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WEIDLINGER-NAVARRO JV NORTHERN NM

Calculation

Calculation Number:	Calculation Title:	Revision:	Page:
11-001-SCAL-001	TWF Storage Building Structural Design	C	1 of 11

1. Project Number:	2. Project Title:	3. Date:
11-001	TA-63 TRU Waste Facility Project Phase B Design	3/25/11

4. Calculation Type:	5. Design Verification Required?	6. Superseded by Calculation No.:
☐ Scoping ☒ Preliminary ☐ Final ☐ Voided	☐ Yes ☒ No	N/A 7. Supersedes Calculation No.: N/A

8.	Revision C	Revision	Revision
9. Originated By:	Jim Weeks Date:3/25/11	Date	Date
10. Checked By:	Chad Rosenberger 3/25/11 Date	Date	Date
11. Approved By:	Jim Weeks Date:3/25/11	Date	Date
12. Other:	Date	Date	Date

Affected Documents

Document No.	Document Title	Revision No.	Responsible Discipline Lead Initials
S-1000	TWF Storage Building Foundation Plan	C	
S-1001	TWF Storage Building Roof Framing Plan	C	
S-2000	TWF Storage Building Structural Elevations	C	
S-2001	TWF Storage Building Structural Elevations	C	
S-3000	TWF Storage Building Structural Sections	C	
S-5001	TWF Storage Building Foundation Details	C	
S-6001	TWF Storage Building Graphic Column Schedule	C	

Record of Revision

Revision No.	Reason for Revision
A	30% Preliminary Design roundtable review set
B	30% Preliminary Design
C	60% Preliminary Design

Attachments

Attachment No.	Title	Total Pages
A	Design Load Development	21
B	STAAD-Pro Modeling and Analysis of Storage/Staging Building Structure	70
C	Foundation Design and SAFE Analysis	109
	Total Calculation Page Count:	200

35020

Originator Initials:		Checker Initials:	
JMW	3/25/11 Date	CR	3/25/11 Date

1.0 Introduction

The TRU Waste Facility (TWF) at TA63 will consist of a multiple buildings for the storage of TRU waste to meet Nuclear Facility requirements for staging of newly generated solid TRU wastes in support of LANL DP programs and missions. A RCRA-permitted pad will be designed and constructed for characterization and testing trailers that are needed to certify containers to the WIPP Waste Acceptance Criteria. Other functions provided at the TWF include intra-site shipping and receiving, operational support facilities, and necessary utilities and services. The TRU Waste Facility project (TWF) will be capable of storing/staging a minimum of 825 drum/drum equivalents (D/DE) with contingency storage up to 1,240 D/DE.

The goals and objectives of the **TRU Waste Facility (TWF)** are as follows:

- Receive newly generated TRU waste from various facilities at LANL and process the containers for shipment to WIPP. The base case facility includes a shipping/receiving area, a characterization/certification area, drum storage area(s), an operations support area and the necessary utility infrastructure.

- Design, permit, construct, and commission the TWF as a Hazard Category 2 nuclear facility with a Resource Conservation and Recovery Act (RCRA) permit to store hazardous wastes.

- Design, construct and operate the TWF within the conditions approved by the LANL Site-Wide Environmental Impact Statement (SWEIS).

The planned facility will include 6 similar Storage/Staging Buildings, a Waste Characterization and Certification Pad, a Shipping and Receiving Canopy, an Operations and Support Building, and a Utility Building.

The Storage/Staging Buildings serve as queue storage for prepackaged waste containers. From this area, containers must be transferred to and from other LANL transuranic waste facilities as well as between the various functions within the facility itself. Here containers will be stored between processes and before intra-site shipment. This function will also provide records and information management to track characterization data and inventory containers from the time of receipt at the TWF until the containers are shipped. The functional area must also be able to assemble/ band drums on pallets and weigh containers.

1.1 Purpose

The purpose of this calculation is to provide the structural design for the Storage/Staging Buildings. The Storage/Staging Buildings are similar structures. The primary structure for each of the Storage Buildings will be single story buildings that will serve as queue storage for prepackaged waste containers. The Storage Buildings are identified as ML 2, Performance Category 2 (PC-2) facilities that contain Safety Significant equipment. Per DOE-STD-1189-2008, Integration of Safety into the Design Process, and as stated in the LANL Transuranic Waste Project "Limit State Determination Document 102355-11-000XXX", the Storage Buildings are classified as a Seismic Design Category -2 (SDC-2) facilities, with a Limit State "B" designation.

1.2 Scope

These calculations are limited to the design of the Storage/Staging Buildings only. The design of the structure includes the roof framing layout and sizing, the design of primary and secondary steel members, the design and analysis of the lateral force resisting system, and the basic foundation design. The design of the individual systems includes sizing framing elements, wall and foundation reinforcing steel, and connections.

1.3 Design Inputs

1. Material
   - a. Reinforced Concrete:
     - i. Foundation, walls, and slabs - nominal weight (150 pcf) Reinforced Concrete Compressive Strength f'c = 4,000 psi @28 days.
     - ii. Grade 60 steel reinforcement - Reinforcing steel deformed bars and stirrups - ASTM A706, fy = 60,000 psi.
   - b. Carbon steel:
     - i. Structural Steel – W-Shapes, ASTM A992/A992M, fy = 50 ksi.
     - ii. Structural Steel – Misc. Shapes and Plates, ASTM A36/A36M, fy = 36 ksi.
     - iii. Structural Steel – HSS Shapes, ASTM A500 Grade B, fy = 46 ksi.
   - c. Welding Material - AWS D1.1, E70XX Low Hydrogen Electrode
   - d. Bolts, Nuts and Washers:
     - i. Common Bolts - ASTM A36 OR A307.
     - ii. High Strength Bolts - ASTM A325.
     - iii. Nuts ASTM A563.
     - iv. Hardened Washers ASTM F436.
     - v. Anchor Bolts and Tie Rods - ASTM F1554, Grade 36.
2. Dead Loads (per ESM Chapter 5, Structural)
   - a. Self-weight of structural systems / framing.
   - b. Future Dead Load = 10 psf on all floors. (LANL ESM)
3. Live Loads (per ASCE 7-05 Section 4.0)
   - a. Typical Floors = 125 psf (Slab-on-Grade) or actual operating load from stacked drums. (TWF Design Criteria Document)
   - b. Forklift axle loading for an 8000 lbs capacity forklift. (TWF Design Criteria Document)
   - c. Roof = 30 psf., not reduced. (LANS STD ISD 341-2)
   - d. Roof= 2000 # concentrated load at panel points of the roof framing trusses (metal joists)

or at any point along primary structural members supporting the roof.

4. Snow Loads (per ASCE 7-05 Section 7.0)

   a. p_g = 16 psf (Ground Snow per LANS STD ISD 341-2).

   b. C_e = 1.0 (Exposure C - Partially Exposed).

   c. C_t = 1.0.

   d. C_s = 1.0.

   e. I = 1.2 (Category IV).

   f. Rain-on-snow surcharge load of 5 psf is required per ASCE 7-05, Section 7.10. $p_f = (0.7\ C_e\ C_t\ I\ p_g$ or $I\ p_g) + P_{surcharge}$ = 19.2 psf + 5.0 psf= 24.2 psf (Rain on Snow - Worst Case Uniform Snow Loading). Rain on snow load is less than roof live load, therefore roof live load controls design. Snow drift load will still need to be considered, which follows below.

5. PC-2 Wind Loads (per ESM Chapter 5, Structural and ASCE 7-05 Section 6.0)

   a. Basic Wind Speed, V = 90 mph.

   b. Exposure Category "C".

   c. Importance Factor, I_w = 1.15

   d. h_e = 13.67 ft

   e. L = 64 ft.

   f. B = 33 ft.

   g. A = 75 ft^2 (Assumed Effective Component Area).

   h. The building meets ASCE 7-05 criteria in Sections 6.4.1.1 and 6.4.1.2 allowing the use of Method 1 for determining wind loads.

   i. $ps = \lambda K_{zt} I p_{s30}$ (per ASCE 7-05 Section 6.0 Equation 6-1).

6. PC-2 Seismic Loads (per ESM Chapter 5, Structural and ASCE 7-05 Section 12 .0)

   a. S_{DS} = 0.75g (per LANS STD ISD 341-2 Chapter 5, Structural)

   b. S_{Dl} = 0.64g. (per LANS STD ISD 341-2 Chapter 5, Structural.)

   c. Importance Factor, I_E = 1.5 (per ASCE 7-05 Section 1.0 Table 1.1 for Category IV).

   d. Seismic Use Group III. (per LANS STD ISD 341-2 Chapter 5, Structural).

   e. Seismic Design Category 2, Limit State B per LANS Transuranic Waste Project Limit States Determination Document.

   f. h_e = 15.0 ft

   g. C_t = 0.028 (per ASCE 7-05 Section 12.8.2.1, ordinary steel moment frame).

   h. x = 0.8 (per ASCE 7-05 Section 12.8.2.1,ordinary steel moment frame).

   i. R = 3.5 (per ASCE 7-05 Table 12.2-1, ordinary steel moment frame)

      (R>3, must meet requirements of AISC 341-05, Part I for SDC-D)

j. R_a = 0.80R from DOE STD 1189 Appendix A Table on page A-5

k. C_d = 3 (per ASCE 7-05 Table 12.2-1)

7. Rain and Flood Loads

a. Flood loads not considered in the design. The proposed structure is not in a flood plain. See Snow Loads section for rain on snow surcharge.

8. Atmospheric Ice Loads

a. Roof live loads are found to control over ice loads and combinations using ice loads.

9. Blast Loads

a. Not considered in the Design of this facility.

10. Load Combinations

Strength Design or Load and Resistance Factor Design. The following load combinations applicable to the TWF:

a. 1.4D (IBC Eqn. 16-1)

b. 1.2D + 1.6(L+H) + 0.5(Lr or S or R) (IBC Eqn. 16-2)

c. 1.2D + (1.0L or 0.8W) + 1.6(Lr or S or R) (IBC Eqn. 16-3)

d. 1.2D + 1.6W + 1.0L + 0.5(Lr or S or R) (IBC Eqn. 16-4)

e. 1.2D +1.0E + 1.0L + 0.7S (IBC Eqn. 16-5)

f. 0.9D + (1.0E or 1.6W) (IBC Eqn. 16-6/7)

11. Geotechnical (assumed initially)

a. The foundations shall founded on 3’ of structural fill.

b. Soil Bearing Pressure - 4000 psf

c. Soil Unit Weight -115 pcf.

d. Coefficient of Sliding Friction - 0.3

e. Lateral Soil Pressure (Pa) = 50 pcf (Equivalent Fluid Pressure).

f. Passive Soils Resistance = 330 pcf

g. Modulus of Subgrade Reaction = 325 pci

1.4 Criteria

The criterion for the design of the Storage/Staging Buildings is based on being designated as a ML-2, Performance Category 2 (PC-2) facility and will be in accordance with the LANS STD ISD 341-2 Chapter 5, Section II and the IBC.

Strength:

The TWF storage/staging building structure and components will be designed to resist all applicable loads listed in Section 1.3 with a demand to capacity (D/C) ratio of less than 1. Capacities for steel are determined in accordance with AISC 360-05 and AISC 341-05, concrete in accordance with ACI 318-05, and cold formed steel in accordance with AISI- NASPEC 2001, including 2004 supplement.

Serviceability:

The deflection of structural members shall not exceed the more restrictive of the limitations of the Table below (IBC 2006, 1604.3), or defined in IBC 2006 1604.3.2 and 1604.3.3

Table of Deflection Limits.

Construction	L	S or W	D + L
Roof Members:			
Supporting Plaster Ceilings	l/360	l/360	l/240
Supporting Nonplaster Ceilings	l/240	l/240	l/180
Not Supporting Ceilings	l/180	l/180	l/120
Floor Members	l/360	N/A	l/240
Exterior Walls and Interior Partitions:			
With brittle Finishes	N/A	l/240	N/A
With Flexible Finishes	N//A	l/120	N/A

N/A = Not Applicable.

The allowable story drift is provided in the Table below (ASCE 7-05, 12.12, incl footnote b). Per ASCE 7-05, Eqn 12.8-15, story drift is determined by $\delta_x = C_d\delta_{xe}/I = (3/1.5)*\delta_{xe}$, where δ_{xe} is the deflection determined by elastic analysis. For this building with a height of 15', the allowable drift = .015*15'*12in/ft = 2.7".

Table of Allowable Story Drift, Δa.

Building	PC-2
Buildings, other than masonry shear wall or masonry wall frame structures, four stories or less with interior walls, partitions, ceilings, and exterior wall systems that have been designed to accommodate the story drifts	$0.015h_{sx}$
Masonry cantilever shear wall structures	$0.010h_{sx}$
Other masonry shear wall structures	$0.007h_{sx}$
Masonry wall frame structures	$0.010h_{sx}$
Other structures	$0.010h_{sx}$

1.5 Assumptions

- Geotechnical properties are initially assumed based on values used for the RLWTF project. These will be verified and checked when the site specific geotechnical report for the TWF project is complete.

2.0 References

- LANL Engineering Standards Manual ISD 341-2, Chapter 5 - Structural (Rev. 5, Effective 6/16/08).
- DOE-STD-1020, "Natural Phenomena Hazards Design and Evaluation Criteria for DOE Facilities," January 2002.
- DOE-STD-1021, "Natural Phenomena Hazards Performance Categorization Criteria for Structures, Systems and Components," April 2002.
- DOE-STD-1189-2008, “Integration of Safety into the Design Process”, March 2008.
- ASCE 7-05, "Minimum Design Loads for Buildings and Other Structures".
- AISC 341-05, “Seismic Provisions for Structural Steel Buildings,” March 9, 2005, Including Supplement 1 November 16, 2005.
- IBC 2006, "International Building Code".
- AISC 360-05, " Specification for Structural Steel Buildings", March 9, 2005.
- ACI 318-05/318R-05, "Building Code Requirements for Structural Concrete", Code and Commentary,2005.
- ACI 360 R-92, ACI Committee Report 360, “Design of Slabs on Grade”, 1992.
- AWS D1,1, "Structural Welding Code -Steel", 2004 Edition.
- AWS D1.3, “Structural Welding Code – Sheet Steel”, 1998 edition.
- AISI- NASPEC, "North American Specification for the Design of Cold-formed Steel Structural Members", 2001 Edition.
- AISI – NASPEC, “North American Specification for the Design of Cold-formed Steel Structural Members”, 2001 Edition, including 2004 Supplement.
- AISI – General-04 “Standard for Cold-formed Steel Framing – General Provisions”, 2004.
- AISI – Header-04 “Standard for Cold-formed Steel Framing – Header Design”, 2004.
- AISI – Wall Stud-04 “Standard for Cold-formed Steel Framing – Wall Stud Design”, 2004.

- TM5-809-12, "Concrete Floor Slabs on Grade Subjected to Heavy Loads", 1987.
- FEMA 451, NEHRP Recommended Provisions: Design Examples, 2006.
- ACI 336.2R-88: Suggested Analysis and Design Procedures for Combined Footings and Mats (Reapproved 2002).
- Geotechnical Engineering Study, Radioactive Liquid Waste Treatment Facility (RLWTF) Technical Area -50, Los Alamos National Laboratory, AMEC Project No. 7-517-000018. AMEC Earth and Environmental, Inc., 2 August 2007.
- ASTM A706 / A706M - 04a, Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
- ASTM A36 / A36M - 04 Standard Specification for Carbon Structural Steel.
- ASTM A992 / A992M - 04a Standard Specification for Structural Steel Shapes.
- ASTM A500 / A500M - 07 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- ASTM A307 - 03 Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- ASTM A325 - 07a Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- ASTM A563 - 07a Standard Specification for Carbons and Alloy Steel Nuts.
- ASTM F436 - 07a Standard Specification for Hardened Steel Washers.
- ASTM F1554 - 07a Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
- Steel Deck Institute Design Manual for Composite Decks, Form Decks and Roof Decks, Publication No. 31
- Steel Deck Institute Diaphragm Design Manual, 3rd Edition.
- ESR-2776, ICC-ES Evaluation Report for Steel Deck Diaphragms Attached with Hilti X-ENP-19Fasteners, Issued April 1, 2010.
- LANL Transuranic (TRU) Waste Project, "Limit State Determination Document 102355-11-000XXX", Project ID: 102355, January 14, 2011, Revision A.

3.0 Calculation Methods

A steel frame with an ordinary steel moment frames in both directions was selected as the structural system for the Storage/Staging buildings. Per ASCE 7-05, Section 12.2.5.7, ordinary steel moment frames are permitted in Seismic Design Category D up to a height of 35'. Braced frames were discounted due to tight limitations on building width and wall thickness. The structural system was modeled and analyzed using the STAAD-Pro (version V8i build 20.07.06) finite element analysis program on a desktop computer (serial # HSH89P1). All steel frame columns and beams, end wall columns, roof purlins, and girts were included in the model. The steel members were modeled using beam elements.

Moment end releases were provided for the beams not included in the moment frames, as well as for the girts and purlins. All of the columns boundary conditions at the foundation were considered pinned.

The analysis considered all applicable load cases and load combinations in accordance with ASCE 7-05. Load factors were included for the load cases. Reactions, displacements, and member forces were developed. The peak reactions will be used for subsequent foundation and connection designs. The peak lateral and vertical deformations were evaluated against the serviceability criteria. The STAAD-Pro software was used to perform a code check (using the LRFD approach) of all members for compliance with the strength requirements for steel members provided in AISC 360-05 and AISC 341-05.

The foundation is designed as a mat foundation where the slab-on-grade is integral with the column mats. In order to meet frost protection requirements, a perimeter beam extends 3feet below grade – the frost line in Los Alamos. The columns mats are founded 3feet below grade to meet the same frost line requirement. The depth of the perimeter beam and the column mats taper at a 2:1 slope at the juncture with the slab. For all elements, the concrete cover is 1 ½ inches at top and 3 inches at bottom.

The foundation is modeled and analyzed on a desktop computer (serial # DLY2QH1) using SAFE (version 12.3.1), a finite element analysis program used for the design of slabs, beams and foundations. All foundation elements - the slab, column mats, and perimeter beams - are modeled using area/slab elements. The soil support is modeled using soil springs with the Modulus of Subgrade reaction as the spring constant. In order to prevent unrealistic lateral displacement of the mat in the model, all four corners of the slab are restrained in the lateral direction. In actuality, lateral movement of the mat is resisted by sliding friction and is checked separately. The analysis considered all applicable load cases and load combinations in accordance with ASCE 7-05. The soil bearing pressure is analyzed using allowable load combinations, while the mat is designed using strength design load combinations. The foundation is designed according to ACI 318-05 requirements.

The slab live load consists of an increased storage load of 384 psf in the drum storage area to account for the actual drum storage weight. The slab live load is 125 psf around the drum storage area to account for miscellaneous storage. Forklift tire loads are also accounted for in the slab design. The forklift tire load is based on a maximum size forklift carrying a 5 ft. x 5 ft. palette loaded with 4 drums, each stacked 3 drums high.

4.0 Results and Conclusions

The final design for the steel structural system meets all strength and serviceability requirements. The design calls for the columns in the moment resisting frame to be W12x96 sections. The beams in the moment frames in the transverse direction are W14x43 sections, and the beams in the moment frames in the longitudinal direction are W14x53 sections. The roof purlins which are spaced at 8’ on-center are W14x22 sections. The wall girts which are spaced at 4’ on-center are W6x9 sections.

All of the steel members analyzed meet the demand to capacity requirements for strength. The controlling strength demand-to-capacity ratios for the respective members are provided in the table below:

Member	Section Property	Member #	Controlling Load Combination	Demand to Capacity Ratio

Primary Columns	W12x96	8	1.2D + 1.0E + L + .2S	.375
Transverse Moment Frame Beams	W14x43	49	1.2D + 1.0E + L + .2S	.445
Longitudinal Moment Frame Beams	W14x53	22	1.2D + 1.0E + L + .2S	.367
Roof Purlins	W14x22	58	1.2D + 1.6Lr + 0.8W	.496
Wall Girts	W6x9	119	1.2D + 1.0E + L + .2S	.583

Lateral deformation and allowable story drift limits controlled the design of the moment frame members. The analysis resulted in the maximum story drift deformations shown below:

Direction	**Node**	**Controlling Load Combination**	**δ_{xe}, in.**	**δ_x, in.**	**Allowable deformation, in. ($0.015h_{sx}$)**
Longitudinal, Model Z	18	1.2D + 1.0E + L + .2S	1.0	2.7	2.7
Transverse, Model X	14	1.2D + 1.0E + L + .2S	.91	2.7	2.7

All of the primary and secondary structural members meet the deformation serviceability criteria as required by IBC 2006, Table 1604.3. The table below summarizes the results of the analysis.

Member	**Beam #**	**Load**	**Deformation, in.**	**Allowable deformation**

Transverse Moment Frame Beams (W14x43)	Physical Member #13	L	.27	L/240 = 1.6”
	13	W	.11	L/240 = 1.6”
	13	D+L	.52	L/180 = 2.2”
Roof Purlins (W14x22)	55	L	.06	L/360 = .53”
	55	W	.03	L/240 = .8”
	55	D+L	.11	L/180 = 1.1”
Wall girts (W6x9)	91	Transverse W	.17	L/120 = 1.6”

The foundation design is summarized below.

Element	Depth (inches)	Dimension	Reinforcing
Slab-on-grade	12	---	#5 at 12” o.c., top and bottom, each way
Column mats	42	4’x 3’ along perimeter 3’x 3’ @corners	#8 at 8” o.c., top and bottom, each way
Perimeter beam	42	12” wide at bottom	(3) #6’s top, (3) #8’s bottom

Foundation design results are as shown below.

Parameter	Max (inches)	Allowable SB / Provided Sliding Resistance	Load Combination
Soil Bearing Pressure	1120.8 psf	4000psf	D + 0.75(0.7 Ex) + 0.75 L +0.75Lr
Sliding Resistance	30.5 kips	191.1 kips (1.5 FoS)	Total Seismic Lateral load

5.0 Calculations and Analyses

See Attachments A thru C for the design and analysis calculations.

Attachment A

Design Load Development

Project Name:	TWF STORAGE BUILDING		
Project Number:			
Subject:	Roof Loads		
By:	JMW	Date:	2/22/2011
Checked:		Date:	
Sheet:	1	of	1

GRAVITY DESIGN LOAD SUMMARY -- ROOF LOADS

ITEM	DESCRIPTION	DECK DESIGN		PURLIN DESIGN		FRAME DESIGN	
DECK	1.5" Type B, 20 ga	2.5	PSF	2.5	PSF	2.5	PSF
INSULATION	6" Batt (1.1 psf per in)	6.6	PSF	6.6	PSF	6.6	PSF
ROOFING	22 gage standing seam	1.3	PSF	1.3	PSF	1.3	PSF
			PSF	0.0	PSF	0.0	PSF
			PSF	0.0	PSF	0.0	PSF
			PSF	0.0	PSF	0.0	PSF
PURLINS	@ 8'-0" o.c. (incl. in calculation)			0.0	PSF	2.8	PSF
M/E/P	Assumed			5.0	PSF	5.0	PSF
CEILING	5/8" gyp board			2.8	PSF	2.8	PSF
					PSF		PSF
					PSF		PSF

	DECK DESIGN		PURLIN DESIGN		FRAME DESIGN	
DEAD LOAD TOTALS	10.4	PSF	18.1	PSF	20.9	PSF
ACTUAL VALUES USED	10.4	PSF	18.1	PSF	20.9	PSF
	MINIMUM		SNOW			
LIVE LOADS	30.0	PSF	24.2	PSF		

SNOW LOADING ANALYSIS

Per ASCE 7-05 Code for Buildings with Flat or Low Slope Roofs (<= 5 deg. or 1 in./ft.)
for Balanced Snow, Drift, and Rain-on-Snow Surcharge Loadings

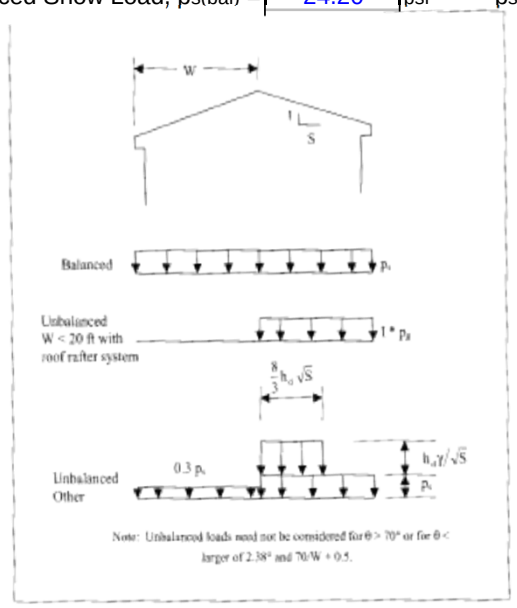
Job Name:	LANL TWF	Subject:	TWF Storage Building		
Job No:		Originator:	JMW	Checker:	CR

Input Data:

Building Classification =	IV		Table 1-1, page 3
Ground Snow Load, p_g =	16.00	psf	Figure 7-1, pages 84-85 and Table 7-1, page 92
Horiz. Dist. fr Eave to Ridge, W =	16.50	ft.	Horizontal Distance from Eave to Ridge
Type of Roof =	Gable		Type of Roof = Monoslope, Gable, or Hip
Roof Slope, S =	1.00	in./ft.	S = Rise per foot of Run
Exposure Factor, C_e =	1.00		Table 7-2, page 92 LANL, ESM PC-2
Thermal Factor, C_t =	1.10		Table 7-3, page 93

Results:

Roof Angle, θ =	4.76	deg.	θ = ATAN(S/12) < 5 deg. $p_s = p_f$
Importance Factor, I =	1.20		Table 7-4, page 93 LANL, ESM PC-2
Snow Density, γ =	16.08	pcf	$\gamma = 0.13*p_g+14$ <= 30 (Eqn. 7-3, page 83)
Flat Roof Snow Load, p_f =	14.78	psf	$p_f = 0.7*C_e*C_t*I*p_g$ (Eqn. 7-1, page 81)
$p_{f(min)}$ =	19.20	psf	$p_{f(min)} = p_g*I$ for p_g <= 20 , $p_{f(min)} = 20*I$ for p_g > 20
$p_s = p_{f(use)}$ =	19.20	psf	$p_{f(use)}$ = maximum of: p_f or $p_{f(min)}$ (Section 7.3, page 81)
Rain-on-Snow Surch., p_{rs} =	5.00	psf	p_{rs} = 5.0 psf when 0 < p_g <=20 and θ < W/50) (Sect. 7.10)
Balanced Snow Load, $p_{s(bal)}$ =	24.20	psf	$p_{s(bal)} = p_s+p_{rs}$



70/W + 0.5 = 4.74 degrees

per ASCE7-05, Fig. 7-5, no need to consider unbalanced snow load

Note: roof live load of 30 psf envelopes balanced snow load of 24.20 psf

WIND LOADING ANALYSIS - MWFRS and Components/Cladding

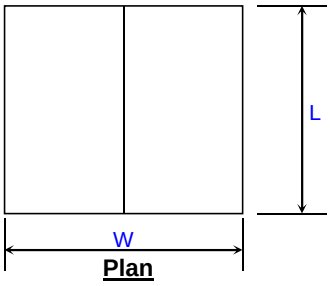
Per ASCE 7-05 Code for Low-Rise, Enclosed Buildings with h <= 60' and Roof θ <= 45°

Using Method 1: Simplified Procedure (Section 6.4)

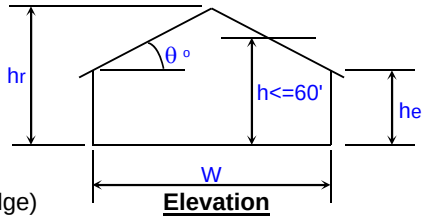
Job Name:	LANL TWF	Subject:	Storage Buildings		
Job Number:		Originator:	JMW	Checker:	CR

Input Data:

Wind Speed, V =	90	mph (Wind Map, Figure 6-1)
Bldg. Classification =	IV	(Table 1-1 Occupancy Category)
Exposure Category =	C	(Sect. 6.5.6)
Ridge Height, hr =	15.00	ft. (hr >= he)
Eave Height, he =	13.67	ft. (he <= hr)
Building Width, W =	33.00	ft. (Normal to Building Ridge)
Building Length, L =	64.00	ft. (Parallel to Building Ridge)
Roof Type =	Gable	(Gable or Monoslope)
Topo. Factor, Kzt =	1.00	(Sect. 6.5.7 & Figure 6-4)
Wall C&C Name =	Wall	(Girt, Siding, Wall, or Fastener)
Wall C&C Eff. Area =	75.00	ft.^2 (for Component/Cladding)
Roof C&C Name =	Joist	(Purlin, Joist, Decking, or Fastener)
Roof C&C Eff. Area =	205.00	ft.^2 (for Component/Cladding)
Overhang Eff. Area =	0.00	ft.^2 (for Component/Cladding)
Hurricane Region?	N	



Plan



Elevation

Resulting Parameters and Net Design Pressures:

For Transverse Direction: (wind perpendicular to ridge)

Roof Angle, θ =	4.61	deg.
Mean Roof Ht., h =	13.67	ft. (h = he for θ < 10 deg.)
Adjustment Factor, λ =	1.210	(adjusts for height and exposure)
Importance Factor, I =	1.15	(Table 6-1)
Wall & Roof End Zone Width, a =	3.300	ft. (use: "2*a" for MWFRS, "a" for C&C)

Transverse MWFRS Net Pressures, ps (psf)

ps = λ*Kzt*I*ps30 (ps30 from Fig. 6-2)

Location	Direction	Zone	Load Case 1	Load Case 2
A = end zone of wall	Horizontal	A	17.81	---
B = end zone of roof	Horizontal	B	0.00	---
C = interior zone of wall	Horizontal	C	11.83	---
D = interior zone of roof	Horizontal	D	0.00	---
E = end zone of windward roof	Vertical	E	-21.43	---
F = end zone of leeward roof	Vertical	F	-12.25	---
G = interior zone of windward roof	Vertical	G	-14.89	---
H = interior zone of leeward roof	Vertical	H	-9.46	---

For Longitudinal Direction: (wind parallel to ridge)

Roof Angle, θ =	0.00	deg. (assumed)
Mean Roof Ht., h =	14.34	ft. (h = (hr+he)/2)
Adjustment Factor, λ =	1.210	(adjusts for height and exposure)

Longitudinal MWFRS Net Pressures, ps (psf)

ps = λ*Kzt*I*ps30 (ps30 from Fig. 6-2)

Location	Direction	Zone	Load Case 1	Load Case 2
A = end zone of wall	Horizontal	A	17.81	---
B = end zone of roof	Horizontal	B	0.00	---
C = interior zone of wall	Horizontal	C	11.83	---
D = interior zone of roof	Horizontal	D	0.00	---
E = end zone of windward roof	Vertical	E	-21.43	---
F = end zone of leeward roof	Vertical	F	-12.25	---
G = interior zone of windward roof	Vertical	G	-14.89	---
H = interior zone of leeward roof	Vertical	H	-9.46	---

(continued)

Total Design MWFRS Horizontal Load (kips)					
Transverse			Longitudinal		
Load Case 1	Load Case 2	Min. Load	Load Case 1	Load Case 2	Min. Load
11.43	---	9.60	6.70	---	4.73

Formulas:
Ph(Trans) = ((Pc*(L-4*a)+Pa*4*a)*he+(Pd*(L-4*a)+Pb*4*a)*(hr-he))/1000
Ph(Trans)(min) = P(min)*L*hr/1000 , where: P(min) = 10.0 psf on projected area
Ph(Long) = (Pa*(he+4*a/W*(hr-he)+he)/2*4*a+Pc*(W*(hr+he)/2-(he+4*a/W*(hr-he)+he)/2*4*a))/1000
Ph(Long)(min) = P(min)*W*(hr+he)/2/1000 , where: P(min) = 10.0 psf on full area

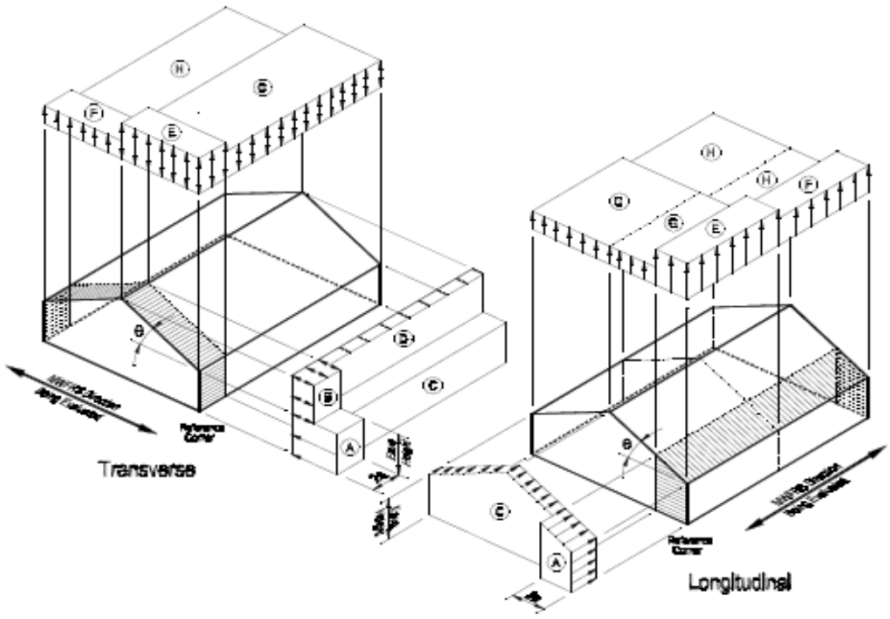
Components & Cladding Net Pressures, p_s (psf)				
Item	Location	Zone	Pos. (+)	Neg. (-)
Wall	4 = interior zone of wall	4	17.67	-19.41
	5 = end zone of wall	5	17.67	-21.99
Roof Joist	1 = interior zone of roof	1	6.54	-18.51
	2 = end zone of roof	2	6.54	-21.99
	3 = corner zone of roof	3	6.54	-21.99
Roof Overhang	2 = end zone of o.h.	2	---	---
	3 = corner zone of o.h.	3	---	---

pnet = λ*Kzt*I*pnet30
(pnet30 from Fig. 6-3)

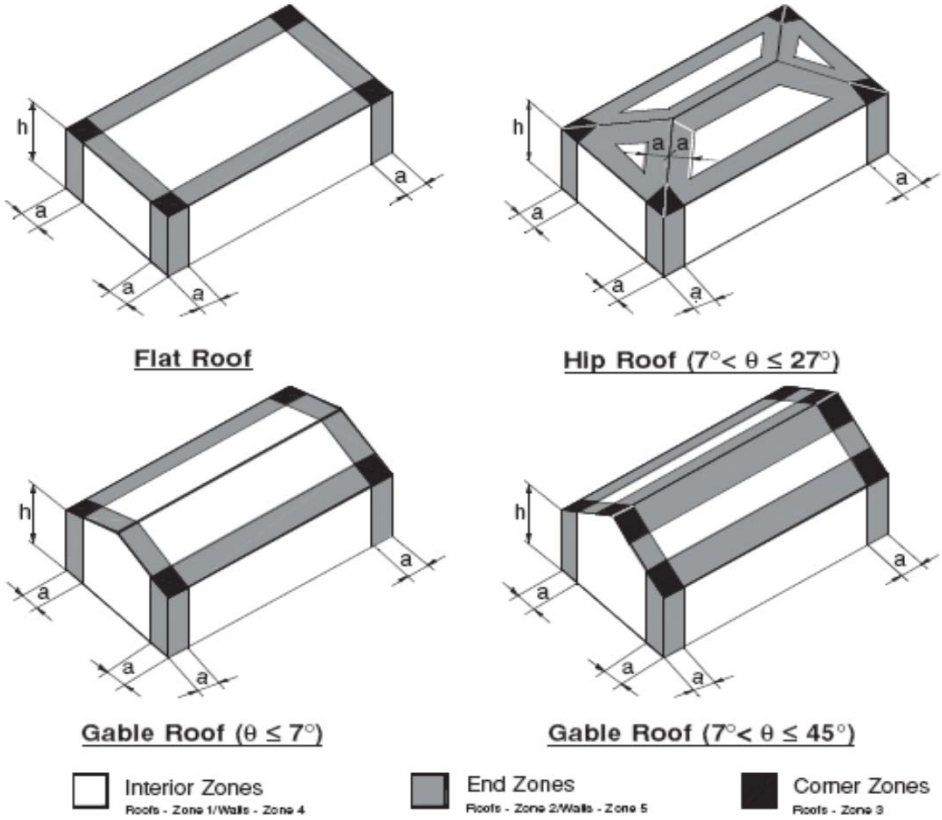
Notes:

1. For Method 1: Simplified Procedure of Section 6.4 to be used for an enclosed low-rise building to determine the design wind loads, all of the following eight conditions of 6.4.1.1 must be met:
   a. Building is a simple diaphragm building, in which wind loads are transmitted through floor and roof diaphragms to the vertical Main Wind-Force Resisting System (MWFRS).
   b. Building is a low-rise building where mean roof height, h <= 60 ft., and h <= min. of L or W.
   c. Building is enclosed and conforms to wind-borne debris provisions of Section 6.5.9.3.
   d. Building is a regular shaped building, having no unusual geometrical irregularity.
   e. Building is not classified as a flexible building so it is considered "rigid".
   f. Building is not subject to across-wind loading, vortex shedding, etc.
   g. Building has an approximately symmetrical cross section in each direction with either a flat roof, or gable roof with θ <= 45 degrees.
   h. Building is exempted from torsional load cases or torsional load cases do not control any of the MWFRSs of the building.
2. Wind pressures (p_{s30}) in Figure 6-2 and (p_{net30}) in Figure 6-3 were prepared based on following:
   a. Mean roof height, h = 30 ft. , Exposure category = B , Importance factor, I =1.0
   b. Velocity pressure exposure coefficient, Kz = 0.70
   c. Directionality factor, Kd = 0.85 , Topographic factor, Kzt = 1.0
   d. Internal pressure coefficients, GCpi = +0.18, -0.18 (enclosed building)
   e. MWFRS pressure coeff's. from Figure 6-10, and C&C pressure coeff's. from Figure 6-11.
   f. MWFRS design wind pressure, P_s = λ*Kzt*I*p_{s30}, in psf.
   g. Components & cladding design wind pressure, P_{net} = λ*Kzt*I*p_{net30}, in psf.
3. Design wind pressures are net pressures (sum of external and internal pressures).
4. Wall net pressure for MWFRS is total for both windward and leeward walls.
5. (+) and (-) signs signify wind pressures acting toward & away from respective surfaces.
6. If pressures for Zones "B" and "D" < 0, assume = 0.
7. For the design of the longitudinal MWFRS use roof angle, θ = 0 degrees.
8. Both load cases 1 and 2 are be checked for roof angle, 25 degrees < θ <= 45 degrees.
9. The total design MWFRS horizontal load is the total horizontal wind load on either the length (L) or the width (W) of the building respectively assuming one end zone of a width = 2*a.
10. Minimum wind load for MWFRS design shall be 10 psf applied to area on projected vertical plane. Minimum wind load for C&C shall be 10 psf acting in either direction normal to surface.
11. References:
    a. ASCE 7-05 Standard, "Minimum Design Loads for Buildings and Other Structures".
    b. "Guide to the Use of the Wind Load Provisions of ASCE 7-02" by: Kishor C. Mehta and James M. Delahay (2004).

(continued)



MWFRS - Wind Zones



Components and Cladding - Wind Zones

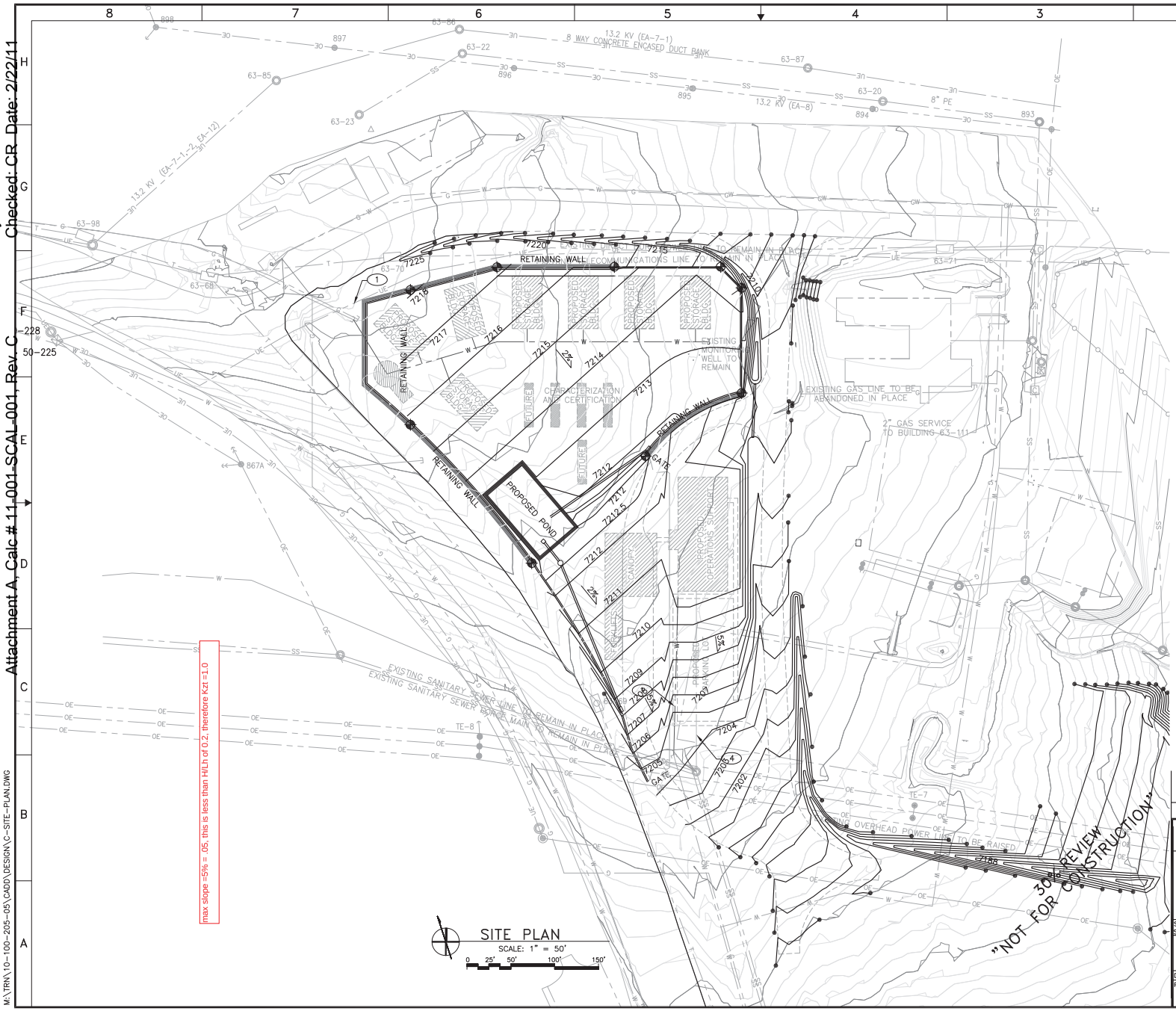
Attachment A, Calc # 11-001-SCAL-001, Rev. C

By: JMW Date: 2/22/11
Checked: CR Date: 2/22/11

GENERAL NOTES

1. FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.
2. IF THIS SHEET IS NOT 24"x36", THEN IT IS A REDUCED SIZE PLOT. USE GRAPHIC SCALE ACCORDINGLY.
3. EXISTING UTILITY LOCATIONS ARE APPROXIMATE ONLY AND SHALL BE FIELD LOCATED PRIOR TO CONSTRUCTION.

KEYED NOTES



SITE PLAN
SCALE: 1" = 50'
0 25' 50' 100' 150'

NO	DATE	CLASS REV	DC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP

ENGINEERING SERVICES

TRU WASTE FACILITY
PHASE "A" SITE DESIGN

SITE PLAN

DRAWN	D. YARDMAN
DESIGN	D. YARDMAN
CHECKED	J. GURULE
DATE	

TA-63 BLDG --

SUBMITTED STEVE DIAMOND
APPROVED FOR RELEASE GREG JURLING

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET C-1005
9 OF 21

D.C.: UNCLASSIFIED REVIEWER: DONALD YARDMAN DATE:

PROJECT ID	DRAWING NO	ESR NO.:	REV
102355	C00000	13435	0

M:\TRN\10-100-205-05\CADD\DESIGN\C-SITE-PLAN.DWG

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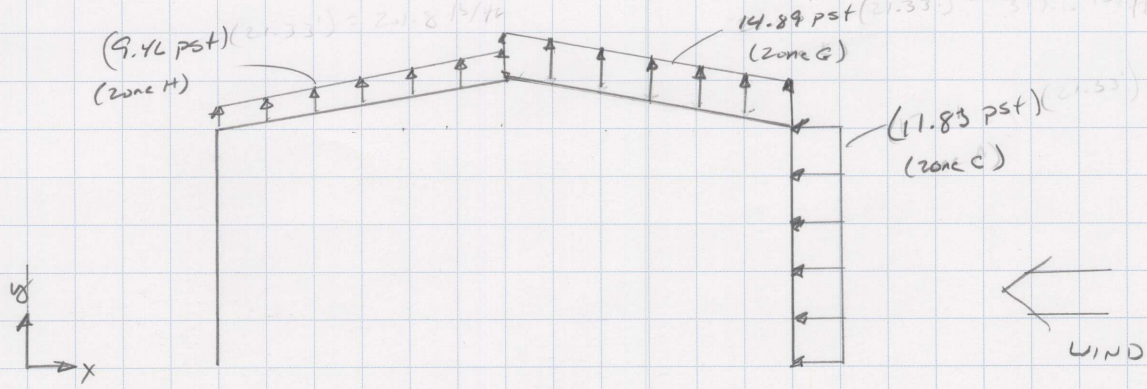
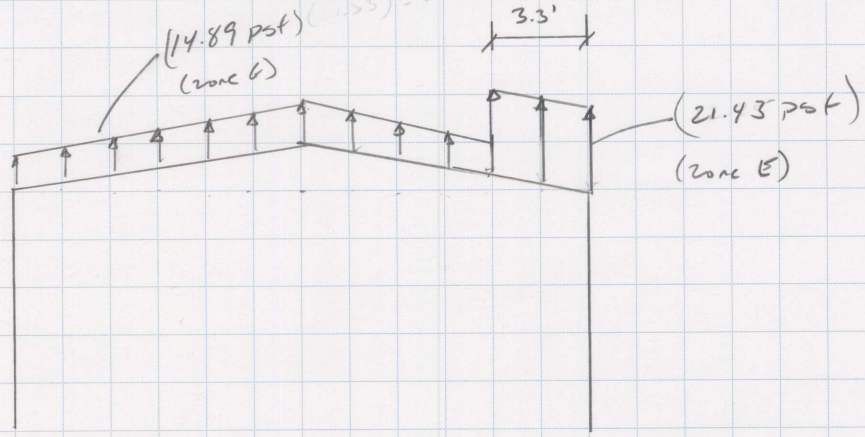
WIND LOADS FOR STORAGE BUILDING FRAMES



TRANSVERSE



LONGITUDINAL

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- ☐ MEETING MINUTES
- ☐ FIELD OBSERVATION
- ☐ TELEPHONE LOG
- ☐ MEMORANDUM
- ☐ DESIGN NOTES

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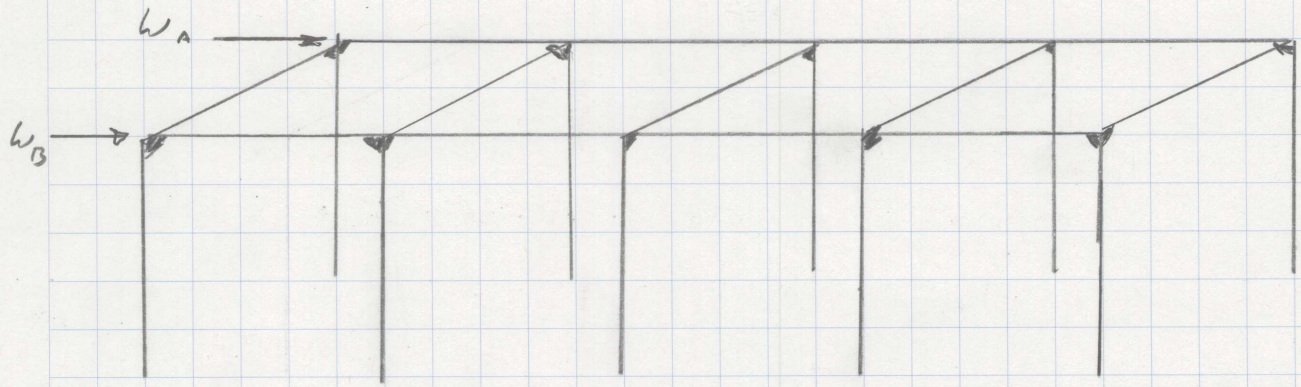

$$W_A = (3.3')(13.67'/2)(17.81\ psf) + \left(\frac{13.67' + 15'}{2}\right)\left(33'/2 - 3.3'\right)(1/2)(11.83\ psf) = 1521\ lbs$$

(includes end zone effect)

$$W_B = \left(\frac{13.67' + 15'}{2}\right)(1/2)(33'/2)(11.83\ psf) = 1399.1\ lbs$$

LONGITUDINAL

ACTION

DISTRIBUTION

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DETERMINE SEISMIC LOADS FOR STORAGE BUILDINGS

SEISMIC DESIGN CATEGORY 2, LIMIT STATE B
(SDC-2, LS B)

PER Appendix A, DOE-STD-1189, for SDC-2, LS B
the seismic design is to comply with
ASCE 7-05 with:

Occupancy Category IV
$I = 1.5$
$R_a = .80R$

From Ch 5, Section 1.7 of the LANL ESM:

$S_{DS} = 0.75g$
$S_{D1} = 0.64g$
Seismic Design Category D

From ASCE 7-05, Table 12.2-1

For an ordinary steel moment frame
(OK for SDC D w/ ht. < 35' per ASCE 7, Sec 12.2.5.7)

$R = 3.5$, $R_a = .80R = 2.8$
$\Omega_0 = 3$
$C_d = 3$

For Special Steel concentrically braced frames
$R = 6$, $R_a = .80R = 4.8$
$\Omega_0 = 2$
$C_d = 5$

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CHECK TO VERIFY THAT OMF ARE ACCEPTABLE FOR SDC D PER ASCE 7-05, SECTION 12.2.5.7

1) ht. = 15' ≤ 35' OK

2) weight of 2 1/2" insulated wall panel

exterior panel	22 gage steel	=	1.25 psf
interior panel	26 gage steel	=	.75 psf
2 1/2" rigid insulation		=	3.75 psf
			5.75 psf

wt. of 5/8" gyp board	=	2.75 psf
metal studs	=	2.0 psf
wall girts	=	2.3 psf
		12.8 psf total

Exterior wall wt. tributary to the moment frame = 12.8 psf < 20 psf

3) Roof Dead Load = 20.9 psf < 35 psf

OK

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Per ASCE 7, Table 12.6-1, the equivalent lateral force analysis procedure is permitted for SDC D bldgs provided they are regular-shaped with $T < 3.5T_s$

$$T_s = \frac{S_{D1}}{S_{DS}} = \frac{.64}{.75} = .85$$

$$3.5T_s = 3.5(.85) = 2.99$$

Per ASCE 7-05, Section 12.8.2.1, the approximate fundamental period equals:

$$T_a = C_t h_n^x$$ where $C_t = .028$ for steel mom. frame

$C_t = .02$ for steel braced frame

Steel moment frame:

$$T_a = .028(15)^{.8} = .24 \text{ sec}$$

h = height to highest level = 15'

$x = .8$ steel moment frame

$x = .75$ steel concentrically braced frame

$T_a < 3.5T_s$ ∴ ok

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Per ASCE 7, eqn 12.8-1, the seismic base shear equals:

$V = C_s W$ Total Base Shear

$$C_s = \frac{S_{DS}}{\left(\frac{R}{I}\right)} = \frac{.75}{(2.8/1.5)} = \underline{\underline{.40}}$$ Steel IMF

(eqn 12.8-2)

CHECK MAX & MIN VALUES $T_L = 6$, ASCE 7, Fig 22-15

$T_L \geq T$ C_s need not exceed $\frac{S_{D1}}{T\left(\frac{R}{I}\right)}$ (eq 12.8-3)

$$= \frac{.64}{.24\left(\frac{2.8}{1.5}\right)} = 1.42 \quad \underline{\underline{ok}}$$

$C_s \geq .01$ $\underline{\underline{ok}}$ (eq 12.8-5)

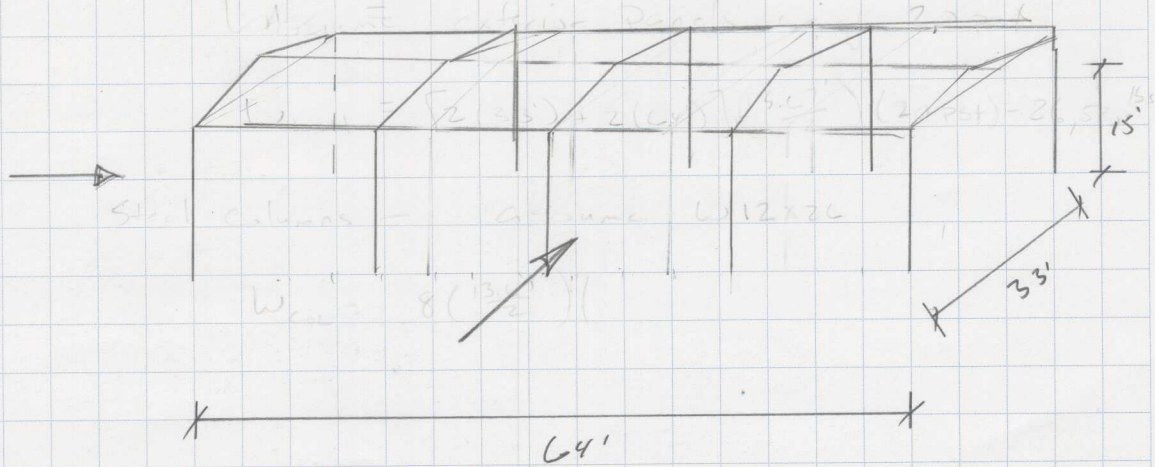
$$S_1 = \frac{S_{D1}}{T_V} = \frac{(3/2)S_{D1}}{1.5} = \frac{(3/2)(.64)}{1.5} = .64$$

$$C_s \geq \frac{.5S_1}{(R/I)} = \frac{.5(.64)}{(2.8/1.5)} = .17 \quad (ok)$$

(eqn 12.8-6, ASCE 7)

W = effective seismic wt.

Determine W:



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Assume: 1) Wall panels, girts, insul, etc, weigh 12.8 psf
2) Columns weigh 96 plf
3) roof beams weigh 43 plf
4) roof dead load (deck, insul, purlins, MEP, etc.) weighs 20.9 psf
5) end wall columns weigh 25 plf

$$W = \underbrace{2(15')(33' + 64')(12.8\,psf)}_{\text{(wall DL)}} + \underbrace{33'(64')(20.9\,psf)}_{\text{(roof DL)}}$$

$$+ \underbrace{4\left[(33')(43\,plf) + 2(15')(96\,plf)\right]}_{\text{(steel frames)}} + \underbrace{8(15')25\,plf}_{\text{end wall columns}}$$

$$W = 101{,}585^{lbs}$$

W per bay in transverse direction equals:

$$W_{TRANS} = \frac{101{,}585^{lbs}}{4} = 25{,}396^{lbs}/bay$$

W per frame in Long. direction equal:

$$W_{LONG} = \frac{101{,}585^{lbs}}{2} = 50{,}793^{lbs}$$

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$V = C_s W$

$V_{TRAN} = .40\,(25{,}396^{lbs}) = 10{,}158^{lbs}$ LOAD ON EA. INT FRAME

5079^{lbs} LOAD ON EA. EXT FRAME

$V_{LONG} = .40\,(50{,}793^{lbs}) = 20{,}317^{lbs}$ LOAD ON EA. SIDE

Horizontal Seismic Load effect:

$E_h = \rho Q_E$ where $Q_E = V$

(eqn 12.4-3, ASCE 7)

$\rho = 1.0$ (ASCE 7, Table 12.3-3 - 4 OMF's each DIR, no tors. irregularities)

FOR TRANSVERSE DIR: $E_h = 1.0(10{,}158^{lbs}) = 10{,}158^{lbs}$

$1.0(5079^{lbs}) = 5079^{lbs}$

FOR LONG. DIR: $E_h = 1.0(20{,}317^{lbs}) = 20{,}317^{lbs}$

Vertical Load Seismic Effect:

$E_v = .2 S_{DS} D$ (eqn 12.4-4)

$S_{DS} = .75g$

$D =$ roof dead load $= 20.9$ psf

$E_v = .2\,(.75)\,(20.9\text{psf}) = 3.1$ psf

positive for Load Comb 5, ASCE 7 Sec 2.3.2

negative for Load Comb 7, ASCE 7, Sec 2.3.2

→ include $(.2)(.75) = .15 \times$ SELF WEIGHT TO ACCOUNT FOR REMAINING DEAD LOAD

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VERTICAL DISTRIBUTION OF SEISMIC FORCE, F_x per ASCE 7-05, SECTION 12.8.3

$$C_v = \frac{w_x h_x^k}{\Sigma w_i h_i^k} \quad (\text{eq } 12.8\text{-}12)$$

at roof level:

$$w_1 = 2\left(\tfrac{15'}{2}\right)(33'+64')(12.8\,psf) + (33')(64')(20.9\,psf)$$
(wall DL) (roof DL)

$$+ 4\left[(33')(43\,plf) + 2(15'/2)(96\,plf)\right] + 8(15'/2)25\,plf$$
(steel trusses) end wall cols

$$w_1 = 75{,}701^{\,lbs}$$

$$C_v = \frac{75{,}701^{\,lbs}(\cancel{k})}{101{,}585^{\,lbs}(\cancel{k})} = .75$$

$$F_x = C_v V$$

F_{TRANS} = .75 (10,158 lbs) = 7619 lbs ea. int. frame
= .75 (5079 lbs) = 3809 lbs ea. ext frame

F_{LONG} = .75 (20,317 lbs) = 15,238 lbs ea. side

F_{TOTAL} in both directions = 2(15,238 lbs) = 3(7619) + 2(3809)
= 30,476 lbs

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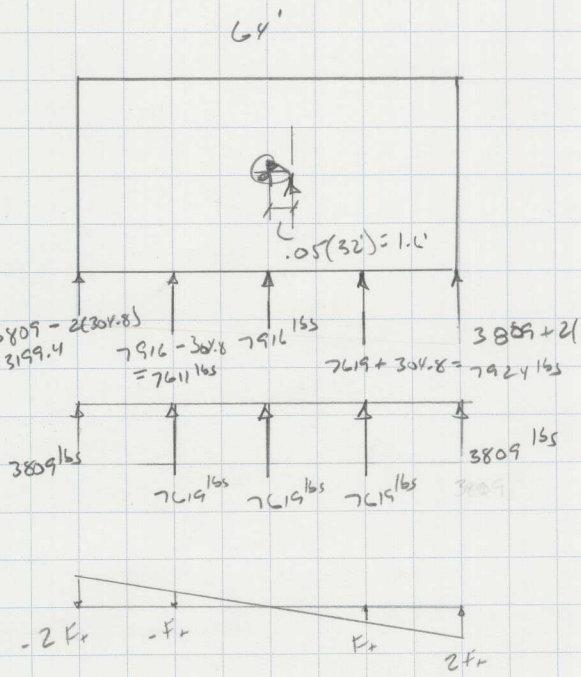
HORIZONTAL DISTRIBUTION – INCLUDE EFFECTS OF 5% ACCIDENTAL TORSION PER ASCE 7, SECTION 12.8.4.2

TRANSVERSE LOADING

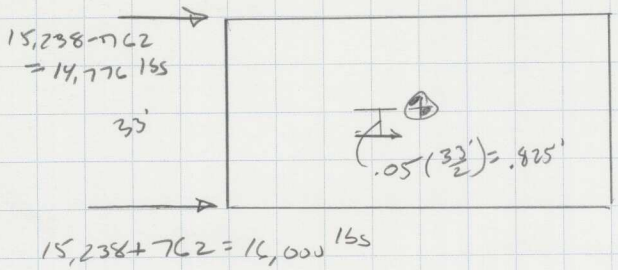


$M = (30{,}476^{lbs})(1.6') = 48{,}762$ ft.lbs

$48{,}762$ ft-lbs $= F_+(32') + 2F_+(64')$

$F_+ = 304.8^{lbs}$

LONGITUDINAL LOADING



$M = (30{,}476^{lbs})(.825') = 25{,}143$ ft.lbs

$F_+ = \frac{25{,}143 \text{ ft-lbs}}{33'} = 762^{lbs}$

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PER ASCE 7, SECTION 12.5.3a, ORTHOGONAL SEISMIC LOADING IS TO BE CONSIDERED W/ 100% IN ONE DIRECTION & 30% IN THE OTHER.

PLEASE RECYCLE

DOE-STD-1189-2008

SDC	Limit State			
	A	B	C	D
1	ASCE 7-05 Occupancy Category I or II (I=1.0) (1) $R_a = R^{(1)}$	ASCE 7-05 Occupancy Category I or II (I=1.0) (1) $R_a = 0.80R^{(1)}$ But $R_a \geq 1.0$	ASCE 7-05 Occupancy Category I or II (I=1.0) (1) $R_a = 0.67R^{(1)}$ But $R_a \geq 1.0$	ASCE 7-05 Occupancy Category I or II (I=1.0) (1) Use $R_a^{(1)} = 1.0$
2	ASCE 7-05 Occupancy Category III or IV(2) $R_a = R^{(1)}$	ASCE 7-05 Occupancy Category III or IV(2) $R_a = 0.80R^{(1)}$ But $R_a \geq 1.0$	ASCE 7-05 Occupancy Category III or IV(2) $R_a = 0.67R^{(1)}$ But $R_a \geq 1.0$	ASCE 7-05 Occupancy Category III or IV(2) Use $R_a^{(1)} = 1.0$

Note (1): I = Importance Factor (see Table 11.5-1 of ASCE 7-05)

R = Response Modification Coefficient given in ASCE 7-05(see Tables 12.2-1 and 15.4-2 of ASCE 7-05).

R_a = Actual (reduced) Response Modification Coefficient to be used in the design

Note (2): ASCE 7-05 Occupancy Category IV (I = 1.5) shall be used if there is a radiological release consequence of concern to the public or the environment resulting from an unmitigated failure of the SSC.

A.2 Safety Classification of SSCs

A.2.1 Public Protection Criteria

The guidance of DOE G 421.1-2 and DOE-STD-3009-94, CN 3, Appendix A, should be used in classifying SSCs as Safety Class (SC) for radiological protection. The words "challenging" or "in the rem range" in those documents should be interpreted as radiological doses equal to or greater than 5 rem TEDE, but less than 25 rem TEDE. In this range, SC designation should be considered, and the rationale for the decision to classify an SSC as SC or not should be explained and justified. SSCs designated as Safety Class based on seismic hazards must also be designated as SDC-3 for seismic design, at a minimum.

