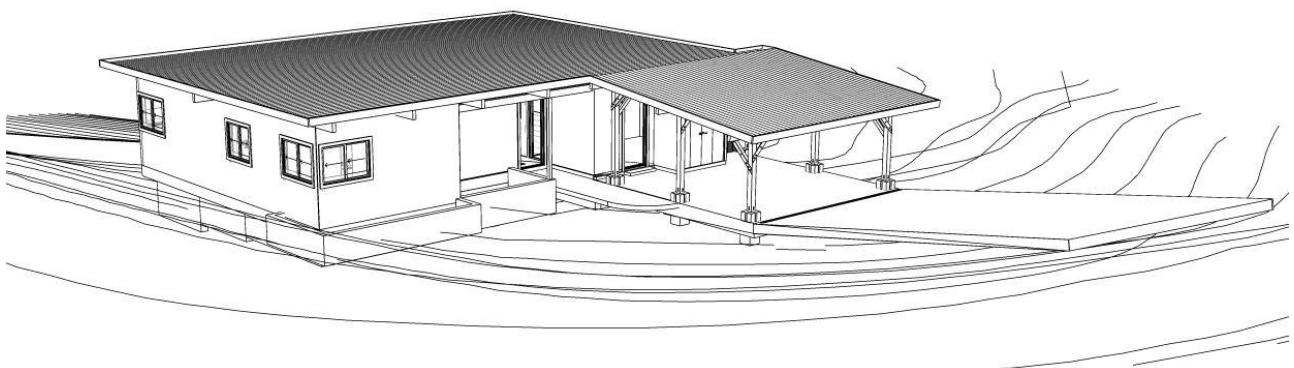


Structural Calculations



August 20, 2021

Residence Remodel

55 Loring Avenue, Mill Valley, CA 94901

Attn: Bryna Holland

re: Thorup Estate



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Summary**SECTION 01**

The project includes renovations, repairs and alterations to improve the function and seismic resistance of a single story, wood framed residence with an attached car port and under-house storage space. The work did not change the building foot print.

Alterations include remodeling the kitchen, bathroom and living room; adding a new bathroom and exterior laundry enclosure. Renovations include installing a retaining wall, sidewalk and exterior hand-rail; replacing the carport foundations and driveway; and seismically strengthening the carport framing and residence foundation walls.

Project Data

[Table: 0101.01]

Type	No./Date	Name	Address	Zip
Client	C001	Bryna Holland	15 Blanca Drive, Novato	94947
Project	P010	Residence Remodel	55 Loring Avenue, Mill Valley	94941
Drawings	Dec. 1 , 2020	PR-01 to PR-11	55 Loring Avenue, Mill Valley	94941

Background**SECTION 02**

The structural calculations address remodeling, repair and strengthening of a single family residence.

The single family residence dates to the 1940's and was built on two combined lots with an average grade of about 1 in 6. It has a reinforced concrete strip foundation, under house storage, plywood sheathed perimeter walls, and a flat T&G plank roof (under an original tar and gravel membrane overlaid with foam) supported by interior posts and beams. The car port structure is also a post and beam structure with roof planks.

During the prior decades the carport posts had significantly decayed below the slab line, leading to uneven carport roof settlement up to 6 inches. In addition surface sliding had piled soil up to a foot deep causing the lower part of the siding to decay. Decayed portions were removed and replaced and a planter/retaining structure was designed to retain the sliding and prevent further decay.

The residence foundation was seismically vulnerable. Two sides of the floor diaphragm were directly supported on the strip foundation but the other two sides were supported on stud walls up to 6 feet tall. The framed foundation walls had very little in-plane strength which made the entire structure vulnerable to earthquake damage from first floor twisting. Each of the two framed walls had a single minimal compression brace that could not prevent seismic translation. Four new shear walls were added.

In summary, over the course of the last five years work was done to mitigate safety hazards including seismic vulnerabilities and wood decay, and improve living spaces.

Project Areas

[Table: 0101.02]

Description	Value	Unit
residence area	1000	SQF
car port area	400	SQF
storage area	100	SQF

**Residence viewed from Loring Drive**

[Fig: 0101.01]

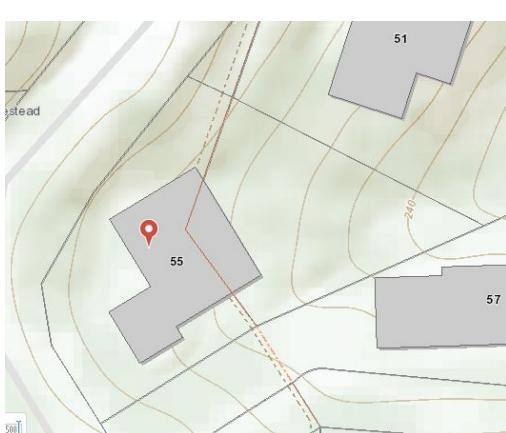
Building Codes and Site**SECTION 03**

The residence is under the jurisdiction of Marin County, California which uses the 2019 California Building Code and the 2019 California Residential Code to permit construction work.

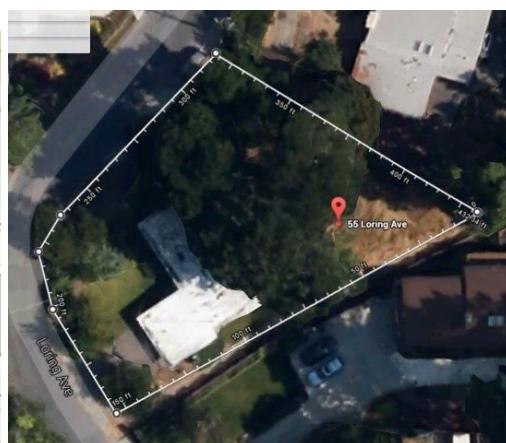
CBC 2019 - Structural Reference Standards

[Table: 0101.03]

Category	Standard	Year
Loading	ASCE-7	2016
Concrete	ACI-318	2014
Wood-National Design Specifications	AWC-NDS	2018
Wood-Special Design Provisions for Wind and Seismic	AWC-SDPWS	2015
Wood Frame Construction Manual	AWC-WFCM	2018

**Site map - Marin County web site**

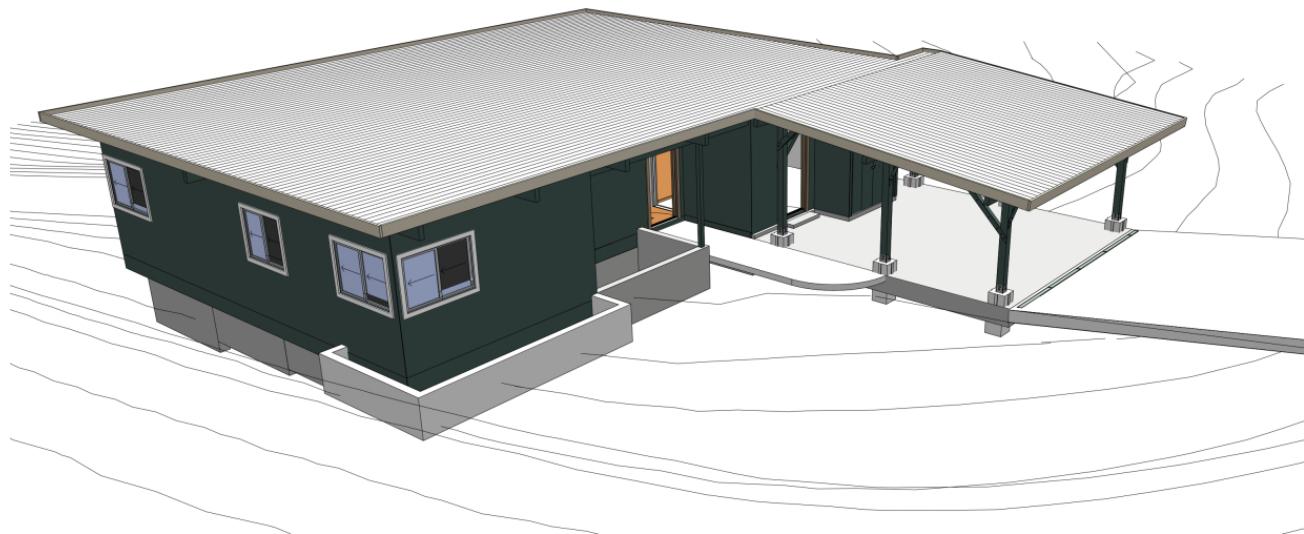
[Fig: 0101.02]

**Site map - Google Earth**

[Fig: 0101.03]

Drawing List**SECTION 04****55 LORING - RESIDENCE REMODEL AND SEISMIC STRENGTHENING**

- PR.01: COVER AND INDEX
- PR.02: PROJECT SCOPE
- PR.03: GENERAL NOTES, CONTRACTORS
- PR.04: SITE PLAN
- PR.05: PLANS
- PR.06: ELEVATIONS
- PR.07: KITCHEN AND BATH REMODEL
- PR.08: MASTER BATH, CLOSET, LAUNDRY
- PR.09: RESIDENCE STRENGTHENING
- PR.10: CARPORT STRENGTHENING
- PR.11: SITE IMPROVEMENTS

**Residence and Carport**

[Fig: 0101.04]

References**SECTION 05**

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331
318-14

AISC

American Institute of Steel
130 East Randolph Street, Suite 2000
Chicago, IL 60601-6219
ANSI/AISC 341-16
Seismic Provisions for Structural Steel Buildings

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001
AISI S100-16
North American Specification for the Design of Cold-formed
Steel Structural Members, 2016

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400
7-16 Minimum Design Loads and Associated Criteria for
Buildings and Other Structures with Supplement No. 1

AWC

American Wood Council
222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175
ANSI/AWC NDS-2018
National Design Specification (NDS) for
Wood Construction with 2018 NDS Supplement
ANSI/AWC SDPWS-2015
Special Design Provisions for Wind and Seismic

CBC

International Code Council
500 New Jersey Avenue, NW
6th Floor, Washington, DC 20001
California Building Standards Commission
2525 Natomas Park Dr # 130, Sacramento, CA 95833
California Building Code

Part 2 of Title 24, 2019 Edition

CRC
International Code Council
500 New Jersey Avenue, NW
6th Floor, Washington, DC 20001
California Building Standards Commission
2525 Natomas Park Dr # 130, Sacramento, CA 95833
California Residential Code
Part 2.5 of Title 24, 2019 Edition

Math and Text Abbreviations**SECTION 06****Math**

D = dead load
DL = dead load
L = live load
LL = live load
E = earthquake load
 F_a = acceleration site coefficient
 F_v = velocity site coefficient
 F_N = normal wind force
 GC_{Ms} = net moment static coefficient
 GC_{Md} = net moment dynamic coefficient
 GC_M = net moment coefficient
 GC_P = net pressure coefficient
 k_1 = hazard coefficient
 k_2 = terrain and structure coefficient
 k_3 = topography coefficient
 K_{zt} = topographic Factor
 K_z = velocity pressure exposure coefficient
MRI = mean return interval
 p_d = net design wind pressure on module - Pa
SDOF = single degree of freedom
 S_s = short period mapped acceleration
 S_{DS} = site design response acceleration
 S_1 = 1 second period mapped acceleration
 S_{MS} = short period parameter
 S_{M1} = 1 second period parameter
T = fundamental period of structure
 T_0 = short period spectral cap
 T_S = long period spectral cap
 V_b = basic wind speed
 V_B = seismic design base shear
W = wind load
W = seismic weight of structure

Text

ASD	Allowable Stress Design
ACI	American Concrete Institute
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
ASTM	American Society for Testing and Materials
AWS	American Welding Society
AB	Anchor Bolt
BDRY	Boundary
CBC	California Building Code
CRC	California Residential Code
CIP	Cast-In-Place
CLR	Clear
CONC	Concrete
CMU	Concrete Masonry Unit
CRSI	Concrete Reinforcing Steel Institute
CONST JT	Construction Joint
CONT	Continuous
CJ	Control Joint
D-C	Demand-Capacity (ratio)
DIA	Diameter
DIM	Dimension
EA	Each
EF	Each Face
EJ	Expansion Joint
ES	Each Side
EW	Each Way
EXP Bolt	Expansion Bolt
EXP JT	Expansion Joint
FTG	Footing
FND	Foundation
GALV	Galvanized
GA	Gauge
GR	Grade
HT	Height
IN	Inch
ID	Inside Diameter
ICBO	International Conference of Building Officials
K	Kip (1000 Pounds)
LWC	Light Weight Concrete
LRFD	Load and Resistance Factor Design
NWC	Normal Weight Concrete
NIC	Not in Contract
OC	On Center
OD	Outside Diameter
OPNG	Opening

PVC	Polyvinyl Chloride
PSF	Pounds per Square Foot
PSI	Pounds per Square Inch
R	Radius
REINF	Reinforced
SIM	Similar
SOG	Slab on Grade
SL	Splice Length
SQ	Square
STD	Standard
SDI	Steel Deck Institute
SF	Step Footing or Square Foot
SYM	Symmetrical
THK	Thick or Thickness
TB	Top and Bottom
TG	Tongue and Groove
TOC	Top of Concrete
TOF	Top of Foundation
TOS	Top of Steel
TOW	Top of Wall
TYP	Typical
UNO	Unless Noted Otherwise
WWF	Welded Wire Fabric
W/	With
WP	Working Point

Load Combinations**SECTION 01**

Basic loads and load combinations are derived from the California Building and Residential Codes.

CBC Load Notation

[Table: 0102.01]

Load Effect	Notes
D Dead load	See IBC 1606 and Chapter 3 of this publication
E Combined effect of horizontal and vertical earthquake-induced forces as defined in ASCE/SEI 12.4.2	See IBC 1613, ASCE/SEI 12.4.2 and Chapter 6 of this publication
Em Maximum seismic load effect of horizontal and vertical forces as set forth in ASCE/SEI 12.4.3	See IBC 1613, ASCE/SEI 12.4.3 and Chapter 6 of this publication
H Load due to lateral earth pressures, ground water pressure or pressure of bulk materials	See IBC 1610 for soil lateral loads
L Live load, except roof live load, including any permitted live load reduction	See IBC 1607 and Chapter 3 of this publication
Li Roof live load including any permitted live load reduction	See IBC 1607 and Chapter 3 of this publication
R Rain load	See IBC 1611 and Chapter 3 of this publication
W Load due to wind pressure	See IBC 1609 and Chapter 5 of this publication

CBC Load Combinations

[Table: 0102.02]

CBC 2019 reference	Equation
Equation 16-1	1.4(D +F)
Equation 16-2	1.2(D + F) + 1.6(L + H) + 0.5(L)
Equation 16-3	1.2(D + F) + 1.6(Lr or S or R) + 1.6H + (f1L or 0.5W)
Equation 16-4	1.2(D + F) + 1.0W + f1L +1.6H + 0.5(Lr or S or R)
Equation 16-5	1.2(D + F) + 1.0E + f1L + 1.6H + f2S
Equation 16-6	0.9D+ 1.0W+ 1.6H
Equation 16-7	0.9(D + F) + 1.0E+ 1.6H

Gravity Loads and Seismic Mass**SECTION 02****Roof unit dead loads**

[Table: 0102.03]

variable	value	[value]	description
ld1	2.0 psf	0.10 KPa	Urethane foam (4 inch thick)
ld2	1.0 psf	0.05 KPa	Three-ply roofing
ld3	5.0 psf	0.24 KPa	Doug Fir decking 2-in.
ld4	1.0 psf	0.05 KPa	Doug Fir beams 4x12 at 12 ft o.c.
-----	-----	-----	-----
roofdl1	9.0 psf	0.43 KPa	Total roof unit load
-----	-----	-----	-----

Floor unit dead loads

[Table: 0102.04]

variable	value	[value]	description
ld1	3.0 psf	0.14 KPa	3/4 in. hardwood flooring
ld2	2.0 psf	0.10 KPa	1/2 in. plywood subfloor
ld3	4.0 psf	0.19 KPa	2x10 joists at 16 in. o.c.
ld4	1.5 psf	0.07 KPa	fixtures
-----	-----	-----	-----
floordl1	10.5 psf	0.50 KPa	Total floor unit load
-----	-----	-----	-----

Interior wall unit dead loads

[Table: 0102.05]

variable	value	[value]	description
ld1	5.5 psf	0.26 KPa	5/8" sheet rock (2)
ld2	2 psf	0.10 KPa	2x4 studs at 16" o.c.
ld3	1.5 psf	0.07 KPa	fixtures
-----	-----	-----	-----
intwalldl1	9 psf	0.43 KPa	Total interior wall unit load
-----	-----	-----	-----

Exterior wall unit dead loads

[Table: 0102.06]

variable	value	[value]	description
ld1	2.0 psf	0.10 KPa	1/2 in plywood sheathing

ld2	2.0 psf	0.10 KPa	2x4 studs at 16 in o.c.
ld3	3.0 psf	0.14 KPa	5/8 in sheet rock
ld4	1.5 psf	0.07 KPa	fixtures
<hr/>			
extwalldl1	8.5 psf	0.41 KPa	Total exterior wall unit load
<hr/>			

Areas

[Table: 0102.07]

variable	value	[value]	description
<hr/>			
arearf1	1700 sf	157.94 sM	roof area
areaflr1	1200 sf	111.48 sM	floor area
htwall1	9 ft	2.74 m	wall height
lenwall1	110 ft	33.53 m	interior wall length
lenwall2	155 ft	47.24 m	exterior wall length 2
<hr/>			

Roof weight

[Equ: 0102.01]

$$rfwt_1 = arearf1 \cdot roofdl_1$$

rfwt1	arearf1	roofdl1
15300.00 lbs [68.06 KN]	1700.00 sf	9.00 psf
<hr/>		

Floor weight

[Equ: 0102.02]

$$flrwt_1 = areaflr1 \cdot floordl_1$$

flrwt1	floordl1	areaflr1
12600.00 lbs [56.05 KN]	10.50 psf	1200.00 sf
<hr/>		

Partition weight

[Equ: 0102.03]

$$partwt_1 = htwall1 \cdot intwalldl1 \cdot lenwall1$$

partwt1	intwalldl1	htwall1	lenwall1
8910.00 lbs [39.63 KN]	9.00 psf	9.00 ft	110.00 ft
<hr/>			

Exterior wall weight

[Equ: 0102.04]

$$\text{exwallwt}_1 = \text{extwalldl}_1 \cdot \text{htwall}_1 \cdot \text{lenwall}_2$$

exwallwt1	extwalldl1	lenwall2	htwall1
11857.50 lbs [52.74 KN]	8.50 psf	155.00 ft	9.00 ft

Total building weight

[Equ: 0102.05]

$$\text{totwt}_1 = \text{exwallwt}_1 + \text{flrwt}_1 + \text{partwt}_1 + \text{rfwt}_1$$

totwt1	flrwt1	rfwt1	exwallwt1	partwt1
48667.50 lbs [216.48 KN]	12600.00 lbs	15300.00 lbs	11857.50 lbs	8910.00 lbs

Material Densities - Seismic Models**SECTION 03**

Because the T&G roof is relatively more flexible, the effective floor load for seismic models is calculated as the sum of the floor and all of the partition weight.

