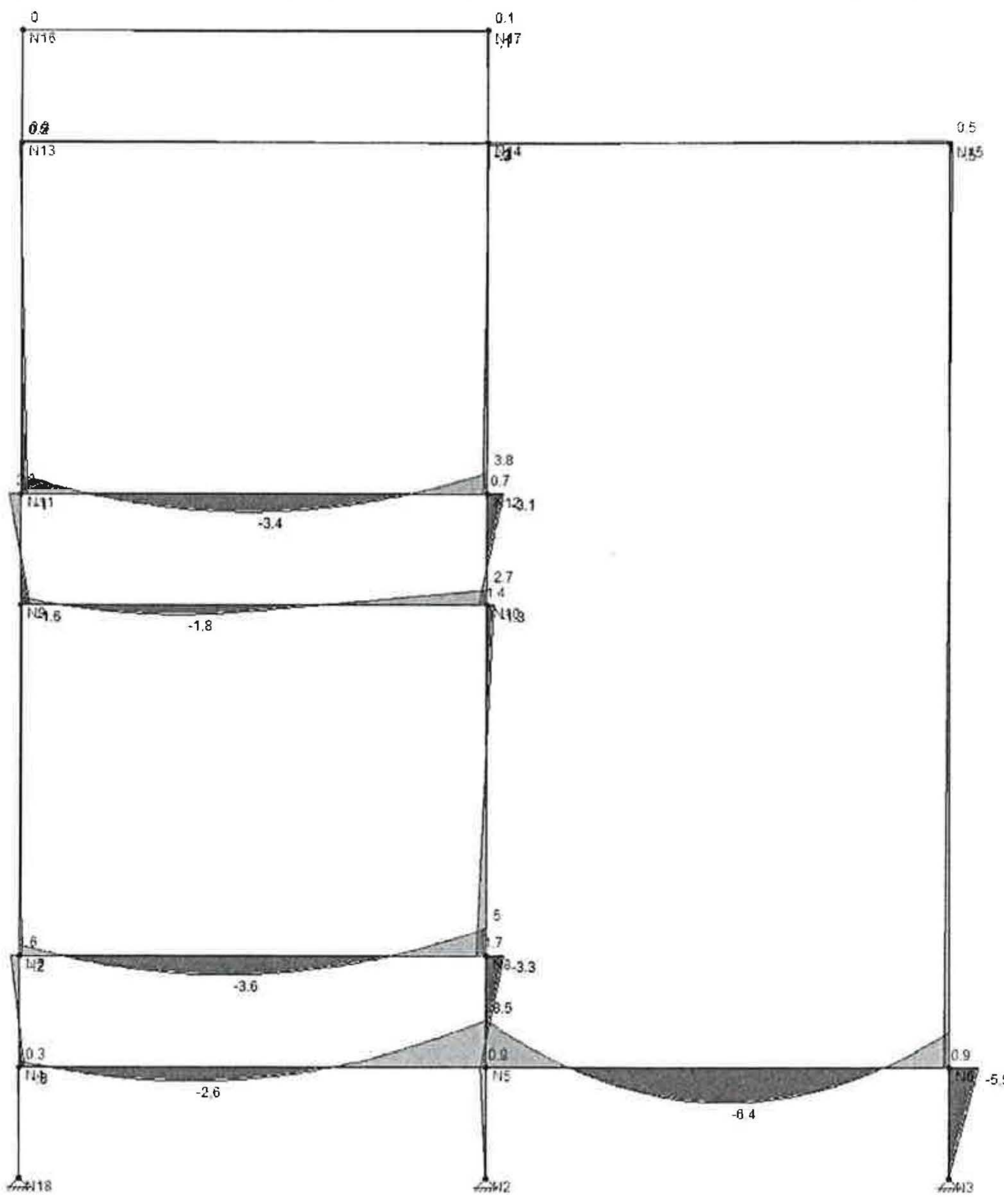
References | System: Line "2" RISA Analysis – w/ Gravity Loads | Comments



	L..	Joint Label	X [k]	Y [k]	MZ [k-ft]
1	1	N1	.141	10.974	0
2	1	N2	.456	18.937	0
3	1	N3	-2.747	6.488	0
4	1	N18	0	0	0
5	1	Totals:	-2.15	36.399	
6	1	COG (ft):	X: 7.019	Y: 4.981	

Loads and Reactions

References	System: Line "2" RISA Analysis – w/ Gravity Loads	Comments



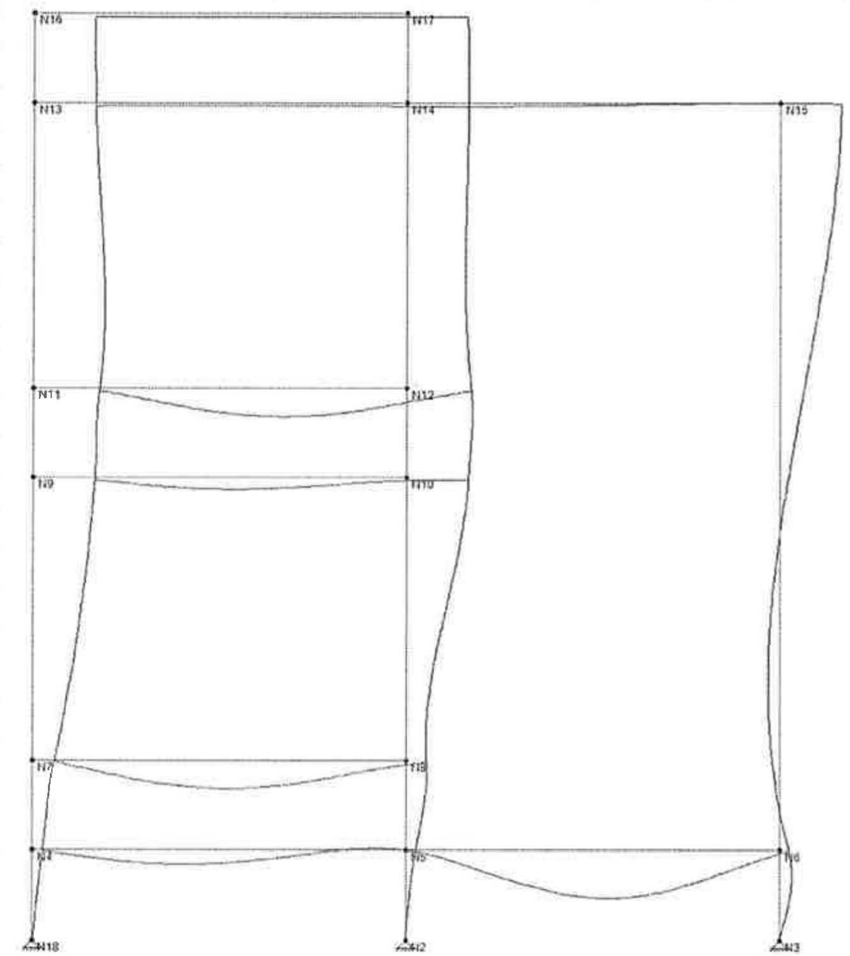
Moments

Max Moment = 8.498 k - ft @ BEAM

Note: $\phi M_{n\,BEAM} = 16.23$ k-ft
$\phi M_{n\,COL} = 7.69$ k-ft

Due to moment combination, moment to columns is minimal

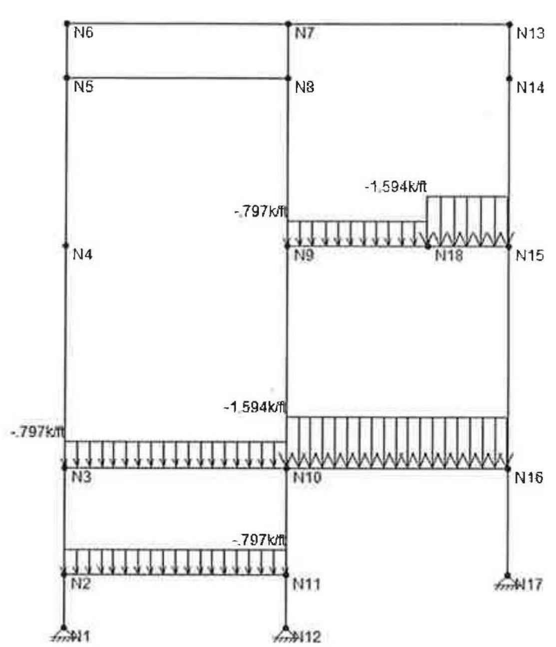
References	System: Line "2" RISA Analysis – w/ Gravity Loads	Comments

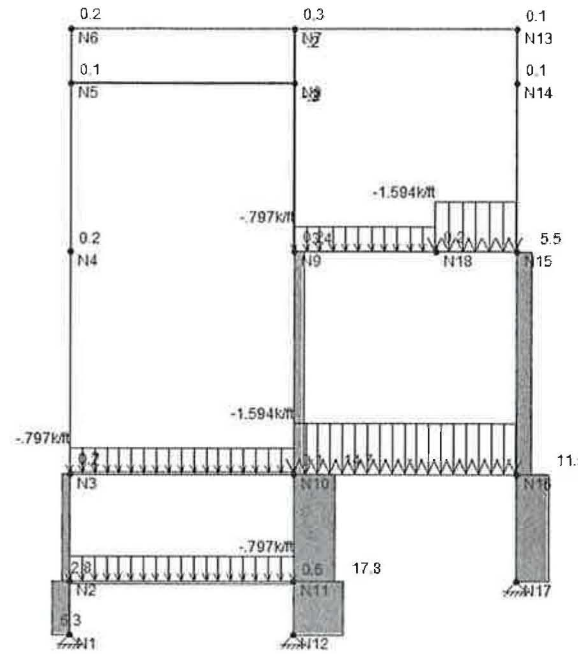


Deflected Shape

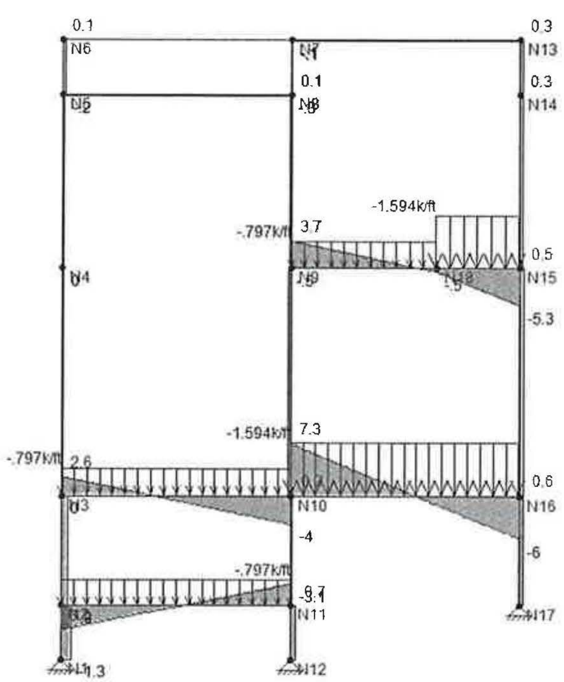
Joint Label	X [in]	Y [in]	Rotatio...
N1	0	0	-2.478e-3
N2	0	0	-2.011e-3
N3	0	0	-7.241e-3
N4	.065	-.006	-3.189e-3
N5	.067	-.01	-4.312e-3
N6	.063	-.004	6.621e-3
N7	.141	-.011	-5.192e-3
N8	.138	-.015	1.905e-3
N9	.409	-.02	-1.928e-3
N10	.412	-.022	-1.163e-3
N11	.437	-.022	-3.644e-3
N12	.434	-.024	3.109e-3
N13	.411	-.022	4.42e-4
N14	.411	-.023	1.118e-5
N15	.41	-.004	-4.98e-4
N16	.408	-.022	-3.227e-5
N17	.408	-.023	9.173e-5
N18	0	0	0

Gridline 3 – Gravity

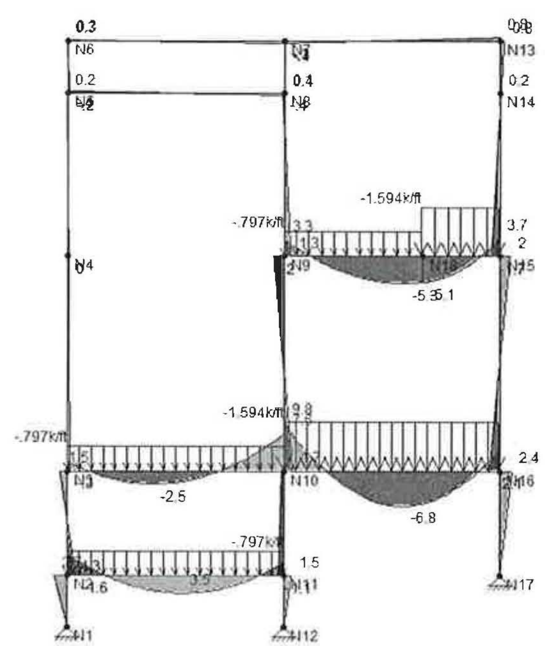




Axial



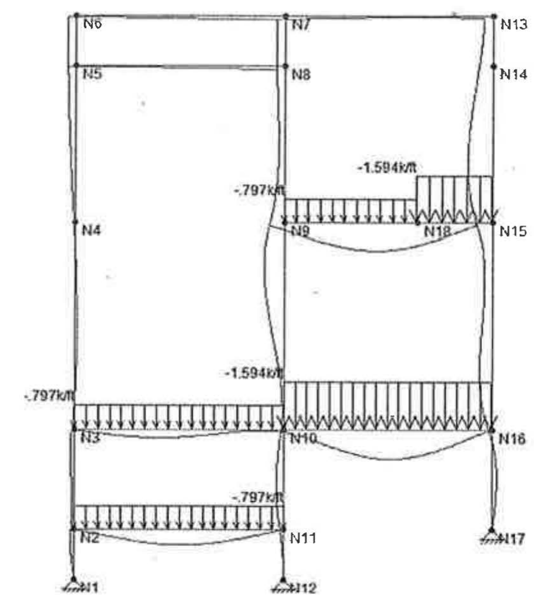
Shear



Moment

Note: $\phi M_{n\,COL} = 7.69$ k.ft

ϕM_{n} BEAM $= 16.23$ k.ft



Deflected Shape

Joint Deflections

	L...	Joint Label	X [in]	Y [in]	Rotatio...
1	1	N1	0	0	3.96e-3
2	1	N2	-.044	-.003	-2.835e-3
3	1	N3	-.039	-.007	-2.74e-3
4	1	N4	-.021	-.007	1.314e-3
5	1	N5	-.099	-.007	1.083e-4
6	1	N6	-.105	-.007	-7.433e-5
7	1	N7	-.105	-.033	2.195e-4
8	1	N8	-.099	-.033	2.135e-4
9	1	N9	-.186	-.034	-6.903e-3
10	1	N10	-.04	-.026	-3.486e-3
11	1	N11	-.045	-.01	4.419e-3
12	1	N12	0	0	7.062e-4
13	1	N13	-.106	-.025	-1.184e-3
14	1	N14	-.17	-.025	-3.623e-3
15	1	N15	-.187	-.025	8.195e-3
16	1	N16	-.04	-.013	9.12e-3
17	1	N17	0	0	-3.209e-3
18	1	N18	-.186	-.308	3.977e-3

References	System: GRID 4 RISA 2D CHECK	Comments

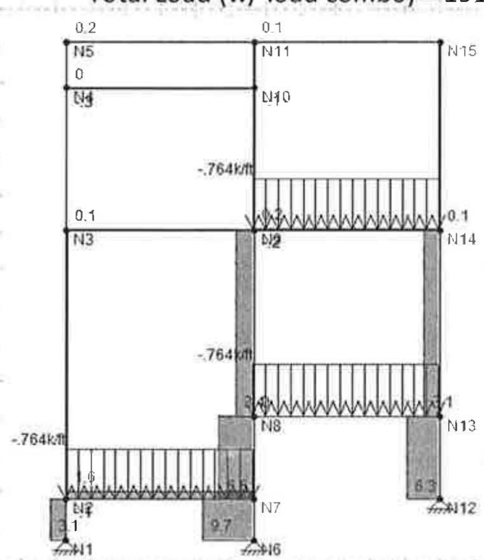
GRAVITY

Dead Load = 26.1 PSF

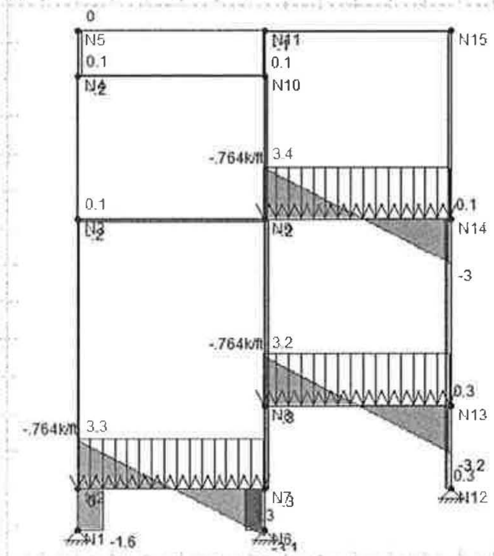
Live Load = 100 PSF

Total Load (w/ load combo) = 191 PSF

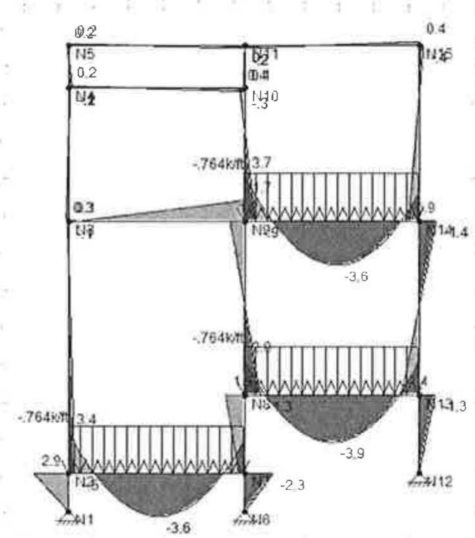
ϕM_n COL = 7.69 k-ft
ϕM_n BEAM = 16.23 k-ft