~~A.2.2 Collocated Worker Protection Criteria~~

Determination of Loads on Model

Building Length	64 ft	Purlin spacing	8 ft		
Building Width	33 ft	Girt Spacing	4 ft		
Eave Height	13.67 ft				
Ridge Height	15 ft				
# of Bays	4	For Wind:	a =	3.3 ft	
		For Snow:		3.6 ft	

Load Type	**Load (psf)**	**Interior Purlins (lb/ft)**	**Exterior Purlins (lb/ft)**
Dead	20.9	167.20	83.60
Live Roof	30	240.00	120.00
Snow Balanced	24.2	193.60	96.80

			Load (psf)	**Interior Purlins (lb/ft)**	**Exterior Purlins (lb/ft)**	**Wall Girts (lb/ft)**	**Top Wall Girts (lb/ft)**
Wind	Transverse	leeward roof	9.46	75.68	37.84		
		windward roof	14.89	119.12	59.56		
		leeward roof end zone	12.25	98.00	49.00		
		windward roof end zone	21.43	171.44	85.72		
		side - interior zone	11.83			47.32	43.42
		side - end zone	17.81			71.24	65.36

			Load (psf)	**Interior Purlins (lb/ft)**	**Exterior Purlins (lb/ft)**	**Exterior Purlin end zone (lbs/ft)**	**End Frame Nodal Load (lbs)**	
							interior side	end zone side
	Longitudinal	roof interior zone	14.89	119.12	59.56	81.14		
		roof end zone	21.43					
		side - interior zone	11.83				1399	1521
		side - end zone	17.81					

Seismic		**Seimic Weight (lbs)**	**Base Shear,V (lbs)**		**Seismic Force, F (lbs)**		**Interior frames (lbs)**	**End Frames (lbs)**
	Transverse	101585	40,634		30,476		7,619	3,809
		Torsional (due to 5% eccentricity)			F1 (lbs)	F2 (lbs)	F3 (lbs)	F4 (lbs)	F5 (lbs)
		M=	48,768	ft-lbs	610	305	0	-305	-610
		Combined Nodal Loads			4,419	7,924	7,619	7,314	3,200
	Longitudinal	101585	40,634		30,476			15,238	
		Torsional (due to 5% eccentricity)			F1 (lbs)	F2 (lbs)			
		M=	25,146	ft-lbs	762	-762			
		Combined Nodal Loads			16,000	14,476			

	Load (psf)	**Interior Purlins (lb/ft)**	**Exterior Purlins (lb/ft)**
Vert.	3.1	25	13

By: JMW Date: 2/22/11
Checked: CR Date: 2/22/11

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PROJECT		SUBJECT
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LOAD COMBINATIONS FOR STORAGE BLDG ANALYSIS (REF: UBC, SECTION 1605.2.1)

The following Loads are not applicable to the bldg frame analysis:

F — there is no fluid or pressure load

F_a — no flood load, not located in a flood plain

H — no earth pressure loads on the frame

L — no live load on the single story frame structure, only roof live loads

R — no rain buildup — the roof is sloped to drain. (a rain on snow load is included in the snow load)

T — no self-restraining forces

LOAD COMBINATIONS CONSIDERED:

		ASCE 7 LC#
1.4D		1
1.2D + .5 L_r	(L_r envelopes bal. snow)	2
1.2D + .5S	(unbalanced snow load)	2
1.2D + 1.6 L_r + .8W	(longitudinal wind)	3
1.2D + 1.6 L_r + .8W	(transverse wind)	3
1.2D + 1.6W + .5 L_r	(long. wind)	4
1.2D + 1.6W + .5 L_r	(trans. wind)	4

PLEASE RECYCLE

By: JMW Date: 2/22/11
Checked: CR Date: 2/22/11

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BY	DATE		
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LOAD COMBINATIONS (CONT.)

1.2D + 1.0E + .2S	(100% TRANS E, 30% LONG E)	5
1.2D + 1.0E + .2S	(30% TRANS E, 100% LONG E)	5
.9D + 1.6W	(trans. wind)	6
.9D + 1.6W	(long. wind)	6
.9D + 1.0E	(100% TRANS E, 30% LONG E)	7
.9D + 1.0E	(30% TRANS E, 100% LONG. E)	7

*	1.2D + 1.0(E_{mh} + E_v) + .2S	(100% trans E, 30% LONG)	#5 w/ overstrength
*	1.2D + 1.0(E_{mh} + E_v) + .2S	(30% trans E, 100% LONG)	#5 w/ overstrength
*	.9D + 1.0(E_{mh} + E_v)	(100% trans E, 30% LONG)	#7 w/ overstrength
*	.9D + 1.0(E_{mh} + E_v)	(30% trans E, 100% LONG)	#7 w/ overstrength

* $E_{mh} = \Omega_0 E$
$\Omega_0 = 3$

} use LOAD COMB 14-17 for Design of shear strength in moment connections per AISC 341-05, Section 11.2a(4)

PLEASE RECYCLE

Attachment B

STAAD-Pro Modeling and Analysis of Storage/Staging Building Structure

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 1	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	

Job Information

	Engineer	Checked	Approved
Name:	JMW	CR	
Date:	01-Feb-11		

Structure Type	SPACE FRAME

Number of Nodes	85	Highest Node	88
Number of Elements	143	Highest Beam	156

Number of Basic Load Cases	10
Number of Combination Load Cases	17

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	LOAD CASE 1 - DEAD LOAD
Primary	2	LOAD CASE 2 - ROOF LIVE LOAD
Primary	3	LOAD CASE 3 - WIND TRANSVERSE
Primary	4	LOAD CASE 4 - WIND LONGITUDINAL
Primary	6	LOAD CASE 6 - SEISMIC TRANSVERSE
Primary	7	LOAD CASE 7 -SEISMIC LONG (Z-DIR)
Primary	8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)
Primary	9	LOAD CASE 9 - BALANCED SNOW LOAD
Primary	27	SEISMIC 5% ECC. TRANSVERSE
Primary	28	SEISMIC 5% ECC LONG
Combination	10	COMBINATION LOAD CASE 10 - ASCE 7,
Combination	11	COMBINATION LOAD CASE 11, ASCE LC
Combination	12	COMBINATION LOAD CASE 12, ASCE LC
Combination	13	COMBINATION LOAD CASE 13, ASCE 7 I
Combination	14	COMBINATION LOAD CASE 14. ASCE 7 I
Combination	17	COMBINATION LOAD CASE 17, ASCE 7 I
Combination	18	COMBINATION LOAD CASE 18, ASCE 7 I
Combination	21	COMBINATION LOAD CASE 21, ASCE 7 I
Combination	22	COMBINATION LOAD CASE 22, ASCE 7 I
Combination	23	COMBINATION LOAD CASE 23, ASCE 7 I
Combination	24	COMBINATION LOAD CASE 24, ASCE 7 I
Combination	25	COMBINATION LOAD CASE 25, ASCE 7 I
Combination	26	COMBINATION LOAD CASE 26, ASCE 7 I
Combination	29	ASCE 7, LC #5, TRANS, OVERSTRENGT
Combination	30	ASCE 7, LC#5 LONG, OVERSTRENGTH
Combination	31	ASCE 7, LC #7, TRANS, OVERSTRENGT
Combination	32	ASCE 7, LC #7, LONG, OVERSTRENGTH

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	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
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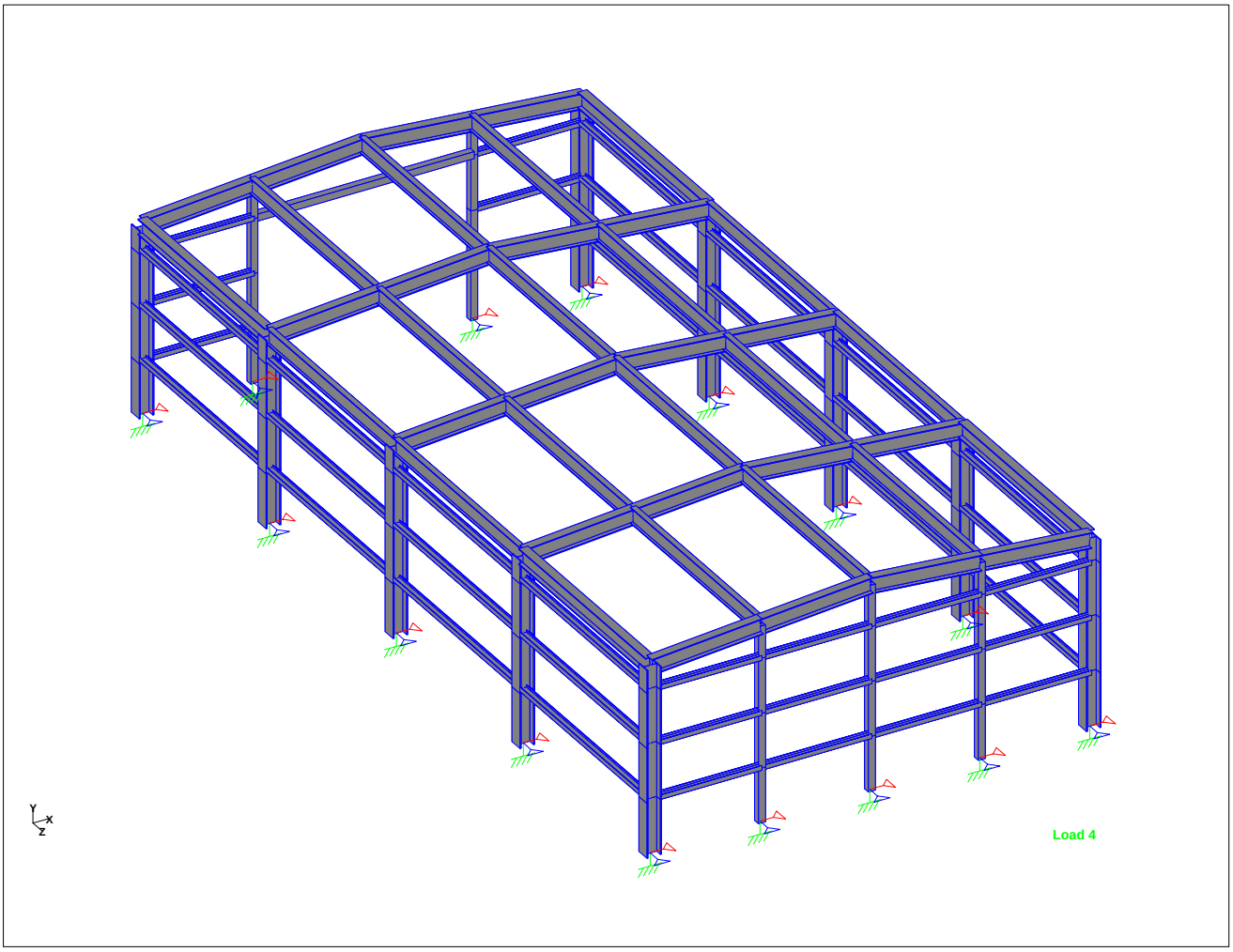
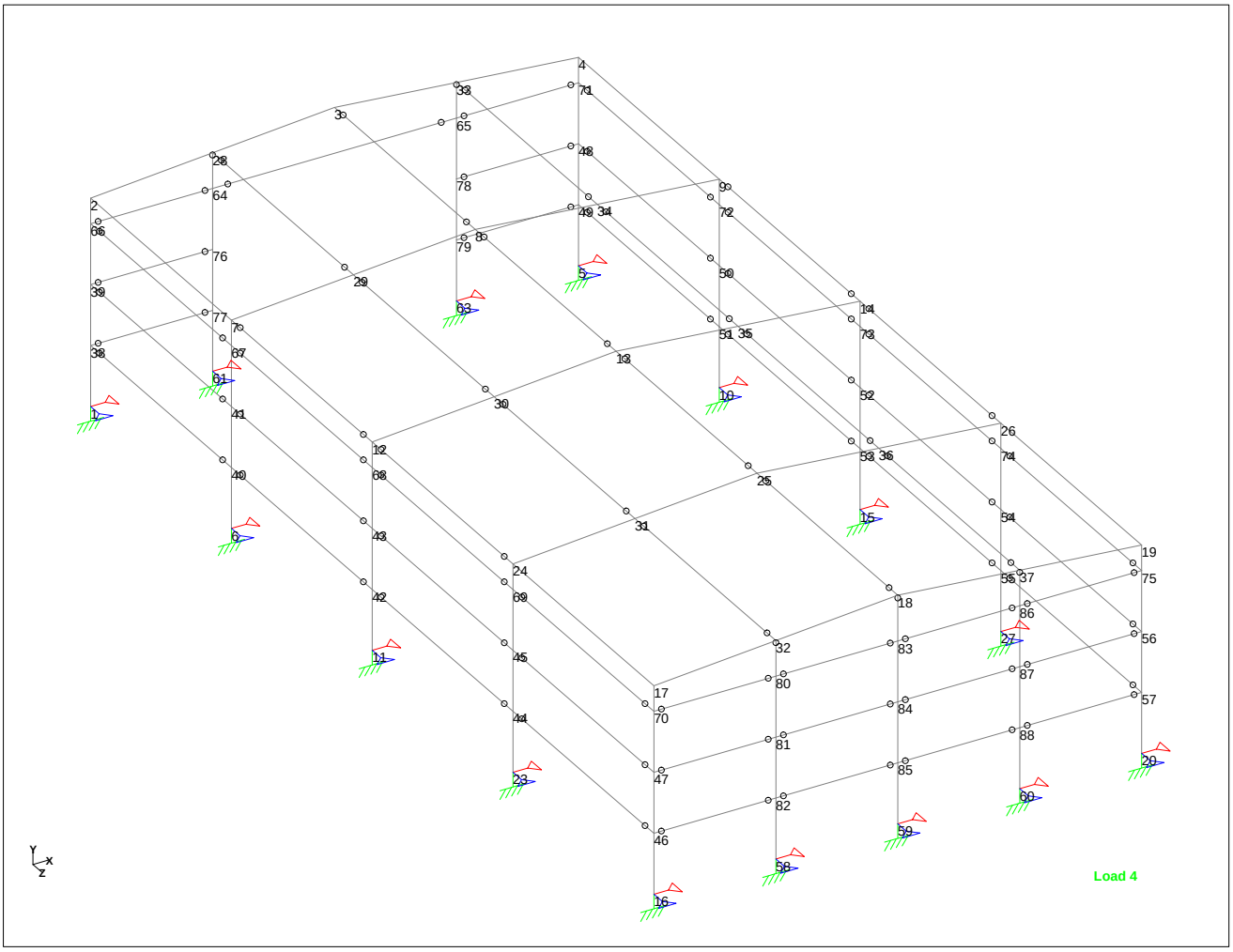


Rendered Model

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 3	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Node Numbers

Nodes

Node	X (ft)	Y (ft)	Z (ft)
1	0.000	0.000	0.000
2	0.000	13.670	0.000
3	16.000	15.000	0.000
4	32.000	13.670	0.000
5	32.000	0.000	0.000
6	0.000	0.000	16.000
7	0.000	13.670	16.000
8	16.000	15.000	16.000
9	32.000	13.670	16.000
10	32.000	0.000	16.000
11	0.000	0.000	31.999
12	0.000	13.670	31.999

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 4	Rev
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Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
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Nodes Cont...

Node	X (ft)	Y (ft)	Z (ft)
13	16.000	15.000	31.999
14	32.000	13.670	31.999
15	32.000	0.000	31.999
16	0.000	0.000	63.999
17	0.000	13.670	63.999
18	16.000	15.000	63.999
19	32.000	13.670	63.999
20	32.000	0.000	63.999
23	0.000	0.000	47.999
24	0.000	13.670	47.999
25	16.000	15.000	47.999
26	32.000	13.670	47.999
27	32.000	0.000	47.999
28	8.000	14.335	0.000
29	8.000	14.335	16.000
30	8.000	14.335	31.999
31	8.000	14.335	47.999
32	8.000	14.335	63.999
33	24.000	14.335	0.000
34	24.000	14.335	16.000
35	24.000	14.335	31.999
36	24.000	14.335	47.999
37	24.000	14.335	63.999
38	0.000	4.000	0.000
39	0.000	8.000	0.000
40	0.000	4.000	16.000
41	0.000	8.000	16.000
42	0.000	4.000	31.999
43	0.000	8.000	31.999
44	0.000	4.000	47.999
45	0.000	8.000	47.999
46	0.000	4.000	63.999
47	0.000	8.000	63.999
48	32.000	8.000	0.000
49	32.000	4.000	0.000
50	32.000	8.000	16.000
51	32.000	4.000	16.000
52	32.000	8.000	31.999
53	32.000	4.000	31.999
54	32.000	8.000	47.999
55	32.000	4.000	47.999
56	32.000	8.000	63.999
57	32.000	4.000	63.999
58	8.000	0.000	63.999
59	16.000	0.000	63.999

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	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
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Nodes Cont...

Node	X (ft)	Y (ft)	Z (ft)
60	24.000	0.000	63.999
61	8.000	0.000	0.000
63	24.000	0.000	0.000
64	8.000	12.002	0.000
65	24.000	12.002	0.000
66	0.000	12.000	0.000
67	0.000	12.000	16.000
68	0.000	12.000	31.999
69	0.000	12.000	47.999
70	0.000	12.000	63.999
71	32.000	12.003	0.000
72	32.000	12.003	16.000
73	32.000	12.003	31.999
74	32.000	12.003	47.999
75	32.000	12.003	63.999
76	8.000	8.001	0.000
77	8.000	4.001	0.000
78	24.000	8.001	0.000
79	24.000	4.001	0.000
80	8.000	12.000	63.999
81	8.000	8.000	63.999
82	8.000	4.000	63.999
83	16.000	12.000	63.999
84	16.000	8.000	63.999
85	16.000	4.000	63.999
86	24.000	12.000	63.999
87	24.000	8.000	63.999
88	24.000	4.000	63.999

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 6	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
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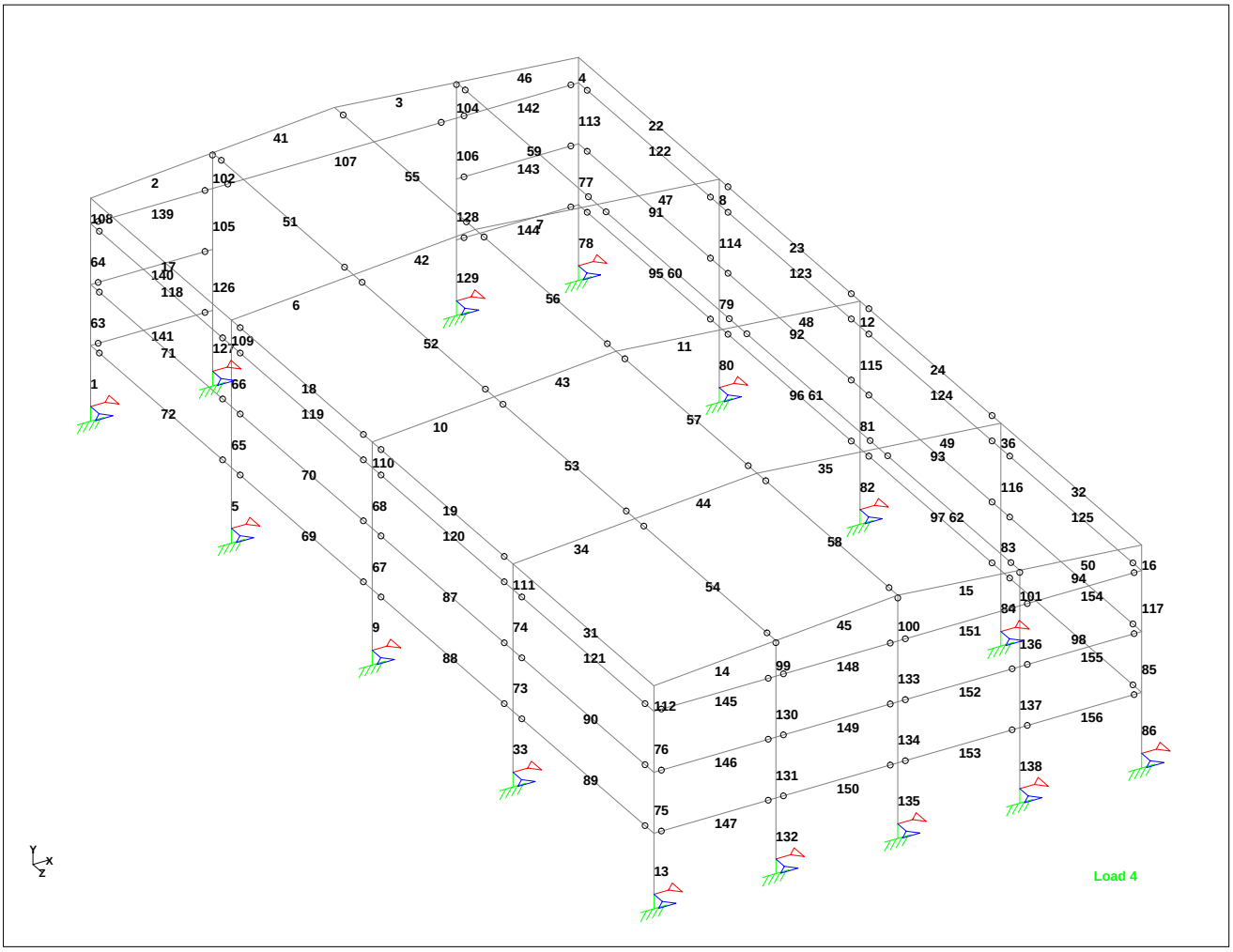
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Beam Numbers

Beams

Beam	Node A	Node B	Length (ft)	Property	β (degrees)
1	1	38	4.000	5	0
2	2	28	8.028	1	0
3	3	33	8.028	1	0
4	4	71	1.667	5	0
5	6	40	4.000	5	0
6	7	29	8.028	1	0
7	8	34	8.028	1	0
8	9	72	1.667	5	0
9	11	42	4.000	5	0
10	12	30	8.028	1	0
11	13	35	8.028	1	0
12	14	73	1.667	5	0

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 7	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
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Beams Cont...

Beam	Node A	Node B	Length (ft)	Property	β (degrees)
13	16	46	4.000	5	0
14	17	32	8.028	1	0
15	18	37	8.028	1	0
16	19	75	1.667	5	0
17	2	7	16.000	6	0
18	7	12	16.000	2	0
19	12	24	16.000	2	0
22	4	9	16.000	6	0
23	9	14	16.000	2	0
24	14	26	16.000	2	0
31	24	17	16.000	6	0
32	26	19	16.000	6	0
33	23	44	4.000	5	0
34	24	31	8.028	1	0
35	25	36	8.028	1	0
36	26	74	1.667	5	0
41	28	3	8.028	1	0
42	29	8	8.028	1	0
43	30	13	8.028	1	0
44	31	25	8.028	1	0
45	32	18	8.028	1	0
46	33	4	8.028	1	0
47	34	9	8.028	1	0
48	35	14	8.028	1	0
49	36	26	8.028	1	0
50	37	19	8.028	1	0
51	28	29	16.000	2	0
52	29	30	16.000	2	0
53	30	31	16.000	2	0
54	31	32	16.000	2	0
55	3	8	16.000	2	0
56	8	13	16.000	2	0
57	13	25	16.000	2	0
58	25	18	16.000	2	0
59	33	34	16.000	2	0
60	34	35	16.000	2	0
61	35	36	16.000	2	0
62	36	37	16.000	2	0
63	38	39	4.000	5	0
64	39	66	4.000	5	0
65	40	41	4.000	5	0
66	41	67	4.000	5	0
67	42	43	4.000	5	0
68	43	68	4.000	5	0
69	40	42	16.000	3	90

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 8	Rev
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Job Title LANL TRU Waste Facility	Ref		
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Beams Cont...

Beam	Node A	Node B	Length (ft)	Property	β (degrees)
70	41	43	16.000	3	90
71	39	41	16.000	3	90
72	38	40	16.000	3	90
73	44	45	4.000	5	0
74	45	69	4.000	5	0
75	46	47	4.000	5	0
76	47	70	4.000	5	0
77	48	49	4.000	5	0
78	49	5	4.000	5	0
79	50	51	4.000	5	0
80	51	10	4.000	5	0
81	52	53	4.000	5	0
82	53	15	4.000	5	0
83	54	55	4.000	5	0
84	55	27	4.000	5	0
85	56	57	4.000	5	0
86	57	20	4.000	5	0
87	43	45	16.000	3	90
88	42	44	16.000	3	90
89	44	46	16.000	3	90
90	45	47	16.000	3	90
91	48	50	16.000	3	90
92	50	52	16.000	3	90
93	52	54	16.000	3	90
94	54	56	16.000	3	90
95	49	51	16.000	3	90
96	51	53	16.000	3	90
97	53	55	16.000	3	90
98	55	57	16.000	3	90
99	32	80	2.335	4	0
100	18	83	3.000	4	0
101	37	86	2.335	4	0
102	28	64	2.333	4	0
104	33	65	2.333	4	0
105	64	76	4.001	4	0
106	65	78	4.001	4	0
107	64	65	16.000	4	0
108	66	2	1.670	5	0
109	67	7	1.670	5	0
110	68	12	1.670	5	0
111	69	24	1.670	5	0
112	70	17	1.670	5	0
113	71	48	4.003	5	0
114	72	50	4.003	5	0
115	73	52	4.003	5	0

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Beams Cont...

Beam	Node A	Node B	Length (ft)	Property	β (degrees)
116	74	54	4.003	5	0
117	75	56	4.003	5	0
118	66	67	16.000	3	90
119	67	68	16.000	3	90
120	68	69	16.000	3	90
121	69	70	16.000	3	90
122	71	72	16.000	3	90
123	72	73	16.000	3	90
124	73	74	16.000	3	90
125	74	75	16.000	3	90
126	76	77	4.001	4	0
127	77	61	4.001	4	0
128	78	79	4.001	4	0
129	79	63	4.001	4	0
130	80	81	4.000	4	0
131	81	82	4.000	4	0
132	82	58	4.000	4	0
133	83	84	4.000	4	0
134	84	85	4.000	4	0
135	85	59	4.000	4	0
136	86	87	4.000	4	0
137	87	88	4.000	4	0
138	88	60	4.000	4	0
139	66	64	8.000	3	90
140	39	76	8.000	3	90
141	38	77	8.000	3	90
142	65	71	8.000	3	90
143	78	48	8.000	3	90
144	79	49	8.000	3	90
145	70	80	8.000	3	90
146	47	81	8.000	3	90
147	46	82	8.000	3	90
148	80	83	8.000	3	90
149	81	84	8.000	3	90
150	82	85	8.000	3	90
151	83	86	8.000	3	90
152	84	87	8.000	3	90
153	85	88	8.000	3	90
154	86	75	8.000	3	90
155	87	56	8.000	3	90
156	88	57	8.000	3	90

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	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
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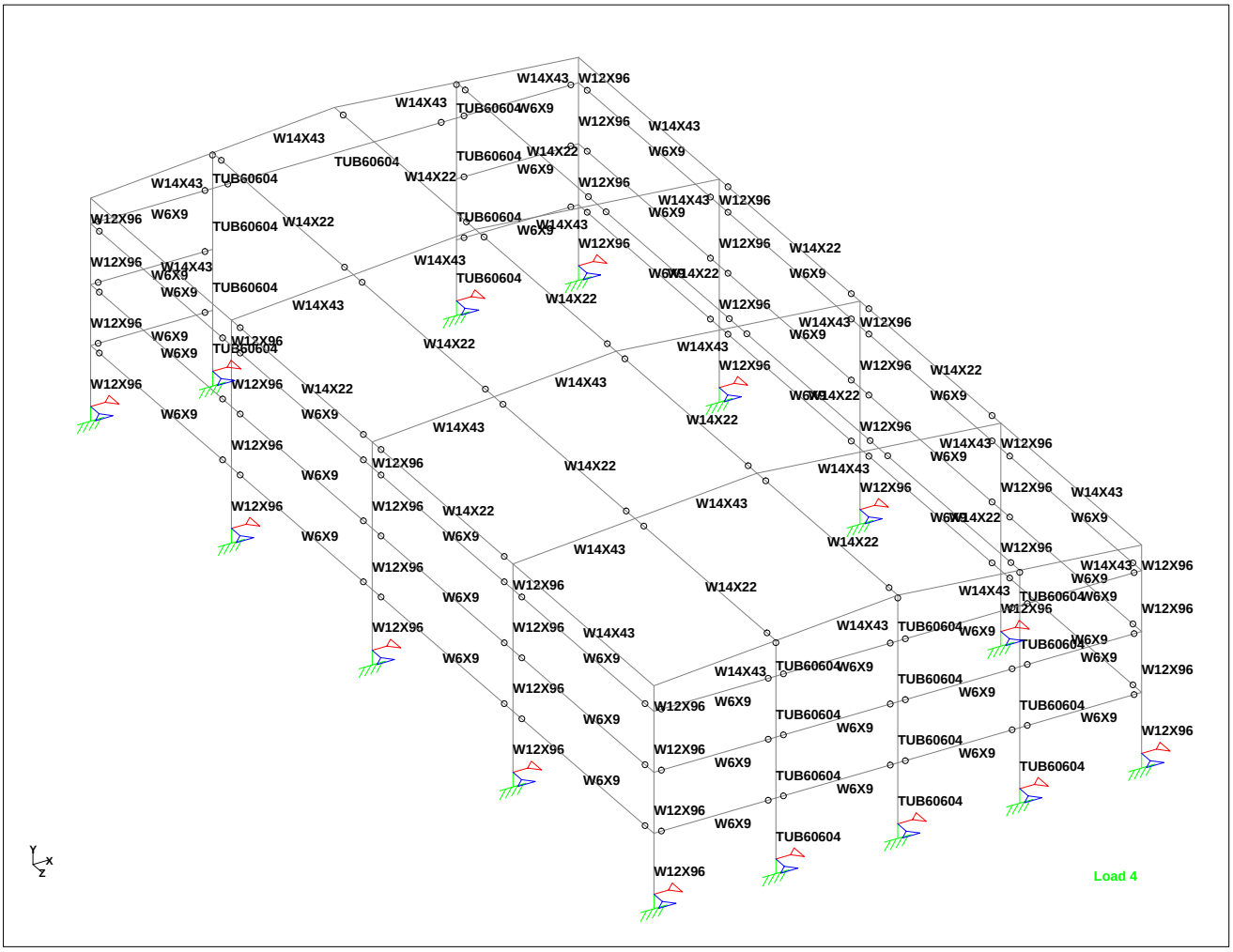

Member Properties

Section Properties

Prop	Section	Area (in^2)	I_{yy} (in^4)	I_{zz} (in^4)	J (in^4)	Material
1	W14X43	12.600	45.200	428.000	0.918	STEEL
2	W14X22	6.490	7.000	199.000	0.180	STEEL
3	W6X9	2.680	2.200	16.400	0.035	STEEL
4	TUB60604	5.590	30.300	30.300	47.527	STEEL
5	W12X96	28.200	270.000	833.000	6.565	STEEL
6	W14X53	15.600	57.700	541.000	1.769	STEEL

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 11	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
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Materials

Mat	Name	E (kip/in^2)	ν	Density (kip/in^3)	α (/°F)
1	STEEL	29E+3	0.300	0.000	6E -6
2	STAINLESSSTEEL	28E+3	0.300	0.000	10E -6
3	ALUMINUM	10E+3	0.330	0.000	13E -6
4	CONCRETE	3.15E+3	0.170	0.000	5E -6

Supports

Node	X (kip/in)	Y (kip/in)	Z (kip/in)	rX (kip-ft/deg)	rY (kip-ft/deg)	rZ (kip-ft/deg)
1	Fixed	Fixed	Fixed	-	Fixed	-
5	Fixed	Fixed	Fixed	-	Fixed	-
6	Fixed	Fixed	Fixed	-	Fixed	-
10	Fixed	Fixed	Fixed	-	Fixed	-
11	Fixed	Fixed	Fixed	-	Fixed	-
15	Fixed	Fixed	Fixed	-	Fixed	-
16	Fixed	Fixed	Fixed	-	Fixed	-
20	Fixed	Fixed	Fixed	-	Fixed	-
23	Fixed	Fixed	Fixed	-	Fixed	-
27	Fixed	Fixed	Fixed	-	Fixed	-
58	Fixed	Fixed	Fixed	-	Fixed	-
59	Fixed	Fixed	Fixed	-	Fixed	-
60	Fixed	Fixed	Fixed	-	Fixed	-
61	Fixed	Fixed	Fixed	-	Fixed	-
63	Fixed	Fixed	Fixed	-	Fixed	-

Releases

Beam ends not shown in this table are fixed in all directions.

Beam	Node	x	y	z	rx	ry	rz
18	7	Fixed	Fixed	Fixed	Fixed	Pin	Pin
18	12	Fixed	Fixed	Fixed	Fixed	Pin	Pin
19	12	Fixed	Fixed	Fixed	Fixed	Pin	Pin
19	24	Fixed	Fixed	Fixed	Fixed	Pin	Pin
23	9	Fixed	Fixed	Fixed	Fixed	Pin	Pin
23	14	Fixed	Fixed	Fixed	Fixed	Pin	Pin
24	14	Fixed	Fixed	Fixed	Fixed	Pin	Pin
24	26	Fixed	Fixed	Fixed	Fixed	Pin	Pin
51	28	Fixed	Fixed	Fixed	Fixed	Pin	Pin
51	29	Fixed	Fixed	Fixed	Fixed	Pin	Pin
52	29	Fixed	Fixed	Fixed	Fixed	Pin	Pin
52	30	Fixed	Fixed	Fixed	Fixed	Pin	Pin
53	30	Fixed	Fixed	Fixed	Fixed	Pin	Pin
53	31	Fixed	Fixed	Fixed	Fixed	Pin	Pin

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 12	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	

Releases Cont...

Beam	Node	x	y	z	rx	ry	rz
54	31	Fixed	Fixed	Fixed	Fixed	Pin	Pin
54	32	Fixed	Fixed	Fixed	Fixed	Pin	Pin
55	3	Fixed	Fixed	Fixed	Fixed	Pin	Pin
55	8	Fixed	Fixed	Fixed	Fixed	Pin	Pin
56	8	Fixed	Fixed	Fixed	Fixed	Pin	Pin
56	13	Fixed	Fixed	Fixed	Fixed	Pin	Pin
57	13	Fixed	Fixed	Fixed	Fixed	Pin	Pin
57	25	Fixed	Fixed	Fixed	Fixed	Pin	Pin
58	25	Fixed	Fixed	Fixed	Fixed	Pin	Pin
58	18	Fixed	Fixed	Fixed	Fixed	Pin	Pin
59	33	Fixed	Fixed	Fixed	Fixed	Pin	Pin
59	34	Fixed	Fixed	Fixed	Fixed	Pin	Pin
60	34	Fixed	Fixed	Fixed	Fixed	Pin	Pin
60	35	Fixed	Fixed	Fixed	Fixed	Pin	Pin
61	35	Fixed	Fixed	Fixed	Fixed	Pin	Pin
61	36	Fixed	Fixed	Fixed	Fixed	Pin	Pin
62	36	Fixed	Fixed	Fixed	Fixed	Pin	Pin
62	37	Fixed	Fixed	Fixed	Fixed	Pin	Pin
69	40	Fixed	Fixed	Fixed	Fixed	Pin	Pin
69	42	Fixed	Fixed	Fixed	Fixed	Pin	Pin
70	41	Fixed	Fixed	Fixed	Fixed	Pin	Pin
70	43	Fixed	Fixed	Fixed	Fixed	Pin	Pin
71	39	Fixed	Fixed	Fixed	Fixed	Pin	Pin
71	41	Fixed	Fixed	Fixed	Fixed	Pin	Pin
72	38	Fixed	Fixed	Fixed	Fixed	Pin	Pin
72	40	Fixed	Fixed	Fixed	Fixed	Pin	Pin
87	43	Fixed	Fixed	Fixed	Fixed	Pin	Pin
87	45	Fixed	Fixed	Fixed	Fixed	Pin	Pin
88	42	Fixed	Fixed	Fixed	Fixed	Pin	Pin
88	44	Fixed	Fixed	Fixed	Fixed	Pin	Pin
89	44	Fixed	Fixed	Fixed	Fixed	Pin	Pin
89	46	Fixed	Fixed	Fixed	Fixed	Pin	Pin
90	45	Fixed	Fixed	Fixed	Fixed	Pin	Pin
90	47	Fixed	Fixed	Fixed	Fixed	Pin	Pin
91	48	Fixed	Fixed	Fixed	Fixed	Pin	Pin
91	50	Fixed	Fixed	Fixed	Fixed	Pin	Pin
92	50	Fixed	Fixed	Fixed	Fixed	Pin	Pin
92	52	Fixed	Fixed	Fixed	Fixed	Pin	Pin
93	52	Fixed	Fixed	Fixed	Fixed	Pin	Pin
93	54	Fixed	Fixed	Fixed	Fixed	Pin	Pin
94	54	Fixed	Fixed	Fixed	Fixed	Pin	Pin
94	56	Fixed	Fixed	Fixed	Fixed	Pin	Pin
95	49	Fixed	Fixed	Fixed	Fixed	Pin	Pin
95	51	Fixed	Fixed	Fixed	Fixed	Pin	Pin
96	51	Fixed	Fixed	Fixed	Fixed	Pin	Pin

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Releases Cont...

Beam	Node	x	y	z	rx	ry	rz
96	53	Fixed	Fixed	Fixed	Fixed	Pin	Pin
97	53	Fixed	Fixed	Fixed	Fixed	Pin	Pin
97	55	Fixed	Fixed	Fixed	Fixed	Pin	Pin
98	55	Fixed	Fixed	Fixed	Fixed	Pin	Pin
98	57	Fixed	Fixed	Fixed	Fixed	Pin	Pin
99	32	Slide	Fixed	Fixed	Fixed	Fixed	Pin
100	18	Slide	Fixed	Fixed	Fixed	Fixed	Pin
101	37	Slide	Fixed	Fixed	Fixed	Fixed	Pin
102	28	Slide	Fixed	Fixed	Fixed	Fixed	Pin
104	33	Slide	Fixed	Fixed	Fixed	Fixed	Pin
107	64	Fixed	Fixed	Fixed	Fixed	Pin	Pin
107	65	Fixed	Fixed	Fixed	Fixed	Pin	Pin
118	66	Fixed	Fixed	Fixed	Fixed	Pin	Pin
118	67	Fixed	Fixed	Fixed	Fixed	Pin	Pin
119	67	Fixed	Fixed	Fixed	Fixed	Pin	Pin
119	68	Fixed	Fixed	Fixed	Fixed	Pin	Pin
120	68	Fixed	Fixed	Fixed	Fixed	Pin	Pin
120	69	Fixed	Fixed	Fixed	Fixed	Pin	Pin
121	69	Fixed	Fixed	Fixed	Fixed	Pin	Pin
121	70	Fixed	Fixed	Fixed	Fixed	Pin	Pin
122	71	Fixed	Fixed	Fixed	Fixed	Pin	Pin
122	72	Fixed	Fixed	Fixed	Fixed	Pin	Pin
123	72	Fixed	Fixed	Fixed	Fixed	Pin	Pin
123	73	Fixed	Fixed	Fixed	Fixed	Pin	Pin
124	73	Fixed	Fixed	Fixed	Fixed	Pin	Pin
124	74	Fixed	Fixed	Fixed	Fixed	Pin	Pin
125	74	Fixed	Fixed	Fixed	Fixed	Pin	Pin
125	75	Fixed	Fixed	Fixed	Fixed	Pin	Pin
139	66	Fixed	Fixed	Fixed	Fixed	Pin	Pin
139	64	Fixed	Fixed	Fixed	Fixed	Pin	Pin
140	39	Fixed	Fixed	Fixed	Fixed	Pin	Pin
140	76	Fixed	Fixed	Fixed	Fixed	Pin	Pin
141	38	Fixed	Fixed	Fixed	Fixed	Pin	Pin
141	77	Fixed	Fixed	Fixed	Fixed	Pin	Pin
142	65	Fixed	Fixed	Fixed	Fixed	Pin	Pin
142	71	Fixed	Fixed	Fixed	Fixed	Pin	Pin
143	78	Fixed	Fixed	Fixed	Fixed	Pin	Pin
143	48	Fixed	Fixed	Fixed	Fixed	Pin	Pin
144	79	Fixed	Fixed	Fixed	Fixed	Pin	Pin
144	49	Fixed	Fixed	Fixed	Fixed	Pin	Pin
145	70	Fixed	Fixed	Fixed	Fixed	Pin	Pin
145	80	Fixed	Fixed	Fixed	Fixed	Pin	Pin
146	47	Fixed	Fixed	Fixed	Fixed	Pin	Pin
146	81	Fixed	Fixed	Fixed	Fixed	Pin	Pin
147	46	Fixed	Fixed	Fixed	Fixed	Pin	Pin

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Releases Cont...

Beam	Node	x	y	z	rx	ry	rz
147	82	Fixed	Fixed	Fixed	Fixed	Pin	Pin
148	80	Fixed	Fixed	Fixed	Fixed	Pin	Pin
148	83	Fixed	Fixed	Fixed	Fixed	Pin	Pin
149	81	Fixed	Fixed	Fixed	Fixed	Pin	Pin
149	84	Fixed	Fixed	Fixed	Fixed	Pin	Pin
150	82	Fixed	Fixed	Fixed	Fixed	Pin	Pin
150	85	Fixed	Fixed	Fixed	Fixed	Pin	Pin
151	83	Fixed	Fixed	Fixed	Fixed	Pin	Pin
151	86	Fixed	Fixed	Fixed	Fixed	Pin	Pin
152	84	Fixed	Fixed	Fixed	Fixed	Pin	Pin
152	87	Fixed	Fixed	Fixed	Fixed	Pin	Pin
153	85	Fixed	Fixed	Fixed	Fixed	Pin	Pin
153	88	Fixed	Fixed	Fixed	Fixed	Pin	Pin
154	86	Fixed	Fixed	Fixed	Fixed	Pin	Pin
154	75	Fixed	Fixed	Fixed	Fixed	Pin	Pin
155	87	Fixed	Fixed	Fixed	Fixed	Pin	Pin
155	56	Fixed	Fixed	Fixed	Fixed	Pin	Pin
156	88	Fixed	Fixed	Fixed	Fixed	Pin	Pin
156	57	Fixed	Fixed	Fixed	Fixed	Pin	Pin

Basic Load Cases

Number	Name
1	LOAD CASE 1 - DEAD LOAD
2	LOAD CASE 2 - ROOF LIVE LOAD
3	LOAD CASE 3 - WIND TRANSVERSE
4	LOAD CASE 4 - WIND LONGITUDINAL
6	LOAD CASE 6 - SEISMIC TRANSVERSE
7	LOAD CASE 7 -SEISMIC LONG (Z-DIR)
8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)
9	LOAD CASE 9 - BALANCED SNOW LOAD
27	SEISMIC 5% ECC. TRANSVERSE
28	SEISMIC 5% ECC LONG

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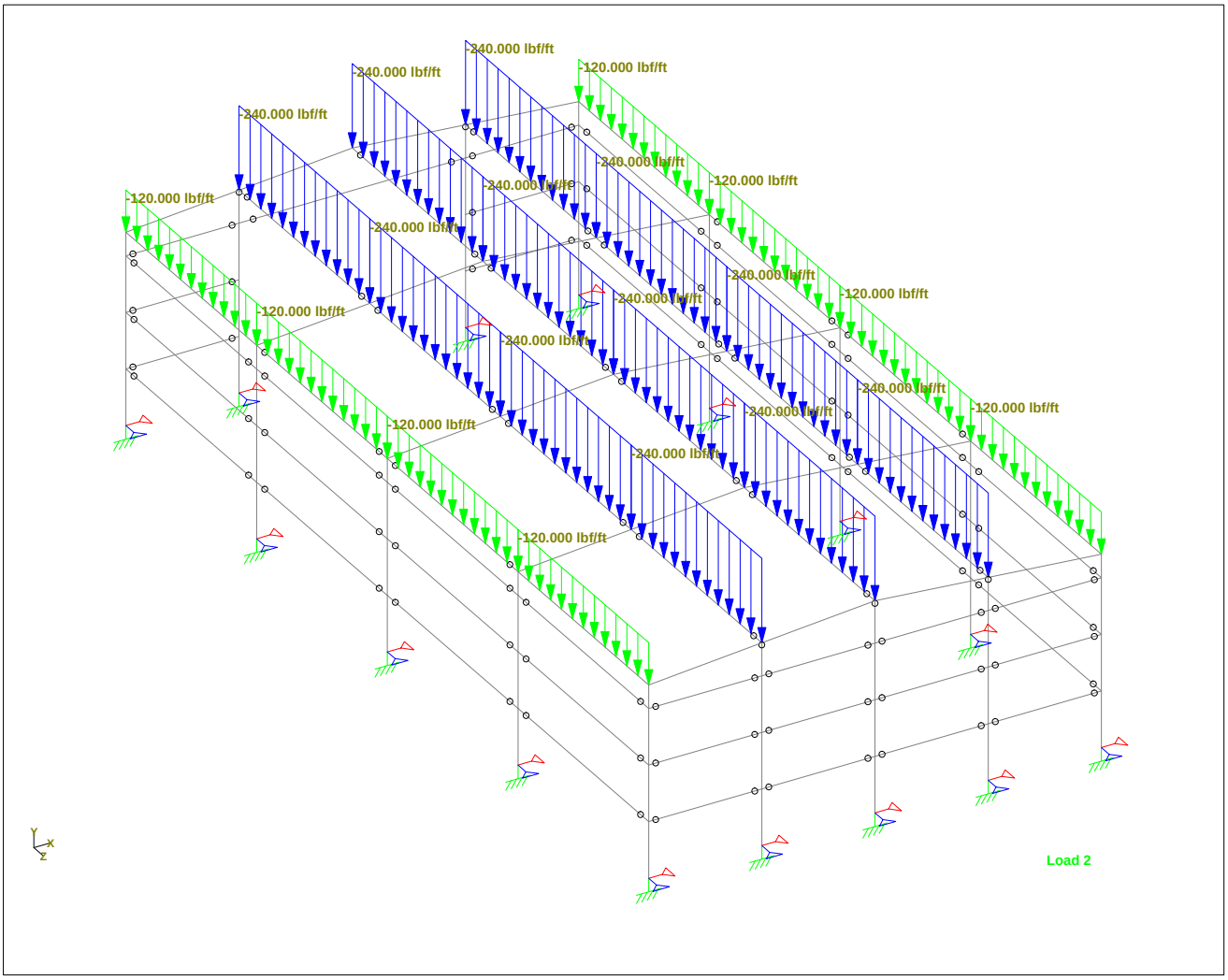

Roof Live Load

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Job Title LANL TRU Waste Facility	Ref		
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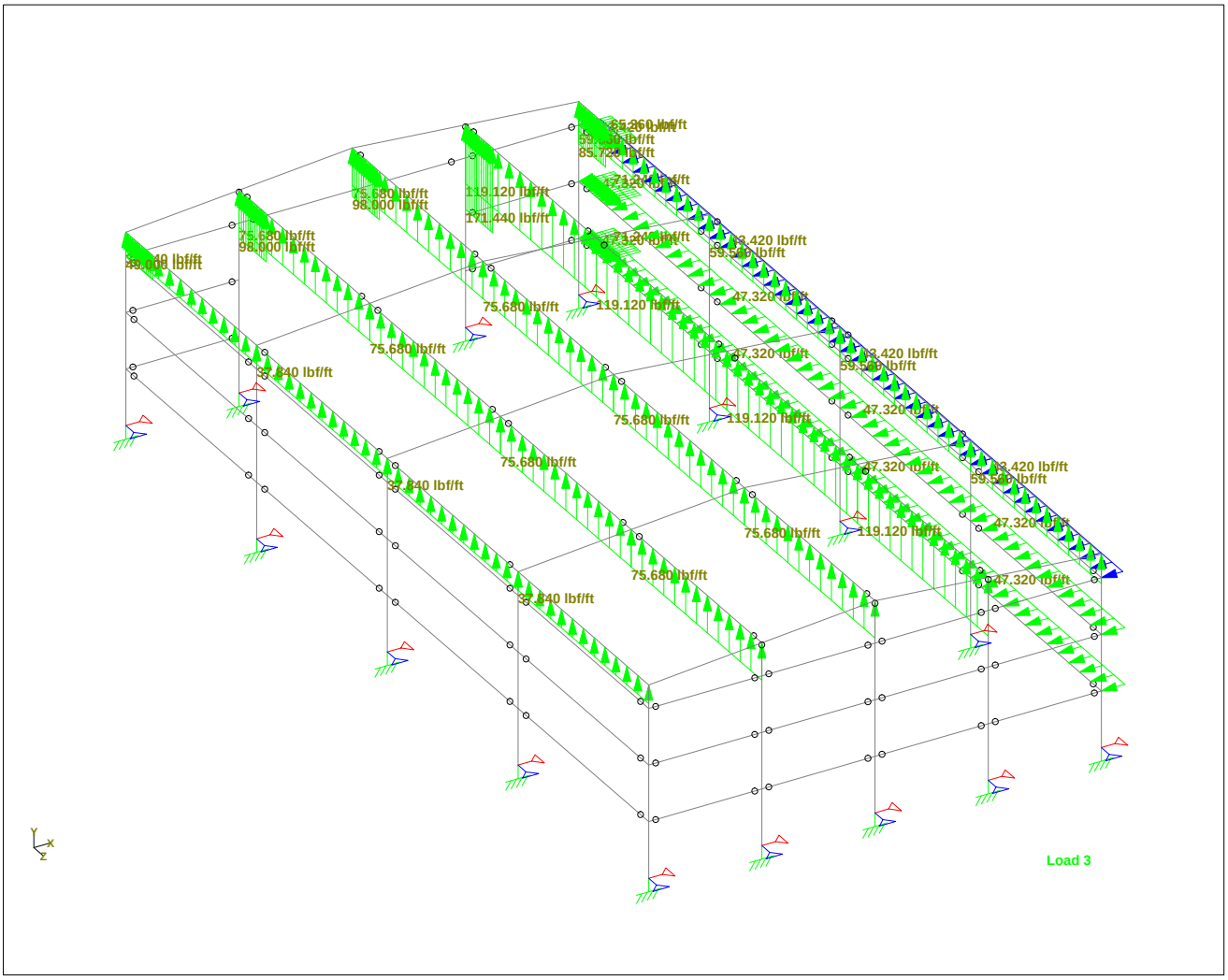
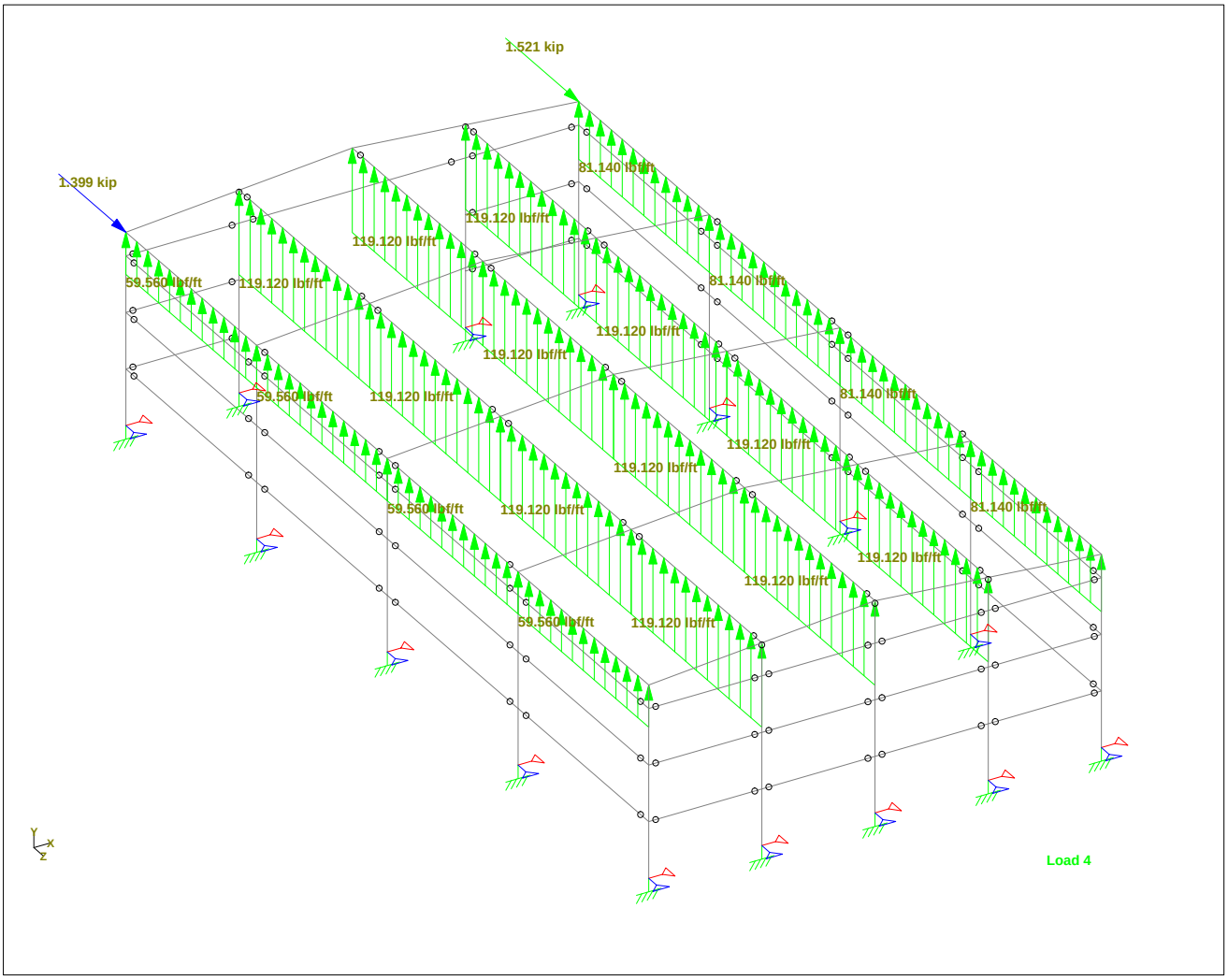


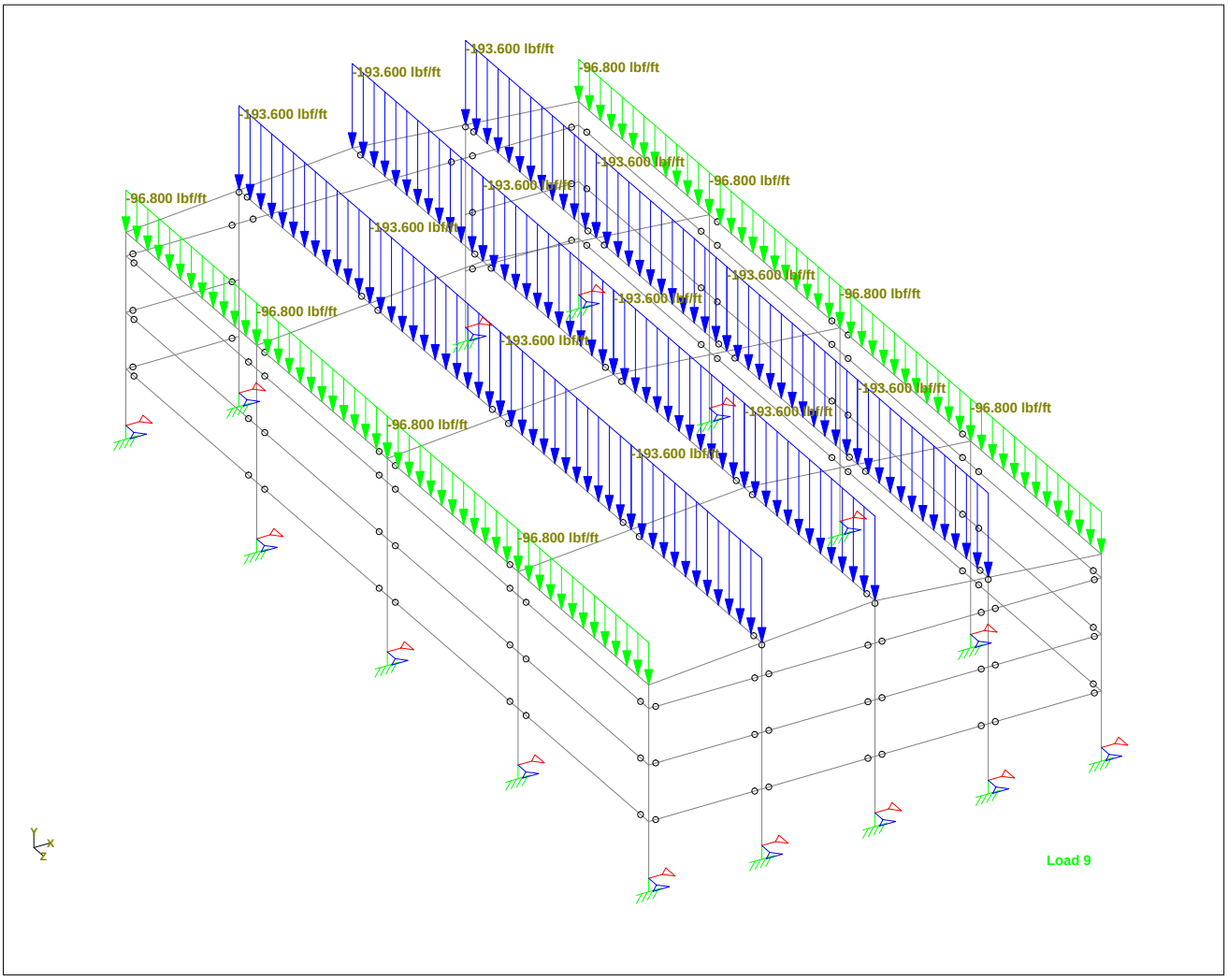
Transverse Wind Load

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 17	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Longitudinal Wind Load

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 18	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Balanced Snow Load

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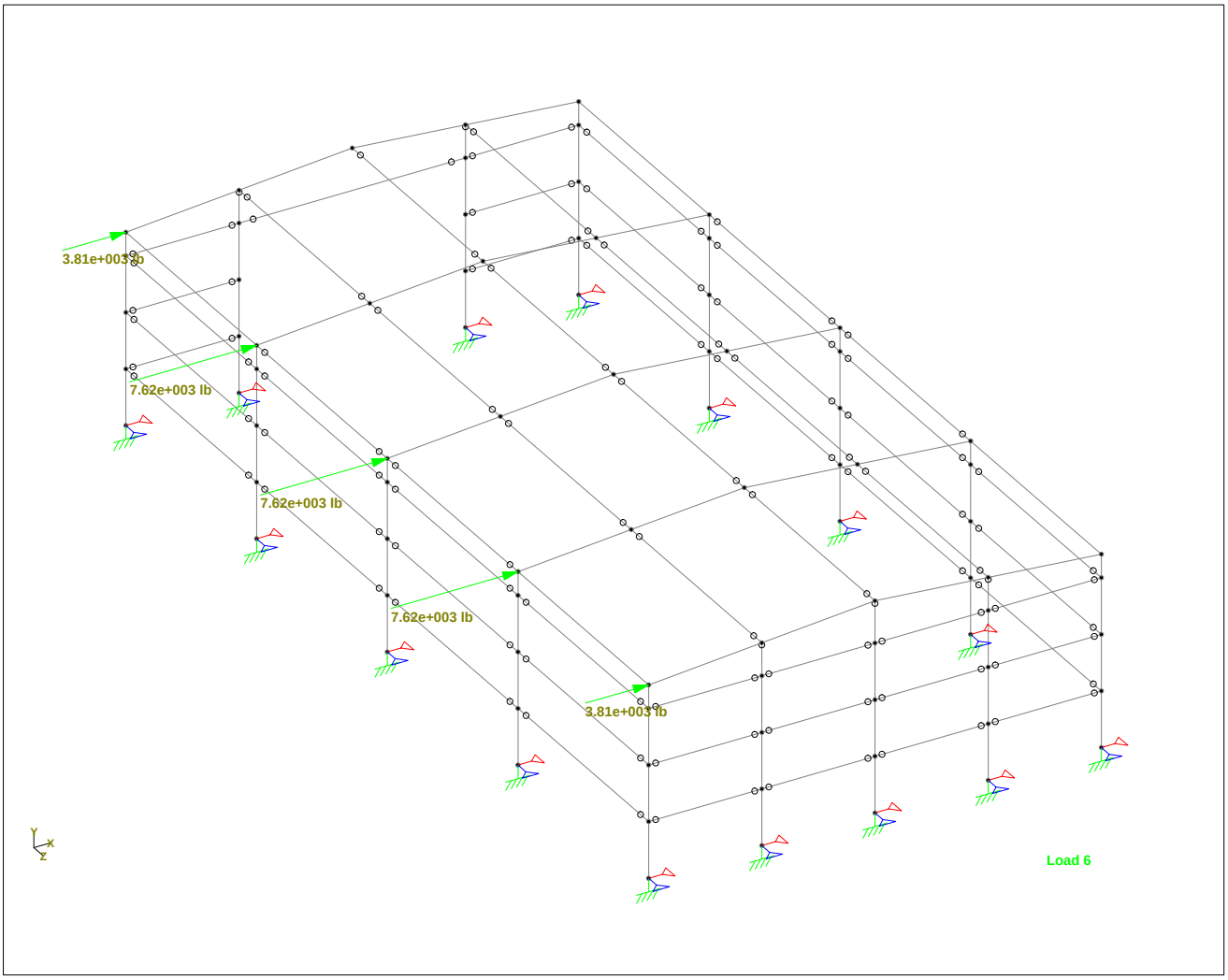
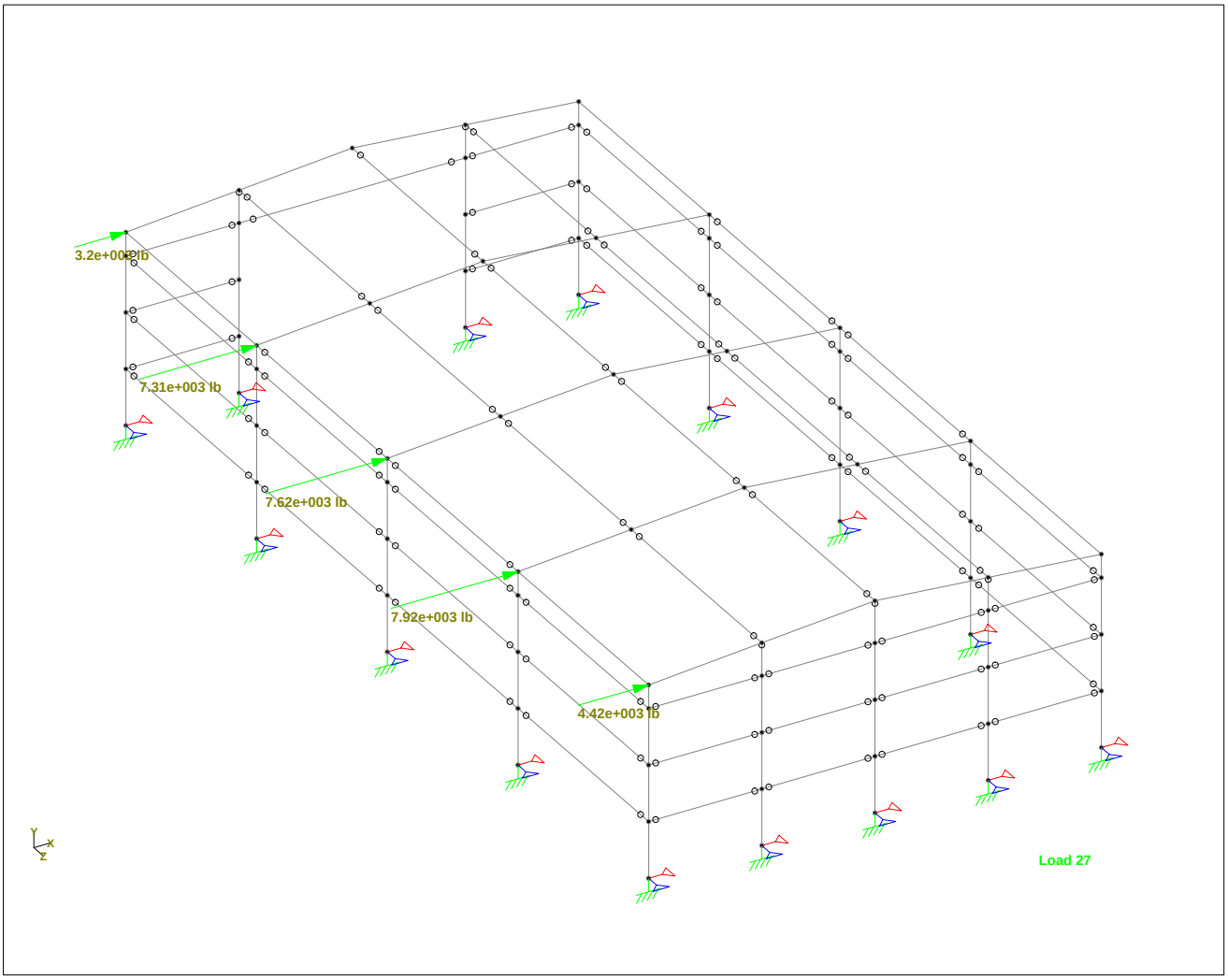
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Transverse Seismic Load

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 20	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Transverse Seismic Loads with 5% Eccentricity