Floor load including partitions

[Equ: 0102.06]

$$\text{eflrdl}_1 = \frac{\text{flrwt}_1 + \text{partwt}_1}{\text{areaflr}_1}$$

eflrdl1	flrwt1	areaflr1	partwt1
17.93 psf [0.86 KPa]	12600.00 lbs	1200.00 sf	8910.00 lbs

Effective floor, roof and wall densities

[Equ: 0102.07]

$$\text{eflrdens}_1 = \frac{\text{eflrdl}_1}{0.5 \cdot \text{IN}}$$

eflrdens1	IN	eflrdl1
0.25 pci [67.58 KNcM]	in	17.93 lbs/sf

$$\text{erfdens}_1 = \frac{\text{roofdl}_1}{1.5 \cdot \text{IN}}$$

```
=====  ===  =====
erfdens1      IN   roofdl1
=====  ===  =====
0.04 pci  [11.31 KNcM]  in  9.00 psf
=====  ===  =====
```

$$ewalldens1 = \frac{extwalldl1}{0.5 \cdot IN}$$

```
=====  =====  ===
ewalldens1  extwalldl1  IN
=====  =====  ===
0.12 pci  [32.05 KNcM]  8.50 psf  in
=====  =====  ===
```

Minimum Wall Sheathing CRC - First Floor**SECTION 01**

The residence is sheathed in exterior 1/2" 5-ply plywood nailed with 8d common nails at 12" oc at edges and field. The boundary nailing capacity is half of the maximum spacing tabulated in the building codes. The residence is checked against the CRC prescriptive wall opening limits, assuming 6" oc (which is not the case) to assess the degree of wall continuity. A CBC analysis is performed in calculation 0301 which estimates the DC ratios for the 12" oc nailing.

**Existing shear wall nailing - 8d at 12" OC**

[Fig: 0201.01]

Existing shear wall nailing - 8d - 2-1/2" penetration

[Fig: 0201.02]

The minimum solid wall percent is given in the following CRC table.

R606.12.2.1 MINIMUM EXTERIOR SOLID WALL LENGTH (%)

[Table: 0201.01]

Seismic Design Category	One story or top story of two story	Wall supporting light-framed second story and roof	Wall supporting masonry second story and roof
Townhouses in C	20	25	35
D0 or D1	25	Not Permitted	Not Permitted
D2	30	Not Permitted	Not Permitted

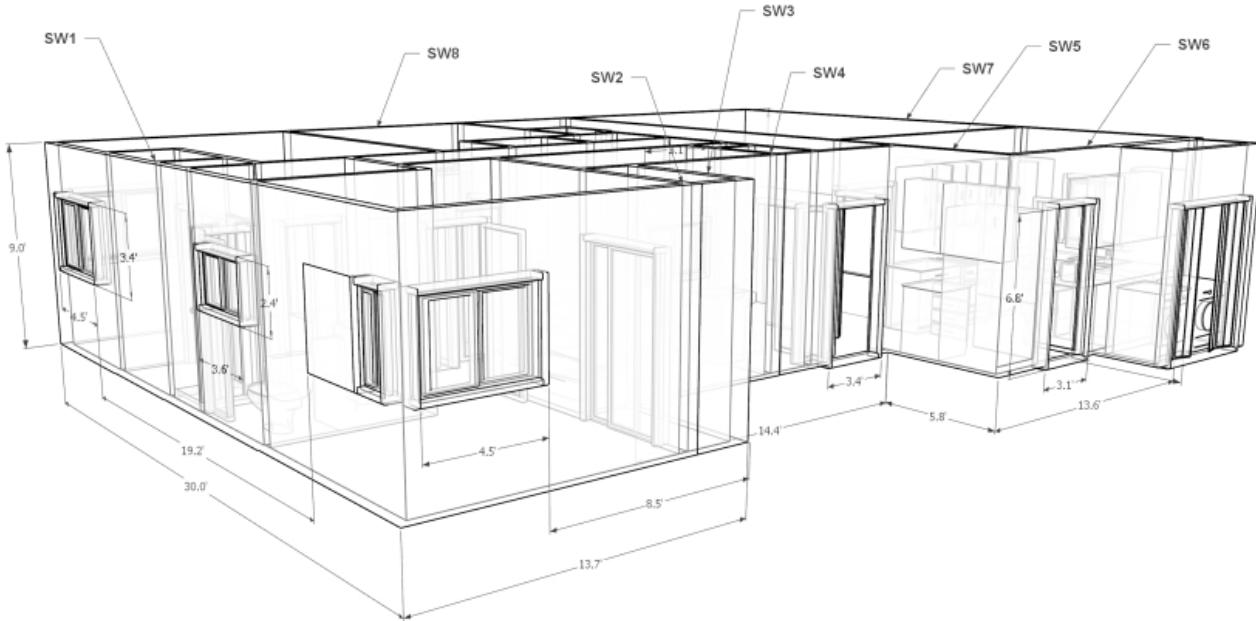
The percent solid wall for each shear wall is:

Percent Solid Shearwall

[Table: 0201.02]

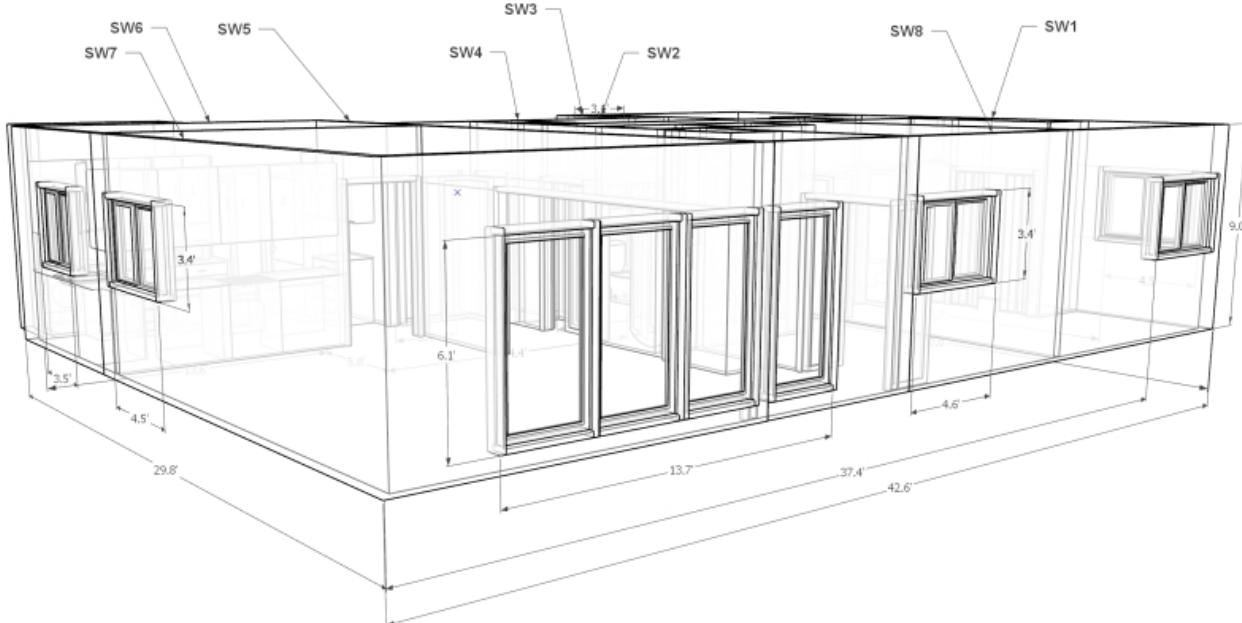
Wall No.	Length (ft)	Openings (ft)	Solid (%)
SW1	30	12.6	58
SW2	13.7	4.5	67
SW3	5.8	0	100
SW4	14.4	6.5	55
SW5	5.8	0	100
SW6	13.6	3.1	77
SW7	30	8	73
SW8	42	22.7	46

Therefore, if edge nailing requirements are met the residence meets the prescriptive opening requirements of the CRC.



First floor shear walls - north and west sides

[Fig: 0201.03]



First floor shear walls - south and east sides

[Fig: 0201.04]

Check required basic fastener spacing:

R602.3(1) FASTENING SCHEDULE

[Table: 0201.03]

Panel thickness	Number and Type of Fastener [a][b][c]	Edge Spacing	Intermediate Spacing
3/8 in.-	6d common (2 in. x 0.11 in) nail (subfloor, wall); 8d common (2 1/2 in. x 0.131 in.) nail (roof); or RSRS- 01 (2 7/8 in. x 0.113 in.) nail (roof)	6 in.	12 in.
1/2 in.	8d common nail (2 1/2 in. x 0.131 in.); or RSRS-01; (2 1/8 in. x 0.113 in.) nail (roof)	6 in.	12 in.
19/32 in.- 1 in.	10d common (3 in. x 0.148 in.) nail; or 8d (2 1/2 in. x 0.131 in.) deformed nail	6 in.	12 in.
1/8 in.-1			
1/4 in.			

Note: Table applies to wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table FI602.3(3) for wood structural panel exterior wall sheathing to wall framing

[a] Nails are smooth-common box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as shown:
80 ksi for shank diameter of 0.192 inch (20d common nail);
90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch and 100 ksi for shank diameters of 0.142 inch or less.

[b] Staples are l6 gage wire and have a minimum 7/16-inch diameter crown width.

[c] Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.

Check code required wind governed fastener spacing:

R602.3(3) WOOD WALL SHEATHING WIND PRESSURE REQUIREMENTS[a,b,c]

[Table: 0201.04]

Minimum Nail Size	6d common\n(2.0 x 0.113)	8d Common\n(2.5 x 0.131)	8d Common\n(2.5 x 0.131)
Minimum Nail Penetration (in)	1.5	1.75	1.75
Minimum Panel Span Rating	24/0	24/16	24/16
Minimum Nominal Thickness (in)	3/8	7/16	7/16
Minimum Stud Spacing (in)	16	16	24
Edge Nail Spacing (in)	6	6	6
Field Nail Spacing (in)	12	12	12
Exposure B Vult (mph)	140	170	140
Exposure C Vult (mph)	115	140	115
Exposure D Vult (mph)	110	135	110

[1] Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.

[2] Table is based on wind pressures acting toward and away from building surfaces in accordance with Section R301.2. Lateral bracing requirements shall be in accordance with Section 8602.10.

[3] Wood structural panels with span ratings of Wall-16 or Wall-24 shall be permitted as an alternate to panels with a 24/0 span rating. Plywood siding rated 16 o.c. or 24 o.c. shall be permitted as an alternate to panels with a 24/16 span rating.

Wall-16 and Plywood siding 16 o.c. shall be used with studs spaced not more than 16 inches on center.

In order to meet the code prescriptive wind and seismic requirements the number of nails at the exterior sheathing panel boundaries need to be doubled - from 12" oc to 6" oc. Refer to CBC analysis in calculation 0301 for an analysis of DC ratios with reduced capacity

Foundation - CRC Requirements

SECTION 02

The existing foundation on the north and west side of the residence is a concrete strip footing directly supporting the floor joists. On the south side the floor joists are supported on 2x4 framed walls varying in height, up to 6 feet. The framing is clad on the outside with 1x10 planks, spaced 1" apart for ventilation.

The foundation has two significant seismic deficiency. The first is a significant torsional irregularity arising from lack of shear stiffness and strength on the south and east walls. The existing structure has only one compression brace along each wall and the spaced planks do not provide meaningful strength or stiffness. This irregularity is a deficiency whether the floor diaphragm is considered semi-rigid or flexible. The second is the lack of adequate anchorage of the sill plates to the foundation. Existing anchorage typically consists of only a single 1/2" anchor bolt and small washer every 3 or 4 feet.

The torsional irregularities disqualify the foundation structure from following a CRC design process.

Seismic Model Inputs - CBC Requirements

SECTION 03

Seismic demands on the residence were analyzed using a 3D FEM model. The model includes the full relevant geometry, loads and stiffness of the walls, roof, floors and foundation.

The in-plane stiffness of the T&G roof is taken as 300 pounds/inch/inch using test data from [USDA1972]. The in-plane stiffness of the plywood shear walls and subfloor is estimated at 1000 pounds/inch/inch after supplementary nailing, using values from CBC tables.

[USDA1972] USDA Forest Products Laboratory. 1972. "Shear Stiffness Of Two-Inch Wood Decks For Roof Systems", U.S.D.A. Forest Service RESEARCH PAPER, FPL 155 1972

AWC4.3A Unit Shear Capacity Wood-Frame Shear Walls [1-7]

[Table: 0201.05]

component	property	-	-	wood	sheath	-	-
panel	thick(in)	5/16	3/8	3/8	7/16	15/32	15/32
nail	depth(in)	1-1/4	1-1/4	1-3/8	1-3/8	1-3/8	1-1/2
nail	size	6d	6d	8d	8d	8d	10d
edge nail	value						
6-in	vs(plf)	360	400	440	480	520	620
OSB 6-in	Ga(kip/in)	13	11	17	15	13	22
PLY 6-in	Ga(kip/in)	9.5	6.5	12	11	10	14
4-in	vs(plf)	540	600	640	700	760	920
OSB 4-in	Ga(kip/in)	18	15	25	22	19	30
PLY 4-in	Ga(kip/in)	12	11	15	14	13	17
3-in	vs(plf)	700	780	820	900	960	1200
OSB 3-in	Ga(kip/in)	24	20	31	28	25	37
PLY 3-in	Ga(kip/in)	14	13	17	17	15	19
2-in	vs(plf)	900	1020	1060	1170	1280	1540
OSB 2-in	Ga(kip/in)	37	32	45	42	39	52
PLY 2-in	Ga(kip/in)	18	17	20	21	20	23

[1] Nominal unit shear capacities shall be adjusted in accordance with 4.3.3 to determine ASD allowable unit shear capacity and LRFD factored unit resistance. For general construction requirements see 4.3.6. For specific requirements, see 4.3.7.1 for wood structural panel shear walls, 4.3.7.2 for particleboard shear walls, and 4.3.7.3 for fiberboard shear walls. See Appendix A for common and box nail dimensions.

[2] Shears are permitted to be increased to values shown for 15/32 inch (nominal) sheathing with same nailing provided (a) studs are spaced a maximum of 16 inches on center, or (b) panels are applied with long dimension across studs.

[3] For species and grades of framing other than Douglas-Fir-Larch or Southern Pine, reduced nominal unit shear capacities shall be determined by multiplying the tabulated nominal unit shear capacity by the Specific Gravity Adjustment Factor = $[1 - (0.5 - G)]$, where G = Specific Gravity of the framing lumber from the NDS (Table I2.3.3A). The Specific Gravity Adjustment Factor shall not be greater than 1.

[4] Apparent shear stiffness values Ga, are based on nail slip in framing with moisture content less than or equal to 19% at time of fabrication and panel stiffness values for shear walls constructed with either OSB or 3-ply plywood panels. When 4-ply or 5-ply plywood panels or composite panels are used, Ga values shall be permitted to be multiplied by 1.2.

[5] Where moisture content of the framing is greater than 19% at time of fabrication, G₁ values shall be multiplied by 0.5.

[6] Where panels are applied on both faces of a shear wall and nail spacing is less than 6" on center 'on either side, panel joints shall be offset to fall on different framing members as shown below. Alternatively, the width of the nailed face of framing members shall be 3" nominal or greater at adjoining panel edges and nails at all panel edges shall be staggered.

[7] Galvanized nails shall be hot-dipped or tumbled.