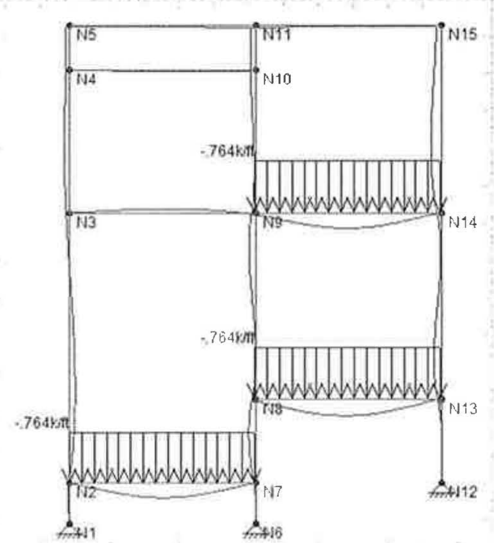
Axial



Shear

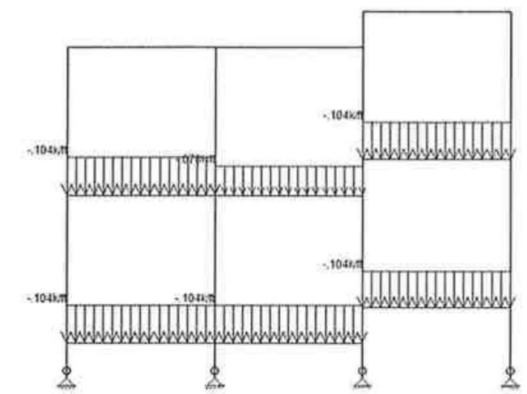


Moment

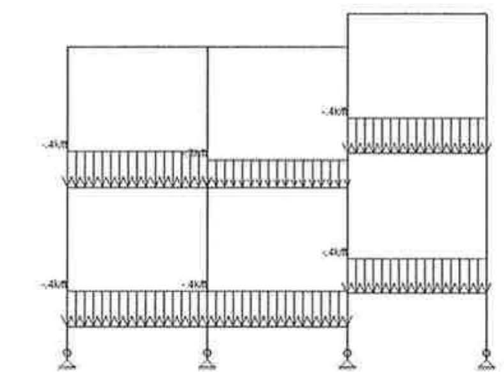


Deflection

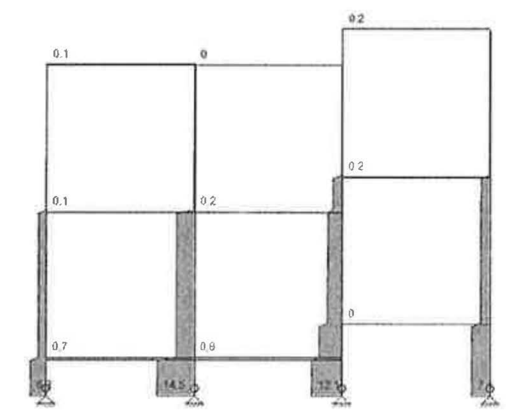
Gridline A - Gravity



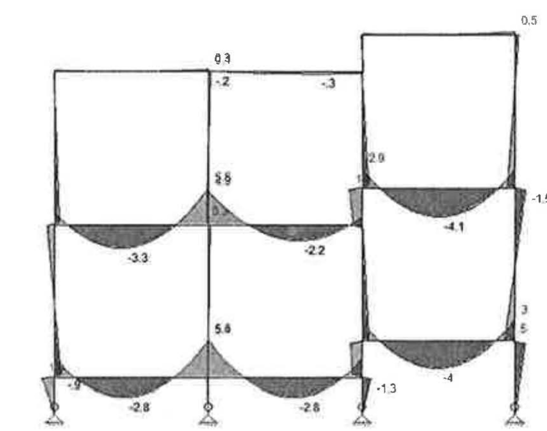
Dead Loading



Live Loading



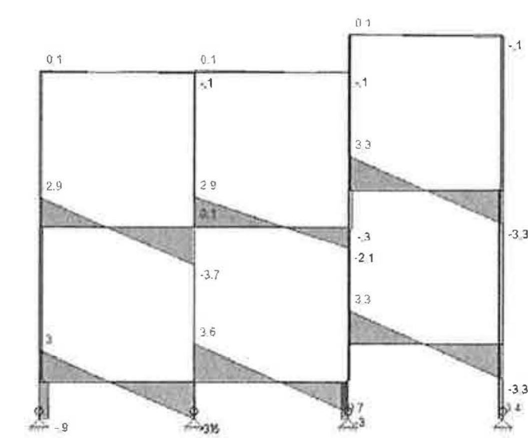
Axial



Moment

ϕM_n BEAM = 16.23 k-ft

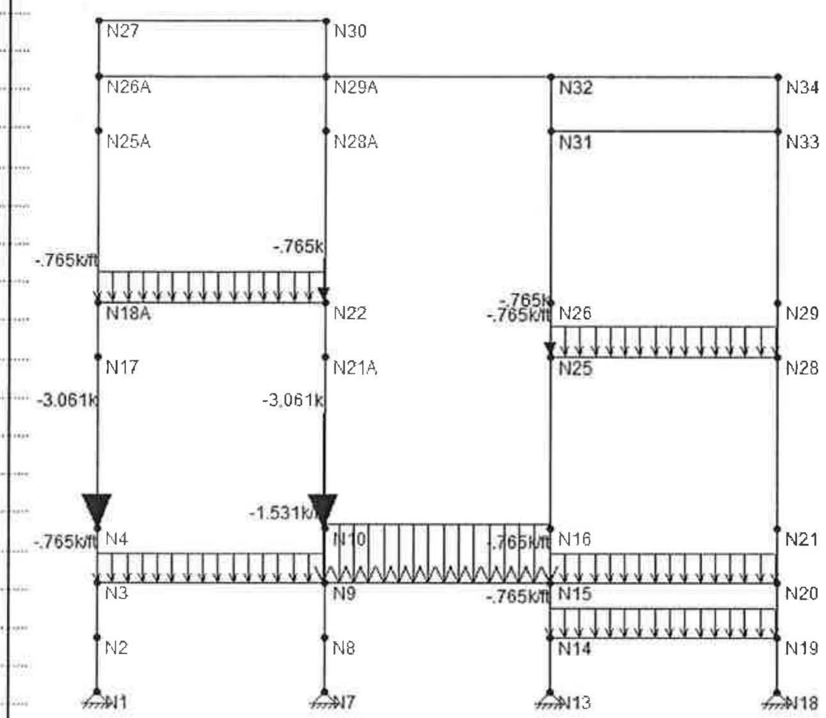
ϕM_n COL = 7.69 k-ft



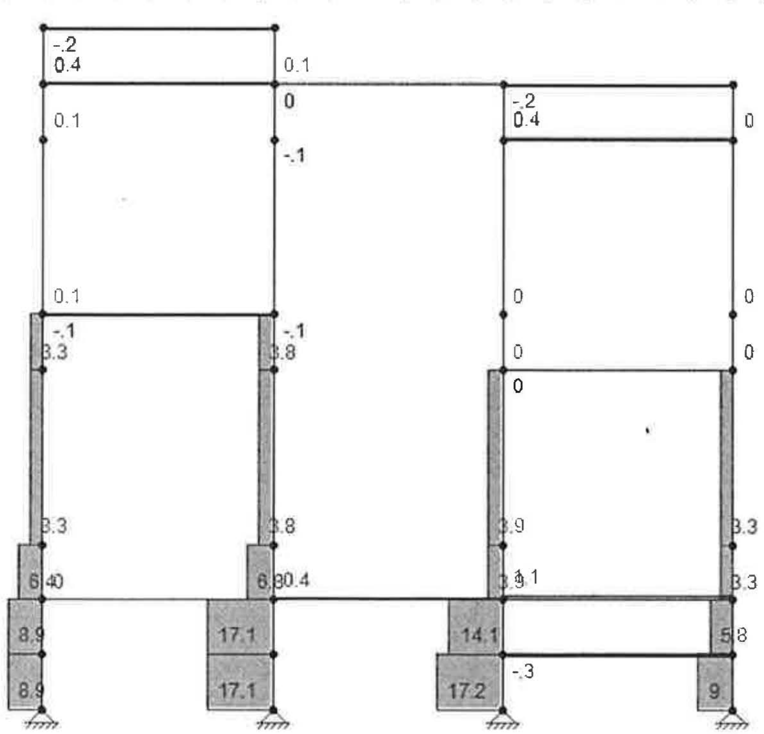
Shear

References	System: Grid Line B Gravity Analysis	Comments

Nodes and Loads

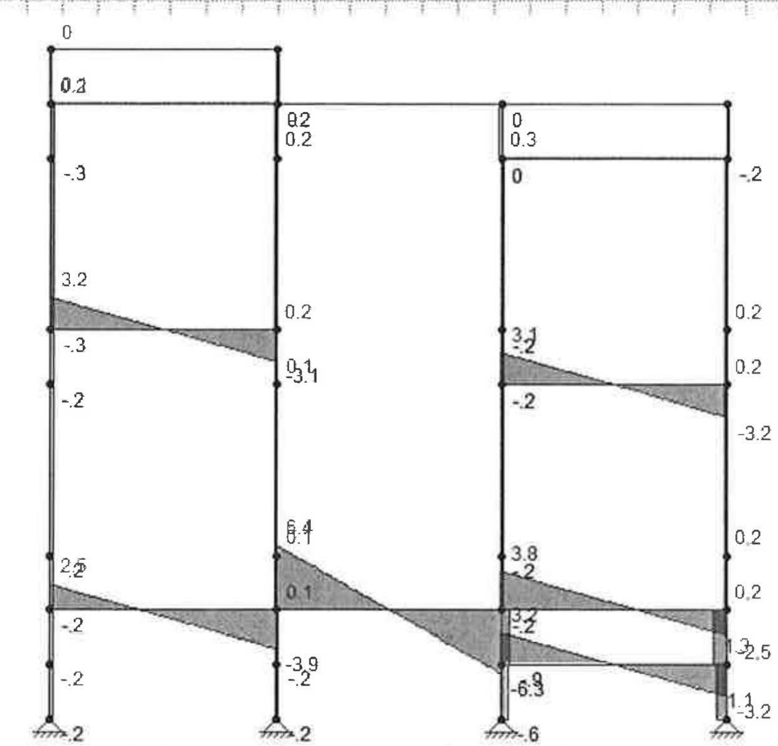


Axial Force

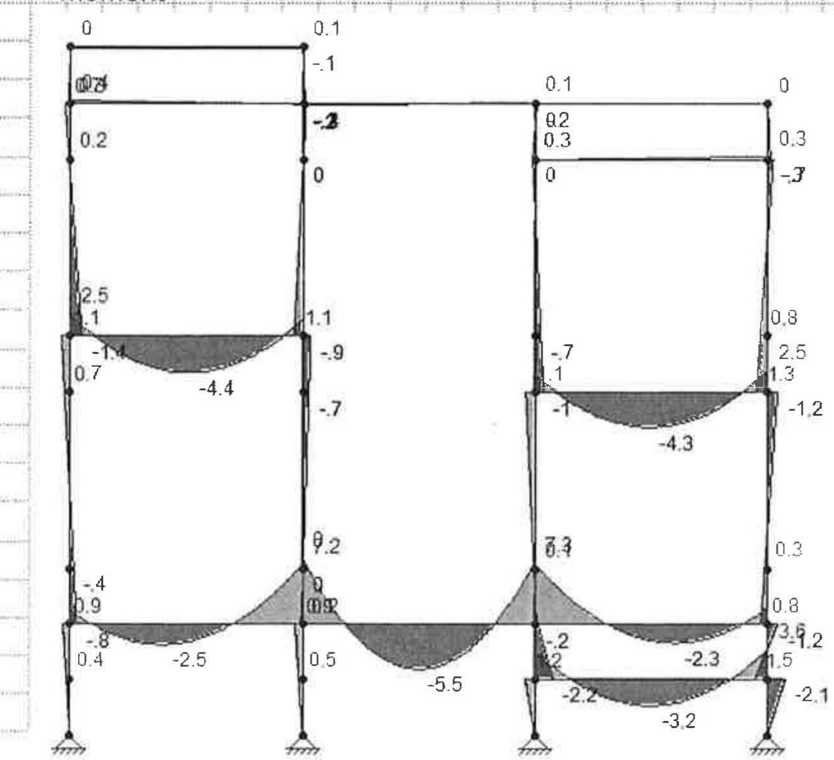


References	System: Grid Line B Gravity Analysis	Comments

Shear Force



Moment

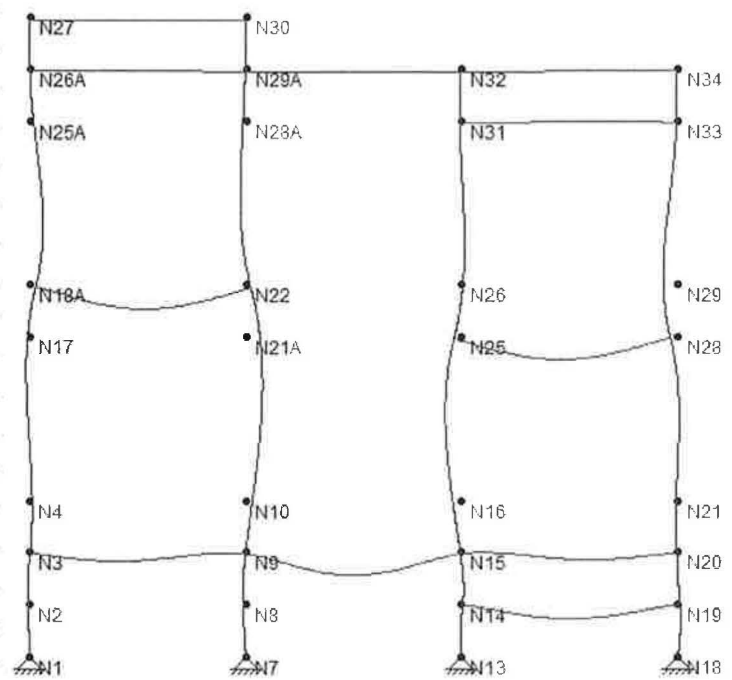


$\phi M_{n_B} = 16.23^{k\text{-}ft}$

$\phi M_{n_C} = 7.69^{k\text{-}ft}$

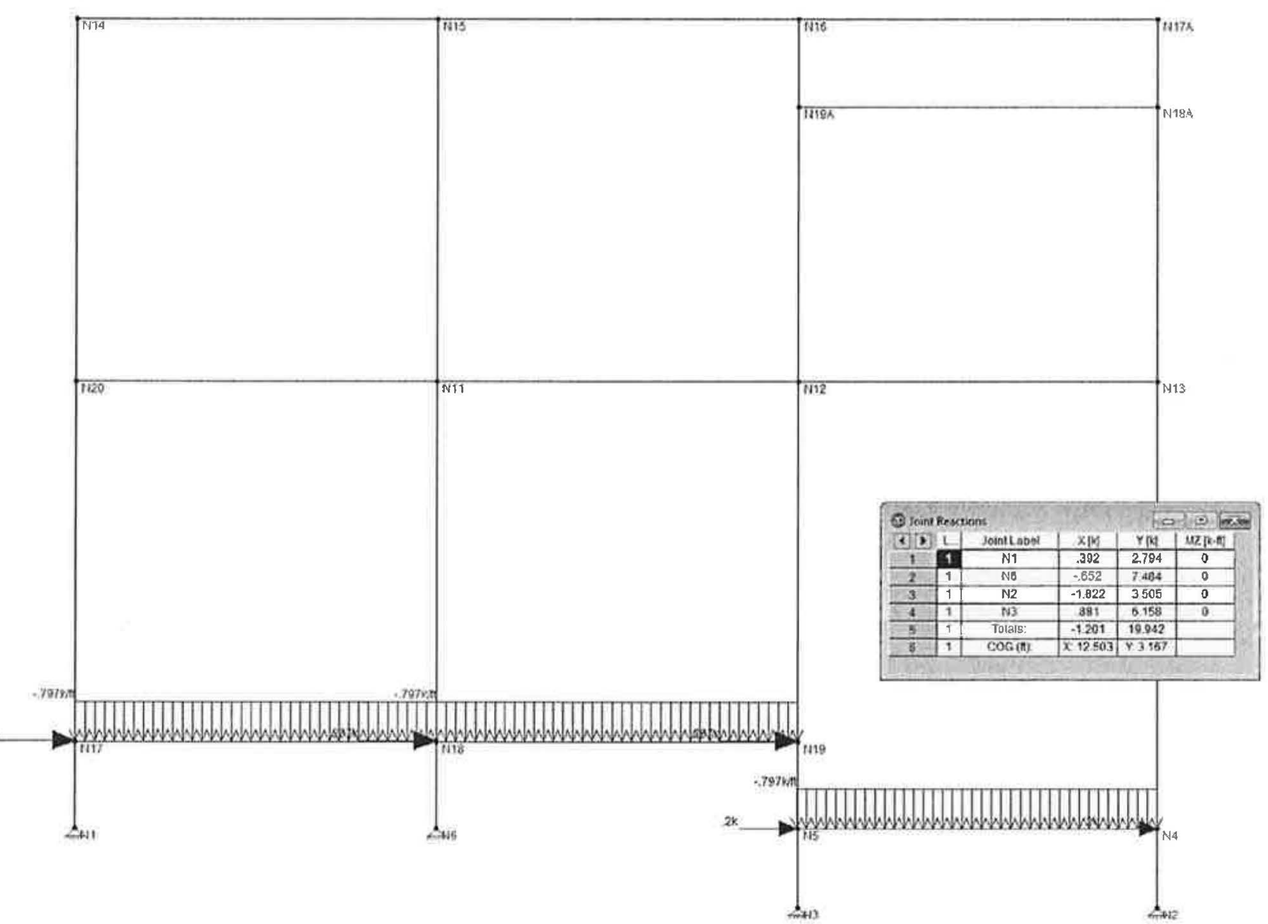
References	System: Grid Line B Gravity Analysis	Comments

Deflected Shape



Joint Label	X [in]	Y [in]	Rotatio...
N1	0	0	1.577e-3
N2	-.03	-.005	4.753e-4
N3	-.006	-.01	-2.829e-3
N4	.019	-.013	3.543e-4
N7	0	0	1.677e-3
N8	-.031	-.009	5.002e-4
N9	-.006	-.019	-3.031e-3
N10	.073	-.022	-3.351e-3
N13	0	0	1.249e-4
N14	.02	-.009	-2.936e-3
N15	-.007	-.017	3.519e-3
N16	-.096	-.019	3.598e-3
N18	0	0	-2.527e-3
N19	.02	-.005	2.812e-3
N20	-.009	-.008	2.139e-3
N21	-.022	-.01	-6.108e-4
N17	-.042	-.019	-1.903e-3
N18A	.055	-.021	-6.512e-3
N21A	.167	-.029	2.688e-3
N22	.055	-.031	6.821e-3
N25	-.086	-.026	-6.501e-3
N26	.015	-.026	-2.271e-3
N28	-.086	-.016	6.319e-3
N29	-.167	-.016	8.288e-4
N25A	.029	-.021	2.904e-3
N26A	-.019	-.021	6.066e-4
N27	-.02	-.021	-1.802e-4
N28A	-.043	-.031	-1.331e-3
N29A	-.019	-.031	-3.041e-4
N30	-.02	-.031	6.688e-5
N31	-.019	-.026	4.484e-4
N32	-.019	-.026	1.69e-5
N33	-.02	-.016	-5.944e-4
N34	-.019	-.016	1.773e-4

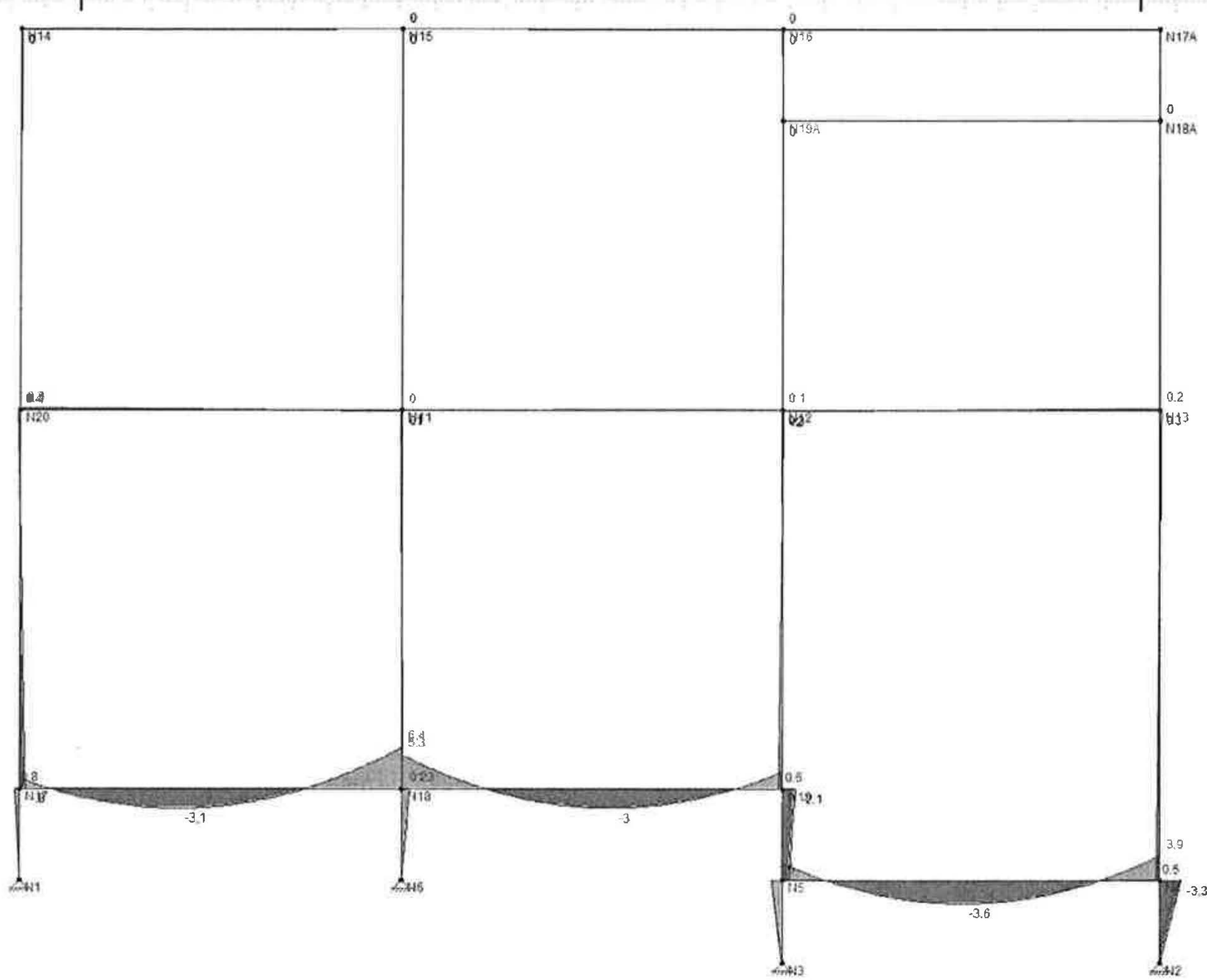
References	System: Line "C" RISA Analysis – w/ Gravity Loads	Comments



	L	Joint Label	X [k]	Y [k]	MZ [k-ft]
1	1	N1	.392	2.794	0
2	1	N6	-.652	7.484	0
3	1	N2	-1.822	3.505	0
4	1	N3	.881	6.158	0
5	1	Totals:	-1.201	19.942	
6	1	COG (ft):	X: 12.503	Y: 3.167	

Loads and Reactions

References | System: | Line "C" RISA Analysis – w/ Gravity Loads | Comments



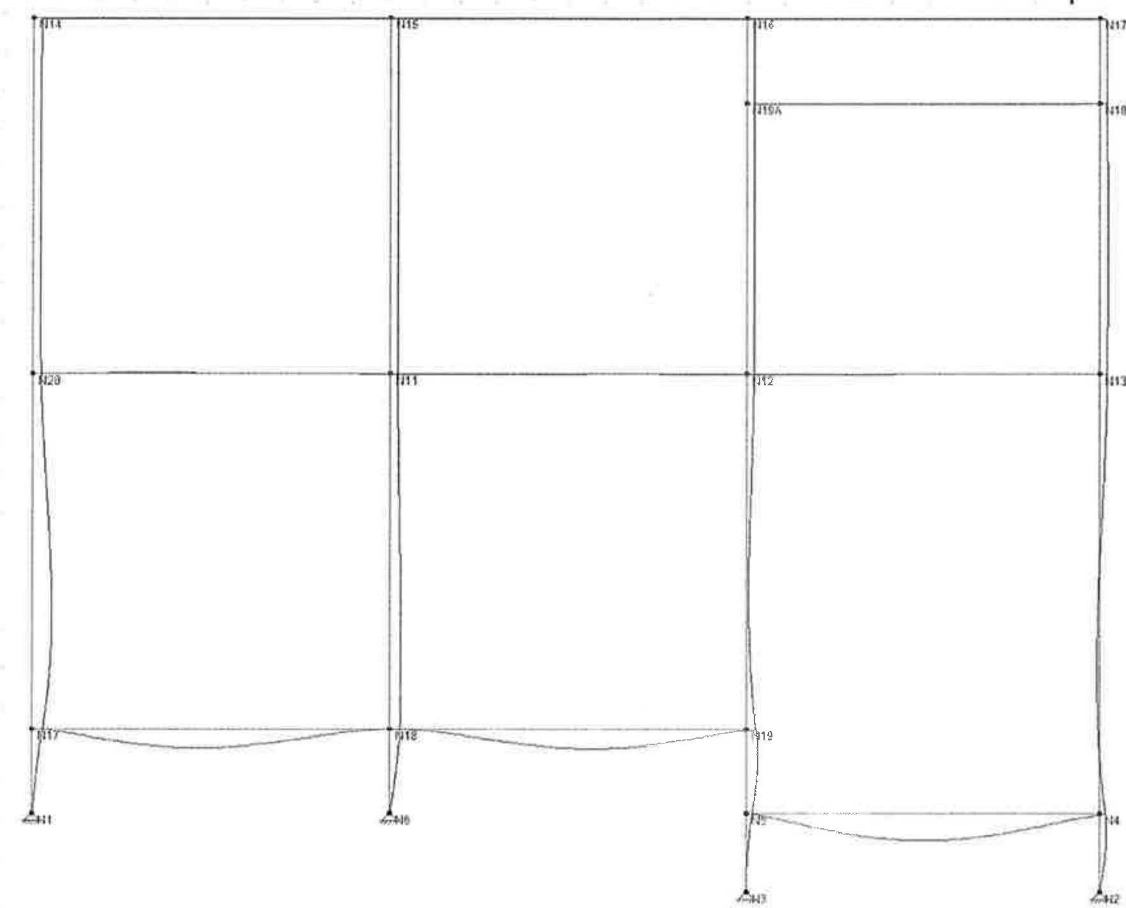
Moments

Max Moment = 6.42 k - ft

$\phi M_{n_B} = 16.23\ k\text{-}ft$

$\phi M_{n_C} = 7.61\ k\text{-}ft$

References | System: | Line "C" RISA Analysis – w/ Gravity Loads | Comments



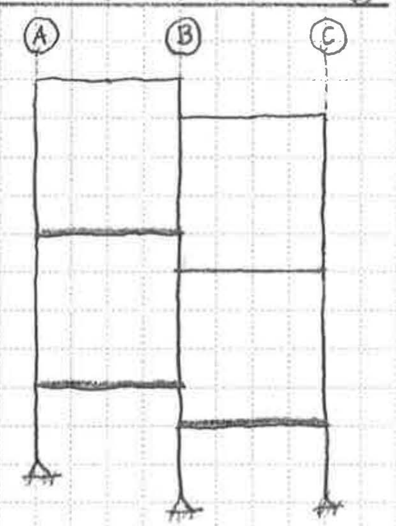
Deflected Shape

Joint Label	X [in]	Y [in]	Rotatio...
N1	0	0	-2.342e-3
N2	0	0	-4.29e-3
N3	0	0	-8.598e-4
N4	.042	-.002	3.432e-3
N5	.044	-.003	-4.595e-3
N6	0	0	-3.957e-3
N17	.071	-.002	-4.318e-3
N18	.07	-.004	-6.662e-4
N19	.07	-.005	3.362e-3
N20	.056	-.002	4.275e-4
N11	.055	-.004	-1.7e-5
N12	.055	-.005	-1.068e-4
N13	.055	-.002	-2.221e-4
N14	.055	-.002	-7.05e-5
N15	.055	-.004	-8.569e-6
N16	.055	-.005	1.977e-5
N17A	.055	-.002	3.549e-5
N18A	.056	-.002	4.114e-5
N19A	.056	-.005	3.438e-5

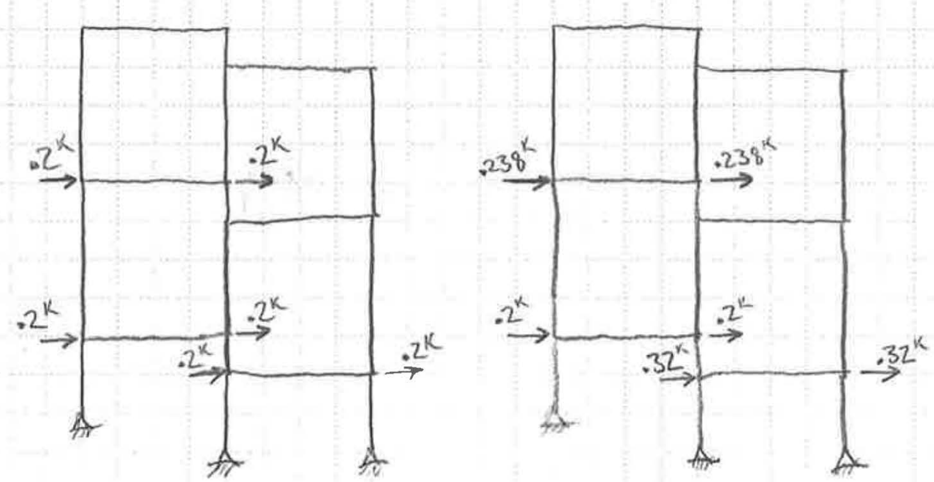
References	System:	Comments

DESIGN CRITERIA
*LATERAL ACCELERATION: 4g
*MODULE WEIGHT: 2^K

FRAME ON GRIDLINE (1)

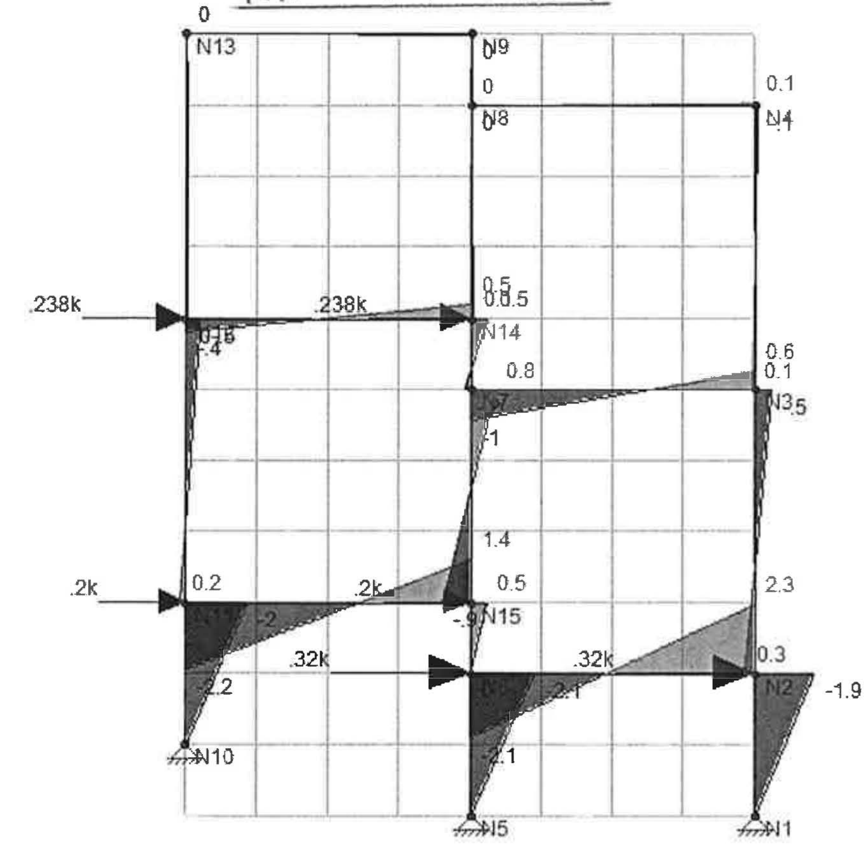


LATERAL FORCES
*BEAMS: HSS 3x3x3/16
*COLUMNS: HSS 5x3x3/16

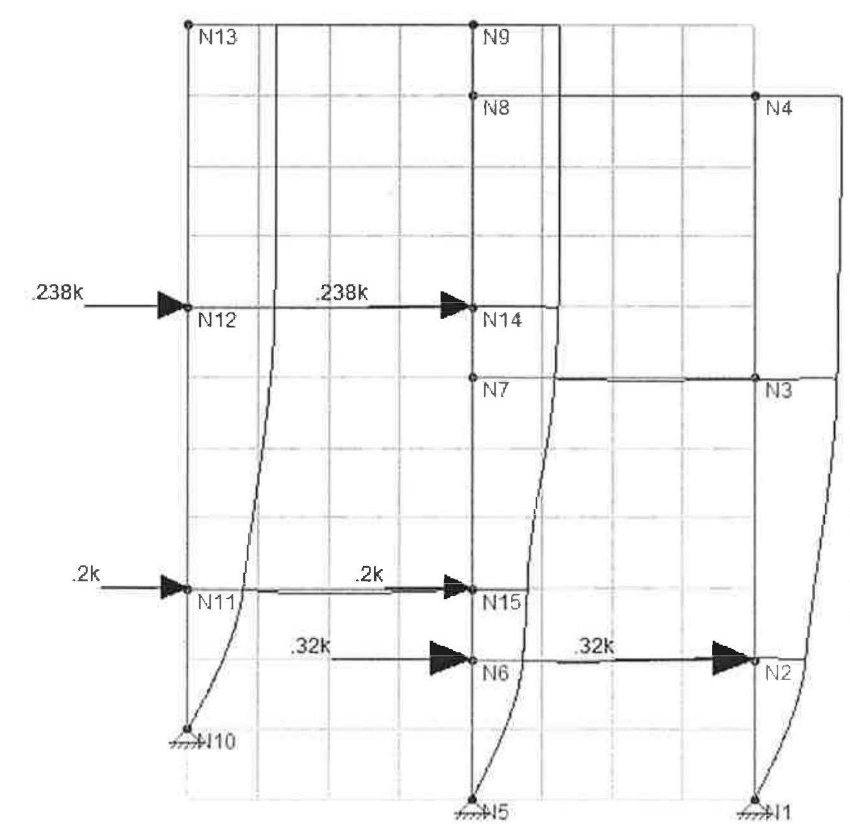


FLEXIBLE DIAPHRAGM RIGID DIAPHRAGM

RIGID DIAPHRAGM



	M_{Max}
BM.	$2.3^{k\text{-}ft}$
COL.	$2.2^{k\text{-}ft}$

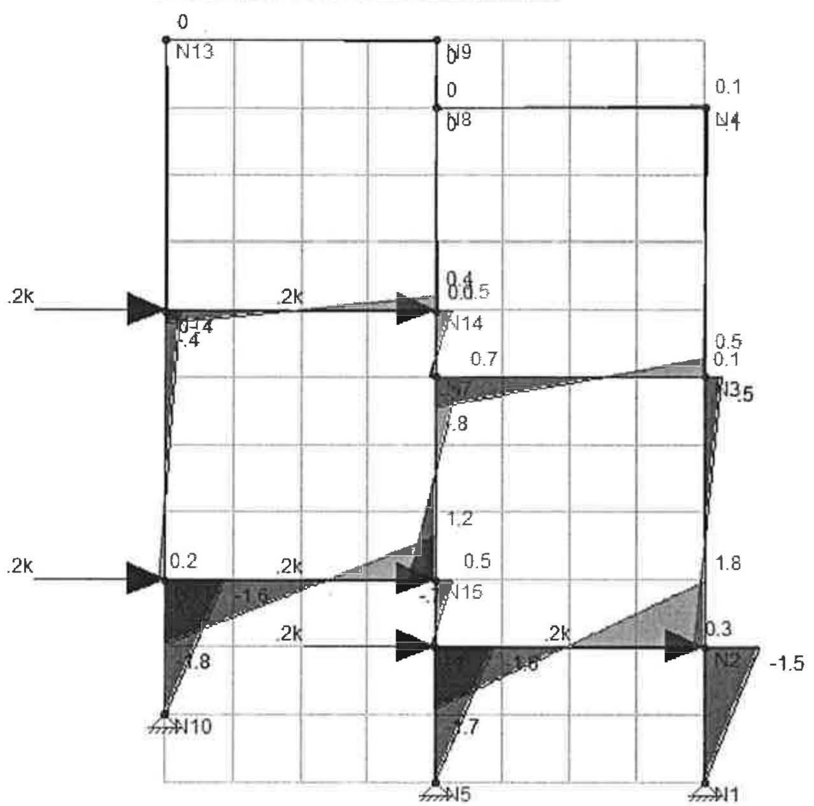


Joint Deflections

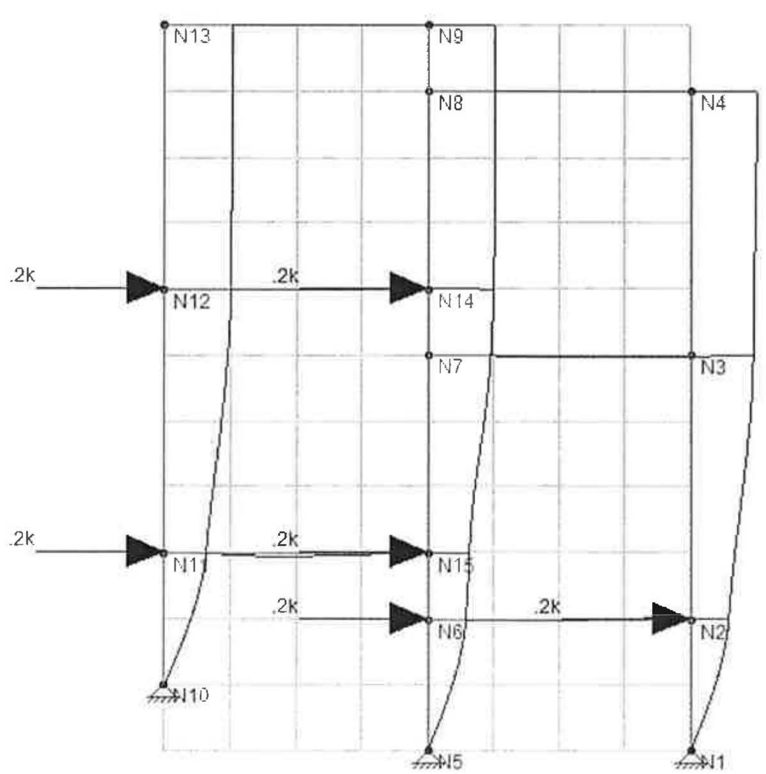
	L...	Joint Label	X [in]
1	1	N1	0
2	1	N2	.433
3	1	N3	.702
4	1	N4	.744
5	1	N5	0
6	1	N6	.433
7	1	N7	.702
8	1	N8	.744
9	1	N9	.744
10	1	N10	0
11	1	N11	.47
12	1	N12	.734
13	1	N13	.744
14	1	N14	.733
15	1	N15	.47