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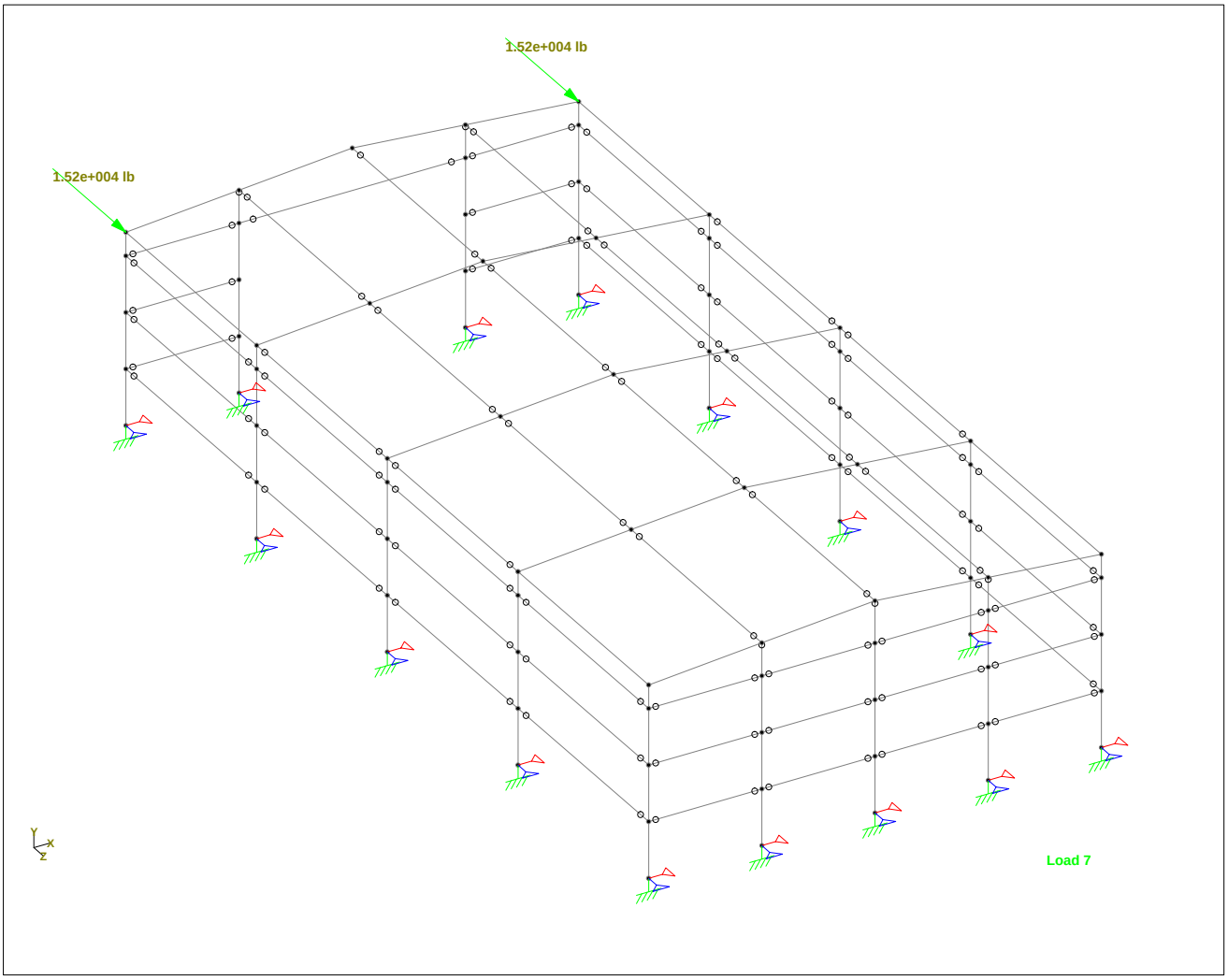
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Longitudinal Seismic Load

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Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
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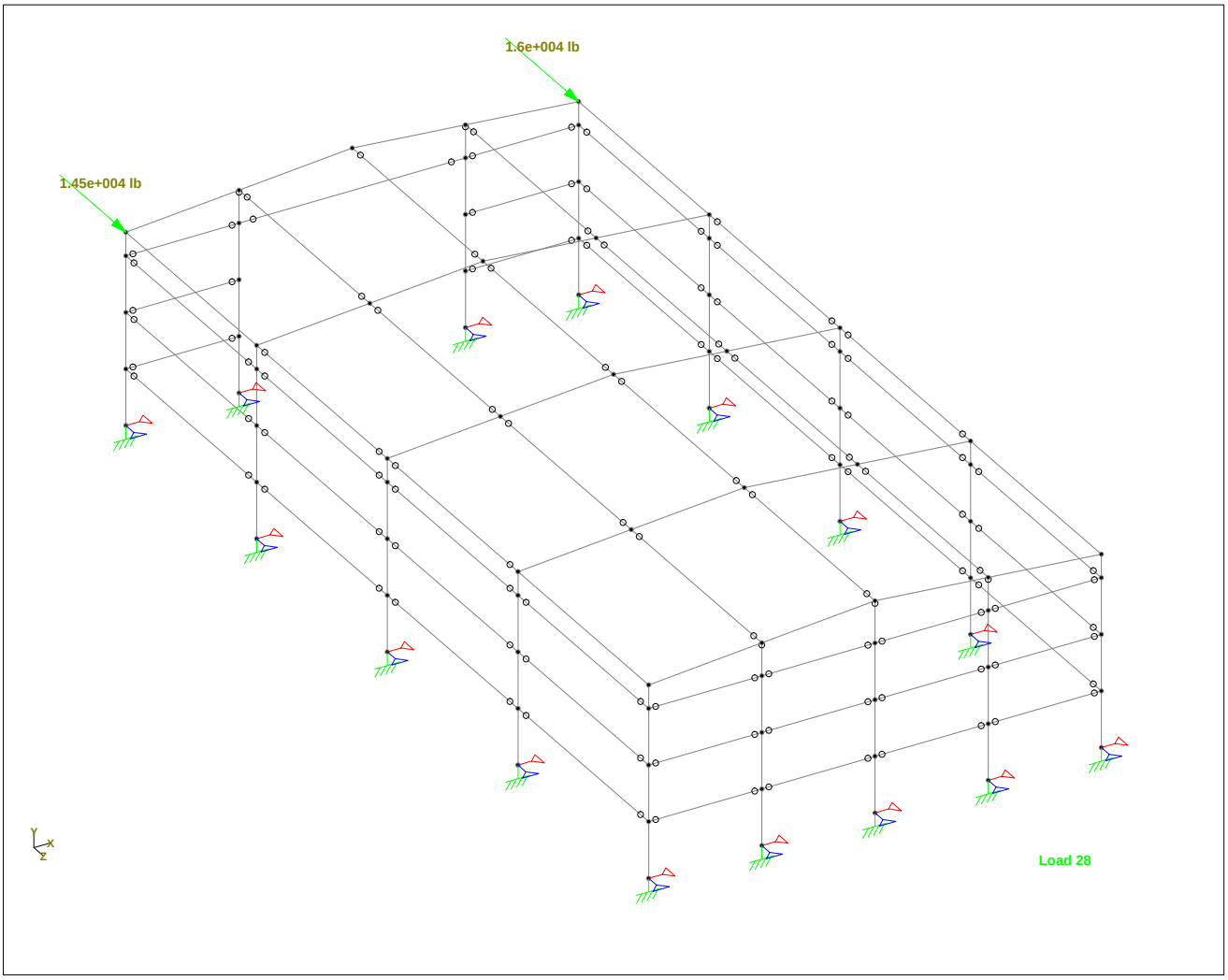

Longitudinal Seismic Load with 5% eccentricity

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Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
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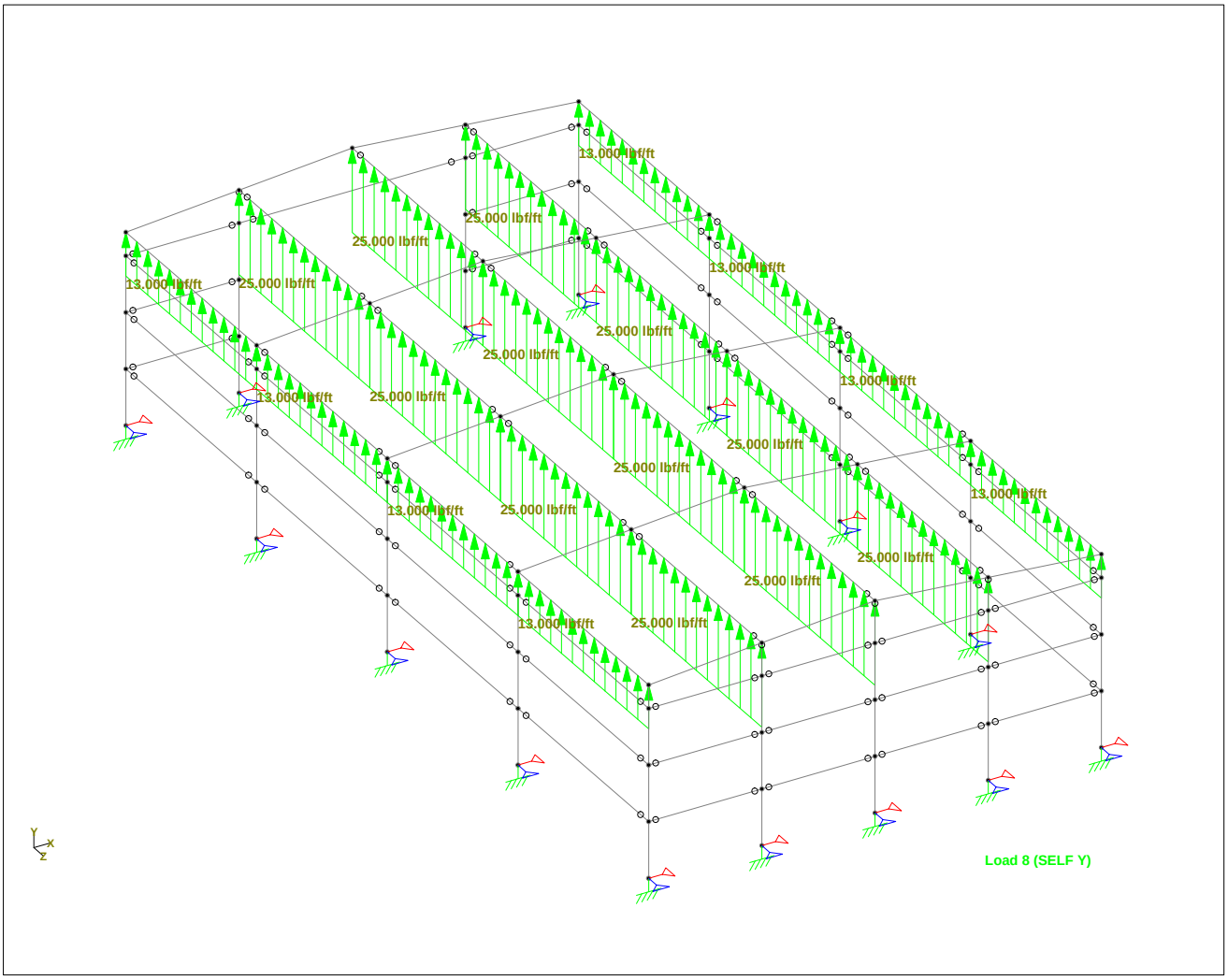

Vertical Seismic Load

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 24	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
10	COMBINATION LOAD CASE 10 - ASCE 7,	1	LOAD CASE 1 - DEAD LOAD	1.40
11	COMBINATION LOAD CASE 11, ASCE LC	1	LOAD CASE 1 - DEAD LOAD	1.20
		2	LOAD CASE 2 - ROOF LIVE LOAD	0.50
12	COMBINATION LOAD CASE 12, ASCE LC	1	LOAD CASE 1 - DEAD LOAD	1.20
13	COMBINATION LOAD CASE 13, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	1.20
		2	LOAD CASE 2 - ROOF LIVE LOAD	1.60
		4	LOAD CASE 4 - WIND LONGITUDINAL	0.80
14	COMBINATION LOAD CASE 14. ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	1.20
		2	LOAD CASE 2 - ROOF LIVE LOAD	1.60
		3	LOAD CASE 3 - WIND TRANSVERSE	0.80
17	COMBINATION LOAD CASE 17, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	1.20
		4	LOAD CASE 4 - WIND LONGITUDINAL	1.60
		2	LOAD CASE 2 - ROOF LIVE LOAD	0.50
18	COMBINATION LOAD CASE 18, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	1.20
		3	LOAD CASE 3 - WIND TRANSVERSE	1.60
		2	LOAD CASE 2 - ROOF LIVE LOAD	0.50
21	COMBINATION LOAD CASE 21, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	1.20
		6	LOAD CASE 6 - SEISMIC TRANSVERSE	1.00
		7	LOAD CASE 7 -SEISMIC LONG (Z-DIR)	0.30
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	-1.00
		9	LOAD CASE 9 - BALANCED SNOW LOAD	0.20
22	COMBINATION LOAD CASE 22, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	1.20
		6	LOAD CASE 6 - SEISMIC TRANSVERSE	0.30
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	-1.00
		9	LOAD CASE 9 - BALANCED SNOW LOAD	0.20
		28	SEISMIC 5% ECC LONG	1.00
23	COMBINATION LOAD CASE 23, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	0.90
		3	LOAD CASE 3 - WIND TRANSVERSE	1.60
24	COMBINATION LOAD CASE 24, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	0.90
		4	LOAD CASE 4 - WIND LONGITUDINAL	1.60
25	COMBINATION LOAD CASE 25, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	0.90
		7	LOAD CASE 7 -SEISMIC LONG (Z-DIR)	0.30
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	1.00
		27	SEISMIC 5% ECC. TRANSVERSE	1.00
26	COMBINATION LOAD CASE 26, ASCE 7 I	1	LOAD CASE 1 - DEAD LOAD	0.90
		6	LOAD CASE 6 - SEISMIC TRANSVERSE	0.30
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	1.00
		28	SEISMIC 5% ECC LONG	1.00
29	ASCE 7, LC #5, TRANS, OVERSTRENGT	1	LOAD CASE 1 - DEAD LOAD	1.20
		27	SEISMIC 5% ECC. TRANSVERSE	3.00
		7	LOAD CASE 7 -SEISMIC LONG (Z-DIR)	0.90
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	-1.00
		9	LOAD CASE 9 - BALANCED SNOW LOAD	0.20
30	ASCE 7, LC#5 LONG, OVERSTRENGTH	1	LOAD CASE 1 - DEAD LOAD	1.20
		28	SEISMIC 5% ECC LONG	3.00

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Combination Load Cases Cont...

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
		7	LOAD CASE 7 -SEISMIC LONG (Z-DIR)	0.90
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	-1.00
		9	LOAD CASE 9 - BALANCED SNOW LOAD	0.20
31	ASCE 7, LC #7, TRANS, OVERSTRENGT	1	LOAD CASE 1 - DEAD LOAD	0.90
		27	SEISMIC 5% ECC. TRANSVERSE	3.00
		7	LOAD CASE 7 -SEISMIC LONG (Z-DIR)	0.90
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	1.00
32	ASCE 7, LC #7, LONG, OVERSTRENGTH	1	LOAD CASE 1 - DEAD LOAD	0.90
		28	SEISMIC 5% ECC LONG	3.00
		6	LOAD CASE 6 - SEISMIC TRANSVERSE	0.90
		8	LOAD CASE 8 - SEISMIC VERT (Y-DIR)	1.00

Node Displacement Summary

	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)
Max X	35	29:ASCE 7, LC	**2.382**	0.153	0.792	2.514	0.003	-0.000	0.003
Min X	12	18:COMBINAT	**-0.226**	-0.002	0.002	0.226	0.000	0.000	0.000
Max Y	35	31:ASCE 7, LC	2.377	**0.269**	0.792	2.519	0.003	-0.000	0.002
Min Y	13	14:COMBINAT	-0.104	**-0.623**	0.000	0.632	0.000	-0.000	-0.000
Max Z	18	30:ASCE 7, LC	-0.015	-0.147	**3.519**	3.522	0.019	-0.001	-0.000
Min Z	28	27:SEISMIC 5%	0.400	-0.057	**-0.003**	0.404	-0.000	-0.000	0.000
Max rX	15	30:ASCE 7, LC	0.000	0.000	0.000	0.000	**0.028**	0.000	-0.001
Min rX	17	14:COMBINAT	-0.072	-0.002	0.001	0.072	**-0.000**	0.000	-0.000
Max rY	9	29:ASCE 7, LC	2.049	-0.005	0.769	2.189	0.001	**0.002**	-0.008
Min rY	17	31:ASCE 7, LC	1.500	-0.001	0.767	1.685	0.001	**-0.002**	-0.007
Max rZ	13	29:ASCE 7, LC	2.348	-0.301	0.812	2.502	0.003	-0.000	**0.005**
Min rZ	15	29:ASCE 7, LC	0.000	0.000	0.000	0.000	0.006	0.000	**-0.017**
Max Rst	25	30:ASCE 7, LC	0.015	-0.353	3.518	**3.536**	0.011	-0.001	0.000

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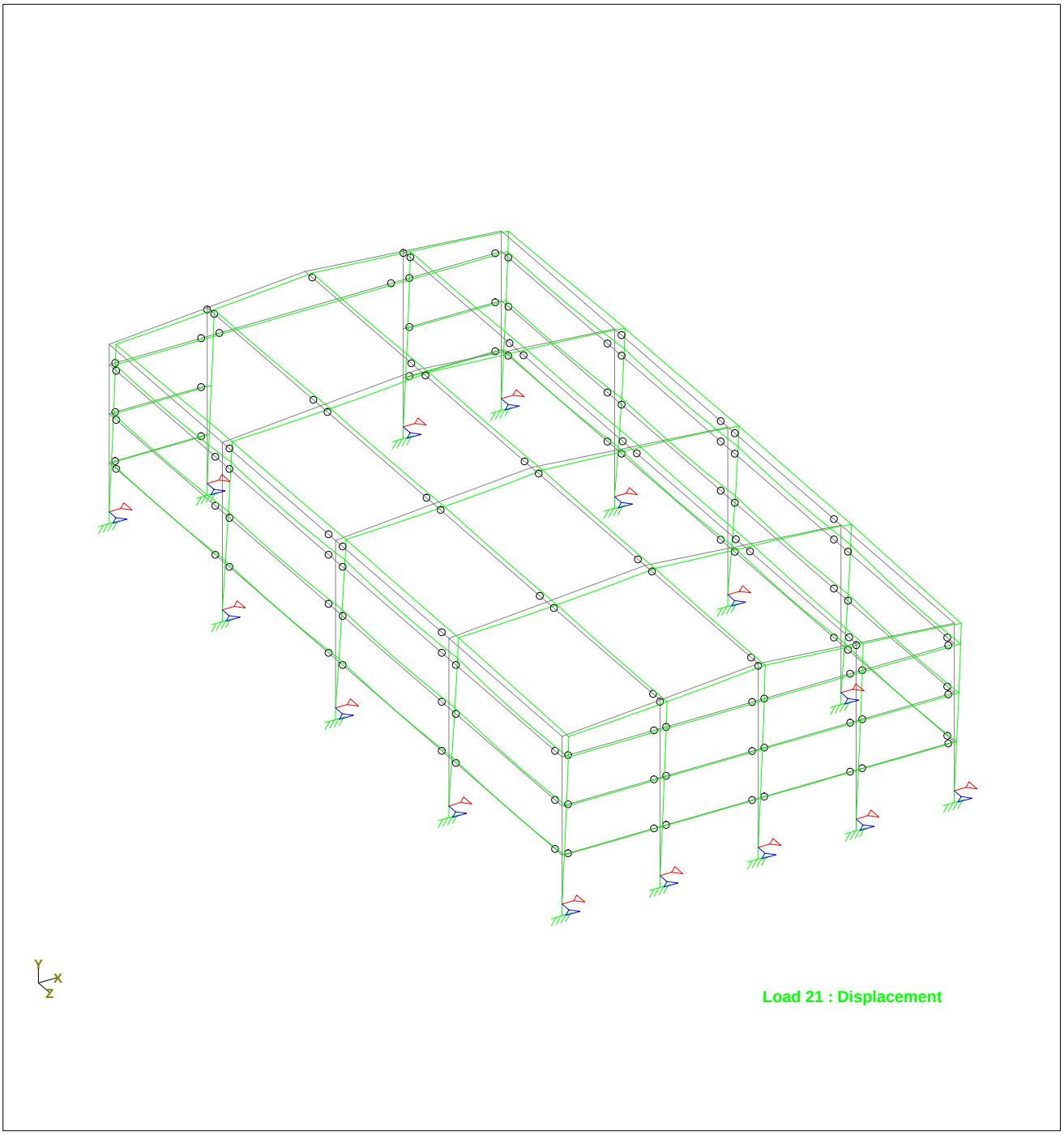

Deformed Shape, COMBINATION LOAD CASE 21, ASCE 7 LC#5

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Job Title LANL TRU Waste Facility	Ref		
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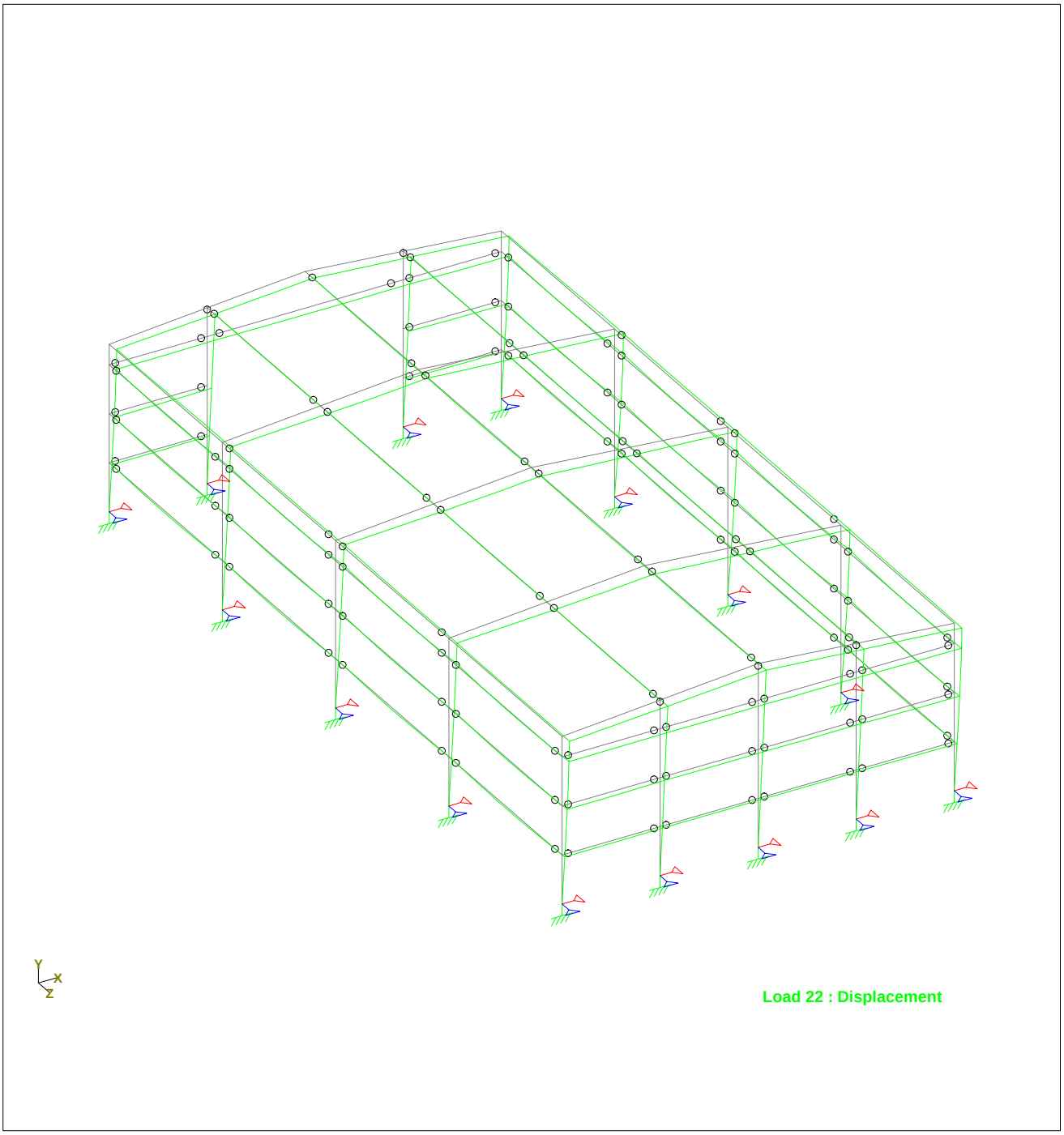

Deformed Shape, COMBINATION LOAD CASE 22, ASCE 7 LC#5

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Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kip)	FY (kip)	FZ (kip)	MX (kip-in)	MY (kip-in)	MZ (kip-in)
Max FX	11	14:COMBINAT	**6.138**	21.045	-0.004	0.000	-0.009	0.000
Min FX	15	29:ASCE 7, LC	**-14.171**	22.706	-3.095	0.000	0.007	0.000
Max FY	10	30:ASCE 7, LC	-3.143	**40.424**	-11.904	0.000	0.121	0.000
Min FY	5	30:ASCE 7, LC	-0.877	**-18.848**	-11.015	0.000	0.183	0.000
Max FZ	20	14:COMBINAT	1.175	11.379	**0.047**	0.000	-0.014	0.000
Min FZ	15	30:ASCE 7, LC	-3.227	12.942	**-13.974**	0.000	0.491	0.000
Max MX	1	1:LOAD CASE	0.528	5.682	-0.020	**0.000**	0.014	0.000
Min MX	1	1:LOAD CASE	0.528	5.682	-0.020	**0.000**	0.014	0.000
Max MY	63	30:ASCE 7, LC	-0.016	0.719	-0.026	0.000	**5.109**	0.000
Min MY	58	31:ASCE 7, LC	-0.243	0.368	-0.004	0.000	**-2.201**	0.000
Max MZ	1	1:LOAD CASE	0.528	5.682	-0.020	0.000	0.014	**0.000**
Min MZ	1	1:LOAD CASE	0.528	5.682	-0.020	0.000	0.014	**0.000**

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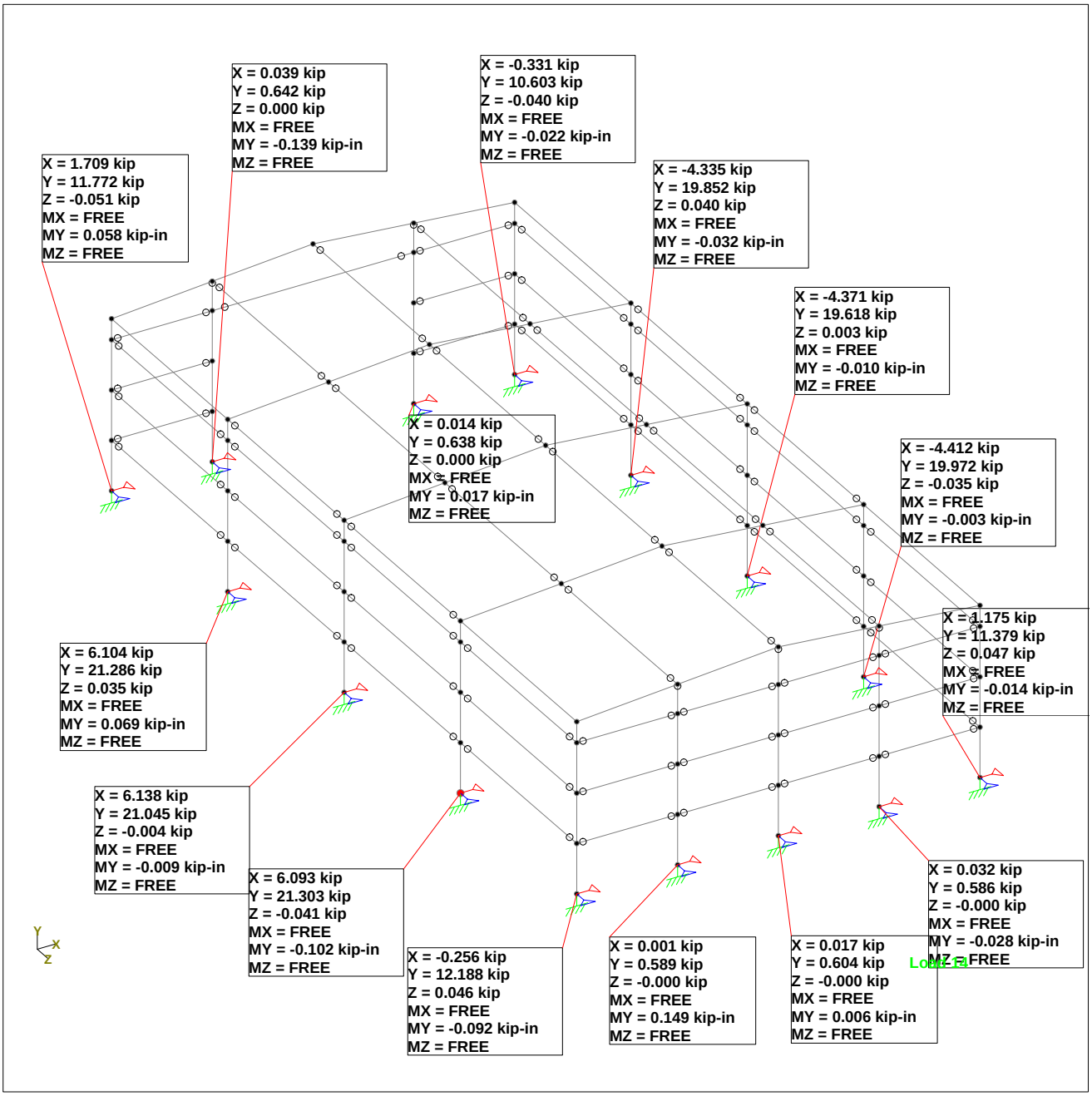
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Reactions, Load Combination 14 (Max Y-Direction Reaction)

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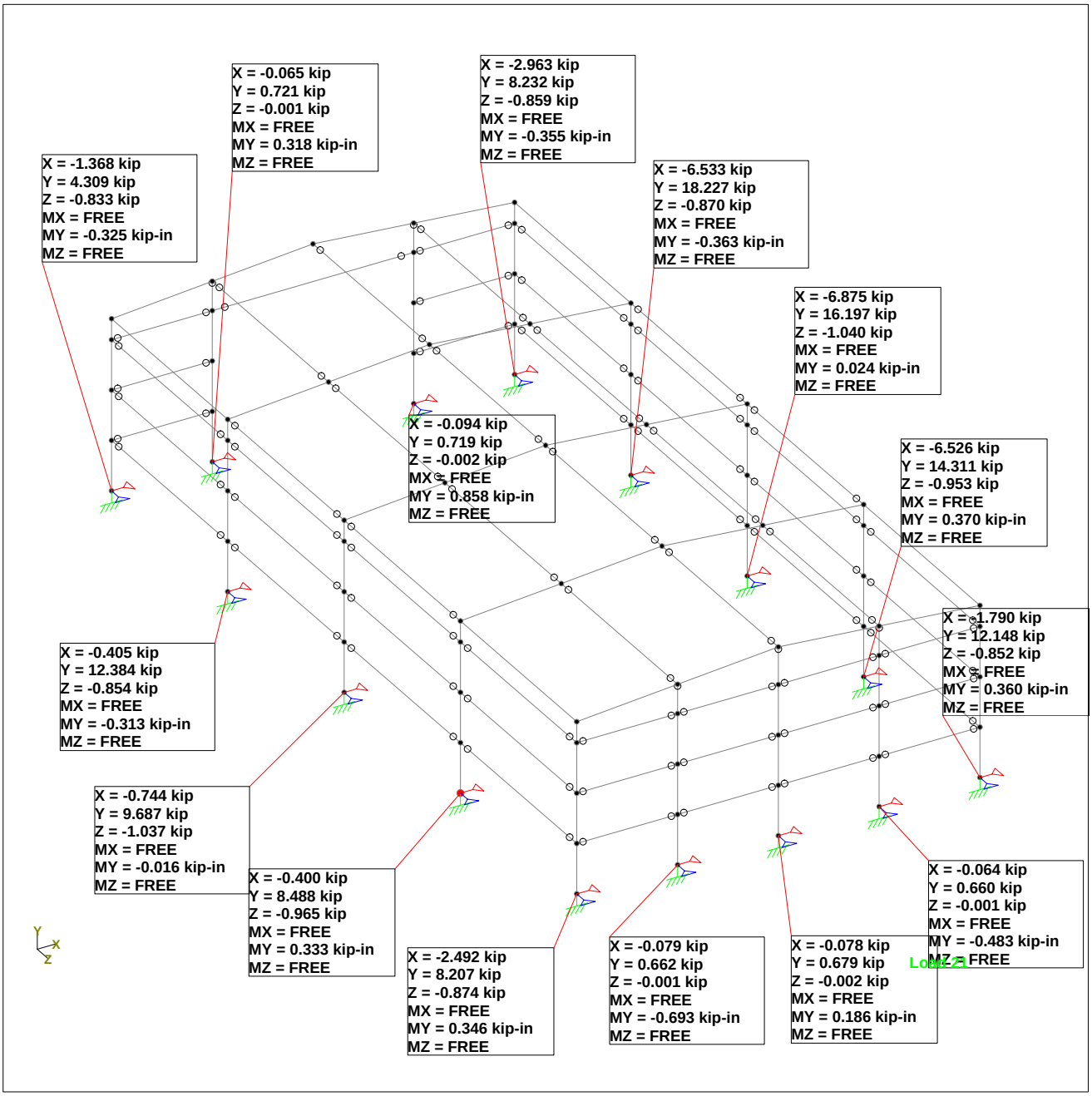
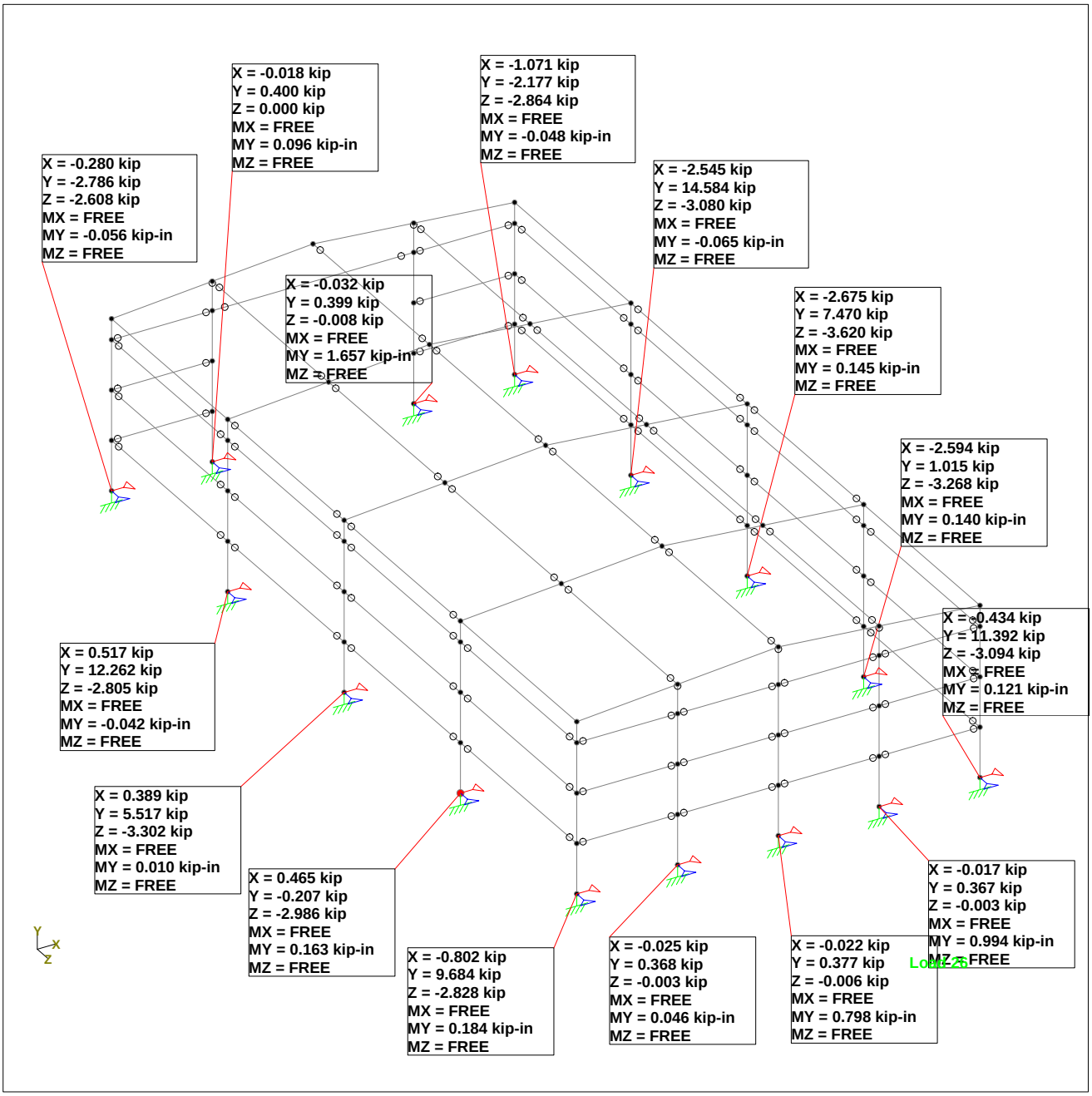
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Reactions, Load Combination 21 (Max X-Direction Reaction)

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 31	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Reactions, Load Combination 26 (Max Z-Direction Reaction)

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 32	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in^2)	Iz (in^4)	Iy (in^4)	Ix (in^4)
1	W12X96	W12X96	0.046	1.000	0.046	Clause H1/2	7	28.200	833.000	270.000	6.860
2	W14X43	W14X43	0.182	1.000	0.182	Clause H1/2	14	12.600	428.000	45.200	1.050
3	W14X43	W14X43	0.100	1.000	0.100	Clause H1/2	13	12.600	428.000	45.200	1.050
4	W12X96	W12X96	0.266	1.000	0.266	Clause H1/2	22	28.200	833.000	270.000	6.860
5	W12X96	W12X96	0.068	1.000	0.068	Clause H1/2	22	28.200	833.000	270.000	6.860
6	W14X43	W14X43	0.348	1.000	0.348	Clause H1/2	14	12.600	428.000	45.200	1.050
7	W14X43	W14X43	0.245	1.000	0.245	Clause H1/2	14	12.600	428.000	45.200	1.050
8	W12X96	W12X96	0.349	1.000	0.349	Clause H1/2	22	28.200	833.000	270.000	6.860
9	W12X96	W12X96	0.072	1.000	0.072	Clause H1/2	22	28.200	833.000	270.000	6.860
10	W14X43	W14X43	0.341	1.000	0.341	Clause H1/2	14	12.600	428.000	45.200	1.050
11	W14X43	W14X43	0.246	1.000	0.246	Clause H1/2	14	12.600	428.000	45.200	1.050
12	W12X96	W12X96	0.177	1.000	0.177	Clause H1/2	21	28.200	833.000	270.000	6.860
13	W12X96	W12X96	0.057	1.000	0.057	Clause H1/2	22	28.200	833.000	270.000	6.860
14	W14X43	W14X43	0.191	1.000	0.191	Clause H1/2	14	12.600	428.000	45.200	1.050
15	W14X43	W14X43	0.104	1.000	0.104	Clause H1/2	14	12.600	428.000	45.200	1.050
16	W12X96	W12X96	0.278	1.000	0.278	Clause H1/2	22	28.200	833.000	270.000	6.860
17	W14X53	W14X53	0.240	1.000	0.240	Clause H1/2	22	15.600	541.000	57.700	1.940
18	W14X22	W14X22	0.241	1.000	0.241	Clause H1/2	14	6.490	199.000	7.000	0.210
19	W14X22	W14X22	0.360	1.000	0.360	Clause H1/2	22	6.490	199.000	7.000	0.210
22	W14X53	W14X53	0.266	1.000	0.266	Clause H1/2	22	15.600	541.000	57.700	1.940
23	W14X22	W14X22	0.227	1.000	0.227	Clause H1/2	14	6.490	199.000	7.000	0.210
24	W14X22	W14X22	0.375	1.000	0.375	Clause H1/2	22	6.490	199.000	7.000	0.210
31	W14X53	W14X53	0.211	1.000	0.211	Clause H1/2	7	15.600	541.000	57.700	1.940
32	W14X53	W14X53	0.239	1.000	0.239	Clause H1/2	22	15.600	541.000	57.700	1.940
33	W12X96	W12X96	0.065	1.000	0.065	Clause H1/2	22	28.200	833.000	270.000	6.860
34	W14X43	W14X43	0.350	1.000	0.350	Clause H1/2	14	12.600	428.000	45.200	1.050
35	W14X43	W14X43	0.246	1.000	0.246	Clause H1/2	14	12.600	428.000	45.200	1.050
36	W12X96	W12X96	0.305	1.000	0.305	Clause H1/2	22	28.200	833.000	270.000	6.860
41	W14X43	W14X43	0.106	1.000	0.106	Clause H1/2	21	12.600	428.000	45.200	1.050
42	W14X43	W14X43	0.246	1.000	0.246	Clause H1/2	14	12.600	428.000	45.200	1.050
43	W14X43	W14X43	0.246	1.000	0.246	Clause H1/2	14	12.600	428.000	45.200	1.050
44	W14X43	W14X43	0.246	1.000	0.246	Clause H1/2	14	12.600	428.000	45.200	1.050
45	W14X43	W14X43	0.104	1.000	0.104	Clause H1/2	14	12.600	428.000	45.200	1.050
46	W14X43	W14X43	0.259	1.000	0.259	Clause H1/2	21	12.600	428.000	45.200	1.050
47	W14X43	W14X43	0.408	1.000	0.408	Clause H1/2	21	12.600	428.000	45.200	1.050
48	W14X43	W14X43	0.382	1.000	0.382	Clause H1/2	21	12.600	428.000	45.200	1.050
49	W14X43	W14X43	0.409	1.000	0.409	Clause H1/2	21	12.600	428.000	45.200	1.050
50	W14X43	W14X43	0.262	1.000	0.262	Clause H1/2	21	12.600	428.000	45.200	1.050
51	W14X22	W14X22	0.456	1.000	0.456	Clause H1/2	14	6.490	199.000	7.000	0.210
52	W14X22	W14X22	0.463	1.000	0.463	Clause H1/2	14	6.490	199.000	7.000	0.210
53	W14X22	W14X22	0.463	1.000	0.463	Clause H1/2	14	6.490	199.000	7.000	0.210
54	W14X22	W14X22	0.462	1.000	0.462	Clause H1/2	14	6.490	199.000	7.000	0.210
55	W14X22	W14X22	0.455	1.000	0.455	Clause H1/2	14	6.490	199.000	7.000	0.210
56	W14X22	W14X22	0.460	1.000	0.460	Clause H1/2	14	6.490	199.000	7.000	0.210
57	W14X22	W14X22	0.460	1.000	0.460	Clause H1/2	14	6.490	199.000	7.000	0.210

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in^2)	Iz (in^4)	Iy (in^4)	Ix (in^4)
58	W14X22	W14X22	0.460	1.000	0.460	Clause H1/2	14	6.490	199.000	7.000	0.210
59	W14X22	W14X22	0.432	1.000	0.432	Clause H1/2	13	6.490	199.000	7.000	0.210
60	W14X22	W14X22	0.433	1.000	0.433	Clause H1/2	13	6.490	199.000	7.000	0.210
61	W14X22	W14X22	0.433	1.000	0.433	Clause H1/2	13	6.490	199.000	7.000	0.210
62	W14X22	W14X22	0.432	1.000	0.432	Clause H1/2	13	6.490	199.000	7.000	0.210
63	W12X96	W12X96	0.095	1.000	0.095	Clause H1/2	7	28.200	833.000	270.000	6.860
64	W12X96	W12X96	0.170	1.000	0.170	Clause H1/2	7	28.200	833.000	270.000	6.860
65	W12X96	W12X96	0.123	1.000	0.123	Clause H1/2	22	28.200	833.000	270.000	6.860
66	W12X96	W12X96	0.210	1.000	0.210	Clause H1/2	22	28.200	833.000	270.000	6.860
67	W12X96	W12X96	0.135	1.000	0.135	Clause H1/2	22	28.200	833.000	270.000	6.860
68	W12X96	W12X96	0.142	1.000	0.142	Clause H1/2	14	28.200	833.000	270.000	6.860
69	W6X9	W6X9	0.066	1.000	0.066	Clause H1/2	22	2.680	16.400	2.200	0.040
70	W6X9	W6X9	0.287	1.000	0.287	Clause H1/2	22	2.680	16.400	2.200	0.040
71	W6X9	W6X9	0.120	1.000	0.120	Clause E	7	2.680	16.400	2.200	0.040
72	W6X9	W6X9	0.074	1.000	0.074	Clause H1/2	22	2.680	16.400	2.200	0.040
73	W12X96	W12X96	0.124	1.000	0.124	Clause H1/2	22	28.200	833.000	270.000	6.860
74	W12X96	W12X96	0.194	1.000	0.194	Clause H1/2	22	28.200	833.000	270.000	6.860
75	W12X96	W12X96	0.108	1.000	0.108	Clause H1/2	22	28.200	833.000	270.000	6.860
76	W12X96	W12X96	0.177	1.000	0.177	Clause H1/2	22	28.200	833.000	270.000	6.860
77	W12X96	W12X96	0.118	1.000	0.118	Clause H1/2	22	28.200	833.000	270.000	6.860
78	W12X96	W12X96	0.057	1.000	0.057	Clause H1/2	22	28.200	833.000	270.000	6.860
79	W12X96	W12X96	0.162	1.000	0.162	Clause H1/2	22	28.200	833.000	270.000	6.860
80	W12X96	W12X96	0.088	1.000	0.088	Clause H1/2	22	28.200	833.000	270.000	6.860
81	W12X96	W12X96	0.179	1.000	0.179	Clause H1/2	22	28.200	833.000	270.000	6.860
82	W12X96	W12X96	0.094	1.000	0.094	Clause H1/2	22	28.200	833.000	270.000	6.860
83	W12X96	W12X96	0.164	1.000	0.164	Clause H1/2	22	28.200	833.000	270.000	6.860
84	W12X96	W12X96	0.086	1.000	0.086	Clause H1/2	22	28.200	833.000	270.000	6.860
85	W12X96	W12X96	0.119	1.000	0.119	Clause H1/2	22	28.200	833.000	270.000	6.860
86	W12X96	W12X96	0.057	1.000	0.057	Clause H1/2	26	28.200	833.000	270.000	6.860
87	W6X9	W6X9	0.070	1.000	0.070	Clause H1/2	22	2.680	16.400	2.200	0.040
88	W6X9	W6X9	0.064	1.000	0.064	Clause H1/2	10	2.680	16.400	2.200	0.040
89	W6X9	W6X9	0.064	1.000	0.064	Clause H1/2	10	2.680	16.400	2.200	0.040
90	W6X9	W6X9	0.067	1.000	0.067	Clause H1/2	22	2.680	16.400	2.200	0.040
91	W6X9	W6X9	0.418	1.000	0.418	Clause H1/2	18	2.680	16.400	2.200	0.040
92	W6X9	W6X9	0.379	1.000	0.379	Clause H1/2	18	2.680	16.400	2.200	0.040
93	W6X9	W6X9	0.380	1.000	0.380	Clause H1/2	18	2.680	16.400	2.200	0.040
94	W6X9	W6X9	0.377	1.000	0.377	Clause H1/2	18	2.680	16.400	2.200	0.040
95	W6X9	W6X9	0.419	1.000	0.419	Clause H1/2	18	2.680	16.400	2.200	0.040
96	W6X9	W6X9	0.378	1.000	0.378	Clause H1/2	18	2.680	16.400	2.200	0.040
97	W6X9	W6X9	0.378	1.000	0.378	Clause H1/2	18	2.680	16.400	2.200	0.040
98	W6X9	W6X9	0.378	1.000	0.378	Clause H1/2	18	2.680	16.400	2.200	0.040
99	TUB60604	TUB60604	0.039	1.000	0.039	Clause H1/2	27	5.590	30.300	30.300	48.500
100	TUB60604	TUB60604	0.069	1.000	0.069	Clause H1/2	25	5.590	30.300	30.300	48.500
101	TUB60604	TUB60604	0.042	1.000	0.042	Clause H1/2	25	5.590	30.300	30.300	48.500
102	TUB60604	TUB60604	0.051	1.000	0.051	Clause H1/2	21	5.590	30.300	30.300	48.500

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in^2)	Iz (in^4)	Iy (in^4)	Ix (in^4)
104	TUB60604	TUB60604	0.041	1.000	0.041	Clause H1/2	6	5.590	30.300	30.300	48.500
105	TUB60604	TUB60604	0.052	1.000	0.052	Clause H1/2	21	5.590	30.300	30.300	48.500
106	TUB60604	TUB60604	0.041	1.000	0.041	Clause H1/2	6	5.590	30.300	30.300	48.500
107	TUB60604	TUB60604	0.080	1.000	0.080	Clause H1/2	13	5.590	30.300	30.300	48.500
108	W12X96	W12X96	0.214	1.000	0.214	Clause H1/2	7	28.200	833.000	270.000	6.860
109	W12X96	W12X96	0.278	1.000	0.278	Clause H1/2	22	28.200	833.000	270.000	6.860
110	W12X96	W12X96	0.160	1.000	0.160	Clause H1/2	14	28.200	833.000	270.000	6.860
111	W12X96	W12X96	0.233	1.000	0.233	Clause H1/2	22	28.200	833.000	270.000	6.860
112	W12X96	W12X96	0.228	1.000	0.228	Clause H1/2	22	28.200	833.000	270.000	6.860
113	W12X96	W12X96	0.202	1.000	0.202	Clause H1/2	22	28.200	833.000	270.000	6.860
114	W12X96	W12X96	0.270	1.000	0.270	Clause H1/2	22	28.200	833.000	270.000	6.860
115	W12X96	W12X96	0.178	1.000	0.178	Clause H1/2	22	28.200	833.000	270.000	6.860
116	W12X96	W12X96	0.256	1.000	0.256	Clause H1/2	22	28.200	833.000	270.000	6.860
117	W12X96	W12X96	0.219	1.000	0.219	Clause H1/2	22	28.200	833.000	270.000	6.860
118	W6X9	W6X9	0.149	1.000	0.149	Clause E	7	2.680	16.400	2.200	0.040
119	W6X9	W6X9	0.509	1.000	0.509	Clause H1/2	22	2.680	16.400	2.200	0.040
120	W6X9	W6X9	0.071	1.000	0.071	Clause H1/2	10	2.680	16.400	2.200	0.040
121	W6X9	W6X9	0.066	1.000	0.066	Clause H1/2	10	2.680	16.400	2.200	0.040
122	W6X9	W6X9	0.388	1.000	0.388	Clause H1/2	18	2.680	16.400	2.200	0.040
123	W6X9	W6X9	0.543	1.000	0.543	Clause H1/2	22	2.680	16.400	2.200	0.040
124	W6X9	W6X9	0.358	1.000	0.358	Clause H1/2	18	2.680	16.400	2.200	0.040
125	W6X9	W6X9	0.350	1.000	0.350	Clause H1/2	18	2.680	16.400	2.200	0.040
126	TUB60604	TUB60604	0.028	1.000	0.028	Clause H1/2	14	5.590	30.300	30.300	48.500
127	TUB60604	TUB60604	0.008	1.000	0.008	Clause H1/2	21	5.590	30.300	30.300	48.500
128	TUB60604	TUB60604	0.029	1.000	0.029	Clause H1/2	21	5.590	30.300	30.300	48.500
129	TUB60604	TUB60604	0.011	1.000	0.011	Clause H1/2	21	5.590	30.300	30.300	48.500
130	TUB60604	TUB60604	0.039	1.000	0.039	Clause H1/2	27	5.590	30.300	30.300	48.500
131	TUB60604	TUB60604	0.017	1.000	0.017	Clause H1/2	25	5.590	30.300	30.300	48.500
132	TUB60604	TUB60604	0.010	1.000	0.010	Clause H1/2	21	5.590	30.300	30.300	48.500
133	TUB60604	TUB60604	0.069	1.000	0.069	Clause H1/2	25	5.590	30.300	30.300	48.500
134	TUB60604	TUB60604	0.012	1.000	0.012	Clause H1/2	25	5.590	30.300	30.300	48.500
135	TUB60604	TUB60604	0.010	1.000	0.010	Clause H1/2	21	5.590	30.300	30.300	48.500
136	TUB60604	TUB60604	0.042	1.000	0.042	Clause H1/2	25	5.590	30.300	30.300	48.500
137	TUB60604	TUB60604	0.017	1.000	0.017	Clause H1/2	25	5.590	30.300	30.300	48.500
138	TUB60604	TUB60604	0.008	1.000	0.008	Clause H1/2	25	5.590	30.300	30.300	48.500
139	W6X9	W6X9	0.079	1.000	0.079	Clause D2	13	2.680	16.400	2.200	0.040
140	W6X9	W6X9	0.018	1.000	0.018	Clause H1/2	21	2.680	16.400	2.200	0.040
141	W6X9	W6X9	0.017	1.000	0.017	Clause H1/2	10	2.680	16.400	2.200	0.040
142	W6X9	W6X9	0.079	1.000	0.079	Clause D2	13	2.680	16.400	2.200	0.040
143	W6X9	W6X9	0.018	1.000	0.018	Clause H1/2	10	2.680	16.400	2.200	0.040
144	W6X9	W6X9	0.017	1.000	0.017	Clause H1/2	10	2.680	16.400	2.200	0.040
145	W6X9	W6X9	0.054	1.000	0.054	Clause D2	14	2.680	16.400	2.200	0.040
146	W6X9	W6X9	0.032	1.000	0.032	Clause D2	13	2.680	16.400	2.200	0.040
147	W6X9	W6X9	0.019	1.000	0.019	Clause H1/2	13	2.680	16.400	2.200	0.040
148	W6X9	W6X9	0.051	1.000	0.051	Clause D2	14	2.680	16.400	2.200	0.040

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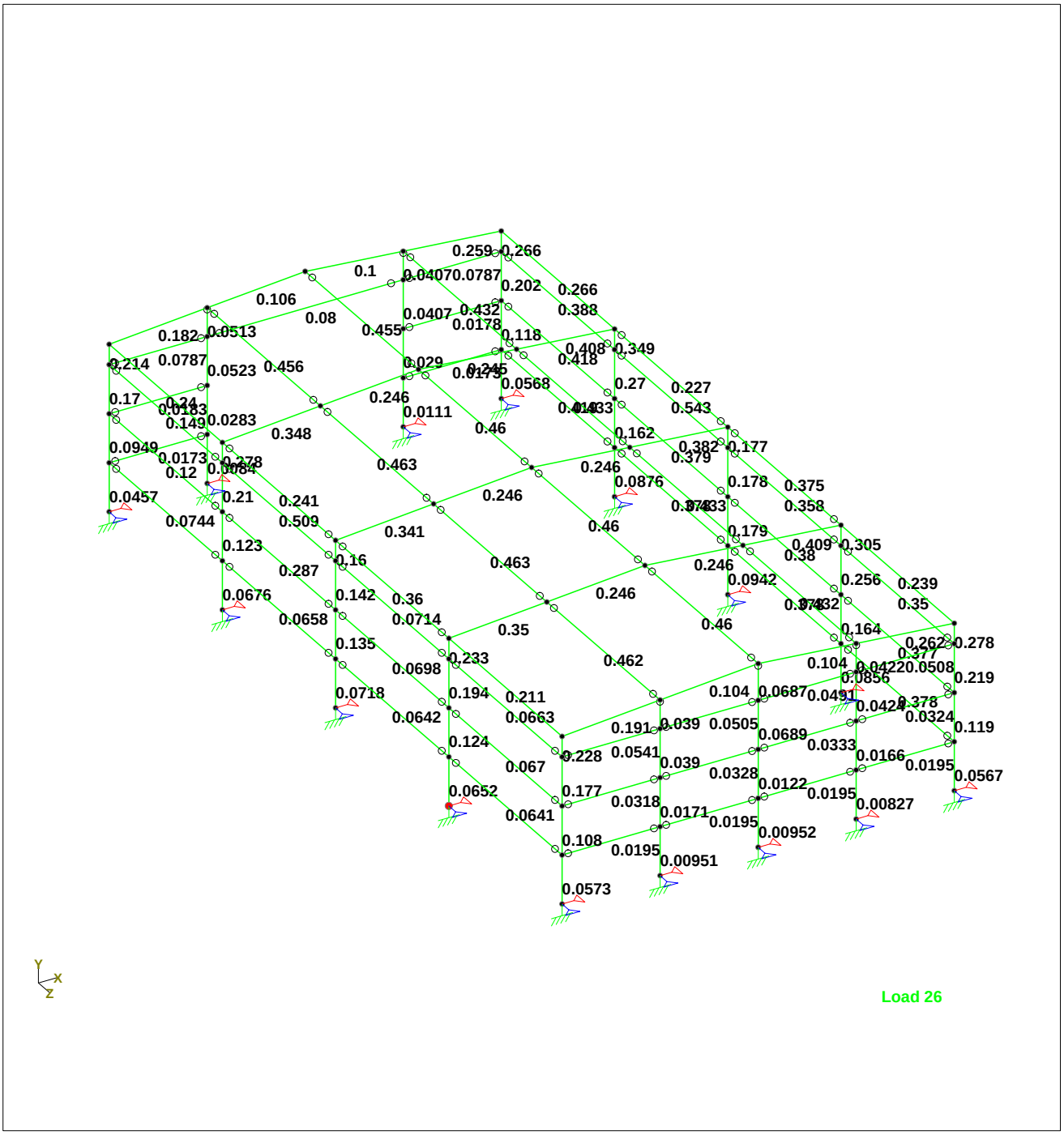
Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in^2)	Iz (in^4)	Iy (in^4)	Ix (in^4)
149	W6X9	W6X9	0.033	1.000	0.033	Clause D2	14	2.680	16.400	2.200	0.040
150	W6X9	W6X9	0.020	1.000	0.020	Clause H1/2	13	2.680	16.400	2.200	0.040
151	W6X9	W6X9	0.049	1.000	0.049	Clause D2	14	2.680	16.400	2.200	0.040
152	W6X9	W6X9	0.033	1.000	0.033	Clause D2	14	2.680	16.400	2.200	0.040
153	W6X9	W6X9	0.020	1.000	0.020	Clause H1/2	13	2.680	16.400	2.200	0.040
154	W6X9	W6X9	0.051	1.000	0.051	Clause D2	13	2.680	16.400	2.200	0.040
155	W6X9	W6X9	0.032	1.000	0.032	Clause D2	14	2.680	16.400	2.200	0.040
156	W6X9	W6X9	0.019	1.000	0.019	Clause H1/2	13	2.680	16.400	2.200	0.040

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 36	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 22-Feb-2011 14:53	



Steel Member Unity Check

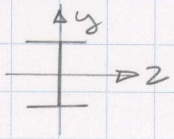
WEIDLINGER ASSOCIATES® INC
CONSULTING ENGINEERS

PROJECT	
BY	DATE
CHECKED BY CR	DATE 2/11/11

SUBJECT
PAGE OF

AISC DESIGN PARAMETERS FOR STAAD-PRO STEEL DESIGN

STEEL FRAME COLUMNS



PARAMETER	VALUE	COMMENT
C_b	1 (default)	Conserv.
F_u	65 ksi	A992 Steel
FYLD	50 ksi	A992 Steel
Kx	1.0	eff. length factor for flex/tors. buckling
Ky	2.0	moment frame sidesway for buckling about weak axis
K_z	2.0	moment frame sidesway for buckling about strong axis
Lx	8'	girts brace against flexural/torsional buckling
Ly	4'	girts brace against weak axis buckling
Lz	member length (default)	
UNB	4'	girts brace bottom flange for bending capacity
UNT	4'	girts brace top flange for bending capacity

PLEASE RECYCLE

WEIDLINGER ASSOCIATES® INC
CONSULTING ENGINEERS

PROJECT		SUBJECT
BY	DATE	
CHECKED BY OR	DATE 2/11/11	PAGE OF

STEEL FRAME BEAMS

PARAMETER	VALUE	COMMENT
C_b	1 (default)	Conserv.
F_u	65 ksi	A992
F_{yLB}	50 ksi	A992
K_x	1.0	eff. length factor for torsion
K_y	1.0	
K_z	1.0	
L_x	8'	purlins brace against flexural/torsional buckling
L_y	8'	Purlins brace against weak axis buckling
L_z	member length	
LNB	8'	Purlins brace bottom flange
LNT	8'	Purlins brace top flange

PLEASE RECYCLE

WEIDLINGER ASSOCIATES® INC
CONSULTING ENGINEERS

PROJECT		SUBJECT	
BY	DATE		
CHECKED BY CR	DATE 2/11/11	PAGE	OF

STEEL FRAME BEAMS (LONG. DIR.)