The shear capacity adjustments for shear wall openings is taken from the AWC table below:

Table 4.3.3.5 Shear Capacity Adjustment Factor, C₀

[Table: 0201.06]

Wall Height - h	Max Opening Height [1]	h/3	h/2	2h/3	5h/6	h
h						
8' Wall	2'-8in		4'-0in	5'-4in	6'-8in	8'-0in
9' Wall	3'-0in		4'-6in	6'-0in	7'-6in	9'-0in
10' Wall	3'-4in		6'-0in	6'-8in	8'-4in	10'-0in
Percent Full-Height Sheathing [2]	Effective Shear Capacity Ratio					
10%	1.00		0.69	0.53	0.43	0.36
20%	1.00		0.71	0.56	0.45	0.38
30%	1.00		0.74	0.59	0.49	0.42
40%	1.00		0.77	0.63	0.53	0.45
50%	1.00		0.80	0.67	0.57	0.50
60%	1.00		0.83	0.71	0.63	0.56
70%	1.00		0.87	0.77	0.69	0.63
80%	1.00		0.91	0.83	0.77	0.71
90%	1.00		0.95	0.91	0.87	0.83
100%	1.00		1.00	1.00	1.00	1.00

[1] The maximum opening height shall be taken as the maximum opening clear height in a perforated shear wall. Where areas above and/or below an opening remain unsheathed, the height of each opening shall be defined as the clear height of the opening plus the unsheathed areas.

[2] The sum of the perforated shear wall segment lengths, $\text{Sum}(L)$, divided by the total length of the perforated shear wall. Lengths of perforated shear wall segments with aspect ratios greater than 2:1 shall be adjusted in accordance with Section 4.3.4.3.

ASCE7-16; Risk II; Site D

[Table: 0201.07]

Parameter	Value
SS	1.512
S1	0.685
FA	1
FV	1.5
SMS	1.512
SM1	1.027
SDS	1.008
SD1	0.685
TL	12
PGA	0.603
PGAM	0.603
FPGA	1
LE	1

Base shear coefficient

[Table: 0201.08]

variable	value	[value]	description
SDS	1.00	1.00	short period design
R1	6.50	6.50	reduction factor
omega	3.00	3.00	overstrength factor

Seismic coefficient

[Equ: 0201.01]

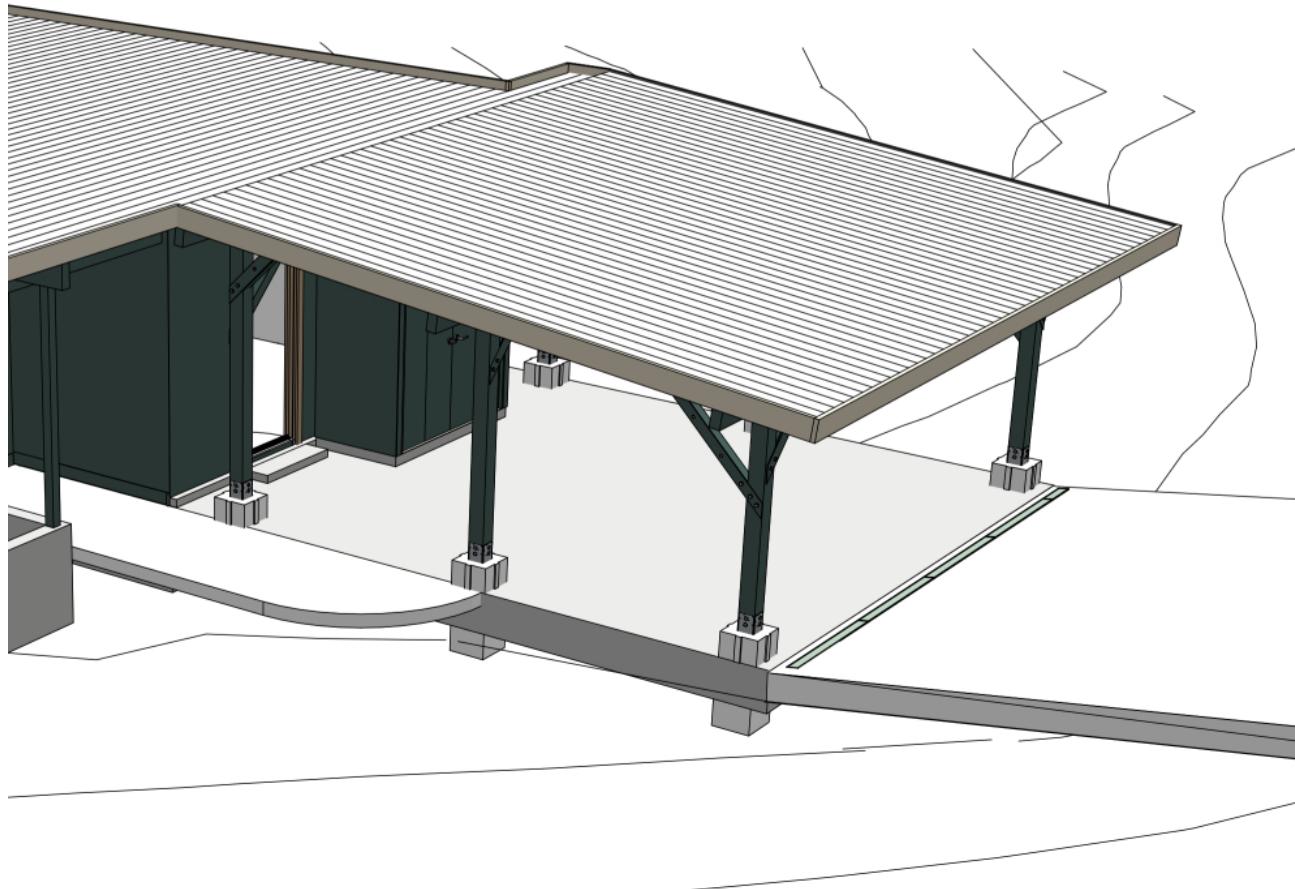
$$C_s = \frac{SDS}{R1}$$

C_s	SDS	R1
0.15 [-] [0.15 [-]]	[-]	6.50 [-]

Structural Deficiencies**SECTION 01**

The carport is a post and beam structure that was connected primarily by gravity and friction and a few nails and screws with minimal capacity.

In addition there was significant post decay. Initially the posts were supported on spread footings and the parking area was gravel. At some point a few decades ago, the posts were encapsulated with a concrete slab up to 8 or 9 inches to provide a better parking surface. The encapsulating concrete trapped water around the columns bases which caused serious decay and eventually led to partial column failure, 90% section loss in some cases and differential settlement up to 7 inches.

**Carport**

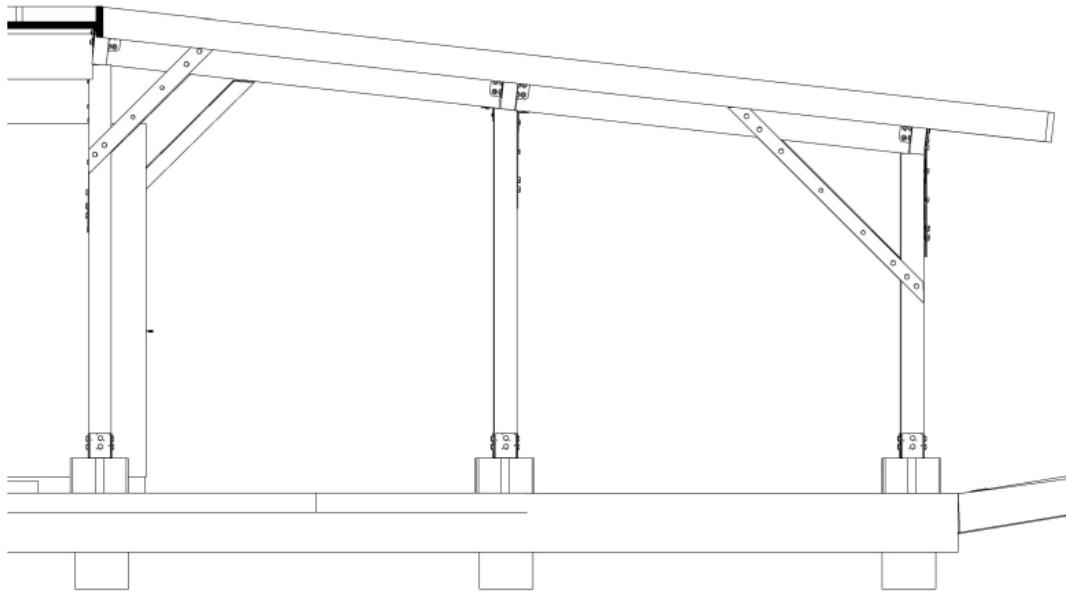
[Fig: 0202.01]

Carport Repairs and Strengthening**SECTION 02**

Beam to beam, post to beam and brace to beam and post connections were strengthened with 1/8" galvanized angles or plates that were attached with lag bolts or galvanized threaded rods or bolts.

The carport was shored and leveled, the decayed bottom of the posts were removed and new concrete foundations

that raised the bottom of the posts above the parking slab were installed to prevent further decay. Each post was positively anchored with double (orthogonal) bases.

**Carport North Elevation**

[Fig: 0202.02]

**Carport West Elevation**

[Fig: 0202.03]

Seismic Model Inputs - CBC Requirements**SECTION 03**

Seismic demands on the carport were analyzed using a 3D FEM model (ETABS). The model includes the geometry, loads and stiffness associated with the post, beams and roof. Column bases, beam to post, and brace connections were modeled as pins.

The in-plane stiffness of the T&G roof is taken as 300 pounds/inch/inch using test data from [USDA1972].

[USDA1972] USDA Forest Products Laboratory. 1972. "Shear Stiffness Of Two-Inch Wood Decks For Roof Systems", U.S.D.A. Forest Service RESEARCH PAPER, FPL 155 1972

ASCE7-16; Risk II; Site D

[Table: 0202.01]

Parameter	Value
SS	1.512
S1	0.685
FA	1
FV	1.5
SMS	1.512
SM1	1.027
SDS	1.008
SD1	0.685
TL	12
PGA	0.603
PGAM	0.603
FPGA	1
LE	1

Base shear coefficient

[Table: 0202.02]

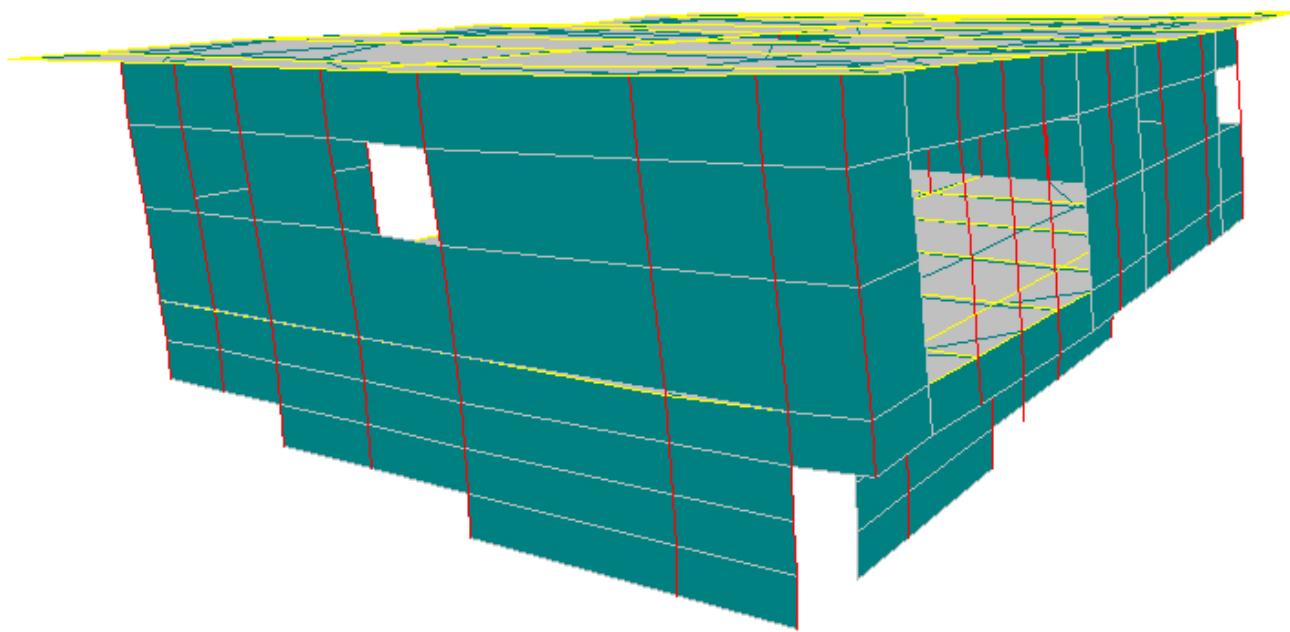
variable	value	[value]	description
SDS	1.00	1.00	short period design
R1	3.25	3.25	reduction factor
omega	2.00	2.00	overstrength factor

Seismic coefficient

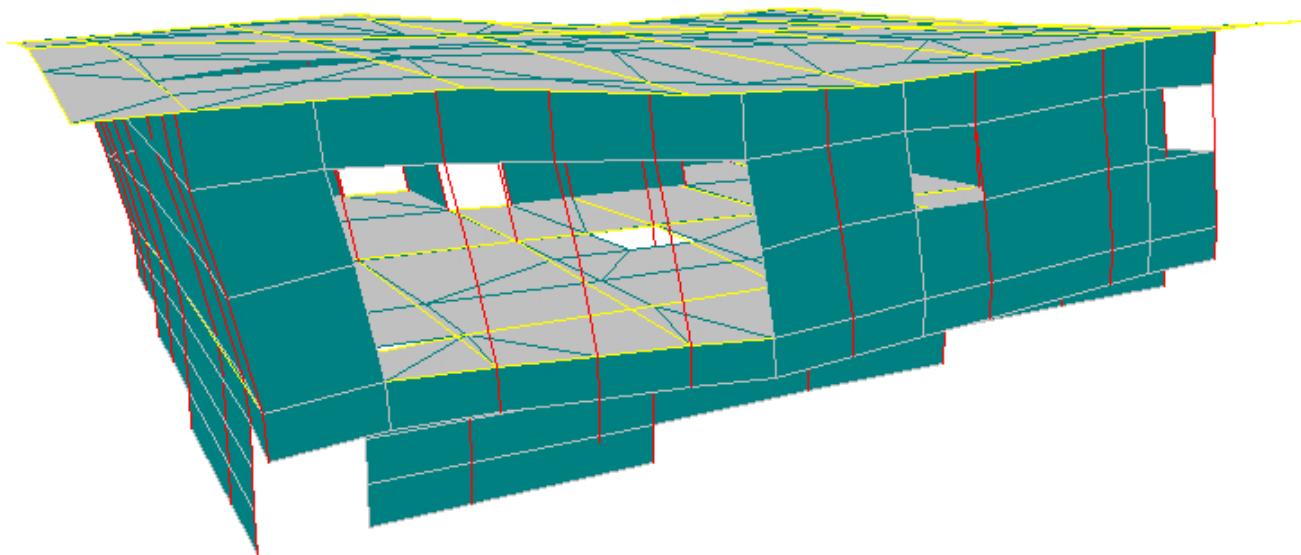
[Equ: 0202.01]

$$C_s = \frac{SDS}{R_1}$$

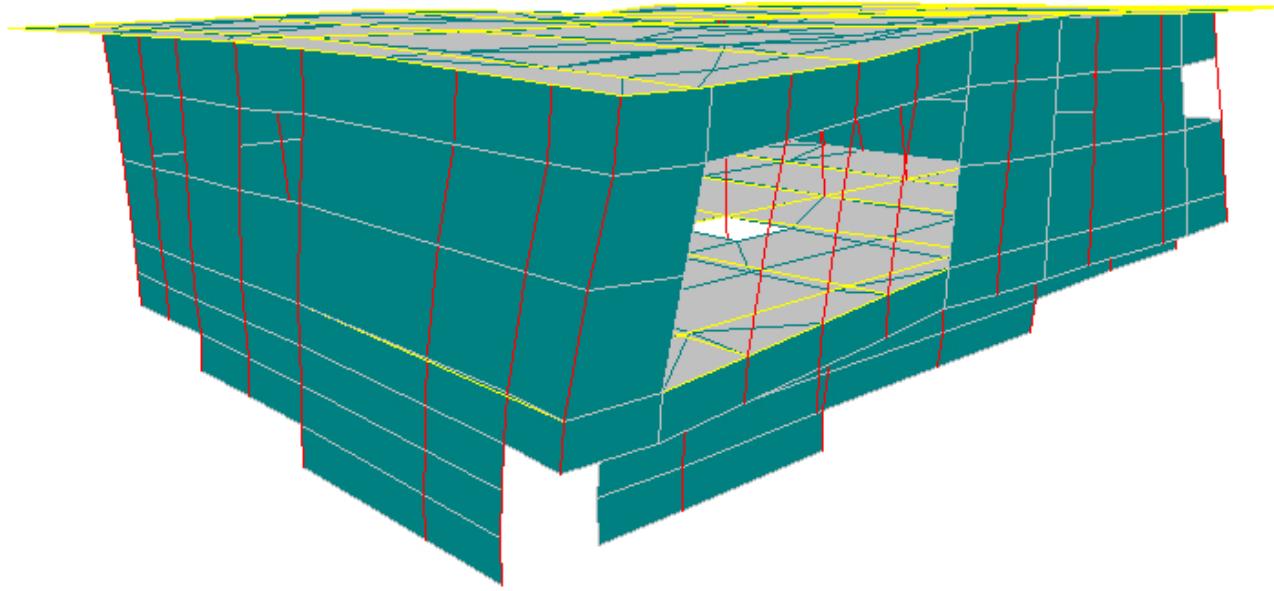
C_s	SDS	R1
0.31 [-] [0.31 [-]]	[-]	3.25 [-]

Seismic Demands for Exterior Walls**SECTION 01****First Mode Deformation (visually amplified)**