MAX STORY DRIFT: .47"
*CONSERVATIVE, SINCE MODELED W/ A PIN @ BASE

FLEXIBLE DIAPHRAGM



	M_{max}
BM.	$1.8^{k\text{-}ft}$
COL.	$1.8^{k\text{-}ft}$



Joint Deflections

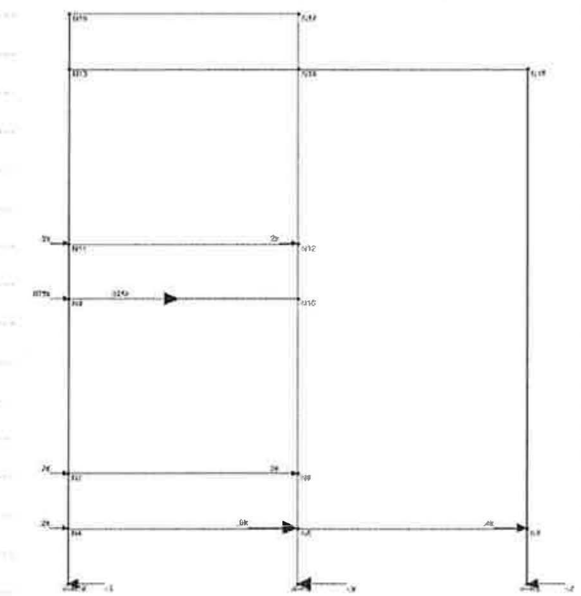
	L...	Joint Label	X [in]
1	1	N1	0
2	1	N2	.343
3	1	N3	.571
4	1	N4	.606
5	1	N5	0
6	1	N6	.343
7	1	N7	.571
8	1	N8	.606
9	1	N9	.606
10	1	N10	0
11	1	N11	.377
12	1	N12	.597
13	1	N13	.606
14	1	N14	.597
15	1	N15	.377

MAX STORY DRIFT: .38"

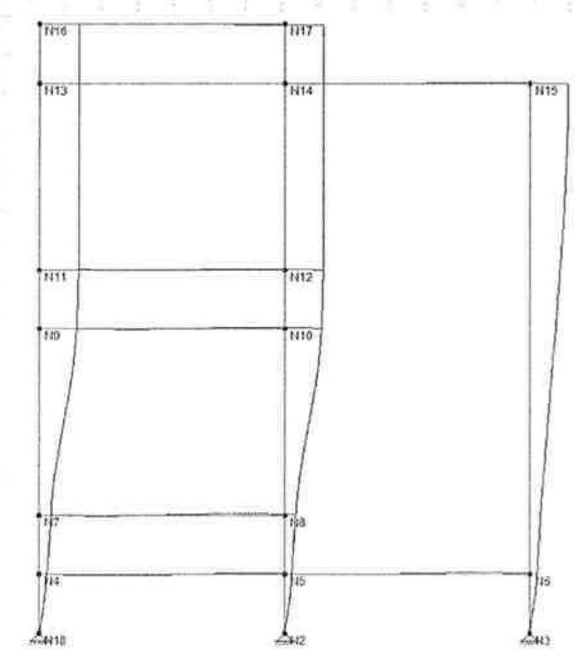
*CONSERVATIVE, SINCE MODELED W/ A PIN @ BASE

References	System:	Comments

Line "2" RISA Analysis – Tributary Area



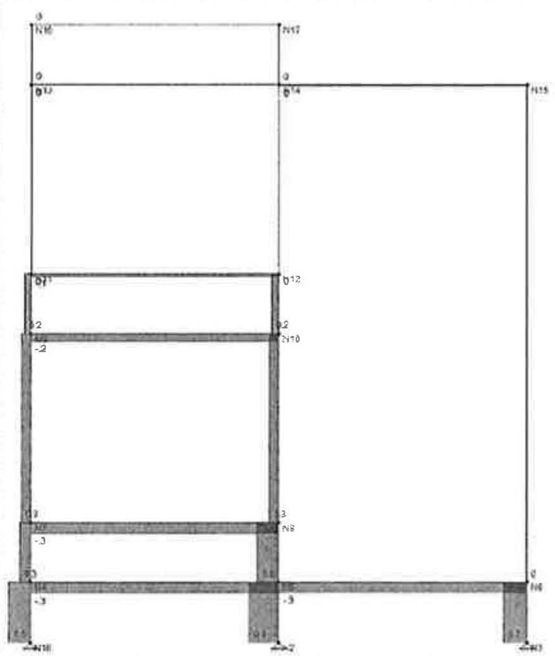
Model



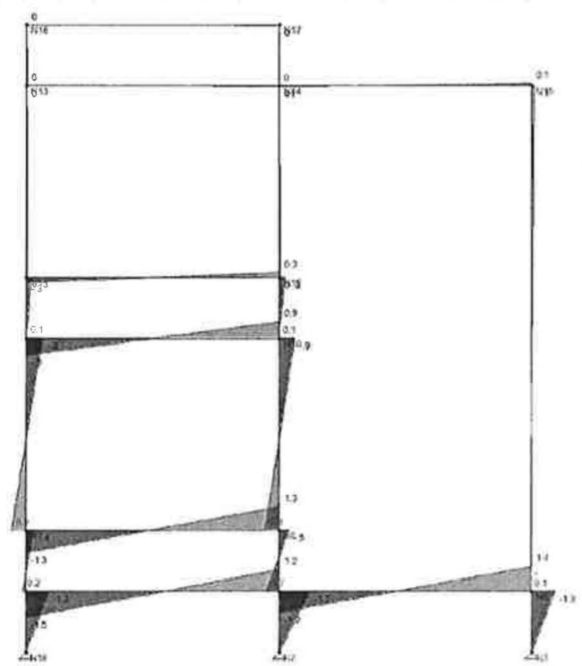
Joint Label	X [in]	Y [in]	Rotatio...
N1	0	0	-4.926e-3
N2	0	0	-5.314e-3
N3	0	0	-4.975e-3
N4	.093	0	-1.749e-3
N5	.093	0	-9.963e-4
N6	.093	0	-1.622e-3
N7	.135	0	-1.232e-3
N8	.135	0	-1.435e-3
N9	.395	.001	-9.81e-4
N10	.395	-.001	-9.615e-4
N11	.414	.001	-3.067e-4
N12	.414	-.001	-3.186e-4
N13	.422	.001	-2.319e-5
N14	.422	-.001	2.67e-5
N15	.422	0	-2.106e-4
N16	.422	.001	-1.138e-5
N17	.422	-.001	-2.816e-5
N18	0	0	0

Deflected Shape

References	System: Line “2” RISA Analysis – Tributary Area	Comments

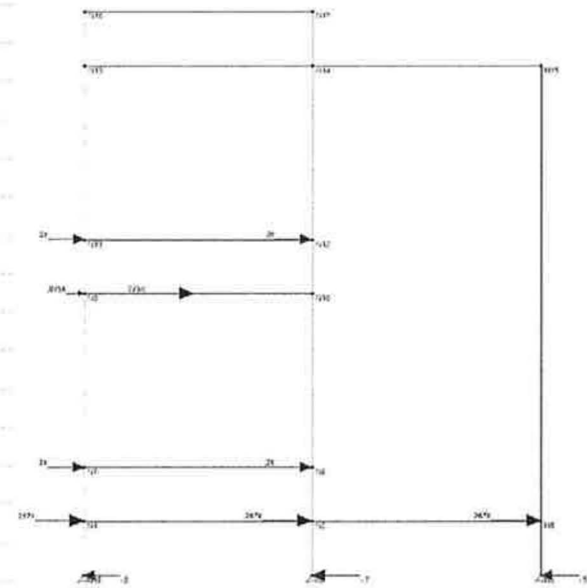


Shear:
Vmax = 0.856k

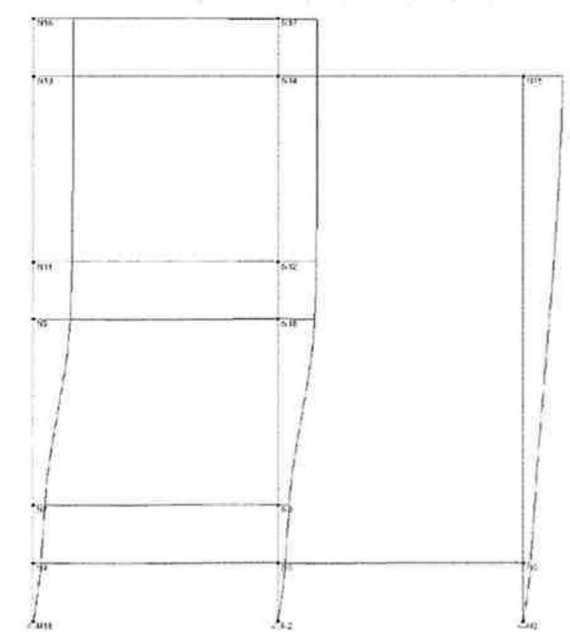


Moment:
Mmax = 1.474k-ftk

References	System: Line “2” RISA Analysis – Stiffness	Comments



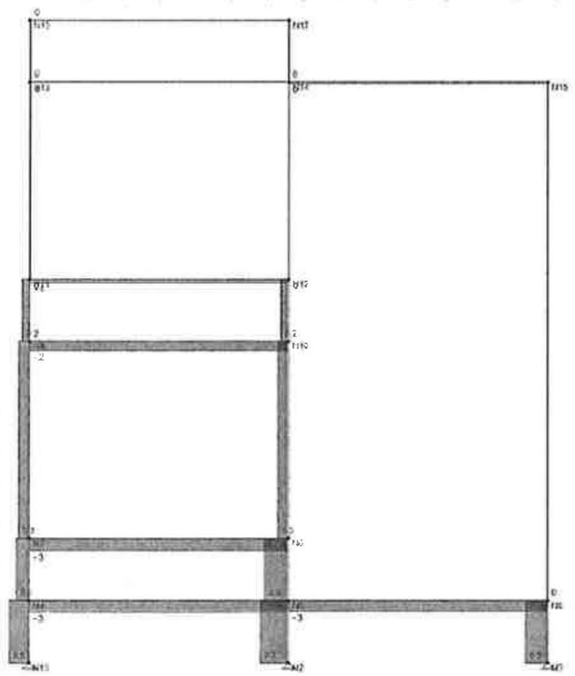
Model



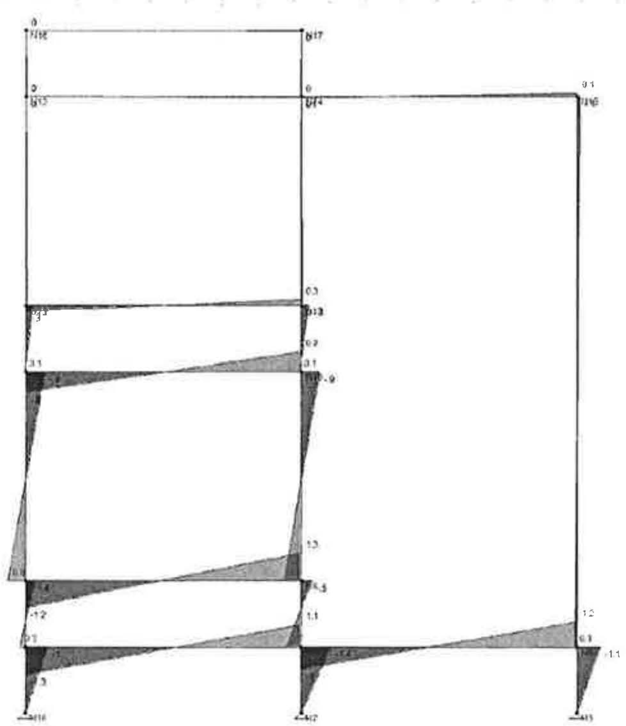
Joint Label	X [in]	Y [in]	Rotatio...
N1	0	0	-4.078e-3
N2	0	0	-4.391e-3
N3	0	0	-4.122e-3
N4	.077	0	-1.522e-3
N5	.077	0	-8.758e-4
N6	.077	0	-1.359e-3
N7	.117	0	-1.21e-3
N8	.117	0	-1.396e-3
N9	.375	.001	-9.747e-4
N10	.375	-.001	-9.568e-4
N11	.394	.001	-3.025e-4
N12	.394	-.001	-3.141e-4
N13	.401	.001	-2.014e-5
N14	.401	-.001	3.102e-5
N15	.401	0	-2.242e-4
N16	.401	.001	-1.e-5
N17	.401	-.001	-2.725e-5
N18	0	0	0

Deflected Shape

References	System:	Comments
	Line “2” RISA Analysis – Stiffness	

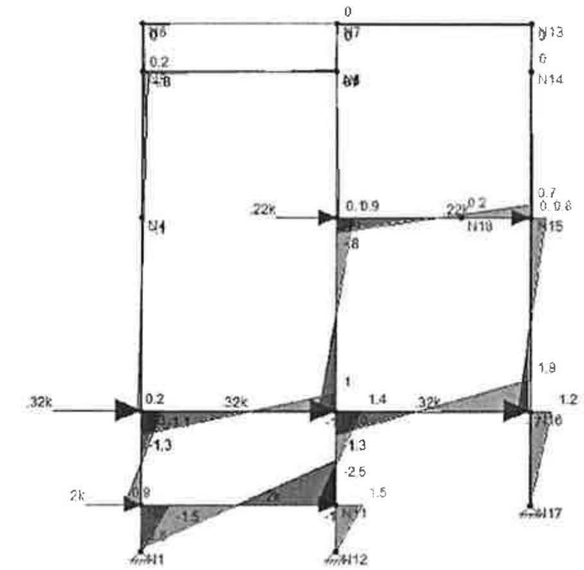


Shear:
Vmax =
0.698k

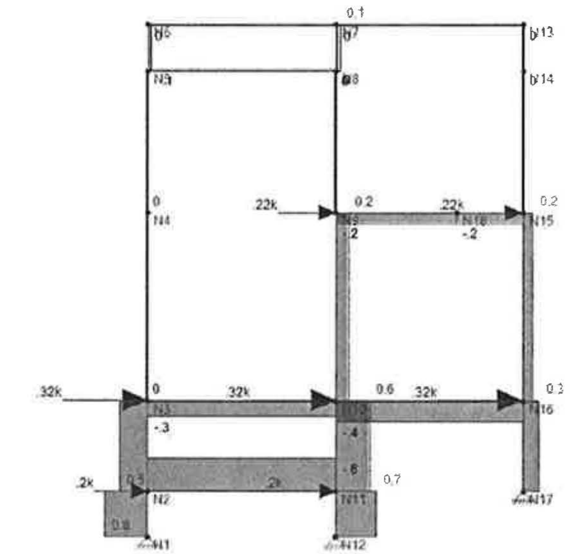


Moment:
Mmax = 1.393k-ftk

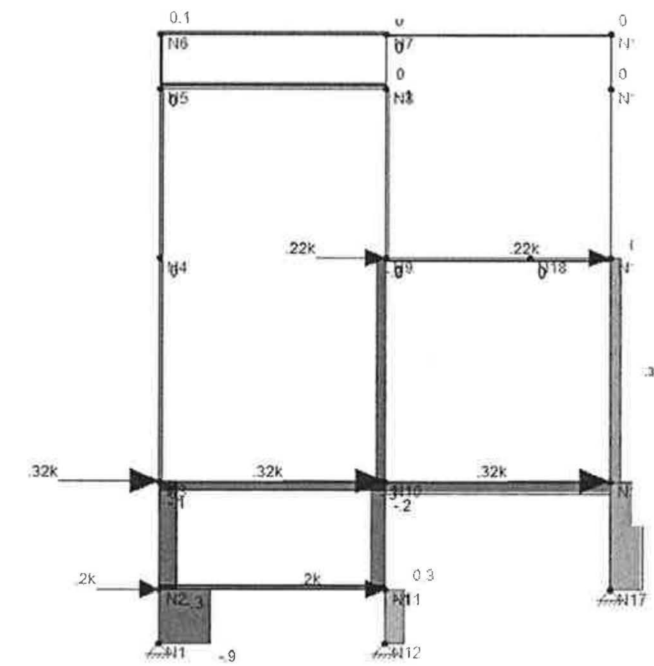
Gridline 3 – Rigid Diaphragm



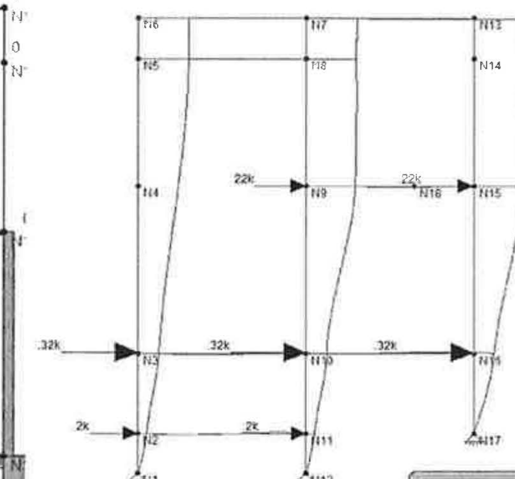
Moment



Shear



Axial



Deflected Shape

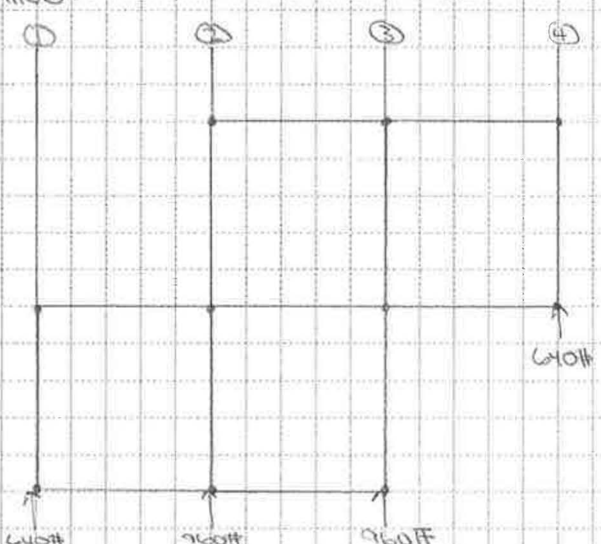
Joint Deflections

	L	Joint Label	X [in]	Y [in]	Rotatio
1	1	N1	0	0	-6.377e-3
2	1	N2	.124	0	-2.488e-3
3	1	N3	.306	0	-1.614e-3
4	1	N4	.592	0	-3.118e-3
5	1	N5	.744	0	-2.859e-4
6	1	N6	.746	0	1.313e-5
7	1	N7	.746	0	5.024e-5
8	1	N8	.744	0	3.088e-5
9	1	N9	.726	0	-9.061e-4
10	1	N10	.306	0	-8.032e-4
11	1	N11	.124	0	-2.61e-3
12	1	N12	0	0	-6.320e-3
13	1	N13	.746	-.001	2.001e-5
14	1	N14	.746	.001	7.825e-6
15	1	N15	.726	-.001	-7.178e-4
16	1	N16	.307	0	-2.421e-3
17	1	N17	0	0	-8.326e-3
18	1	N18	.726	.002	3.017e-4

MAX MOMENT: 2.8 K-ft
MAX SHEAR: 0.8 K

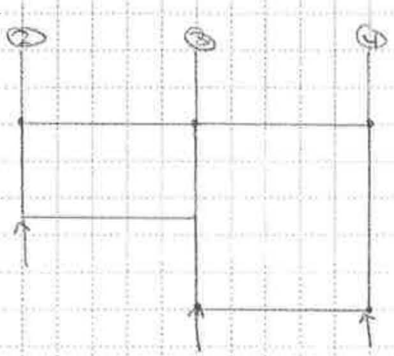
References	System: GRIDLINE 3 - RIGID DIAPHRAGM	Comments

LEVEL 1 FRAMING

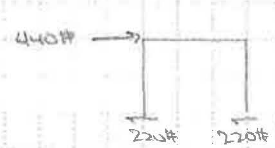


Level 1 Framing Diaph: 800# x 4 = 3200#
10 columns
3200# x (3/10) = 960#

LEVEL 2 FRAMING:



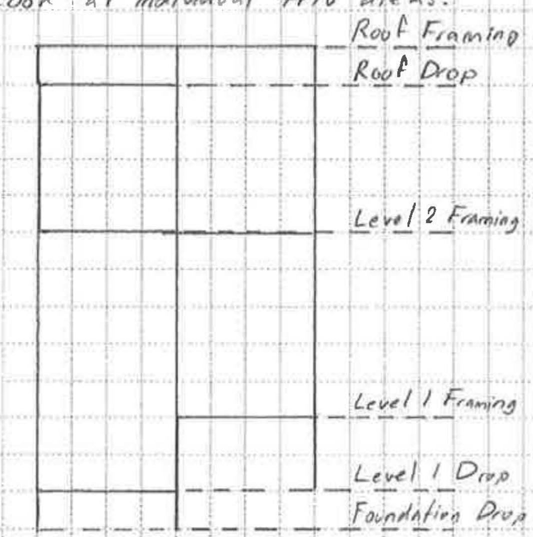
Level 2 Framing diaph: 800# + (750)(0.4) = 1100#
5 columns
1100# x (2/5) = 440#



References	System: GRID 4 RISA 2D CHECK	Comments

FLEXIBLE DIAPHRAGM

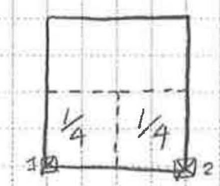
Look at individual trib areas:



Weight of each module: 2000 #

Force = 0.4 W

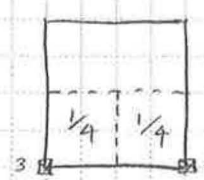
Level 1 Drop:



$W_1 = 1/4\,(2000\#) = 500\# = W_2$

$F_1 = 500\#\,(0.4) = 200\#$ or $0.2k = F_2$

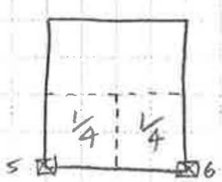
Level 1 Framing:



$W_3 = 1/4\,(2000\#) = 500\# = W_4$

$F_3 = 500\#(0.4) = 200\#$ or $0.2k = F_4$

Level 2 Framing:

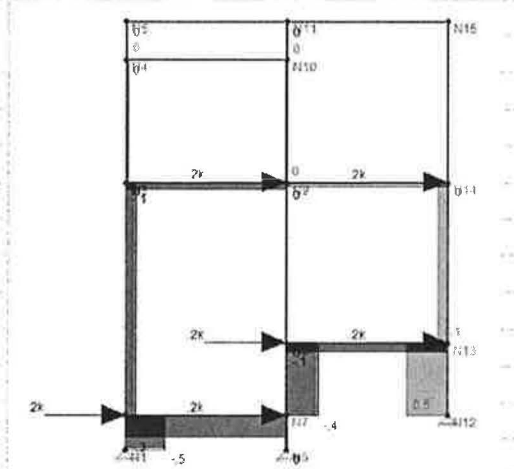


$W_5 = 1/4\,(2000\#) = 500\# = W_6$

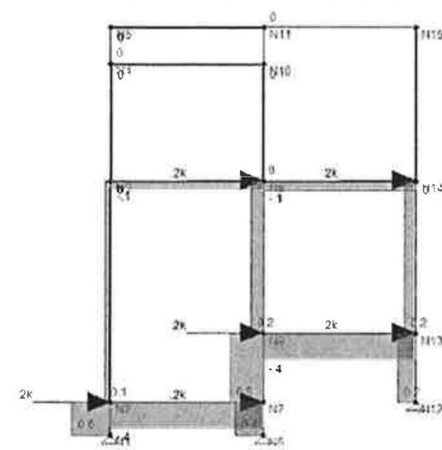
$F_5 = 500\#\,(0.4) = 200\#$ or $0.2k = F_6$

References	System: GRID 4 RISA 2D CHECK	Comments

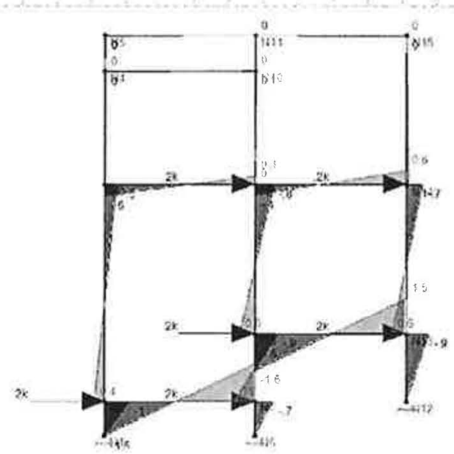
FLEXIBLE DIAPHRAGM



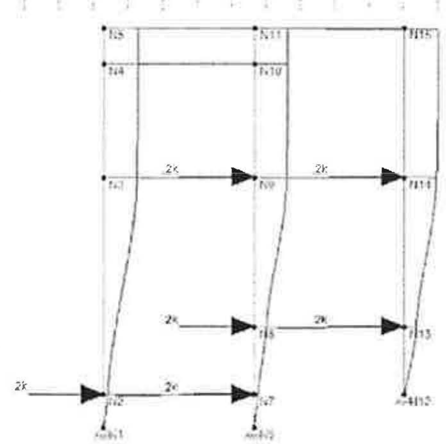
Axial



Shear



Moment



Deflection

Max Moment: 1.6k'

Max Shear: 0.6k

Joint Deflections

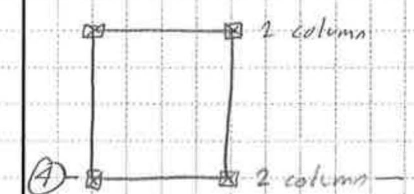
	L...	Joint Label	X [in]	Y [in]	Rotatio...
1	1	N1	0	0	-3.557e-3
2	1	N2	.063	0	-1.32e-3
3	1	N3	.543	0	-5.517e-4
4	1	N4	.564	0	-3.021e-5
5	1	N5	.565	0	-1.784e-5
6	1	N6	0	0	-3.403e-3
7	1	N7	.064	0	-1.77e-3
8	1	N8	.202	0	-1.558e-3
9	1	N9	.543	0	-2.826e-4
10	1	N10	.564	0	-5.752e-5
11	1	N11	.565	0	-1.388e-5
12	1	N12	0	0	-5.974e-3
13	1	N13	.202	0	-1.551e-3
14	1	N14	.543	0	-7.751e-4
15	1	N15	.565	0	5.102e-5

References	System: GRID 4 RISA 2D CHECK	Comments

RIGID DIAPHRAGM

Assume all columns equal stiffness

Level 1 Drop:

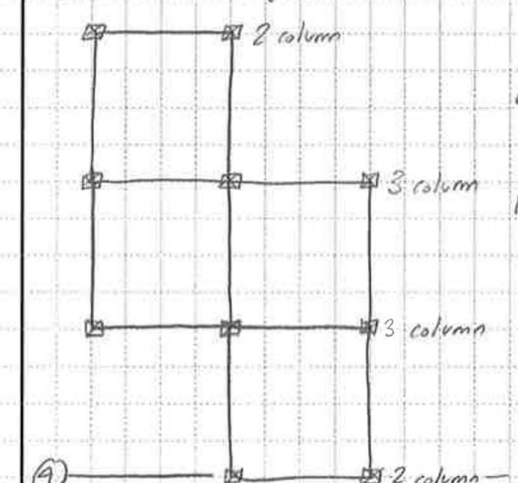


W = 2000#

Line 4: $2000\# (0.4)\left(\frac{2\ \text{column}}{4\ \text{total}}\right) = 400\#$

Per column: $\frac{400\#}{2} = 200\#$ or $0.2k$

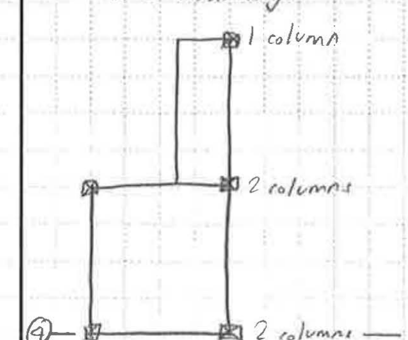
Level 1 Framing:



Line 4: $2000\# (0.4)(4\ \text{modules})\left(\frac{2\ \text{column}}{10\ \text{total}}\right)$
$= 640\#$

Per column: $\frac{640\#}{2} = 320\#$ or $0.32k$

Level 2 Framing:

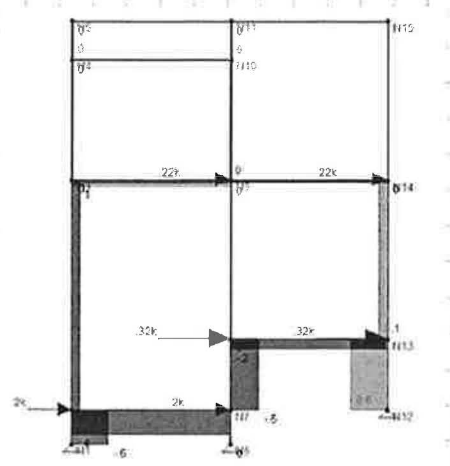


Line 4: $[2000\#(0.4) + 750\#(0.4)]\left(\frac{2\ \text{columns}}{5\ \text{columns}}\right)$
$= 440\#$

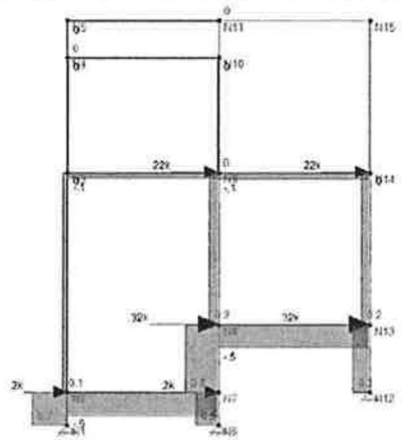
Per column: $\frac{440\#}{2} = 220\#$ or $0.22k$