Parameter	Value	Comment
Fu	65 ksi	A992
Fyld	50 ksi	A992
Lx	member length (default)	
Ly	"	"
Lz	"	"
UNT	0	Deck braces top flange
UNB	member length	(default)

Purlins/girts

Parameter	Value	Comment
Fu	58 ksi	A36
FyLD	36 ksi	A36
LX	member length (default)	
Ly	"	
Lz	"	
UNB	"	
UNT	0	Deck provides cont. bracing of top flange

PLEASE RECYCLE

WEIDLINGER ASSOCIATES INC
CONSULTING ENGINEERS

☐ MEETING MINUTES
☐ FIELD OBSERVATION
☐ TELEPHONE LOG
☐ MEMORANDUM
☐ DESIGN NOTES

PROJECT	
WAI NUMBER	
BY JMW	DATE 2/11/11
CHECKED BY CR	DATE 2/11/11

TO	
FIRM	
PHONE	FAX
PAGE	OF

SUBJECT

STORY DRIFT ANALYSIS

Per ASCE 7-05 eqn 12.8-15, story drift is determined by

$$\delta_x = \frac{C_d \delta_{xe}}{I}$$

$C_d = 3$ (Table 12.2-1, ASCE 7, OMF)

δ_{xe} = deflection determined by elastic analysis

$I = 1.5$

$$\delta_x = \left(\frac{3}{1.5}\right)\delta_{xe} = 2.0\,\delta_{xe}$$

Per ASCE 7-05 Table 12.12-1, the allowable story drift = $.015 h_{sx}$

$$\delta_{all} = .015(15')(12''/') = 2.7''$$

ACTION

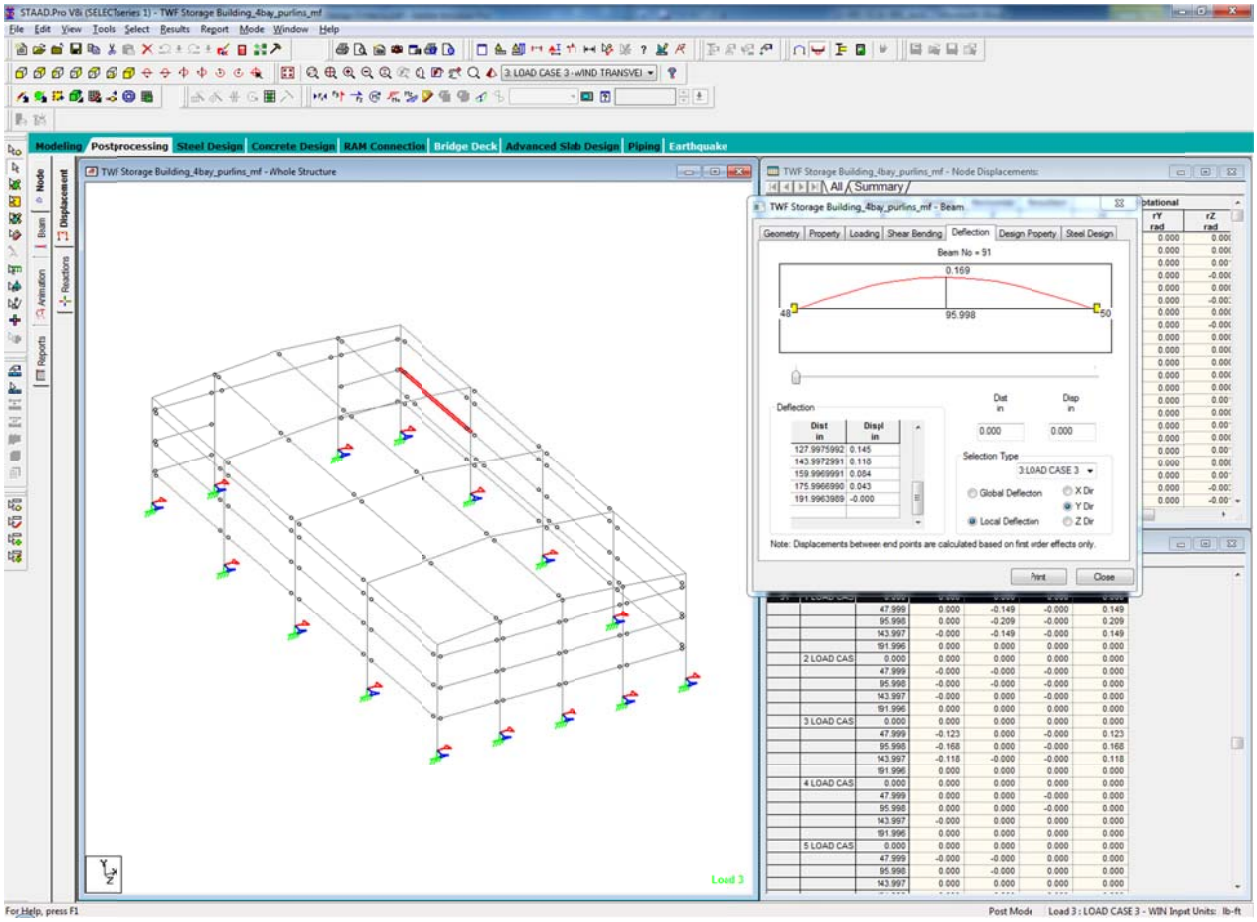
From STAAD-Pro Analysis:

MAX TRANS STORY DRIFT, δ_{xe} = $\delta_x = 2.0(.807'') = 1.6''$ OK

MAX LONG STORY DRIFT, $\delta_{xe} = 1.018$ $\delta_x = 2.0(.906'') = 1.8''$ OK

DISTRIBUTION

Wall Girt Member Deformation

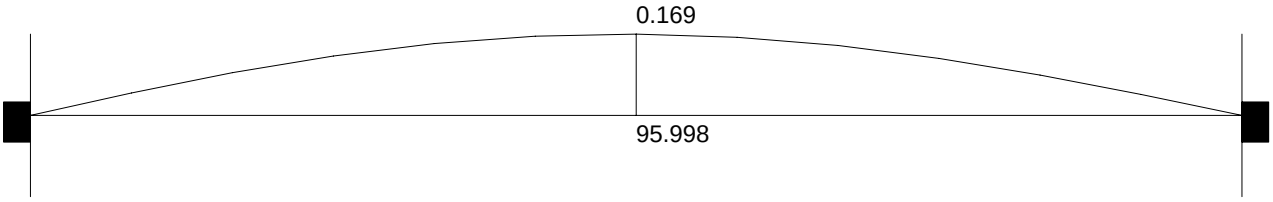


Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 1	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 10-Feb-2011 10:08	

STAAD.Pro Query Deflection Result

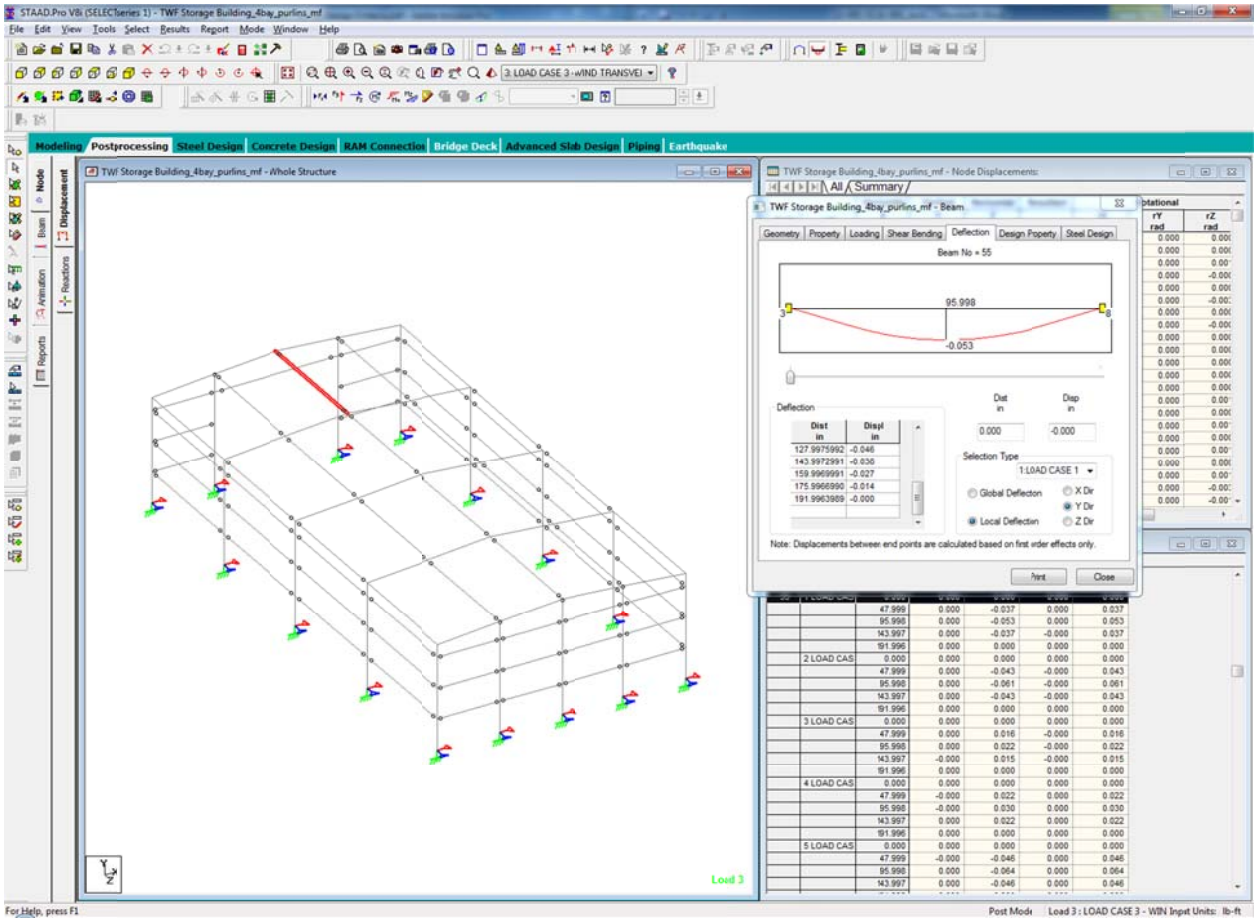
Beam no. 91

Deflection in Local Y axis. Load case 3.



Distin	Y(in)	Z(in)
0.000000	0.0000	0.0000
15.999700	0.0464	0.0000
31.999400	0.0885	0.0000
47.999100	0.1233	0.0000
63.998800	0.1489	0.0000
79.998500	0.1642	0.0000
95.998199	0.1686	0.0000
111.997899	0.1620	0.0000
127.997599	0.1449	0.0000
143.997299	0.1183	0.0000
159.996999	0.0838	0.0000
175.996699	0.0435	0.0000
191.996399	-0.0000	-0.0000

Roof Purlin Member Deformation

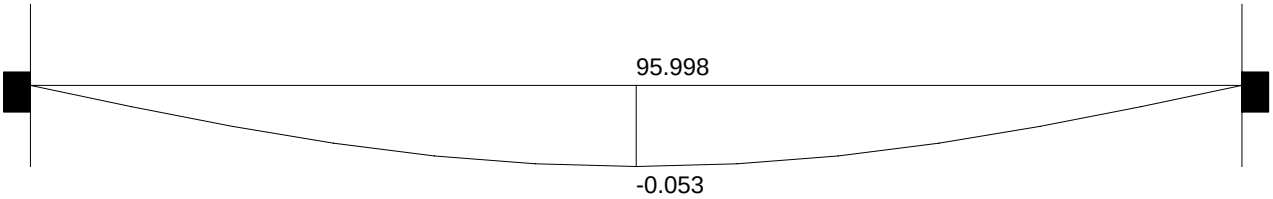


Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 1	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 10-Feb-2011 10:08	

STAAD.Pro Query Deflection Result

Beam no. 55

Deflection in Local Y axis. Load case 1.



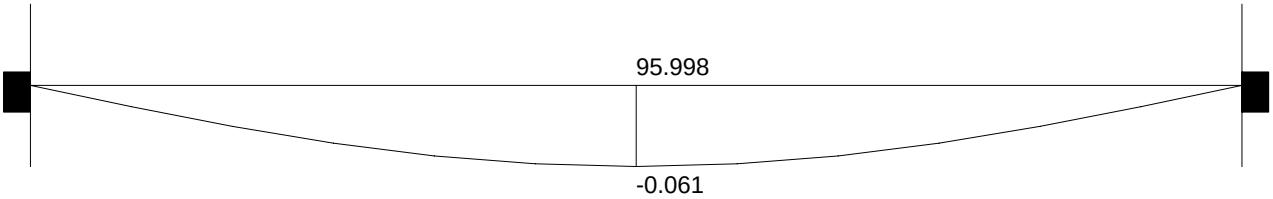
Distin	Y(in)	Z(in)
0.000000	-0.0000	0.0000
15.999700	-0.0139	0.0000
31.999400	-0.0267	0.0000
47.999100	-0.0377	0.0000
63.998800	-0.0459	0.0000
79.998500	-0.0511	0.0000
95.998199	-0.0528	0.0000
111.997899	-0.0511	0.0000
127.997599	-0.0459	0.0000
143.997299	-0.0377	0.0000
159.996999	-0.0267	0.0000
175.996699	-0.0139	0.0000
191.996399	-0.0000	0.0000

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 1	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 10-Feb-2011 10:08	

STAAD.Pro Query Deflection Result

Beam no. 55

Deflection in Local Y axis. Load case 2.



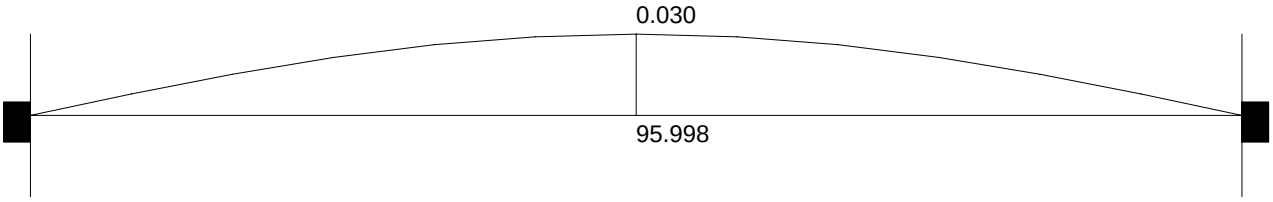
Distin	Y(in)	Z(in)
0.000000	-0.0000	0.0000
15.999700	-0.0161	0.0000
31.999400	-0.0310	0.0000
47.999100	-0.0437	0.0000
63.998800	-0.0533	0.0000
79.998500	-0.0593	0.0000
95.998199	-0.0613	0.0000
111.997899	-0.0593	0.0000
127.997599	-0.0533	0.0000
143.997299	-0.0437	0.0000
159.996999	-0.0310	0.0000
175.996699	-0.0161	0.0000
191.996399	-0.0000	-0.0000

Software licensed to Weidlinger Associates, Inc.	Job No 21082016	Sheet No 1	Rev
	Part		
Job Title LANL TRU Waste Facility	Ref		
	By JMW	Date 01-Feb-11	Chd CR
Client LANS	File TWF Storage Building_4b	Date/Time 10-Feb-2011 10:08	

STAAD.Pro Query Deflection Result

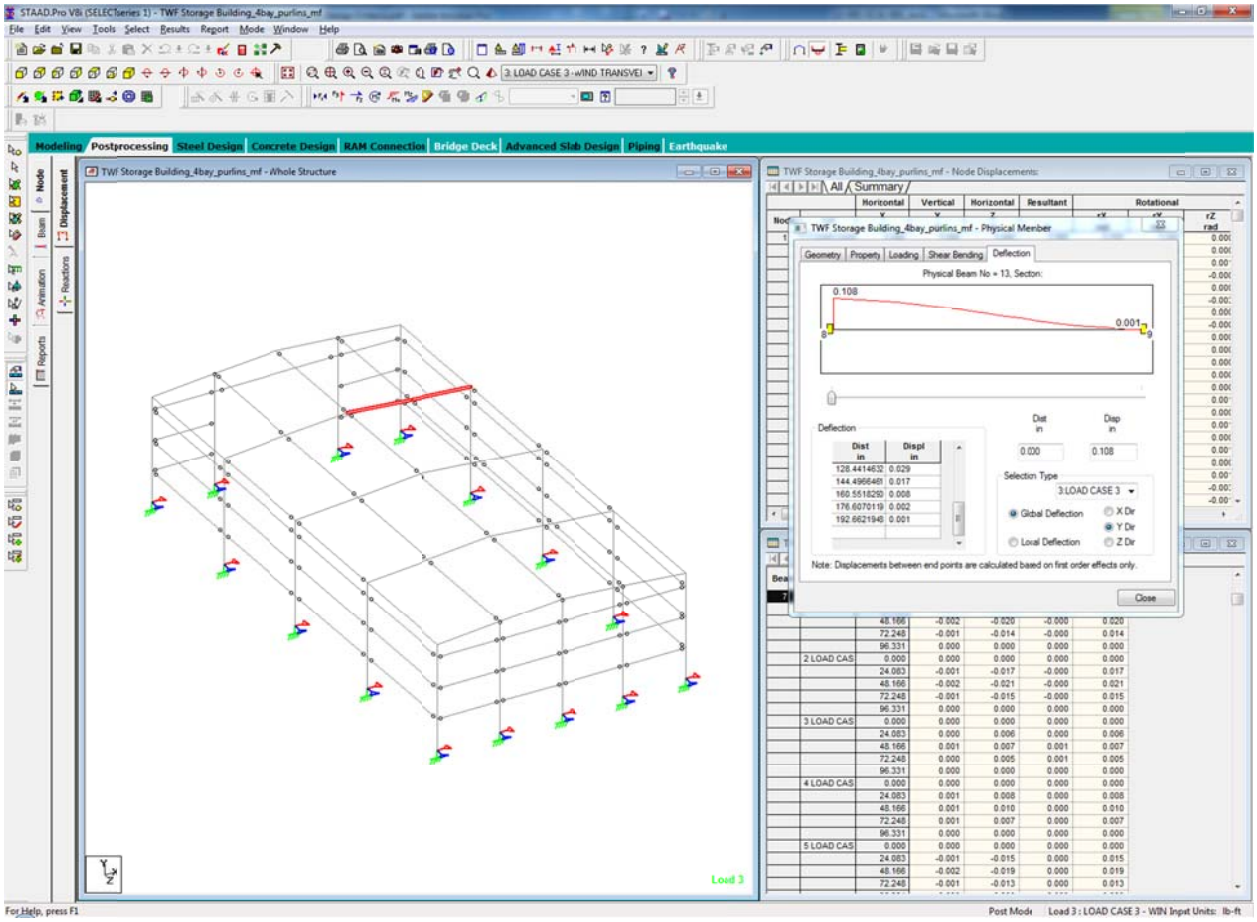
Beam no. 55

Deflection in Local Y axis. Load case 4.



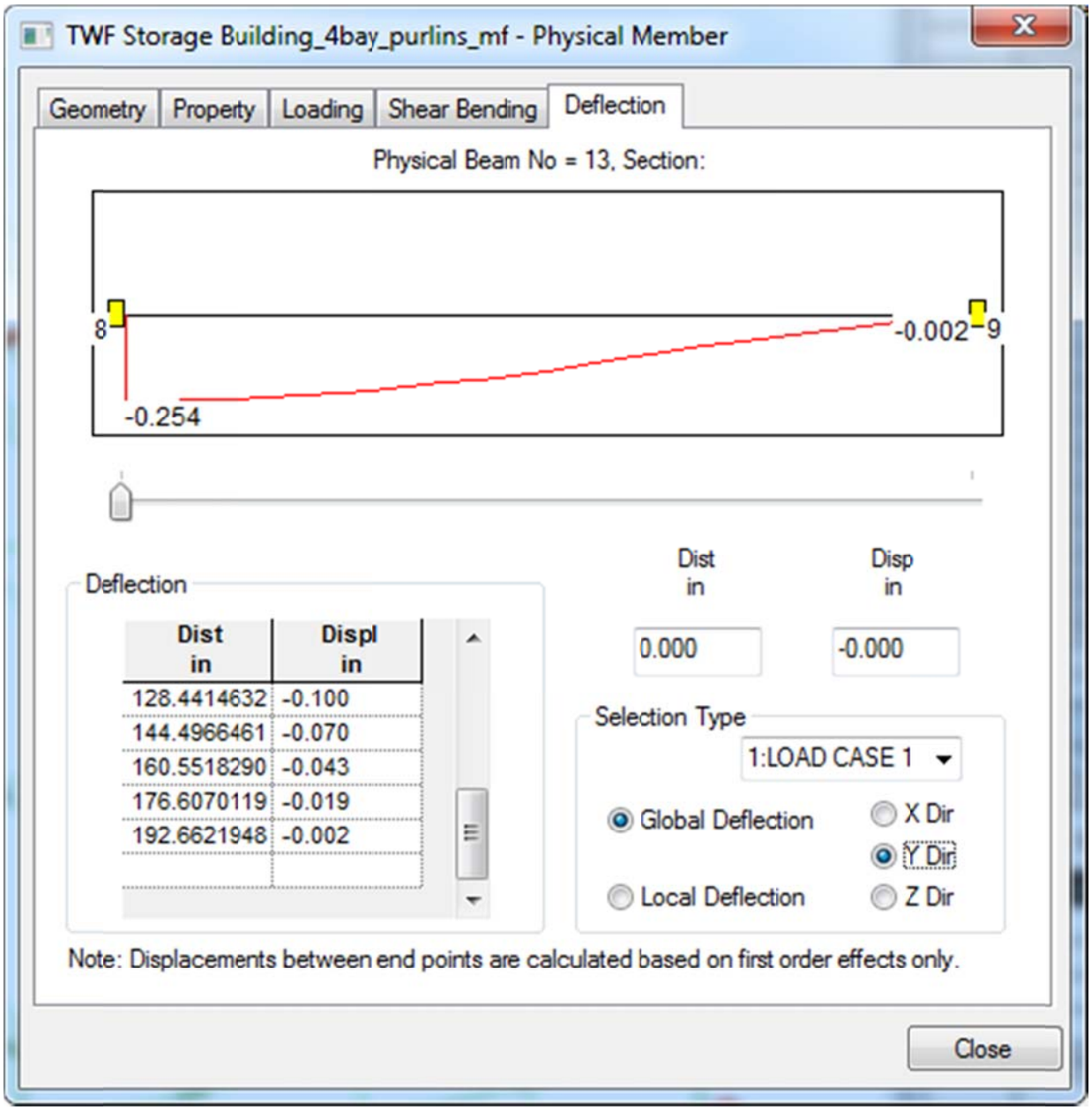
Distin	Y(in)	Z(in)
0.000000	0.0000	-0.0000
15.999700	0.0080	-0.0000
31.999400	0.0154	-0.0000
47.999100	0.0217	-0.0000
63.998800	0.0265	-0.0000
79.998500	0.0294	-0.0000
95.998199	0.0304	-0.0000
111.997899	0.0294	-0.0000
127.997599	0.0265	-0.0000
143.997299	0.0217	-0.0000
159.996999	0.0154	-0.0000
175.996699	0.0080	-0.0000
191.996399	-0.0000	-0.0000

Ordinaary Moment Frame Member Deformation



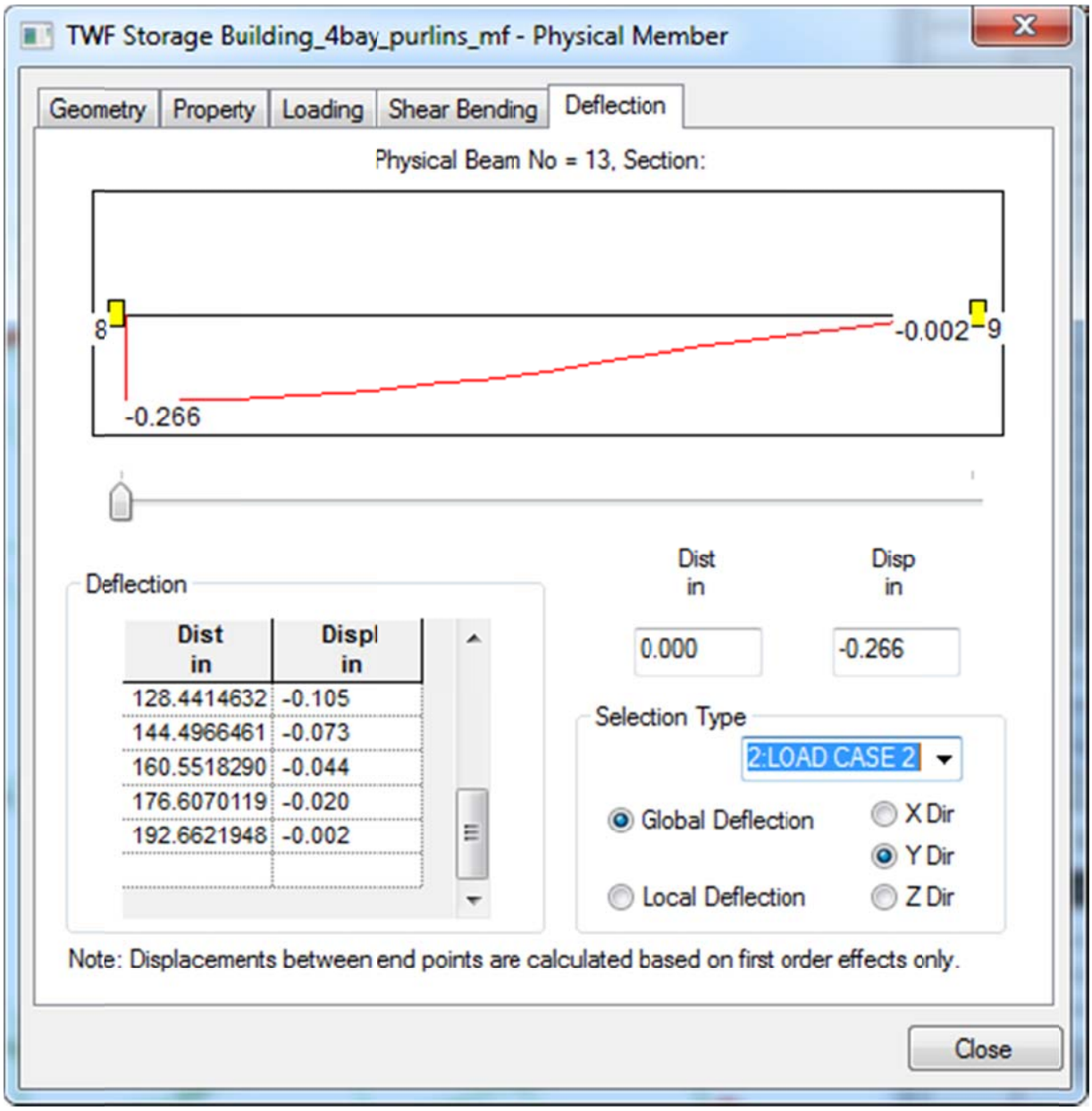
Ordinary Moment Frame Beam Member Deformation

Dead Load



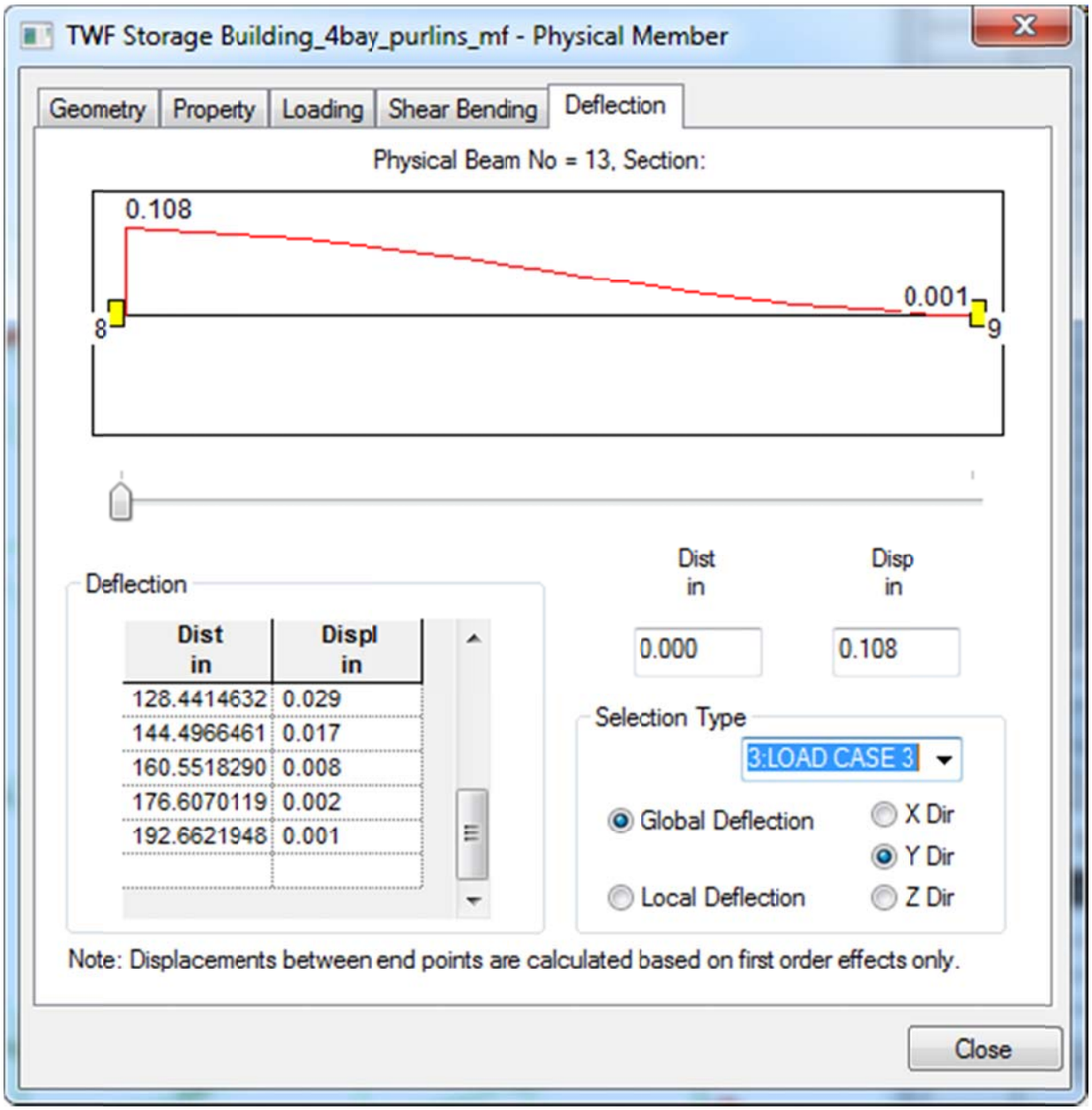
Ordinary Momentt Frame Beam Member Deformation

Roof Live Load



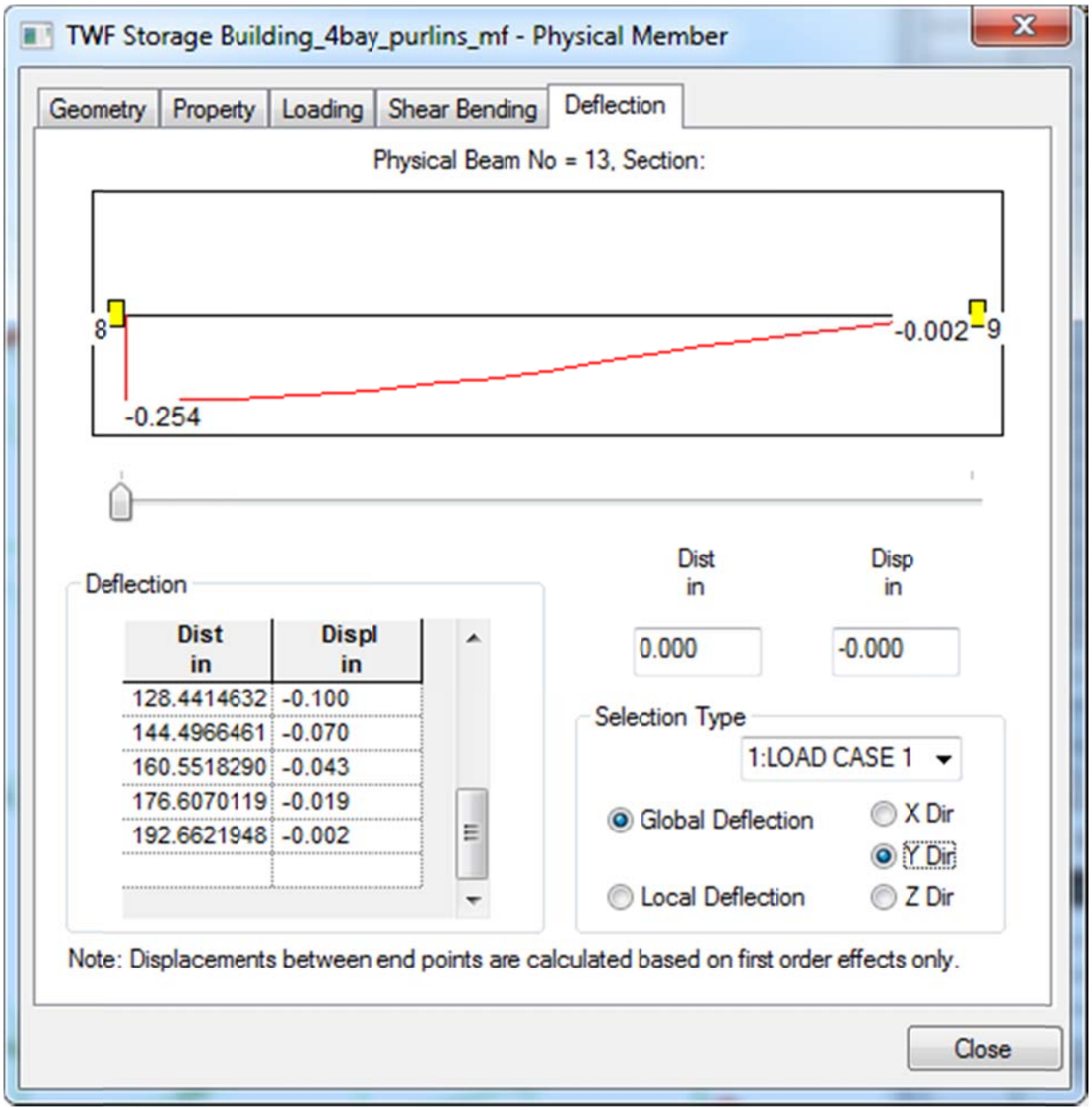
Ordinary Moment Frame Beam Member Deformation

Transverse Wind Load



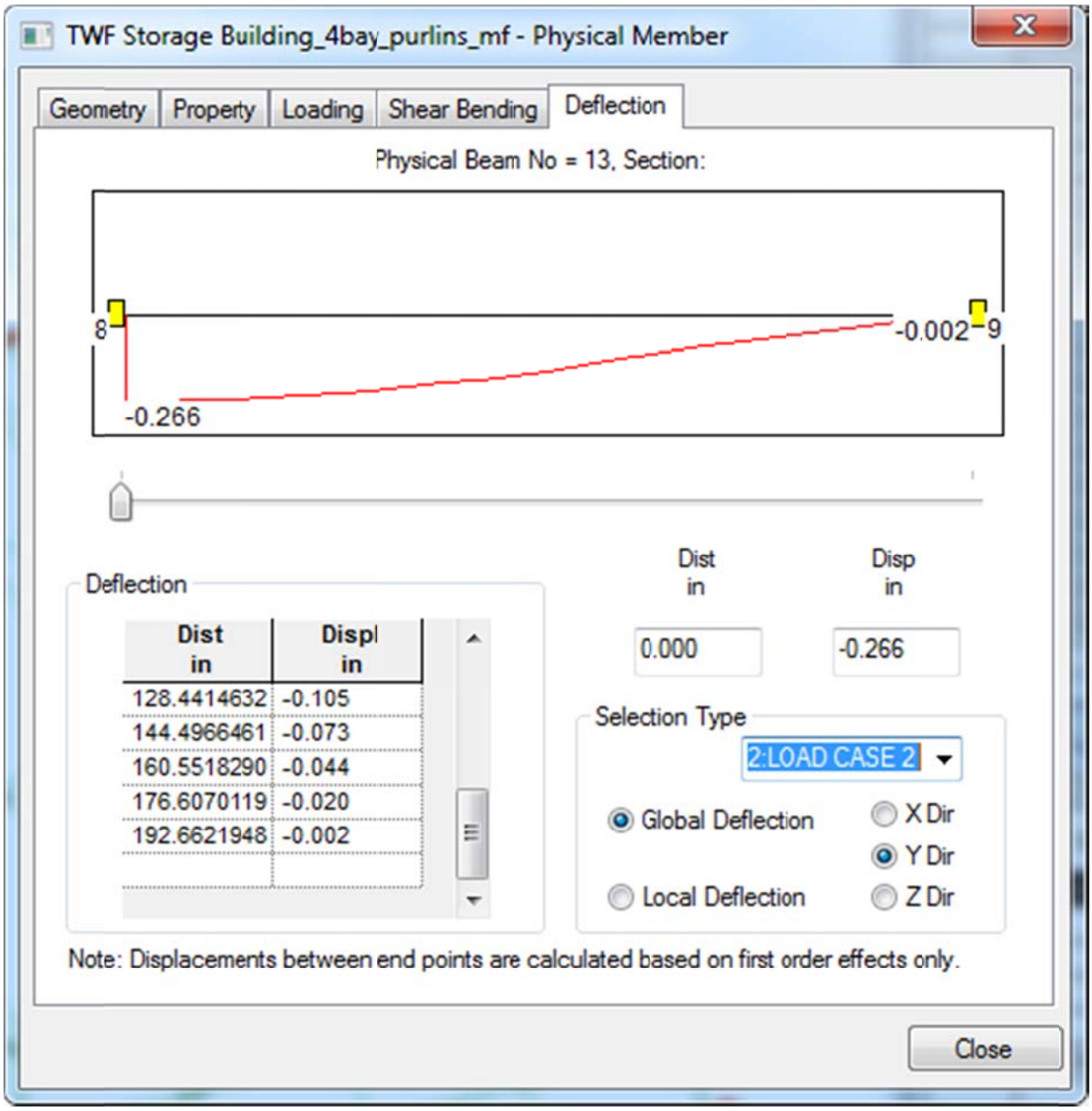
Ordinary Moment Frame Beam Member Deformation

Dead Load



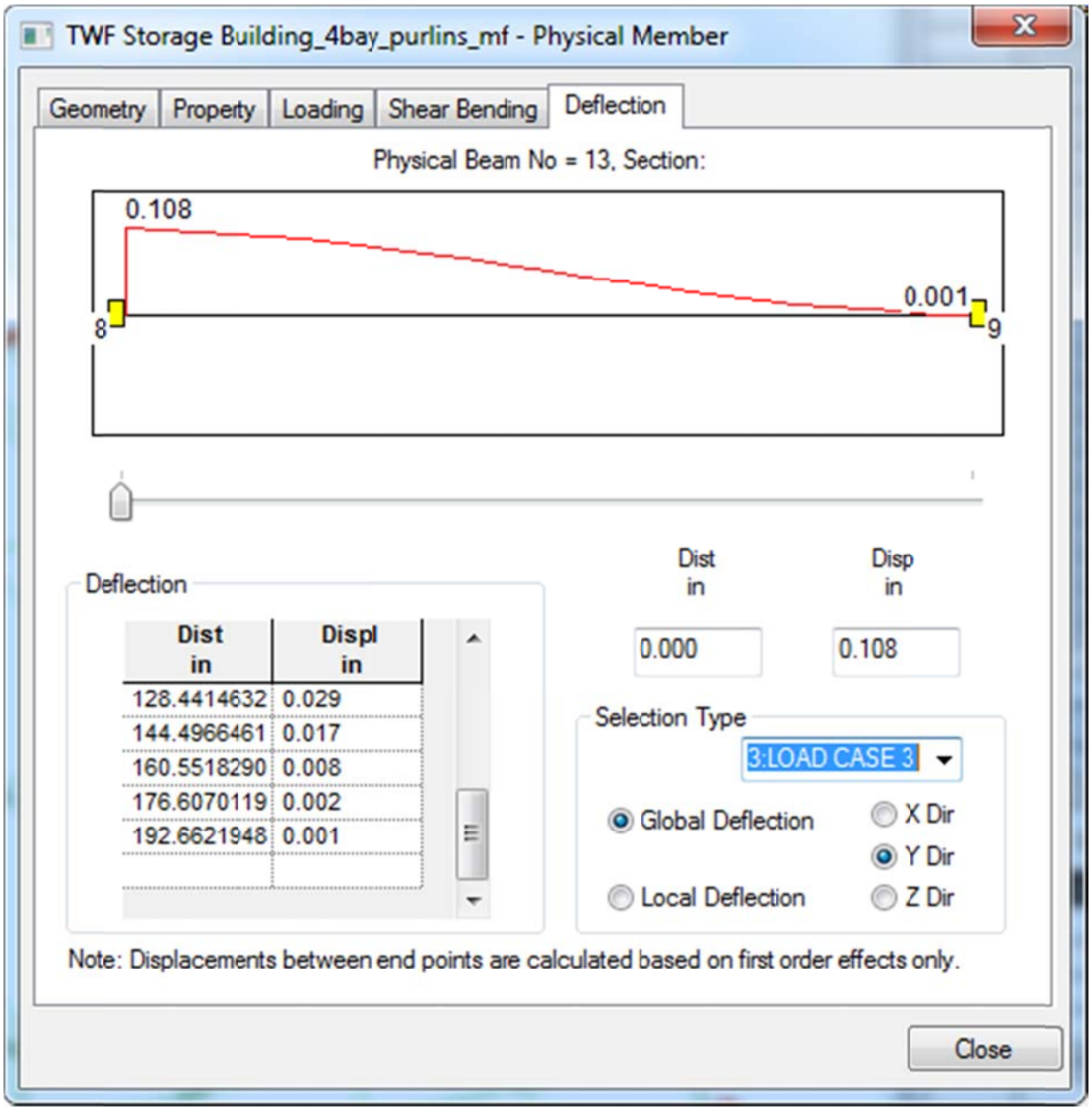
Ordinary Moment Frame Beam Member Deformation

Roof Live Load



Ordinary Moment Frame Beam Member Deformation

Transverse Wind Load



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*           STAAD.Pro V8i SELECTseries1            *
*           Version  20.07.06.35                   *
*           Proprietary Program of                 *
*           Bentley Systems, Inc.                  *
*           Date=    FEB 22, 2011                  *
*           Time=    14:53:42                      *
*                                                  *
*      USER ID: Weidlinger Associates, Inc.        *
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INPUT FILE: TWF Storage Building_4bay_purlins_omf.STD
     2. START JOB INFORMATION
     3. ENGINEER DATE 01-FEB-11
     4. JOB NAME LANL TRU WASTE FACILITY
     5. JOB CLIENT LANS
     6. JOB NO 21082016
     7. ENGINEER NAME JMW
     8. CHECKER NAME CR
     9. END JOB INFORMATION
    10. INPUT WIDTH 79
    11. UNIT FEET POUND
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    15. 11 0 0 31.9993; 12 0 13.67 31.9993; 13 16 15 31.9993; 14 32 13.67 31.9993
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    33. MEMBER INCIDENCES
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53. DEFINE PMEMBER
54. 1 63 64 108 PMEMBER 1
55. 5 65 66 109 PMEMBER 2
56. 9 67 68 110 PMEMBER 3
57. 33 73 74 111 PMEMBER 4
58. 13 75 76 112 PMEMBER 5
59. 36 116 83 84 PMEMBER 6
60. 12 115 81 82 PMEMBER 7
61. 8 114 79 80 PMEMBER 8
62. 4 113 77 78 PMEMBER 9
63. 2 41 PMEMBER 10
64. 3 46 PMEMBER 11
65. 6 42 PMEMBER 12
66. 7 47 PMEMBER 13
67. 10 43 PMEMBER 14
68. 11 48 PMEMBER 15
69. 34 44 PMEMBER 16
70. 35 49 PMEMBER 17
71. 14 45 PMEMBER 18
72. 15 50 PMEMBER 19
73. 102 105 126 127 PMEMBER 20
74. 104 106 128 129 PMEMBER 21
75. 16 117 85 86 PMEMBER 22
76. DEFINE MATERIAL START
77. ISOTROPIC STEEL
78. E 4.176E+009
79. POISSON 0.3
80. DENSITY 489.024
81. ALPHA 6E-006
82. DAMP 0.03
83. END DEFINE MATERIAL
84. MEMBER PROPERTY AMERICAN
85. 2 3 6 7 10 11 14 15 34 35 41 TO 50 TABLE ST W14X43
86. 18 19 23 24 51 TO 62 TABLE ST W14X22
87. 69 TO 72 87 TO 98 118 TO 125 139 TO 156 TABLE ST W6X9
88. 99 TO 102 104 TO 107 126 TO 138 TABLE ST TUB60604
89. 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 108 TO 117 TABLE ST W12X96
90. 17 22 31 32 TABLE ST W14X53
91. CONSTANTS
92. BETA 90 MEMB 69 TO 72 87 TO 98 118 TO 125 139 TO 156
93. MATERIAL STEEL ALL
94. SUPPORTS
95. 1 5 6 10 11 15 16 20 23 27 58 TO 61 63 FIXED BUT MX MZ
96. MEMBER RELEASE
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 97. 18 19 23 24 51 TO 62 69 TO 72 87 TO 98 107 118 TO 125 139 TO 156 START MY MZ
 98. 18 19 23 24 51 TO 62 69 TO 72 87 TO 98 107 118 TO 125 139 TO 156 END MY MZ
 99. 102 START FX MZ
100. 104 START FX MZ
101. 99 START FX MZ
102. 100 START FX MZ
103. 101 START FX MZ
104. START GROUP DEFINITION
105. MEMBER
106. _GIRTS 69 TO 72 87 TO 98 118 TO 125 139 TO 156
107. _FRAME_COLUMNS 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 108 TO 117
108. _PURLINS 18 19 23 24 51 TO 62
109. _FRAME_BEAMS 2 3 6 7 10 11 14 15 34 35 41 TO 50
110. _END_COLUMNS 99 TO 102 104 TO 106 126 TO 138
111. _FRAME_BMS_LONG 17 22 31 32
112. JOINT
113. END GROUP DEFINITION
114. LOAD 1 LOADTYPE DEAD  TITLE LOAD CASE 1 - DEAD LOAD
115. SELFWEIGHT Y -1 LIST 1 TO 19 22 TO 24 31 TO 36 41 TO 102 104 TO 156
116. MEMBER LOAD
117. 51 TO 62 UNI GY -167.2
118. 17 TO 19 22 TO 24 31 32 UNI GY -83.6
119. LOAD 2 LOADTYPE ROOF LIVE  TITLE LOAD CASE 2 - ROOF LIVE LOAD
120. MEMBER LOAD
121. 51 TO 62 UNI GY -240
122. 17 TO 19 22 TO 24 31 32 UNI GY -120
123. LOAD 3 LOADTYPE WIND  TITLE LOAD CASE 3 - WIND TRANSVERSE
124. MEMBER LOAD
125. 59 TO 62 UNI Y 119.12
126. 22 TO 24 32 UNI Y 59.56
127. 59 UNI Y 171.44 0 3.3
128. 22 UNI Y 85.72 0 3.3
129. 51 TO 58 UNI Y 75.68
130. 17 TO 19 31 UNI Y 37.84
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133. 91 TO 98 UNI Y 47.32
134. 122 TO 125 UNI Y 43.42
135. 91 95 UNI Y 71.24 0 3.3
136. 122 UNI Y 65.36 0 3.3
137. LOAD 4 LOADTYPE SEISMIC  TITLE LOAD CASE 4 - WIND LONGITUDINAL
138. MEMBER LOAD
139. 51 TO 62 UNI GY 119.12
140. 17 TO 19 31 UNI GY 59.56
141. 22 TO 24 32 UNI GY 81.14
142. JOINT LOAD
143. 2 FZ 1399.1
144. 4 FZ 1521
145. LOAD 6 LOADTYPE SEISMIC  TITLE LOAD CASE 6 - SEISMIC TRANSVERSE (X-DIR)
146. JOINT LOAD
147. 7 12 24 FX 7619
148. 2 17 FX 3809
149. LOAD 7 LOADTYPE SEISMIC  TITLE LOAD CASE 7 -SEISMIC LONG (Z-DIR)
150. JOINT LOAD
151. 2 4 FZ 15238
152. LOAD 8 LOADTYPE SEISMIC  TITLE LOAD CASE 8 - SEISMIC VERT (Y-DIR)
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153. MEMBER LOAD
154. 51 TO 62 UNI GY 25
155. 17 TO 19 22 TO 24 31 32 UNI GY 13
156. SELFWEIGHT Y 0.15 LIST 1 TO 19 22 TO 24 31 TO 36 41 TO 102 104 TO 156
157. LOAD 9 LOADTYPE SNOW  TITLE LOAD CASE 9 - BALANCED SNOW LOAD
158. MEMBER LOAD
159. 51 TO 62 UNI GY -193.6
160. 17 TO 19 22 TO 24 31 32 UNI GY -96.8
161. LOAD 27 LOADTYPE SEISMIC  TITLE SEISMIC 5% ECC. TRANSVERSE
162. JOINT LOAD
163. 17 FX 4419
164. 24 FX 7924
165. 12 FX 7619
166. 7 FX 7314
167. 2 FX 3200
168. LOAD 28 LOADTYPE SEISMIC  TITLE SEISMIC 5% ECC LONG
169. JOINT LOAD
170. 4 FZ 16000
171. 2 FZ 14476
172. LOAD COMB 10 COMBINATION LOAD CASE 10 - ASCE 7, LC#1
173. 1 1.4
174. LOAD COMB 11 COMBINATION LOAD CASE 11, ASCE LC #2
175. 1 1.2 2 0.5
176. LOAD COMB 12 COMBINATION LOAD CASE 12, ASCE LC#2
177. 1 1.2
178. LOAD COMB 13 COMBINATION LOAD CASE 13, ASCE 7 LC #3
179. 1 1.2 2 1.6 4 0.8
180. LOAD COMB 14 COMBINATION LOAD CASE 14. ASCE 7 LC#3
181. 1 1.2 2 1.6 3 0.8
182. LOAD COMB 17 COMBINATION LOAD CASE 17, ASCE 7 LC #$
183. 1 1.2 4 1.6 2 0.5
184. LOAD COMB 18 COMBINATION LOAD CASE 18, ASCE 7 LC#4
185. 1 1.2 3 1.6 2 0.5
186. LOAD COMB 21 COMBINATION LOAD CASE 21, ASCE 7 LC#5
187. 1 1.2 6 1.0 7 0.3 8 -1.0 9 0.2
188. LOAD COMB 22 COMBINATION LOAD CASE 22, ASCE 7 LC#5
189. 1 1.2 6 0.3 8 -1.0 9 0.2 28 1.0
190. LOAD COMB 23 COMBINATION LOAD CASE 23, ASCE 7 LC#6
191. 1 0.9 3 1.6
192. LOAD COMB 24 COMBINATION LOAD CASE 24, ASCE 7 LC#6
193. 1 0.9 4 1.6
194. LOAD COMB 25 COMBINATION LOAD CASE 25, ASCE 7 LC#7
195. 1 0.9 7 0.3 8 1.0 27 1.0
196. LOAD COMB 26 COMBINATION LOAD CASE 26, ASCE 7 LC#7
197. 1 0.9 6 0.3 8 1.0 28 1.0
198. LOAD COMB 29 ASCE 7, LC #5, TRANS, OVERSTRENGTH
199. 1 1.2 27 3.0 7 0.9 8 -1.0 9 0.2
200. LOAD COMB 30 ASCE 7, LC#5 LONG, OVERSTRENGTH
201. 1 1.2 28 3.0 7 0.9 8 -1.0 9 0.2
202. LOAD COMB 31 ASCE 7, LC #7, TRANS, OVERSTRENGTH
203. 1 0.9 27 3.0 7 0.9 8 1.0
204. LOAD COMB 32 ASCE 7, LC #7, LONG, OVERSTRENGTH
205. 1 0.9 28 3.0 6 0.9 8 1.0
206. PERFORM ANALYSIS
```

P R O B L E M S T A T I S T I C S

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS = 85/ 143/ 15

SOLVER USED IS THE OUT-OF-CORE BASIC SOLVER

ORIGINAL/FINAL BAND-WIDTH= 64/ 12/ 74 DOF
TOTAL PRIMARY LOAD CASES = 10, TOTAL DEGREES OF FREEDOM = 450
SIZE OF STIFFNESS MATRIX = 34 DOUBLE KILO-WORDS
REQRD/AVAIL. DISK SPACE = 12.7/ 552492.5 MB

```
LOAD LIST 1 TO 28
PARAMETER 1
CODE AISC UNIFIED
METHOD LRFD
UNT 8 MEMB 2 3 6 7 10 11 14 15 34 35 41 TO 50
UNB 8 MEMB 2 3 6 7 10 11 14 15 34 35 41 TO 50
LY 4 MEMB 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 108 TO 117
FYLD 7.2E+006 MEMB 1 TO 19 22 TO 24 31 TO 36 41 TO 102 104 TO 106 108 TO 156
FU 9.36E+006 ALL
LX 8 MEMB 1 TO 16 33 TO 36 41 TO 50 63 TO 68 73 TO 86 108 TO 117
LY 8 MEMB 2 3 6 7 10 11 14 15 34 35 41 TO 50
UNT 4 MEMB 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 99 TO 102 104 TO 106 -
108 TO 117 126 TO 138
UNB 4 MEMB 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 99 TO 102 104 TO 106 -
108 TO 117 126 TO 138
KZ 2 MEMB 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 108 TO 117
KY 2 MEMB 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 108 TO 117
MAIN 500 MEMB 69 TO 72 87 TO 98 118 TO 125 139 TO 156
CHECK CODE ALL
```

STAAD.PRO CODE CHECKING - (AISC-360-05-LRFD)
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ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

```
MEMBER     TABLE       RESULT/   CRITICAL COND/     RATIO/     LOADING/
                         FX            MY             MZ       LOCATION
========================================================================

     1  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.046          7
                -6740.75 T     -10885.78           0.00        4.00
     2  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.182         14
                11858.62 C       -591.72       40412.90        0.00
     3  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.100         13
                11772.59 C         -1.38      -22043.72        0.00
     4  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.266         22
                 -353.91 T     -52891.12       31188.43        0.00
     5  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.068         22
                18345.94 C     -11172.11        8650.69        4.00
     6  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.348         14
                 7338.06 C       -558.22       83455.24        0.00
     7  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.245         14
                 6495.55 C        -13.93      -59945.70        0.00
     8  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.349         22
                18827.24 C     -59950.69       57281.18        0.00
     9  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.072         22
                11448.55 C     -13208.07        8142.15        4.00
    10  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.341         14
                 7304.79 C         -0.75       83912.95        0.00
    11  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.246         14
                 6457.66 C         -1.70      -60200.98        0.00
    12  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.177         21
                14055.17 C      -5480.91       82519.75        1.67
    13  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.057         22
                13201.24 C     -11251.02       -4015.02        4.00
    14  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.191         14
                11938.36 C        716.47       42060.01        0.00
    15  ST   W14X43                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.104         14
                11080.28 C         24.08      -23073.53        0.00
    16  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.278         22
                13215.14 C     -54769.47       31126.68        0.00
    17  ST   W14X53                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.240         22
                 9083.44 C        793.83       55108.88       16.00
```

ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
18	ST W14X22		(AISC SECTIONS)		
		PASS	Clause H1/2	0.241	14
		-501.63 T	0.00	-9231.41	8.00
19	ST W14X22		(AISC SECTIONS)		
		PASS	Clause H1/2	0.360	22
		10250.93 C	0.00	-5197.89	8.00
22	ST W14X53		(AISC SECTIONS)		
		PASS	Clause H1/2	0.266	22
		9729.59 C	1266.08	59855.38	16.00
23	ST W14X22		(AISC SECTIONS)		
		PASS	Clause H1/2	0.227	14
		-345.15 T	0.00	-8675.41	8.00
24	ST W14X22		(AISC SECTIONS)		
		PASS	Clause H1/2	0.375	22
		10923.81 C	0.00	-5197.89	8.00
31	ST W14X53		(AISC SECTIONS)		
		PASS	Clause H1/2	0.211	7
		4406.04 C	-280.69	-50940.38	0.00
32	ST W14X53		(AISC SECTIONS)		
		PASS	Clause H1/2	0.239	22
		5471.87 C	-1168.94	54905.46	16.00
33	ST W12X96		(AISC SECTIONS)		
		PASS	Clause H1/2	0.065	22
		5876.54 C	-11994.32	8444.33	4.00
34	ST W14X43		(AISC SECTIONS)		
		PASS	Clause H1/2	0.350	14
		7343.94 C	681.96	83299.61	0.00
35	ST W14X43		(AISC SECTIONS)		
		PASS	Clause H1/2	0.246	14
		6502.91 C	10.63	-60167.39	0.00
36	ST W12X96		(AISC SECTIONS)		
		PASS	Clause H1/2	0.305	22
		5258.47 C	-50109.44	57951.45	0.00
41	ST W14X43		(AISC SECTIONS)		
		PASS	Clause H1/2	0.106	21
		8562.18 C	-472.64	-22444.59	0.00
42	ST W14X43		(AISC SECTIONS)		
		PASS	Clause H1/2	0.246	14
		6542.29 C	-13.92	-59945.71	8.03
43	ST W14X43		(AISC SECTIONS)		
		PASS	Clause H1/2	0.246	14
		6506.80 C	-1.71	-60201.00	8.03
44	ST W14X43		(AISC SECTIONS)		
		PASS	Clause H1/2	0.246	14
		6545.95 C	10.62	-60167.41	8.03

ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

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MEMBER     TABLE       RESULT/   CRITICAL COND/     RATIO/     LOADING/
                         FX            MY             MZ       LOCATION
========================================================================


    45  ST   W14X43                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.104        14
                   11225.45 C         23.59      -23073.48        8.03
    46  ST   W14X43                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.259        21
                    9646.08 C      -2918.80       51313.16        8.03
    47  ST   W14X43                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.408        21
                    7781.56 C      -2891.93       89295.62        8.03
    48  ST   W14X43                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.382        21
                    7782.35 C         -1.94       93977.37        8.03
    49  ST   W14X43                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.409        21
                    7789.84 C       3008.73       89212.59        8.03
    50  ST   W14X43                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.262        21
                    9669.61 C       3041.39       51579.02        8.03
    51  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.456        14
                     118.65 C          0.00      -17403.30        8.00
    52  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.463        14
                     229.72 C          0.00      -17616.53        8.00
    53  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.463        14
                     239.54 C          0.00      -17617.40        8.00
    54  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.462        14
                     124.93 C          0.00      -17616.75        8.00
    55  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.455        14
                     -24.76 T          0.00      -17403.30        8.00
    56  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.460        14
                     -46.94 T          0.00      -17616.53        8.00
    57  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.460        14
                     -47.85 T          0.00      -17617.40        8.00
    58  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.460        14
                     -27.41 T          0.00      -17616.75        8.00
    59  ST   W14X22                   (AISC SECTIONS)
                         PASS     Clause H1/2        0.432        13
                      73.07 C          0.00      -16504.73        8.00
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ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

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MEMBER     TABLE       RESULT/   CRITICAL COND/     RATIO/     LOADING/
                         FX            MY             MZ       LOCATION
========================================================================


    60  ST   W14X22                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.433        13
                    140.90 C          0.00      -16504.52        8.00
    61  ST   W14X22                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.433        13
                    144.58 C          0.00      -16505.34        8.00
    62  ST   W14X22                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.432        13
                     83.08 C          0.00      -16504.73        8.00
    63  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.095         7
                  -6740.75 T     -23342.76          -0.22        4.00
    64  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.170         7
                  -6740.75 T     -42246.76           0.19        4.00
    65  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.123        22
                  17632.21 C     -21414.52       17301.36        4.00
    66  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.210        22
                  16918.48 C     -39475.51       25952.08        4.00
    67  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.135        22
                  10734.82 C     -25497.75       16284.36        4.00
    68  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.142        14
                  19316.42 C        -14.81       73661.74        4.00
    69  ST   W6X9                      (AISC SECTIONS)
                         PASS     Clause H1/2        0.066        22
                    109.41 C       -393.16           0.00        8.00
    70  ST   W6X9                      (AISC SECTIONS)
                         PASS     Clause H1/2        0.287        22
                   3131.32 C       -393.16           0.00        8.00
    71  ST   W6X9                      (AISC SECTIONS)
                         PASS     Clause E           0.120         7
                   1611.63 C          0.00           0.00        0.00
    72  ST   W6X9                      (AISC SECTIONS)
                         PASS     Clause H1/2        0.074        22
                    341.84 C       -393.16           0.00        8.00
    73  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.124        22
                   5162.81 C     -23167.27       16888.66        4.00
    74  ST   W12X96                    (AISC SECTIONS)
                         PASS     Clause H1/2        0.194        22
                   4449.08 C     -37074.81       25333.07        4.00
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ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

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MEMBER     TABLE       RESULT/   CRITICAL COND/     RATIO/     LOADING/
                         FX            MY             MZ       LOCATION
========================================================================


    75  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.108        22
                 12536.66 C     -23803.66       -4611.93        4.00
    76  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.177        22
                 11872.08 C     -41442.22        4671.08        4.00
    77  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.118        22
                   675.18 C     -24539.71       11248.91        0.00
    78  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.057        22
                  1339.77 C     -11516.06        5896.49        0.00
    79  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.162        22
                 19953.46 C     -23541.28       33522.22        0.00
    80  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.088        22
                 20667.19 C     -12270.54       16761.18        0.00
    81  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.179        22
                 12687.63 C     -27951.93       34569.85        0.00
    82  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.094        22
                 13401.36 C     -14480.38       17284.95        0.00
    83  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.164        22
                  6384.69 C     -25325.67       33914.48        0.00
    84  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.086        22
                  7098.42 C     -13122.93       16957.33        0.00
    85  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.119        22
                 14244.79 C     -26054.74        5300.16        0.00
    86  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.057        26
                 11104.55 C     -12377.09        1736.72        0.00
    87  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause H1/2        0.070        22
                 -1955.00 T       -393.18           0.00        8.00
    88  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause H1/2        0.064        10
                   -52.75 T       -407.74           0.00        8.00
    89  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause H1/2        0.064        10
                   -31.47 T       -407.72           0.00        8.00
```

ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
90	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.067	22
		-1271.36 T	-393.16	0.00	8.00
91	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.418	18
		-198.42 T	-349.48	2733.02	8.00
92	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.379	18
		36.87 C	-349.47	2422.66	8.00
93	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.380	18
		46.37 C	-349.49	2422.78	8.00
94	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.377	18
		-222.17 T	-349.48	2422.69	8.00
95	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.419	18
		-17.27 T	-349.48	2733.02	8.00
96	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.378	18
		-29.90 T	-349.47	2422.66	8.00
97	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.378	18
		-32.25 T	-349.49	2422.78	8.00
98	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.378	18
		-18.42 T	-349.48	2422.69	8.00
99	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.039	27
		0.00 C	-4.26	1737.33	2.34
100	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.069	25
		42.71 C	-22.86	3034.29	3.00
101	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.042	25
		33.25 C	-6.86	1868.88	2.34
102	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.051	21
		59.80 C	-8.27	2269.43	2.33
104	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.041	6
		0.00 T	-4.05	1812.18	2.33
105	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.052	21
		314.89 C	-6.60	2269.43	0.00

ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

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MEMBER     TABLE       RESULT/   CRITICAL COND/     RATIO/     LOADING/
                         FX            MY             MZ       LOCATION
========================================================================


   106  ST   TUB60604                 (AISC SECTIONS)
                        PASS     Clause H1/2        0.041         6
                     -0.11 T         -5.94        1812.18        0.00
   107  ST   TUB60604                 (AISC SECTIONS)
                        PASS     Clause H1/2        0.080        13
                 -10385.15 T          0.00        -728.97        8.00
   108  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.214         7
                  -6740.75 T     -53490.17           4.25        1.67
   109  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.278        22
                  16505.99 C     -55033.33       29563.88        1.67
   110  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.160        14
                  18949.76 C          0.05       83912.98        1.67
   111  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.233        22
                   4036.59 C     -45375.95       28858.76        1.67
   112  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.228        22
                  11508.73 C     -50172.78       13964.36        1.67
   113  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.202        22
                     10.22 C     -42820.32       18161.37        0.00
   114  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.270        22
                  19239.31 C     -43230.85       50297.16        0.00
   115  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.178        22
                  12491.04 C     -27951.93       34569.79        4.00
   116  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.256        22
                   5670.54 C     -40731.49       50885.70        0.00
   117  ST   W12X96                   (AISC SECTIONS)
                        PASS     Clause H1/2        0.219        22
                  13579.79 C     -45306.11       18618.35        0.00
   118  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause E           0.149         7
                   2006.06 C          0.00           0.00        0.00
   119  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause H1/2        0.509        22
                   6120.84 C       -393.16           0.00        8.00
   120  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause H1/2        0.071        10
                    200.48 C       -407.74           0.00        8.00
```

ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
121	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.066	10
		-569.35 T	-407.72	0.00	8.00
122	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.388	18
		-326.56 T	-349.48	2507.73	8.00
123	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.543	22
		6588.82 C	-393.16	0.00	8.00
124	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.358	18
		180.42 C	-349.49	2223.10	8.00
125	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.350	18
		-368.45 T	-349.48	2223.02	8.00
126	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.028	14
		415.95 C	1.39	-1186.23	0.00
127	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.008	21
		618.32 C	-2.14	259.65	0.00
128	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.029	21
		464.37 C	-12.36	1198.43	0.00
129	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.011	21
		616.04 C	-6.10	377.98	0.00
130	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.039	27
		0.00 T	-4.26	1737.33	0.00
131	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.017	25
		199.41 C	-10.45	716.59	0.00
132	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.010	21
		559.75 C	-5.30	316.50	0.00
133	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.069	25
		97.32 C	-22.84	3034.29	0.00
134	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.012	25
		208.88 C	-15.22	492.86	0.00
135	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.010	21
		576.79 C	-7.93	311.31	0.00

ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
136	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.042	25
		86.49 C	-7.15	1868.88	0.00
137	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.017	25
		198.05 C	-4.82	701.00	0.00
138	ST TUB60604		(AISC SECTIONS)		
		PASS	Clause H1/2	0.008	25
		309.61 C	-2.33	310.00	0.00
139	ST W6X9		(AISC SECTIONS)		
		PASS	Clause D2	0.079	13
		-9490.68 T	0.00	0.00	8.00
140	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.018	21
		-693.50 T	-98.29	0.00	4.00
141	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.017	10
		136.04 C	-101.93	0.00	4.00
142	ST W6X9		(AISC SECTIONS)		
		PASS	Clause D2	0.079	13
		-9490.74 T	0.00	0.00	8.00
143	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.018	10
		-440.53 T	-101.93	0.00	4.00
144	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.017	10
		136.17 C	-101.93	0.00	4.00
145	ST W6X9		(AISC SECTIONS)		
		PASS	Clause D2	0.054	14
		-6522.69 T	0.00	0.00	0.00
146	ST W6X9		(AISC SECTIONS)		
		PASS	Clause D2	0.032	13
		-3836.29 T	0.00	0.00	0.00
147	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.019	13
		-1384.84 T	-87.37	0.00	4.00
148	ST W6X9		(AISC SECTIONS)		
		PASS	Clause D2	0.051	14
		-6094.42 T	0.00	0.00	0.00
149	ST W6X9		(AISC SECTIONS)		
		PASS	Clause D2	0.033	14
		-3956.02 T	0.00	0.00	0.00
150	ST W6X9		(AISC SECTIONS)		
		PASS	Clause H1/2	0.020	13
		-1401.23 T	-87.37	0.00	4.00

ALL UNITS ARE - POUN FEET (UNLESS OTHERWISE NOTED)

```
MEMBER     TABLE       RESULT/   CRITICAL COND/     RATIO/     LOADING/
                         FX            MY             MZ       LOCATION
========================================================================


   151  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause D2          0.049        14
                 -5917.24 T          0.00           0.00        0.00
   152  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause D2          0.033        14
                 -4011.93 T          0.00           0.00        0.00
   153  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause H1/2        0.020        13
                 -1401.17 T        -87.37           0.00        4.00
   154  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause D2          0.051        13
                 -6129.48 T          0.00           0.00        8.00
   155  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause D2          0.032        14
                 -3905.60 T          0.00           0.00        0.00
   156  ST   W6X9                     (AISC SECTIONS)
                        PASS     Clause H1/2        0.019        13
                 -1384.76 T        -87.37           0.00        4.00

  226. *PARAMETER 2
  227. *CODE AISC UNIFIED
  228. *FYLD 50000 MEMB 1 TO 16
  229. *FU 65000 MEMB 1 TO 16
  230. *LX 96 MEMB 2 3 6 7 10 11 14 15
  231. *METHOD LRFD
  232. *PROFILE W14 MEMB 2 3 6 7 10 11 14 15 17 TO 19 22 TO 24 31 32 34 35 41 TO 62
  233. *UNB 96 MEMB 2 3 6 7 10 11 14 15
  234. *UNT 96 MEMB 2 3 6 7 10 11 14 15
  235. *PROFILE W12 MEMB 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 108 TO 117
  236. *DMAX 6 MEMB 1 69 TO 72 87 TO 98 118 TO 125 139 TO 156
  237. *SELECT MEMB 1 TO 19 22 TO 24 31 TO 36 41 TO 98 108 TO 125 139 TO 156
  238. *GROUP MEMB 69 TO 72 87 TO 98 118 TO 125 139 TO 156
  239. *GROUP MEMB 1 4 5 8 9 12 13 16 33 36 63 TO 68 73 TO 86 108 TO 117
  240. *GROUP MEMB 18 19 23 24 51 TO 62
  241. *GROUP MEMB 2 3 6 7 10 11 14 15 34 35 41 TO 50
  242. *GROUP MEMB 17 22 31 32
  243. *PERFORM ANALYSIS
  244. *PARAMETER 3
  245. *CODE AISC UNIFIED
  246. *METHOD LRFD
  247. *CHECK CODE ALL
  248. FINISH
```

```
     *********** END OF THE STAAD.Pro RUN ***********

       **** DATE= FEB 22,2011   TIME= 14:53:44 ****

**************************************************************
*         For questions on STAAD.Pro, please contact         *
*    Bentley Systems Offices at the following locations      *
*                                                            *
*               Telephone             Web / Email            *
*                                                            *
*  USA:      +1 (714)974-2500                                *
*  UK        +44(1454)207-000                                *
*  SINGAPORE +65 6225-6158                                   *
*  EUROPE    +31 23 5560560                                  *
*  INDIA     +91(033)4006-2021                               *
*  JAPAN     +81(03)5952-6500    http://www.ctc-g.co.jp      *
*  CHINA     +86 10 5929 7000                                *
*  THAILAND  +66(0)2645-1018/19 partha.p@reisoftwareth.com   *
*                                                            *
* Worldwide    http://selectservices.bentley.com/en-US/      *
*                                                            *
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Attachment C

Foundation Design and SAFE Analysis

WEIDLINGER ASSOCIATES® INC
CONSULTING ENGINEERS

PROJECT TRU WASTE	SUBJECT Storage Bldg Fnd.
BY RJH DATE 3/11/11	
CHECKED BY DATE	PAGE OF

Column Reactions for FND. Design

Column Reaction are derived using STAAD Structural Analysis Program.