[Fig: 0301.01]

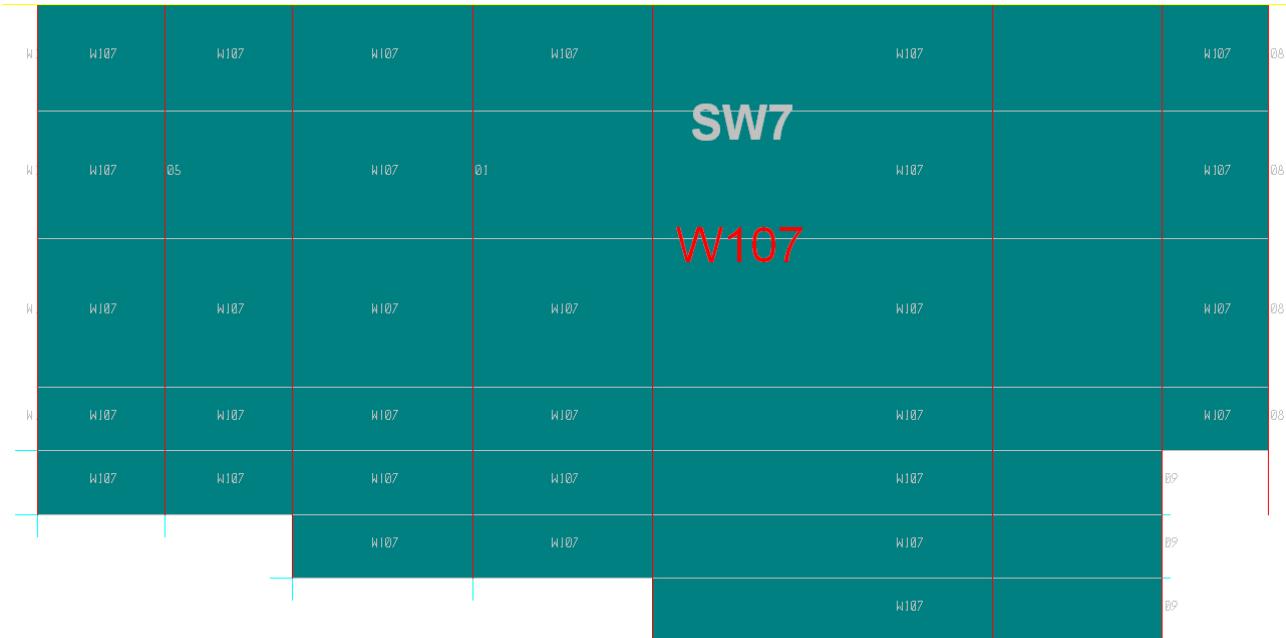
**Second Mode Deformation (visually amplified)**

[Fig: 0301.02]



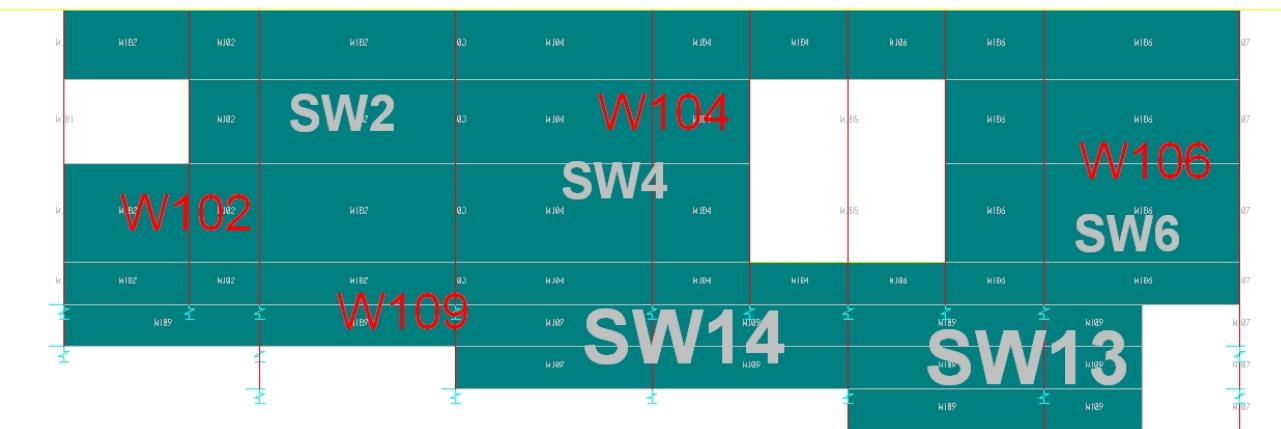
Third Mode Deformation (visually amplified)

[Fig: 0301.03]

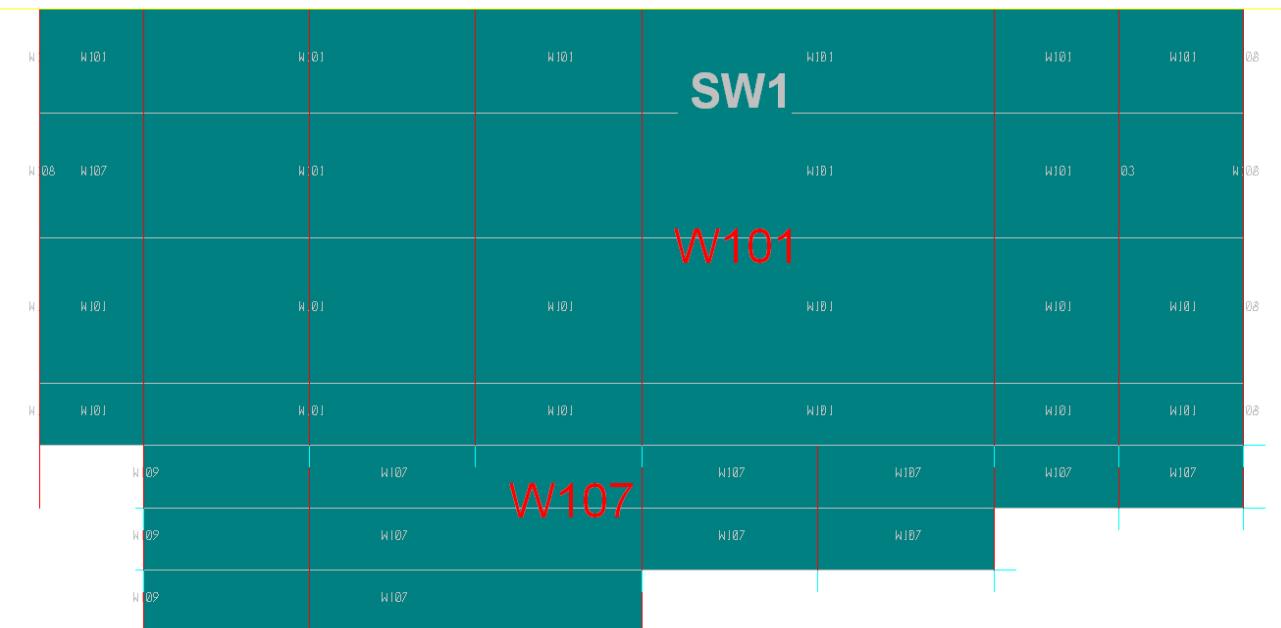


SW7 - South Shear Wall Elements SW101

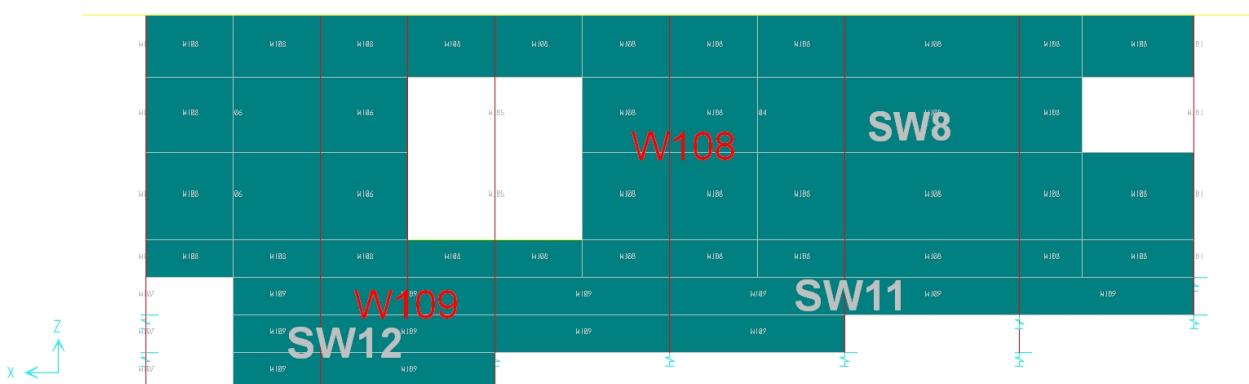
[Fig: 0301.04]

**SW2, SW4, SW6 West Shear Wall Elements - SW102, SW104, SW106**

[Fig: 0301.05]

**SW1 North Shear Wall Elements - SW101**

[Fig: 0301.06]

**SW8 East Shear Wall Elements - SW108**

[Fig: 0301.07]

ETABS Input Summary

[Table: 0301.01]

LOAD CASE DEFINITION DATA

LOAD	LTYPE	I	II	III	A	B	C	D1	D2
1	0	0.000	0.000	0.000	1.000	0.300	0.300	0.000	0.000
2	0	0.000	0.000	0.000	0.300	1.000	0.300	0.000	0.000

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD

DYNAMIC 1 . . . SPECTRAL DIRECTION 1

DYNAMIC 2 . . . SPECTRAL DIRECTION 2

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 . . . TIME HISTORY MODAL ANALYSIS

DYNAMIC 2 . . . NOT USED

DISPLACEMENT MAXIMA & MINIMA IN FRAME

WITH (COLUMN#,CASE#)

	LOCAL X-TRAN	LOCAL Y-TRAN	LOCAL Z-TRAN	LOCAL XX-ROTN	LOCAL YY-ROTN	LOCAL ZZ-ROTN
MIN	-0.01984	-0.00393	-0.50598	-0.00893	-0.00189	-0.00138
	(2, 2)	(27, 1)	(63, 2)	(67, 2)	(16, 1)	(8, 2)
MAX	0.69920	0.81052	0.23803	0.00282	0.00678	0.00167
	(64, 1)	(82, 2)	(49, 2)	(2, 1)	(12, 1)	(7, 2)

WALL FORCE MAXIMA & MINIMA IN FRAME

WITH (ELEM#,CASE#)

	MAJOR MOMENT	MAJOR SHEAR	MINOR MOMENT	MINOR SHEAR	AXIAL FORCE	TORSIONAL MOMENT
MIN	-0.1581E+03	-0.3731E+01	-0.6057E-03	-0.6914E-04	-0.9540E+00	-0.3589E-02
	(101, 2)	(101, 2)	(104, 2)	(104, 2)	(107, 2)	(108, 1)
MAX	0.1578E+03	0.2337E+01	0.6388E-03	0.5147E-04	0.7663E+00	0.2476E-02
	(107, 2)	(107, 2)	(104, 2)	(102, 2)	(102, 2)	(107, 2)

FLOOR FORCE MAXIMA & MINIMA IN FRAME

WITH (ELEM#,CASE#)

PROP FORCE FORCE

ID 11 22

1

MIN	-0.3585E-03	-0.1514E-02
	(8, 2)	(8, 2)
MAX	0.2953E-03	0.1413E-02
	(14, 2)	(8, 2)

2

MIN	-0.9517E-04	-0.4019E-03
	(8, 2)	(8, 2)
MAX	0.7838E-04	0.3752E-03
	(14, 2)	(8, 2)

ETABS Eigenvalues

[Table: 0301.02]

STRUCTURAL TIME PERIODS AND FREQUENCIES

MODE	PERIOD (TIME)	FREQUENCY (CYCLES/UNIT TIME)	CIRCULAR/FREQ (RADIAN/UNIT TIME)
1	0.53952	1.85350	11.64587

2	0.50634	1.97497	12.40909
3	0.37881	2.63987	16.58676
4	0.30659	3.26171	20.49392
5	0.20504	4.87714	30.64400
6	0.14072	7.10646	44.65123
7	0.12038	8.30735	52.19664
8	0.08812	11.34803	71.30178
9	0.08684	11.51536	72.35314
10	0.07069	14.14602	88.88208

MODAL PARTICIPATION FACTORS

MODE	X-TRANS	Y-TRANS	Z-ROTN
NUMBER	DIRECTION	DIRECTION	DIRECTION
1	0.07285	-0.28556	-7.40594
2	0.25636	0.08404	4.39616
3	0.00221	-0.00654	60.91933
4	-0.01250	0.02421	-5.27632
5	0.00713	-0.19737	-7.02955
6	-0.21966	0.02749	-14.44215
7	-0.10070	-0.06390	38.72897
8	-0.03686	0.00040	-2.49839
9	0.00698	0.01739	-3.82790
10	-0.00496	-0.00627	5.59411

MODAL DIRECTION FACTORS

MODE	X-TRANS	Y-TRANS	Z-ROTN
NUMBER	DIRECTION	DIRECTION	DIRECTION
1	7.71274	91.27298	1.01429
2	92.18805	7.46448	0.34747
3	0.21077	2.38354	97.40569
4	9.06374	32.81362	58.12264
5	0.08223	89.05951	10.85826
6	83.98605	1.48230	14.53164
7	15.85965	10.89143	73.24892
8	98.80493	0.51433	0.68074
9	0.59747	98.63851	0.76402
10	0.91519	0.97642	98.10839

EFFECTIVE MASS FACTORS

NUMBER	%-MASS	<%-SUM>	%-MASS	<%-SUM>	%-MASS	<%-SUM>
1	3.90	< 3.9>	59.92	< 59.9>	0.96	< 1.0>
2	48.29	< 52.2>	5.19	< 65.1>	0.34	< 1.3>
3	0.00	< 52.2>	0.03	< 65.1>	64.68	< 66.0>
4	0.11	< 52.3>	0.43	< 65.6>	0.49	< 66.5>
5	0.04	< 52.3>	28.62	< 94.2>	0.86	< 67.3>
6	35.45	< 87.8>	0.56	< 94.7>	3.64	< 71.0>
7	7.45	< 95.3>	3.00	< 97.8>	26.14	< 97.1>
8	1.00	< 96.3>	0.00	< 97.8>	0.11	< 97.2>
9	0.04	< 96.3>	0.22	< 98.0>	0.26	< 97.5>
10	0.02	< 96.3>	0.03	< 98.0>	0.55	< 98.0>

ETABS Story Shears

[Table: 0301.03]

COORDINATES OF CENTERS OF CUMULATIVE MASS & CENTERS OF RIGIDITY

STORY	DIAPHRAGM	/-----	CENTER OF MASS	-----/	CENTER OF RIGIDITY--/	
LEVEL	NUMBER	MASS	ORDINATE-X	ORDINATE-Y	ORDINATE-X	ORDINATE-Y
ROOF						
WINTOP	1	0.046	277.763	202.598	264.774	203.475
	1	0.054	278.706	200.942	262.890	190.041
WINBOT	1	0.063	278.026	198.763	245.047	203.759
	1	0.130	280.866	205.918	171.905	238.081
FLOOR	1	0.134	282.490	208.273	43.027	297.137
	1	0.135	284.189	209.256	532.139	347.254
FNDBOT	1	0.136	285.420	209.878	283.134	204.655

STATIC LOAD CONDITION LATERAL STORY SHEARS FOR ALL DIAPHRAGMS

VALUES ARE AT THE GLOBAL ORIGIN IN THE GLOBAL COORDINATES

/-----LOAD CONDITIONS-----/

LEVEL	DIRN	I	II	III	A	B	C
ROOF	X	0.00	0.00	0.00	4.66	0.00	0.00
ROOF	Y	0.00	0.00	0.00	0.00	4.66	0.00
WINTOP	X	0.00	0.00	0.00	5.34	0.00	0.00
WINTOP	Y	0.00	0.00	0.00	0.00	5.34	0.00
WINBOT	X	0.00	0.00	0.00	5.89	0.00	0.00
WINBOT	Y	0.00	0.00	0.00	0.00	5.89	0.00
FLOOR	X	0.00	0.00	0.00	8.20	0.00	0.00
FLOOR	Y	0.00	0.00	0.00	0.00	8.20	0.00
FNDTOP	X	0.00	0.00	0.00	8.27	0.00	0.00
FNDTOP	Y	0.00	0.00	0.00	0.00	8.27	0.00
FNDMID	X	0.00	0.00	0.00	8.29	0.00	0.00
FNDMID	Y	0.00	0.00	0.00	0.00	8.29	0.00
FNDBOT	X	0.00	0.00	0.00	8.29	0.00	0.00
FNDBOT	Y	0.00	0.00	0.00	0.00	8.29	0.00

ETABS Force and Displacement Summary

[Table: 0301.04]

LOAD CASE DEFINITION DATA

LOAD	LTYPE	I	II	III	A	B	C	D1	D2
1	0	0.000	0.000	0.000	1.000	0.300	0.300	0.000	0.000
2	0	0.000	0.000	0.000	0.300	1.000	0.300	0.000	0.000

FOR DYNAMICS BY THE RESPONSE SPECTRUM METHOD

DYNAMIC 1 . . . SPECTRAL DIRECTION 1

DYNAMIC 2 . . . SPECTRAL DIRECTION 2

FOR DYNAMICS BY THE TIME HISTORY METHOD

DYNAMIC 1 . . . TIME HISTORY MODAL ANALYSIS

DYNAMIC 2 . . . NOT USED

DISPLACEMENT MAXIMA & MINIMA IN FRAME

WITH (COLUMN#, CASE#)