References	System: GRID 4 RISA 2D CHECK	Comments

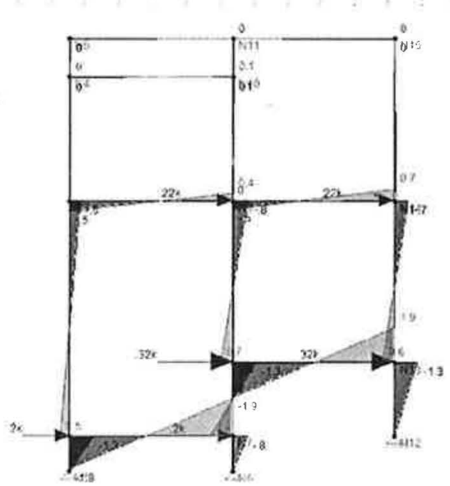
RIGID DIAPHRAGM



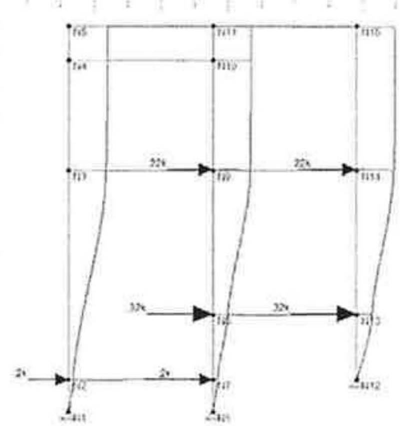
Axial



Shear



Moment



Deflection

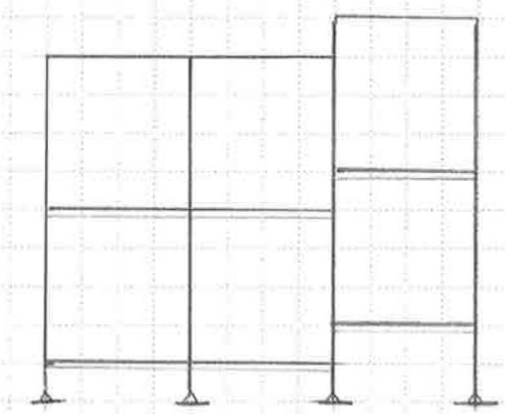
Max Moment: 2.03 k'

Max Shear: 0.7k

Joint Deflections

	L	Joint Label	X [in]	Y [in]	Rotatio
1	1	N1	0	0	-4.519e-3
2	1	N2	078	0	-1.575e-3
3	1	N3	644	0	-4.559e-4
4	1	N4	653	0	-3.155e-5
5	1	N5	669	0	-2.09e-5
6	1	N6	0	0	-4.207e-3
7	1	N7	073	0	-2.231e-3
8	1	N8	262	0	-2.008e-3
9	1	N9	644	0	-2.959e-4
10	1	N10	668	0	-6.743e-5
11	1	N11	669	0	-1.475e-5
12	1	N12	0	0	-7.811e-3
13	1	N13	263	0	-1.89e-3
14	1	N14	644	0	-8.605e-4
15	1	N15	669	0	2.866e-6

References	System: GRIDLINE A - RISA INPUT	Comments



each 8'4" × 8'4" grid weighs approx 2k

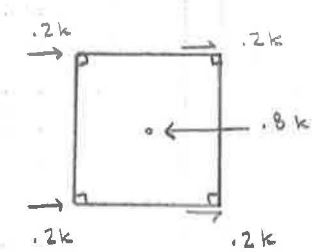
"sky bridge" second floor hallway weighs approx .75 k

$F_{EQ} = .4g$

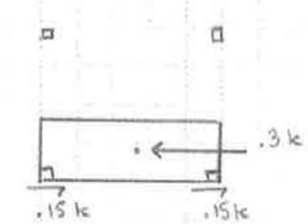
$F_{EQ} = .4(2k) = .8k$ 8'4" × 8'4"

$F_{EQ} = .4(.75k) = .3k$ skybridge

FLEXURAL DIAPHRAGM



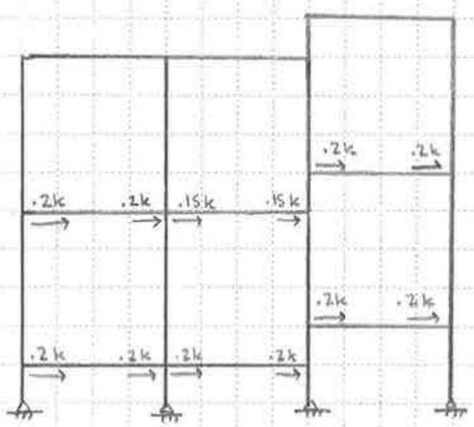
8'-4" × 8'-4"
PLAN



SKYBRIDGE
PLAN

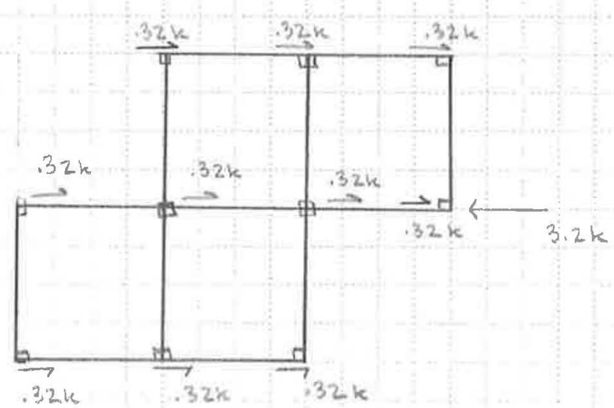
$\frac{.8k}{4 \text{ columns}} = .2k$ / column

References	System:	Comments

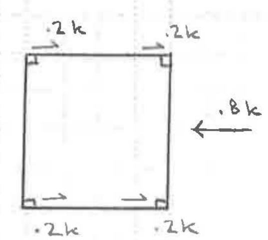


FLEXIBLE DIAPHRAGM

RIGID DIAPHRAGM

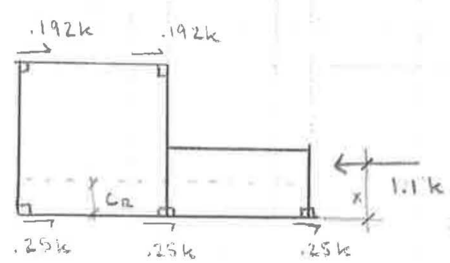


FIRST FLOOR PLAN

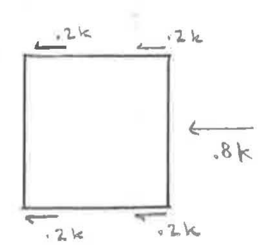


RISE

$\frac{3.2k}{10 \text{ columns}} = .32\ k/\text{column}$



SECOND FLOOR PLAN



References	System:	Comments

Equivalent force = .8 + .3 = 1.1 k

$x = \left[.8\left(\frac{8'4"}{2}\right) + .3\left(\frac{2'8"}{2}\right)\right] \frac{1}{1.1k} = 3.73'$

center of rigidity

$C_R = \frac{2(k)(8'4") + 3(k)(0')}{5(k)} = 3.47'$

torsional moment = 1.11k (3.73' - 3.47') = .29 kft

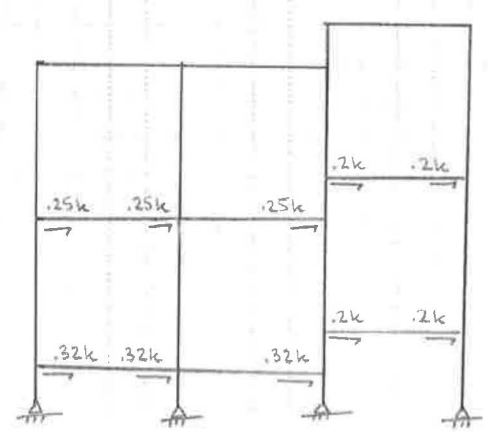
$F_D = \frac{1.11k}{5 \text{ columns}} = .22\ k/\text{column}$

$F_T = \frac{.29 \text{ kft}}{3.47'} \cdot \frac{1}{3 \text{ columns}} = .028\ k/\text{column}$ (gridline A)

$F_T = \frac{.29 \text{ kft}}{(8'4" - 3.47')} \cdot \frac{1}{2 \text{ columns}} = .028\ k/\text{column}$ (gridline B)

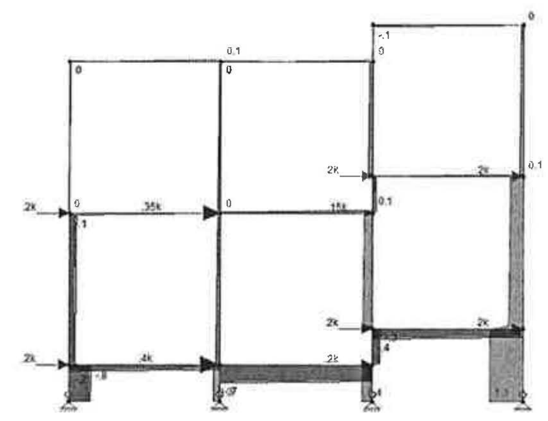
gridline A = $F_D + F_T$ = .248 k

gridline B = $F_D - F_T$ = .192 k

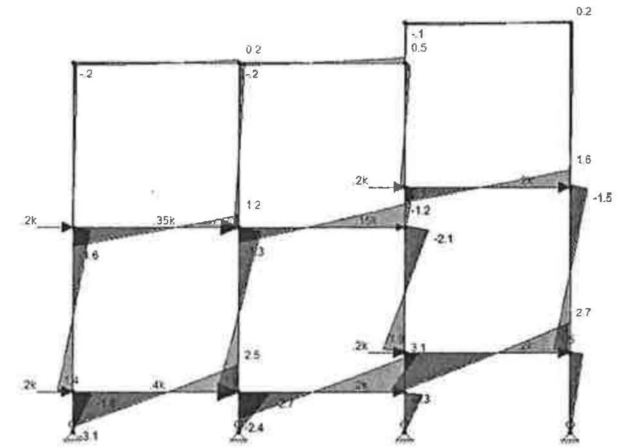


RIGID DIAPHRAGM

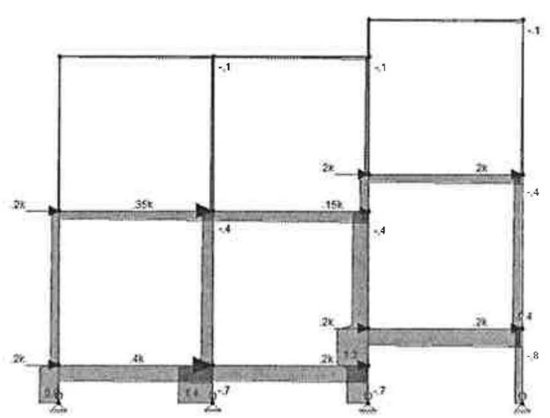
Gridline A - Flexible Diaphragm



Axial



Moment

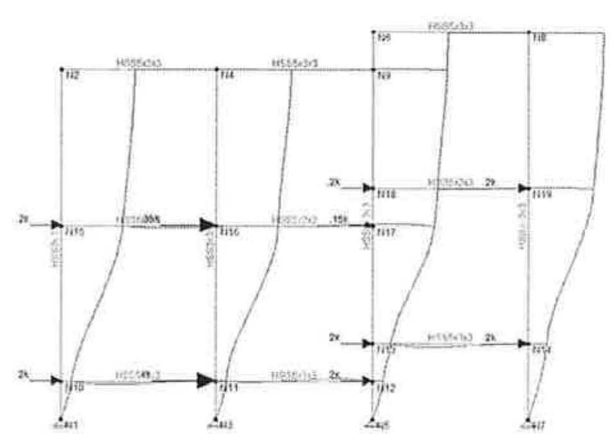


Shear

Max moment: 3.1 k-ft

Max axial: 1.3 k

Max shear: 1.4 k

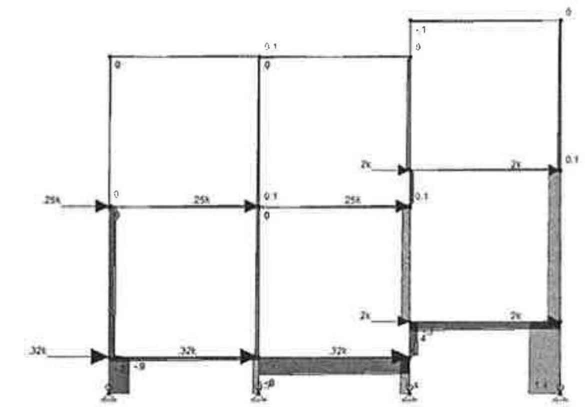


Deflected Shape

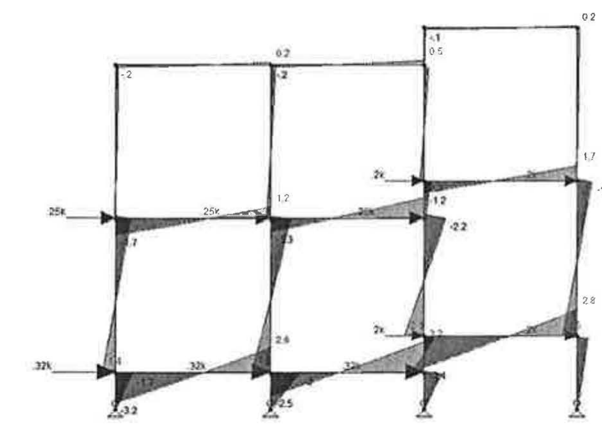
Joint Deflections

	L...	Joint Label	X [in]	Y [in]	Rotatio...
1	1	N1	0	0	0
2	1	N2	1.184	.001	-4.111e-4
3	1	N3	0	0	0
4	1	N4	1.184	0	-1.187e-4
5	1	N5	0	0	0
6	1	N6	1.195	0	-2.393e-4
7	1	N7	0	0	0
8	1	N8	1.195	-.003	-1.417e-4
9	1	N9	1.184	0	-5.597e-4
10	1	N10	.162	0	-3.894e-3
11	1	N11	.163	0	-1.805e-3
12	1	N12	.164	0	-3.786e-3
13	1	N13	.287	0	-4.089e-3
14	1	N14	.288	-.001	-2.089e-3
15	1	N15	.983	.001	-2.283e-3
16	1	N16	.983	0	-6.316e-4
17	1	N17	.983	0	-2.882e-3
18	1	N18	1.037	0	-9.384e-4
19	1	N19	1.037	-.003	-1.969e-3

Gridline A - Rigid Diaphragm



Axial

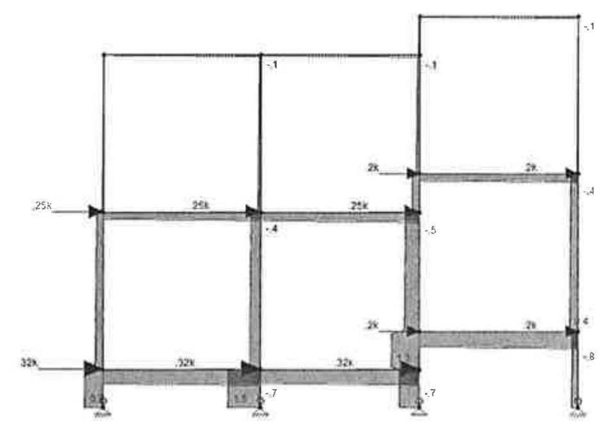


Moment

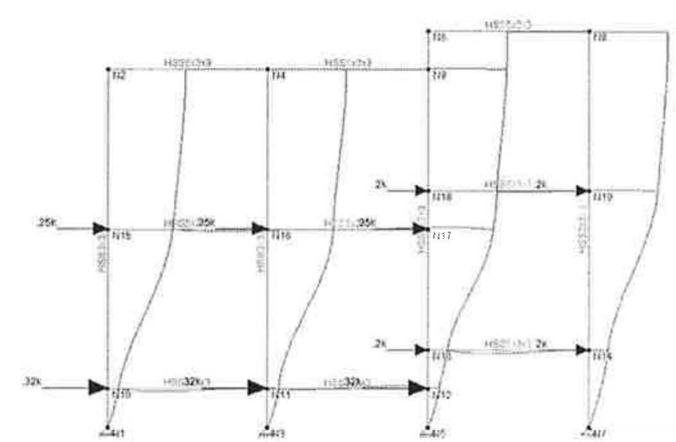
Max moment: 3.2 k-ft

Max axial: 1.4 k

Max shear: 1.5 k



Shear



Deflected Shape

Joint Deflections

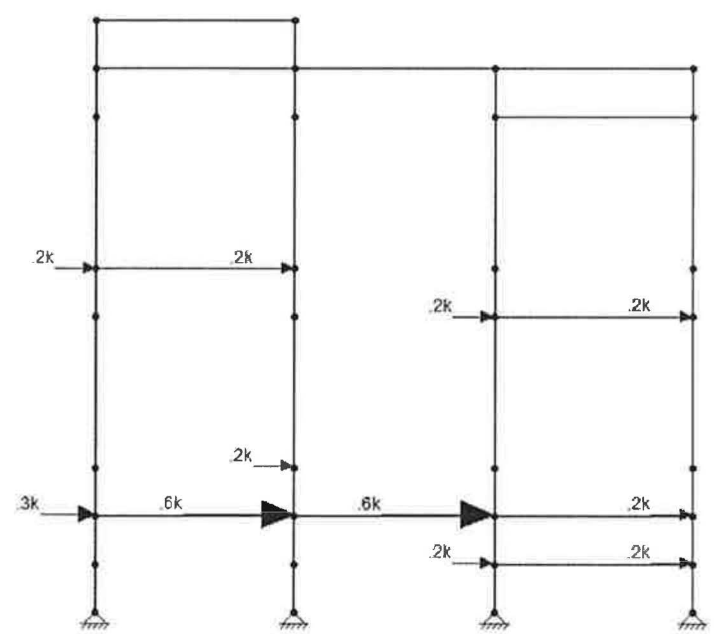
	L...	Joint Label	X [in]	Y [in]	Rotatio...
1	1	N1	0	0	0
2	1	N2	1.217	.001	-4.102e-4
3	1	N3	0	0	0
4	1	N4	1.217	0	-1.193e-4
5	1	N5	0	0	0
6	1	N6	1.228	0	-2.439e-4
7	1	N7	0	0	0
8	1	N8	1.228	-.003	-1.376e-4
9	1	N9	1.217	0	-5.658e-4
10	1	N10	.171	0	-4.067e-3
11	1	N11	.171	0	-1.885e-3
12	1	N12	.172	0	-3.941e-3
13	1	N13	.299	0	-4.188e-3
14	1	N14	.3	-.001	-2.172e-3
15	1	N15	1.015	.001	-2.328e-3
16	1	N16	1.015	0	-6.475e-4
17	1	N17	1.015	0	-2.943e-3
18	1	N18	1.069	0	-9.291e-4
19	1	N19	1.069	-.003	-2.022e-3

References

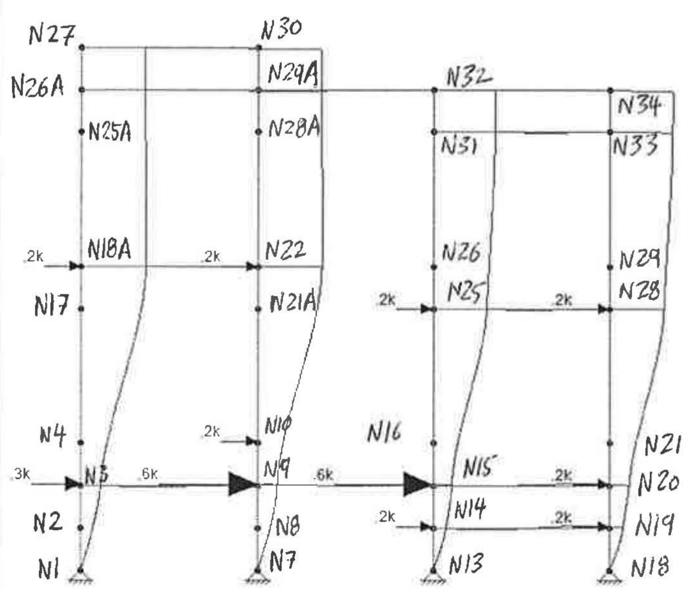
System: Modular House Grid B Flexible Diaphragm

Comments

Loads Applied



Deflections



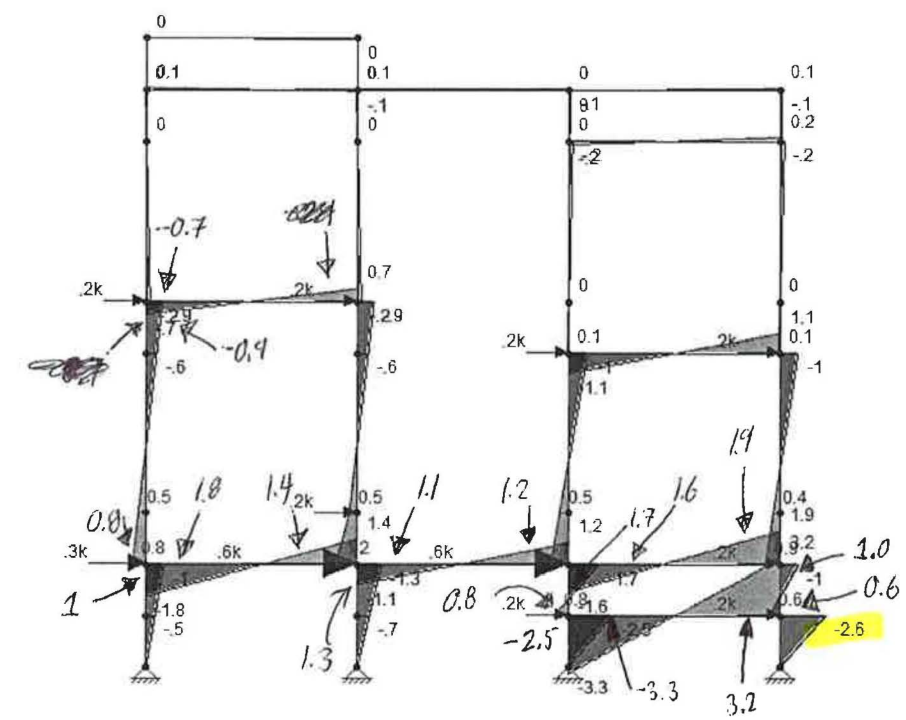
	L...	Joint Label	X [in]	Y [in]	Rotatio...
1	1	N1	0	0	-7.353e-3
2	1	N2	.167	0	-6.071e-3
3	1	N3	.272	0	-2.225e-3
4	1	N4	.367	0	-5.349e-3
5	1	N7	0	0	-7.895e-3
6	1	N8	.177	0	-6.195e-3
7	1	N9	.272	0	-1.092e-3
8	1	N10	.357	0	-5.357e-3
9	1	N13	0	0	-9.639e-3
10	1	N14	.185	0	-3.457e-3
11	1	N15	.27	0	-1.272e-3
12	1	N16	.354	.001	-5.262e-3
13	1	N18	0	0	-9.715e-3
14	1	N19	.184	0	-3.236e-3
15	1	N20	.27	-.001	-2.291e-3
16	1	N21	.368	-.001	-5.53e-3
17	1	N17	.844	0	-4.436e-3
18	1	N18A	.909	.001	-7.35e-4
19	1	N21A	.842	0	-4.541e-3
20	1	N22	.909	0	-7.701e-4
21	1	N25	.764	.002	-1.241e-3
22	1	N26	.798	.002	-1.529e-3
23	1	N28	.764	-.002	-1.109e-3
24	1	N29	.796	-.002	-1.5e-3
25	1	N25A	.898	0	4.366e-4
26	1	N26A	.891	0	7.81e-5
27	1	N27	.89	0	8.697e-7
28	1	N28A	.898	0	4.473e-4
29	1	N29A	.891	0	7.545e-5
30	1	N30	.89	0	-6.956e-7
31	1	N31	.886	.002	-2.405e-4
32	1	N32	.891	.002	-6.561e-5
33	1	N33	.886	-.002	-2.392e-4
34	1	N34	.891	-.002	-1.046e-4

References

System: Modular House Grid B Flexible Diaphragm

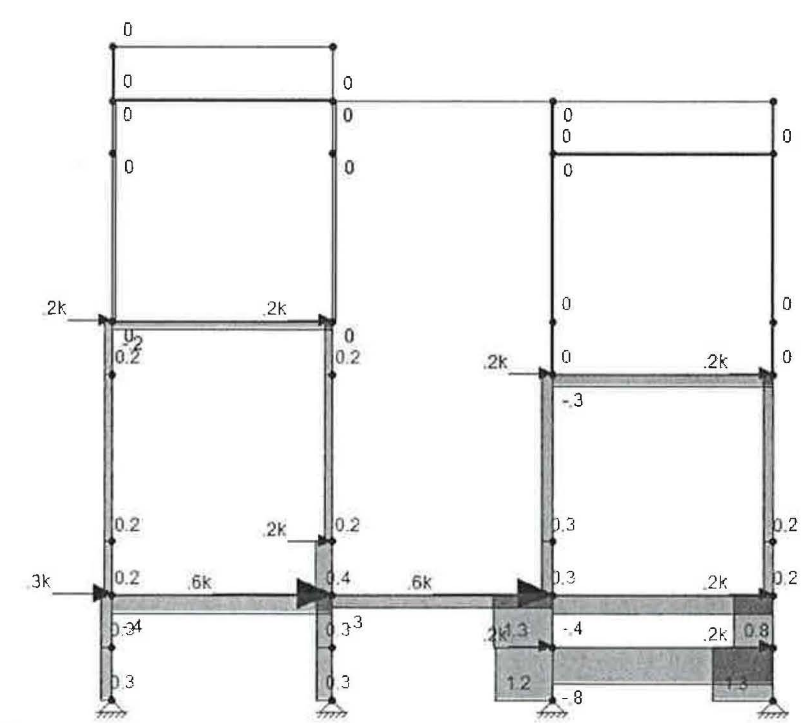
Comments

Moments



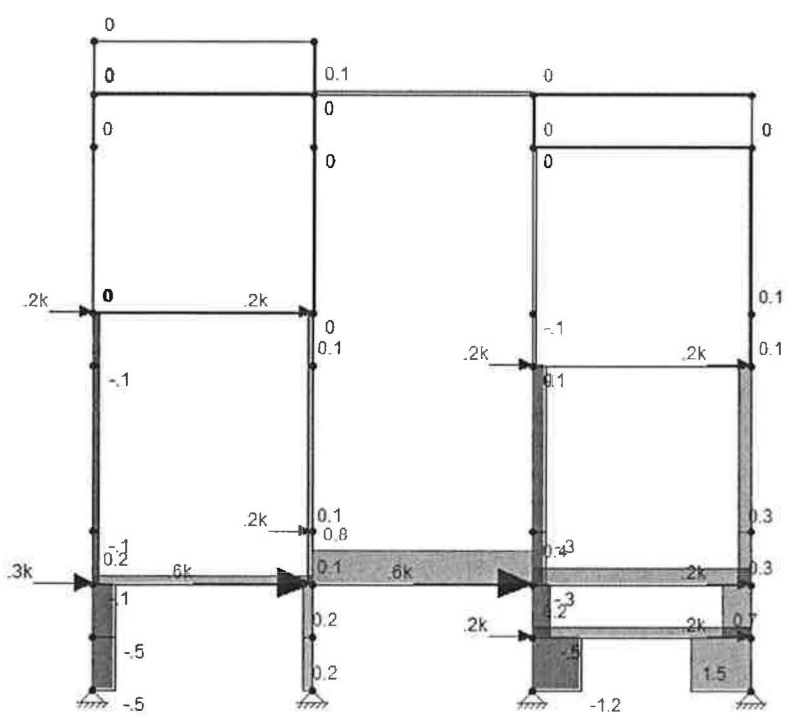
$M_{max} = -2.6$ kft

Shear



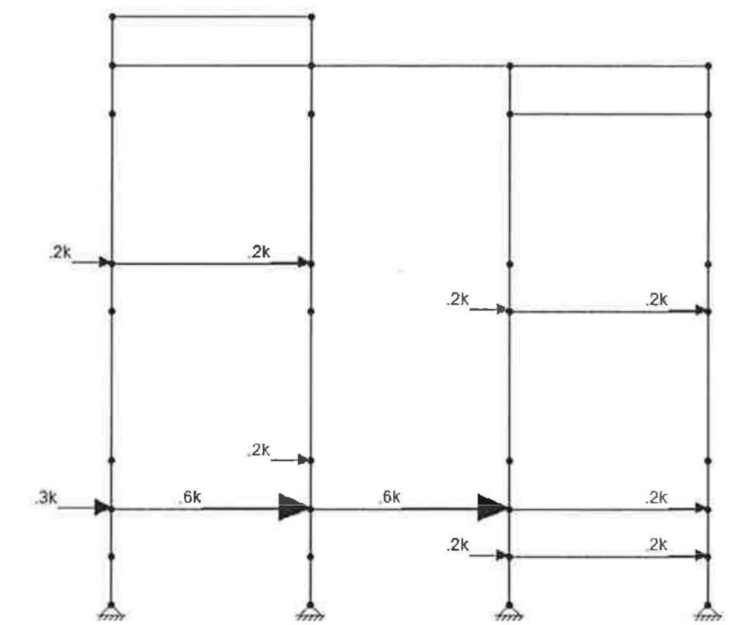
References	System: Modular House Grid B Flexible Diaphragm	Comments