The STAAD structural model has a coordinate system oriented differently than that used in the SAFE program.

STAAD	=	SAFE
X-direction		Y-direction
Z-direction		X-direction
Y-direction		Z-direction

Therefore, column Reactions from STAAD output labeled as being in the "X-direction" are relabeled as being in the "Y-direction" in the SAFE Foundation analysis. Reactions labeled "Z-direction", are relabeled as "X-direction" in SAFE. Vertical Reactions are labeled or assumed to be in "Z-direction" in SAFE.

PLEASE RECYCLE

WEIDLINGER ASSOCIATES® INC
CONSULTING ENGINEERS

PROJECT TRU WASTE	SUBJECT STORAGE BLDG
BY RTH DATE 3/11/11	
CHECKED BY DATE	PAGE OF

Load Combo's entered into SAFE

ALLOWABLE LOAD COMBO 8 fr. ASCE 2.4.1

8) $0.6D + 0.7E + H$

ASCE 12.4.2 states that

$E = E_h - E_v$ (ASCE 12.4-2)

BUT ASCE 12.4.2.2. has exception where

$E_v = 0$

for determining demands on soil structure interface of foundations

PLEASE RECYCLE

Dead Load Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	1	0.528	5.682	-0.02	0	0	0
D1	5	1	-0.528	5.683	-0.02	0	0	0
A2	6	1	2.105	8.917	0.016	0	0	0
D2	10	1	-2.105	8.917	0.016	0	0	0
A3	11	1	2.106	8.665	0	0	0	0
D3	15	1	-2.106	8.665	0	0	0	0
A4	23	1	2.105	8.917	-0.016	0	0	0
D4	27	1	-2.105	8.917	-0.016	0	0	0
A5	16	1	-0.263	5.683	0.02	0	0	0
D5	20	1	0.263	5.683	0.02	0	0	0
B5	58	1	-0.006	0.491	0	0	0	0
	59	1	0	0.503	0	0	0	0
C5	60	1	0.006	0.49	0	0	0	0
B1	61	1	0.009	0.534	0	0	0	0
C1	63	1	-0.009	0.532	0	0	0	0

Roof Live Load Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	2	0.536	3.838	-0.018	0	0	0
D1	5	2	-0.536	3.839	-0.018	0	0	0
A2	6	2	2.382	7.682	0.014	0	0	0
D2	10	2	-2.382	7.682	0.014	0	0	0
A3	11	2	2.383	7.68	0	0	0	0
D3	15	2	-2.383	7.68	0	0	0	0
A4	23	2	2.382	7.682	-0.014	0	0	0
D4	27	2	-2.382	7.682	-0.014	0	0	0
A5	16	2	-0.272	3.838	0.018	0	0	0
D5	20	2	0.271	3.839	0.018	0	0	0
B5	58	2	-0.006	0	0	0	0	0
	59	2	0	0	0	0	0	0
C5	60	2	0.006	-0.001	0	0	0	0
B1	61	2	0.009	0.001	0	0	0	0
C1	63	2	-0.009	-0.001	0	0	0	0

Wind Load (Transverse, X-Direction) Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	3	0.272	-1.483	0.001	0	0	0
D1	5	3	1.451	-2.948	0.015	0	0	0
A2	6	3	-0.291	-2.132	-0.01	0	0	0
D2	10	3	2.502	-3.924	-0.003	0	0	0
A3	11	3	-0.252	-2.051	-0.005	0	0	0
D3	15	3	2.461	-3.835	0.004	0	0	0
A4	23	3	-0.305	-2.111	0.001	0	0	0
D4	27	3	2.406	-3.774	0.01	0	0	0
A5	16	3	0.618	-0.966	-0.008	0	0	0
D5	20	3	0.531	-1.979	-0.007	0	0	0
B5	58	3	0.022	0	0	0	0	0
	59	3	0.022	0	0	0	0	0
C5	60	3	0.02	0.001	0	0	0	0
B1	61	3	0.017	-0.001	0	0	0	0
C1	63	3	0.049	0.001	0	0	0	0

Wind Load (Longitudinal, Z-Direction) Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	4	-0.268	-2.528	-0.242	0	0	0
D1	5	4	0.264	-2.745	-0.259	0	0	0
A2	6	4	-1.18	-3.19	-0.279	0	0	0
D2	10	4	1.184	-3.491	-0.304	0	0	0
A3	11	4	-1.183	-3.812	-0.319	0	0	0
D3	15	4	1.183	-4.157	-0.344	0	0	0
A4	23	4	-1.184	-4.393	-0.28	0	0	0
D4	27	4	1.18	-4.782	-0.3	0	0	0
A5	16	4	0.137	-1.324	-0.283	0	0	0
D5	20	4	-0.133	-1.454	-0.308	0	0	0
B5	58	4	0.003	0	0	0	0	0
	59	4	0	0	-0.001	0	0	0
C5	60	4	-0.003	0.001	0	0	0	0
B1	61	4	-0.005	0	0	0	0	0
C1	63	4	0.004	0	-0.001	0	0	0

Seismic Load (Transverse, X-Direction) Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	6	-2.167	-1.961	0.013	0	0	0
D1	5	6	-2.163	1.96	-0.013	0	0	0
A2	6	6	-3.63	-2.921	0.008	0	0	0
D2	10	6	-3.307	2.922	-0.008	0	0	0
A3	11	6	-3.971	-3.255	0.001	0	0	0
D3	15	6	-3.648	3.255	-0.001	0	0	0
A4	23	6	-3.625	-2.911	-0.006	0	0	0
D4	27	6	-3.302	2.912	0.006	0	0	0
A5	16	6	-2.092	-1.971	-0.011	0	0	0
D5	20	6	-2.189	1.97	0.011	0	0	0
B5	58	6	-0.071	0	0	0	0	0
	59	6	-0.078	0	0	0	0	0
C5	60	6	-0.072	-0.001	0	0	0	0
B1	61	6	-0.078	0	0	0	0	0
C1	63	6	-0.081	0	0	0	0	0

Seismic Load (Longitudinal, Z-Direction) Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	7	0	-6.741	-2.721	0	0	0
D1	5	7	0	-6.741	-2.721	0	0	0
A2	6	7	0	6.741	-2.955	0	0	0
D2	10	7	0	6.741	-2.955	0	0	0
A3	11	7	0	0	-3.461	0	0	0
D3	15	7	0	0	-3.461	0	0	0
A4	23	7	-0.002	-6.278	-3.115	0	0	0
D4	27	7	0.002	-6.279	-3.115	0	0	0
A5	16	7	-0.001	6.278	-2.976	0	0	0
D5	20	7	0.001	6.279	-2.976	0	0	0
B5	58	7	0	0	-0.003	0	0	0
	59	7	0	0	-0.006	0	0	0
C5	60	7	0	0	-0.003	0	0	0
B1	61	7	0	0	-0.004	0	0	0
C1	63	7	0	0	-0.004	0	0	0

Seismic Load (Vertical, Y-Direction) Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	8	-0.079	-0.855	0.003	0	0	0
D1	5	8	0.079	-0.855	0.003	0	0	0
A2	6	8	-0.315	-1.343	-0.003	0	0	0
D2	10	8	0.315	-1.343	-0.003	0	0	0
A3	11	8	-0.315	-1.305	0	0	0	0
D3	15	8	0.315	-1.305	0	0	0	0
A4	23	8	-0.315	-1.343	0.003	0	0	0
D4	27	8	0.315	-1.343	0.003	0	0	0
A5	16	8	0.039	-0.855	-0.003	0	0	0
D5	20	8	-0.039	-0.855	-0.003	0	0	0
B5	58	8	0.001	-0.074	0	0	0	0
	59	8	0	-0.075	0	0	0	0
C5	60	8	-0.001	-0.073	0	0	0	0
B1	61	8	-0.001	-0.08	0	0	0	0
C1	63	8	0.001	-0.08	0	0	0	0

Snow Load Reactions

Location	Node	Load Case	Force X (kips)	Force Y (kips)	Force Z (kips)			
A1	1	9	0.433	3.096	-0.014	0	0	0
D1	5	9	-0.433	3.096	-0.014	0	0	0
A2	6	9	1.921	6.197	0.011	0	0	0
D2	10	9	-1.921	6.196	0.011	0	0	0
A3	11	9	1.922	6.195	0	0	0	0
D3	15	9	-1.922	6.195	0	0	0	0
A4	23	9	1.921	6.197	-0.011	0	0	0
D4	27	9	-1.921	6.197	-0.011	0	0	0
A5	16	9	-0.219	3.096	0.014	0	0	0
D5	20	9	0.219	3.097	0.014	0	0	0
B5	58	9	-0.005	0	0	0	0	0
	59	9	0	0	0	0	0	0
C5	60	9	0.005	-0.001	0	0	0	0
B1	61	9	0.007	0.001	0	0	0	0
C1	63	9	-0.007	-0.001	0	0	0	0

By: RH Date: 3/24/11
Checked: JMW Date: 3/24/11

WEIDLINGER ASSOCIATES INC
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☐ MEETING MINUTES
☐ FIELD OBSERVATION
☐ TELEPHONE LOG
☐ MEMORANDUM
☐ DESIGN NOTES

PROJECT TRU WASTE	TO STORAGE BLDG
WAI NUMBER	FIRM
BY RTH DATE 3/20/11	PHONE FAX
CHECKED BY DATE	PAGE OF

SUBJECT

Determination of SLAB LL

- Per Design Criteria use 125 psf around area where drums stacked

- area where drums stacked:
  - refer to arch. plans or sketches
  - per phone conversation w/ Manny Tarin on 3/24/11:
    - Drums wt assumed to be 800#
    - Drums stacked 3 drums high
    - assume 4 drums per palette or 12 drums total when stacked 3 high
    - Palette is 5'x5'

$$\frac{(800\#/\text{drum})(12\text{ drums})}{(5'\times 5'\text{ palette})} = \frac{9600\#}{25\text{ s.f.}} = 384\#$$

∴ use 384 psf in area where drums stored
(in SAFE ASSIGN 384 − 125 = 259 psf over 125)

ACTION

- Forklift load.
  - assume model w/ max capacity
  - Refer to Forklift Specs.
  - FOR MODEL 7FDU80:
    - Gross wt = 21,670 lbs
    - Weight distribution, full load
      front = 35,040
      rear = 4,130
    - Load capacity = 17,500 lbs

DISTRIBUTION

By: RH Date: 3/24/11
Checked: JMW Date: 3/24/11

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PROJECT	TRU WASTE
WAI NUMBER	
BY	RTH
DATE	3/20/11
CHECKED BY	
DATE	

TO	STORAGE BLDGS
FIRM	
PHONE	FAX
PAGE	OF

SUBJECT

Determination of Slab LL Cont'd:

- Forklift load cont'd:
  - weight distribution on forklift axles:

$$\text{front} = \frac{35040^{\#}}{(35040^{\#} + 4130^{\#})} = 0.89$$

$$\text{rear} = 1.0 - 0.84 = 0.11$$

- max. actual load on axles:

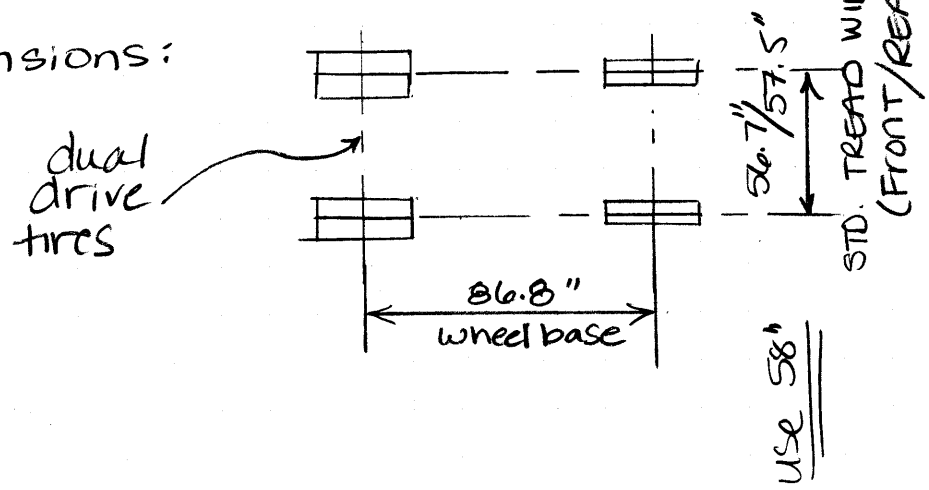
palette + forklift wt = $9600^{\#} + 21{,}670^{\#}$
$= 31{,}270^{\#}$

front axle load = $.89\,(31{,}270^{\#}) = 27{,}830^{\#}$

rear axle load = $.11\,(31270^{\#}) = 3440^{\#}$

ACTION

- axle dimensions:



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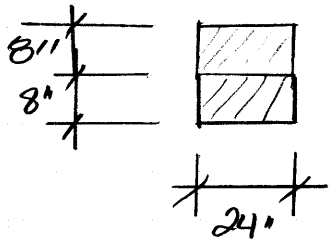
PROJECT: TRU WASTE	TO: STORAGE BLDGS
WAI NUMBER	FIRM
BY: RTH DATE: 3/20/11	PHONE FAX
CHECKED BY DATE	PAGE OF

SUBJECT

Determination of Slab LL Cont'd:

· Forklift load:

- assume wheel area in contact w/ slab



- front tire is 2 wheels
- rear tire is 1 wheel but for simplicity use same area

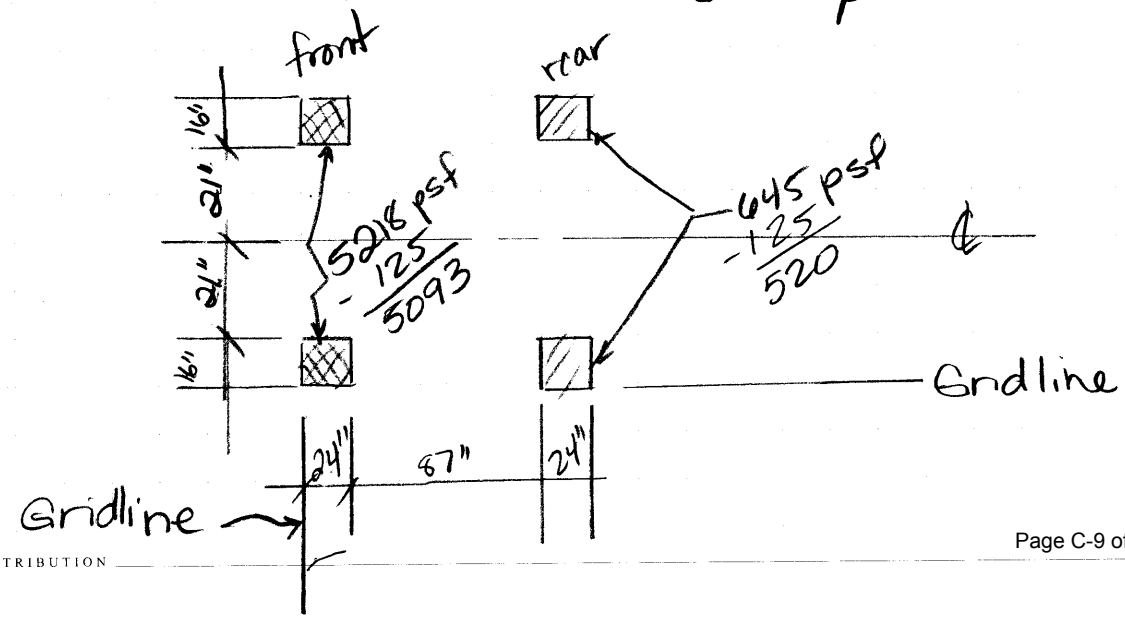
- front tire area load $= \dfrac{(27{,}830\#/2)}{(24'' \times 16'')/144\ in^2/ft^2}$

$= 5218$ psf

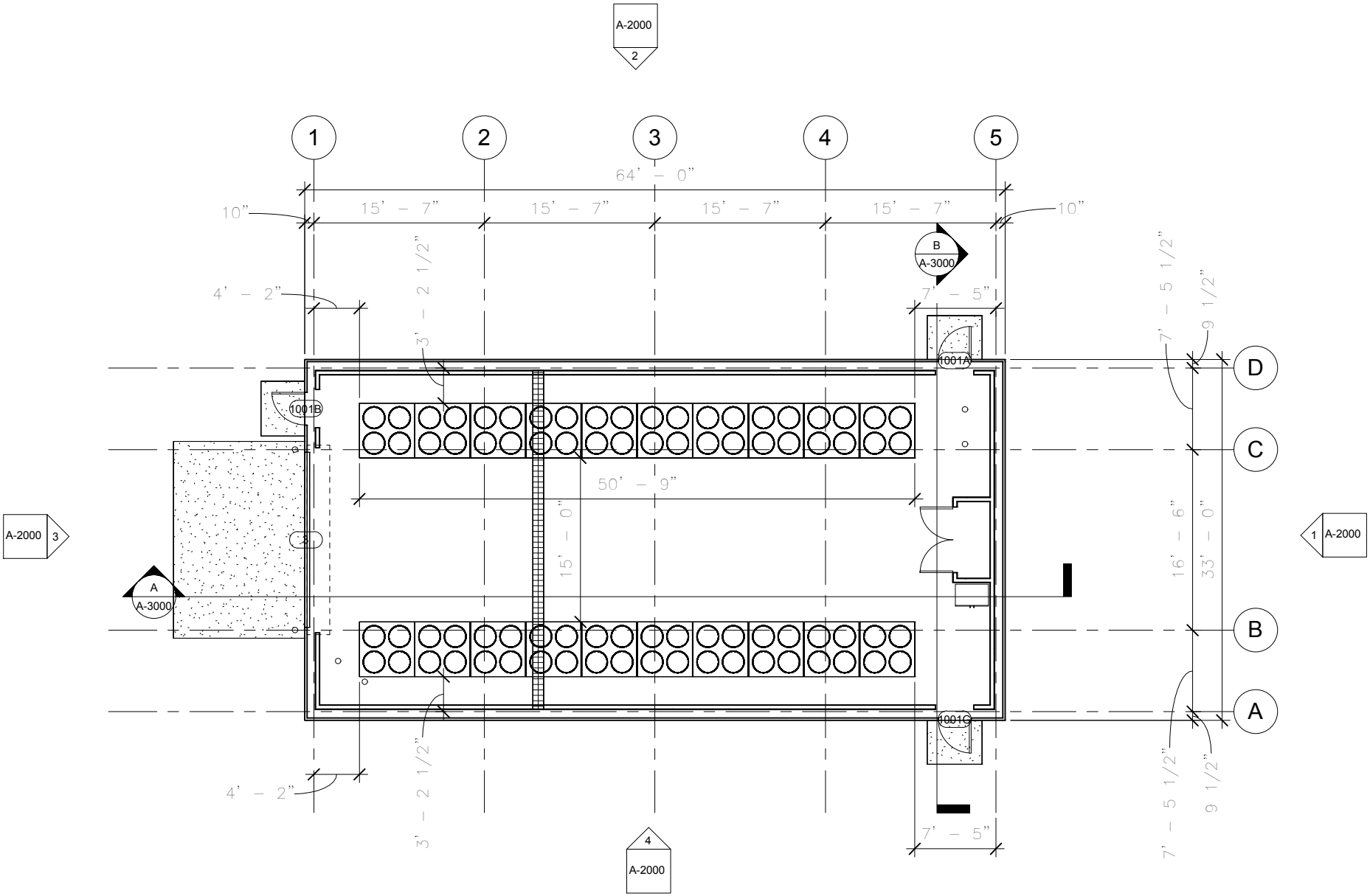
- rear tire area load $= \dfrac{(3440\#/2)}{(24'' \times 16'')/144\ in^2/ft}$

$= 645$ psf

ACTION

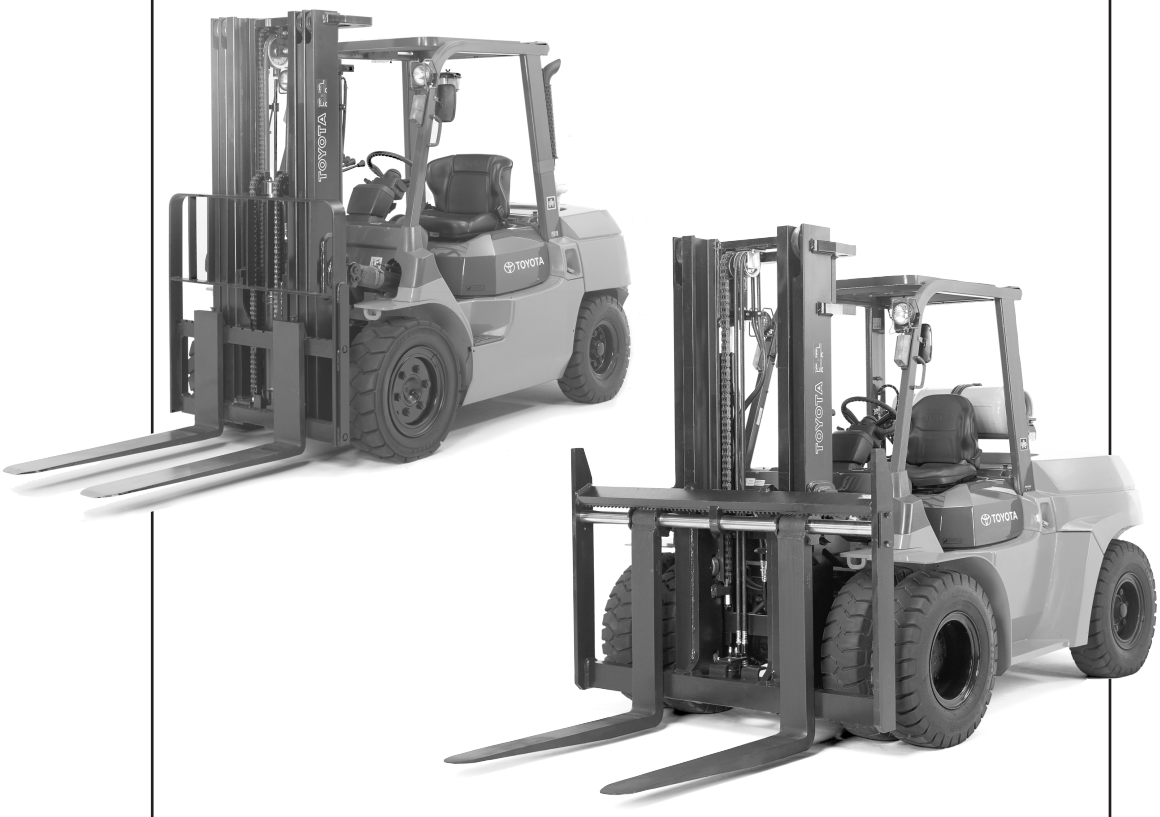


DISTRIBUTION


A-2000
2
1
2
3
4
5
64' – 0"
10"
15' – 7"
15' – 7"
15' – 7"
15' – 7"
10"
B
A-3000
4' – 2"
3' – 2 1/2"
7' – 5"
7' – 5 1/2"
9 1/2"
1001A
1001B
1001C
D
C
B
A
50' – 9"
15' – 0"
16' – 6"
33' – 0"
A-2000
3
1
A-2000
A
A-3000
4' – 2"
3' – 2 1/2"
7' – 5"
7' – 5 1/2"
9 1/2"
4
A-2000

7-SERIES PNEUMATIC

8,000–17,500 LBS



SPECIFICATIONS

TOYOTA
INDUSTRIAL EQUIPMENT

8,000 – 17,500 lbs. Standard Features

SAFETY

- EPA/CARB certified engine with 3-way closed loop catalytic muffler system
- Double action hand operated parking brake
- Electric horn
- Neutral start safety switch
- System of Active Stability (SAS)
  - *Active control rear stabilizer (n/a for dual drive tire configurations)*
  - *Active mast control function*
  - *SAS operation monitor*
- Asbestos free components
- High visibility overhead guard
- Low noise emissions
- Key lowering interlock

PERFORMANCE

- GM 4.3L, 262 ci, V6 gasoline engine
- Toyota 4.6L, 281 ci, inline 6 cyl diesel engine (13Z)
- Planetary drive axle
- Centralized Hydraulic Power System (CHPS)
  - *Power brakes*
  - *Hydrostatic power steering*
  - *Hydraulic functions*
- Hydraulic valve lifters (GM engine)
- Reverse-phase type 2 stator torque converter
  - *4 element, 2-stage, 3-phase type*
  - *8:1 torque multiplication*
- Class III hook carriage (8,000, 9,000, and 10,000 lb. models)
- Class IV hook carriage (11,000, 13,500 and 17,500 lb. models)
- Hydraulic oil cooler (on specified models)
- Dual Drive Tires (13,500, 15,500 and 17,500 lb. models)
- Rubber mounted high-efficiency radiator
- Radiator lint screen
- 8-inch Cyclone air cleaner
- External Air Intake located high on overhead guard leg
- Diesel sedimentor (water separator)
- Diesel suction filter
- Alternator with internal regulator
- Sealed Starter (GM engine)
- Air cleaner discharge valve
- Transmission oil cooler
- Transistorized ignition (GM engine)
- UL "G" gasoline model
- UL "D" diesel model
- 3-Way hydraulic control valve
- Anti-restart ignition key switch

OPERABILITY AND ERGONOMICS

- Ergonomically designed instrument display
- Integrated monitoring system
  - *Digital hour meter*
  - *Battery charge warning lamp*
  - *Engine coolant temperature gauge*
  - *Engine oil pressure warning lamp*
  - *Clogged air filter warning lamp*
  - *Fuel gauge (gasoline/diesel only)*
  - *SAS warning lamp*
  - *Swing lock cylinder activation lamp*
- Automatic fork leveling
- Memory tilt steering column
- Two spoke steering wheel
- Heavy-duty non-slip floor mat
- 4-Way vinyl semi-suspension seat
  - *Fore/aft adjustment*
  - *Weight adjustment*
  - *Back tilt adjustment*
  - *Lumbar support adjustment*
- Large hood mounted clipboard
- Pen/Pencil/Cup holder
- Adjustable front headlights and guards
- Electric shift control
- Combination headlight, turn signal lever
- Sealed engine hood compartment (steel) with sound and heat insulation
- Non-slip hand pad on engine hood
- Dual operator assist grips
- Low wide entry steps
- 2-Stage limited free lift mast (V-Mast)
- Wide view carriage bars
- Load backrest extension
- Pendant mounted pedals
- Independent brake & inching pedals
- Draw bar pin (except BCS models)
- Rubber mounted hydraulic control valve
- Cowl mounted hydraulic control levers with rubber boot covers

SERVICEABILITY

- Easy access no-tools floorboard
- Engine hood assist damper with lock device
- Low maintenance battery
- Easy access fuse panel box
- Fully opening Engine Compartment hood
- Easy access engine air filter
- Quick removal radiator cover and lint screen

8,000 – 17,500 lbs. Optional Equipment

- EZ-Pedal foot directional control
- Travel Speed Control System (selected models)
- Steel cab enclosure
- 2-stage full free lift mast (FV)
- 3-stage full free lift mast (FSV)
- LPG fuel system configurations with swing out tank bracket and one touch latch system
  - *UL-LP*
  - *UL-LPS*
  - *UL-LP/G dual fuel*
- Optional swing down feature for LPG tank bracket
- Engine protection system (selected models)
- Dual fuel system (gasoline/LPG)
- Hang on sideshifter
- Pin-type carriage & attachments (select models)
  - *Pin-type carriage with pin fork lock collars*
  - *Integral pin-type sideshifter*
  - *Integral pin-type sideshifting fork positioner*
- LPG low-fuel warning indicator
- Tilt cylinder boots (selected models)
- Keyless ignition switch
- Fire extinguisher
- Front combination lights
- Rear working light
- Mast mounted headlights (heavy duty)
- Strobe light (yellow, clear, red & blue)
- High mount rear combination light bar
- Back-up alarm
- Rear view mirrors (left & right)
- Upswept exhaust system
- 4-Way hydraulic control valve
- 3-Way full suspension seat with anti-cinching seat belt
  - *Fore/aft adjustment*
  - *Weight adjustment*
  - *Tilt adjustment*
- 4-Way cloth semi-suspension seat
- Accumulator
- O.K. Monitor
- High mount Pre-Cleaner for air intake
- Box-fin radiator
- Cooling fan booster
- Sealed alternator (standard with LPS)
- Tapered forks
- Fully tapered and polished forks
- Various load backrest extension heights
- Various carriage widths
- Adjustable dB Smart Alarm
- Combination inching/brake pedal (standard with EZ-Pedal option)
- Dual drive tires (selected models)
- Transmission oil temp gauge
- Solid pneumatic tires (front & rear)
- 12V-60A high capacity alternator
- OHG mounted pencil & tape holder
- Operator compartment light
- Tilt cylinder boots (selected models)
- Dual element Cyclone air cleaner

8,000 – 11,000 lbs. Truck Specifications

Models			7FGU35	7FDU35	7FGKU40	7FDKU40	7FGU45	7FDU45	7FGAU50	7FDAU50
Load Capacity (at 24" Load Center)		lbs.	8000		9000		10,000		11,000	
Body/Frame Construction			Welded steel body and frame							
Steering Type			Hydrostatic power steering							
Brakes			Hydraulic (foot)							
Transmission	Type		Reverse-phase type 2 stator torque converter with 8:1 torque multiplication							
	Speed (fwd/rev)		1/1							
Engine	Make/Model		GM 4.3L	TOYOTA 13Z	GM 4.3L	TOYOTA 13Z	GM 4.3L	TOYOTA 13Z	GM 4.3L	TOYOTA 13Z
	Type		6-cyl. OHV gasoline	6-cyl. OHV diesel	6-cyl. OHV gasoline	6-cyl. OHV diesel	6-cyl. OHV gasoline	6-cyl. OHV diesel	6-cyl. OHV gasoline	6-cyl. OHV diesel
Piston Displacement		cu. in.	262	281	262	281	262	281	262	281
Rated Horsepower - Net rpm		SAE HP	85 @ 2350 rpm	76 @ 2200 rpm	85 @ 2350 rpm	76 @ 2200 rpm	85 @ 2350 rpm	76 @ 2200 rpm	85 @ 2350 rpm	76 @ 2200 rpm
Rated Torque - Net rpm		SAE ft-lb.	217 @ 1200 rpm	192 @ 1600 rpm	217 @ 1200 rpm	192 @ 1600 rpm	217 @ 1200 rpm	192 @ 1600 rpm	217 @ 1200 rpm	192 @ 1600 rpm

EXTERIOR DIMENSIONS

Models				7FGU35	7FDU35	7FGKU40	7FDKU40	7FGU45	7FDU45	7FGAU50	7FDAU50
A	Maximum Fork Height (MFH)		in.	120	120	120	120	120	120	120.5	120.5
B	Mast Lowered Height		in.	83	83	83	83	86.5	86.5	96.5	96.5
C	Free Lift		in.	4.3	4.3	4.3	4.3	4.5	4.5	4.7	4.7
D	Load Distance*		in.	20.5	20.5	20.5	20.5	22.4	22.4	23.0	23.0
E	Wheelbase		in.	72.4	72.4	72.4	72.4	78.7	78.7	78.7	78.7
F	Fork Size (TxWxL)		in.	2x6x42	2x6x42	2x6x42	2x6x42	2x6x42	2x6x42	2.6x6x48	2.6x6x48
G	Length to Fork Face		in.	115	115	117.1	117.1	123.0	123.0	125.4	125.4
H	Overhead Guard Height		in.	86.2	86.2	86.2	86.2	90.0	90.0	90.0	90.0
I	Tilt Range (Fwd/Bwd)		deg	6/12	6/12	6/12	6/12	6/12	6/12	6/12	6/12
J	Outside Turning Radius		in.	101.8	101.8	104.3	104.3	108.3	108.3	110.2	110.2
K	Rt Angle Stacking Aisle Width**		in.	122.2	122.2	124.8	124.8	130.7	130.7	133.2	133.2
L	Overall Width		in.	57.1	57.1	57.1	57.1	57.1	57.1	57.1	57.1
M	Carriage Width		in.	46	46	46	46	46	46	46	46
N	Std Tread Width (Front/Rear)		in.	45.3/43.3	45.3/43.3	45.3/43.3	45.3/43.3	45.3/43.3	45.3/43.3	45.3/43.3	45.3/43.3
O	Underclearance	Minimum w/ load	in.	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
		Center of W.B.	in.	7.5	7.5	7.5	7.5	8.3	8.3	8.3	8.3

PERFORMANCE DATA

				7FGU35	7FDU35	7FGKU40	7FDKU40	7FGU45	7FDU45	7FGAU50	7FDAU50
Maximum Travel Speed	Full Load	Forward	mph	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
		Reverse	mph	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7
	No Load	Forward	mph	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
		Reverse	mph	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Lifting Speeds (V mast)		Full Load	fpm	101	101	101	101	87.1	95.0	87.1	95.0
		No Load	fpm	109	109	109	109	95	103	95	103
Lowering Speeds (V mast)		Full Load	fpm	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0
		No Load	fpm	109	109	109	109	99.0	99.0	99.0	99.0
Maximum Drawbar Pull		Full Load	lbs	7900	8350	7900	8350	7900	8350	7900	8350
		No Load	lbs	3090	3090	3090	3090	3750	3750	3970	3970
Maximum Gradeability		Full Load	%	42	43	38	39	34	35	31	32
		No Load	%	22	21	19	19	22	22	22	22

TRUCK WEIGHTS

				7FGU35	7FDU35	7FGKU40	7FDKU40	7FGU45	7FDU45	7FGAU50	7FDAU50
Gross Weight (empty)			lbs	12460	12740	13320	13610	14580	14930	15950	16300
Weight Distribution	Full Load	Front	lbs	18160	18200	19550	19600	21940	22070	24300	24430
		Rear	lbs	2300	2540	2770	3010	2640	2860	2650	2870
	No Load	Front	lbs	5250	5290	5030	5070	6040	6180	6730	6860
		Rear	lbs	7210	7450	8290	8540	8540	8750	9220	9440

FUEL CAPACITY

Gasoline Fuel Tank	US gal	27.7	27.7	27.7	27.7	31.7	31.7	31.7	31.7

ATTACHMENT

Auxiliary Function Pressure Relief	psi	2630	2630	2630	2630	2630	2630	2630	2630
Auxiliary Function Flow Rate (max)	gpm	29	30	29	30	29	33	29	33

TIRES

Type (front/rear)		Pneumatic/Pneumatic			
Size	Drive (Front)	28x12-15-20PR (I)	28x12-15-20PR (I)	32x12-15-20PR (I)	32x12-15-20PR (I)
	Steer (Rear)	7.00-12-12PR (I)	7.00-12-12PR (I)	7.00-12-12PR (I)	7.00-12-12PR (I)

** Centerline of front axle to front face of forks*

*** Add load length and clearance*

13,500 – 17,500 lbs. Truck Specifications

Models			7FGU60	7FDU60	7FGU70	7FDU70	7FGU80	7FDU80
Load Capacity (at 24" Load Center)		lbs.	13,500		15,500		17,500	
Body/Frame Construction			Welded steel body and frame					
Steering Type			Hydrostatic power steering					
Brakes			Hydraulic (foot)					
Transmission	Type		Reverse-phase type 2 stator torque converter with 8:1 torque multiplication					
	Speed (fwd/rev)		1/1					
Engine	Make/Model		GM 4.3L	TOYOTA 13Z	GM 4.3L	TOYOTA 13Z	GM 4.3L	TOYOTA 13Z
	Type		6-cyl. OHV gasoline	6-cyl. OHV diesel	6-cyl. OHV gasoline	6-cyl. OHV diesel	6-cyl. OHV gasoline	6-cyl. OHV diesel
Piston Displacement		cu. in.	262	281	262	281	262	281
Rated Horsepower - Net rpm		SAE HP	89 @ 2600 rpm	81 @ 2300 rpm	89 @ 2600 rpm	81 @ 2300 rpm	89 @ 2600 rpm	81 @ 2300 rpm
Rated Torque - Net rpm		SAE ft-lb.	217 @ 1200 rpm	192 @ 1600 rpm	217 @ 1200 rpm	192 @ 1600 rpm	217 @ 1200 rpm	192 @ 1600 rpm

EXTERIOR DIMENSIONS

	Models			7FGU60	7FDU60	7FGU70	7FDU70	7FGU80	7FDU80
A	Maximum Fork Height (MFH)		in.	120.5	120.5	120.5	120.5	121	121
B	Mast Lowered Height		in.	96.9	96.9	96.9	96.9	102.8	102.8
C	Free Lift		in.	4.9	4.9	4.9	4.9	5.1	5.1
D	Load Distance*		in.	23.2	23.2	23.2	23.2	23.4	23.4
E	Wheelbase		in.	86.6	86.6	86.6	86.6	86.6	86.6
F	Fork Size (TxWxL)		in.	2.6x6x48	2.6x6x48	2.6x6x48	2.6x6x48	2.8x6x48	2.8x6x48
G	Length to Fork Face		in.	131.9	131.9	133.9	133.9	137.0	137.0
H	Overhead Guard Height		in.	90.4	90.4	90.4	90.4	90.4	90.4
I	Tilt Range (Fwd/Bwd)		deg	6/10	6/10	6/10	6/10	6/10	6/10
J	Outside Turning Radius		in.	121.2	121.2	123.2	123.2	125.9	125.9
K	Rt Angle Stacking Aisle Width**		in.	144.5	144.5	146.4	146.4	149.4	149.4
L	Overall Width		in.	77.4	77.4	77.4	77.4	77.4	77.4
M	Carriage Width		in.	67	67	67	67	67	67
N	Std Tread Width (Front/Rear)		in.	56.7/57.5	56.7/57.5	56.7/57.5	56.7/57.5	56.7/57.5	56.7/57.5
O	Underclearance	Minimum w/ load	in.	5.1	5.1	5.1	5.1	5.1	5.1
		Center of W.B.	in.	8.7	8.7	8.7	8.7	8.7	8.7

PERFORMANCE DATA

Maximum Travel Speed	Full Load	Forward	mph	11.8	11.8	11.8	11.8	11.8	11.8
		Reverse	mph	11.8	11.8	11.8	11.8	11.8	11.8
	No Load	Forward	mph	13.0	13.0	13.0	13.0	13.0	13.0
		Reverse	mph	13.0	13.0	13.0	13.0	13.0	13.0
Lifting Speeds (V mast)		Full Load	fpm	80.8	80.8	80.8	80.8	72.9	72.9
		No Load	fpm	86.7	86.7	86.7	86.7	85.0	85.0
Lowering Speeds (V mast)		Full Load	fpm	98.5	98.5	98.5	98.5	98.5	98.5
		No Load	fpm	92.6	92.6	92.6	92.6	94.6	94.6
Maximum Drawbar Pull		Full Load	lbs	10350	10350	10350	10350	10150	10150
		No Load	lbs	3980	3980	3825	3825	3665	3665
Maximum Gradeability		Full Load	%	34	34	30	30	26	26
		No Load	%	23	23	20	20	18	18

TRUCK WEIGHTS

Gross Weight (empty)			lbs	18300	18540	19800	20020	21450	21670
Weight Distribution	Full Load	Front	lbs	29060	29170	31980	32090	34930	35040
		Rear	lbs	2740	2870	3320	3430	4020	4130
	No Load	Front	lbs	8200	8310	8030	8140	7850	7960
		Rear	lbs	10100	10230	11770	11880	13600	13710

FUEL CAPACITY

Gasoline Fuel Tank		US gal	31.7	31.7	31.7	31.7	31.7	31.7

ATTACHMENT

Auxiliary Function Pressure Relief	psi	2990	2990	2990	2990	2990	2990
Auxiliary Function Flow Rate (max)	gpm	35	35	35	35	35	35

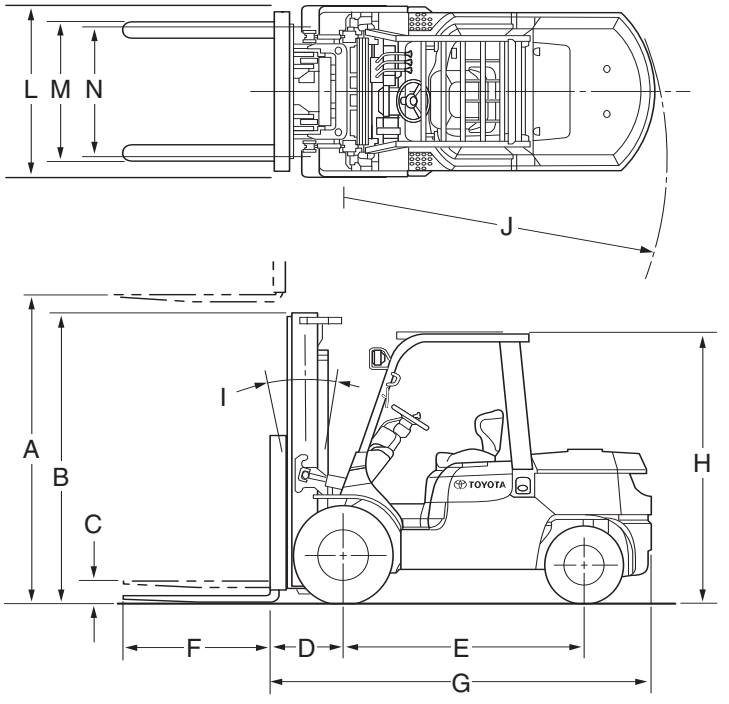
TIRES

Type (front/rear)		Pneumatic/Pneumatic		
Size	Drive (Front)	8.25-15-12PR(I)	8.25-15-12PR(I)	8.25-15-14PR(I)
	Steer (Rear)	8.25-15-12PR(I)	8.25-15-12PR(I)	8.25-15-14PR(I)

** Centerline of front axle to front face of forks*

*** Add load length and clearance*

8,000 – 17,500 lbs. Truck Dimensions



7FGAU50 model shown above

8,000 – 10,000 lbs. Mast Specifications

7FGU/DU35 & 7FGKU/DKU40

Mast Type	Maximum Fork Height (top of forks)	Overall Height			Free Lift		7FG/DU35						7FGKU/DKU40					
			Extended				Single Tire			Optional Dual Tires			Single Tire			Optional Dual Tires		
		Lowered	Without Load Backrest	With Load Backrest	Without Load Backrest	With Load Backrest	Tilt Range		Load Capacity @ 24" Load Center	Tilt Range		Load Capacity @ 24" Load Center	Tilt Range		Load Capacity @ 24" Load Center	Tilt Range		Load Capacity @ 24" Load Center
							FWD	BWD		FWD	BWD		FWD	BWD		FWD	BWD	
	in.	in.	in.	in.	in.	in.	deg.	deg.	lbs.	deg.	deg.	lbs.	deg.	deg.	lbs.	deg.	deg.	lbs.
V	120	83.1	151.6	166.2	4.3	4.3	6	12	8000	6	12	8000	6	12	9000	6	12	9000
	131.5	90.2	163.4	178.0	4.3	4.3	6	12	8000	6	12	8000	6	12	9000	6	12	9000
	139.5	94.1	171.3	185.9	4.3	4.3	6	12	8000	6	12	8000	6	12	9000	6	12	9000
	147.5	98.0	179.1	193.7	4.3	4.3	6	12	8000	6	12	8000	6	12	9000	6	12	9000
	159	107.9	190.9	205.5	4.3	4.3	6	12	8000	6	12	8000	6	12	9000	6	12	9000
	179	117.7	210.6	225.2	4.3	4.3	6	12	8000	6	12	8000	6	12	9000	6	12	9000
	198.5	127.6	230.3	244.9	4.3	4.3	6	6	7800	6	12	7800	6	6	7940	6	12	9000
	218.5	139.4	250.0	264.6	4.3	4.3	6	6	6950	6	12	7400	6	6	6100	6	12	8200
FV	120	83.1	152.8	166.2	50.4	35.0	6	12	8000	6	12	8000	6	12	9000	6	12	9000
	131.5	90.2	164.6	178.0	57.5	42.1	6	12	8000	6	12	8000	6	12	9000	6	12	9000
FSV	159	78.4	192.1	205.5	45.7	30.3	6	6	8000	6	6	8000	6	6	9000	6	6	9000
	171	83.1	203.9	217.3	50.4	35.0	6	6	8000	6	6	8000	6	6	9000	6	6	9000
	187	90.2	219.7	233.1	57.5	42.1	6	6	7700	6	6	7700	6	6	8800	6	6	9000
	198.5	94.1	231.5	244.9	61.4	46.0	6	6	7500	6	6	7500	6	6	7500	6	6	9000
	218.5	100.0	251.2	264.6	67.3	51.9	6	6	6200	6	6	7250	6	6	5730	6	6	9000
	238	107.9	270.9	284.3	75.2	59.8	6	6	4600	6	6	7050	6	6	4520	6	6	7280

Note: Height of standard load backrest is 48 in.

7FGU/7FDU45

Mast Type	Maximum Fork Height (top of forks)	Overall Height			Free Lift		Single Tire			Optional Dual Tires		
		Lowered	Extended				Tilt Range		Load Capacity @ 24" Load Center	Tilt Range		Load Capacity @ 24" Load Center
			Without Load Backrest	With Load Backrest	Without Load Backrest	With Load Backrest	FWD	BWD		FWD	BWD	
	in.	in.	in.	in.	in.	in.	deg.	deg.	lbs.	deg.	deg.	lbs.
V	120	86.6	146.7	166.2	4.3	4.3	6	12	10000	6	12	10000
	131.5	92.5	158.5	178.0	4.3	4.3	6	12	10000	6	12	10000
	139.5	96.5	166.3	185.8	4.3	4.3	6	12	10000	6	12	10000
	147.5	102.4	174.2	193.7	4.3	4.3	6	12	10000	6	12	10000
	159	110.2	186.0	205.5	4.3	4.3	6	12	10000	6	12	10000
	179	120.1	205.7	225.2	4.3	4.3	6	6	10000	6	12	10000
	198.5	129.9	225.4	244.9	4.3	4.3	6	6	8850	6	12	9750
	218.5	139.8	245.1	264.6	4.3	4.3	6	6	6200	6	12	8800
FV	120	86.6	147.2	166.1	59.5	38.6	6	12	10000	6	12	10000
	131.5	92.5	159.1	178.0	65.5	44.6	6	12	10000	6	12	10000
FSV	159	83.5	186.8	205.5	56.3	35.4	6	6	10000	6	6	10000
	171	86.6	198.6	217.3	59.5	38.6	6	6	9750	6	6	9750
	187	92.5	214.4	233.1	65.4	44.5	6	6	9300	6	6	9700
	198.5	96.5	226.2	244.9	69.3	48.4	6	6	8800	6	6	9450
	218.5	102.4	245.9	264.6	75.2	54.3	6	6	6650	6	6	9000
	238	110.2	265.6	284.3	83.1	62.2	6	6	5150	6	6	8600

Note: Height of standard load backrest is 48 in.

11,000 – 17,500 lbs. Mast Specifications

7FGAU/7FDAU50

Mast Type	Maximum Fork Height (top of forks)	Overall Height			Free Lift		Single Tire			Optional Dual Tires		
		Lowered	Extended				Tilt Range		Load Capacity @ 24" Load Center	Tilt Range		Load Capacity @ 24" Load Center
			Without Load Backrest	With Load Backrest	Without Load Backrest	With Load Backrest	FWD	BWD		FWD	BWD	
	in.	in.	in.	in.	in.	in.	deg.	deg.	lbs.	deg.	deg.	lbs.
V	120.5	96.5	153.7	174.6	4.9	4.9	6	12	11000	6	12	11000
	132	102.4	165.6	186.5	4.9	4.9	6	12	11000	6	12	11000
	140	110.2	173.4	194.3	4.9	4.9	6	12	11000	6	12	11000
	148	110.2	181.3	202.2	4.9	4.9	6	12	11000	6	12	11000
	159.5	120.1	193.1	214.0	4.9	4.9	6	12	11000	6	12	11000
	179.5	129.9	212.8	233.7	4.9	4.9	6	6	11000	6	12	11000
	199	139.8	232.5	253.4	4.9	4.9	6	6	9000	6	12	10600
FSV	159.5	89.4	194.3	214.0	55.1	35.4	6	6	10800	6	6	10800
	171.5	92.5	206.1	225.8	58.3	38.6	6	6	10600	6	6	10600
	187.5	96.5	221.9	241.6	62.2	42.5	6	6	9500	6	6	10200
	199	102.4	233.7	253.4	68.1	48.4	6	6	9000	6	6	10000
	219	110.2	253.4	273.1	76.0	56.3	6	6	6800	6	6	9500
	238.5	120.1	273.0	292.7	85.8	66.1	6	6	5300	6	6	9000

Note: Height of standard load backrest is 54 in.

7FGU/7FDU60 & 7FGU/7FDU70

Mast Type	Maximum Fork Height (top of forks)	Overall Height			Free Lift		7FGU/DU60			7FGU/DU70		
		Lowered	Extended				Tilt Range		Load Capacity @ 24" Load Center	Tilt Range		Load Capacity @ 24" Load Center
			Without Load Backrest	With Load Backrest	Without Load Backrest	With Load Backrest	FWD	BWD		FWD	BWD	
	in.	in.	in.	in.	in.	in.	deg.	deg.	lbs.	deg.	deg.	lbs.
V	120.5	96.9	156.7	174.5	4.9	4.9	6	10	13500	6	10	15500
	132	102.8	168.5	186.0	4.9	4.9	6	10	13500	6	10	15500
	140	106.7	176.4	194.0	4.9	4.9	6	10	13500	6	10	15500
	148	110.6	184.3	202.0	4.9	4.9	6	10	13500	6	10	15500
	179.5	130.3	215.8	233.5	4.9	4.9	6	10	13200	6	10	15500
	218.5	150.0	255.1	272.5	4.9	4.9	6	10	12500	6	10	14600
FSV	159.5	92.9	196.9	213.5	56.1	39.0	6	6	13300	6	6	15500
	171.5	96.9	208.7	225.5	60.0	42.9	6	6	12900	6	6	14800
	187.5	100.4	224.4	241.5	63.6	46.5	6	6	12400	6	6	14600
	199	110.6	236.2	253.0	73.8	56.7	6	6	11650	6	6	13700
	219	120.5	255.9	273.0	83.7	66.5	6	6	10800	6	6	12700
	238.5	122.4	275.6	292.5	85.6	68.5	6	6	9850	6	6	11600

Note: Height of standard load backrest is 54 in.

7FGU/7FDU80

Mast Type	Maximum Fork Height (top of forks)	Overall Height			Free Lift		Tilt Range		Load Capacity @ 24" Load Center
		Lowered	Extended						
			Without Load Backrest	With Load Backrest	Without Load Backrest	With Load Backrest	FWD	BWD	
	in.	in.	in.	in.	in.	in.	deg.	deg.	lbs.
V	121	102.8	160.8	175.0	5.1	5.1	6	10	17500
	132.5	106.7	172.6	186.5	5.1	5.1	6	10	17500
	140.5	110.6	180.5	194.5	5.1	5.1	6	10	17500
	148.5	120.5	188.4	202.5	5.1	5.1	6	10	17500
	180	140.2	219.9	234.0	5.1	5.1	6	10	17500

Note: Height of standard load backrest is 54 in.

Some product features described herein are optional. Please consult your dealer for specifications. Details and specifications of equipment are based on information available at the time of printing and may change without notice.

00722-71006 8/04
Litho in U.S.A. (15M)

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TOYOTA
INDUSTRIAL EQUIPMENT

Check Sliding:

Per STAAD Steel Calculations, Maximum Lateral Load (Loads and Applied Forces - Seismic):

$$Lateral_{eq} := 30.5kip$$

Total Dead Load of Building (Support Loads from STAAD Steel Columns):

$$DL_{bldg} := (5.683 + 8.917)\cdot 4\cdot kip + (8.665)\cdot 2\cdot kip + 0.51\cdot 4kip = 77.77\cdot kip$$

Total Dead Load of Foundation:

$$DL_{slab} := 0.150\frac{kip}{ft^3}\cdot(64.33ft\cdot 33.5ft)\cdot 1ft = 323.3\cdot kip$$

$$DL_{thickened} := 0.150\frac{kip}{ft^3}\cdot[(4ft\cdot 3ft\cdot 30in)\cdot 6 + (3\cdot ft\cdot 3\cdot ft\cdot 30\cdot in)\cdot 4] = 40.5\cdot kip$$

$$DL_{turndown} := 0.150\frac{kip}{ft^3}\cdot(1ft\cdot 27.5ft\cdot 30in)\cdot 2 + 0.150\frac{kip}{ft^3}\cdot(1ft\cdot 13.583ft\cdot 30in)\cdot 8 = 61.4\cdot kip$$

Total Dead Load: Building Load + Foundation Load:

$$DL_{total} := DL_{bldg} + DL_{slab} + DL_{thickened} + DL_{turndown} = 502.9\cdot kip$$

Base Friction:

Coefficient of Friction (Geotechnical Report):

$$\mu := 0.38$$

$Friction := \mu\cdot DL_{total} = 191.1\cdot kip$ >>$Lateral_{eq}$, OK

Safety Factor: $SF := \frac{Friction}{Lateral_{eq}} = 6.266$ >> 1.5, OK

SAFE ANALYSIS RESULTS

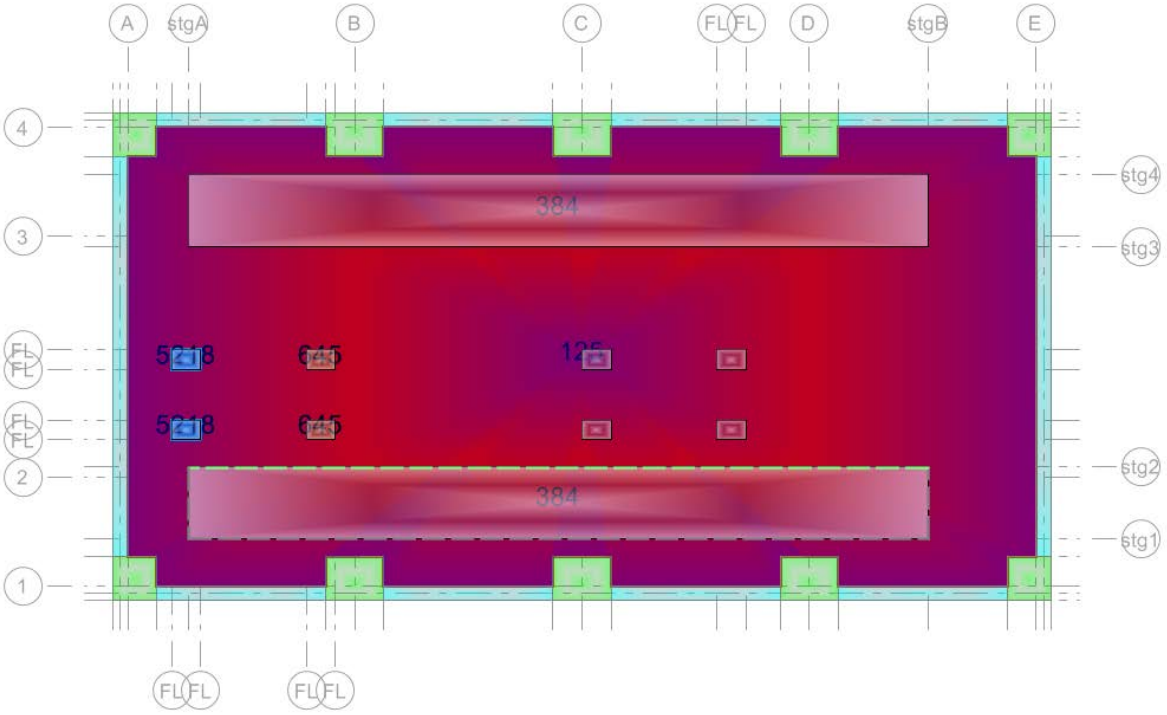
SUPPLEMENT

Due to SAFE's limitations in its capabilities to print analysis results, specific analysis results are "captured" from the programs graphics and tables. Printing the desired results directly from SAFE's Report Writer results in enormous amounts of insignificant data. This supplement is an effort to only capture significant data.

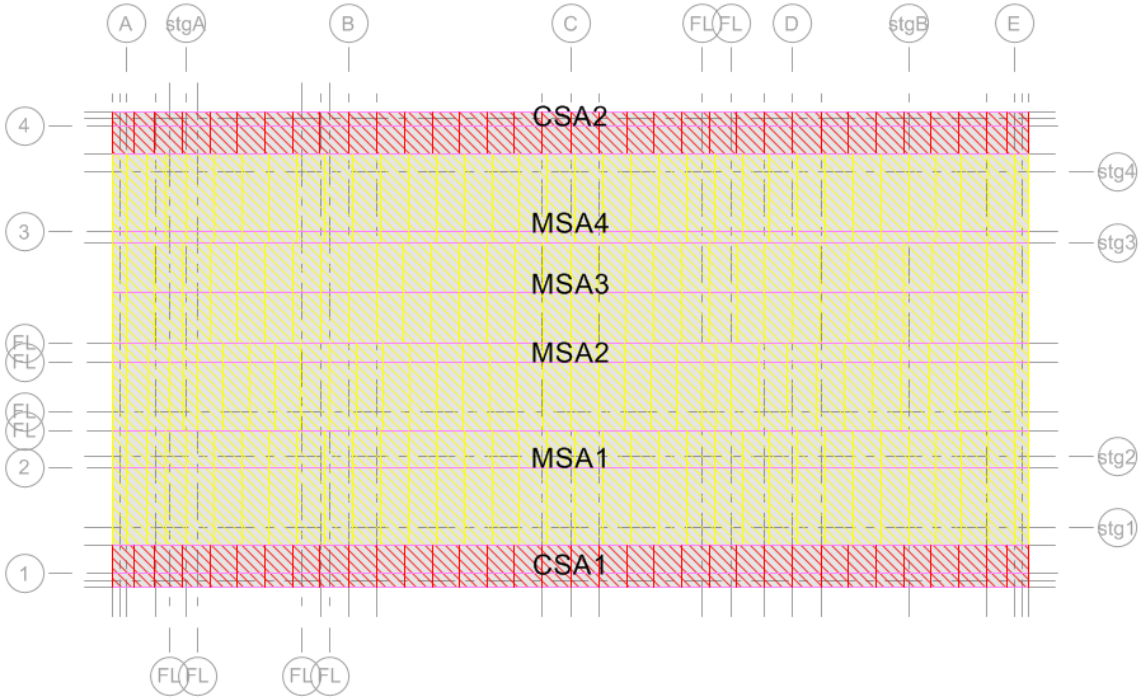
The following Captures are taken from the following SAFE File:

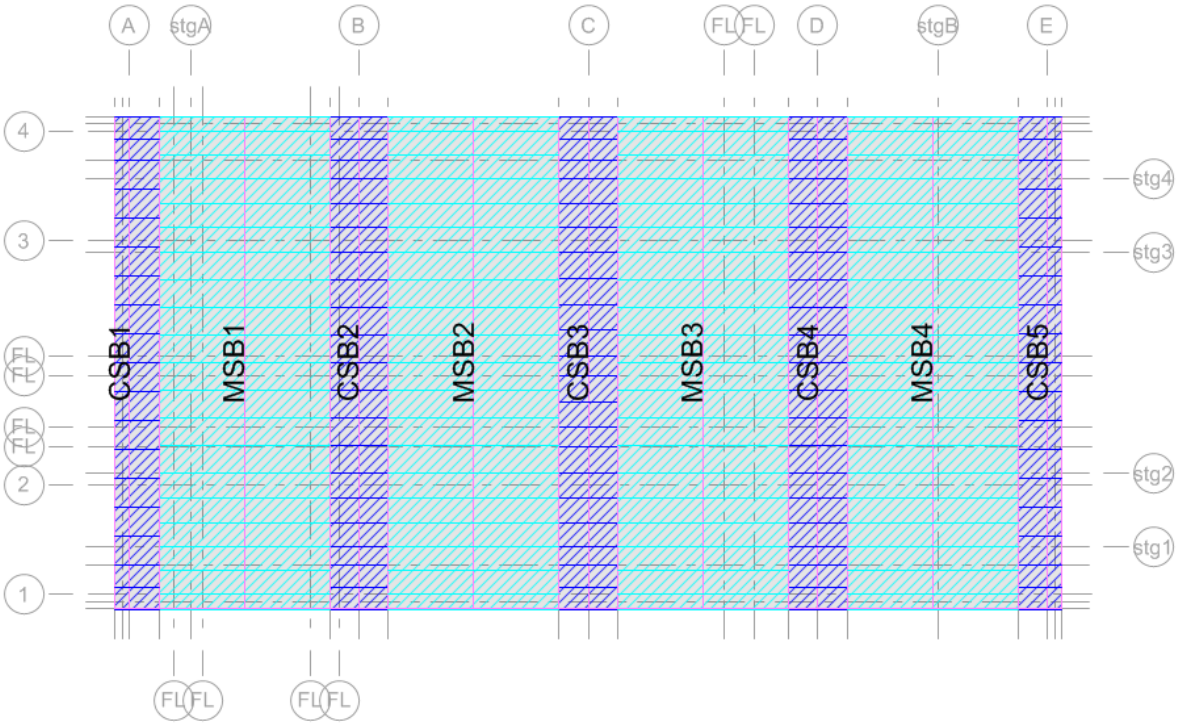
TWF Storage Bldg1 FINAL.