	LOCAL X-TRAN	LOCAL Y-TRAN	LOCAL Z-TRAN	LOCAL XX-ROTN	LOCAL YY-ROTN	LOCAL ZZ-ROTN
MIN	-0.01984	-0.00393	-0.50598	-0.00893	-0.00189	-0.00138
	(2, 2) (27, 1) (63, 2) (67, 2) (16, 1) (8, 2)					
MAX	0.69920	0.81052	0.23803	0.00282	0.00678	0.00167
	(64, 1) (82, 2) (49, 2) (2, 1) (12, 1) (7, 2)					

WALL FORCE MAXIMA & MINIMA IN FRAME

WITH (ELEM#, CASE#)

	MAJOR MOMENT	MAJOR SHEAR	MINOR MOMENT	MINOR SHEAR	AXIAL FORCE	TORSIONAL MOMENT
MIN	-0.1581E+03	-0.3731E+01	-0.6057E-03	-0.6914E-04	-0.9540E+00	-0.3589E-02
	(101, 2) (101, 2) (104, 2) (104, 2) (107, 2) (108, 1)					
MAX	0.1578E+03	0.2337E+01	0.6388E-03	0.5147E-04	0.7663E+00	0.2476E-02
	(107, 2) (107, 2) (104, 2) (102, 2) (102, 2) (107, 2)					

FLOOR FORCE MAXIMA & MINIMA IN FRAME

WITH (ELEM#, CASE#)

PROP FORCE FORCE

ID 11 22

1

MIN -0.3585E-03-0.1514E-02
(8, 2) (8, 2)
MAX 0.2953E-03 0.1413E-02
(14, 2) (8, 2)

2

MIN -0.9517E-04-0.4019E-03
(8, 2) (8, 2)
MAX 0.7838E-04 0.3752E-03
(14, 2) (8, 2)

ETABS Eigenvalues

[Table: 0301.05]

STRUCTURAL TIME PERIODS AND FREQUENCIES

MODE NUMBER	PERIOD (TIME)	FREQUENCY (CYCLES/UNIT TIME)	CIRCULAR/FREQ (RADIAN/UNIT TIME)
1	0.53952	1.85350	11.64587
2	0.50634	1.97497	12.40909
3	0.37881	2.63987	16.58676
4	0.30659	3.26171	20.49392
5	0.20504	4.87714	30.64400
6	0.14072	7.10646	44.65123
7	0.12038	8.30735	52.19664
8	0.08812	11.34803	71.30178
9	0.08684	11.51536	72.35314
10	0.07069	14.14602	88.88208

MODAL PARTICIPATION FACTORS

MODE NUMBER	X-TRANS DIRECTION	Y-TRANS DIRECTION	Z-ROTN DIRECTION

1	0.07285	-0.28556	-7.40594
2	0.25636	0.08404	4.39616
3	0.00221	-0.00654	60.91933
4	-0.01250	0.02421	-5.27632
5	0.00713	-0.19737	-7.02955
6	-0.21966	0.02749	-14.44215
7	-0.10070	-0.06390	38.72897
8	-0.03686	0.00040	-2.49839
9	0.00698	0.01739	-3.82790
10	-0.00496	-0.00627	5.59411

MODAL DIRECTION FACTORS

MODE	X-TRANS	Y-TRANS	Z-ROTN
NUMBER	DIRECTION	DIRECTION	DIRECTION
1	7.71274	91.27298	1.01429
2	92.18805	7.46448	0.34747
3	0.21077	2.38354	97.40569
4	9.06374	32.81362	58.12264
5	0.08223	89.05951	10.85826
6	83.98605	1.48230	14.53164
7	15.85965	10.89143	73.24892
8	98.80493	0.51433	0.68074
9	0.59747	98.63851	0.76402
10	0.91519	0.97642	98.10839

EFFECTIVE MASS FACTORS

NUMBER	%-MASS	<%-SUM>	%-MASS	<%-SUM>	%-MASS	<%-SUM>
1	3.90	< 3.9>	59.92	< 59.9>	0.96	< 1.0>
2	48.29	< 52.2>	5.19	< 65.1>	0.34	< 1.3>
3	0.00	< 52.2>	0.03	< 65.1>	64.68	< 66.0>
4	0.11	< 52.3>	0.43	< 65.6>	0.49	< 66.5>
5	0.04	< 52.3>	28.62	< 94.2>	0.86	< 67.3>
6	35.45	< 87.8>	0.56	< 94.7>	3.64	< 71.0>
7	7.45	< 95.3>	3.00	< 97.8>	26.14	< 97.1>
8	1.00	< 96.3>	0.00	< 97.8>	0.11	< 97.2>
9	0.04	< 96.3>	0.22	< 98.0>	0.26	< 97.5>
10	0.02	< 96.3>	0.03	< 98.0>	0.55	< 98.0>

ETABS Story Shears

[Table: 0301.06]

COORDINATES OF CENTERS OF CUMULATIVE MASS & CENTERS OF RIGIDITY

STORY	DIAPHRAGM /-----	CENTER OF MASS-----/	-----/	-----/	CENTER OF RIGIDITY--/	
LEVEL	NUMBER	MASS	ORDINATE-X	ORDINATE-Y	ORDINATE-X	ORDINATE-Y
ROOF						
	1	0.046	277.763	202.598	264.774	203.475
WINTOP						
	1	0.054	278.706	200.942	262.890	190.041
WINBOT						
	1	0.063	278.026	198.763	245.047	203.759
FLOOR						
	1	0.130	280.866	205.918	171.905	238.081

FNDTOP	1	0.134	282.490	208.273	43.027	297.137
FNDMID	1	0.135	284.189	209.256	532.139	347.254
FNDBOT	1	0.136	285.420	209.878	283.134	204.655

STATIC LOAD CONDITION LATERAL STORY SHEARS FOR ALL DIAPHRAGMS

VALUES ARE AT THE GLOBAL ORIGIN IN THE GLOBAL COORDINATES

/-----LOAD CONDITIONS-----/							
LEVEL	DIRN	I	II	III	A	B	C
ROOF	X	0.00	0.00	0.00	4.66	0.00	0.00
ROOF	Y	0.00	0.00	0.00	0.00	4.66	0.00
WINTOP	X	0.00	0.00	0.00	5.34	0.00	0.00
WINTOP	Y	0.00	0.00	0.00	0.00	5.34	0.00
WINBOT	X	0.00	0.00	0.00	5.89	0.00	0.00
WINBOT	Y	0.00	0.00	0.00	0.00	5.89	0.00
FLOOR	X	0.00	0.00	0.00	8.20	0.00	0.00
FLOOR	Y	0.00	0.00	0.00	0.00	8.20	0.00
FNDTOP	X	0.00	0.00	0.00	8.27	0.00	0.00
FNDTOP	Y	0.00	0.00	0.00	0.00	8.27	0.00
FNDMID	X	0.00	0.00	0.00	8.29	0.00	0.00
FNDMID	Y	0.00	0.00	0.00	0.00	8.29	0.00
FNDBOT	X	0.00	0.00	0.00	8.29	0.00	0.00
FNDBOT	Y	0.00	0.00	0.00	0.00	8.29	0.00

Seismic Capacities and D-C ratios for Exterior Walls

SECTION 02

AWC4.3A Unit Shear Capacity Wood-Frame Shear Walls [1-7]

[Table: 0301.07]

component	property	-	-	wood	sheath	-	-
panel	thick(in)	5/16	3/8	3/8	7/16	15/32	15/32
nail	depth(in)	1-1/4	1-1/4	1-3/8	1-3/8	1-3/8	1-1/2
nail	size	6d	6d	8d	8d	8d	10d
edge nail	value						
6-in	vs(plf)	360	400	440	480	520	620
OSB 6-in	Ga(kip/in)	13	11	17	15	13	22
PLY 6-in	Ga(kip/in)	9.5	6.5	12	11	10	14
4-in	vs(plf)	540	600	640	700	760	920
OSB 4-in	Ga(kip/in)	18	15	25	22	19	30
PLY 4-in	Ga(kip/in)	12	11	15	14	13	17
3-in	vs(plf)	700	780	820	900	960	1200
OSB 3-in	Ga(kip/in)	24	20	31	28	25	37
PLY 3-in	Ga(kip/in)	14	13	17	17	15	19
2-in	vs(plf)	900	1020	1060	1170	1280	1540
OSB 2-in	Ga(kip/in)	37	32	45	42	39	52
PLY 2-in	Ga(kip/in)	18	17	20	21	20	23

Table 4.3.3.5 Shear Capacity Adjustment Factor, Co

[Table: 0301.08]

Wall Height - h	Maximum Opening Height [1]	h/3	h/2	2h/3	5h/6	h
h						
8' Wall	2'-8"		4'-0"	5'-4"	6'-6"	8'-0"
			0"	4"	8"	
10' Wall	3'-4"		6'-0"	6'-4"	8'-0"	10'-0"
			8"	4"		
Percent Full-Height Sheathing 2	Effective Shear Capacity Ratio					
10%	1.00		0.69	0.53	0.43	0.36
20%	1.00		0.71	0.56	0.45	0.38
30%	1.00		0.74	0.59	0.49	0.42
40%	1.00		0.77	0.63	0.53	0.45
50%	1.00		0.80	0.67	0.57	0.50
60%	1.00		0.83	0.71	0.63	0.56
70%	1.00		0.87	0.77	0.69	0.63
80%	1.00		0.91	0.83	0.77	0.71
90%	1.00		0.95	0.91	0.87	0.83
100%	1.00		1.00	1.00	1.00	1.00

[1] The maximum opening height shall be taken as the maximum opening clear height in a perforated shear wall. Where areas above and/or below an opening remain unsheathed, the height of each opening shall be defined as the clear height of the opening plus the unsheathed areas.

[2] The sum of the perforated shear wall segment lengths, a_i ,

divided by the total length of the perforated shear wall. Lengths of perforated shear wall segments with aspect ratios greater than 2:1 shall be adjusted in accordance with Section 4.3.4.3.

From table 4.3A the nominal unit strength of the shear walls is 520 plf. From table 4.3.3.5 the effective strength is between 50 and 100 percent of the nominal strength.

Effective Shearwall Capacity

[Table: 0301.09]

Wall No.	Length (ft)	Openings (ft)	Solid (%)	coeff	v'(plf)	V (lbs)
SW1	30	12.6	58	0.83	432	12948
SW2	13.7	4.5	67	0.87	452	6198
SW3	5.8	0	100	1	520	3016
SW4	14.4	6.5	55	0.8	416	5990
SW5	5.8	0	100	1	520	3016
SW6	13.6	3.1	77	0.9	468	6365
SW7	30	8	73	0.87	452	13572
SW8	42	22.7	46	0.55	286	12012

D-C ratios are shown for 6" oc boundary nails and estimated DC ratios if the existing 12" oc nailing is taken to have half the capacity. If the capacity is reduced by half to account for the 12" oc boundary nailing the shear walls have the capacity to meet the design loads.

First Floor D-C Ratio

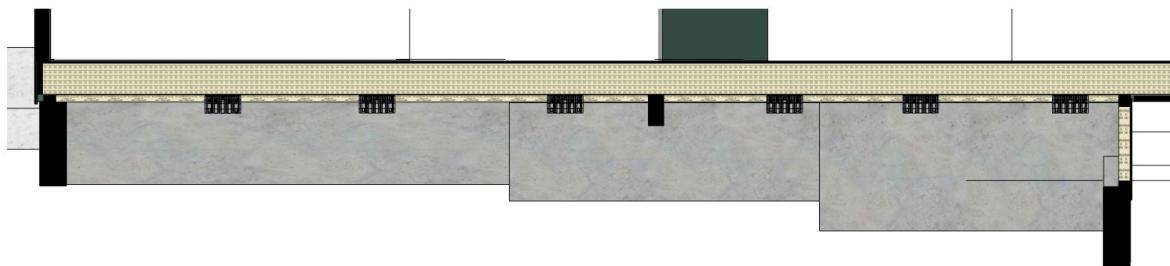
[Table: 0301.10]

Label	Type	Vd (lbs)	Vc (lbs)	D-C (6")	D-C (12")
SW1	wall	4000	12948	0.3	0.6
SW2	wall	1500	6198	0.25	0.5
SW3	wall	-	-	-	-
SW4	wall	1500	5990	0.25	0.5
SW5	wall	-	-	-	-
SW6	wall	1500	6365	0.25	0.5
SW7	wall	4000	13572	0.3	0.6
SW8	wall	4000	12012	0.3	0.6

Seismic D-C ratios for Foundation Walls

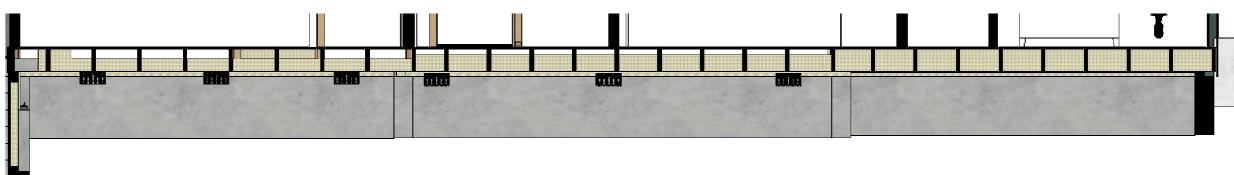
SECTION 03

Foundation retrofits included Simpson retrofit foundation plates (URFP) and plywood shear walls with boundary nailing at 4" oc (see table 0201.05). The URFP capacity is 1500 lbs and the shear wall capacity is 960 plf.



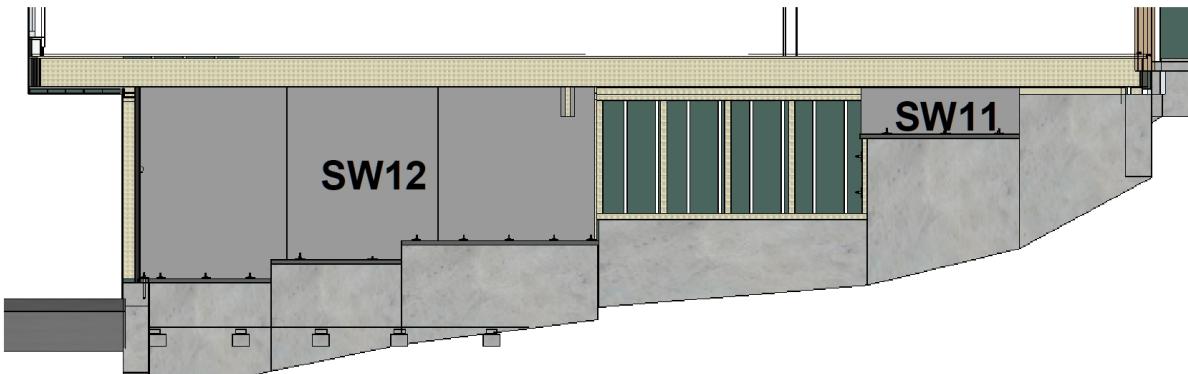
SW1 - North Elevation URFP

[Fig: 0301.08]

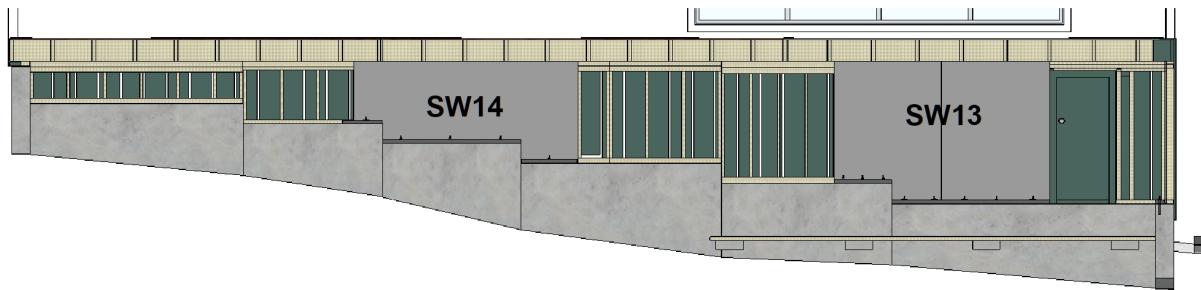


SW4, SW6 - West Elevation URFP

[Fig: 0301.09]

**SW11, SW12 - South Elevation**

[Fig: 0301.10]