Axial

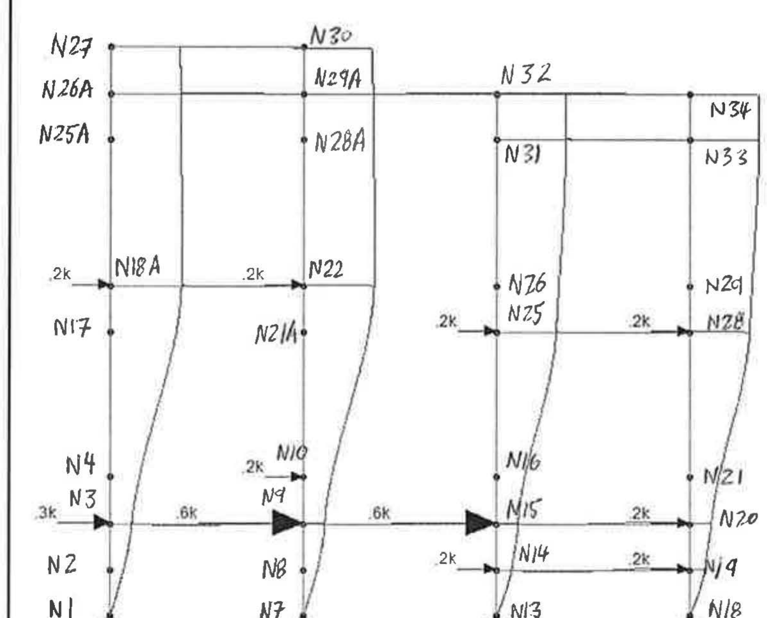


References	System: Modular House Grid B Rigid Diaphragm	Comments

Loads Applied



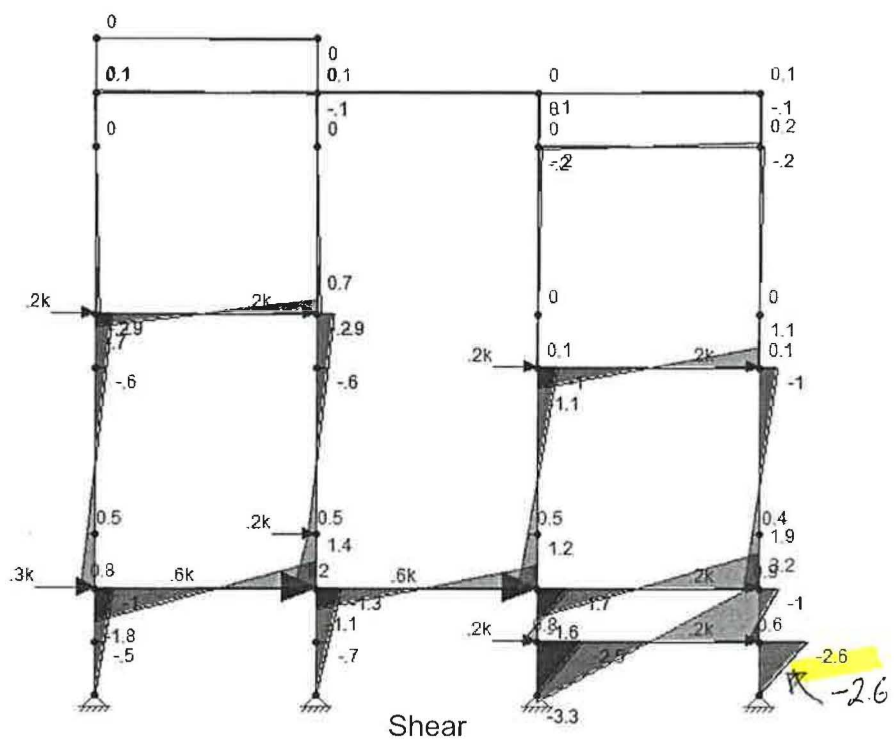
Deflections



	L...	Joint Label	X [in]	Y [in]	Rotatio...
1	3	N1	0	0	-7.353e-3
2	3	N2	.167	0	-6.071e-3
3	3	N3	.272	0	-2.225e-3
4	3	N4	.367	0	-5.349e-3
5	3	N7	0	0	-7.895e-3
6	3	N8	.177	0	-6.195e-3
7	3	N9	.272	0	-1.092e-3
8	3	N10	.357	0	-5.357e-3
9	3	N13	0	0	-9.639e-3
10	3	N14	.185	0	-3.457e-3
11	3	N15	.27	0	-1.272e-3
12	3	N16	.354	.001	-5.262e-3
13	3	N18	0	0	-9.715e-3
14	3	N19	.184	0	-3.236e-3
15	3	N20	.27	-.001	-2.291e-3
16	3	N21	.368	-.001	-5.53e-3
17	3	N17	.844	0	-4.436e-3
18	3	N18A	.909	.001	-7.35e-4
19	3	N21A	.842	0	-4.541e-3
20	3	N22	.909	0	-7.701e-4
21	3	N25	.764	.002	-1.241e-3
22	3	N26	.798	.002	-1.529e-3
23	3	N28	.764	-.002	-1.109e-3
24	3	N29	.796	-.002	-1.5e-3
25	3	N25A	.898	0	4.366e-4
26	3	N26A	.891	0	7.81e-5
27	3	N27	.89	0	8.697e-7
28	3	N28A	.898	0	4.473e-4
29	3	N29A	.891	0	7.545e-5
30	3	N30	.89	0	-6.956e-7
31	3	N31	.886	.002	-2.405e-4
32	3	N32	.891	.002	-6.561e-5
33	3	N33	.886	-.002	-2.392e-4
34	3	N34	.891	-.002	-1.046e-4

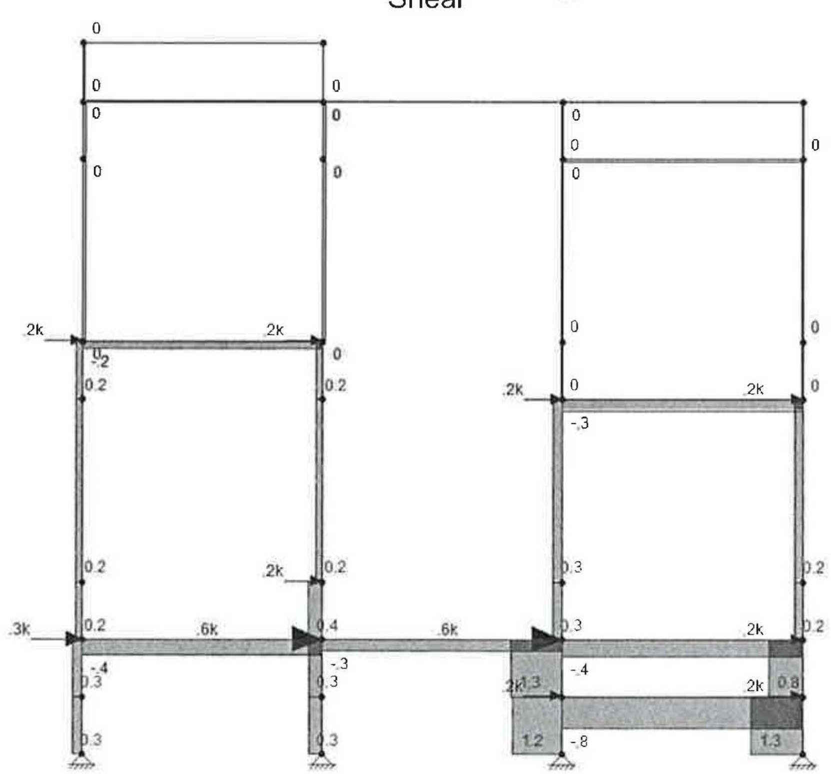
References	System: Modular House Grid B Rigid Diaphragm	Comments

Moments



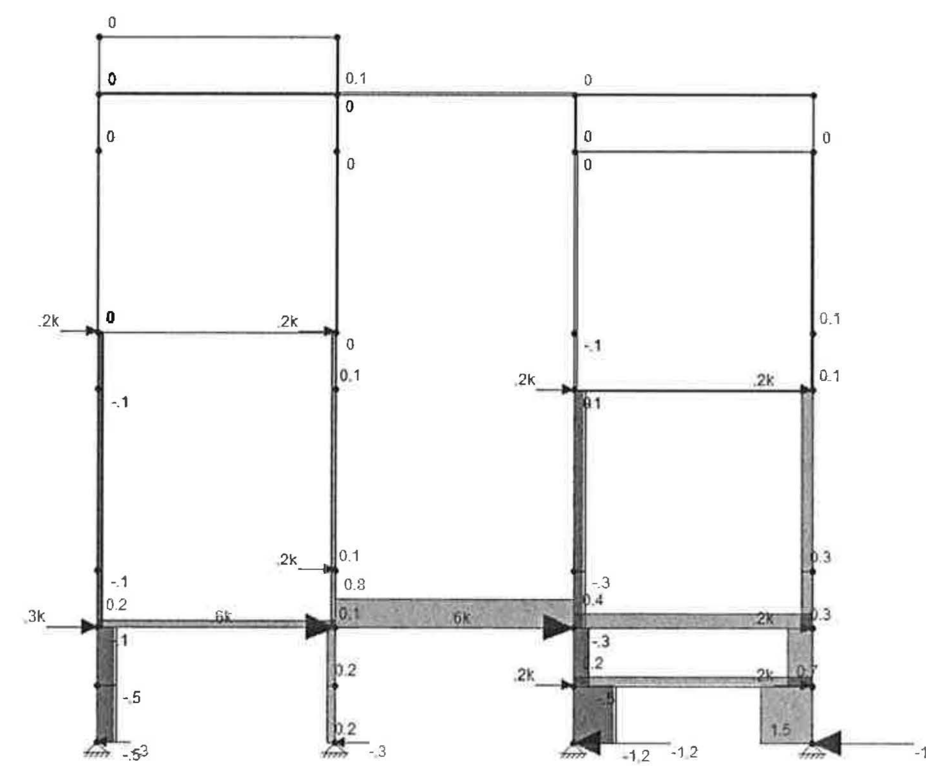
$M_{max} = 2.6$ kft

Shear

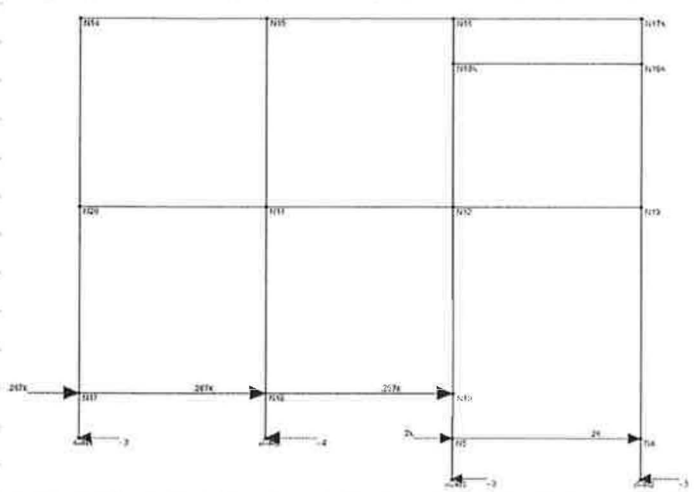


References	System: Modular House Grid B Rigid Diaphragm Analysis	Comments

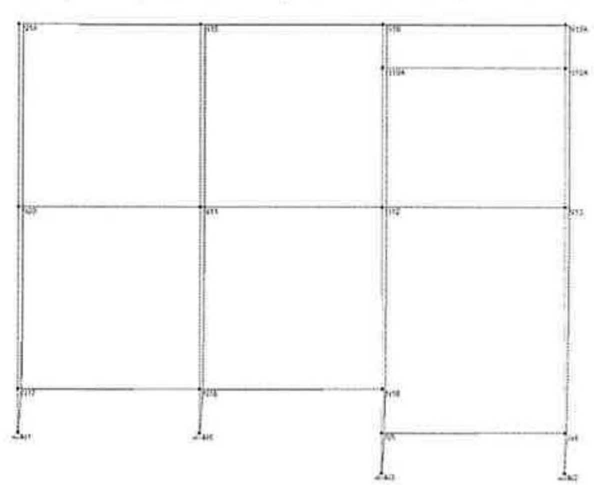
Axial



References | System: Line “C” RISA Analysis – Tributary Area | Comments



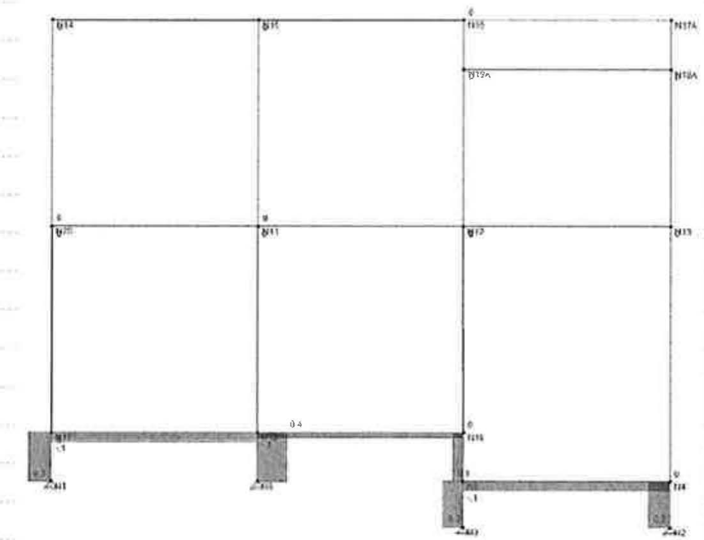
Model



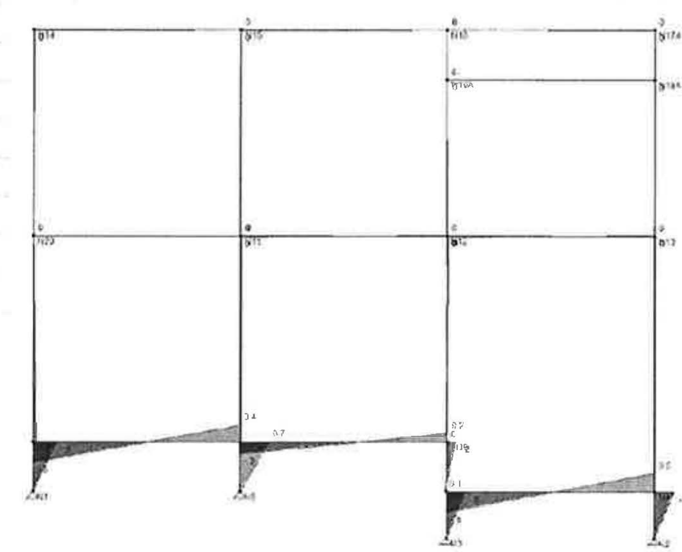
Joint Label	X [in]	Y [in]	Rotatio...
N1	0	0	-2.129e-3
N2	0	0	-1.654e-3
N3	0	0	-1.627e-3
N4	.028	0	-4.788e-4
N5	.029	0	-5.56e-4
N6	0	0	-2.255e-3
N17	.04	0	-6.327e-4
N18	.04	0	-3.655e-4
N19	.04	0	-1.698e-4
N20	.06	0	4.592e-6
N11	.06	0	-1.177e-5
N12	.06	0	-1.918e-5
N13	.06	0	-1.743e-5
N14	.06	0	-3.31e-6
N15	.06	0	-3.15e-7
N16	.06	0	-1.814e-7
N17A	.06	0	-1.535e-7
N18A	.06	0	-6.127e-7
N19A	.06	0	-4.21e-7

Deflected Shape

References | System: Line “C” RISA Analysis – Tributary Area | Comments



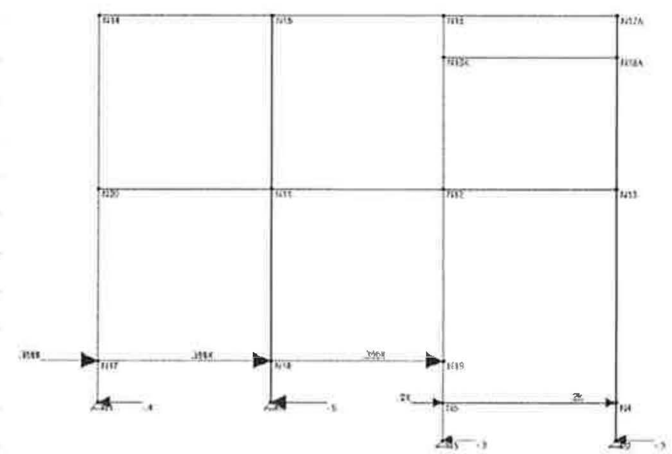
Shear:
Vmax = 0..374k

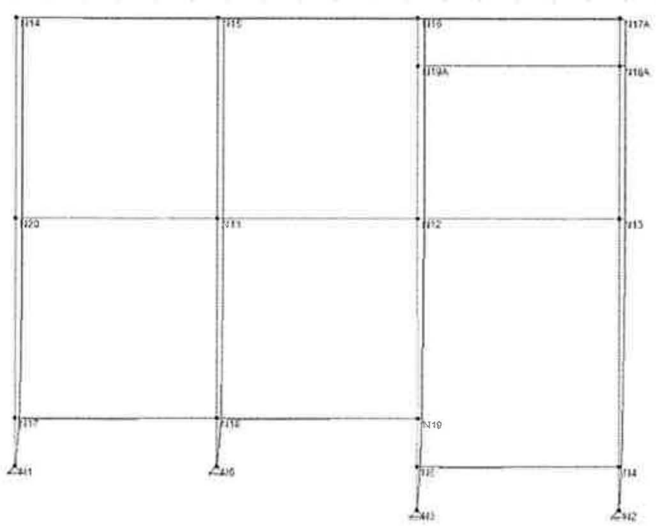


Moment:
Mmax = .749k-ftk

References	System: Line "C" RISA Analysis – Stiffness	Comments

Model

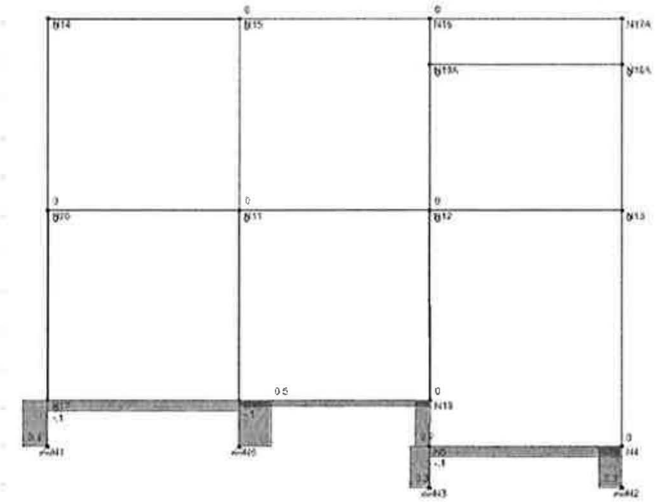




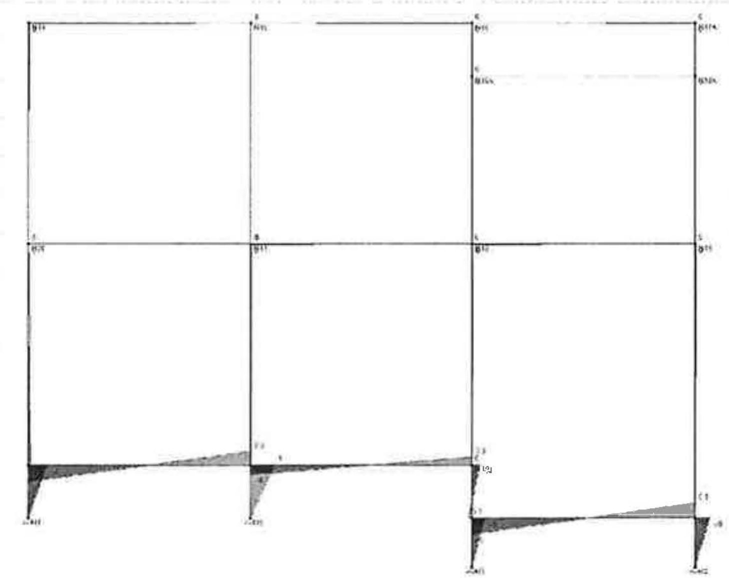
Joint Label	X [in]	Y [in]	Rotatio...
N1	0	0	-2.694e-3
N2	0	0	-1.974e-3
N3	0	0	-1.92e-3
N4	.034	0	-5.639e-4
N5	.034	0	-7.155e-4
N6	0	0	-2.857e-3
N17	.05	0	-8.028e-4
N18	.05	0	-4.533e-4
N19	.051	0	-2.698e-4
N20	.076	0	6.514e-6
N11	.076	0	-1.66e-5
N12	.076	0	-1.968e-5
N13	.076	0	-3.034e-5
N14	.076	0	-4.402e-6
N15	.076	0	-4.766e-7
N16	.076	0	-1.033e-7
N17A	.076	0	-1.983e-7
N18A	.076	0	-4.767e-8
N19A	.076	0	-1.084e-6

Deflected Shape

References	System: Line "C" RISA Analysis – Stiffness	Comments



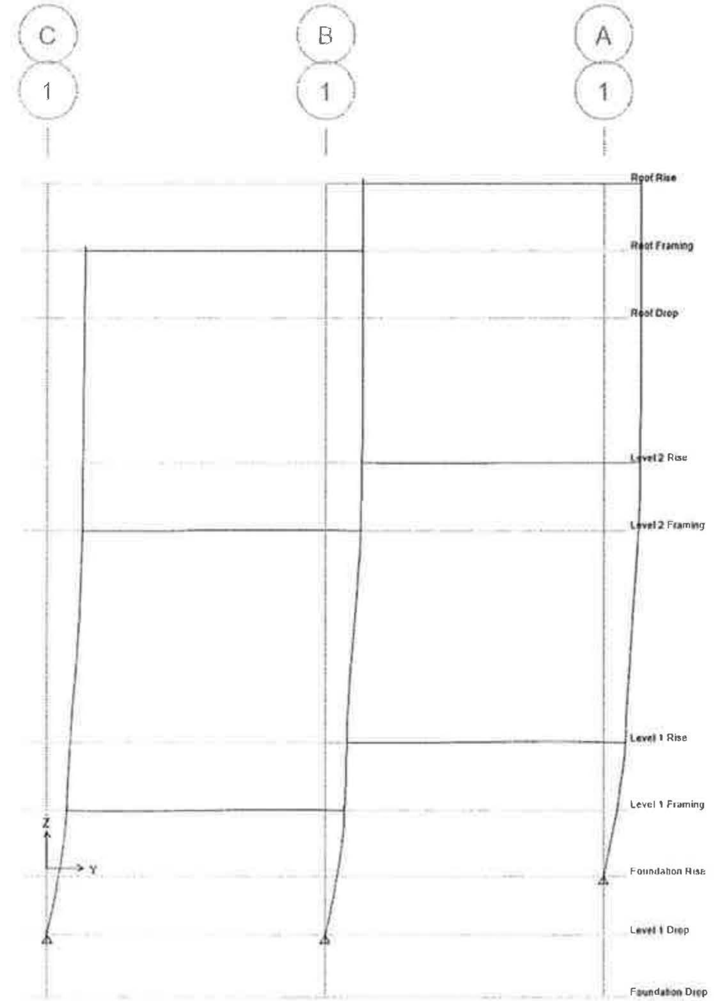
Shear:
Vmax =
0.476k



Moment:
Mmax = .953k-ftk

Elevation on Line 1

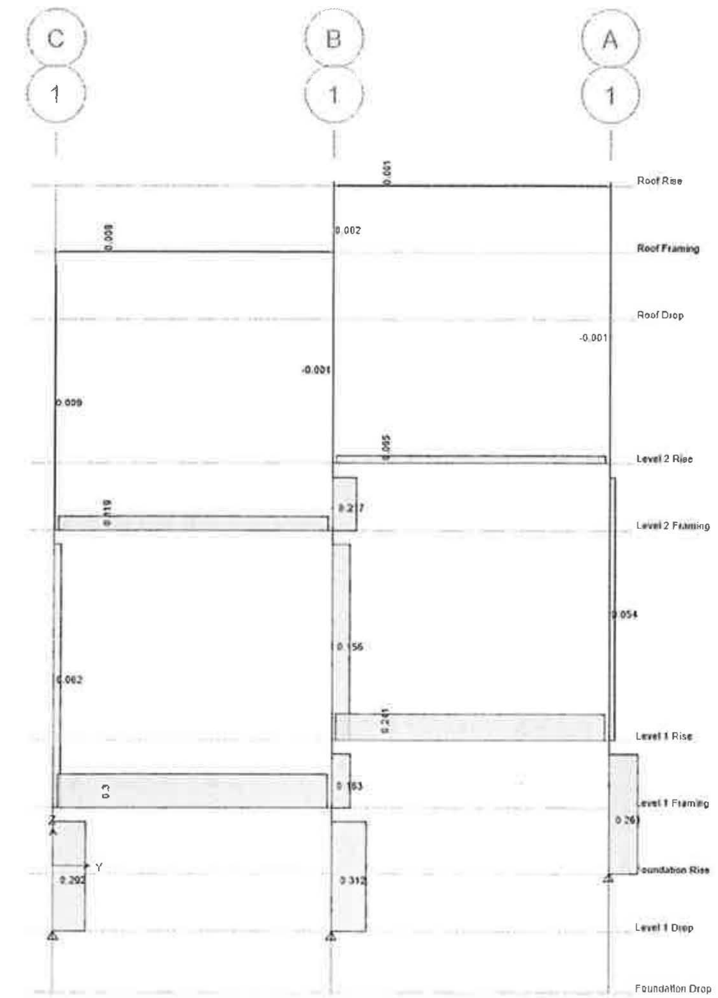
Elevation



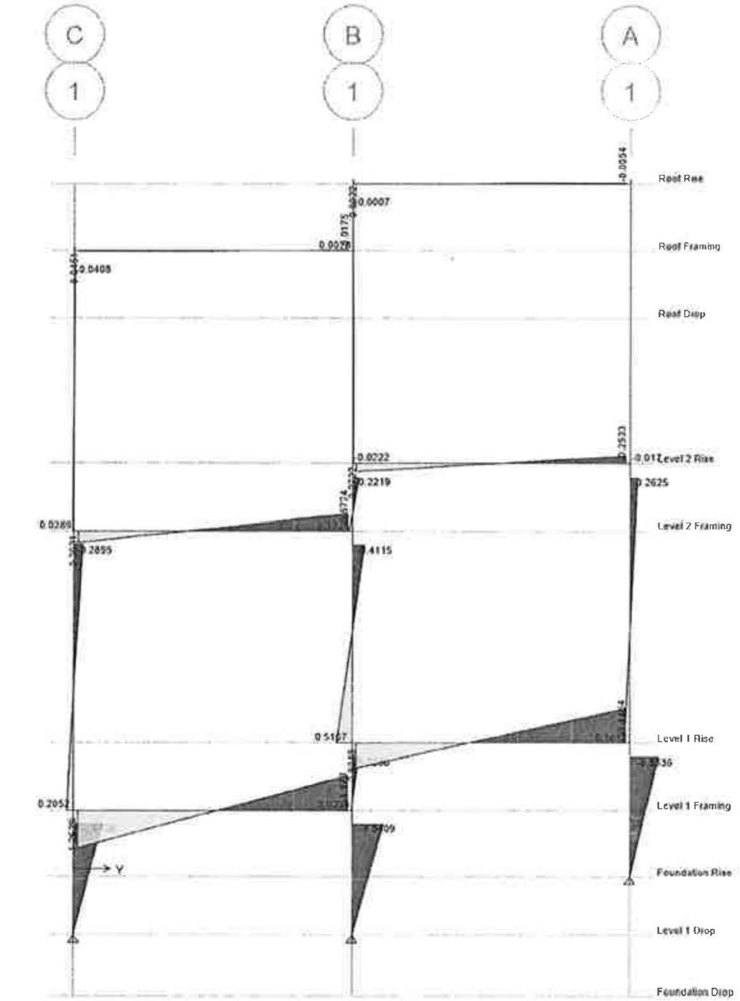
Deformed Shape

LEVEL	Displacement (inches)
Roof Rise	0.340
Roof Framing	0.340
Level 2 Rise	0.331
Level 2 Framing	0.316
Level 1 Rise	0.195
Level 1 Framing	0.176
Level 1 Drop	0.000