SLAB LIVE LOADED AREA:



DESIGN STRIPS: LAYER A and LAYER B



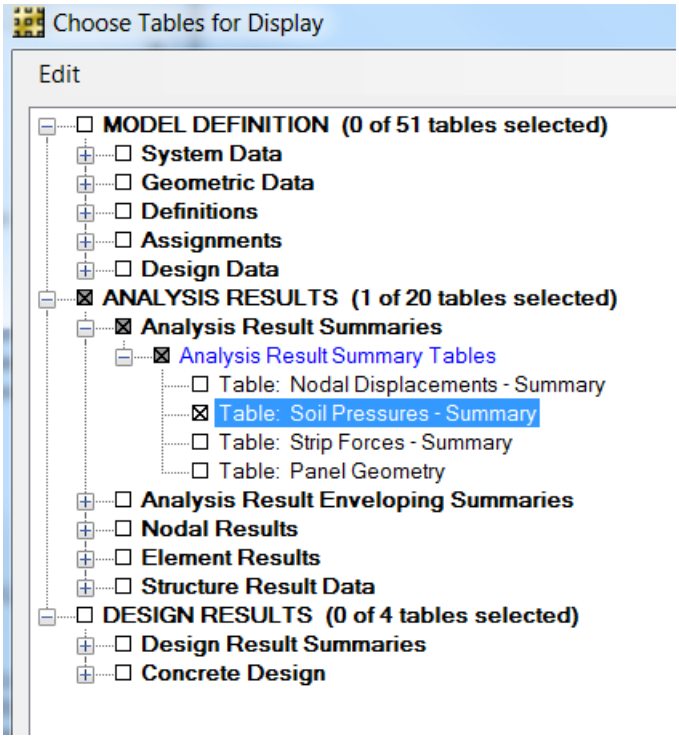


Strip Text	Point Text	GlobalX ft	GlobalY ft	WBLeft ft	WBRight ft	WALeft ft	WARight ft
CSA1	1	-1	0			2	1
CSA1	2	63.3333	0	2	1		
CSA2	13	-1	31.4167			1	2
CSA2	14	63.3333	31.4167	1	2		
CSB1	15	0	-1			1	2
CSB1	16	0	32.4167	1	2		
CSB2	67	15.5833	-1			2	2
CSB2	20	15.5833	32.4167	2	2		
CSB3	77	31.1667	-1			2	2
CSB3	25	31.1667	32.4167	2	2		
CSB4	82	46.75	-1			2	2
CSB4	32	46.75	32.4167	2	2		
CSB5	43	62.3333	-1			2	1
CSB5	44	62.3333	32.4167	2	1		
MSA1	3	-1	7.4583			2.5417	5.4583
MSA1	4	63.3333	7.4583	2.5417	5.4583		
MSA2	5	-1	14.8333			1.3334	4.8333
MSA2	6	63.3333	14.8333	1.3334	4.8333		
MSA3	9	-1	19.6875			3.5208	3.5208
MSA3	10	63.3333	19.6875	3.5208	3.5208		
MSA4	11	-1	23.9583			5.4584	0.75
MSA4	12	63.3333	23.9583	5.4584	0.75		
MSB1	17	7.7917	-1			5.7917	5.7917
MSB1	19	7.7917	32.4167	5.7917	5.7917		
MSB2	21	23.375	-1			5.7917	5.7917
MSB2	30	23.375	32.4167	5.7917	5.7917		
MSB3	31	38.9584	-1			5.7917	5.7917
MSB3	37	38.9584	32.4167	5.7917	5.7917		
MSB4	38	54.5417	-1			5.7917	5.7917
MSB4	39	54.5417	32.4167	5.7917	5.7917		

LOAD COMBINATIONS USED IN SAFE ANALYSIS: The Load combinations are noted as either the Allowable (Allow) or Strength Design (SD) load combination. The ASCE Load Case number is shown. When the ASCE Load combination has an "or", such as Live Roof "or" Snow, then the selected load case is shown in parenthesis.

- Load Definitions
  - Load Patterns
  - Load Cases
  - Load Combinations
    - ASCE 1 Allow
    - ASCE 1 SD
    - ASCE 3a SD (Lr-L)
    - ASCE 2 Allow
    - ASCE 3 Allow
    - ASCE 4a Allow (Lr)
    - ASCE 4b Allow (S)
    - ASCE 5a Allow (Wx)
    - ASCE 5b Allow (Wy)
    - ASCE 5c Allow (Ex)
    - ASCE 5d Allow (Ey)
    - ASCE 6a Allow (Wx-Lr)
    - ASCE 6b Allow (Wx-S)
    - ASCE 6c Allow (Wy-Lr)
    - ASCE 6d Allow (Wy-S)
    - ASCE 6e Allow (Ex-Lr)
    - ASCE 6f Allow (Ex-S)
    - ASCE 6g Allow (Ey-Lr)
    - ASCE 6h Allow (Ey-S)
    - ASCE 7a Allow (Wx)
    - ASCE 7b Allow (Wy)
    - ASCE 8a Allow (Ex-nv)
    - ASCE 8b Allow (Ey-nv)
    - ASCE 2b SD (S)
    - ASCE 3b SD (S-L)
    - ASCE 3c SD (Lr-Wx)
    - ASCE 3d SD (Lr-Wy)
    - ASCE 3e SD (S-Wx)
    - ASCE 3f SD (S-Wy)
    - ASCE 2a SD (Lr)
    - ASCE 4a SD (Wx-Lr)
    - ASCE 4b SD (Wy-Lr)
    - ASCE 4c SD (Wx-S)
    - ASCE 4d SD (Wy-S)
    - ASCE 5a SD (Ex)
    - ASCE 5b SD (Ey)
    - ASCE 6a SD (Wx)
    - ASCE 6b SD (Wy)
    - ASCE 7a SD (Ex-nv)
    - ASCE 7b SD (Ey-nv)
- Groups

SOIL BEARING RESULTS: Using SAFE's TABLES showing analysis data, the following Table is taken from the following branch with only Allowable Load Combinations selected:



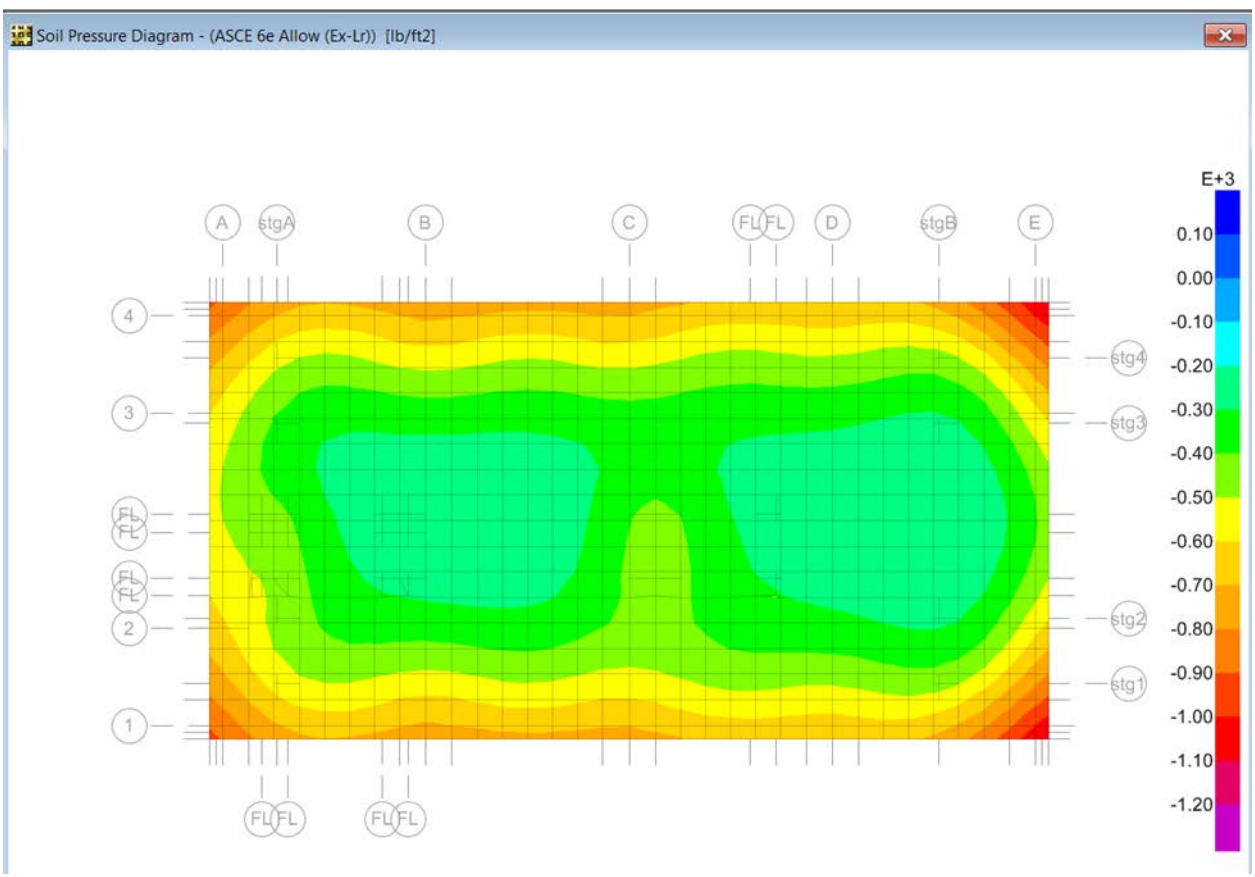
The Table is sorted by the "MaxPress" field:

Panel Text	OutputCase Text	CaseType Text	MaxPress lb/ft2	MinPress lb/ft2	GlobalXMax	GlobalYMax	GlobalXMin ft	GlobalYMin ft
391	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
408	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
407	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
390	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
376	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
375	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
393	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
392	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
391	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
407	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
390	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
408	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
392	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
376	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
393	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
375	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
391	ASCE 4a Allow (Lr)	Combination	-956.11	-1063.22	62.3333	32.4167	62.3333	32.4167

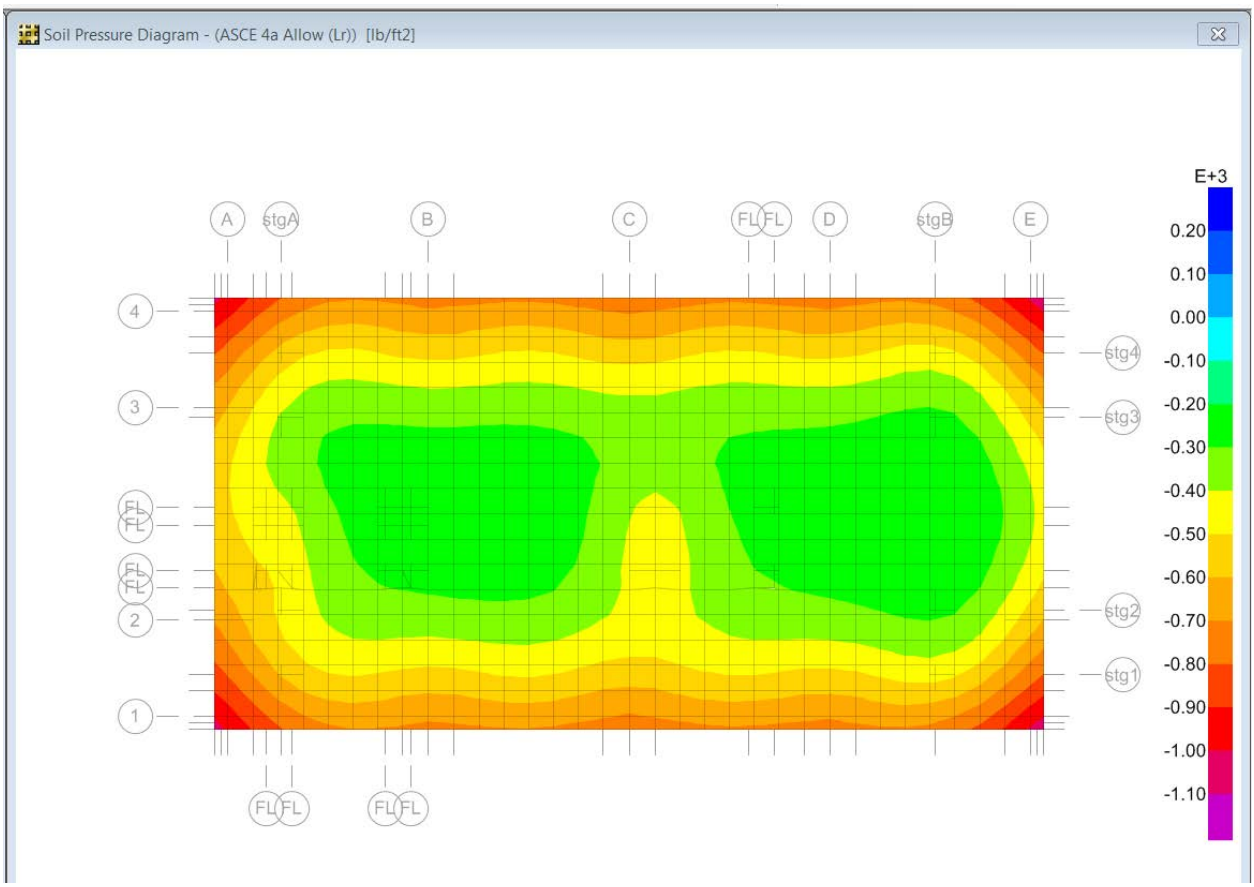
The Table is sorted by the "MinPress" field:

Panel Text	OutputCase Text	CaseType Text	MaxPress lb/ft2	MinPress lb/ft2	GlobalXMax	GlobalYMax	GlobalXMin ft	GlobalYMin ft
391	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
408	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
407	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
390	ASCE 6e Allow (Ex-Lr)	Combination	-1006.89	-1120.8	62.3333	32.4167	62.3333	32.4167
376	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
393	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
392	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
375	ASCE 6e Allow (Ex-Lr)	Combination	-1005.62	-1119.27	62.3333	0	62.3333	0
391	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
408	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
407	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
390	ASCE 6f Allow (Ex-S)	Combination	-989.29	-1100.28	62.3333	32.4167	62.3333	32.4167
376	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
375	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
393	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
392	ASCE 6f Allow (Ex-S)	Combination	-988.07	-1098.82	62.3333	0	62.3333	0
393	ASCE 3 Allow	Combination	-954.87	-1079.17	62.3333	0	62.3333	0
375	ASCE 3 Allow	Combination	-954.87	-1079.17	62.3333	0	62.3333	0

The following is the Soil Bearing Pressure for Load Combination ASCE 6e Allow (Ex-Lr) or D+0.75Ex+0.75L+ 0.75Lr:



The following is the Soil Bearing Pressure for Load Combination ASCE 4a Allow (Lr) or D+0.75L+0.75Lr:



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TRU Waste Facility

Project Number: 11-001

Prepared for

LANL

SAFE Analysis & Design Report

Prepared by

Weildinger Assocaites, Inc.

Model Name: Mat Foundation

31 March 2011

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Model Definition

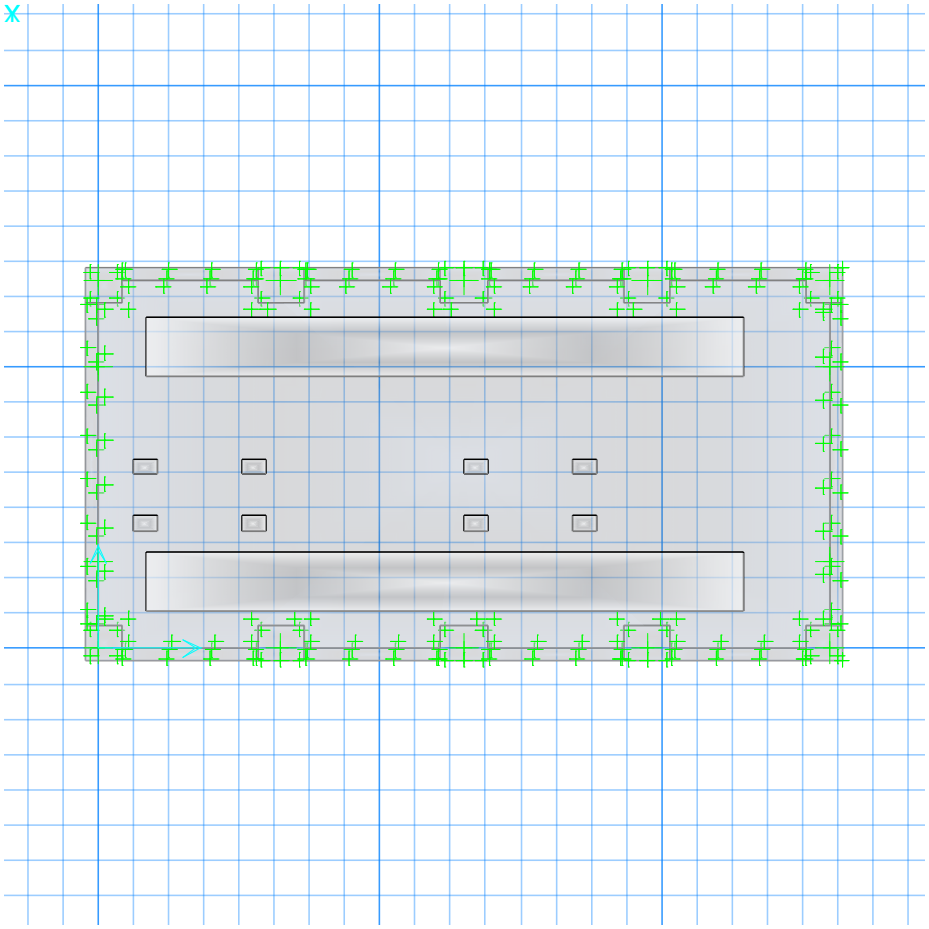


Figure 1: Finite element model

1. Model geometry

This section provides model geometry information, including items such as joint coordinates, joint restraints, and element connectivity.

1.1. Connectivity

Table 1: Concrete Slab Design Summary 02 - Span Definition Data

Table 1: Concrete Slab Design Summary 02 - Span Definition Data

Strip	SpanID	SpanLength	StartDist	GlobalX1	GlobalY1	GlobalX2	GlobalY2
		ft	ft	ft	ft	ft	ft
CSA1	Span 1	64.3333	0.0000	-1.0000	0.0000	63.3333	0.0000
CSA2	Span 1	64.3333	0.0000	-1.0000	31.4167	63.3333	31.4167
CSB1	Span 1	33.4167	0.0000	0.0000	-1.0000	0.0000	32.4167
CSB2	Span 1	33.4167	0.0000	15.5833	-1.0000	15.5833	32.4167
CSB3	Span 1	33.4167	0.0000	31.1667	-1.0000	31.1667	32.4167
CSB4	Span 1	33.4167	0.0000	46.7500	-1.0000	46.7500	32.4167
CSB5	Span 1	33.4167	0.0000	62.3333	-1.0000	62.3333	32.4167
MSA1	Span 1	64.3333	0.0000	-1.0000	7.4583	63.3333	7.4583
MSA2	Span 1	64.3333	0.0000	-1.0000	14.8333	63.3333	14.8333
MSA3	Span 1	64.3333	0.0000	-1.0000	19.6875	63.3333	19.6875
MSA4	Span 1	64.3333	0.0000	-1.0000	23.9583	63.3333	23.9583
MSB1	Span 1	33.4167	0.0000	7.7917	-1.0000	7.7917	32.4167
MSB2	Span 1	33.4167	0.0000	23.3750	-1.0000	23.3750	32.4167
MSB3	Span 1	33.4167	0.0000	38.9584	-1.0000	38.9584	32.4167
MSB4	Span 1	33.4167	0.0000	54.5417	-1.0000	54.5417	32.4167

2. Model properties

This section provides model properties, including items such as material properties, section properties, and support properties.

2.1. Material properties

Table 2: Material Properties 03 - Concrete

Table 2: Material Properties 03 - Concrete

Material	E	U	A	UnitWt	Fc	LtWtConc
	kip/in2		1/F	lb/ft3	kip/in2	
4000Psi	3604.997	0.200000	5.5000E-06	1.5000E+02	4.000	No

Table 3: Material Properties 04 - Rebar

Table 3: Material Properties 04 - Rebar

Material	E	UnitWt	Fy	Fu
	kip/in2	lb/ft3	kip/in2	kip/in2
A615Gr60	29000.000	4.9000E+02	60.000	90.000

Table 4: Material Properties 05 - Tendon

Table 4: Material Properties 05 - Tendon

Material	E	UnitWt	Fy	Fu
	kip/in2	lb/ft3	kip/in2	kip/in2
A416Gr270	28500.000	4.9000E+02	245.100	270.000

Table 5: Material Properties 02 - Steel

Table 5: Material Properties 02 - Steel

Material	E	U	A	UnitWt	Fy	Fu
	kip/in2		1/F	lb/ft3	kip/in2	kip/in2
Steel	29000.000	0.300000	6.5000E-06	4.9000E+02	36.000	58.000

2.2. Section properties

Table 6: Slab Properties 02 - Solid Slabs

Table 6: Slab Properties 02 - Solid Slabs

Slab	Type	MatProp	Thickness	Ortho
			in	
Column Mat	Mat	4000Psi	42.0000	No
Floor Slab	Mat	4000Psi	12.0000	No
Perimeter	Footing	4000Psi	42.0000	No
Stg slab	Mat	4000Psi	12.0000	No

Table 7: Beam Properties 02 - Rectangular Beam

Table 7: Beam Properties 02 - Rectangular Beam

Beam	MatProp	Depth	WidthTop	WidthBot
		in	in	in
BEAM1	4000Psi	42.0000	24.0000	12.0000

Table 8: Beam Properties 06 - Design Data

Table 8: Beam Properties 06 - Design Data

Beam	MatRebarL	MatRebarS	FlngWOpt	CoverTop	CoverBot	NoDesign
				in	in	
BEAM1	A615Gr60	A615Gr60	Analysis Property	1.5000	3.0000	No

Table 9: Column Properties 02 - Rectangular

Table 9: Column Properties 02 - Rectangular

Column	MatProp	SecDim2	SecDim3	AutoRigid	AutoDrop	IncludeCap
		in	in			
COL Primary	Steel	15.0000	15.0000	No	No	No
COL Secondary	Steel	12.0000	12.0000	No	No	No

2.3. Support properties

Table 10: Soil Properties

Table 10: Soil Properties

Soil	Subgrade
	lb/ft3
SOIL	5.6160E+05

Table 11: Spring Properties - Point

Table 11: Spring Properties - Point

Spring	Ux	Uy	Uz	Rx	Ry	Rz	NonlinOpt
	kip/in	kip/in	kip/in	kip-in/rad	kip-in/rad	kip-in/rad	
PSPR1	0.0000	0.0000	0.0010	0.000	0.000	0.000	None (Linear)

Table 12: Spring Properties - Line

Table 12: Spring Properties - Line

Spring	VertStiff kip/in/in	RotStiff kip/rad	NonlinOpt
LSPR1	0.00100	0.0010	None (Linear)

3. Model assignments

This section provides model assignments, including assignments to slabs, beams, and joints.

3.1. Slab assignments

Table 13: Slab Property Assignments

Table 13: Slab Property Assignments

Area	SlabProp
8	Column Mat
9	Column Mat
10	Column Mat
11	None
12	None
13	Column Mat
14	None
15	Column Mat
16	None
17	None
18	None
19	None
20	None
21	None
22	Column Mat
23	Column Mat
24	Perimeter
25	Column Mat
26	Column Mat
27	Column Mat
28	Perimeter
29	Perimeter
30	Perimeter
31	Perimeter
32	None
33	Perimeter
34	Perimeter
35	Perimeter
36	Perimeter
37	Perimeter
39	Floor Slab

3.2. Column assignments

Table 14: Column Property Assignments

Table 14: Column Property Assignments

Line	ColProp
1	COL Primary
2	COL Primary
3	COL Primary
4	COL Primary
5	COL Primary
6	COL Primary
7	COL Primary
8	COL Primary
9	COL Primary
10	COL Primary
11	COL Secondary
12	COL Secondary
13	COL Secondary
14	COL Secondary

3.3. Support assignments

Table 15: Soil Property Assignments

Table 15: Soil Property Assignments

Area	SoilProp
8	SOIL
9	SOIL
10	SOIL
13	SOIL
15	SOIL
22	SOIL
23	SOIL
24	SOIL
25	SOIL
26	SOIL
27	SOIL
28	SOIL
29	SOIL
30	SOIL
31	SOIL
33	SOIL
34	SOIL
35	SOIL
36	SOIL
37	SOIL
39	SOIL

Table 16: Point Restraint Assignments

Table 16: Point Restraint Assignments

Point	Ux	Uy	Uz	Rx	Ry	Rz
7	Yes	Yes	No	No	No	No
8	Yes	Yes	No	No	No	No
100	No	No	No	Yes	Yes	No
102	No	No	No	Yes	Yes	No
104	No	No	No	Yes	Yes	No
106	No	No	No	Yes	Yes	No
108	No	No	No	Yes	Yes	No
110	No	No	No	Yes	Yes	No
112	No	No	No	Yes	Yes	No
114	No	No	No	Yes	Yes	No
116	No	No	No	Yes	Yes	No
118	No	No	No	Yes	Yes	No
120	No	No	No	Yes	Yes	No
122	No	No	No	Yes	Yes	No
124	No	No	No	Yes	Yes	No
126	No	No	No	Yes	Yes	No

4. Model loading

This section provides model loading information, including load patterns, load cases, and load combinations.

4.1. Load patterns

Table 17: Load Patterns

Table 17: Load Patterns

LoadPat	Type	SelfWtMult
Slab DEAD	DEAD	1.000000
Slab LIVE	LIVE	0.000000
Col Dead	SUPER DEAD	0.000000
Col Roof Live	LIVE	0.000000
Col Wind (X-dir)	WIND	0.000000
Col Wind (Y-dir)	WIND	0.000000
Col Seismic (X-dir)	QUAKE	0.000000
Col Seismic (Y-dir)	QUAKE	0.000000
Col Seismic (vertical)	QUAKE	0.000000
Col Snow	SNOW	0.000000

Table 18: Load Assignments - Surface Loads

Table 18: Load Assignments - Surface Loads

Area	LoadPat	Dir	UnifLoad	A	B	C
			lb/ft2	lb/ft3	lb/ft3	lb/ft2
39	Slab LIVE	Gravity	125.28	0.0000E+00	0.0000E+00	0.00
11	Slab LIVE	Gravity	259.20	0.0000E+00	0.0000E+00	0.00
12	Slab LIVE	Gravity	259.20	0.0000E+00	0.0000E+00	0.00
14	Slab LIVE	Gravity	5093.28	0.0000E+00	0.0000E+00	0.00
16	Slab LIVE	Gravity	5093.28	0.0000E+00	0.0000E+00	0.00
17	Slab LIVE	Gravity	519.84	0.0000E+00	0.0000E+00	0.00
18	Slab LIVE	Gravity	519.84	0.0000E+00	0.0000E+00	0.00

Table 19: Load Assignments - Point Loads, Part 1 of 2

Table 19: Load Assignments - Point Loads, Part 1 of 2

Point	LoadPat	Fx	Fy	Fgrav
		kip	kip	kip
100	Col Dead	-0.020	-0.528	5.683
100	Col Roof Live	-0.018	-0.536	3.839
100	Col Wind (Y-dir)	0.015	1.451	-2.984
100	Col Wind (X-dir)	-0.259	0.264	-2.745
100	Col Seismic (Y-dir)	-0.013	-2.163	1.960
100	Col Seismic (X-dir)	-2.721	0.000	-6.741
100	Col Seismic (vertical)	3.000E-03	0.079	-0.855
100	Col Snow	-0.014	-0.433	3.096
102	Col Dead	0.016	-2.105	8.917
102	Col Roof Live	0.014	-2.382	7.682
102	Col Wind (Y-dir)	-3.000E-03	2.502	-3.924
102	Col Wind (X-dir)	-0.304	1.184	-3.491

Table 19: Load Assignments - Point Loads, Part 1 of 2

Point	LoadPat	Fx	Fy	Fgrav
		kip	kip	kip
102	Col Seismic (Y-dir)	-8.000E-03	2.922	-3.307
102	Col Seismic (X-dir)	-2.955	0.000	6.741
102	Col Seismic (vertical)	-3.000E-03	0.315	-1.343
102	Col Snow	0.011	-1.921	6.196
104	Col Dead	0.000	-2.106	8.665
104	Col Roof Live	0.000	-2.383	7.680
104	Col Wind (Y-dir)	4.000E-03	2.461	-3.835
104	Col Wind (X-dir)	-0.344	1.183	-4.157
104	Col Seismic (Y-dir)	-1.000E-03	3.255	-3.648
104	Col Seismic (X-dir)	-3.461	0.000	0.000
104	Col Seismic (vertical)	0.000	0.315	-1.305
104	Col Snow	0.000	-1.922	6.195
106	Col Dead	-0.016	-2.105	8.917
106	Col Roof Live	-0.014	-2.382	7.682
106	Col Wind (Y-dir)	0.010	2.406	-3.774
106	Col Wind (X-dir)	-0.300	1.180	-4.782
106	Col Seismic (Y-dir)	6.000E-03	-3.302	2.912
106	Col Seismic (X-dir)	-3.115	-2.000E-03	-6.279
106	Col Seismic (vertical)	3.000E-03	0.315	-1.343
106	Col Snow	-0.011	-1.921	6.197
108	Col Dead	0.020	0.263	5.683
108	Col Roof Live	0.018	0.271	3.839
108	Col Wind (Y-dir)	-7.000E-03	0.531	-1.979
108	Col Wind (X-dir)	-0.308	-0.133	-1.454
108	Col Seismic (Y-dir)	0.011	-2.189	1.970
108	Col Seismic (X-dir)	-2.976	1.000E-03	6.279
108	Col Seismic (vertical)	-3.000E-03	-0.339	-0.855
108	Col Snow	0.014	0.219	3.097
110	Col Dead	0.020	-0.263	5.683
110	Col Roof Live	0.018	-0.272	3.838
110	Col Wind (Y-dir)	-8.000E-03	0.618	-0.966
110	Col Wind (X-dir)	-0.283	0.137	-1.324
110	Col Seismic (Y-dir)	-0.011	-2.092	-1.971
110	Col Seismic (X-dir)	-2.976	-1.000E-03	6.278
110	Col Seismic (vertical)	-3.000E-03	0.339	-0.855
110	Col Snow	0.014	-0.219	3.096
112	Col Dead	-0.016	2.105	8.917
112	Col Roof Live	-0.014	2.382	7.682
112	Col Wind (Y-dir)	1.000E-03	-0.305	-2.111
112	Col Wind (X-dir)	-0.280	-1.184	-4.393
112	Col Seismic (Y-dir)	-6.000E-03	-3.625	-2.911
112	Col Seismic (X-dir)	-3.115	-2.000E-03	-6.278
112	Col Seismic (vertical)	3.000E-03	-0.315	-1.343
112	Col Snow	-0.011	1.921	6.197
114	Col Dead	0.000	2.106	8.665
114	Col Roof Live	0.000	2.383	7.680
114	Col Wind (Y-dir)	-5.000E-03	-0.252	-2.051
114	Col Wind (X-dir)	-0.319	-1.183	-3.812
114	Col Seismic (Y-dir)	1.000E-03	-3.255	-3.971
114	Col Seismic (X-dir)	-3.461	0.000	0.000
114	Col Seismic (vertical)	0.000	-0.315	-1.305
114	Col Snow	0.000	1.922	6.195
116	Col Dead	0.016	2.105	8.917
116	Col Roof Live	0.014	2.382	7.682

Table 19: Load Assignments - Point Loads, Part 1 of 2

Point	LoadPat	Fx	Fy	Fgrav
		kip	kip	kip
116	Col Wind (Y-dir)	-0.010	-0.291	-2.132
116	Col Wind (X-dir)	-0.279	-1.180	-3.190
116	Col Seismic (Y-dir)	8.000E-03	-3.630	-2.921
116	Col Seismic (X-dir)	-2.955	0.000	6.741
116	Col Seismic (vertical)	-3.000E-03	-0.315	-1.343
116	Col Snow	0.011	1.921	6.197
118	Col Dead	-0.020	0.528	5.683
118	Col Roof Live	-0.018	0.536	3.838
118	Col Wind (Y-dir)	1.000E-03	0.272	-1.483
118	Col Wind (X-dir)	-0.242	-0.268	-2.528
118	Col Seismic (Y-dir)	0.013	-2.167	-1.961
118	Col Seismic (X-dir)	-2.721	0.000	-6.741
118	Col Seismic (vertical)	3.000E-03	-0.079	-0.855
118	Col Snow	-0.014	0.433	3.096
120	Col Dead	0.000	9.000E-03	0.534
120	Col Roof Live	0.000	9.000E-03	-1.000E-03
120	Col Wind (Y-dir)	0.000	0.017	-1.000E-03
120	Col Wind (X-dir)	0.000	-5.000E-03	0.000
120	Col Seismic (Y-dir)	0.000	-0.078	0.000
120	Col Seismic (X-dir)	-4.000E-03	0.000	0.000
120	Col Seismic (vertical)	0.000	-1.000E-03	-0.080
120	Col Snow	0.000	7.000E-03	1.000E-03
122	Col Dead	0.000	-9.000E-03	0.534
122	Col Roof Live	0.000	-9.000E-03	-1.000E-03
122	Col Wind (Y-dir)	0.000	0.049	1.000E-03
122	Col Wind (X-dir)	-1.000E-03	4.000E-03	0.000
122	Col Seismic (Y-dir)	0.000	-0.081	0.000
122	Col Seismic (X-dir)	-4.000E-03	0.000	0.000
122	Col Seismic (vertical)	0.000	1.000E-03	-0.080
122	Col Snow	0.000	-7.000E-03	-1.000E-03
124	Col Dead	0.000	-6.000E-03	0.491
124	Col Roof Live	0.000	-6.000E-03	0.000
124	Col Wind (Y-dir)	0.000	0.022	0.000
124	Col Wind (X-dir)	0.000	3.000E-03	0.000
124	Col Seismic (Y-dir)	0.000	-0.071	0.000
124	Col Seismic (X-dir)	-3.000E-03	0.000	0.000
124	Col Seismic (vertical)	0.000	1.000E-03	-0.074
124	Col Snow	0.000	-5.000E-03	0.000
126	Col Dead	0.000	6.000E-03	0.490
126	Col Roof Live	0.000	6.000E-03	-1.000E-03
126	Col Wind (Y-dir)	0.000	0.022	0.000
126	Col Wind (X-dir)	0.000	-3.000E-03	1.000E-03
126	Col Seismic (Y-dir)	0.000	-0.072	-1.000E-03
126	Col Seismic (X-dir)	-3.000E-03	0.000	0.000
126	Col Seismic (vertical)	0.000	-1.000E-03	-0.073
126	Col Snow	0.000	-5.000E-03	-1.000E-03
155	Slab LIVE	0.000	0.000	13.915
159	Slab LIVE	0.000	0.000	13.915
163	Slab LIVE	0.000	0.000	1.720
167	Slab LIVE	0.000	0.000	1.720

Table 19: Load Assignments - Point Loads, Part 2 of 2

Table 19: Load Assignments - Point Loads, Part 2 of 2

Point	Mx	My	Mz	XDim	YDim
	kip-ft	kip-ft	kip-ft	in	in
100	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000
100	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
102	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
104	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
106	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
108	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
110	0.0000	0.0000	0.0000	0.0000	0.0000
112	0.0000	0.0000	0.0000	0.0000	0.0000
112	0.0000	0.0000	0.0000	0.0000	0.0000
112	0.0000	0.0000	0.0000	0.0000	0.0000
112	0.0000	0.0000	0.0000	0.0000	0.0000
112	0.0000	0.0000	0.0000	0.0000	0.0000

Table 19: Load Assignments - Point Loads, Part 2 of 2

Point	Mx	My	Mz	XDim	YDim
	kip-ft	kip-ft	kip-ft	in	in
112	0.0000	0.0000	0.0000	0.0000	0.0000
112	0.0000	0.0000	0.0000	0.0000	0.0000
112	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
114	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
116	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
118	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
120	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
122	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
124	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000

Table 19: Load Assignments - Point Loads, Part 2 of 2

Point	Mx	My	Mz	XDim	YDim
	kip-ft	kip-ft	kip-ft	in	in
126	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000
126	0.0000	0.0000	0.0000	0.0000	0.0000
155	0.0000	0.0000	0.0000	24.0000	16.0000
159	0.0000	0.0000	0.0000	24.0000	16.0000
163	0.0000	0.0000	0.0000	24.0000	16.0000
167	0.0000	0.0000	0.0000	24.0000	16.0000

4.2. Load cases

Table 20: Load Cases 02 - Static

Table 20: Load Cases 02 - Static

LoadCase	InitialCond	AType
Dead	Zero	Linear
Seismic X	Zero	Linear
Seismic Y	Zero	Linear
Seismic X-no vert	Zero	Linear
Seismic Y-no vert	Zero	Linear
Live	Zero	Linear
Live-Roof	Zero	Linear
Snow	Zero	Linear
Wind X	Zero	Linear
Wind Y	Zero	Linear

Table 21: Load Cases 06 - Loads Applied

Table 21: Load Cases 06 - Loads Applied

LoadCase	LoadPat	SF
Dead	Slab DEAD	1.000000
Dead	Col Dead	1.000000
Seismic X	Col Seismic (X-dir)	1.000000
Seismic X	Col Seismic (vertical)	1.000000
Seismic Y	Col Seismic (Y-dir)	1.000000
Seismic Y	Col Seismic (vertical)	1.000000
Seismic X-no vert	Col Seismic (X-dir)	1.000000
Seismic X-no vert	Col Seismic (vertical)	0.000000
Seismic Y-no vert	Col Seismic (Y-dir)	1.000000
Seismic Y-no vert	Col Seismic (vertical)	0.000000
Live	Slab LIVE	1.000000
Live-Roof	Col Roof Live	1.000000
Snow	Col Snow	1.000000
Wind X	Col Wind (X-dir)	1.000000
Wind Y	Col Wind (Y-dir)	1.000000

4.3. Load combinations

Table 22: Load Combinations

Table 22: Load Combinations

Combo	Load	SF	Type	DSStrength	DSServInit	DSServNorm	DSServLong
ASCE 1 Allow	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 1 SD	Dead	1.400000	Linear Add	Yes	No	No	No
ASCE 6a SD (Wx)	Dead	0.900000	Linear Add	Yes	No	No	No
ASCE 6a SD (Wx)	Wind X	1.600000					
ASCE 6b SD (Wy)	Dead	0.900000	Linear Add	Yes	No	No	No
ASCE 6b SD (Wy)	Wind Y	1.600000					
ASCE 7a SD (Ex-nv)	Dead	0.900000	Linear Add	Yes	No	No	No
ASCE 7a SD (Ex-nv)	Seismic X-no vert	1.000000					
ASCE 7b SD (Ey-nv)	Dead	0.900000	Linear Add	Yes	No	No	No
ASCE 7b SD (Ey-nv)	Seismic Y-no vert	1.000000					
ASCE 2b SD (S)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 2b SD (S)	Live	1.600000					
ASCE 2b SD (S)	Snow	0.500000					
ASCE 3b SD (S-L)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 3b SD (S-L)	Snow	1.600000					
ASCE 3b SD (S-L)	Live	1.000000					
ASCE 3c SD (Lr-Wx)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 3c SD (Lr-Wx)	Live-Roof	1.600000					
ASCE 3c SD (Lr-Wx)	Wind X	0.800000					
ASCE 3d SD (Lr-Wy)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 3d SD (Lr-Wy)	Live-Roof	1.600000					
ASCE 3d SD (Lr-Wy)	Wind Y	0.800000					
ASCE 3e SD (S-Wx)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 3e SD (S-Wx)	Snow	1.600000					
ASCE 3e SD (S-Wx)	Wind X	0.800000					
ASCE 3f SD (S-Wy)	Dead	1.200000	Linear Add	Yes	No	No	No

Table 22: Load Combinations

Combo	Load	SF	Type	DSStrength	DSServInit	DSServNorm	DSServLong
ASCE 3f SD (S-Wy)	Snow	1.600000					
ASCE 3f SD (S-Wy)	Wind Y	0.800000					
ASCE 2a SD (Lr)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 2a SD (Lr)	Live	1.600000					
ASCE 2a SD (Lr)	Live-Roof	0.500000					
ASCE 4a SD (Wx-Lr)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 4a SD (Wx-Lr)	Wind X	1.600000					
ASCE 4a SD (Wx-Lr)	Live	1.000000					
ASCE 4a SD (Wx-Lr)	Live-Roof	0.500000					
ASCE 4b SD (Wy-Lr)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 4b SD (Wy-Lr)	Wind Y	1.600000					
ASCE 4b SD (Wy-Lr)	Live	1.000000					
ASCE 4b SD (Wy-Lr)	Live-Roof	0.500000					
ASCE 4c SD (Wx-S)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 4c SD (Wx-S)	Wind X	1.600000					
ASCE 4c SD (Wx-S)	Live	1.000000					
ASCE 4c SD (Wx-S)	Snow	0.500000					
ASCE 4d SD (Wy-S)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 4d SD (Wy-S)	Wind Y	1.600000					
ASCE 4d SD (Wy-S)	Live	1.000000					
ASCE 4d SD (Wy-S)	Snow	0.500000					
ASCE 5a SD (Ex)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 5a SD (Ex)	Seismic X	1.000000					
ASCE 5a SD (Ex)	Live	1.000000					
ASCE 5a SD (Ex)	Snow	0.200000					
ASCE 5b SD (Ey)	Dead	1.200000	Linear Add	Yes	No	No	No
ASCE 5b SD (Ey)	Seismic Y	1.000000					
ASCE 5b SD (Ey)	Live	1.000000					
ASCE 5b SD (Ey)	Snow	0.200000					
ASCE 3a SD (Lr-L)	Dead	1.200000	Linear Add	Yes	No	No	No

Table 22: Load Combinations

Combo	Load	SF	Type	DSStrength	DSServInit	DSServNorm	DSServLong
ASCE 3a SD (Lr-L)	Live-Roof	1.600000					
ASCE 3a SD (Lr-L)	Live	1.000000					
ASCE 2 Allow	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 2 Allow	Live	1.000000					
ASCE 3 Allow	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 3 Allow	Live-Roof	1.000000					
ASCE 4a Allow (Lr)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 4a Allow (Lr)	Live	0.750000					
ASCE 4a Allow (Lr)	Live-Roof	0.750000					
ASCE 4b Allow (S)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 4b Allow (S)	Live	0.750000					
ASCE 4b Allow (S)	Snow	0.750000					
ASCE 5a Allow (Wx)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 5a Allow (Wx)	Wind X	1.000000					
ASCE 5b Allow (Wy)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 5b Allow (Wy)	Wind Y	1.000000					
ASCE 5c Allow (Ex)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 5c Allow (Ex)	Seismic X	0.700000					
ASCE 5d Allow (Ey)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 5d Allow (Ey)	Seismic Y	0.700000					
ASCE 6a Allow (Wx-Lr)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6a Allow (Wx-Lr)	Wind X	0.750000					
ASCE 6a Allow (Wx-Lr)	Live	0.750000					
ASCE 6a Allow (Wx-Lr)	Live-Roof	0.750000					
ASCE 6b Allow (Wx-S)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6b Allow (Wx-S)	Wind X	0.750000					
ASCE 6b Allow (Wx-S)	Live	0.750000					
ASCE 6b Allow (Wx-S)	Snow	0.750000					
ASCE 6c Allow (Wy-Lr)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6c Allow (Wy-Lr)	Wind Y	0.750000					

Table 22: Load Combinations

Combo	Load	SF	Type	DSStrength	DSServInit	DSServNorm	DSServLong
ASCE 6c Allow (Wy-Lr)	Live	0.750000					
ASCE 6c Allow (Wy-Lr)	Live-Roof	0.750000					
ASCE 6d Allow (Wy-S)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6d Allow (Wy-S)	Wind Y	0.750000					
ASCE 6d Allow (Wy-S)	Live	0.750000					
ASCE 6d Allow (Wy-S)	Snow	0.750000					
ASCE 6e Allow (Ex-Lr)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6e Allow (Ex-Lr)	Seismic X	0.525000					
ASCE 6e Allow (Ex-Lr)	Live	0.750000					
ASCE 6e Allow (Ex-Lr)	Live-Roof	0.750000					
ASCE 6f Allow (Ex-S)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6f Allow (Ex-S)	Seismic X	0.525000					
ASCE 6f Allow (Ex-S)	Live	0.750000					
ASCE 6f Allow (Ex-S)	Snow	0.750000					
ASCE 6g Allow (Ey-Lr)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6g Allow (Ey-Lr)	Seismic Y	0.525000					
ASCE 6g Allow (Ey-Lr)	Live	0.750000					
ASCE 6g Allow (Ey-Lr)	Live-Roof	0.750000					
ASCE 6h Allow (Ey-S)	Dead	1.000000	Linear Add	No	No	Yes	No
ASCE 6h Allow (Ey-S)	Seismic Y	0.525000					
ASCE 6h Allow (Ey-S)	Live	0.750000					
ASCE 6h Allow (Ey-S)	Snow	0.750000					
ASCE 7a Allow (Wx)	Dead	0.600000	Linear Add	No	No	Yes	No
ASCE 7a Allow (Wx)	Wind X	1.000000					
ASCE 8a Allow (Ex-nv)	Dead	0.600000	Linear Add	No	No	Yes	No
ASCE 8a Allow (Ex-nv)	Seismic X-no vert	0.700000					
ASCE 8b Allow (Ey-nv)	Dead	0.600000	Linear Add	No	No	Yes	No
ASCE 8b Allow (Ey-nv)	Seismic Y-no vert	0.700000					
ASCE 7b Allow (Wy)	Dead	0.600000	Linear Add	No	No	Yes	No

Table 22: Load Combinations

Combo	Load	SF	Type	DSStrength	DSServInit	DSServNorm	DSServLong
ASCE 7b Allow (Wy)	Wind Y	1.000000					

Analysis Results

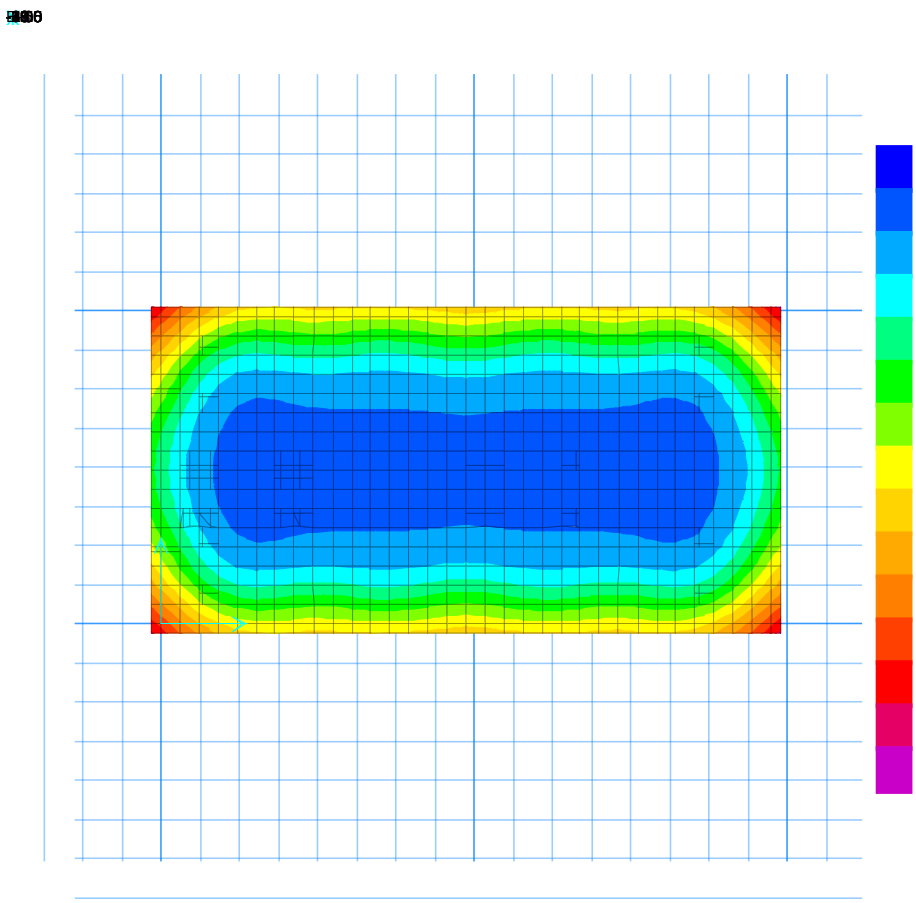


Figure 2: Deformed shape

5. Analysis results

5.1. Support results

This section provides support results, including items such as column, support, and spring reactions, .

5.2. Structure results

Table 23: Sum Of Reactions, Part 1 of 2

Table 23: Sum Of Reactions, Part 1 of 2

OutputCase	GlobalFX	GlobalFY	GlobalFZ	GlobalMX	GlobalMY	GlobalMZ
	kip	kip	kip	kip-ft	kip-ft	kip-ft
ASCE 1 Allow	-2.563E-10	-1.542E-12	592.198	9302.5953	-18454.0358	3.044E-09
ASCE 1 SD	-3.588E-10	-2.159E-12	829.077	13023.6333	-25835.6501	4.262E-09
ASCE 3a SD (Lr-L)	-7.734E-10	1.600E-03	1211.236	18884.2659	-36822.7223	0.0997
ASCE 2 Allow	-2.563E-10	-1.542E-12	994.494	15479.5573	-30068.1076	3.044E-09
ASCE 3 Allow	-5.475E-10	1.000E-03	653.637	10267.7138	-20368.9155	0.0623
ASCE 4a Allow (Lr)	-4.747E-10	7.500E-04	939.999	14659.1557	-28600.7494	0.0467
ASCE 4b Allow (S)	-4.326E-10	7.500E-03	931.091	14519.1143	-28323.0895	0.4675
ASCE 5a Allow (Wx)	2.919	1.000E-03	560.323	8780.1809	-17470.3355	-47.7449
ASCE 5b Allow (Wy)	2.000E-03	-9.503	566.959	8879.3918	-17717.5008	-275.2904
ASCE 5c Allow (Ex)	21.329	2.800E-03	584.001	9173.8227	-18269.6196	-334.9125
ASCE 5d Allow (Ey)	4.486E-09	11.584	574.307	9055.5128	-17964.6552	427.3330
ASCE 6a Allow (Wx-Lr)	2.189	1.500E-03	916.093	14267.3448	-27862.9743	-35.7619
ASCE 6b Allow (Wx-S)	2.189	8.250E-03	907.184	14127.3036	-27585.3143	-35.3412
ASCE 6c Allow (Wy-Lr)	1.500E-03	-7.127	921.070	14341.7531	-28048.3482	-206.4210
ASCE 6d Allow (Wy-S)	1.500E-03	-7.120	912.161	14201.7118	-27770.6883	-206.0003
ASCE 6e Allow (Ex-Lr)	15.997	2.850E-03	933.852	14562.5762	-28462.4373	-251.1376
ASCE 6f Allow (Ex-S)	15.997	9.600E-03	924.943	14422.5349	-28184.7774	-250.7168
ASCE 6g Allow (Ey-Lr)	3.082E-09	8.688	926.581	14473.8438	-28233.7140	320.5465
ASCE 6h Allow (Ey-S)	3.124E-09	8.695	917.673	14333.8026	-27956.0542	320.9673
ASCE 7a Allow (Wx)	2.919	1.000E-03	323.444	5059.1428	-10088.7212	-47.7449
ASCE 7b Allow (Wy)	2.000E-03	-9.503	330.080	5158.3538	-10335.8865	-275.2904
ASCE 8a Allow (Ex-nv)	21.329	2.800E-03	355.319	5581.5292	-11143.1729	-334.9125
ASCE 8b Allow (Ey-nv)	4.548E-09	11.584	345.624	5463.2193	-10838.2086	427.3330
ASCE 2b SD (S)	-4.251E-10	5.000E-03	1379.092	21435.4519	-41499.6912	0.3117
ASCE 3b SD (S-L)	-6.836E-10	0.016	1192.231	18585.5112	-36230.3813	0.9973
ASCE 3c SD (Lr-Wx)	2.335	2.400E-03	783.439	12289.3724	-24421.6903	-38.0962
ASCE 3d SD (Lr-Wy)	1.600E-03	-7.601	788.748	12368.7412	-24619.4225	-220.1326
ASCE 3e SD (S-Wx)	2.335	0.017	764.435	11990.6177	-23829.3492	-37.1986
ASCE 3f SD (S-Wy)	1.600E-03	-7.586	769.743	12069.9864	-24027.0814	-219.2350
ASCE 2a SD (Lr)	-4.531E-10	5.000E-04	1385.031	21528.8128	-41684.7978	0.0312
ASCE 4a SD (Wx-Lr)	4.670	2.100E-03	1092.653	16986.7726	-33142.4342	-76.3608
ASCE 4b SD (Wy-Lr)	3.200E-03	-15.204	1103.271	17145.5102	-33537.8987	-440.4334
ASCE 4c SD (Wx-S)	4.670	6.600E-03	1086.714	16893.4118	-32957.3276	-76.0803
ASCE 4d SD (Wy-S)	3.200E-03	-15.200	1097.332	17052.1493	-33352.7921	-440.1529

Table 23: Sum Of Reactions, Part 1 of 2

OutputCase	GlobalFX	GlobalFY	GlobalFZ	GlobalMX	GlobalMY	GlobalMZ
	kip	kip	kip	kip-ft	kip-ft	kip-ft
ASCE 5a SD (Ex)	30.470	6.000E-03	1111.137	17311.7949	-33804.3963	-478.3218
ASCE 5b SD (Ey)	6.420E-09	16.550	1097.288	17142.7808	-33368.7330	610.6003
ASCE 6a SD (Wx)	4.670	1.600E-03	481.978	7536.4728	-15034.7118	-76.3919
ASCE 6b SD (Wy)	3.200E-03	-15.205	492.595	7695.2103	-15430.1762	-440.4646
ASCE 7a SD (Ex-nv)	30.470	4.000E-03	532.978	8372.2958	-16709.7058	-478.4464
ASCE 7b SD (Ey-nv)	6.487E-09	16.548	519.129	8203.2817	-16274.0424	610.4757

Table 23: Sum Of Reactions, Part 2 of 2

Table 23: Sum Of Reactions, Part 2 of 2

OutputCase	GlobalX	GlobalY	GlobalZ
	ft	ft	ft
ASCE 1 Allow	0.0000	0.0000	0.0000
ASCE 1 SD	0.0000	0.0000	0.0000
ASCE 3a SD (Lr-L)	0.0000	0.0000	0.0000
ASCE 2 Allow	0.0000	0.0000	0.0000
ASCE 3 Allow	0.0000	0.0000	0.0000
ASCE 4a Allow (Lr)	0.0000	0.0000	0.0000
ASCE 4b Allow (S)	0.0000	0.0000	0.0000
ASCE 5a Allow (Wx)	0.0000	0.0000	0.0000
ASCE 5b Allow (Wy)	0.0000	0.0000	0.0000
ASCE 5c Allow (Ex)	0.0000	0.0000	0.0000
ASCE 5d Allow (Ey)	0.0000	0.0000	0.0000
ASCE 6a Allow (Wx-Lr)	0.0000	0.0000	0.0000
ASCE 6b Allow (Wx-S)	0.0000	0.0000	0.0000
ASCE 6c Allow (Wy-Lr)	0.0000	0.0000	0.0000
ASCE 6d Allow (Wy-S)	0.0000	0.0000	0.0000
ASCE 6e Allow (Ex-Lr)	0.0000	0.0000	0.0000
ASCE 6f Allow (Ex-S)	0.0000	0.0000	0.0000
ASCE 6g Allow (Ey-Lr)	0.0000	0.0000	0.0000
ASCE 6h Allow (Ey-S)	0.0000	0.0000	0.0000
ASCE 7a Allow (Wx)	0.0000	0.0000	0.0000
ASCE 7b Allow (Wy)	0.0000	0.0000	0.0000
ASCE 8a Allow (Ex-nv)	0.0000	0.0000	0.0000
ASCE 8b Allow (Ey-nv)	0.0000	0.0000	0.0000
ASCE 2b SD (S)	0.0000	0.0000	0.0000
ASCE 3b SD (S-L)	0.0000	0.0000	0.0000
ASCE 3c SD (Lr-Wx)	0.0000	0.0000	0.0000
ASCE 3d SD (Lr-Wy)	0.0000	0.0000	0.0000
ASCE 3e SD (S-Wx)	0.0000	0.0000	0.0000
ASCE 3f SD (S-Wy)	0.0000	0.0000	0.0000
ASCE 2a SD (Lr)	0.0000	0.0000	0.0000
ASCE 4a SD (Wx-Lr)	0.0000	0.0000	0.0000
ASCE 4b SD (Wy-Lr)	0.0000	0.0000	0.0000
ASCE 4c SD (Wx-S)	0.0000	0.0000	0.0000

Table 23: Sum Of Reactions, Part 2 of 2

OutputCase	GlobalX	GlobalY	GlobalZ
	ft	ft	ft
ASCE 4d SD (Wy-S)	0.0000	0.0000	0.0000
ASCE 5a SD (Ex)	0.0000	0.0000	0.0000
ASCE 5b SD (Ey)	0.0000	0.0000	0.0000
ASCE 6a SD (Wx)	0.0000	0.0000	0.0000
ASCE 6b SD (Wy)	0.0000	0.0000	0.0000
ASCE 7a SD (Ex-nv)	0.0000	0.0000	0.0000
ASCE 7b SD (Ey-nv)	0.0000	0.0000	0.0000

Design

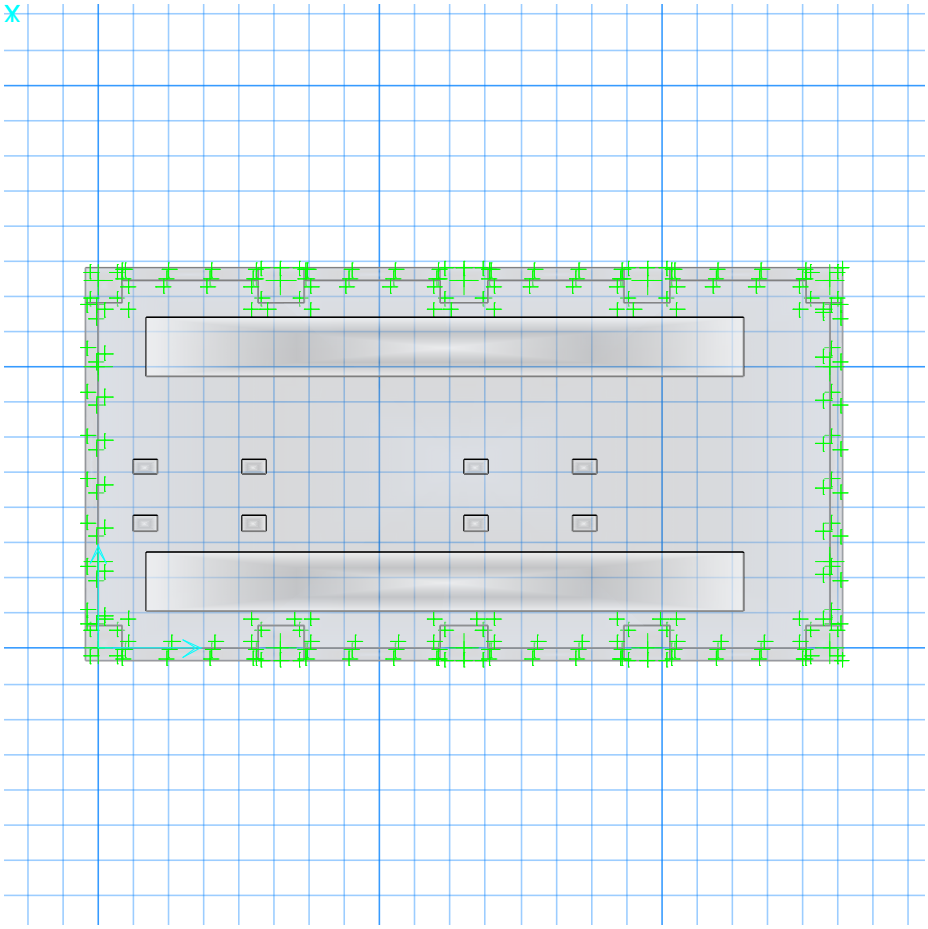


Figure 3: Finite element model

6. Design summary

This section provides design information for beams, strips, and punching checks.