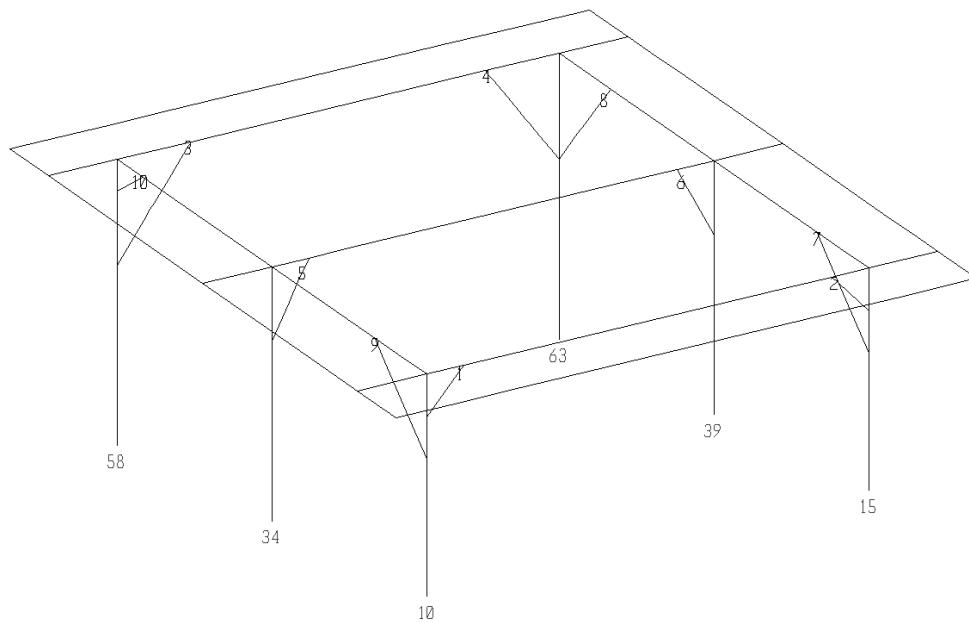
**SW13, SW14 - East Elevation**

[Fig: 0301.11]

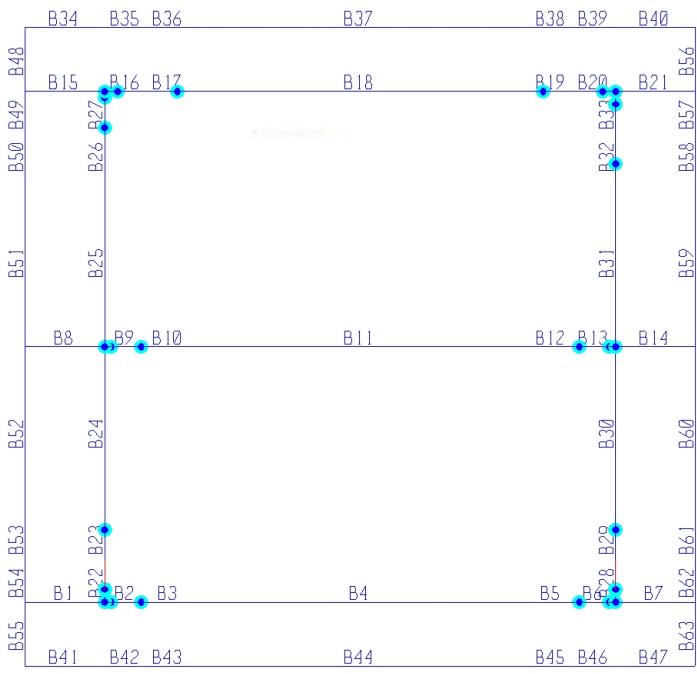
Foundation D-C Ratio

[Table: 0301.11]

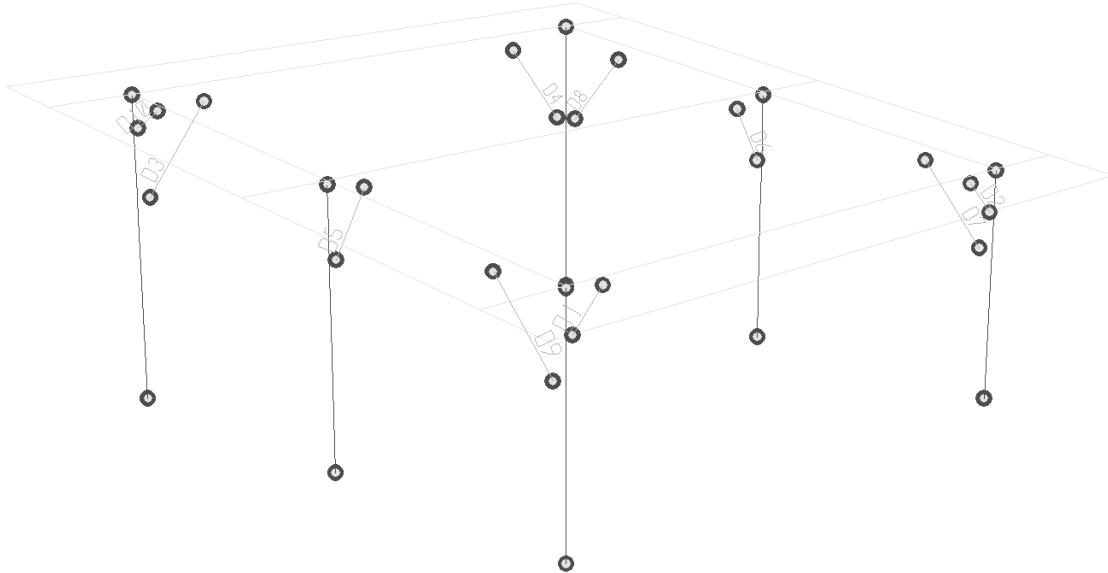
Label	Type	Vd (lbs)	Vc (lbs)	D-C
SW1	URFP	6000	9000	0.67
SW4	URFP	3000	4500	0.67
SW6	URFP	3000	4500	0.67
SW11-SW12	wall	6000	12000	0.5 (4" oc bdry)
SW13-SW14	wall	6000	12000	0.5 (4" oc bdry)

Seismic Demands for Carport Braces and Beam Connections**SECTION 01****Column and Brace Numbers**

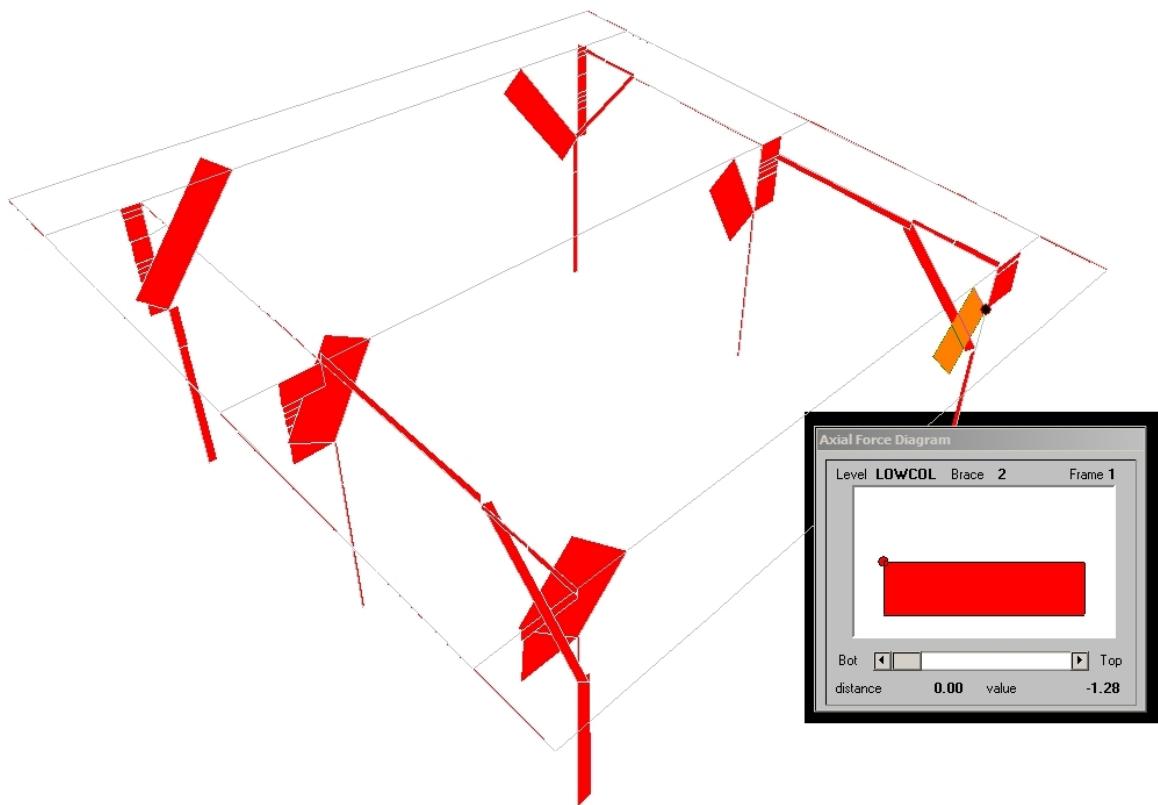
[Fig: 0302.01]

**Beam Numbers**

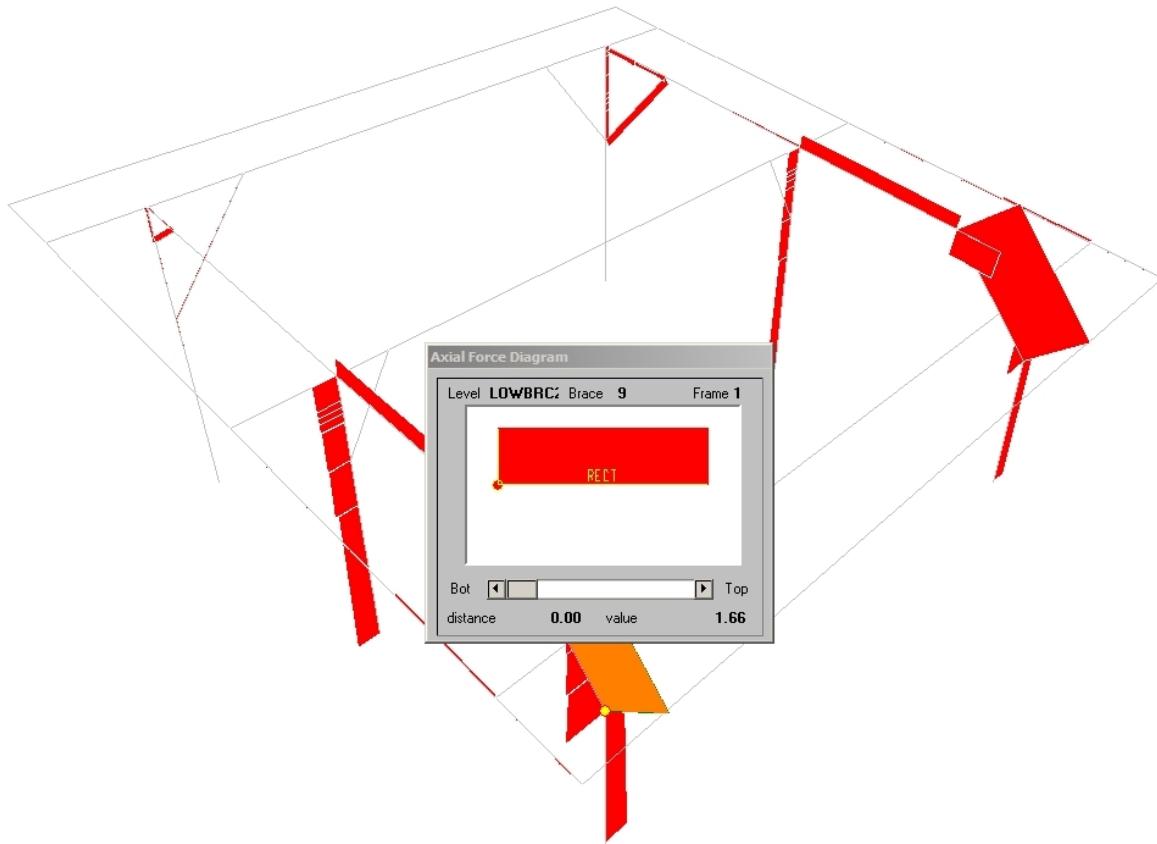
[Fig: 0302.02]

**Element Pin Connections**

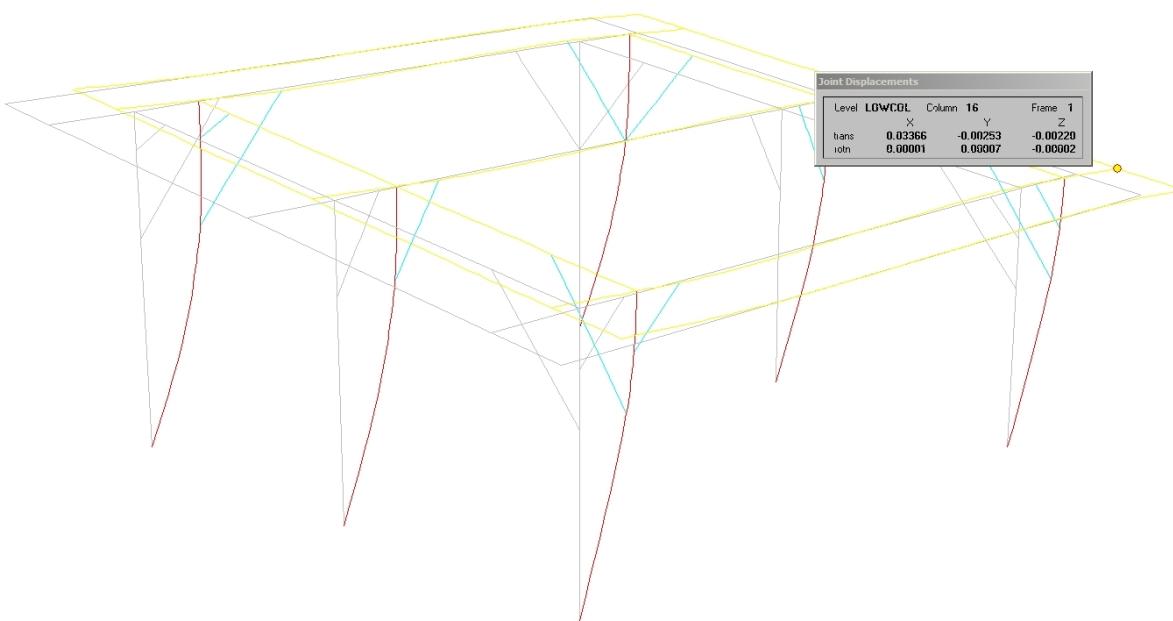
[Fig: 0302.03]

**Axial Forces - Transverse Seismic**

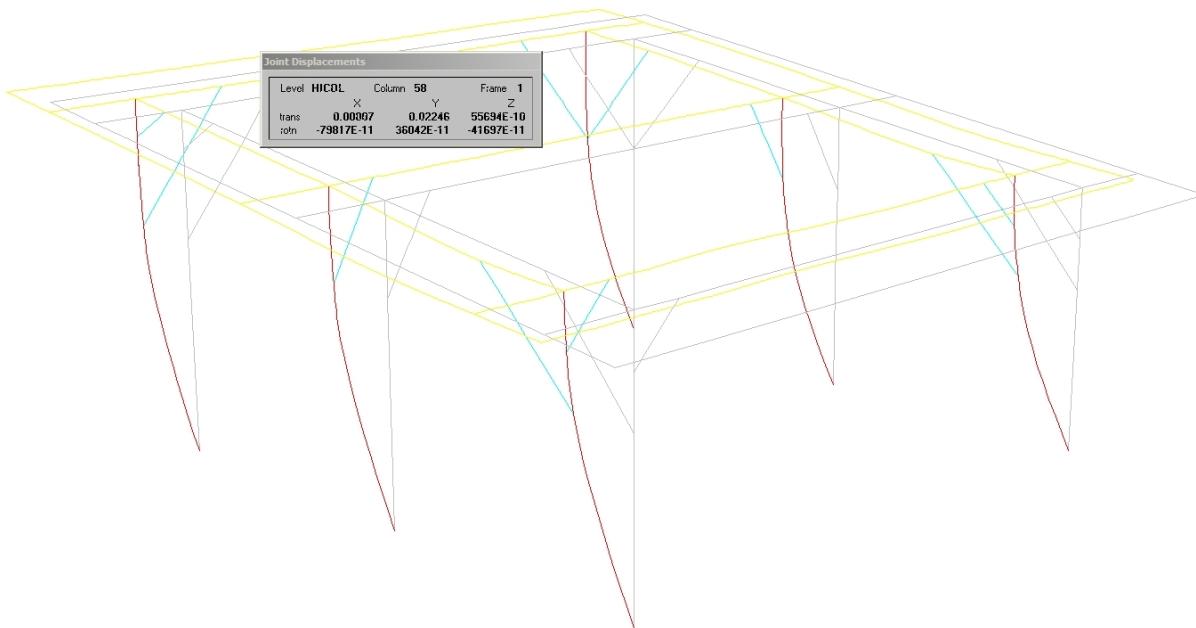
[Fig: 0302.04]

**Axial Forces - Longitudinal Seismic**

[Fig: 0302.05]

**Deformations - Transverse Seismic (visually amplified)**

[Fig: 0302.06]

**Deformations - Longitudinal Seismic (visually amplified)**

[Fig: 0302.07]

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 Extended Three Dimensional Analysis of Building Systems
 NONLINEAR Version 6.22
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CARPORT
SEISMIC ANALYSIS
J O B C O N T R O L I N F O R M A T I O N
 NUMBER OF STORIES----- 11
 NUMBER OF FLOOR DIAPHRAGMS ON EACH LEVEL----- 1
 NUMBER OF DIFFERENT FRAMES----- 1
 NUMBER OF TOTAL FRAMES----- 1
 NUMBER OF MASS TYPES----- 0
 NUMBER OF LOAD CASES----- 0
 NUMBER OF STRUCTURAL PERIODS----- 3
 NUMBER OF MATERIAL PROPERTIES----- 1
 NUMBER OF PROPERTIES FOR COLUMNS----- 1
 NUMBER OF PROPERTIES FOR BEAMS----- 2
 NUMBER OF PROPERTIES FOR FLOORS----- 1
 NUMBER OF PROPERTIES FOR BRACES----- 1
 NUMBER OF PROPERTIES FOR PANELS----- 0
 NUMBER OF PROPERTIES FOR SUPPORTS/LINKS----- 0
 CODE FOR STATIC LATERAL ANALYSIS----- 11
 CODE FOR DYNAMIC LATERAL ANALYSIS----- 1
 CODE FOR STRUCTURE TYPE----- 0
 CODE FOR P-DELTA ANALYSIS ----- 0

CODE FOR FRAME JOINT STIFFNESS MODIFICATION-- 2
 CODE FOR FRAME SELF WEIGHT LOAD CONDITION--- 0
 CODE FOR TYPE OF UNITS----- 1
 GRAVITATIONAL ACCELERATION----- 0.3864E+03
 EIGEN CONVERGENCE TOLERANCE----- 0.1000E-03
 EIGEN CUTOFF TIME PERIOD----- 0.0000E+00
 P-DELTA FACTOR----- 0.1000E+01

CARPORT

SEISMIC ANALYSIS

STRUCTURAL STORY DATA . . .