ETABS Comparison - Lateral 1



Shear



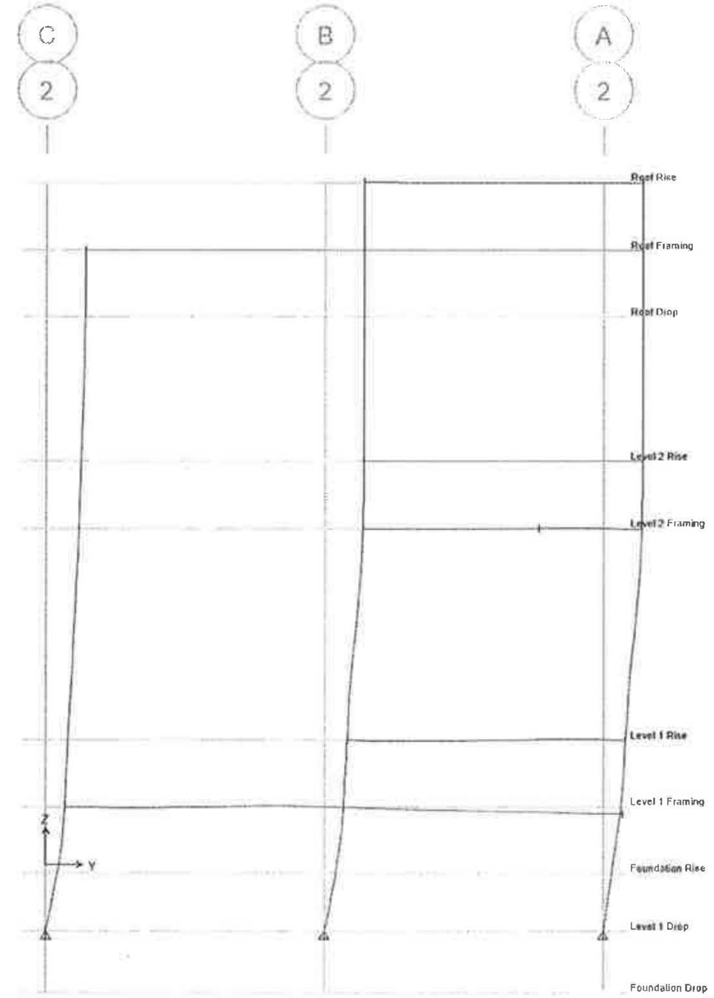
Moment

	MAX (+)	MIN (-)
Shear	0.87 kips	
Moment	1.18 k-ft	1.25 k-ft

ETABS Comparison - Lateral 2

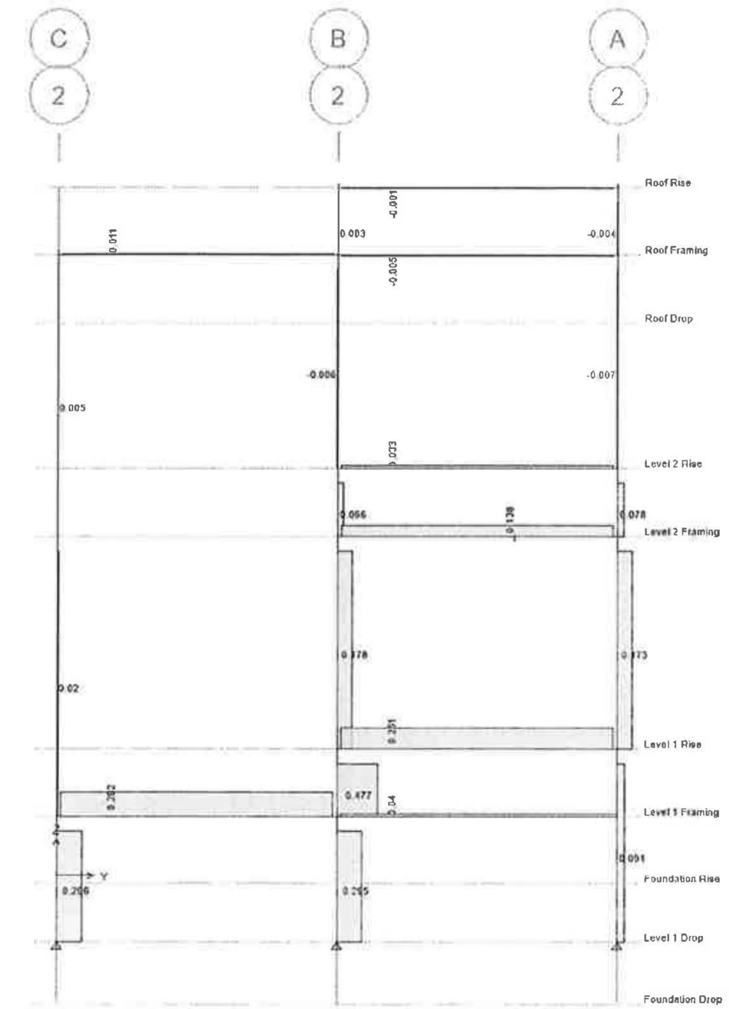
Elevation of Line 2

Elevation

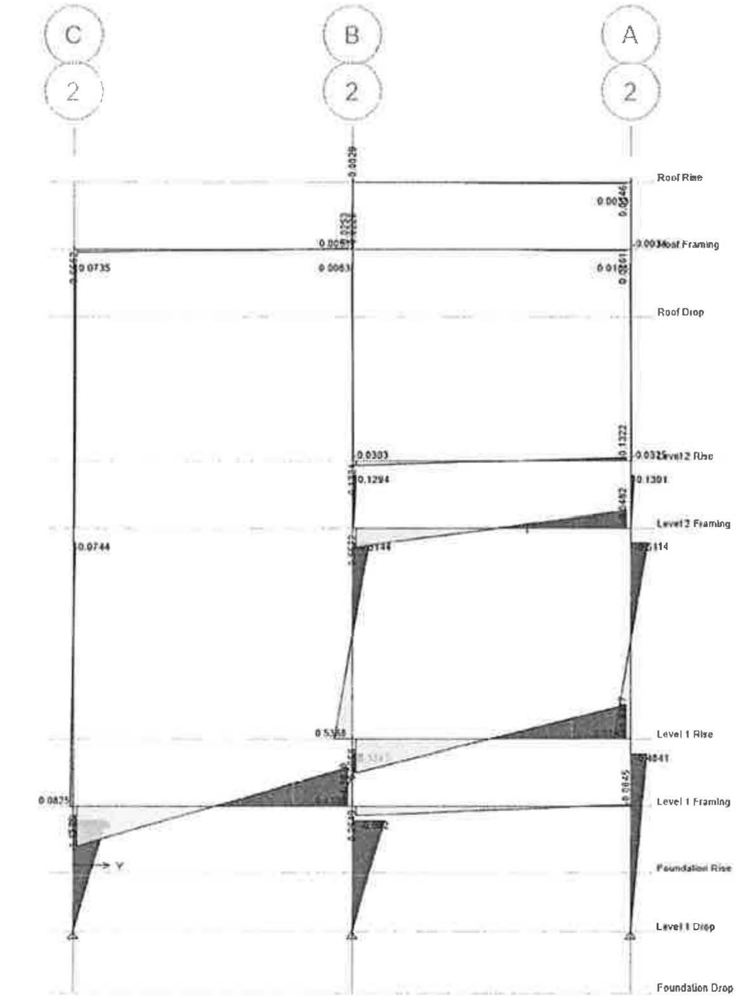


Deformed Shape

LEVEL	Displacement (inches)
Roof Rise	0.340
Roof Framing	0.340
Level 2 Rise	0.331
Level 2 Framing	0.316
Level 1 Rise	0.195
Level 1 Framing	0.176
Level 1 Drop	0.000



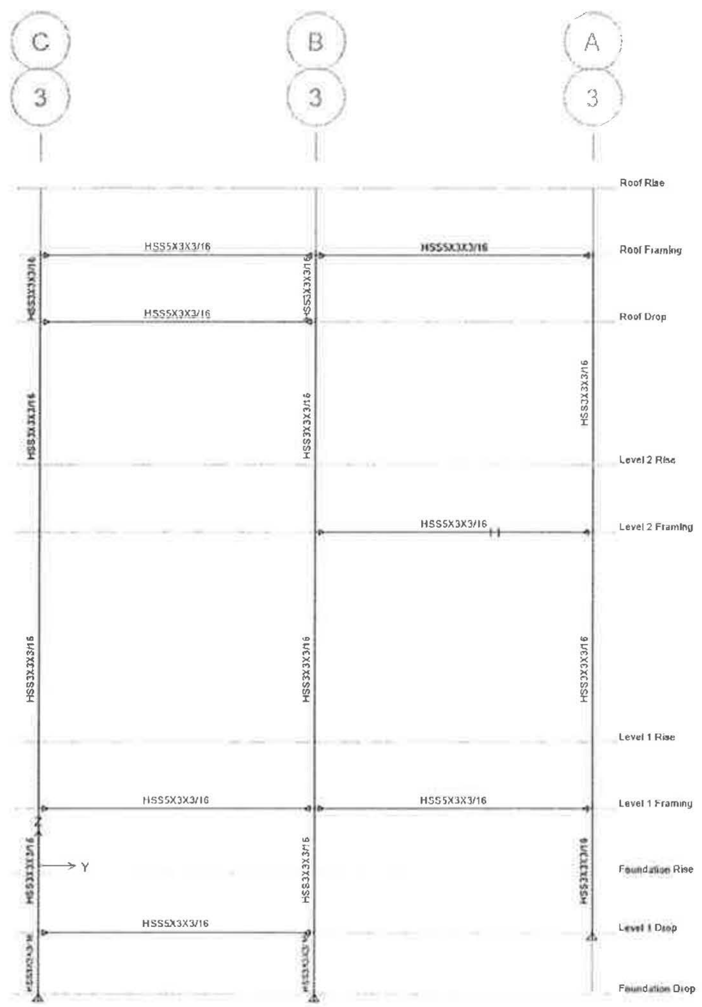
Shear



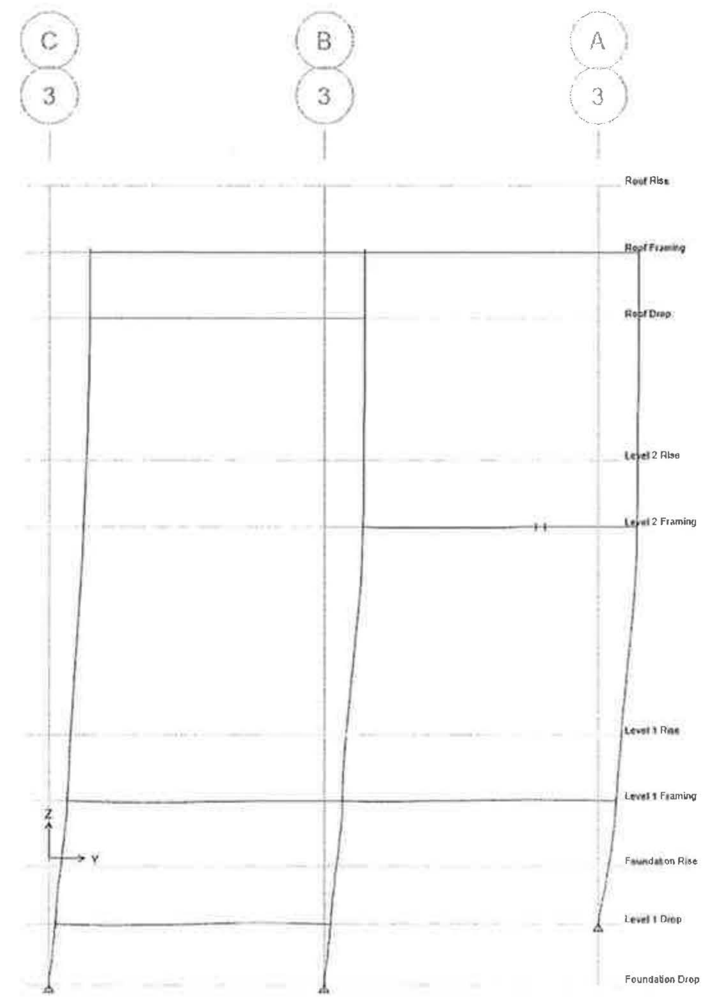
Moment

	MAX (+)	MIN (-)
Shear	0.68 kips	
Moment	1.18 k-ft	1.18 k-ft

Elevation of Line 3

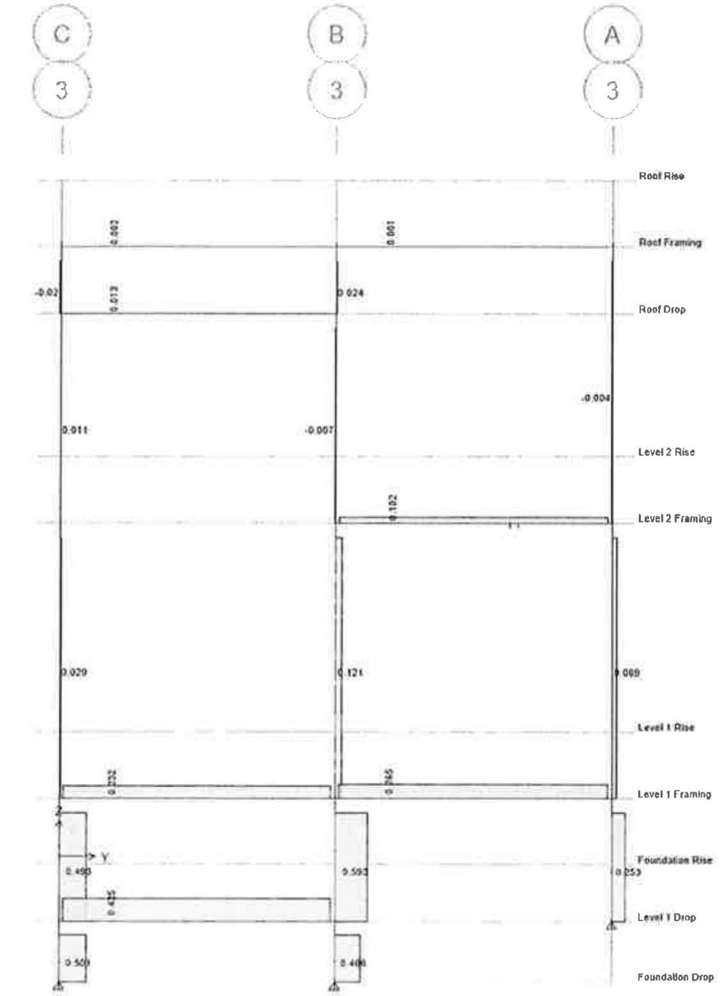


Elevation

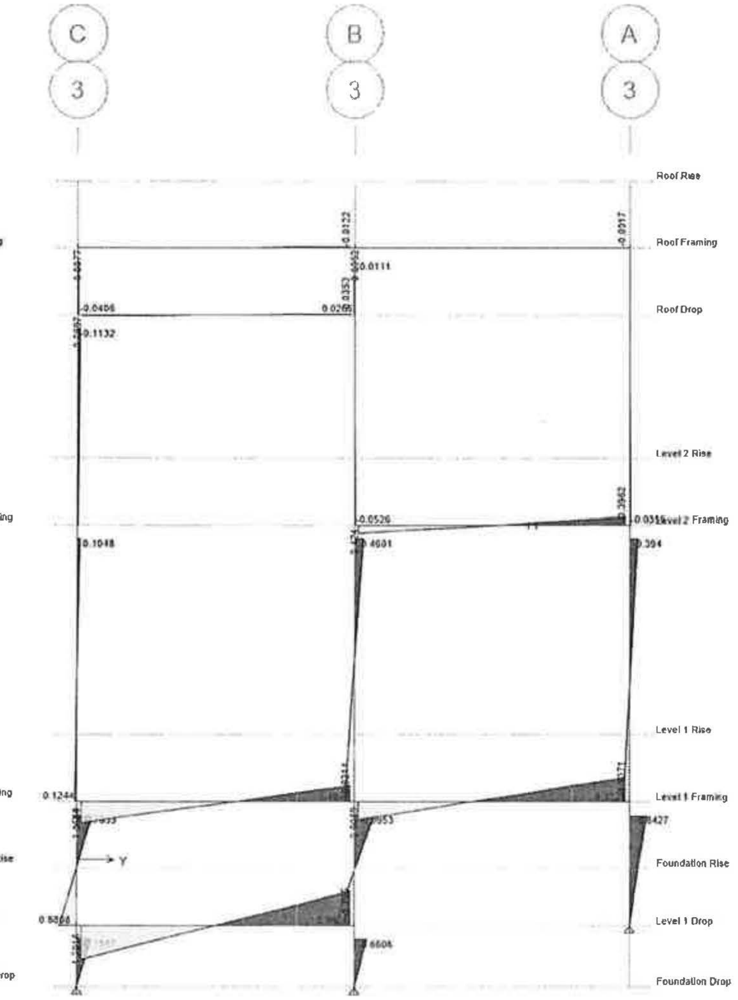


Deformed Shape

LEVEL	Displacement (inches)
Roof Rise	---
Roof Framing	0.367
Level 2 Rise	---
Level 2 Framing	0.355
Level 1 Rise	---
Level 1 Framing	0.168
Level 1 Drop	0.057



Shear

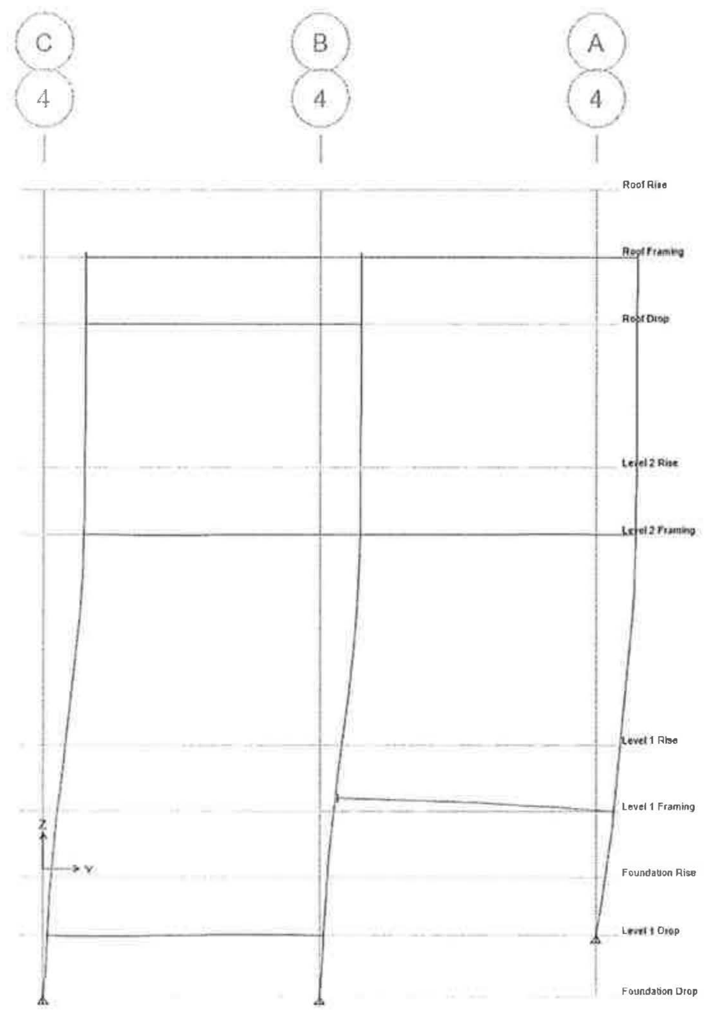


Moment

	MAX (+)	MIN (-)
Shear	1.22 kips	
Moment	1.70 k-ft	1.74 k-ft

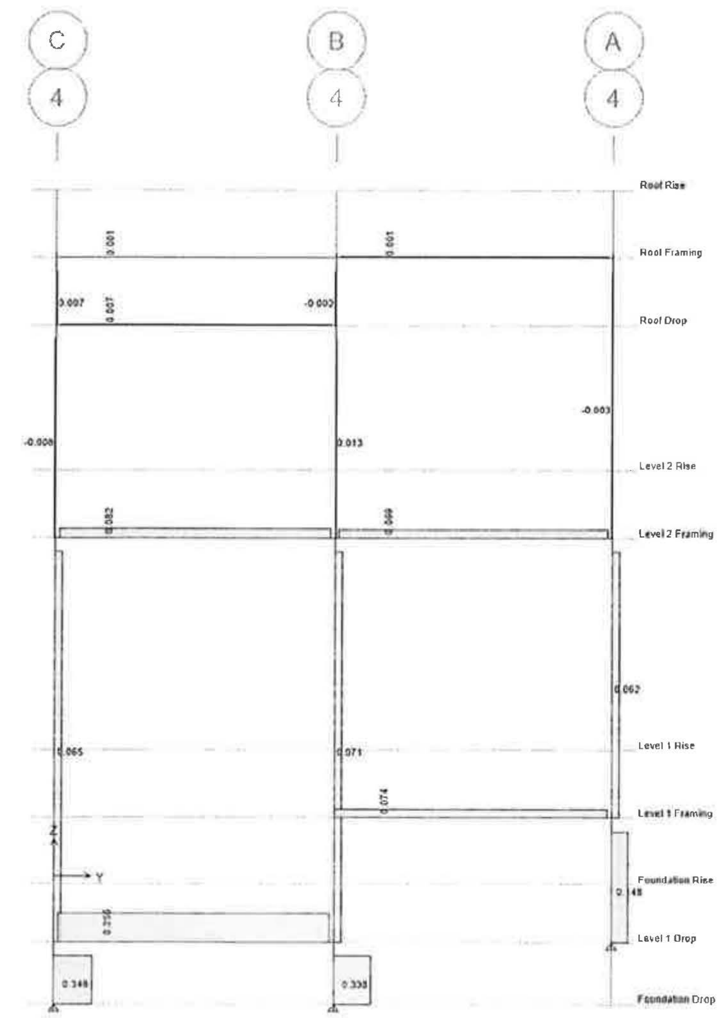
Elevation of Line 4

Elevation

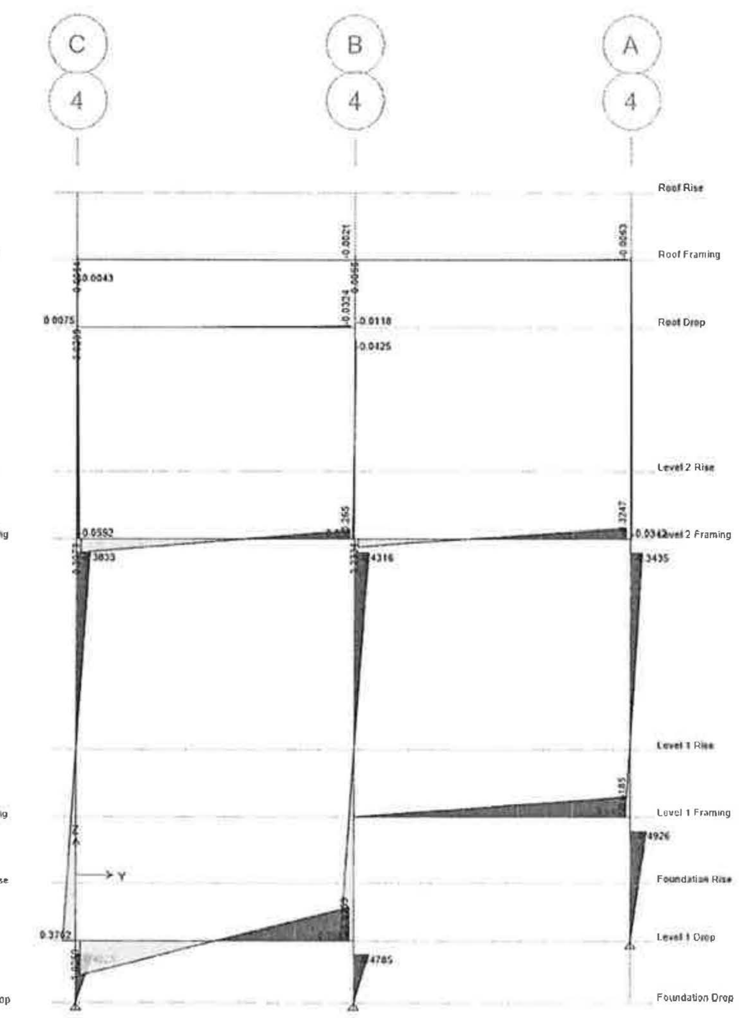


Deformed Shape

LEVEL	Displacement (inches)
Roof Rise	---
Roof Framing	0.378
Level 2 Rise	---
Level 2 Framing	0.364
Level 1 Rise	---
Level 1 Framing	0.163
Level 1 Drop	0.037



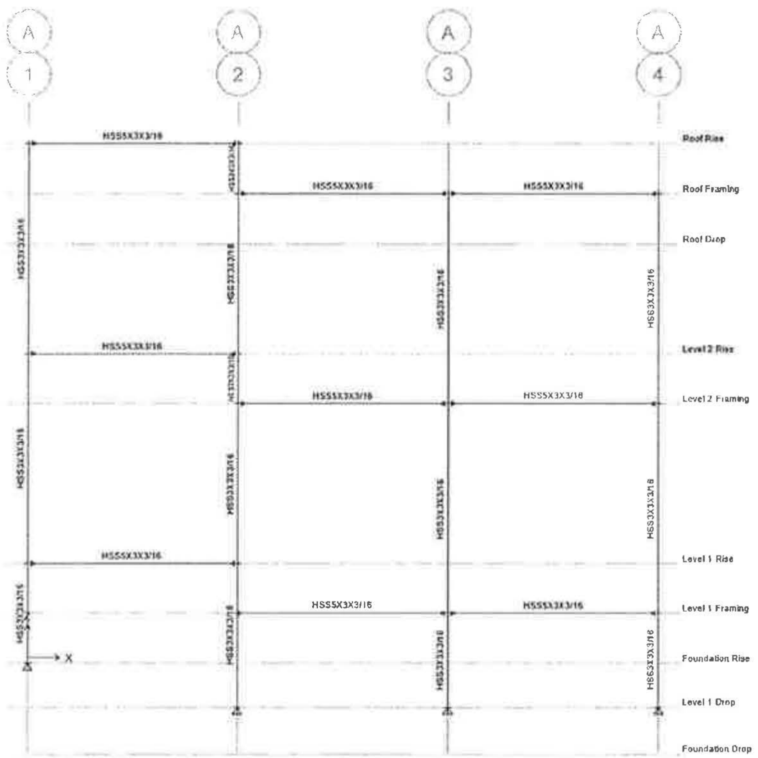
Shear



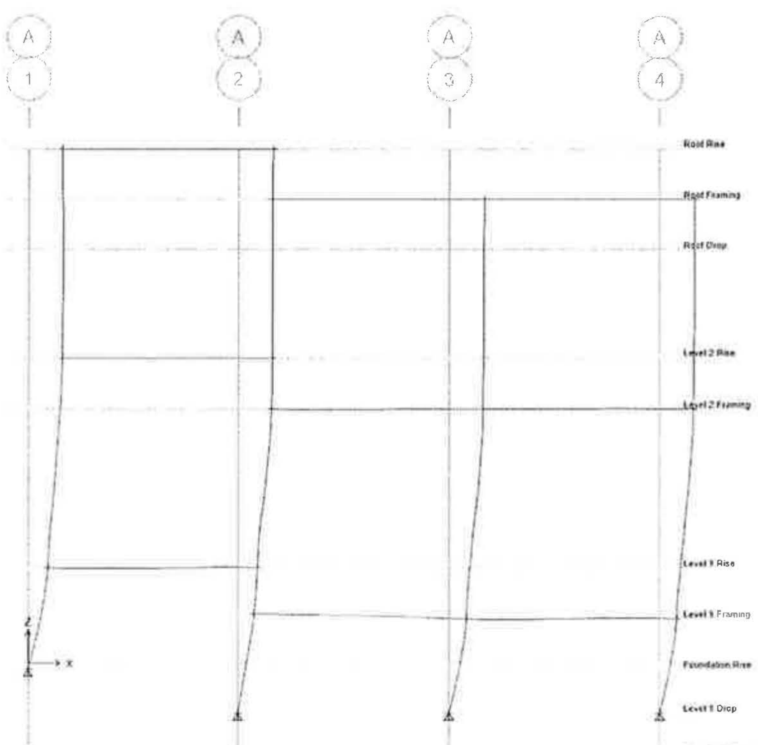
Moment

	MAX (+)	MIN (-)
Shear	0.83 kips	
Moment	1.03 k-ft	1.04 k-ft

Elevation of Line A

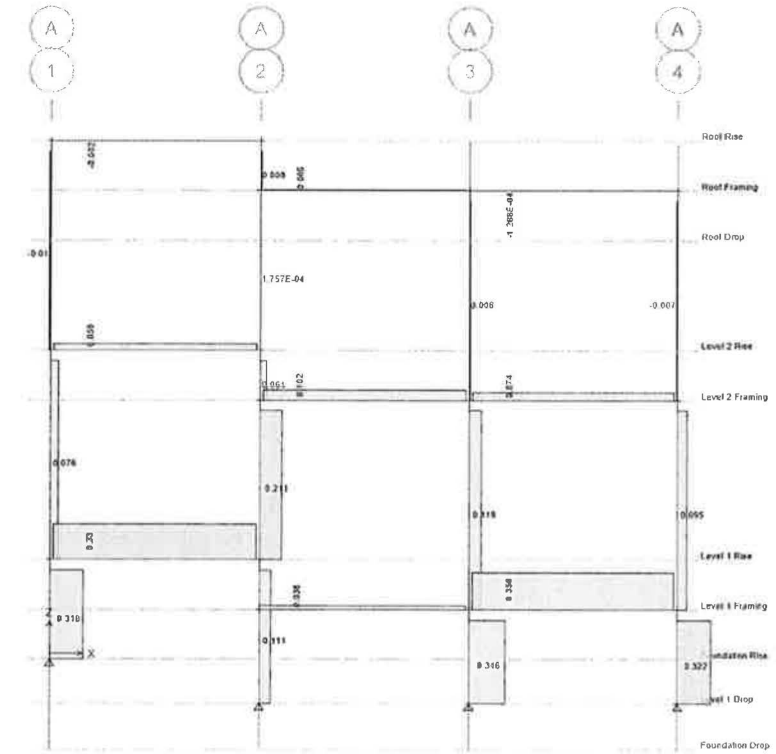


Elevation

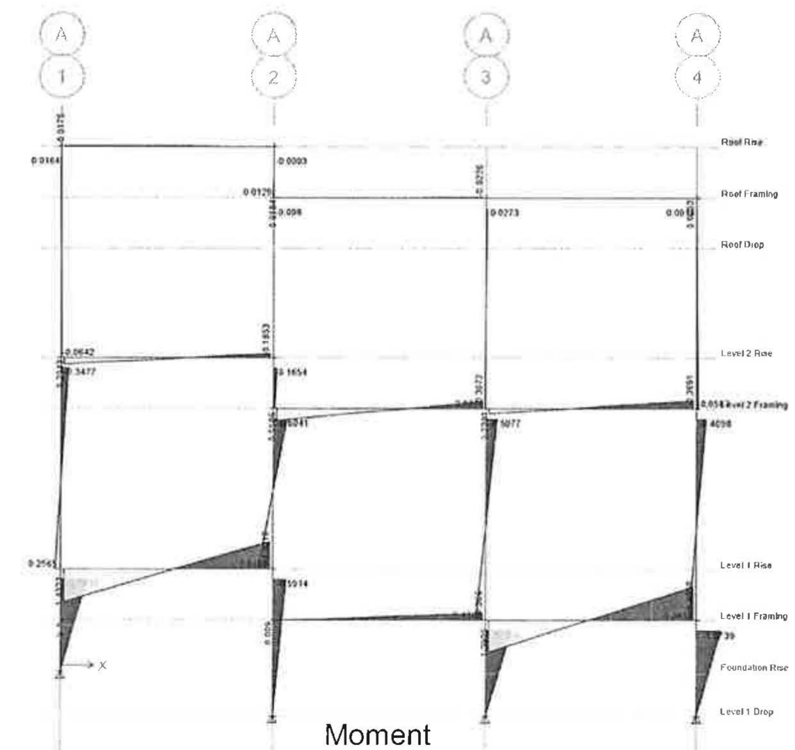


Deformed Shape

LEVEL	Displacement (inches)
Roof Rise	0.412
Roof Framing	0.411
Level 2 Rise	0.408
Level 2 Framing	0.399
Level 1 Rise	0.232
Level 1 Framing	0.199
Level 1 Drop	0