6.1. Preferences

Table 24: Design Preferences 01 - Resistance Factors

Table 24: Design Preferences 01 - Resistance Factors

PhiTen	PhiComp	PhiShear
0.900000	0.650000	0.750000

Table 25: Design Preferences 02 - Rebar Cover - Slabs

Table 25: Design Preferences 02 - Rebar Cover - Slabs

CoverTop	CoverBot	BarSize	InnerLayer	PTCGSTop	PTCGSBotExt	PTCGSBotInt	SlabType
in	in			in	in	in	
1.5000	3.0000	#5	B	1.0000	1.7500	1.0000	Two Way

Table 26: Design Preferences 03 - Rebar Cover - Beams

Table 26: Design Preferences 03 - Rebar Cover - Beams

CoverTop	CoverBot	BarSizeF	BarSizeS	PTCGSTop	PTCGSBot
in	in			in	in
1.5000	3.0000	#8	#4	2.0000	2.0000

Table 27: Design Preferences 04 - Prestress Data

Table 27: Design Preferences 04 - Prestress Data

InitConcRat	InitTopTen	InitBotTen	InitExComp	FinTopTen	FinBotTen	FinExComp	SusExComp	LLFraction
0.800000	3.000000	3.000000	0.600000	6.000000	6.000000	0.600000	0.450000	0.500000

6.2. Overwrites

Table 28: Slab Design Overwrites 01 - Strip Based

Table 28: Slab Design Overwrites 01 - Strip Based

Strip	Layer	DesignType	RLLF	IgnorePT	RebarMat
CSA1	A	Column	1.000000	No	A615Gr60
CSA2	A	Column	1.000000	No	A615Gr60
CSB1	B	Column	1.000000	No	A615Gr60
CSB2	B	Column	1.000000	No	A615Gr60
CSB3	B	Column	1.000000	No	A615Gr60
CSB4	B	Column	1.000000	No	A615Gr60

Table 28: Slab Design Overwrites 01 - Strip Based

Strip	Layer	DesignType	RLLF	IgnorePT	RebarMat
CSB5	B	Column	1.000000	No	A615Gr60
MSA1	A	Middle	1.000000	No	A615Gr60
MSA2	A	Middle	1.000000	No	A615Gr60
MSA3	A	Middle	1.000000	No	A615Gr60
MSA4	A	Middle	1.000000	No	A615Gr60
MSB1	B	Middle	1.000000	No	A615Gr60
MSB2	B	Middle	1.000000	No	A615Gr60
MSB3	B	Middle	1.000000	No	A615Gr60
MSB4	B	Middle	1.000000	No	A615Gr60

Table 29: Slab Design Overwrites 02 - Finite Element Based, Part 1 of 2

Table 29: Slab Design Overwrites 02 - Finite Element Based, Part 1 of 2

Area	RebarMat
8	A615Gr60
9	A615Gr60
10	A615Gr60
11	A615Gr60
12	A615Gr60
13	A615Gr60
14	A615Gr60
15	A615Gr60
16	A615Gr60
17	A615Gr60
18	A615Gr60
19	A615Gr60
20	A615Gr60
21	A615Gr60
22	A615Gr60
23	A615Gr60
24	A615Gr60
25	A615Gr60
26	A615Gr60
27	A615Gr60
28	A615Gr60
29	A615Gr60
30	A615Gr60
31	A615Gr60
32	A615Gr60
33	A615Gr60
34	A615Gr60
35	A615Gr60
36	A615Gr60
37	A615Gr60
39	A615Gr60

Table 29: Slab Design Overwrites 02 - Finite Element Based, Part 2 of 2

Table 29: Slab Design Overwrites 02 - Finite Element Based, Part 2 of 2

Area	RLLF	Design	IgnorePT
8	1.000000	Yes	No
9	1.000000	Yes	No
10	1.000000	Yes	No
11	1.000000	Yes	No
12	1.000000	Yes	No
13	1.000000	Yes	No
14	1.000000	Yes	No
15	1.000000	Yes	No
16	1.000000	Yes	No
17	1.000000	Yes	No
18	1.000000	Yes	No
19	1.000000	Yes	No
20	1.000000	Yes	No
21	1.000000	Yes	No
22	1.000000	Yes	No
23	1.000000	Yes	No
24	1.000000	Yes	No
25	1.000000	Yes	No
26	1.000000	Yes	No
27	1.000000	Yes	No
28	1.000000	Yes	No
29	1.000000	Yes	No
30	1.000000	Yes	No
31	1.000000	Yes	No
32	1.000000	Yes	No
33	1.000000	Yes	No
34	1.000000	Yes	No
35	1.000000	Yes	No
36	1.000000	Yes	No
37	1.000000	Yes	No
39	1.000000	Yes	No

Table 30: Punching Shear Design Overwrites 01 - General

Table 30: Punching Shear Design Overwrites 01 - General

Point	Check	LocType	EffDepth	ReinfType
99	Program Determined	Auto	Auto	None
101	Program Determined	Auto	Auto	None
103	Program Determined	Auto	Auto	None
105	Program Determined	Auto	Auto	None
107	Program Determined	Auto	Auto	None
109	Program Determined	Auto	Auto	None
111	Program Determined	Auto	Auto	None

Table 30: Punching Shear Design Overwrites 01 - General

Point	Check	LocType	EffDepth	ReinfType
113	Program Determined	Auto	Auto	None
115	Program Determined	Auto	Auto	None
117	Program Determined	Auto	Auto	None
119	Program Determined	Auto	Auto	None
121	Program Determined	Auto	Auto	None
123	Program Determined	Auto	Auto	None
125	Program Determined	Auto	Auto	None
155	Program Determined	Auto	Auto	None
159	Program Determined	Auto	Auto	None
163	Program Determined	Auto	Auto	None
167	Program Determined	Auto	Auto	None

6.3. Slab design

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 1 of 3

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 1 of 3

Strip	SpanID	Location	FTopCombo	FTopMoment	FTopArea
				kip-ft	in2
CSA1	Span 1	Start	ASCE 7a SD (Ex-nv)	-35.3908	0.2267
CSA1	Span 1	Middle	ASCE 4b SD (Wy-Lr)	0.0000	0.3041
CSA1	Span 1	End	ASCE 4d SD (Wy-S)	-3.6477	1.0363
CSA2	Span 1	Start	ASCE 7a SD (Ex-nv)	-35.3783	0.2266
CSA2	Span 1	Middle	ASCE 5b SD (Ey)	0.0000	0.2492
CSA2	Span 1	End	ASCE 5a SD (Ex)	-5.3275	1.0028
CSB1	Span 1	Start	ASCE 7b SD (Ey-nv)	-23.7613	0.1532
CSB1	Span 1	Middle	ASCE 3a SD (Lr-L)	-27.7714	0.1564
CSB1	Span 1	End	ASCE 6b SD (Wy)	-23.6123	0.1540
CSB2	Span 1	Start	ASCE 3d SD (Lr-Wy)	-4.3217	0.1006
CSB2	Span 1	Middle	ASCE 3d SD (Lr-Wy)	-3.2603	0.0759
CSB2	Span 1	End	ASCE 3d SD (Lr-Wy)	-4.3268	0.1007
CSB3	Span 1	Start	ASCE 5b SD (Ey)	-4.1917	0.1064
CSB3	Span 1	Middle	ASCE 2a SD (Lr)	-5.7141	0.1331
CSB3	Span 1	End	ASCE 3d SD (Lr-Wy)	-4.5025	0.1048
CSB4	Span 1	Start	ASCE 3d SD (Lr-Wy)	-4.3902	0.1022
CSB4	Span 1	Middle	ASCE 3d SD (Lr-Wy)	-3.3155	0.0772
CSB4	Span 1	End	ASCE 3d SD (Lr-Wy)	-4.3808	0.1020
CSB5	Span 1	Start	ASCE 5a SD (Ex)	-2.6746	0.9234
CSB5	Span 1	Middle	ASCE 3d SD (Lr-Wy)	-25.1512	0.1457
CSB5	Span 1	End	ASCE 5a SD (Ex)	-2.7046	0.9234
MSA1	Span 1	Start	ASCE 2a SD (Lr)	-45.9293	0.2551

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 1 of 3

Strip	SpanID	Location	FTopCombo	FTopMoment kip-ft	FTopArea in2
MSA1	Span 1	Middle	ASCE 4b SD (Wy-Lr)	-0.1972	0.3036
MSA1	Span 1	End	ASCE 4b SD (Wy-Lr)	-0.2648	0.3439
MSA2	Span 1	Start	ASCE 2a SD (Lr)	-13.2181	0.2894
MSA2	Span 1	Middle	ASCE 6b SD (Wy)	-0.0779	0.1481
MSA2	Span 1	End	ASCE 3d SD (Lr-Wy)	-6.6289	0.1457
MSA3	Span 1	Start	ASCE 1 SD	-7.8382	0.1713
MSA3	Span 1	Middle	ASCE 7b SD (Ey-nv)	0.0000	0.1623
MSA3	Span 1	End	ASCE 1 SD	-7.8581	0.1717
MSA4	Span 1	Start	ASCE 1 SD	-7.8796	0.1722
MSA4	Span 1	Middle	ASCE 5b SD (Ey)	0.0000	0.2260
MSA4	Span 1	End	ASCE 5b SD (Ey)	-0.1381	0.2576
MSB1	Span 1	Start	ASCE 3d SD (Lr-Wy)	-13.0930	0.3049
MSB1	Span 1	Middle	ASCE 2a SD (Lr)	-14.4518	0.3366
MSB1	Span 1	End	ASCE 3d SD (Lr-Wy)	-13.5184	0.3148
MSB2	Span 1	Start	ASCE 3d SD (Lr-Wy)	-12.7286	0.2964
MSB2	Span 1	Middle	ASCE 3d SD (Lr-Wy)	-9.7973	0.2280
MSB2	Span 1	End	ASCE 3d SD (Lr-Wy)	-13.3505	0.3109
MSB3	Span 1	Start	ASCE 3d SD (Lr-Wy)	-12.8668	0.2996
MSB3	Span 1	Middle	ASCE 2a SD (Lr)	-12.1901	0.2838
MSB3	Span 1	End	ASCE 3d SD (Lr-Wy)	-13.4759	0.3138
MSB4	Span 1	Start	ASCE 5a SD (Ex)	-61.8923	0.4040
MSB4	Span 1	Middle	ASCE 3d SD (Lr-Wy)	-11.4178	0.2898
MSB4	Span 1	End	ASCE 5a SD (Ex)	-59.2829	0.3893

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 2 of 3

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 2 of 3

Strip	SpanID	Location	FBotCombo	FBotMoment kip-ft	FBotArea in2
CSA1	Span 1	Start	ASCE 5a SD (Ex)	31.3714	0.1985
CSA1	Span 1	Middle	ASCE 3d SD (Lr-Wy)	49.4039	0.3095
CSA1	Span 1	End	ASCE 6b SD (Wy)	1.9676	1.0160
CSA2	Span 1	Start	ASCE 5a SD (Ex)	31.9822	0.2020
CSA2	Span 1	Middle	ASCE 5a SD (Ex)	52.4812	0.3143
CSA2	Span 1	End	ASCE 5a SD (Ex)	2.6840	0.9921
CSB1	Span 1	Start	ASCE 3d SD (Lr-Wy)	20.4367	0.1194
CSB1	Span 1	Middle	ASCE 2b SD (S)	5.1774	0.0302
CSB1	Span 1	End	ASCE 5b SD (Ey)	20.4196	0.1193
CSB2	Span 1	Start	ASCE 3d SD (Lr-Wy)	37.1892	0.2174
CSB2	Span 1	Middle	ASCE 7b SD (Ey-nv)	0.0000	0.0363
CSB2	Span 1	End	ASCE 3a SD (Lr-L)	35.6135	0.2081
CSB3	Span 1	Start	ASCE 3d SD (Lr-Wy)	37.7676	0.2207
CSB3	Span 1	Middle	ASCE 2b SD (S)	8.5448	0.2368
CSB3	Span 1	End	ASCE 3a SD (Lr-L)	36.2695	0.2120
CSB4	Span 1	Start	ASCE 3d SD (Lr-Wy)	36.9153	0.2157
CSB4	Span 1	Middle	ASCE 6b SD (Wy)	0.0000	0.0569
CSB4	Span 1	End	ASCE 3a SD (Lr-L)	34.7902	0.2033
CSB5	Span 1	Start	ASCE 6b SD (Wy)	2.2252	0.8869
CSB5	Span 1	Middle	ASCE 7a SD (Ex-nv)	0.0000	0.0109
CSB5	Span 1	End	ASCE 7a SD (Ex-nv)	4.7853	0.8554
MSA1	Span 1	Start	ASCE 2b SD (S)	36.9467	0.2146
MSA1	Span 1	Middle	ASCE 6b SD (Wy)	0.2358	0.2314

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 2 of 3

Strip	SpanID	Location	FBotCombo	FBotMoment	FBotArea
				kip-ft	in2
MSA1	Span 1	End	ASCE 4b SD (Wy-Lr)	0.0000	0.3102
MSA2	Span 1	Start	ASCE 2b SD (S)	15.5870	0.4009
MSA2	Span 1	Middle	ASCE 2b SD (S)	26.5457	0.6864
MSA2	Span 1	End	ASCE 4b SD (Wy-Lr)	0.0000	0.1178
MSA3	Span 1	Start	ASCE 2b SD (S)	3.4549	0.0885
MSA3	Span 1	Middle	ASCE 2a SD (Lr)	10.9808	0.2835
MSA3	Span 1	End	ASCE 5b SD (Ey)	0.0000	0.1411
MSA4	Span 1	Start	ASCE 1 SD	5.5392	0.1432
MSA4	Span 1	Middle	ASCE 7a SD (Ex-nv)	0.0510	0.1287
MSA4	Span 1	End	ASCE 7b SD (Ey-nv)	0.0000	0.2337
MSB1	Span 1	Start	ASCE 3d SD (Lr-Wy)	9.5088	0.2662
MSB1	Span 1	Middle	ASCE 2b SD (S)	10.5600	0.2917
MSB1	Span 1	End	ASCE 3c SD (Lr-Wx)	8.9640	0.2512
MSB2	Span 1	Start	ASCE 3d SD (Lr-Wy)	10.8080	0.3052
MSB2	Span 1	Middle	ASCE 7b SD (Ey-nv)	0.0000	0.1098
MSB2	Span 1	End	ASCE 3c SD (Lr-Wx)	9.9952	0.2807
MSB3	Span 1	Start	ASCE 3d SD (Lr-Wy)	10.5585	0.2985
MSB3	Span 1	Middle	ASCE 2b SD (S)	5.8809	0.1623
MSB3	Span 1	End	ASCE 3c SD (Lr-Wx)	9.4675	0.2662
MSB4	Span 1	Start	ASCE 6b SD (Wy)	0.2523	0.3177
MSB4	Span 1	Middle	ASCE 6b SD (Wy)	0.0000	0.2240
MSB4	Span 1	End	ASCE 5b SD (Ey)	7.6075	0.2877

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 3 of 3

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 3 of 3

Strip	SpanID	Location	VCombo	VForce	VArea	Status	Layer
				kip	in2/ft		
CSA1	Span 1	Start		0.000	0.0000	OK	A
CSA1	Span 1	Middle	ASCE 3a SD (Lr-L)	15.184	0.0000	OK	A
CSA1	Span 1	End	ASCE 3a SD (Lr-L)	15.122	0.0000	OK	A
CSA2	Span 1	Start		0.000	0.0000	OK	A
CSA2	Span 1	Middle	ASCE 3a SD (Lr-L)	15.169	0.0000	OK	A
CSA2	Span 1	End	ASCE 3a SD (Lr-L)	15.197	0.0000	OK	A
CSB1	Span 1	Start		0.000	0.0000	OK	B
CSB1	Span 1	Middle	ASCE 2a SD (Lr)	5.109	0.0000	OK	B
CSB1	Span 1	End	ASCE 6b SD (Wy)	1.889	0.0000	OK	B
CSB2	Span 1	Start		0.000	0.0000	OK	B
CSB2	Span 1	Middle	ASCE 2b SD (S)	0.714	0.0000	OK	B
CSB2	Span 1	End	ASCE 2a SD (Lr)	0.786	0.0000	OK	B
CSB3	Span 1	Start		0.000	0.0000	OK	B
CSB3	Span 1	Middle	ASCE 2a SD (Lr)	1.492	0.0000	OK	B
CSB3	Span 1	End	ASCE 2a SD (Lr)	0.907	0.0000	OK	B
CSB4	Span 1	Start		0.000	0.0000	OK	B
CSB4	Span 1	Middle	ASCE 2b SD (S)	0.855	0.0000	OK	B
CSB4	Span 1	End	ASCE 2a SD (Lr)	0.736	0.0000	OK	B
CSB5	Span 1	Start		0.000	0.0000	OK	B
CSB5	Span 1	Middle	ASCE 5a SD (Ex)	3.819	0.0000	OK	B
CSB5	Span 1	End	ASCE 6b SD (Wy)	1.577	0.0000	OK	B
MSA1	Span 1	Start		0.000	0.0000	OK	A
MSA1	Span 1	Middle	ASCE 3d SD (Lr-Wy)	0.273	0.0000	OK	A
MSA1	Span 1	End	ASCE 3d SD (Lr-Wy)	1.911	0.0000	OK	A
MSA2	Span 1	Start		0.000	0.0000	OK	A

Table 31: Concrete Slab Design Summary 01 - Flexural And Shear Data, Part 3 of 3

Strip	SpanID	Location	VCombo	VForce	VArea	Status	Layer
				kip	in2/ft		
MSA2	Span 1	Middle	ASCE 2a SD (Lr)	0.316	0.0000	OK	A
MSA2	Span 1	End	ASCE 1 SD	0.115	0.0000	OK	A
MSA3	Span 1	Start		0.000	0.0000	OK	A
MSA3	Span 1	Middle	ASCE 5b SD (Ey)	0.165	0.0000	OK	A
MSA3	Span 1	End	ASCE 1 SD	0.159	0.0000	OK	A
MSA4	Span 1	Start		0.000	0.0000	OK	A
MSA4	Span 1	Middle	ASCE 3d SD (Lr-Wy)	0.244	0.0000	OK	A
MSA4	Span 1	End	ASCE 3d SD (Lr-Wy)	1.754	0.0000	OK	A
MSB1	Span 1	Start		0.000	0.0000	OK	B
MSB1	Span 1	Middle	ASCE 2a SD (Lr)	2.760	0.0000	OK	B
MSB1	Span 1	End	ASCE 3d SD (Lr-Wy)	1.941	0.0000	OK	B
MSB2	Span 1	Start		0.000	0.0000	OK	B
MSB2	Span 1	Middle	ASCE 2b SD (S)	2.519	0.0000	OK	B
MSB2	Span 1	End	ASCE 2b SD (S)	1.883	0.0000	OK	B
MSB3	Span 1	Start		0.000	0.0000	OK	B
MSB3	Span 1	Middle	ASCE 3d SD (Lr-Wy)	2.020	0.0000	OK	B
MSB3	Span 1	End	ASCE 2b SD (S)	1.977	0.0000	OK	B
MSB4	Span 1	Start		0.000	0.0000	OK	B
MSB4	Span 1	Middle	ASCE 3d SD (Lr-Wy)	1.972	0.0000	OK	B
MSB4	Span 1	End	ASCE 3d SD (Lr-Wy)	2.112	0.0000	OK	B

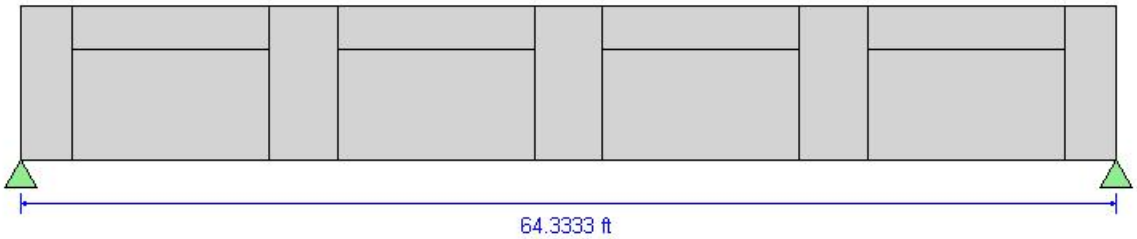
ACI 318-08 Concrete Strip Design

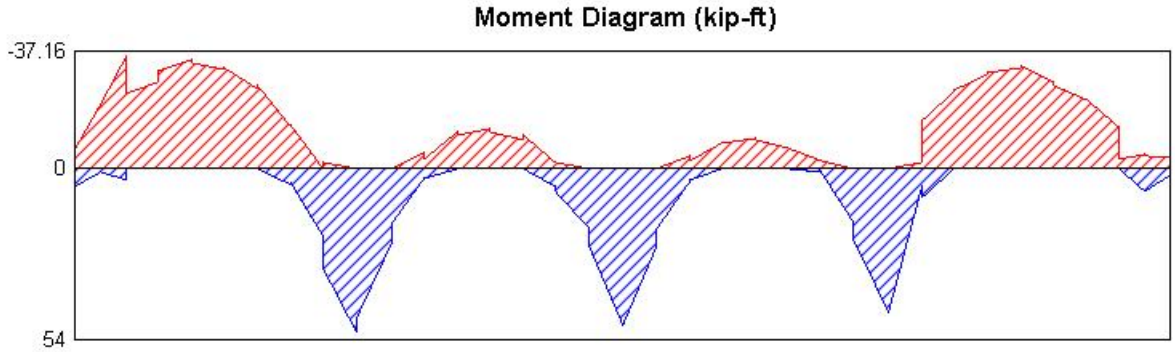
Geometric Properties

Combination = Overall Envelope
Strip Label = CSA1
Length = 64.3333 ft
Distance to Top Rebar Center = 1.8125 in
Distance to Bot Rebar Center = 3.3125 in

Material Properties

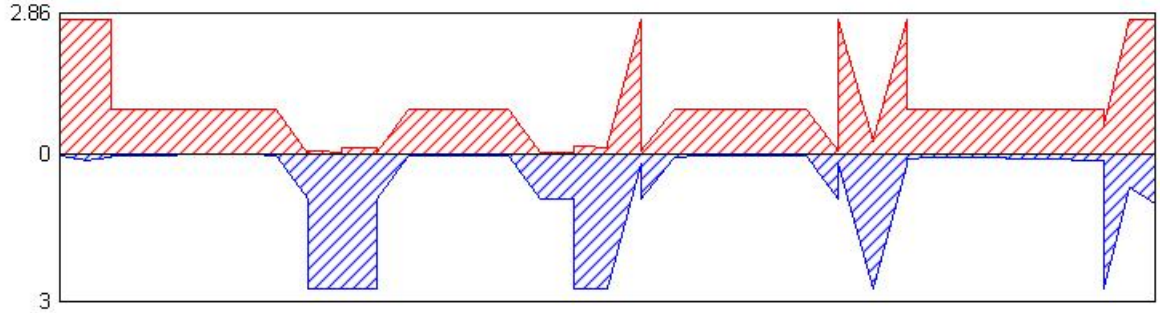
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





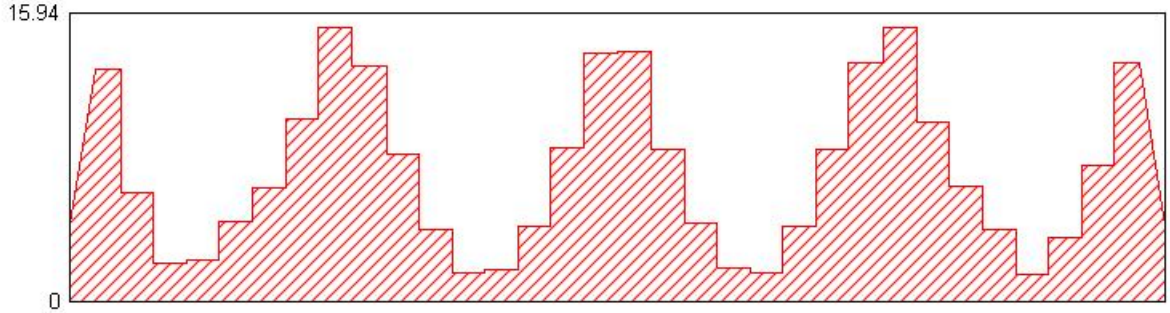
Moment (-)	-35.3908	0	-3.6477
Moment (+)	31.3714	49.4039	1.9676

Longitudinal Reinforcement (in2)



As (top)	0.2267	0.3041	1.0363
Combo	ASCE 7a SD (Ex-nv)	ASCE 4b SD (Wy-Lr)	ASCE 4d SD (Wy-S)
As (bot)	0.1985	0.3095	1.016
Combo	ASCE 5a SD (Ex)	ASCE 3d SD (Lr-Wy)	ASCE 6b SD (Wy)

Shear Diagram (kip)



Shear	0	15.184	15.122

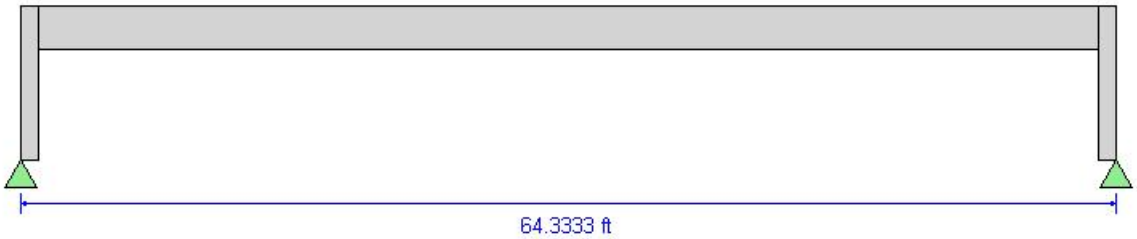
ACI 318-08 Concrete Strip Design

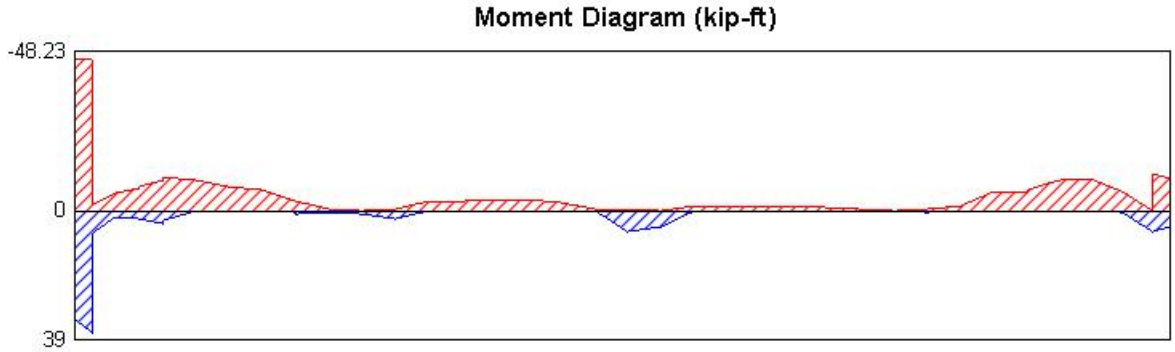
Geometric Properties

Combination = Overall Envelope
Strip Label = MSA1
Length = 64.3333 ft
Distance to Top Rebar Center = 1.8125 in
Distance to Bot Rebar Center = 3.3125 in

Material Properties

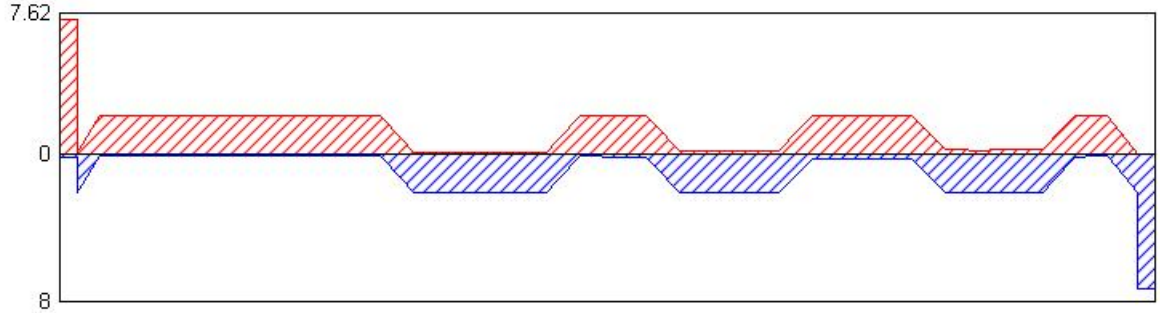
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





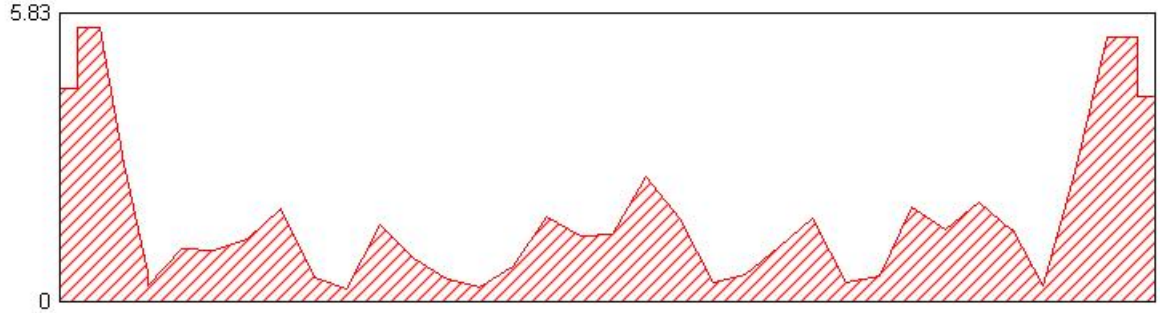
Moment (-)	-45.9294	-0.1972	-0.2648
Moment (+)	36.9467	0.2358	0

Longitudinal Reinforcement (in2)



As (top)	0.2551	0.3036	0.3439
Combo	ASCE 2a SD (Lr)	ASCE 4b SD (Wy-Lr)	ASCE 4b SD (Wy-Lr)
As (bot)	0.2146	0.2314	0.3102
Combo	ASCE 2b SD (S)	ASCE 6b SD (Wy)	ASCE 4b SD (Wy-Lr)

Shear Diagram (kip)



Shear	0	0.273	1.911

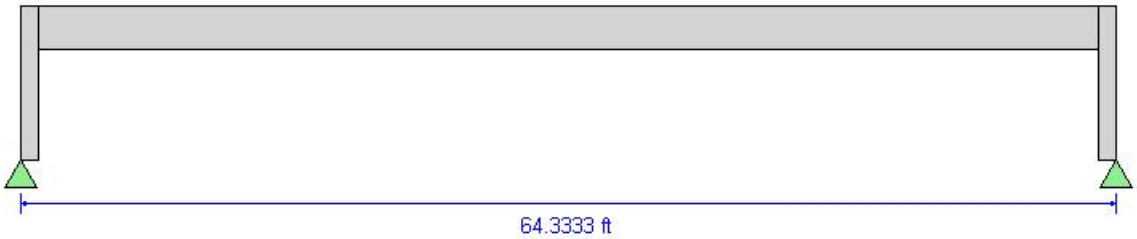
ACI 318-08 Concrete Strip Design

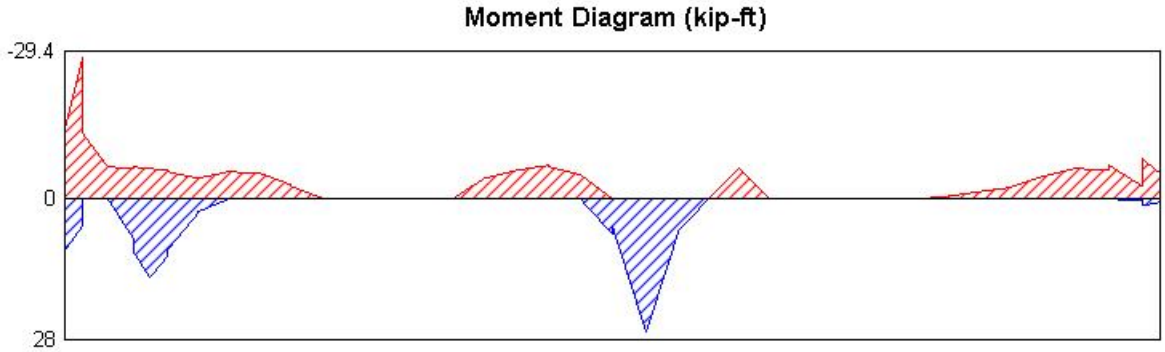
Geometric Properties

Combination = Overall Envelope
Strip Label = MSA2
Length = 64.3333 ft
Distance to Top Rebar Center = 1.8125 in
Distance to Bot Rebar Center = 3.3125 in

Material Properties

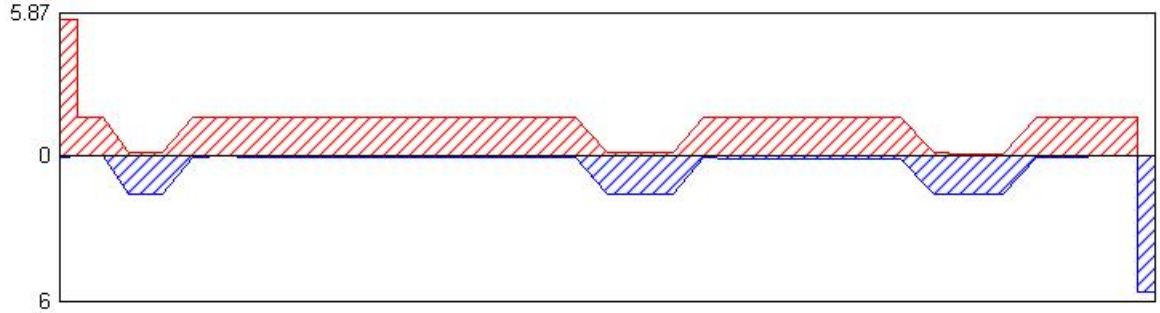
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





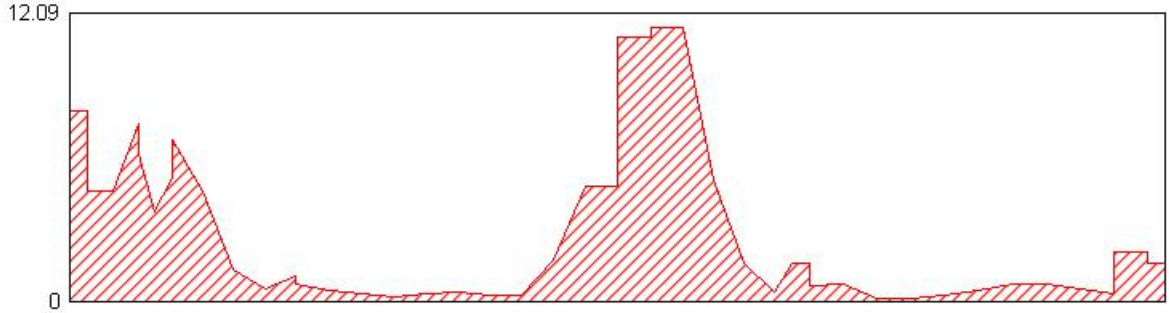
Moment (-)	-13.2181	-0.0779	-6.6289
Moment (+)	15.587	26.5457	0

Longitudinal Reinforcement (in2)



As (top)	0.2894	0.1481	0.1457
Combo	ASCE 2a SD (Lr)	ASCE 6b SD (Wy)	ASCE 3d SD (Lr-Wy)
As (bot)	0.4009	0.6864	0.1178
Combo	ASCE 2b SD (S)	ASCE 2b SD (S)	ASCE 4b SD (Wy-Lr)

Shear Diagram (kip)



Shear	0	0.316	0.115

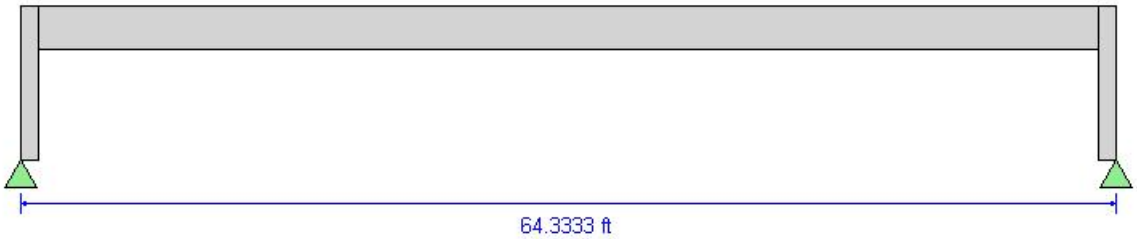
ACI 318-08 Concrete Strip Design

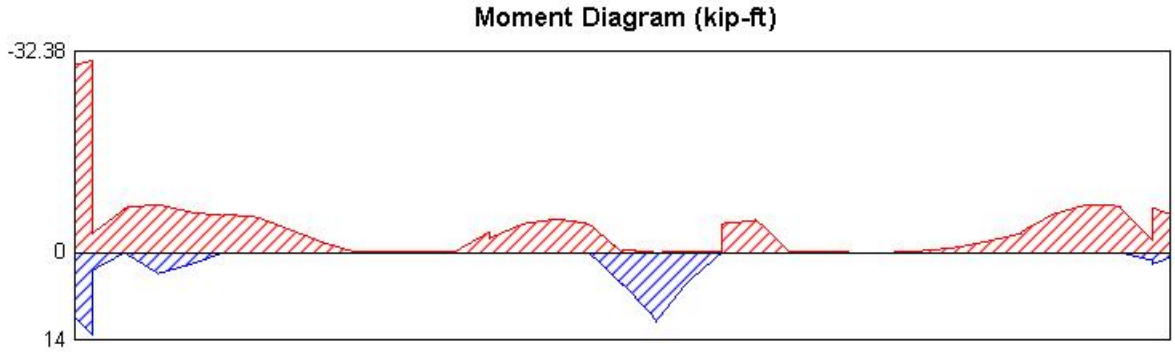
Geometric Properties

Combination = Overall Envelope
Strip Label = MSA3
Length = 64.3333 ft
Distance to Top Rebar Center = 1.8125 in
Distance to Bot Rebar Center = 3.3125 in

Material Properties

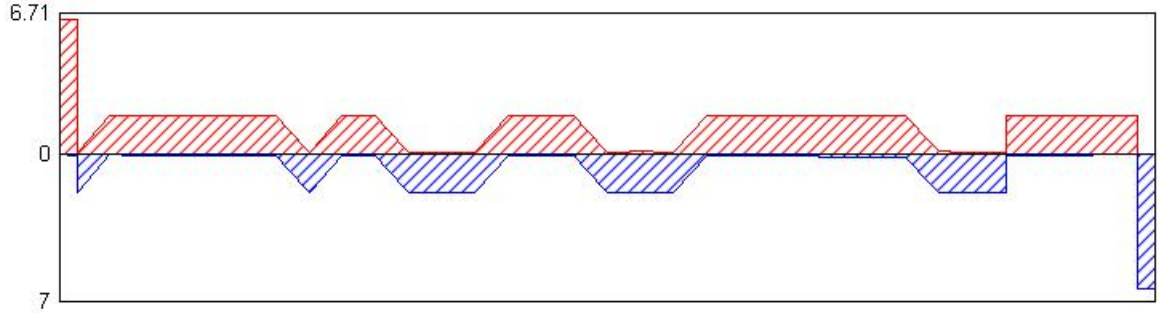
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





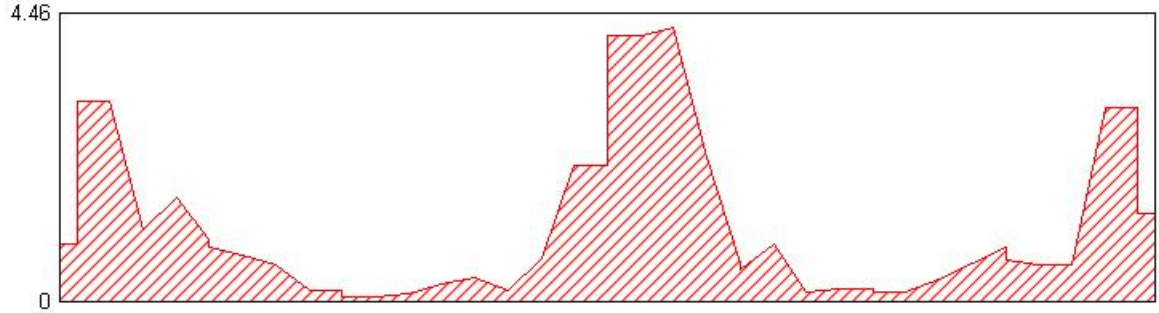
Moment (-)	-7.8382	0	-7.8581
Moment (+)	3.4549	10.9808	0

Longitudinal Reinforcement (in2)



As (top)	0.1713	0.1623	0.1717
Combo	ASCE 1 SD	ASCE 7b SD (Ey-nv)	ASCE 1 SD
As (bot)	0.0885	0.2835	0.1411
Combo	ASCE 2b SD (S)	ASCE 2a SD (Lr)	ASCE 5b SD (Ey)

Shear Diagram (kip)



Shear	0	0.165	0.159

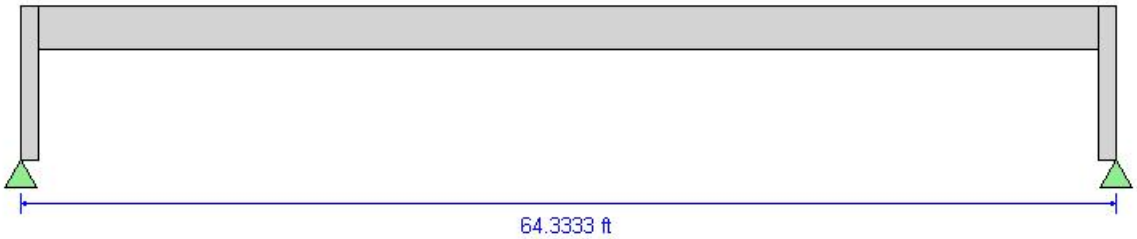
ACI 318-08 Concrete Strip Design

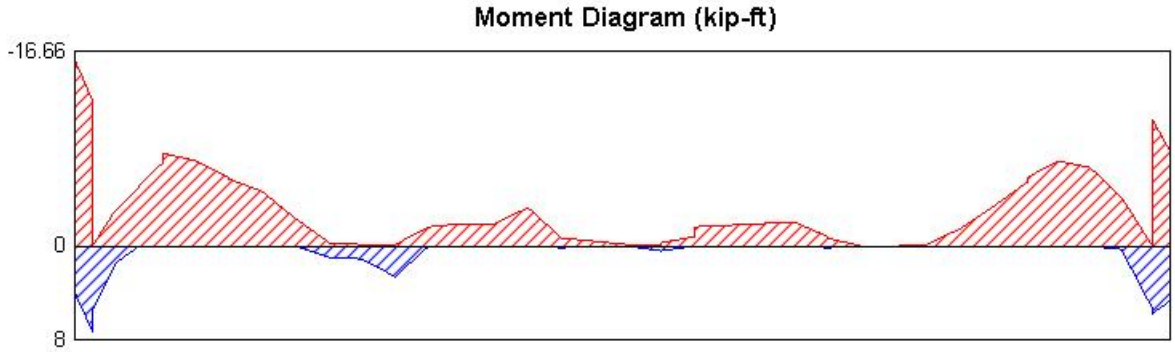
Geometric Properties

Combination = Overall Envelope
Strip Label = MSA4
Length = 64.3333 ft
Distance to Top Rebar Center = 1.8125 in
Distance to Bot Rebar Center = 3.3125 in

Material Properties

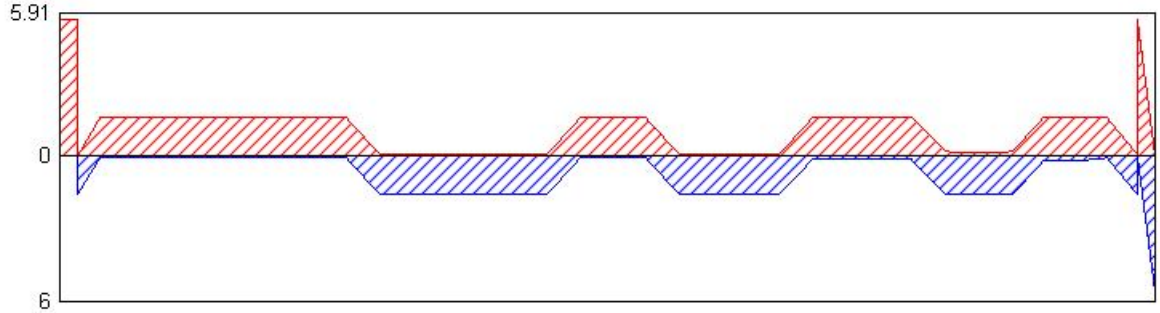
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





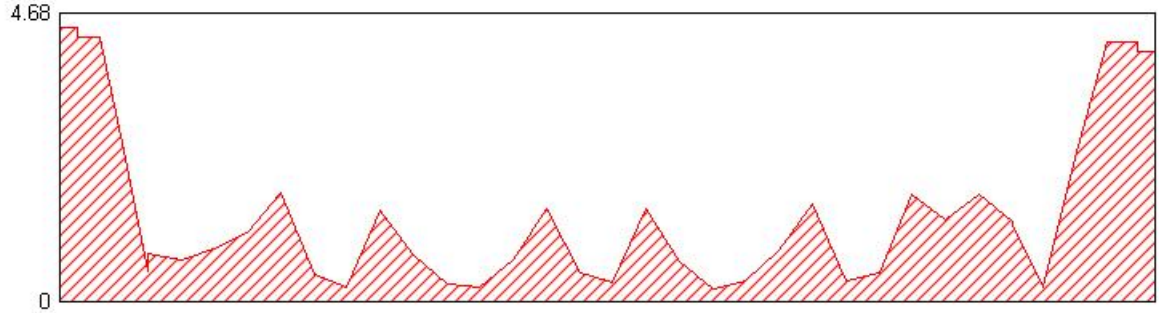
Moment (-)	-7.8796	0	-0.1381
Moment (+)	5.5392	0.051	0

Longitudinal Reinforcement (in2)



As (top)	0.1722	0.226	0.2576
Combo	ASCE 1 SD	ASCE 5b SD (Ey)	ASCE 5b SD (Ey)
As (bot)	0.1432	0.1287	0.2337
Combo	ASCE 1 SD	ASCE 7a SD (Ex-nv)	ASCE 7b SD (Ey-nv)

Shear Diagram (kip)



Shear	0	0.244	1.754

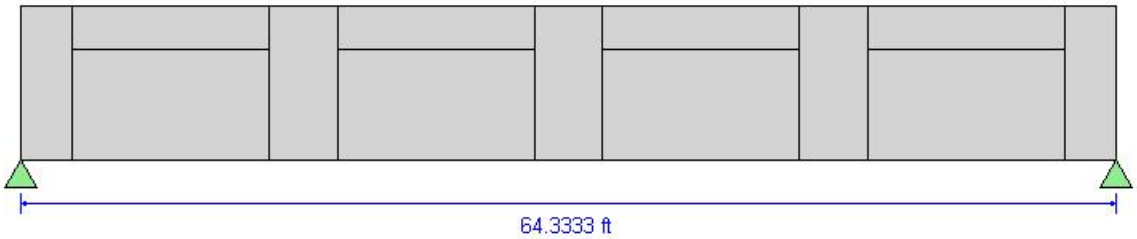
ACI 318-08 Concrete Strip Design

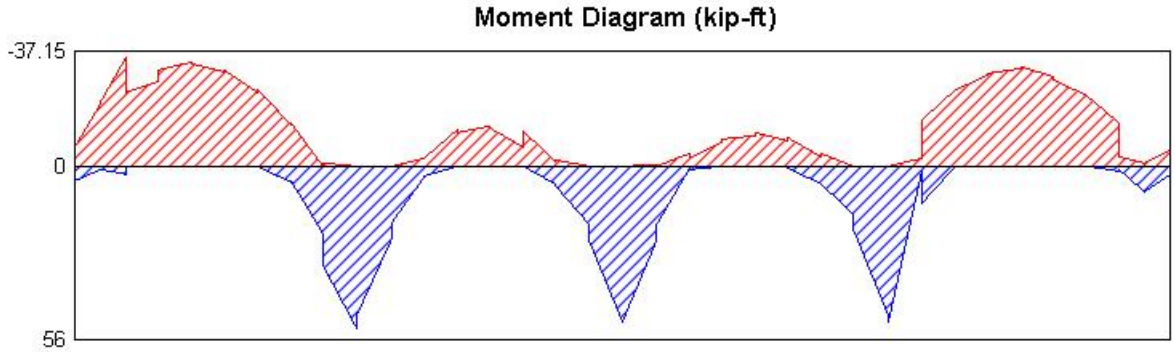
Geometric Properties

Combination = Overall Envelope
Strip Label = CSA2
Length = 64.3333 ft
Distance to Top Rebar Center = 1.8125 in
Distance to Bot Rebar Center = 3.3125 in

Material Properties

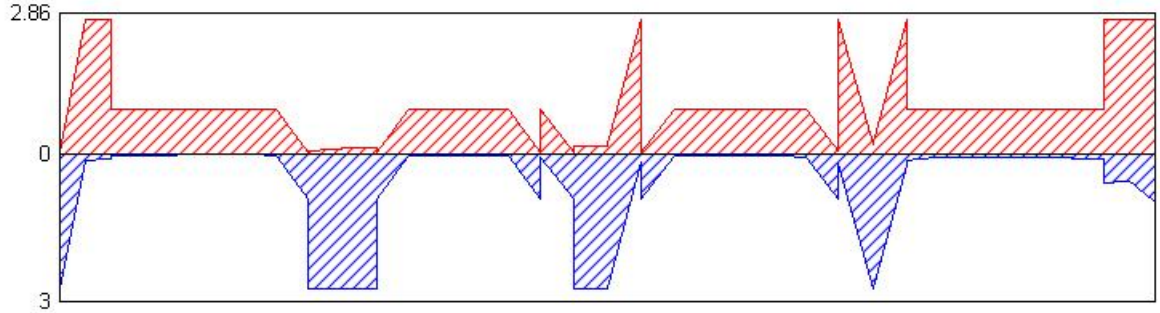
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





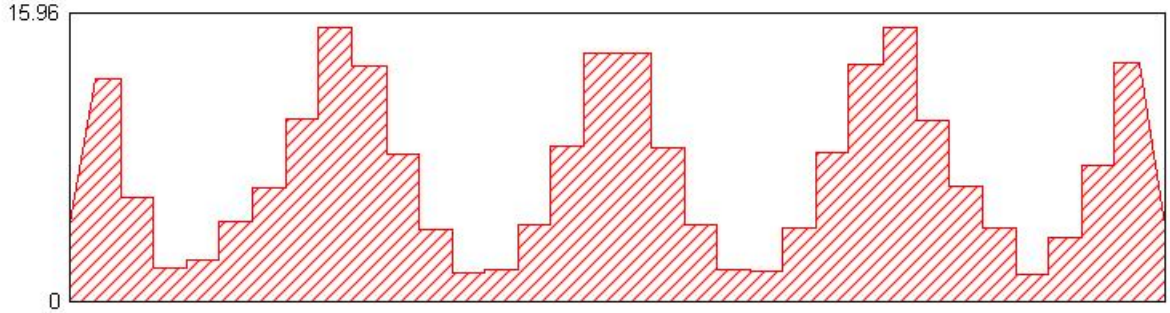
Moment (-)	-35.3782	0	-5.3275
Moment (+)	31.9822	52.4812	2.684

Longitudinal Reinforcement (in2)



As (top)	0.2266	0.2492	1.0028
Combo	ASCE 7a SD (Ex-nv)	ASCE 5b SD (Ey)	ASCE 5a SD (Ex)
As (bot)	0.202	0.3143	0.9921
Combo	ASCE 5a SD (Ex)	ASCE 5a SD (Ex)	ASCE 5a SD (Ex)

Shear Diagram (kip)



Shear	0	15.169	15.197

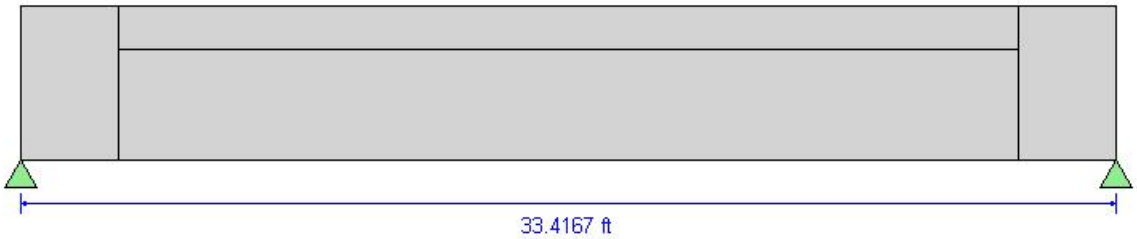
ACI 318-08 Concrete Strip Design

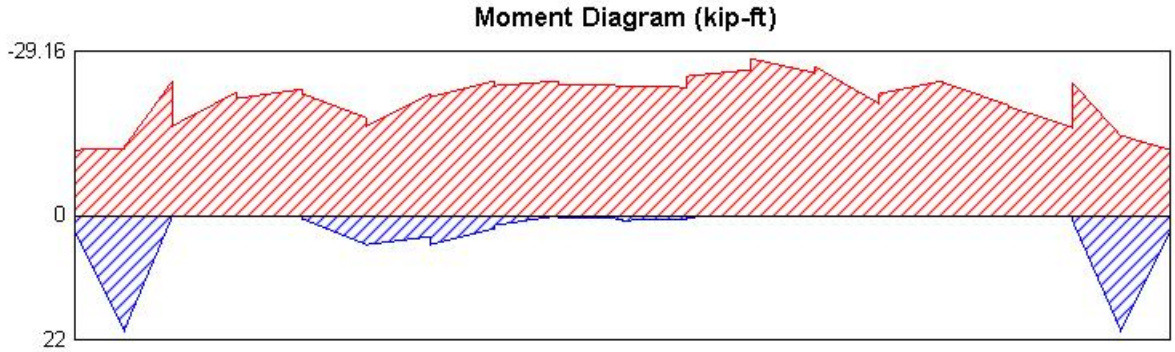
Geometric Properties

Combination = Overall Envelope
Strip Label = CSB1
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

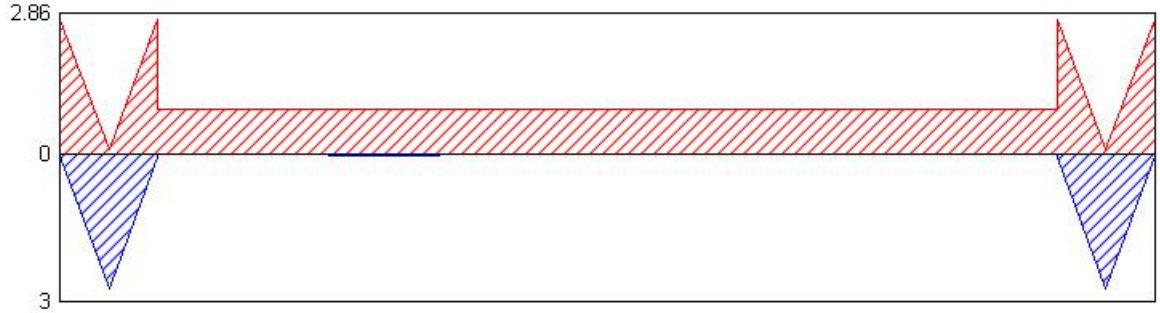
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





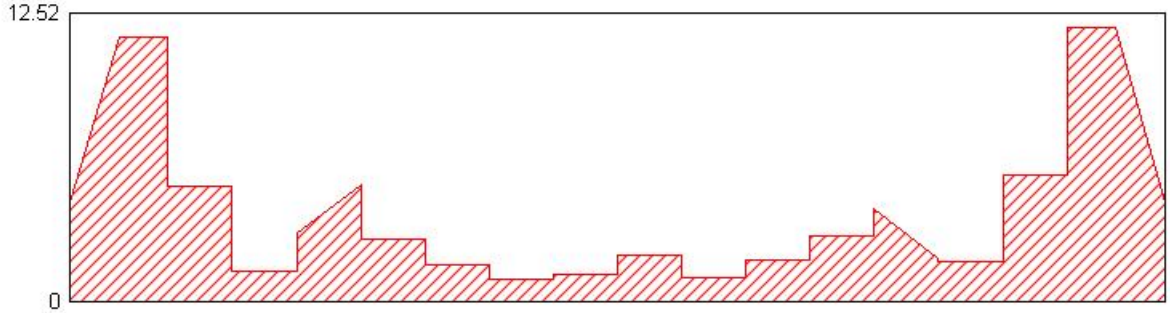
Moment (-)	-23.7613	-27.7714	-23.6123
Moment (+)	20.4367	5.1774	20.4196

Longitudinal Reinforcement (in2)



As (top)	0.1532	0.1564	0.154
Combo	ASCE 7b SD (Ey-nv)	ASCE 3a SD (Lr-L)	ASCE 6b SD (Wy)
As (bot)	0.1194	0.0302	0.1193
Combo	ASCE 3d SD (Lr-Wy)	ASCE 2b SD (S)	ASCE 5b SD (Ey)

Shear Diagram (kip)



Shear	0	5.109	1.889

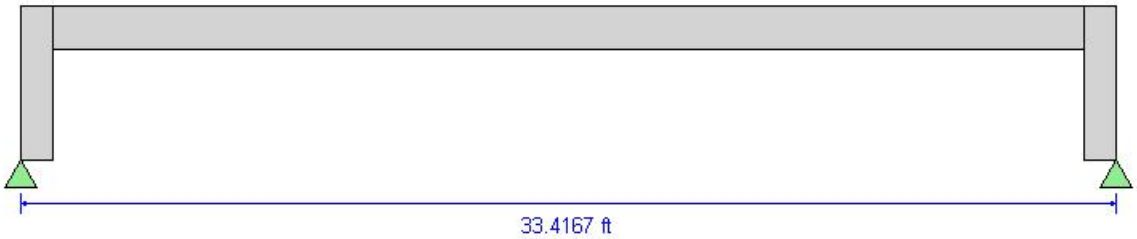
ACI 318-08 Concrete Strip Design

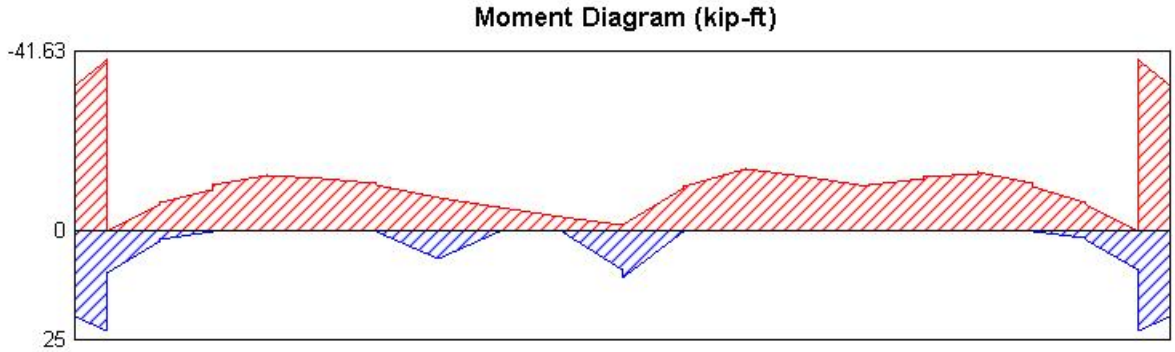
Geometric Properties

Combination = Overall Envelope
Strip Label = MSB1
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

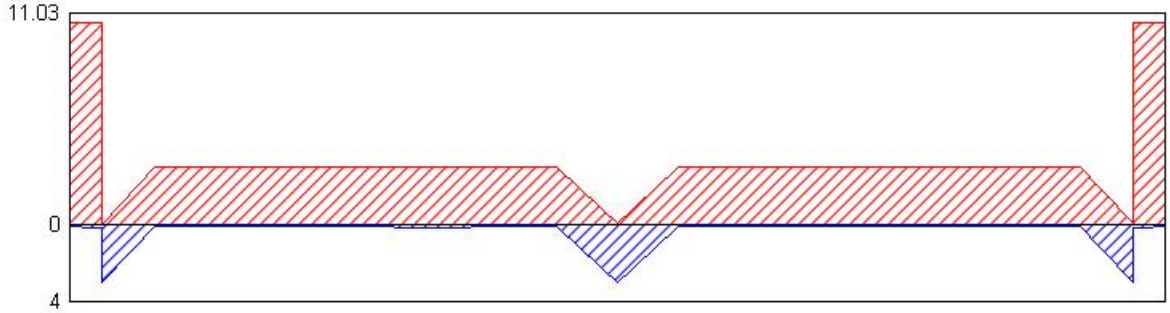
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





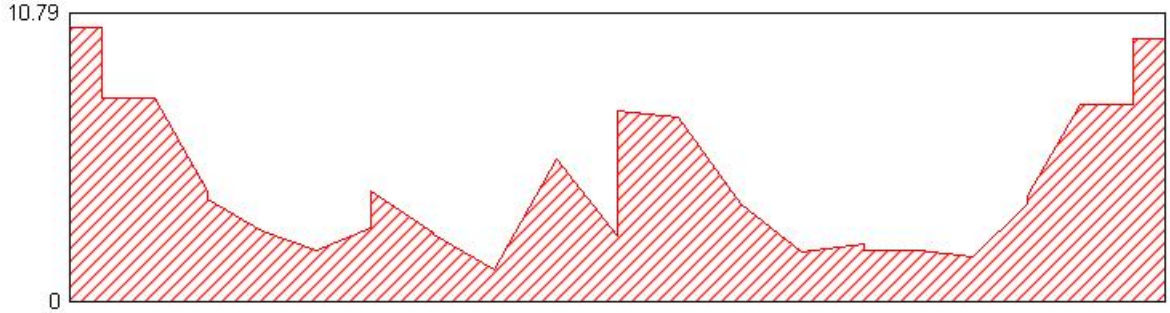
Moment (-)	-13.093	-14.4517	-13.5184
Moment (+)	9.5088	10.56	8.964

Longitudinal Reinforcement (in2)



As (top)	0.3049	0.3366	0.3148
Combo	ASCE 3d SD (Lr-Wy)	ASCE 2a SD (Lr)	ASCE 3d SD (Lr-Wy)
As (bot)	0.2662	0.2917	0.2512
Combo	ASCE 3d SD (Lr-Wy)	ASCE 2b SD (S)	ASCE 3c SD (Lr-Wx)

Shear Diagram (kip)



Shear	0	2.76	1.941

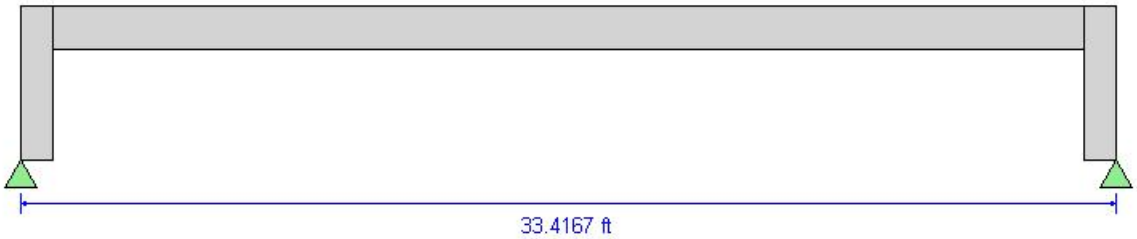
ACI 318-08 Concrete Strip Design

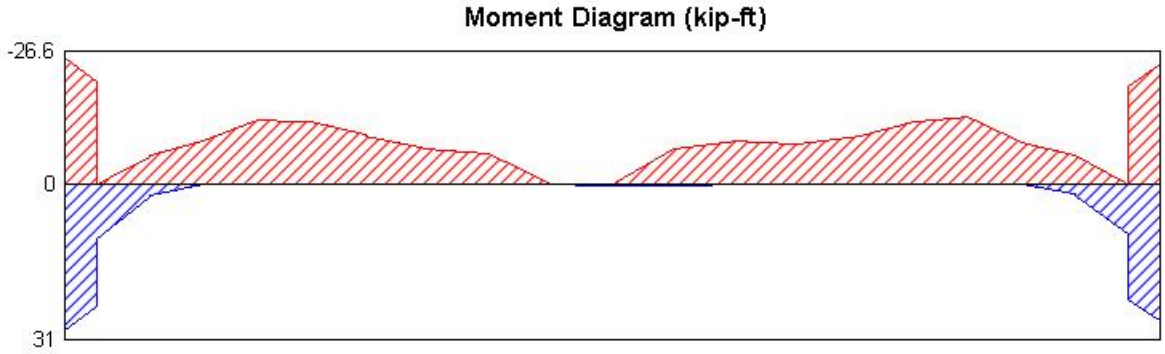
Geometric Properties

Combination = Overall Envelope
Strip Label = MSB2
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

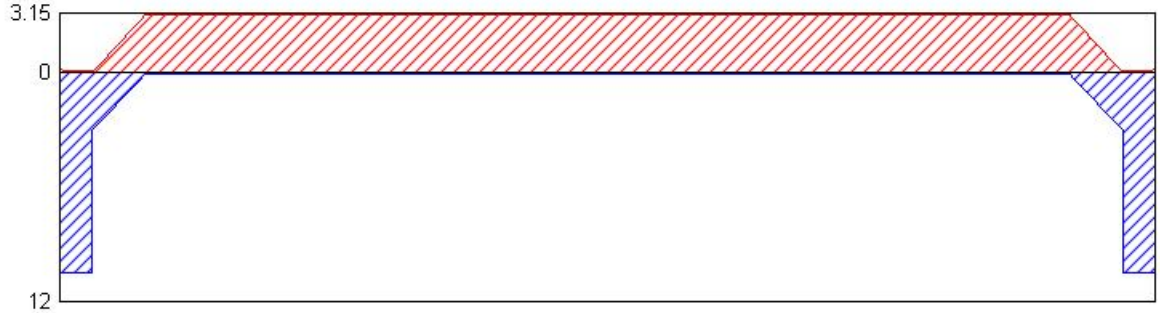
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





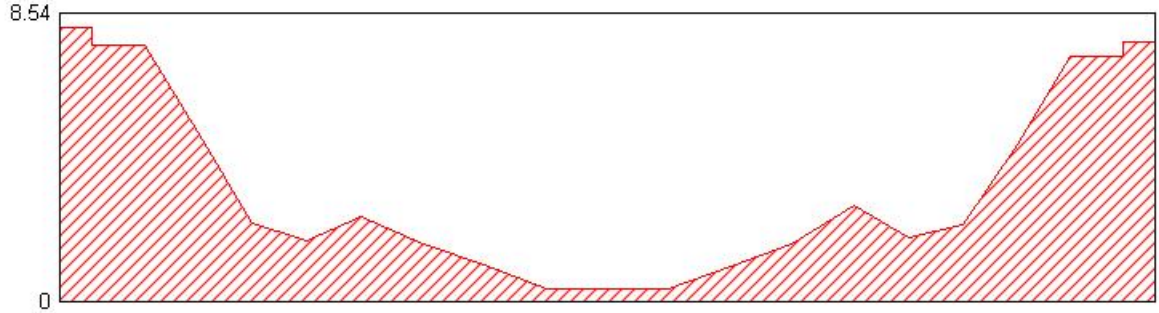
Moment (-)	-12.7286	-9.7972	-13.3505
Moment (+)	10.808	0	9.9952

Longitudinal Reinforcement (in2)



As (top)	0.2964	0.228	0.3109
Combo	ASCE 3d SD (Lr-Wy)	ASCE 3d SD (Lr-Wy)	ASCE 3d SD (Lr-Wy)
As (bot)	0.3052	0.1098	0.2807
Combo	ASCE 3d SD (Lr-Wy)	ASCE 7b SD (Ey-nv)	ASCE 3c SD (Lr-Wx)

Shear Diagram (kip)