STORY STORY NUMBER OF

LEVEL HEIGHT DIAPHRAGMS

HITRIM	3.00	0
HICOL	2.00	0
HIBRAC1	2.00	0
HIBRAC2	8.00	0
MIDCOL	8.00	0
LOWBRC2	2.00	0
LOWBRC1	2.00	0
LOWCOL	3.00	0
LOWTRIM	13.00	0
LOWBC1	16.00	0
LOWBC2	52.00	0

CARPORT

SEISMIC ANALYSIS

MATERIAL PROPERTIES

ID	TYPE	ELASTIC MODULUS	POISONS RATIO	UNIT WEIGHT	UNIT MASS	COEFF OF EXPANSION
1	0	0.1000E+05	0.3000	0.2300E-04	0.6000E-07	0.0000E+00

MATERIAL PROPERTIES FOR DESIGN

ID TYPE FY FC FYS FCS FBMAJ FBMIN

SECTION PROPERTIES FOR COLUMNS

SECTION	MAT	MAJOR	MINOR	FLANGE	WEB
ID	TYPE	ID	DIM	DIM	THICK
1	RECT	1	5.500	5.500	0.000
					0.000

SECTION PROPERTY REDUCTION FACTORS FOR COLUMNS

TORSION	MAJOR	MINOR
ID	J	I
1	1.000	1.000
		1.000

ANALYSIS SECTION PROPERTIES FOR COLUMNS

AXIAL	MAJOR	MINOR	TORSION	MAJOR	MINOR
ID	A	AV	AV	J	I
1	30.250	25.208	25.208	0.1289E+03	0.7626E+02
					0.7626E+02

SECTION PROPERTIES FOR BEAMS

SECTION	MAT	DEPTH	DEPTH	BEAM	FLANGE	WEB
ID	TYPE	ID	BELOW	ABOVE	WIDTH	THICK
1	RECT	1	11.250	0.000	3.500	0.000
2	RECT	1	5.500	0.000	1.500	0.000
						0.000

SECTION PROPERTY REDUCTION FACTORS FOR BEAMS

TORSION		MAJOR		MINOR	
ID	J	I	I		
1	1.000	1.000	1.000		
2	1.000	1.000	1.000		

ANALYSIS SECTION PROPERTIES FOR BEAMS

AXIAL		MAJOR		MINOR		TORSION		MAJOR		MINOR	
ID	A	AV	AV	J	I	I					
1	39.375	32.813	32.813	0.1293E+03	0.4153E+03	0.4020E+02					
2	8.250	6.875	6.875	0.5125E+01	0.2080E+02	0.1547E+01					

CARPORT

SEISMIC ANALYSIS

SECTION PROPERTIES FOR FLOORS

ELEMENT		FLOOR		FLOOR	
ID	TYPE	ID	T11	T22	T12
1	MEMB	1	1.500	1.500	0.100

CARPORT

SEISMIC ANALYSIS

SECTION PROPERTIES FOR BRACES

SECTION		MAT	MAJOR	MINOR	FLANGE	WEB
ID	TYPE	ID	DIM	DIM	THICK	THICK
1	RECT	1	3.500	3.500	0.000	0.000

SECTION PROPERTY REDUCTION FACTORS FOR BRACES

TORSION		MAJOR		MINOR	
ID	J	I	I		
1	1.000	1.000	1.000		

ANALYSIS SECTION PROPERTIES FOR BRACES

AXIAL		MAJOR		MINOR		TORSION		MAJOR		MINOR	
ID	A	AV	AV	J	I	I					
1	12.250	10.208	10.208	0.2113E+02	0.1251E+02	0.1251E+02					

CARPORT

SEISMIC ANALYSIS

FRAME CONTROL INFORMATION

CARPORT

FRAME ID NUMBER-----	1
NUMBER OF COLUMN LINES-----	72
NUMBER OF BEAM BAYS-----	63
NUMBER OF FLOOR BAYS-----	24
NUMBER OF JOINT LOAD PATTERNS-----	0
NUMBER OF BEAM SPAN LOAD PATTERNS-----	0
NUMBER OF FLOOR SURFACE LOAD PATTERNS-----	0
CODE FOR JOINT DATA-----	0
MAXIMUM NUMBER OF BRACE ELEMENTS-----	10
MAXIMUM NUMBER OF PANEL ELEMENTS-----	0
MAXIMUM NUMBER OF LINK ELEMENTS-----	0
MAXIMUM NUMBER OF LOADS PER BEAM SPAN-----	4

SEISMIC ANALYSIS

INPUT AND/OR GENERATED BRACING DATA

BRACE	LEVEL	COLUMN	COLUMN	PROP	PIN	END	LEVELS	BRACE
ID	AT TOP	AT BOT	AT TOP	ID	MAJ/MIN	DROPPED		LENGTH

1	LOWCOL	10	11	1	3/3	2	22.63
2	LOWCOL	15	14	1	3/3	2	22.63
3	HICOL	58	60	1	3/3	8	51.22
4	HICOL	63	61	1	3/3	8	51.22
5	MIDCOL	34	35	1	3/3	5	32.25
6	MIDCOL	39	38	1	3/3	5	32.25
7	LOWBRC2	15	31	1	3/3	5	48.17
8	HIBRAC2	63	47	1	3/3	6	48.17
9	LOWBRC2	10	26	1	3/3	5	48.17
10	HIBRAC1	58	50	1	3/3	2	18.87

LEVEL /-----ELEMENT TYPE-----/

ID	COLUMN	BEAM	BRACE	PANEL	FL00R
HITRIM	0.000	0.052	0.000	0.000	0.105
HICOL	0.001	0.241	0.014	0.000	0.175
HIBRAC1	0.003	0.035	0.003	0.000	0.140
HIBRAC2	0.007	0.088	0.007	0.000	0.350
MIDCOL	0.017	0.360	0.012	0.000	0.561
LOWBRC2	0.014	0.088	0.014	0.000	0.350
LOWBRC1	0.006	0.035	0.000	0.000	0.140
LOWCOL	0.009	0.241	0.006	0.000	0.175
LOWTRIM	0.033	0.052	0.000	0.000	0.105
LOWBC1	0.061	0.000	0.037	0.000	0.000
LOWBC2	0.142	0.000	0.014	0.000	0.000
BASELINE	0.109	0.000	0.000	0.000	0.000
TOTALS	0.401E+00	0.119E+01	0.106E+00	0.000E+00	0.210E+01

CARPORT

SEISMIC ANALYSIS

DIAPHRAGM MASS DATA

RESULTANTS OF STORY & TRIBUTARY ELEMENT MASSES

STORY	DIAPHRAGM	DIAPHRAGM	DIAPHRAGM	DIAPHRAGM	DIAPHRAGM
LEVEL	NUMBER	MASS	MMI	X-M	Y-M
HITRIM					
	1	0.000	0.3774E+01	126.00	240.00
HICOL					
	1	0.001	0.9170E+01	126.00	216.00
HIBRAC1					
	1	0.000	0.4748E+01	124.59	200.25
HIBRAC2					
	1	0.001	0.1189E+02	127.44	184.49
MIDCOL					
	1	0.002	0.2315E+02	125.73	121.40
LOWBRC2					
	1	0.001	0.1273E+02	126.00	59.34
LOWBRC1					
	1	0.000	0.5014E+01	126.00	43.93
LOWCOL					
	1	0.001	0.9719E+01	126.00	26.32
LOWTRIM					
	1	0.000	0.6148E+01	126.00	20.99
LOWBC1					

1 0.000 0.3905E+01 132.70 134.66
LOWBC2
1 0.000 0.6311E+01 126.00 111.62
CARPORT
SEISMIC ANALYSIS
STATIC SEISMIC LOAD CALCULATION DATA . . .
UNIFORM BUILDING CODE 1994
UBC ZONE FACTOR (Z)----- 0.40
UBC IMPORTANCE FACTOR (I)----- 1.00
UBC SITE COEFFICIENT (S) ----- 1.20
LOAD CONDITION A (X-DIRECTION) . . .
PERIOD OF PREDOMINANT X STRUCTURAL MODE----- 0.500
UBC (METHOD A) PERIOD FOR X DIRECTION----- 0.500
UBC STRUCTURAL SYSTEM COEFFICIENT (RW)----- 4.000
TOP LEVEL OF TRIANGULAR DISTRIBUTION----- HITRIM
BOTTOM LEVEL OF TRIANGULAR DISTRIBUTION----- BASELINE
LOAD CONDITION B (Y-DIRECTION) . . .
PERIOD OF PREDOMINANT Y STRUCTURAL MODE----- 0.500
UBC (METHOD A) PERIOD FOR Y DIRECTION----- 0.500
UBC STRUCTURAL SYSTEM COEFFICIENT (RW)----- 4.000
TOP LEVEL OF TRIANGULAR DISTRIBUTION----- HITRIM
BOTTOM LEVEL OF TRIANGULAR DISTRIBUTION----- BASELINE
ADDITIONAL STORY ECCENTRICITIES . . .
LEVEL EYA EXB
HITRIM 0.00 0.00
HICOL 0.00 0.00
HIBRAC1 0.00 0.00
HIBRAC2 0.00 0.00
MIDCOL 0.00 0.00
LOWBRC2 0.00 0.00
LOWBRC1 0.00 0.00
LOWCOL 0.00 0.00
LOWTRIM 0.00 0.00
LOWBC1 0.00 0.00
LOWBC2 0.00 0.00
CARPORT
SEISMIC ANALYSIS
UBC '94 SEISMIC LOADS FOR DIRECTION X
V = ZICW/RW, C = 1.25S/T**(2/3)
T = 0.5000
Z = 0.4000
S = 1.2000
I = 1.0000
C = 2.3811
RW= 4.0000
W = 3.7
V = 0.2381W
= 0.89
FT= 0.00
CARPORT

SEISMIC ANALYSIS

UBC '94 SEISMIC LOADS FOR DIRECTION Y

V = ZICW/RW, C = 1.25S/T**(2/3)

T = 0.5000

Z = 0.4000

S = 1.2000

I = 1.0000

C = 2.3811

RW= 4.0000

W = 3.7

V = 0.2381W

= 0.89

FT= 0.00

CARPORT

SEISMIC ANALYSIS

STRUCTURAL LATERAL LOAD CONDITIONS

AS ADJUSTED BY CODE SEISMIC REQUIREMENTS

STRUCTURAL LATERAL LOAD CONDITION A (X-DIRECTION) FOR DIAPHRAGM 1

LEVEL	FX	FY	X	Y
HITRIM	0.05	0.00	126.00	240.00
HICOL	0.12	0.00	126.00	216.00
HIBRAC1	0.05	0.00	124.59	200.25
HIBRAC2	0.12	0.00	127.44	184.49
MIDCOL	0.23	0.00	125.73	121.40
LOWBRC2	0.11	0.00	126.00	59.34
LOWBRC1	0.04	0.00	126.00	43.93
LOWCOL	0.09	0.00	126.00	26.32
LOWTRIM	0.04	0.00	126.00	20.99
LOWBC1	0.02	0.00	132.70	134.66
LOWBC2	0.02	0.00	126.00	111.62

CARPORT

STRUCTURAL LATERAL LOAD CONDITION B (Y-DIRECTION) FOR DIAPHRAGM 1

LEVEL	FX	FY	X	Y
HITRIM	0.00	0.05	126.00	240.00
HICOL	0.00	0.12	126.00	216.00
HIBRAC1	0.00	0.05	124.59	200.25
HIBRAC2	0.00	0.12	127.44	184.49
MIDCOL	0.00	0.23	125.73	121.40
LOWBRC2	0.00	0.11	126.00	59.34
LOWBRC1	0.00	0.04	126.00	43.93
LOWCOL	0.00	0.09	126.00	26.32
LOWTRIM	0.00	0.04	126.00	20.99
LOWBC1	0.00	0.02	132.70	134.66
LOWBC2	0.00	0.02	126.00	111.62

CARPORT

STRUCTURAL LATERAL LOAD CONDITION C (ROTATION) FOR DIAPHRAGM 1

LEVEL	MZ
HITRIM	0.00
HICOL	0.00
HIBRAC1	0.00

HIBRAC2	0.00
MIDCOL	0.00
LOWBRC2	0.00
LOWBRC1	0.00
LOWCOL	0.00
LOWTRIM	0.00
LOWBC1	0.00
LOWBC2	0.00

SEISMIC ANALYSIS

COORDINATES OF CENTERS OF CUMULATIVE MASS & CENTERS OF RIGIDITY

STORY	DIAPHRAGM	/-----	CENTER OF MASS	-----/	CENTER OF RIGIDITY--/	
LEVEL	NUMBER	MASS	ORDINATE-X	ORDINATE-Y	ORDINATE-X	ORDINATE-Y
HITRIM						
HICOL	1	0.000	126.000	240.000	126.237	116.614
HIBRAC1	1	0.002	126.000	222.418	126.451	114.938
HIBRAC2	1	0.002	125.669	217.208	126.590	114.735
MIDCOL	1	0.003	126.324	205.099	126.682	114.562
LOWBRC2	1	0.006	126.065	168.525	126.433	114.186
LOWBRC1	1	0.007	126.053	149.224	126.382	114.455
LOWCOL	1	0.007	126.050	142.460	126.366	114.476
LOWTRIM	1	0.008	126.043	127.052	126.345	114.502
LOWBC1	1	0.009	126.041	121.166	126.295	114.701
LOWBC2	1	0.009	126.224	121.537	126.104	116.163
		0.010	126.215	121.120	126.055	117.272

STATIC LOAD CONDITION LATERAL STORY SHEARS FOR ALL DIAPHRAGMS

VALUES ARE AT THE GLOBAL ORIGIN IN THE GLOBAL COORDINATES

/-----/ LOAD CONDITIONS -----/							
LEVEL	DIRN	I	II	III	A	B	C
HITRIM	X	0.00	0.00	0.00	0.05	0.00	0.00
HITRIM	Y	0.00	0.00	0.00	0.00	0.05	0.00
HICOL	X	0.00	0.00	0.00	0.16	0.00	0.00
HICOL	Y	0.00	0.00	0.00	0.00	0.16	0.00
HIBRAC1	X	0.00	0.00	0.00	0.21	0.00	0.00
HIBRAC1	Y	0.00	0.00	0.00	0.00	0.21	0.00
HIBRAC2	X	0.00	0.00	0.00	0.34	0.00	0.00
HIBRAC2	Y	0.00	0.00	0.00	0.00	0.34	0.00
MIDCOL	X	0.00	0.00	0.00	0.57	0.00	0.00

MIDCOL	Y	0.00	0.00	0.00	0.00	0.57	0.00
LOWBRC2	X	0.00	0.00	0.00	0.68	0.00	0.00
LOWBRC2	Y	0.00	0.00	0.00	0.00	0.68	0.00
LOWBRC1	X	0.00	0.00	0.00	0.72	0.00	0.00
LOWBRC1	Y	0.00	0.00	0.00	0.00	0.72	0.00
LOWCOL	X	0.00	0.00	0.00	0.81	0.00	0.00
LOWCOL	Y	0.00	0.00	0.00	0.00	0.81	0.00
LOWTRIM	X	0.00	0.00	0.00	0.85	0.00	0.00
LOWTRIM	Y	0.00	0.00	0.00	0.00	0.85	0.00
LOWBC1	X	0.00	0.00	0.00	0.87	0.00	0.00
LOWBC1	Y	0.00	0.00	0.00	0.00	0.87	0.00
LOWBC2	X	0.00	0.00	0.00	0.89	0.00	0.00
LOWBC2	Y	0.00	0.00	0.00	0.00	0.89	0.00
CARPORT							