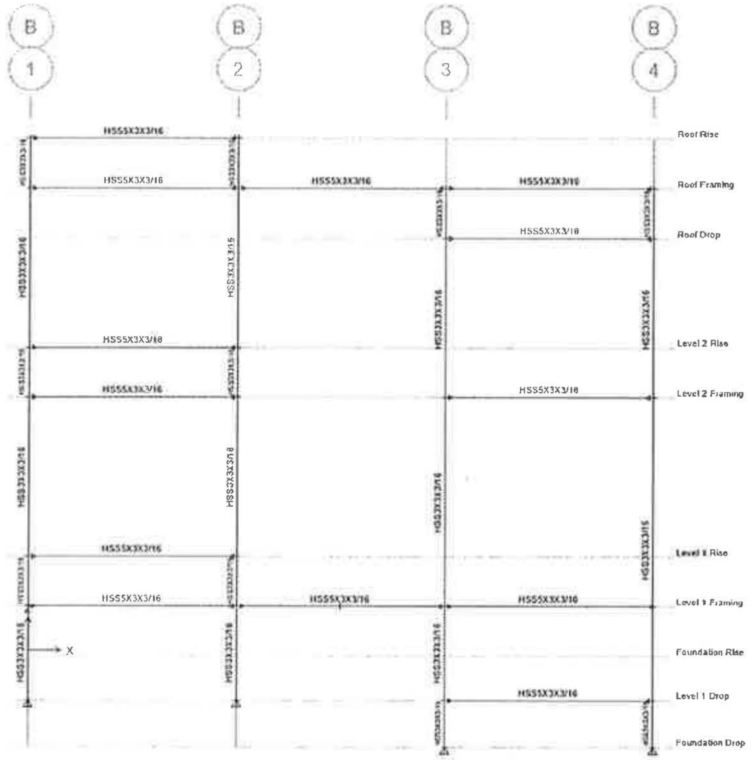
Shear



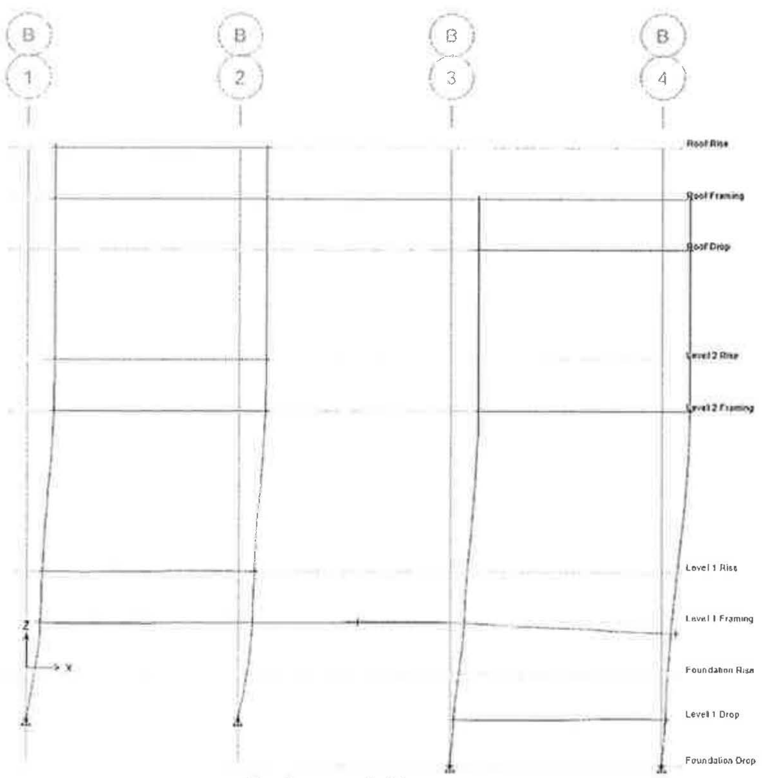
Moment

	MAX (+)	MIN (-)
Shear	1.10 kips	
Moment	1.43 k-ft	-1.49 k-ft

Elevation on Line B

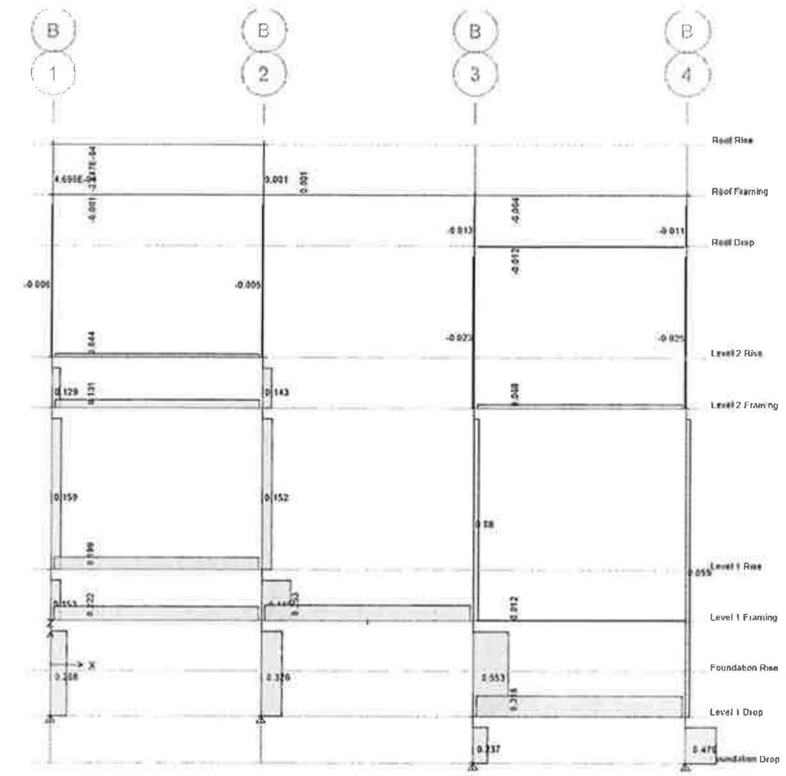


Elevation

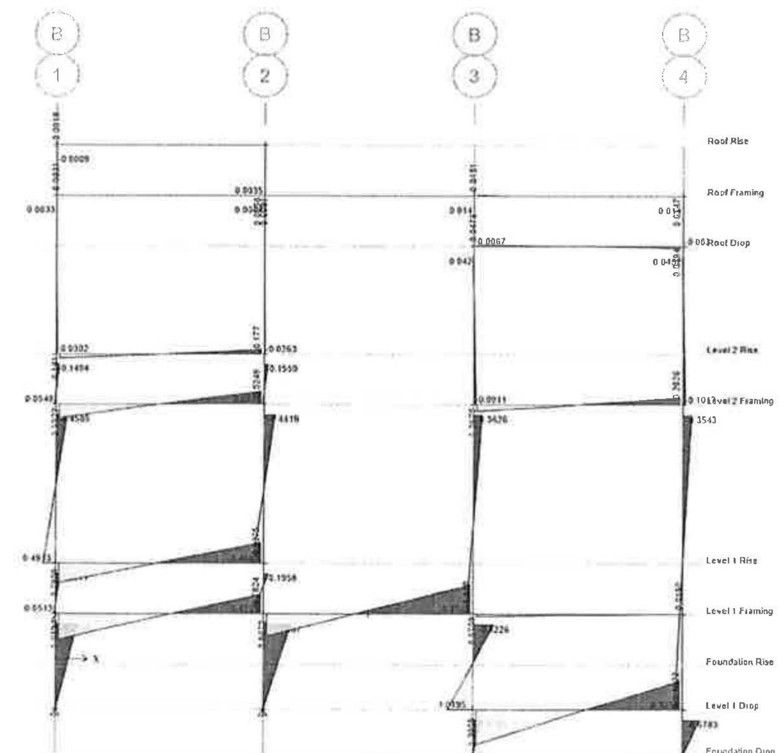


Deformed Shape

LEVEL	Displacement (inches)
Roof Rise	0.324
Roof Framing	0.324
Level 2 Rise	0.320
Level 2 Framing	0.310
Level 1 Rise	0.185
Level 1 Framing	0.162
Level 1 Drop	0.042



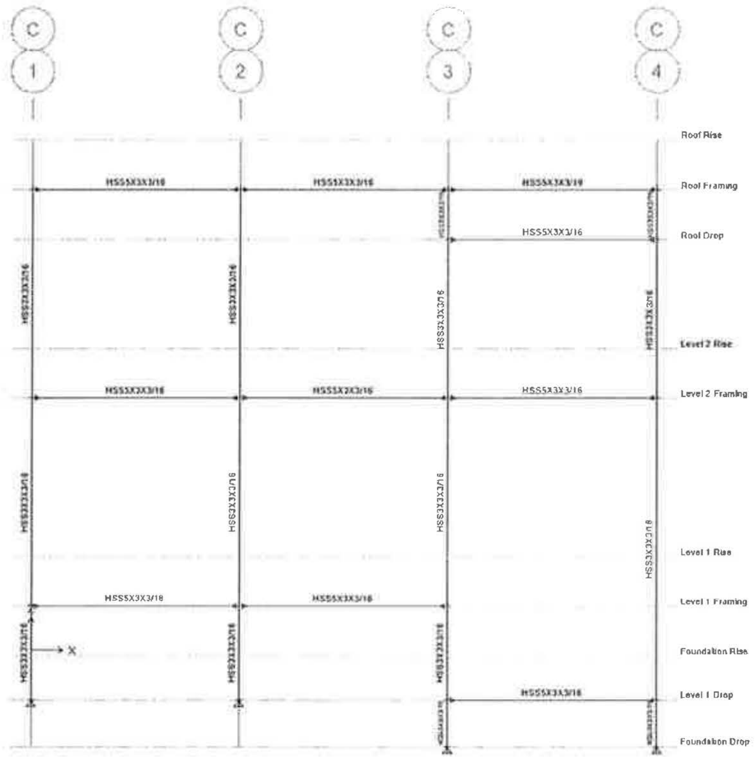
Shear



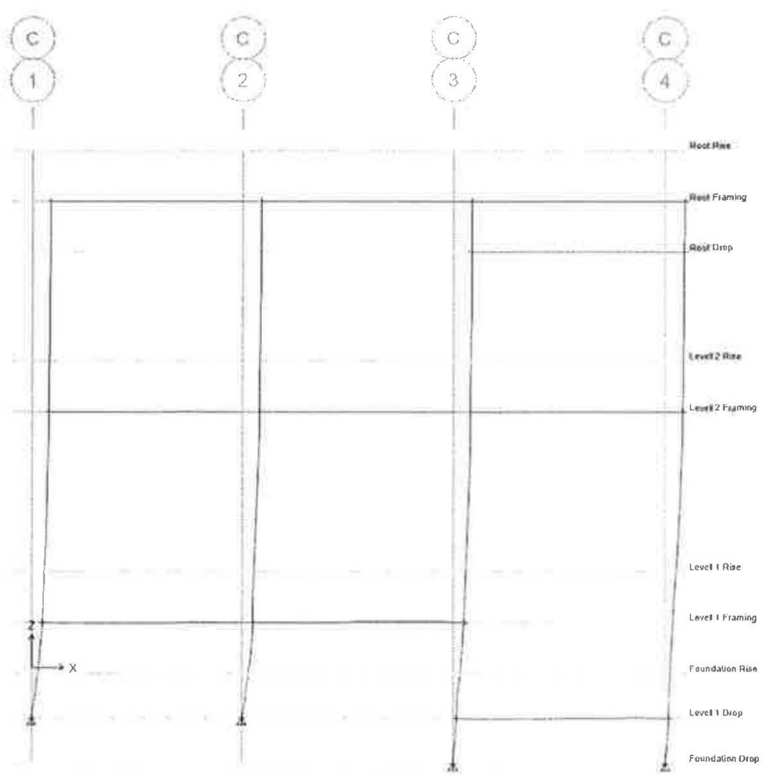
Moment

	MAX (+)	MIN (-)
Shear	1.10 kips	
Moment	1.40 k-ft	1.18 k-ft

Elevation on Line C

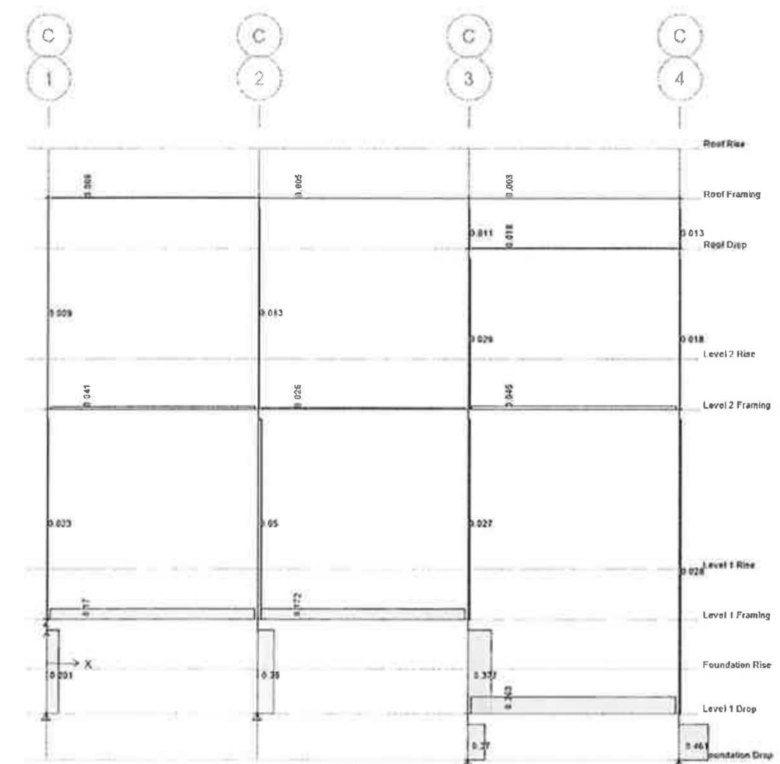


Elevation

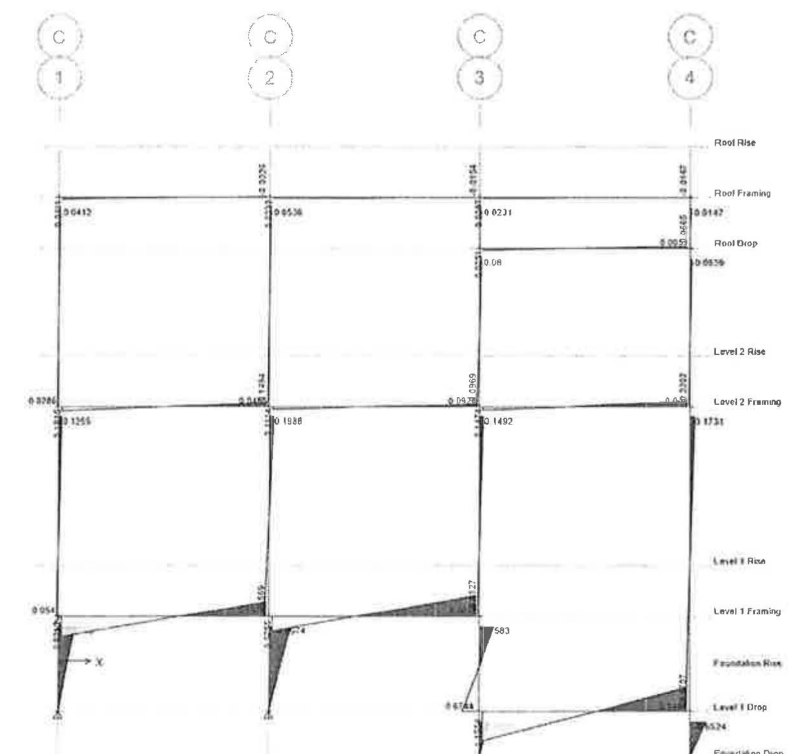


Deformed Shape

LEVEL	Displacement (inches)
Roof Rise	---
Roof Framing	0.226
Level 2 Rise	---
Level 2 Framing	0.204
Level 1 Rise	---
Level 1 Framing	0.125
Level 1 Drop	0.039



Shear



Moment

	MAX (+)	MIN (-)
Shear	1.19 kips	
Moment	1.16 k-ft	0.97 k-ft

Detail 2 : S.3.10

References	System: Panel Connections (capacities)	Comments

HSS → C 3x5x2" : A36

$l_w = 10"$

min weld = 1/8" E60 electrode → 60 ksi

Shear strength weld metal

(J 2-3) $\phi R_n = 0.75(0.6)(60\,ksi)(.707)(1/8")(10") =$ 24 kips ← GOV

Base metal:

$\phi R_n = 0.9(0.6)(36\,ksi)(3/16")(10") =$ 38.5 kips

C 3x5x2" → L 2½ x 1½ x 3/16 :

½" ⌀ Bolt A 325

Bolt shear = $R_n = F_n A_b$

(J 3-1) $\phi R_n = (0.75)(54\,ksi)(.196\,in^2) =$ 8 kips

Bearing on plate = $\phi R_n = \phi[1.2\, l_c t F_u \le 2.4\, d t F_u]$

tearout = $0.75[1.2(.75")(3/16")(58\,ksi)] =$ 7.3 kips

bearing = $0.75[2.4)(1/2")(3/16)(58\,ksi)] =$ 9.8 kips

Shear yielding: $R_n = 0.60 F_y A_{gv}$

(J 4-3) $\phi R_n = (1.0)(0.60)(36\,ksi)(1\tfrac{1}{2} \times 3/16") =$ 6 kips

(J 4-4) Shear rupture: $R_n = 0.60\, F_u A_{nv}$

$\phi R_n = (0.75)(0.60)(58\,ksi)(1.5 - .5)(3/16") =$ 4.5 kips ← GOV

(J 4-1) Tensile yielding: $R_n = F_y A_g$

$\phi R_n = (0.9)(36\,ksi)(2" \times 3/16") =$ 12.2 kips

(J 4-2) Tensile rupture: $R_n = F_u A_e$

$A_e \Rightarrow A_n = (2 - .5")(3/16) = 0.28\,in^2$

$0.85(A_g) = 0.85(2 \times 3/16) = 0.32\,in^2$

$\phi R_n = (0.75)(58\,ksi)(0.32\,in^2) =$ 13.4 kips

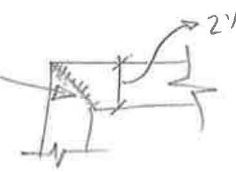
References	System: Panel Connections (capacities)	Comments

Block Shear :

(J 4-5) $(0.75)[0.6(58\,ksi)(1\tfrac{1}{2} - .5)(3/16") + (58\,ksi)(2 - .5)(3/16)] =$ 17 kips

$0.75[0.6(36\,ksi)(1\tfrac{1}{2}")(3/16") + (58\,ksi)(2" - .5")(3/16")] =$ 17 kips

Angle Corner Weld



(J 2-3) $l_w = 3.5" \times 2 = 7"$

min weld = 1/8"

weld metal:

$\phi R_n = 0.75(0.6)(60\,ksi)(.707)(1/8")(7") =$ 16.7 kips ← GOV

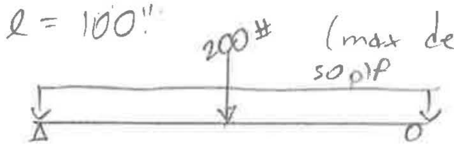
Base metal : ∠

$\phi R_n = 0.9(0.6)(36\,ksi)(3/16")(7") =$ 25.5 kips

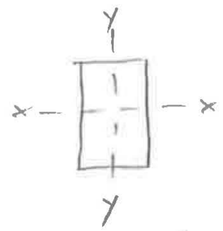
References	System: Guard Rail Deflection	Comments

HSS $3 \times 2 \times \frac{3}{16}$

$l = 100''$ (max deflection in center)



max $l = 20''$



$\Delta_{max} = \dfrac{Pl^3}{48EI}$ or $\Delta_{max} = \dfrac{5wl^4}{384EI}$

$I_x = 1.77 in^4$
$I_y = 0.932 in^4$

beam braced @ 6 supports along length conservatively use $l = 24''$

x-x:

$\Delta_{max_p} = \dfrac{(200\#)(24'')^3}{48(29{,}000{,}000 psi)(1.77^4)} = \underline{0.0011''}$

$\Delta_{max_w} = \dfrac{(50plf)(5)(24'')^4(12)}{384(29\times10^6 psi)(1.77 in^4)} = \underline{0.05''}$

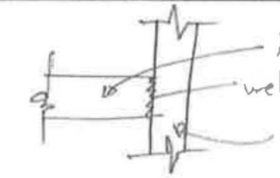
Y-Y

$\Delta_{max_p} = 0.0011'' \times \dfrac{1.77''}{0.932''} = \underline{0.0021''}$

$\Delta_{max_w} = 0.05'' \times \dfrac{1.77''}{0.932''} = \underline{0.096''}$

Detail 4: S.3.10

References	System: Guardrail Connections	Comments



A36 E60 → 60ksi

$l_w = 10''$
min weld $= \frac{1}{8}''$

Weld metal shear strength:

$\phi R_n = 0.75(0.6)(60ksi)(.707)(\frac{1}{8}'')(10'') = \underline{24 \text{ kips}}$

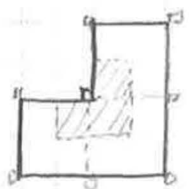
Base metal:

$\phi R_n = 0.9(0.6)(36ksi)(\frac{3}{16}'')(10'') = \underline{37.5 \text{ kips}}$

References	System: FRAME ANALYSIS	Comments

AXIAL ON COLUMN CONT.

1ST FLOOR



T.A: 3(4x4) = 48 sf

$P_D = 1.25^k$
$P_L = 4.8^k$

$\Sigma P_D = 2.15^k$
$\Sigma P_L = 8.25^k$

FROM RISA MAXIMUM AXIAL = 1^k
→ LOAD COMBOS
$1.2D + 1.6L = 1.2(2.15^k) + 1.6(8.25^k) = \underline{15.78^k}$

$0.9D + 1.0E = 0.9(2.15^k) + 1.0(1^k) = 2.93^k$
$1.2D + 1.0E + 0.5L = 0.9(2.15) + 1.0^k + 0.5(8.25) = 7.06^k$

$15.78^k < 86.4^k$ ✓ (BASE)
$< 63.3^k$ ✓ (COL)

FROM RISA (LATERAL)
MAX SHEAR = $1.5^k < 23^k$ (COLUMN) ✓
MAX MOMENT = 26 k-ft

BEAM LOADING (DEAD + LIVE WORSE CASE)
→ 1ST FLOOR LINE B

w_D = 26.1 psf (8') = .21 klf
w_L = 100 psf (8') = .8 KLF

$M = \dfrac{w\ell^2}{12}$ w/ $\ell = 8'$ ∴ M_D = 1.12 k-ft
M_L = 4.3 k-ft

$V = \dfrac{w\ell}{2}$ w/ $\ell = 8'$ V_D = .84 K
V_L = 3.2 K

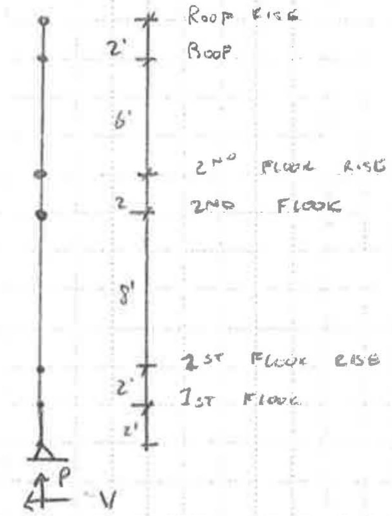
LOAD COMBOS (BEAMS)

SHEAR → 1.2D + 1.6L, EARTHQUAKE MINIMAL, $V = 6.13^k$

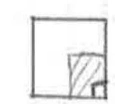
$6.13^k < 19.5^k$ (BEAM) ✓
$< 81^k$ (CONNECT) ✓

References	System: FRAME ANALYSIS	Comments

AXIAL ON COLUMNS
LARGEST BEARING @ B-2



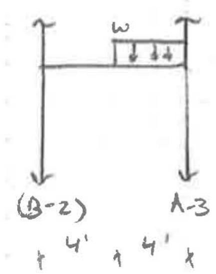
AXIAL FROM
• 2ND RISE



T.A = 4'x4' = 16 sf
DEAD = 26.1 psf
LIVE = 100 psf

$P_D = .417^k$
$P_L = 1.6^k$

• 2ND FLOOR



w_D = 26.1 psf (4') = 104.4 plf
w_L = 100 psf (4') = 400 plf

$V_{B-2} = \dfrac{Pb^2}{\ell^3}(3a+b)$, a = 6'
b = 2'
P = w(4')

$V_D = P_D = .0653^k$
$V_L = P_L = .25^k$

1ST FLOOR RISE
SAME AS 2ND FLOOR RISE

$P_D = .417^k$
$P_L = 1.6^k$

References	System: FRAME ANALYSIS	Comments

MOMENT COMBOS

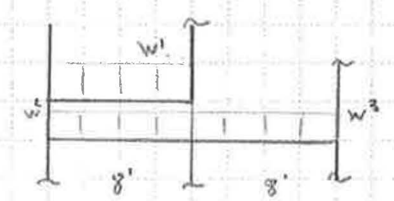
$1.2D + 1.6L = 1.2(1.12) + 1.6(4.3) = \underline{8.33^{k \cdot ft}}$

$1.2D + 1.0E + 0.5L = 1.2(1.12) + 1.0(2.6) + 0.5(4.3) = 6.09^{k}$

$0.9D + E = 0.9(1.12) + 2.6 = 3.61^{k \cdot ft}$

$8.33^{k \cdot ft} < 16.24^{k \cdot ft}$ (BEAM)
$< 11.1\ k \cdot ft$ (MOM CONNECT)

POINTS OF INTEREST
→ ELEVATION OF LINE B



$W_1 = $ psf (4')
$W_2 = $ psf (4')
$W_3 = $ psf (8')

$W_1 \rightarrow W_{D1} = 26.1\,psf\,(4) = 104.4\ plf$
$W_{L1} = 100\,psf\,(4) = 400\ plf$

$W_2 \rightarrow W_{D2} = 104.4\ plf$
$W_{L2} = 400\ plf$

$W_3 \rightarrow W_{D3} = 26.1\,psf\,(8') = 208.8\ plf$
$W_{L3} = 200\,psf\,(8') = $ [illegible] plf