Shear	0	2.519	1.883

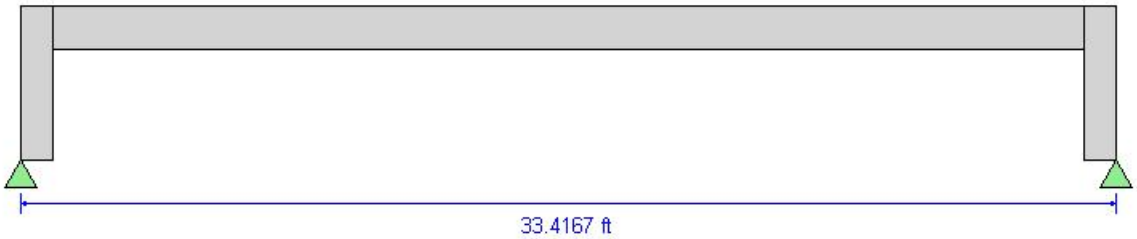
ACI 318-08 Concrete Strip Design

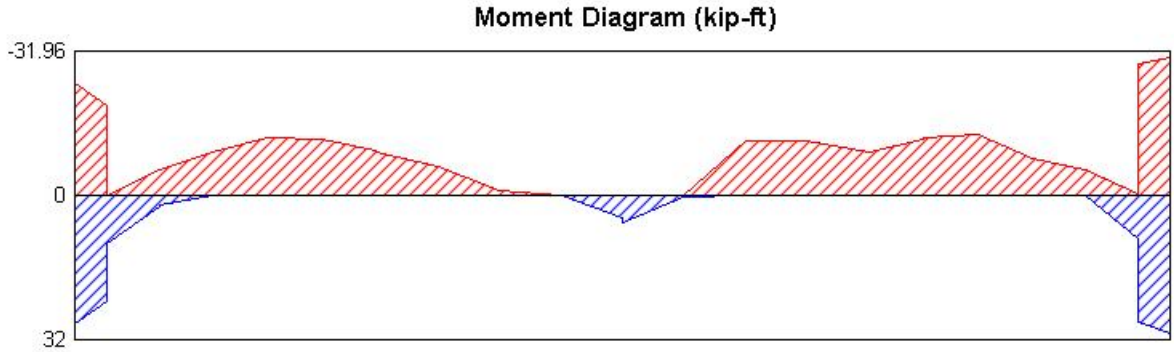
Geometric Properties

Combination = Overall Envelope
Strip Label = MSB3
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

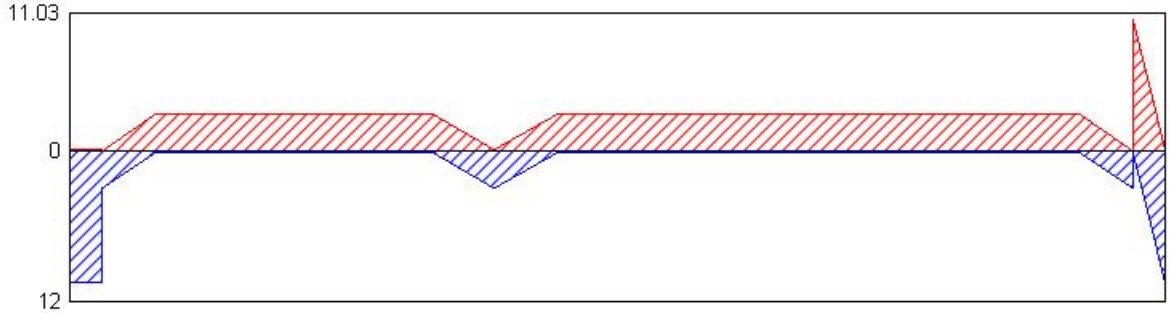
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





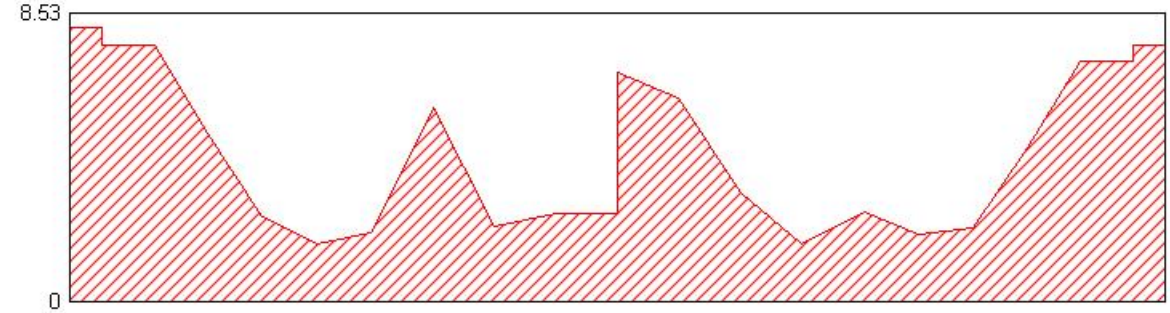
Moment (-)	-12.8667	-12.1901	-13.4759
Moment (+)	10.5585	5.8809	9.4675

Longitudinal Reinforcement (in2)



As (top)	0.2996	0.2838	0.3138
Combo	ASCE 3d SD (Lr-Wy)	ASCE 2a SD (Lr)	ASCE 3d SD (Lr-Wy)
As (bot)	0.2985	0.1623	0.2662
Combo	ASCE 3d SD (Lr-Wy)	ASCE 2b SD (S)	ASCE 3c SD (Lr-Wx)

Shear Diagram (kip)



Shear	0	2.02	1.977

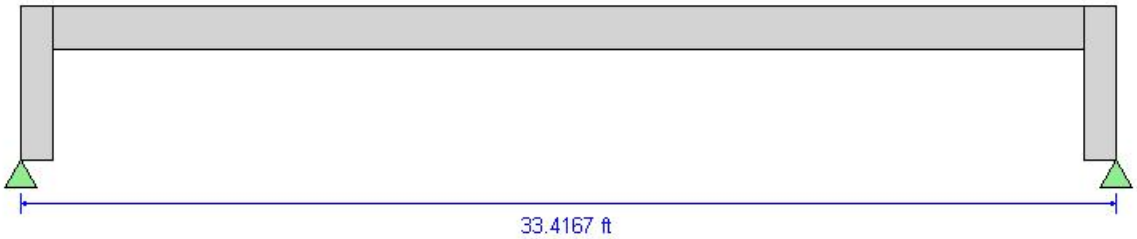
ACI 318-08 Concrete Strip Design

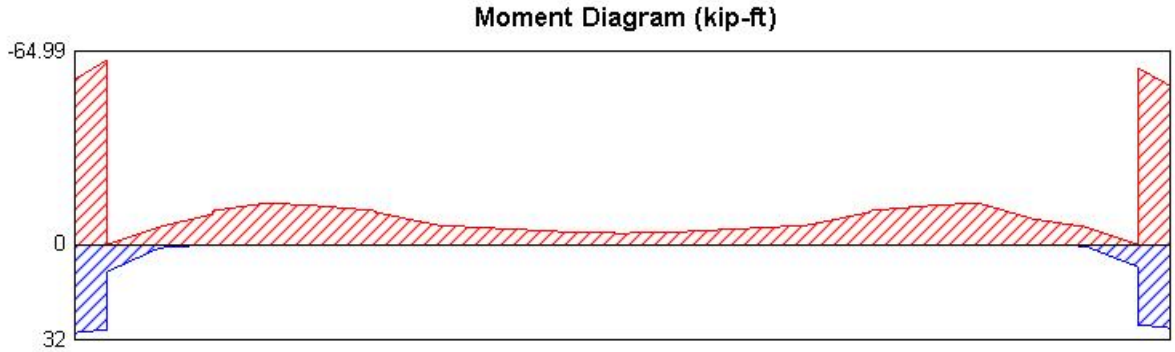
Geometric Properties

Combination = Overall Envelope
Strip Label = MSB4
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

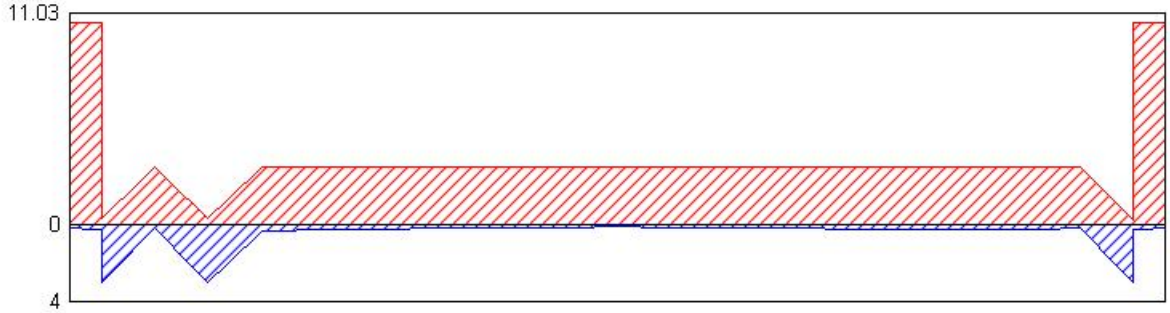
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





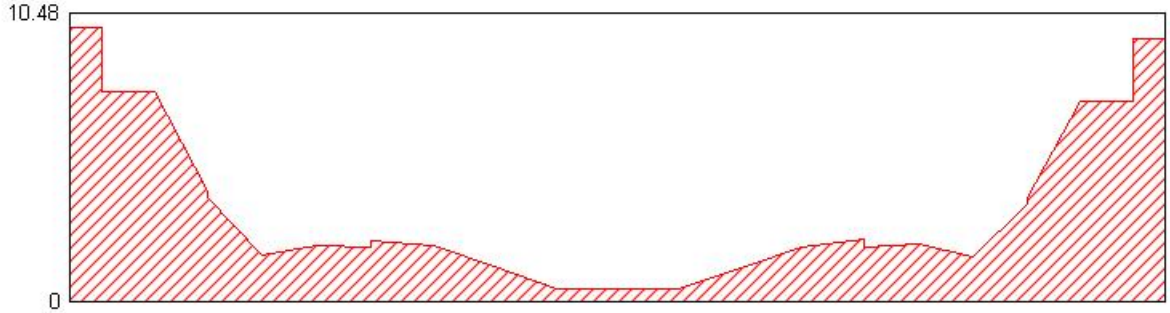
Moment (-)	-61.8923	-11.4178	-59.2829
Moment (+)	0.2523	0	7.6075

Longitudinal Reinforcement (in2)



As (top)	0.404	0.2898	0.3893
Combo	ASCE 5a SD (Ex)	ASCE 3d SD (Lr-Wy)	ASCE 5a SD (Ex)
As (bot)	0.3177	0.224	0.2877
Combo	ASCE 6b SD (Wy)	ASCE 6b SD (Wy)	ASCE 5b SD (Ey)

Shear Diagram (kip)



Shear	0	1.972	2.112

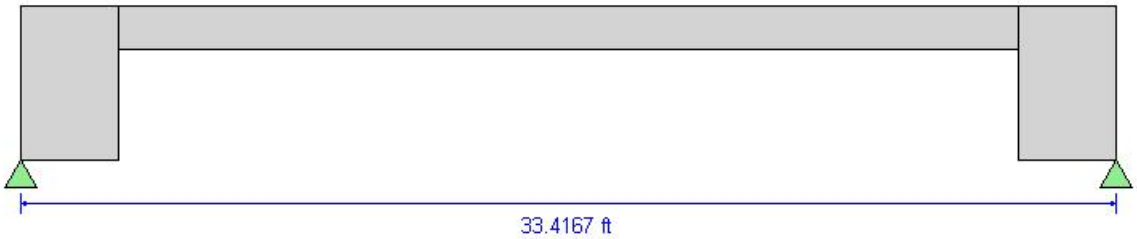
ACI 318-08 Concrete Strip Design

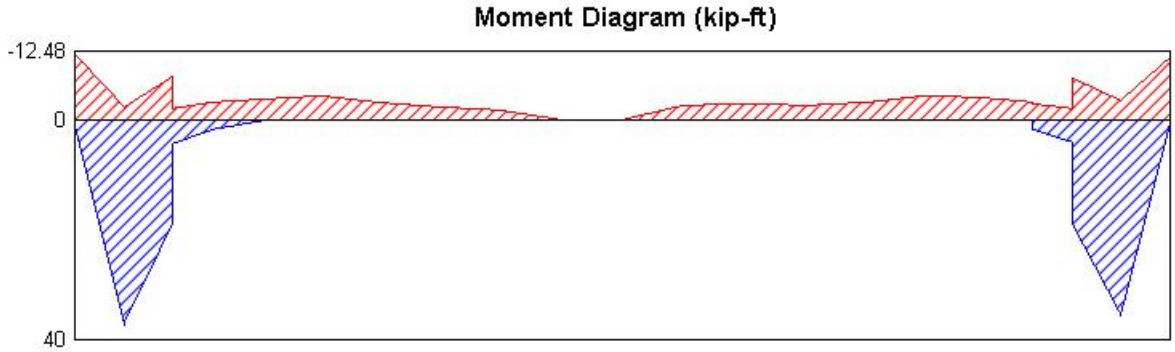
Geometric Properties

Combination = Overall Envelope
Strip Label = CSB2
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

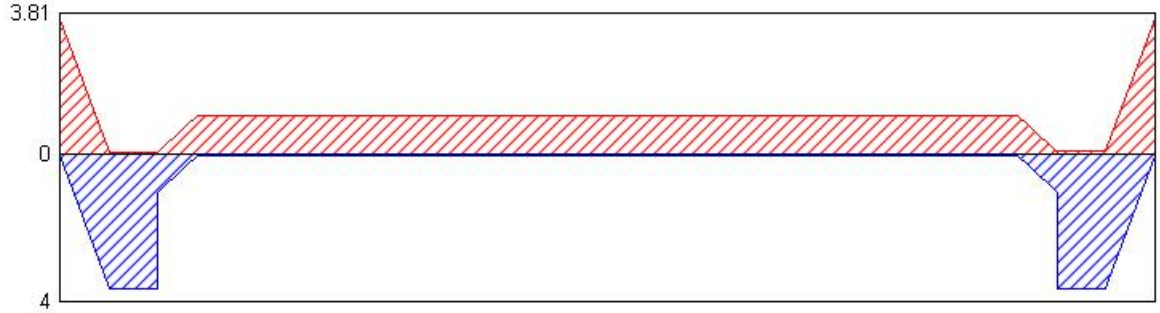
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





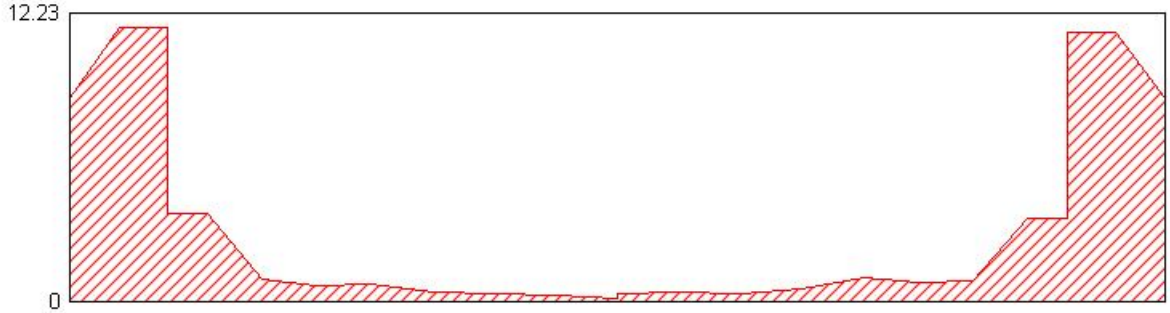
Moment (-)	-4.3217	-3.2603	-4.3268
Moment (+)	37.1892	0	35.6135

Longitudinal Reinforcement (in2)



As (top)	0.1006	0.0759	0.1007
Combo	ASCE 3d SD (Lr-Wy)	ASCE 3d SD (Lr-Wy)	ASCE 3d SD (Lr-Wy)
As (bot)	0.2174	0.0363	0.2081
Combo	ASCE 3d SD (Lr-Wy)	ASCE 7b SD (Ey-nv)	ASCE 3a SD (Lr-L)

Shear Diagram (kip)



Shear	0	0.714	0.786

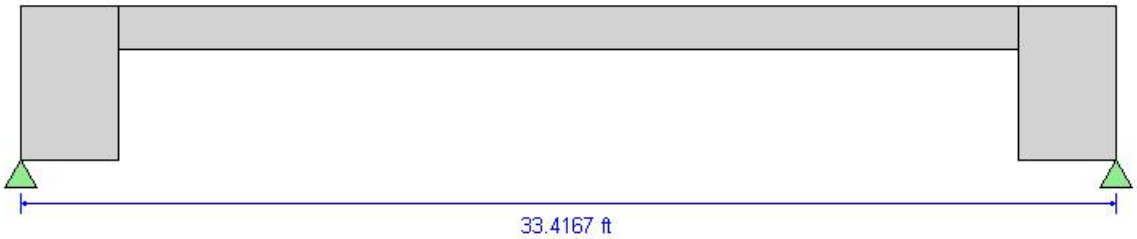
ACI 318-08 Concrete Strip Design

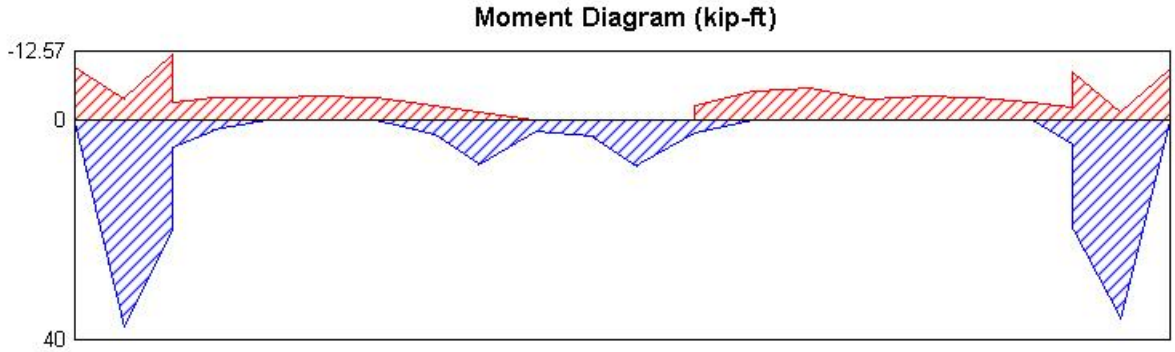
Geometric Properties

Combination = Overall Envelope
Strip Label = CSB3
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

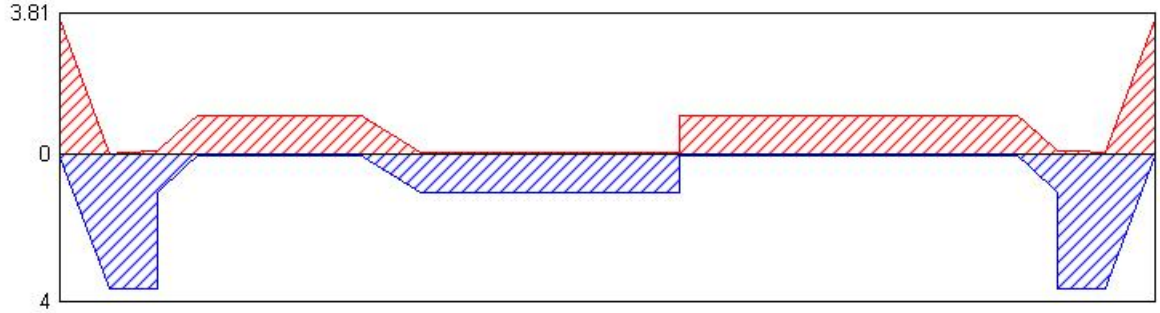
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





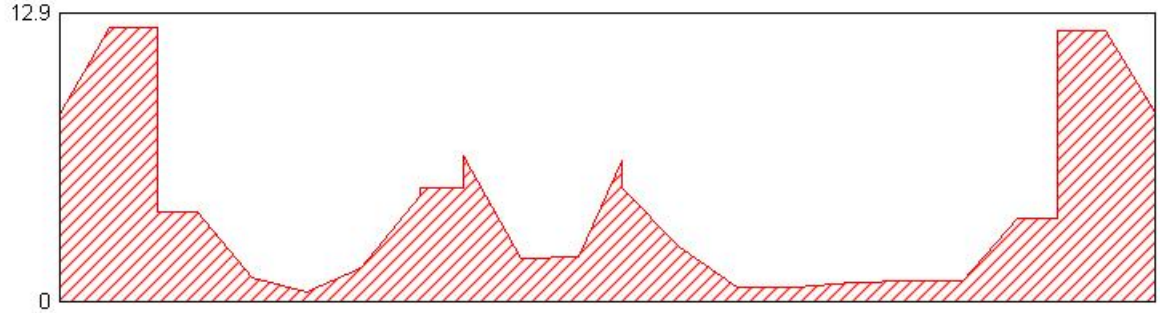
Moment (-)	-4.1917	-5.7141	-4.5025
Moment (+)	37.7676	8.5448	36.2695

Longitudinal Reinforcement (in2)



As (top)	0.1064	0.1331	0.1048
Combo	ASCE 5b SD (Ey)	ASCE 2a SD (Lr)	ASCE 3d SD (Lr-Wy)
As (bot)	0.2207	0.2368	0.212
Combo	ASCE 3d SD (Lr-Wy)	ASCE 2b SD (S)	ASCE 3a SD (Lr-L)

Shear Diagram (kip)



Shear	0	1.492	0.907

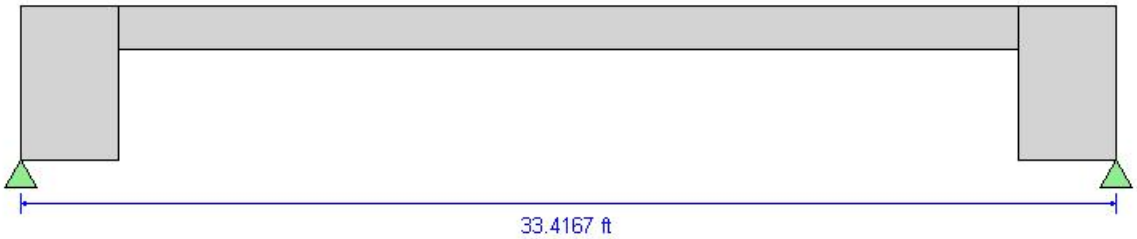
ACI 318-08 Concrete Strip Design

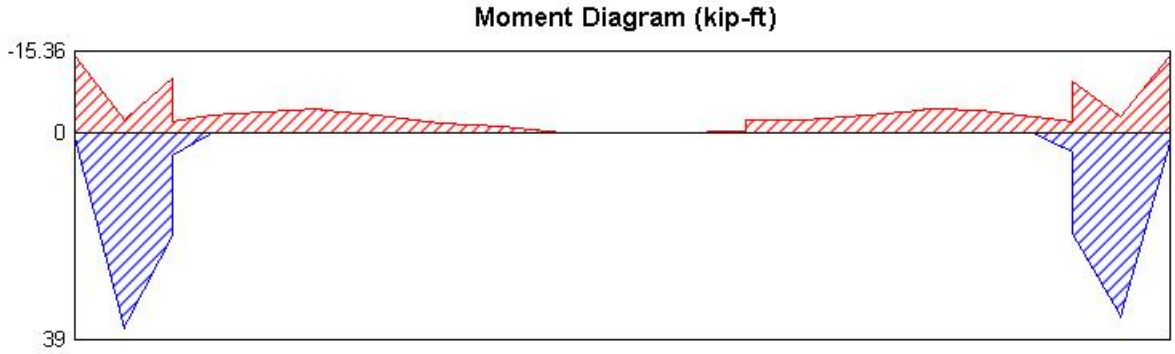
Geometric Properties

Combination = Overall Envelope
Strip Label = CSB4
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

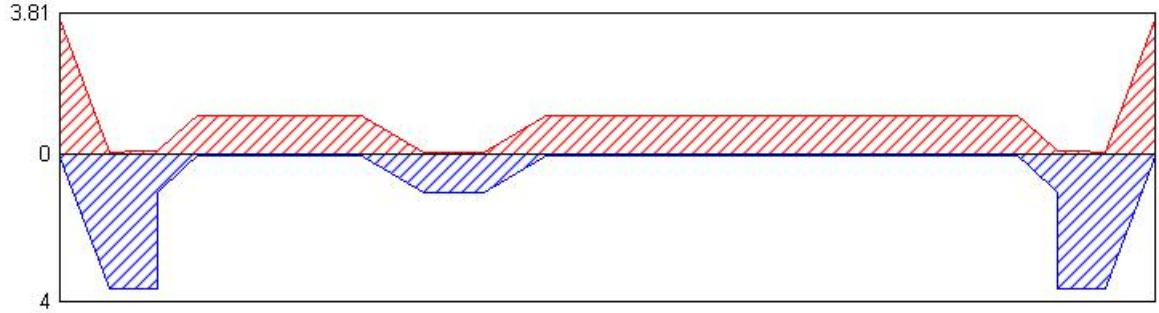
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





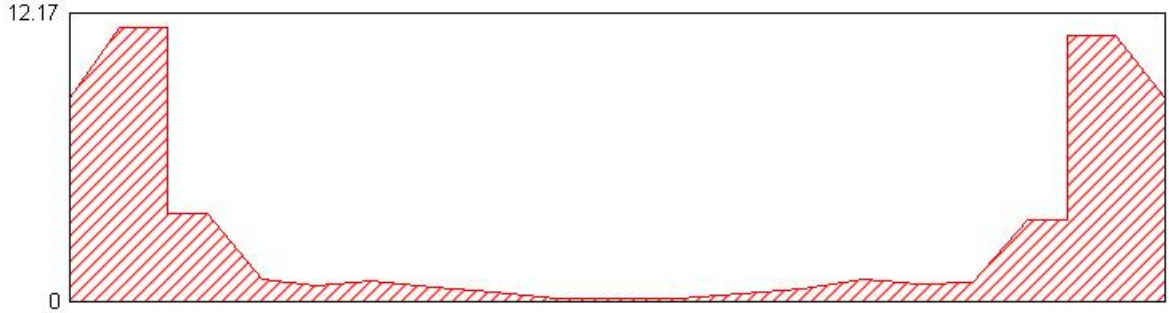
Moment (-)	-4.3902	-3.3155	-4.3808
Moment (+)	36.9153	0	34.7902

Longitudinal Reinforcement (in2)



As (top)	0.1022	0.0772	0.102
Combo	ASCE 3d SD (Lr-Wy)	ASCE 3d SD (Lr-Wy)	ASCE 3d SD (Lr-Wy)
As (bot)	0.2157	0.0569	0.2033
Combo	ASCE 3d SD (Lr-Wy)	ASCE 6b SD (Wy)	ASCE 3a SD (Lr-L)

Shear Diagram (kip)



Shear	0	0.855	0.736

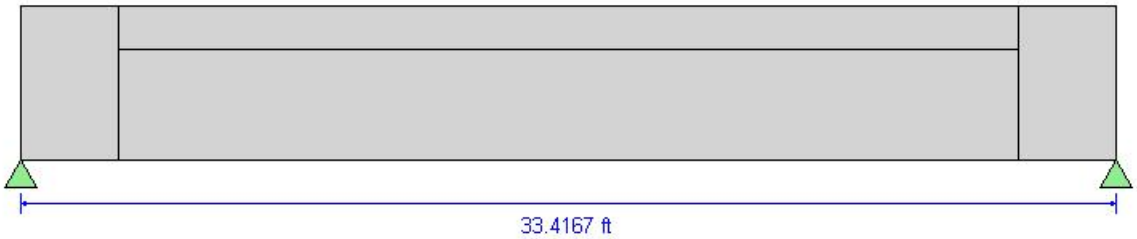
ACI 318-08 Concrete Strip Design

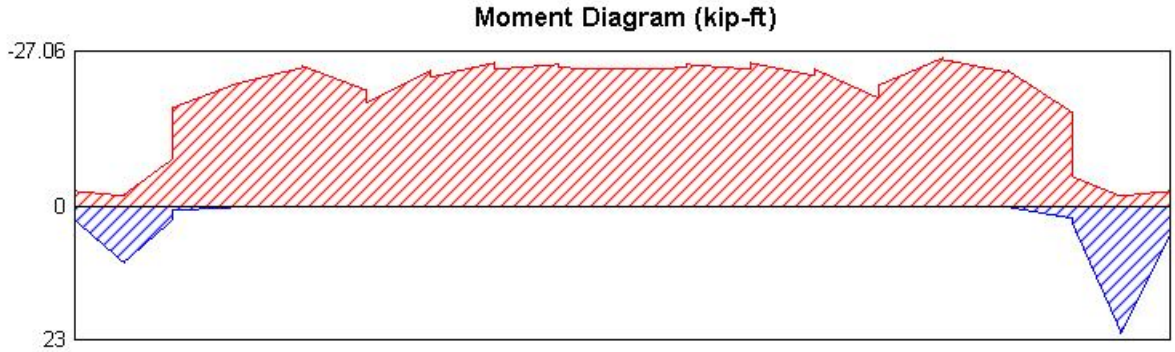
Geometric Properties

Combination = Overall Envelope
Strip Label = CSB5
Length = 33.4167 ft
Distance to Top Rebar Center = 2.4375 in
Distance to Bot Rebar Center = 3.9375 in

Material Properties

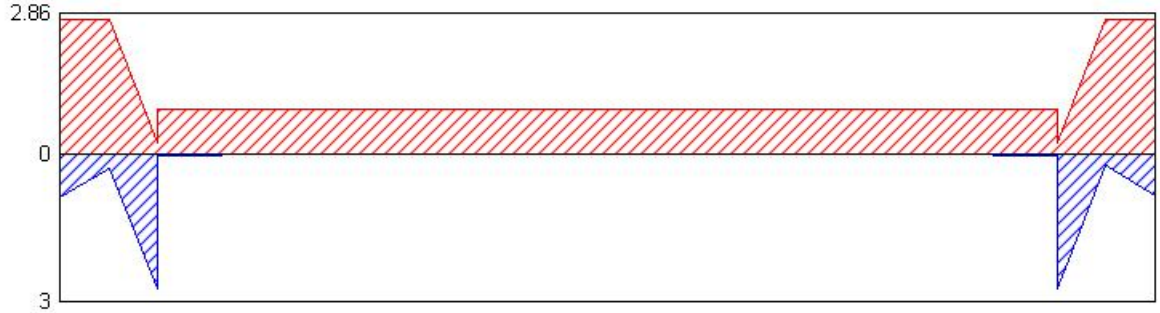
Concrete Comp. Strength = 4 kip/in2
Concrete Modulus = 3604.997 kip/in2
Longitudinal Rebar Yield = 60 kip/in2





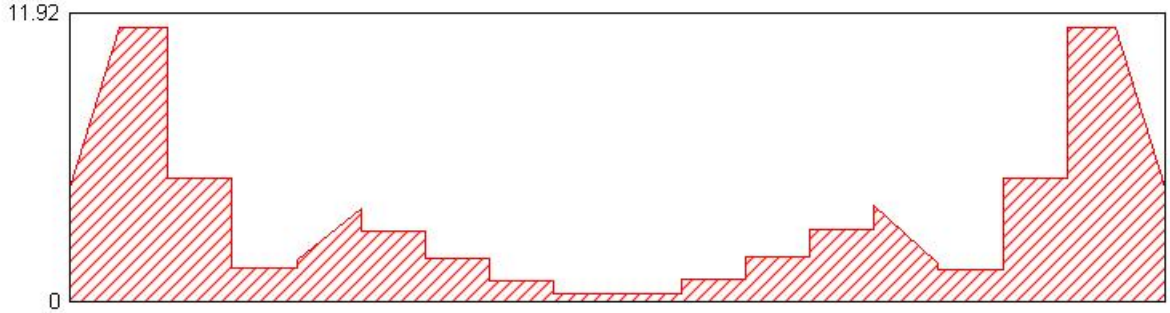
Moment (-)	-2.6746	-25.1511	-2.7046
Moment (+)	2.2252	0	4.7853

Longitudinal Reinforcement (in2)



As (top)	0.9234	0.1457	0.9234
Combo	ASCE 5a SD (Ex)	ASCE 3d SD (Lr-Wy)	ASCE 5a SD (Ex)
As (bot)	0.8869	0.0109	0.8554
Combo	ASCE 6b SD (Wy)	ASCE 7a SD (Ex-nv)	ASCE 7a SD (Ex-nv)

Shear Diagram (kip)



Shear	0	3.819	1.577

6.4. Beam design

6.5. Punching check/design

Table 32: Concrete Slab Design 02 - Punching Shear Data, Part 1 of 3

Table 32: Concrete Slab Design 02 - Punching Shear Data, Part 1 of 3

Point	GlobalX	GlobalY	Location	Perimeter	Depth	Status	Ratio
	ft	ft		in	in		
99	0.0000	31.4167	Corner	78.8950	39.8750	OK	0.039785
101	15.5833	31.4167	Corner	265.8946	39.8750	OK	0.030572
103	31.1667	31.4167	Edge	133.7700	39.8750	OK	0.020648
105	46.7500	31.4167	Corner	265.8946	39.8750	OK	0.031850
107	62.3333	31.4167	Corner	78.8950	39.8750	OK	0.039334
109	62.3333	0.0000	Corner	78.8950	39.8750	OK	0.039474
111	46.7500	0.0000	Corner	265.8946	39.8750	OK	0.035405
113	31.1667	0.0000	Edge	133.7700	39.8750	OK	0.021939
115	15.5833	0.0000	Corner	265.8946	39.8750	OK	0.034490
117	0.0000	0.0000	Corner	78.8950	39.8750	OK	0.038777
119	0.0000	7.4583	Corner	165.3946	39.8750	OK	0.031447
121	0.0000	23.9583	Corner	165.3958	39.8750	OK	0.032870
123	62.3333	7.4583	Corner	165.3946	39.8750	OK	0.032580
125	62.3333	23.9583	Corner	165.3958	39.8750	OK	0.032559
155	33.1667	16.1667	Interior	119.5000	9.8750	OK	0.088883
159	33.1667	11.3333	Interior	119.5000	9.8750	OK	0.088337
163	42.4170	16.1667	Interior	119.5000	9.8750	OK	0.009176
167	42.4170	11.3333	Interior	119.5000	9.8750	OK	0.008633

Table 32: Concrete Slab Design 02 - Punching Shear Data, Part 2 of 3

Table 32: Concrete Slab Design 02 - Punching Shear Data, Part 2 of 3

Point	Combo	Vu	ShrStrMax	Mu2	ShrStrCap
		kip	kip/in2	kip-ft	kip/in2
99	ASCE 3a SD (Lr-L)	-11.353	0.0075	-3.5783	0.1897
101	ASCE 4b SD (Wy-Lr)	-3.979	0.0058	-11.3365	0.1897
103	ASCE 3c SD (Lr-Wx)	-19.666	0.0039	1.6606	0.1897
105	ASCE 3d SD (Lr-Wy)	-16.006	0.0060	-9.6763	0.1897
107	ASCE 3a SD (Lr-L)	-11.029	0.0075	-6.9102	0.1897
109	ASCE 3a SD (Lr-L)	-11.050	0.0075	6.9494	0.1897
111	ASCE 5b SD (Ey)	-4.121	0.0067	13.1730	0.1897
113	ASCE 3d SD (Lr-Wy)	-20.925	0.0042	-2.2641	0.1897
115	ASCE 5b SD (Ey)	-3.044	0.0065	13.0517	0.1897
117	ASCE 3a SD (Lr-L)	-10.948	0.0074	3.9502	0.1897
119	ASCE 3d SD (Lr-Wy)	-8.561	0.0060	21.8865	0.1897

Table 32: Concrete Slab Design 02 - Punching Shear Data, Part 2 of 3

Point	Combo	Vu	ShrStrMax	Mu2	ShrStrCap
		kip	kip/in2	kip-ft	kip/in2
121	ASCE 3a SD (Lr-L)	-7.784	0.0062	-25.7490	0.1897
123	ASCE 3a SD (Lr-L)	-8.528	0.0062	28.8334	0.1897
125	ASCE 3a SD (Lr-L)	-8.507	0.0062	-28.7296	0.1897
155	ASCE 2a SD (Lr)	-19.584	0.0169	-0.2504	0.1897
159	ASCE 2a SD (Lr)	-19.438	0.0168	0.2689	0.1897
163	ASCE 2a SD (Lr)	-1.759	0.0017	-0.1232	0.1897
167	ASCE 2a SD (Lr)	-1.581	0.0016	0.1466	0.1897

Table 32: Concrete Slab Design 02 - Punching Shear Data, Part 3 of 3

Table 32: Concrete Slab Design 02 - Punching Shear Data, Part 3 of 3

Point	Mu3	ReinfType	NumRails	StudPerRail
	kip-ft			
99	-7.2194	None		
101	16.5338	None		
103	-0.5460	None		
105	-32.7741	None		
107	6.7536	None		
109	6.7502	None		
111	-14.4659	None		
113	-0.0164	None		
115	16.9966	None		
117	-7.0585	None		
119	-8.3977	None		
121	-9.0476	None		
123	8.6555	None		
125	8.6567	None		
155	1.128E-13	None		
159	-2.578E-13	None		
163	-0.1258	None		
167	-0.1498	None		

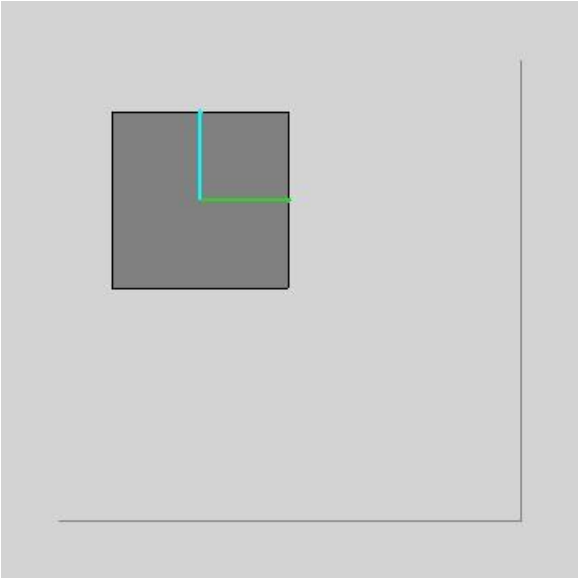
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 2
Point Label = 99
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 0 ft
Global Y-Coordinate = 31.4167 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 78.895 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 718359.08 in4
Section Inertia I33 = 718359.08 in4
Section Inertia I23 = 305963.18 in4
Shear Force = -11.353 kip
Moment Mu2 = -3.5783 kip-ft
Moment Mu3= -7.2194 kip-ft
Max Design Shear Stress = 0.0075 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.04



Column Punching Perimeter

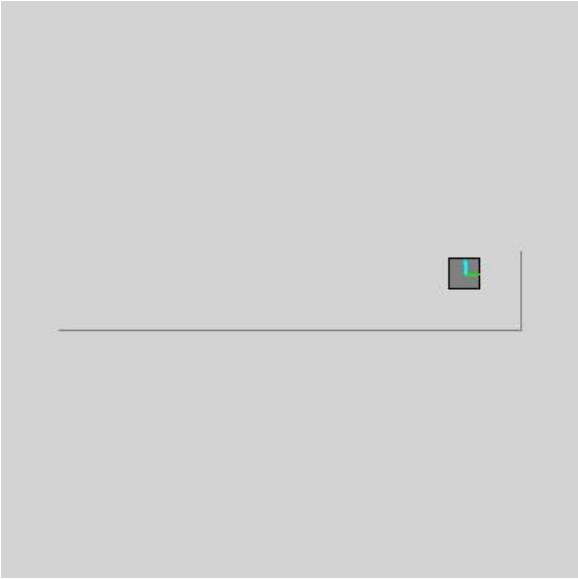
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 31
Point Label = 101
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 15.5833 ft
Global Y-Coordinate = 31.4167 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 265.8946 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 933538.3 in4
Section Inertia I33 = 56954730.09 in4
Section Inertia I23 = 2991601.09 in4
Shear Force = -3.979 kip
Moment Mu2 = -11.3365 kip-ft
Moment Mu3= 16.5338 kip-ft
Max Design Shear Stress = 0.0058 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.03



Column Punching Perimeter

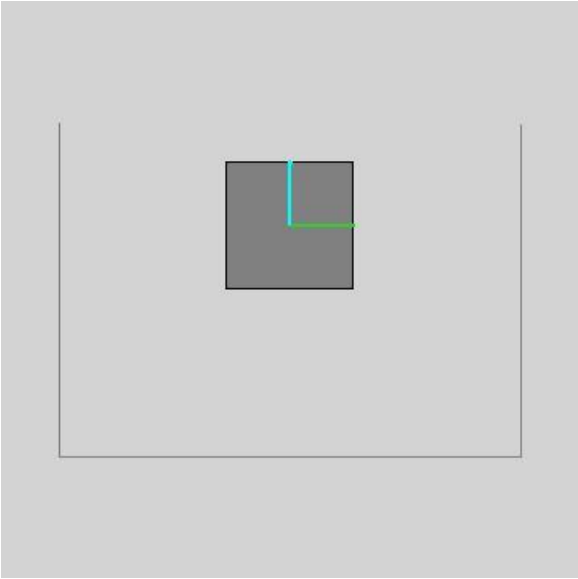
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 25
Point Label = 103
Column Shape = Rectangular
Column Location = Edge
Global X-Coordinate = 31.1667 ft
Global Y-Coordinate = 31.4167 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 133.77 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 1326839.48 in4
Section Inertia I33 = 3207334.7 in4
Section Inertia I23 = 0 in4
Shear Force = -19.666 kip
Moment Mu2 = 1.6606 kip-ft
Moment Mu3= -0.546 kip-ft
Max Design Shear Stress = 0.0039 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.02



Column Punching Perimeter

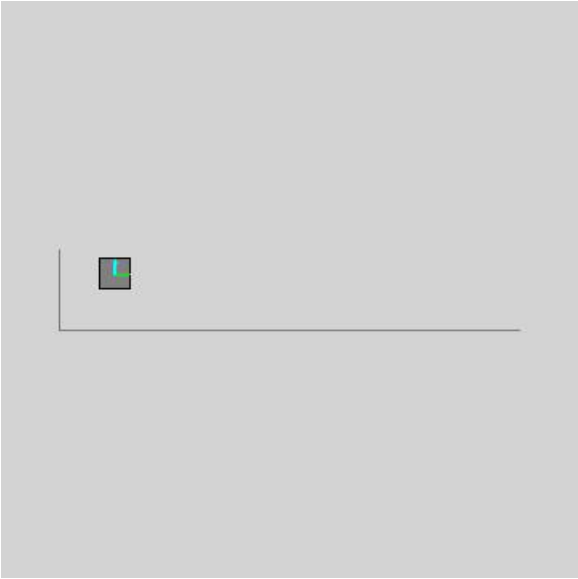
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 26
Point Label = 105
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 46.75 ft
Global Y-Coordinate = 31.4167 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 265.8946 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 933538.3 in4
Section Inertia I33 = 56954730.09 in4
Section Inertia I23 = -2991601.09 in4
Shear Force = -16.006 kip
Moment Mu2 = -9.6763 kip-ft
Moment Mu3= -32.7741 kip-ft
Max Design Shear Stress = 0.006 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.03



Column Punching Perimeter

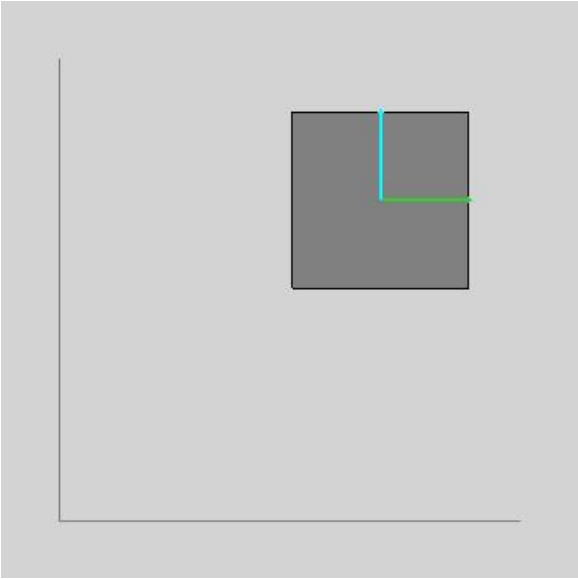
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 2
Point Label = 107
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 62.3333 ft
Global Y-Coordinate = 31.4167 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 78.895 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 718359.08 in4
Section Inertia I33 = 718359.08 in4
Section Inertia I23 = -305963.18 in4
Shear Force = -11.029 kip
Moment Mu2 = -6.9102 kip-ft
Moment Mu3= 6.7536 kip-ft
Max Design Shear Stress = 0.0075 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.04



Column Punching Perimeter

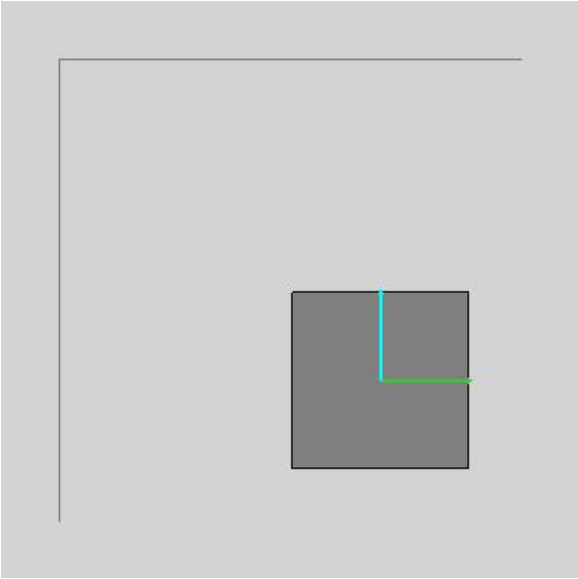
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 2
Point Label = 109
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 62.3333 ft
Global Y-Coordinate = 0 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 78.895 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 718359.08 in4
Section Inertia I33 = 718359.08 in4
Section Inertia I23 = 305963.18 in4
Shear Force = -11.05 kip
Moment Mu2 = 6.9494 kip-ft
Moment Mu3= 6.7502 kip-ft
Max Design Shear Stress = 0.0075 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.04



Column Punching Perimeter

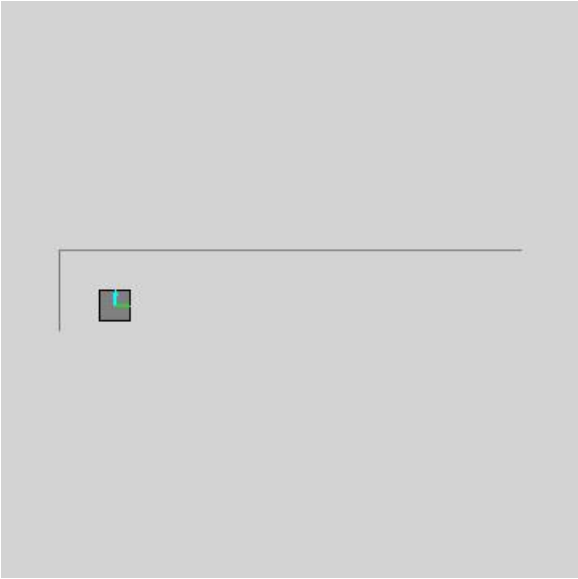
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 35
Point Label = 111
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 46.75 ft
Global Y-Coordinate = 0 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 265.8946 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 933538.3 in4
Section Inertia I33 = 56954730.09 in4
Section Inertia I23 = 2991601.09 in4
Shear Force = -4.121 kip
Moment Mu2 = 13.173 kip-ft
Moment Mu3= -14.4659 kip-ft
Max Design Shear Stress = 0.0067 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.04



Column Punching Perimeter

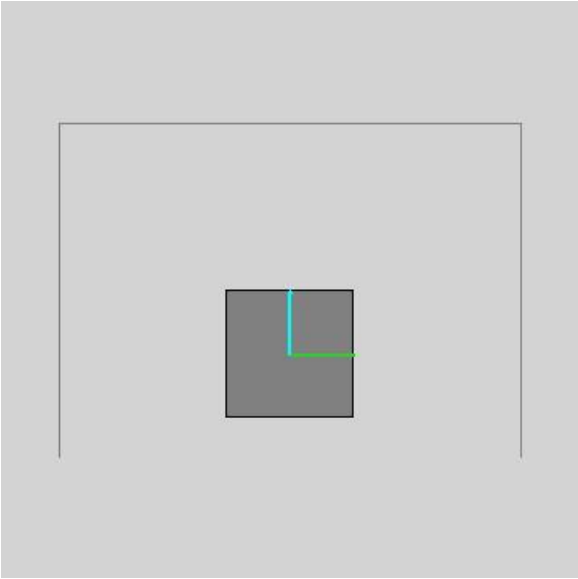
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 26
Point Label = 113
Column Shape = Rectangular
Column Location = Edge
Global X-Coordinate = 31.1667 ft
Global Y-Coordinate = 0 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 133.77 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 1326839.48 in4
Section Inertia I33 = 3207334.7 in4
Section Inertia I23 = 2.328E-10 in4
Shear Force = -20.925 kip
Moment Mu2 = -2.2641 kip-ft
Moment Mu3= -0.0164 kip-ft
Max Design Shear Stress = 0.0042 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.02



Column Punching Perimeter

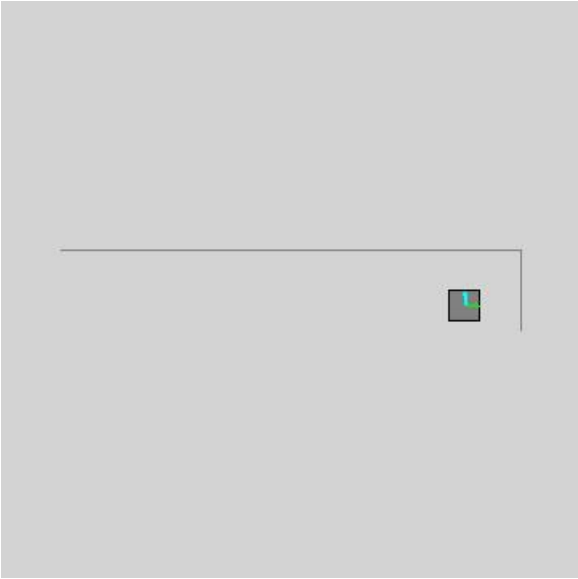
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 35
Point Label = 115
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 15.5833 ft
Global Y-Coordinate = 0 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 265.8946 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 933538.3 in4
Section Inertia I33 = 56954730.09 in4
Section Inertia I23 = -2991601.09 in4
Shear Force = -3.044 kip
Moment Mu2 = 13.0517 kip-ft
Moment Mu3= 16.9966 kip-ft
Max Design Shear Stress = 0.0065 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.03



Column Punching Perimeter

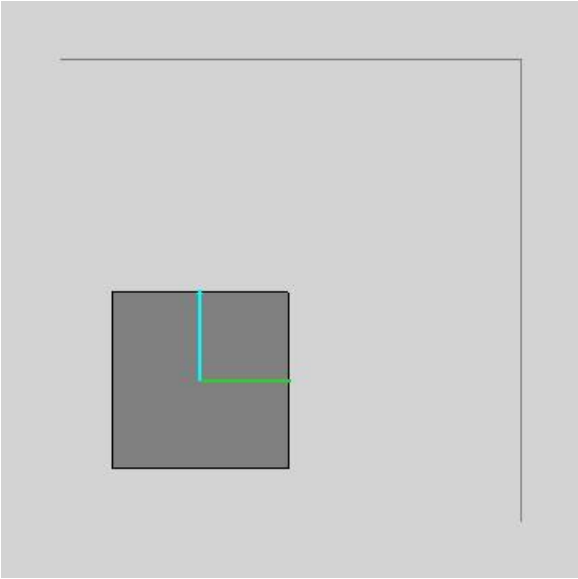
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 2
Point Label = 117
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 0 ft
Global Y-Coordinate = 0 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 78.895 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 718359.08 in4
Section Inertia I33 = 718359.08 in4
Section Inertia I23 = -305963.18 in4
Shear Force = -10.948 kip
Moment Mu2 = 3.9502 kip-ft
Moment Mu3= -7.0585 kip-ft
Max Design Shear Stress = 0.0074 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.04



Column Punching Perimeter

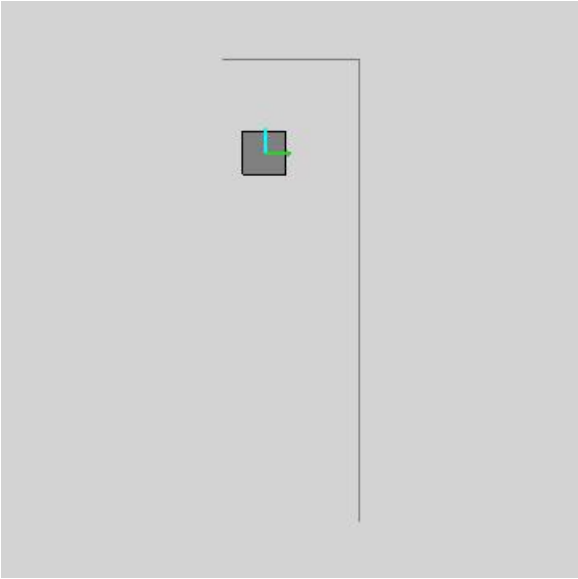
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 26
Point Label = 119
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 0 ft
Global Y-Coordinate = 7.4583 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 165.3946 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 12286811.71 in4
Section Inertia I33 = 801833.48 in4
Section Inertia I23 = -1409761.46 in4
Shear Force = -8.561 kip
Moment Mu2 = 21.8865 kip-ft
Moment Mu3= -8.3977 kip-ft
Max Design Shear Stress = 0.006 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.03



Column Punching Perimeter

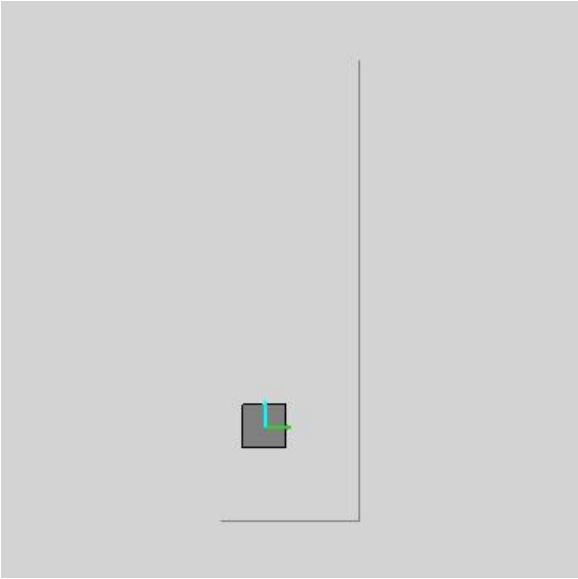
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 2
Point Label = 121
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 0 ft
Global Y-Coordinate = 23.9583 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 165.3958 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 12287111.74 in4
Section Inertia I33 = 801834.39 in4
Section Inertia I23 = 1409777.78 in4
Shear Force = -7.784 kip
Moment Mu2 = -25.749 kip-ft
Moment Mu3= -9.0476 kip-ft
Max Design Shear Stress = 0.0062 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.03



Column Punching Perimeter

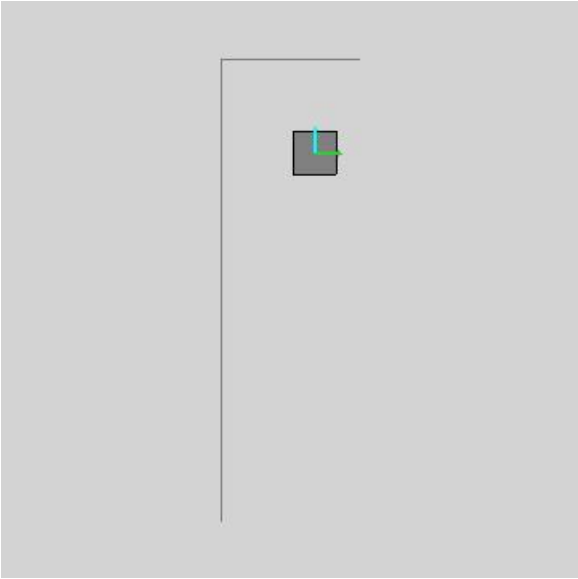
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 2
Point Label = 123
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 62.3333 ft
Global Y-Coordinate = 7.4583 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 165.3946 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 12286811.71 in4
Section Inertia I33 = 801833.48 in4
Section Inertia I23 = 1409761.46 in4
Shear Force = -8.528 kip
Moment Mu2 = 28.8334 kip-ft
Moment Mu3= 8.6555 kip-ft
Max Design Shear Stress = 0.0062 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.03



Column Punching Perimeter

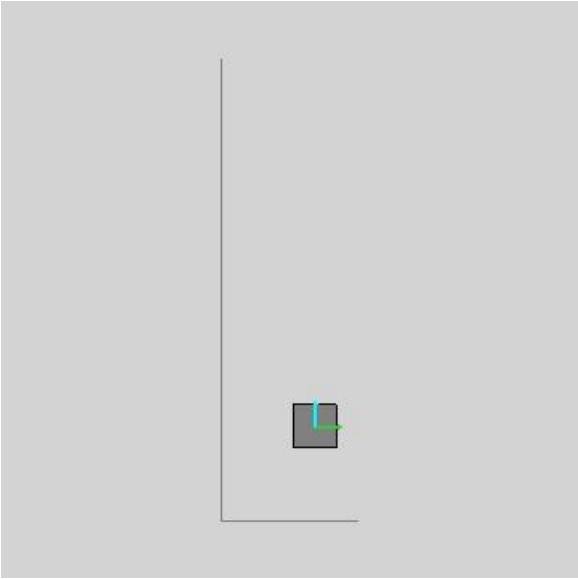
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 2
Point Label = 125
Column Shape = Rectangular
Column Location = Corner
Global X-Coordinate = 62.3333 ft
Global Y-Coordinate = 23.9583 ft

Column Punching Check

Avg. Eff. Slab Thickness = 39.875 in
Eff. Punching Perimeter = 165.3958 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 12287111.74 in4
Section Inertia I33 = 801834.39 in4
Section Inertia I23 = -1409777.78 in4
Shear Force = -8.507 kip
Moment Mu2 = -28.7296 kip-ft
Moment Mu3= 8.6567 kip-ft
Max Design Shear Stress = 0.0062 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.03



Column Punching Perimeter

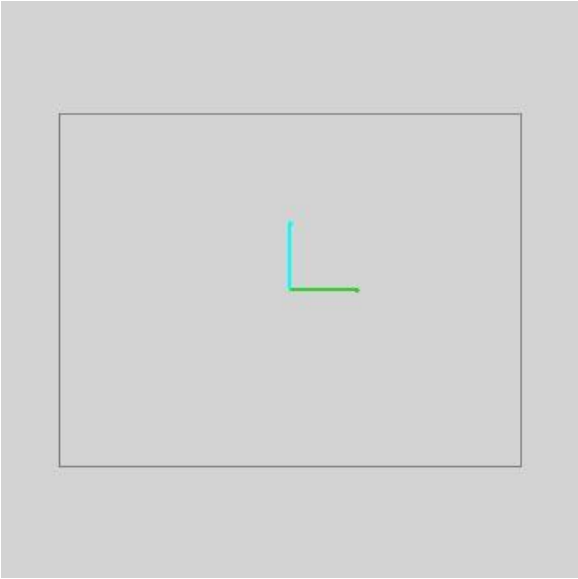
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 29
Point Label = 155
Column Shape = Rectangular
Column Location = Interior
Global X-Coordinate = 33.1667 ft
Global Y-Coordinate = 16.1667 ft

Load Punching Check

Avg. Eff. Slab Thickness = 9.875 in
Eff. Punching Perimeter = 119.5 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 144646.46 in4
Section Inertia I33 = 216017.82 in4
Section Inertia I23 = 0 in4
Shear Force = -19.584 kip
Moment Mu2 = -0.2504 kip-ft
Moment Mu3= 1.128E-13 kip-ft
Max Design Shear Stress = 0.0169 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.09



Column Punching Perimeter

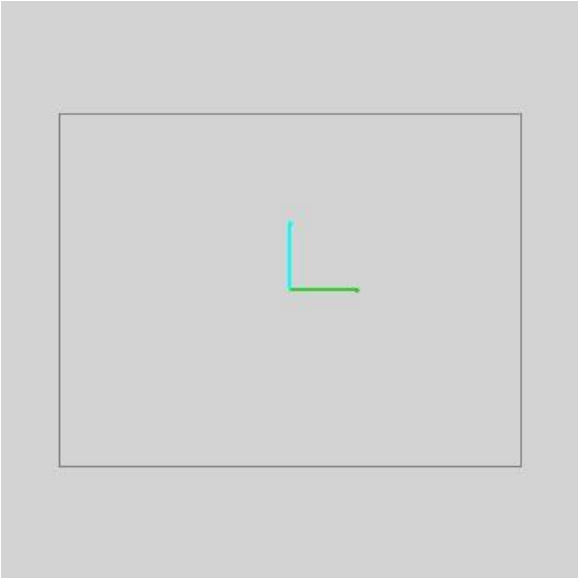
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 29
Point Label = 159
Column Shape = Rectangular
Column Location = Interior
Global X-Coordinate = 33.1667 ft
Global Y-Coordinate = 11.3333 ft

Load Punching Check

Avg. Eff. Slab Thickness = 9.875 in
Eff. Punching Perimeter = 119.5 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 144646.46 in4
Section Inertia I33 = 216017.82 in4
Section Inertia I23 = 0 in4
Shear Force = -19.438 kip
Moment Mu2 = 0.2689 kip-ft
Moment Mu3= -2.578E-13 kip-ft
Max Design Shear Stress = 0.0168 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 0.09



Column Punching Perimeter

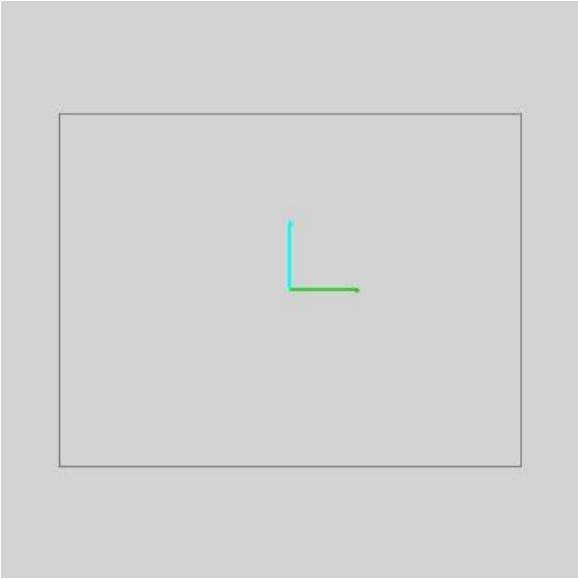
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 29
Point Label = 163
Column Shape = Rectangular
Column Location = Interior
Global X-Coordinate = 42.417 ft
Global Y-Coordinate = 16.1667 ft

Load Punching Check

Avg. Eff. Slab Thickness = 9.875 in
Eff. Punching Perimeter = 119.5 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 144646.46 in4
Section Inertia I33 = 216017.82 in4
Section Inertia I23 = 0 in4
Shear Force = -1.759 kip
Moment Mu2 = -0.1232 kip-ft
Moment Mu3= -0.1258 kip-ft
Max Design Shear Stress = 0.0017 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 9.176E-03



Column Punching Perimeter

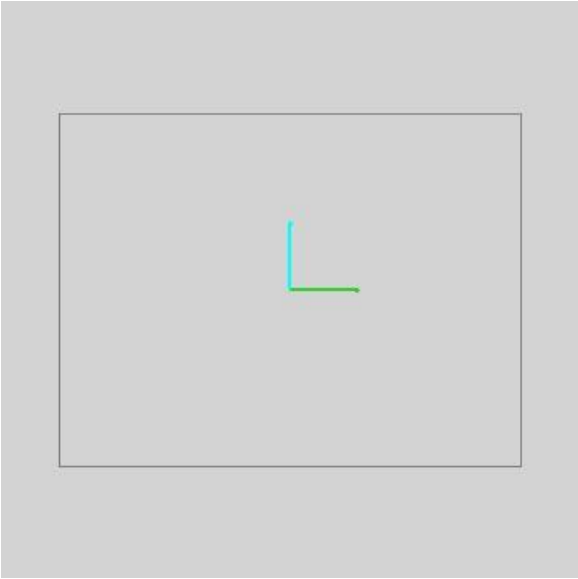
ACI 318-08 Punching Shear Check & Design

Geometric Properties

Combination = 29
Point Label = 167
Column Shape = Rectangular
Column Location = Interior
Global X-Coordinate = 42.417 ft
Global Y-Coordinate = 11.3333 ft

Load Punching Check

Avg. Eff. Slab Thickness = 9.875 in
Eff. Punching Perimeter = 119.5 in
Cover = 2.125 in
Conc. Comp. Strength = 4 kip/in2
Reinforcement Ratio = 0.0000
Section Inertia I22 = 144646.46 in4
Section Inertia I33 = 216017.82 in4
Section Inertia I23 = 0 in4
Shear Force = -1.581 kip
Moment Mu2 = 0.1466 kip-ft
Moment Mu3= -0.1498 kip-ft
Max Design Shear Stress = 0.0016 kip/in2
Conc. Shear Stress Capacity = 0.1897 kip/in2
Punching Shear Ratio = 8.633E-03



Column Punching Perimeter