$M_{@END} = \frac{wl^2}{12}$

END MOMENTS

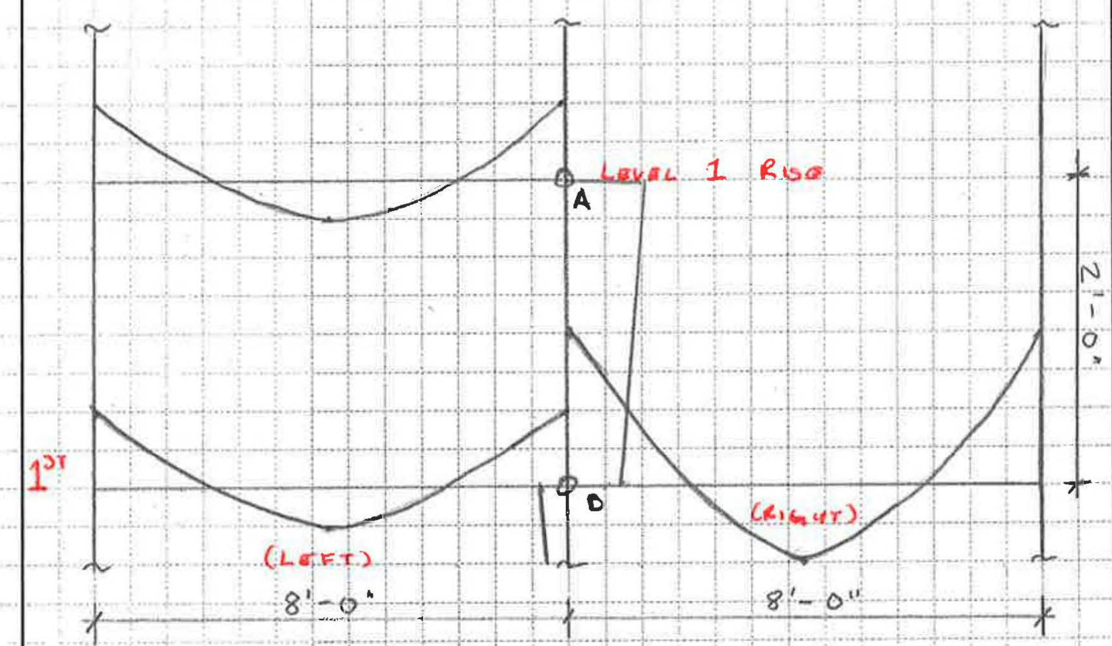
FIRST FLOOR RISE: DEAD $= .56^{k \cdot ft}$
LIVE $= 2.13^{k \cdot ft}$

FIRST FLOOR (LEFT): DEAD $= .56\ k \cdot ft$
LIVE $= 2.13^{k \cdot ft}$

FIRST FLOOR (RIGHT): DEAD $= 1.11^{k \cdot ft}$
LIVE $= 4.27^{k \cdot ft}$

References	System: FRAME ANALYSIS	Comments

MOMENT DIAGRAMS



AXIAL AT POINT A (DEAD)

$P = V_{BEAM} = \frac{wl}{2} = \frac{104.4\,plf\,(8)}{2} = .42^{k}$

INFLECTION → $\frac{M_{COMB}}{P} = \frac{2.23^{k \cdot ft}}{.42^{k}} = 5.31\ ft$ $\qquad 5.31^{ft} - 2^{ft} = 3.31^{ft}$

$3.31^{ft} / 5.31^{ft} = .6233$

@ 2' (LEVEL 1 RISE DEAD) $= .56(.6233) = .3491^{k \cdot ft}$

$\therefore \Sigma M_{@B} = M_{RIGHT} - M_{LEFT} - L1R - M_{BOT}$

$M_{BOT} = M_R - M_L - L1R$

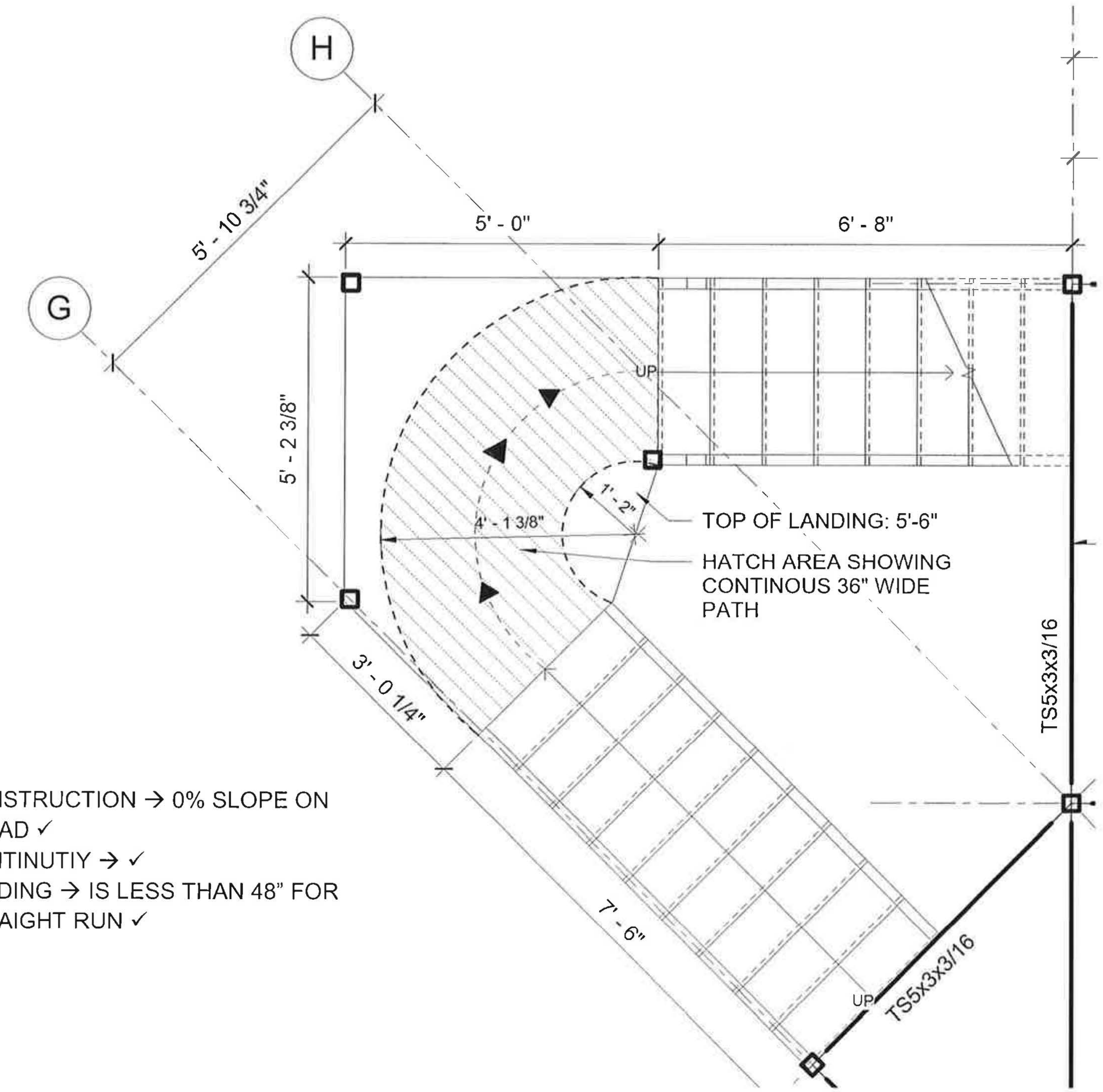
DEAD $\quad 1.11 - .56 - .35 = .19^{k \cdot ft}$
LIVE $\quad 4.27 - 2.13 - 2.13(.6233) = .81^{k \cdot ft}$

COMBOS @ B
$1.2D + 1.6L = 1.52^{k \cdot ft}$ $\qquad 1.2D + 1.0E + 0.5L = 3.23^{k \cdot ft} < 7.69^{k \cdot ft}$ ✓
$0.9D + 1.0E = 2.77^{k \cdot ft}$

References	System: Phase 2 Stairs Code Compliancy	Comments
1011.7	Construction → Stair shall not be more than a 2% → Water shall not accumulate on landing	
1011.6	Vertical Rise → Flight shall not be less than the stairs between Floor/ Landing	
	Landings → Shall not be less than the stairs → Where stairway has a straight run the depth need not exceed 48 in	
1011.3	Headroom → Clearance not less than 80 in	
1011.5.2	Riser Height → max: 7 in, min: 4 in Tread Run → min: 11 in	
1014.3.2 1014.2	Handrails → Section 1014 → Height 34" to 38" → Graspibility: Type 2 → Continuity: Continuous (no exceptions)	
1015.2	Guards → Required	

MODULAR HOUSE SENIOR PROJECT
ARCE 453/460
CODE:
DATE: 04-25-2017
Building 21- 122E. Cal Poly
San Luis Obispo, California 93410
(IBC 2012)
BY: SD

References	System:	Comments



CONSTRUCTION → 0% SLOPE ON TREAD ✓
CONTINUTIY → ✓
LANDING → IS LESS THAN 48" FOR STRAIGHT RUN ✓

MODULAR HOUSE SENIOR PROJECT
ARCE 453/460

CODE:

DATE: 04-25-2017

Building 21- 122E. Cal Poly
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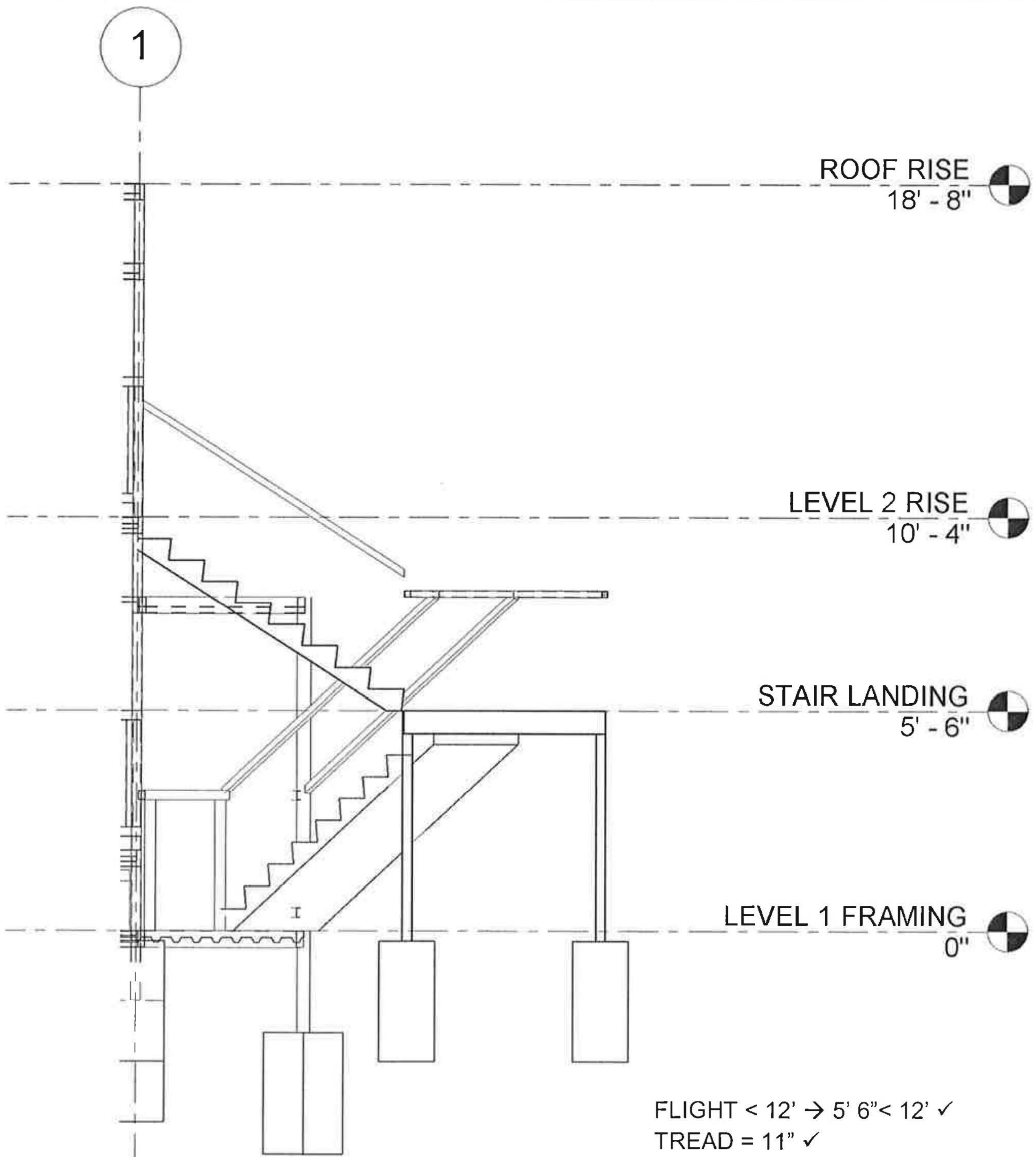
(IBC 2012)

BY: SD

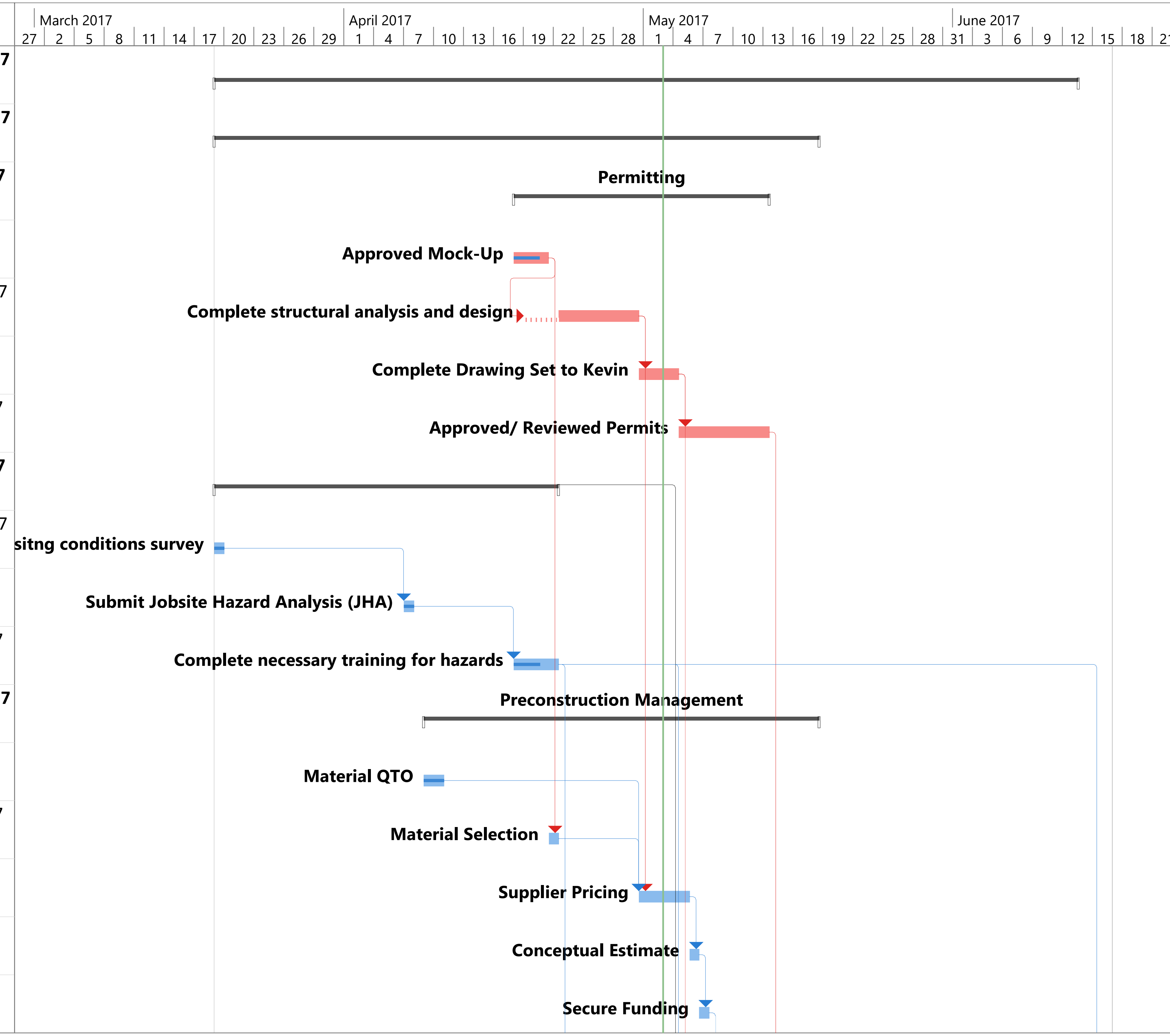
References	System:	Comments



FLIGHT < 12' → 5' 6"< 12' ✓
TREAD = 11" ✓
RISE = 6 ½" ✓

Phase 2 Stairs 3

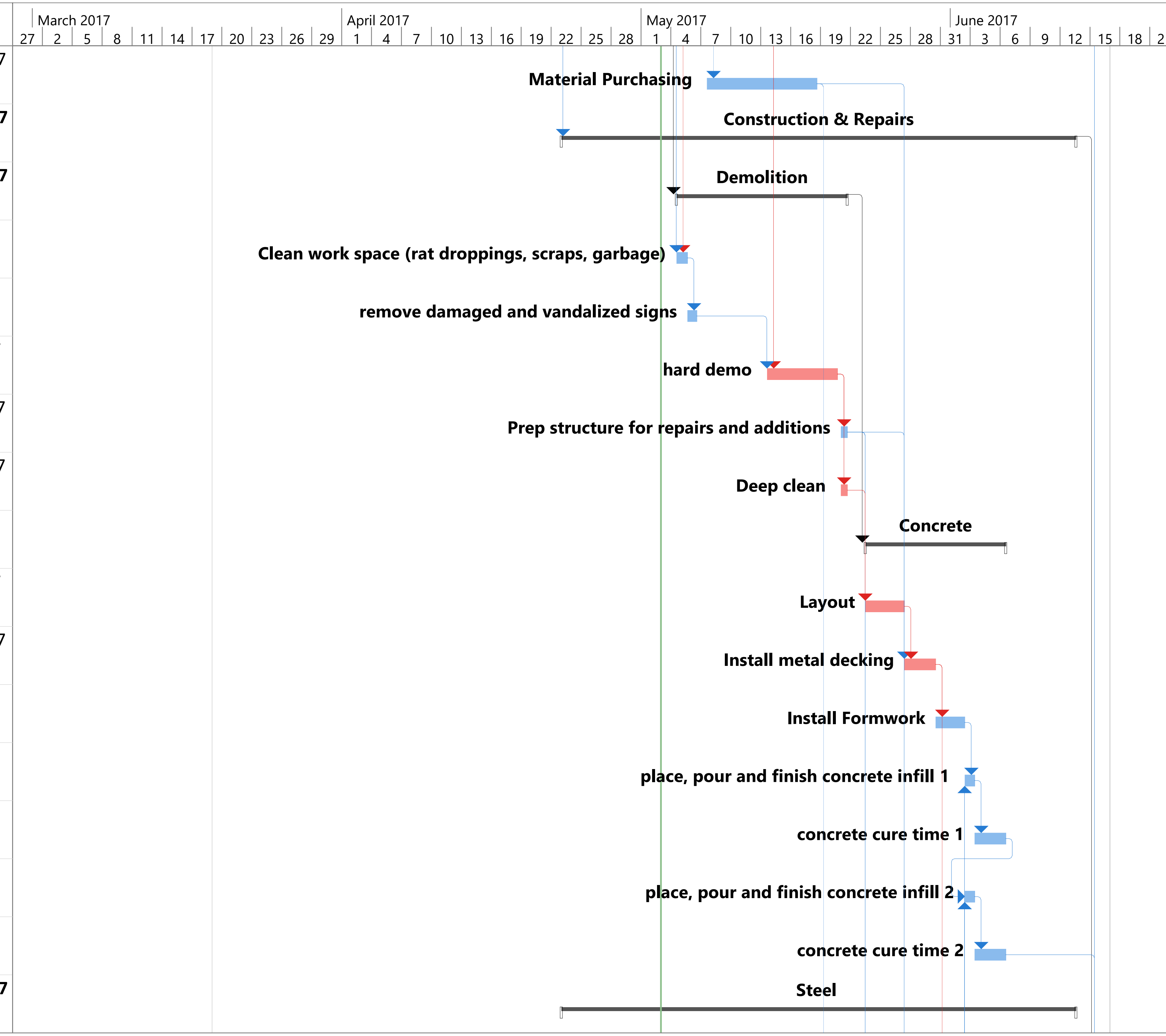
ID		Task Mode	Task Name	Duration	Start	Finish
1			**Modular House**	**47.88 days?**	**Sun 3/19/17**	**Tue 6/13/17**
2			**Preconstruction**	**32.88 days?**	**Sun 3/19/17**	**Thu 5/18/17**
3			**Permitting**	**14.38 days**	**Tue 4/18/17**	**Sat 5/13/17**
4			Approved Mock-Up	2 days	Tue 4/18/17	Fri 4/21/17
5			Complete structural analysis and design	5 days	Wed 4/19/17	Sun 4/30/17
6			Complete Drawing Set to Kevin	1 day	Sun 4/30/17	Thu 5/4/17
7			Approved/ Reviewed Permits	6 days	Thu 5/4/17	Sat 5/13/17
8			**Site Investigation**	**18.88 days**	**Sun 3/19/17**	**Sat 4/22/17**
9			Exisitng conditions survey	1 day	Sun 3/19/17	Sun 3/19/17
10			Submit Jobsite Hazard Analysis (JHA)	1 day	Fri 4/7/17	Fri 4/7/17
11			Complete necessary training for hazards	3 days	Tue 4/18/17	Sat 4/22/17
12			**Preconstruction Management**	**21.25 days?**	**Sun 4/9/17**	**Thu 5/18/17**
13			Material QTO	2 days	Sun 4/9/17	Mon 4/10/17
14			Material Selection	1 day?	Fri 4/21/17	Sat 4/22/17
15			Supplier Pricing	2 days	Sun 4/30/17	Fri 5/5/17
16			Conceptual Estimate	1 day	Fri 5/5/17	Sat 5/6/17
17			Secure Funding	1 day	Sat 5/6/17	Sun 5/7/17



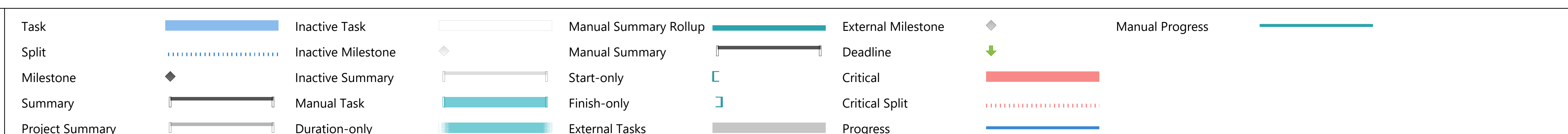
Project: Modular House Workin
Date: Wed 5/3/17

Task		Inactive Task		Manual Summary Rollup		External Milestone		Manual Progress	
Split		Inactive Milestone		Manual Summary		Deadline			
Milestone		Inactive Summary		Start-only		Critical			
Summary		Manual Task		Finish-only		Critical Split			
Project Summary		Duration-only		External Tasks		Progress			

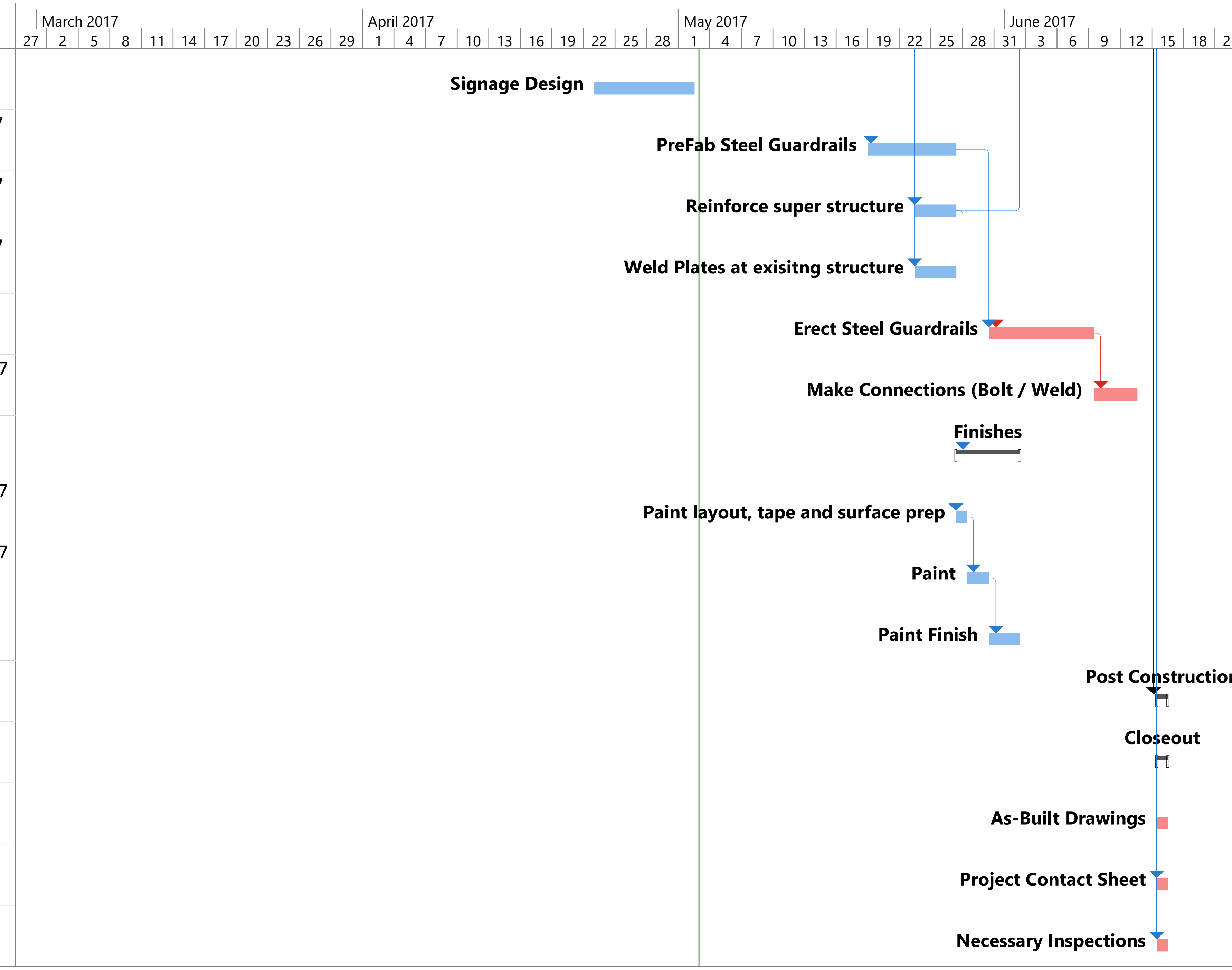
ID		Task Mode	Task Name	Duration	Start	Finish
18			Material Purchasing	5 days	Sun 5/7/17	Thu 5/18/17
19			**Construction & Repairs**	**28.5 days**	**Sun 4/23/17**	**Tue 6/13/17**
20			**Demolition**	**11 days**	**Thu 5/4/17**	**Sun 5/21/17**
21			Clean work space (rat droppings, scraps, garbage)	1 day	Thu 5/4/17	Fri 5/5/17
22			remove damaged and vandalized signs	1 day	Fri 5/5/17	Sat 5/6/17
23			hard demo	4 days	Sat 5/13/17	Sat 5/20/17
24			Prep structure for repairs and additions	1 day	Sun 5/21/17	Sun 5/21/17
25			Deep clean	1 day	Sun 5/21/17	Sun 5/21/17
26			**Concrete**	**8 days**	**Tue 5/23/17**	**Tue 6/6/17**
27			Layout	2 days	Tue 5/23/17	Sat 5/27/17
28			Install metal decking	2 days	Sat 5/27/17	Tue 5/30/17
29			Install Formwork	1 day	Tue 5/30/17	Fri 6/2/17
30			place, pour and finish concrete infill 1	1 day	Fri 6/2/17	Sat 6/3/17
31			concrete cure time 1	2 days	Sat 6/3/17	Tue 6/6/17
32			place, pour and finish concrete infill 2	1 day	Fri 6/2/17	Sat 6/3/17
33			concrete cure time 2	2 days	Sat 6/3/17	Tue 6/6/17
34			**Steel**	**28.5 days**	**Sun 4/23/17**	**Tue 6/13/17**



Project: Modular House Workin
Date: Wed 5/3/17



ID		Task Mode	Task Name	Duration	Start	Finish
35			Signage Design	5 days	Sun 4/23/17	Tue 5/2/17
36			PreFab Steel Guardrails	5 days	Fri 5/19/17	Sat 5/27/17
37			Reinforce super structure	2 days	Tue 5/23/17	Sat 5/27/17
38			Weld Plates at exisitng structure	2 days	Tue 5/23/17	Sat 5/27/17
39			Erect Steel Guardrails	5 days	Tue 5/30/17	Fri 6/9/17
40			Make Connections (Bolt / Weld)	3 days	Fri 6/9/17	Tue 6/13/17
41			**Finishes**	**3 days**	**Sat 5/27/17**	**Fri 6/2/17**
42			Paint layout, tape and surface prep	1 day	Sat 5/27/17	Sun 5/28/17
43			Paint	1 day	Sun 5/28/17	Tue 5/30/17
44			Paint Finish	1 day	Tue 5/30/17	Fri 6/2/17
45			**Post Construction**	**1 day**	**Thu 6/15/17**	**Fri 6/16/17**
46			**Closeout**	**1 day**	**Thu 6/15/17**	**Fri 6/16/17**
47			As-Built Drawings	1 day	Thu 6/15/17	Fri 6/16/17
48			Project Contact Sheet	1 day	Thu 6/15/17	Fri 6/16/17
49			Necessary Inspections	1 day	Thu 6/15/17	Fri 6/16/17



Project: Modular House Workin
Date: Wed 5/3/17

Task	Inactive Task	Manual Summary Rollup	External Milestone	Manual Progress
Split	Inactive Milestone	Manual Summary	Deadline	
Milestone	Inactive Summary	Start-only	Critical	
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