STATIC LOAD CONDITION LATERAL FRAME DRIFT RATIOS FOR DIAPHRAGM 1

VALUES ARE AT THE FRAME ORIGIN IN THE FRAME LOCAL COORDINATES

/-----LOAD CONDITIONS-----/

LEVEL	DIRN	I	II	III	A	B	C
HITRIM	X	0.00000	0.00000	0.00000	0.00002	0.00001	0.00000
HITRIM	Y	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000
HITRIM	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HICOL	X	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000
HICOL	Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HICOL	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC1	X	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000
HIBRAC1	Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC1	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC2	X	0.00000	0.00000	0.00000	0.00001	-0.00001	0.00000
HIBRAC2	Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC2	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
MIDCOL	X	0.00000	0.00000	0.00000	0.00003	0.00000	0.00000
MIDCOL	Y	0.00000	0.00000	0.00000	0.00000	-0.00002	0.00000
MIDCOL	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBRC2	X	0.00000	0.00000	0.00000	0.00003	0.00000	0.00000
LOWBRC2	Y	0.00000	0.00000	0.00000	0.00001	0.00003	0.00000
LOWBRC2	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBRC1	X	0.00000	0.00000	0.00000	0.00004	0.00000	0.00000
LOWBRC1	Y	0.00000	0.00000	0.00000	0.00001	0.00005	0.00000
LOWBRC1	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWCOL	X	0.00000	0.00000	0.00000	0.00005	0.00000	0.00000
LOWCOL	Y	0.00000	0.00000	0.00000	0.00001	0.00003	0.00000
LOWCOL	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWTRIM	X	0.00000	0.00000	0.00000	0.00011	0.00000	0.00000
LOWTRIM	Y	0.00000	0.00000	0.00000	0.00002	0.00005	0.00000
LOWTRIM	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBC1	X	0.00000	0.00000	0.00000	0.00027	0.00000	0.00000
LOWBC1	Y	0.00000	0.00000	0.00000	0.00002	0.00013	0.00000
LOWBC1	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBC2	X	0.00000	0.00000	0.00000	0.00052	0.00000	0.00000

LOWBC2	Y	0.00000	0.00000	0.00000	0.00004	0.00038	0.00000
LOWBC2	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

STRUCTURAL TIME PERIODS AND FREQUENCIES

MODE	PERIOD	FREQUENCY	CIRCULAR/FREQ
NUMBER	(TIME)	(CYCLES/UNIT TIME)	(RADIAN/UNIT TIME)
1	0.12353	8.09552	50.86566
2	0.09821	10.18244	63.97819
3	0.09772	10.23350	64.29899

MODAL PARTICIPATION FACTORS

MODE	X-TRANS	Y-TRANS	Z-ROTN
NUMBER	DIRECTION	DIRECTION	DIRECTION
1	0.09758	0.00029	-0.78367
2	-0.00983	0.01423	-7.91733
3	0.00115	0.09709	1.16317

MODAL DIRECTION FACTORS

MODE	X-TRANS	Y-TRANS	Z-ROTN
NUMBER	DIRECTION	DIRECTION	DIRECTION
1	99.36060	0.00096	0.63844
2	32.87273	2.11559	65.01169
3	0.70362	97.89345	1.40293

EFFECTIVE MASS FACTORS

NUMBER	%-MASS	<%-SUM>	%-MASS	<%-SUM>	%-MASS	<%-SUM>
1	98.83	< 98.8>	0.00	< 0.0>	0.64	< 0.6>
2	1.00	< 99.8>	2.10	< 2.1>	64.93	< 65.6>
3	0.01	< 99.8>	97.83	< 99.9>	1.40	< 67.0>

SEISMIC ANALYSIS

COORDINATES OF CENTERS OF CUMULATIVE MASS & CENTERS OF RIGIDITY

STORY DIAPHRAGM /-----CENTER OF MASS-----//--CENTER OF RIGIDITY--/

LEVEL	NUMBER	MASS	ORDINATE-X	ORDINATE-Y	ORDINATE-X	ORDINATE-Y
-------	--------	------	------------	------------	------------	------------

HITRIM	1	0.000	126.000	240.000	126.237	116.614
HICOL	1	0.002	126.000	222.418	126.451	114.938
HIBRAC1	1	0.002	125.669	217.208	126.590	114.735
HIBRAC2	1	0.003	126.324	205.099	126.682	114.562
MIDCOL	1	0.006	126.065	168.525	126.433	114.186
LOWBRC2	1	0.007	126.053	149.224	126.382	114.455
LOWBRC1	1	0.007	126.050	142.460	126.366	114.476
LOWCOL	1	0.008	126.043	127.052	126.345	114.502
LOWTRIM	1	0.009	126.041	121.166	126.295	114.701

LOWBC1

1 0.009 126.224 121.537 126.104 116.163

LOWBC2

1 0.010 126.215 121.120 126.055 117.272

STATIC LOAD CONDITION LATERAL STORY SHEARS FOR ALL DIAPHRAGMS

VALUES ARE AT THE GLOBAL ORIGIN IN THE GLOBAL COORDINATES

/-----LOAD CONDITIONS-----/

LEVEL	DIRN	I	II	III	A	B	C
HITRIM	X	0.00	0.00	0.00	0.05	0.00	0.00
HITRIM	Y	0.00	0.00	0.00	0.00	0.05	0.00
HICOL	X	0.00	0.00	0.00	0.16	0.00	0.00
HICOL	Y	0.00	0.00	0.00	0.00	0.16	0.00
HIBRAC1	X	0.00	0.00	0.00	0.21	0.00	0.00
HIBRAC1	Y	0.00	0.00	0.00	0.00	0.21	0.00
HIBRAC2	X	0.00	0.00	0.00	0.34	0.00	0.00
HIBRAC2	Y	0.00	0.00	0.00	0.00	0.34	0.00
MIDCOL	X	0.00	0.00	0.00	0.57	0.00	0.00
MIDCOL	Y	0.00	0.00	0.00	0.00	0.57	0.00
LOWBRC2	X	0.00	0.00	0.00	0.68	0.00	0.00
LOWBRC2	Y	0.00	0.00	0.00	0.00	0.68	0.00
LOWBRC1	X	0.00	0.00	0.00	0.72	0.00	0.00
LOWBRC1	Y	0.00	0.00	0.00	0.00	0.72	0.00
LOWCOL	X	0.00	0.00	0.00	0.81	0.00	0.00
LOWCOL	Y	0.00	0.00	0.00	0.00	0.81	0.00
LOWTRIM	X	0.00	0.00	0.00	0.85	0.00	0.00
LOWTRIM	Y	0.00	0.00	0.00	0.00	0.85	0.00
LOWBC1	X	0.00	0.00	0.00	0.87	0.00	0.00
LOWBC1	Y	0.00	0.00	0.00	0.00	0.87	0.00
LOWBC2	X	0.00	0.00	0.00	0.89	0.00	0.00
LOWBC2	Y	0.00	0.00	0.00	0.00	0.89	0.00

CARPORT

STATIC LOAD CONDITION LATERAL FRAME DRIFT RATIOS FOR DIAPHRAGM 1

VALUES ARE AT THE FRAME ORIGIN IN THE FRAME LOCAL COORDINATES

/-----LOAD CONDITIONS-----/

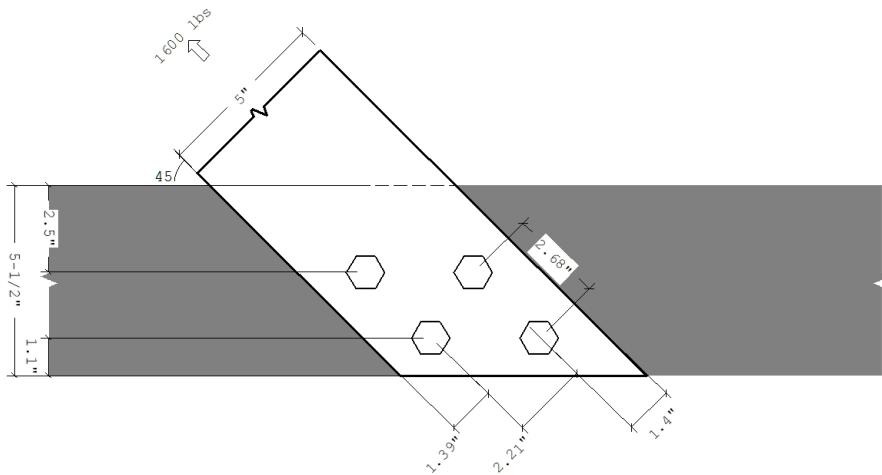
LEVEL	DIRN	I	II	III	A	B	C
HITRIM	X	0.00000	0.00000	0.00000	0.00002	0.00001	0.00000
HITRIM	Y	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000
HITRIM	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HICOL	X	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000
HICOL	Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HICOL	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC1	X	0.00000	0.00000	0.00000	0.00000	0.00001	0.00000
HIBRAC1	Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC1	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC2	X	0.00000	0.00000	0.00000	0.00001	-0.00001	0.00000
HIBRAC2	Y	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
HIBRAC2	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

MIDCOL	X	0.00000	0.00000	0.00000	0.00003	0.00000	0.00000
MIDCOL	Y	0.00000	0.00000	0.00000	0.00000	-0.00002	0.00000
MIDCOL	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBRC2	X	0.00000	0.00000	0.00000	0.00003	0.00000	0.00000
LOWBRC2	Y	0.00000	0.00000	0.00000	0.00001	0.00003	0.00000
LOWBRC2	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBRC1	X	0.00000	0.00000	0.00000	0.00004	0.00000	0.00000
LOWBRC1	Y	0.00000	0.00000	0.00000	0.00001	0.00005	0.00000
LOWBRC1	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWCOL	X	0.00000	0.00000	0.00000	0.00005	0.00000	0.00000
LOWCOL	Y	0.00000	0.00000	0.00000	0.00001	0.00003	0.00000
LOWCOL	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWTRIM	X	0.00000	0.00000	0.00000	0.00011	0.00000	0.00000
LOWTRIM	Y	0.00000	0.00000	0.00000	0.00002	0.00005	0.00000
LOWTRIM	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBC1	X	0.00000	0.00000	0.00000	0.00027	0.00000	0.00000
LOWBC1	Y	0.00000	0.00000	0.00000	0.00002	0.00013	0.00000
LOWBC1	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
LOWBC2	X	0.00000	0.00000	0.00000	0.00052	0.00000	0.00000
LOWBC2	Y	0.00000	0.00000	0.00000	0.00004	0.00038	0.00000
LOWBC2	ROTZ	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

Seismic Capacities and D-C Ratios for Braces

SECTION 02

Woodworks 11.2 is used for connection capacities. The software does not allow a single bolt row so a two bolt configuration is analyzed and capacities are reduced by a factor of 2.



Brace plate reinforcement (two-bolt rows shown - one row analyzed)

[Fig: 0302.08]

One Steel Side Member Bolted at Angle To Main Member

Connection Data:

Main:

Lumber-soft D.Fir-L No.1 dry seasoned 5.50 x 5.50"
Member extends indefinitely, and end assumed to be free.

Side Plate:

ASTM A36 Grade A Steel 0.1250 x 5.00"
End is flush with edge of main member.

Side member is sloped 135.0 degrees with respect to the main member.

Temperature (T) : T <= 100 deg F

Loads:

Along side member: 1600 lbs ten minutes duration in tension.

Connector Design:**Fasteners:**

Bolt diameter: 5/8"
2 rows of 2 Bolts = 4 Bolts
Row Spacing: 2.21"
Bolt spacing in row: 2.68"

Design Results using NDS 2015:**Parallel to Grain:**

Load: P = -1131 lbs
Row tear out capacity Rt = 19802 lbs Ratio: 0.06

Perpendicular to Grain:

Lateral load: Q = 1131 lbs

Resultant:

Combined lateral load: N = 1600 lbs at 45.0 degrees
Lateral capacity: Z' = 3889 lbs Ratio: 0.41

=====

Only one bolt per row is used so the lateral capacity is reduced by a factor of two.

=> DC ratio = .82

Additional Data:**Adjustment factors:**

CD	CM	Ct	Cg	Cdelta	Cd	Cst	Cft
1.60	1.00	1.00	0.99	0.76	-	-	1.00

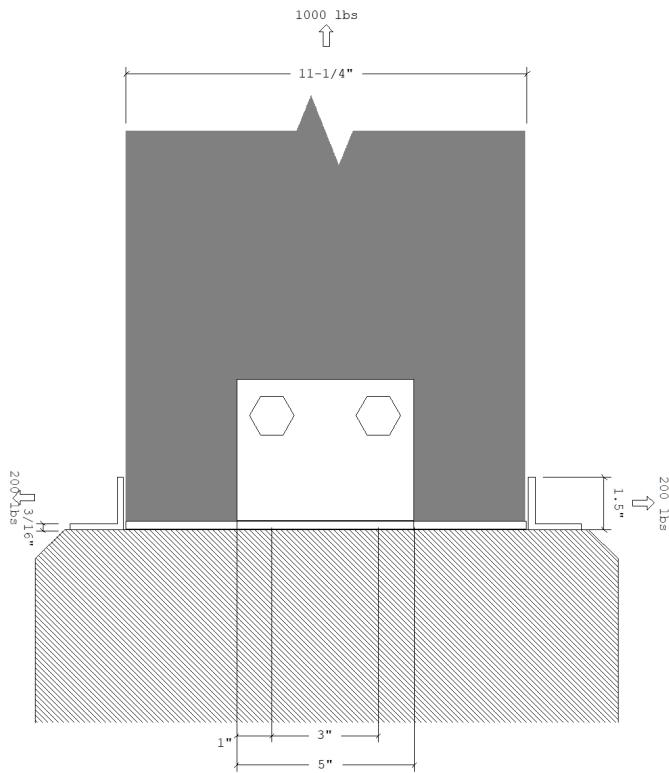
Yield Limit Values (lbs):

Im	Is	II	III _m	III _s	IV
2868	1510	1304	1593	812	1128

Seismic Capacities and D-C Ratios for Beam Connections**SECTION 03**

Beam to beam angle connections provide a load path for drag forces and loss of bearing if columns shift in an

earthquake.



Bolted Column to Base Angle Connector

Connection Data:

Column:

Timber-soft D.Fir-L No.1 dry seasoned 11.25 x 3.50"

Temperature (T) : $T \leq 100 \text{ deg F}$

Loads:

Lateral: 200 lbs ten minutes duration

Uplift: 1000 lbs ten minutes duration

Connector Design:

Components:

	Area (sq in)	Weight (lbs)
2 Side plates: 4.000 x 5.000 x 0.1250"	20.0	0.709
1 Base plate: 3.500 x 11.250 x 0.2500"	39.4	2.792
2 Clip Angles: 1-1/2 x 1-1/2 x 3/16 x 0.500 in	1.4	0.077
Totals:	82.3	4.363

Plate Steel:

Grade: ASTM A36/A36M Fy: 35525 psi Fu: 58000 psi

Steel Design Checks:

Each Side Plate:

Ratio of net area to gross area: 0.675

Tension in plate: $T = 500 \text{ lbs}$ Resistance $T_r = 12238 \text{ lbs}$

Fasteners:

Face Plate:

Bolts: ASTM A307 Fy: 45,000 psi Fu: 60,000 psi

Bolt diameter: 3/4"

2 rows of 1 Bolts = 2 Bolts

Row Spacing: 3"

Steel Design Checks:

Shear per bolt: V = 250 lbs Resistance: Vr = 5869 lbs

Bearing per bolt: B = 250 lbs Resistance: Br = 2583 lbs

Design Results using NDS 2015:

Load: P = 1000 lbs

Lateral capacity: Z' = 5745 lbs Ratio: 0.17

Tension capacity net area Tr = 42455 lbs Ratio: 0.02

Row tear out capacity Rt = 18360 lbs Ratio: 0.05

Group tear out capacity Gt = 35758 lbs Ratio: 0.03

Horizontal Bearing:

Lateral load: Q = 200 lbs

Max. bearing load: Qr = 200 lbs

Max. bending load: Yr = 230 lbs

Additional Data:

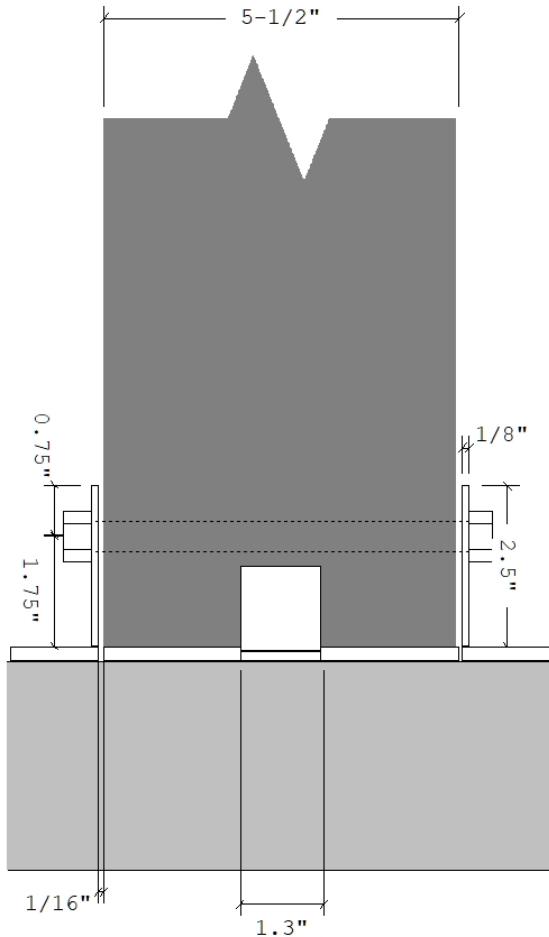
Adjustment factors:

CD	CM	Ct	Cg	Cdelta	Cd	Cst	Cft
1.60	1.00	1.00	1.00	0.57	-	-	1.00

Yield Limit Values (lbs):

Im	Is	II	III _m	III _s	IV
3675	4078	-	-	3142	4417

Top of column connections provide a shear load path to the foundation.



Bolted Column to Base Angle Connector

Connection Data:

Column:

Lumber Post D.Fir-L No.1 dry seasoned 5.50 x 5.50"

Temperature (T) : T <= 100 deg F

Loads:

Lateral: 500 lbs ten minutes duration

Uplift: 150 lbs ten minutes duration

Connector Design:

Components:	Area (sq in)	Weight (lbs)
2 Side plates: 2.500 x 1.500 x 0.1250"	3.7	0.133
1 Base plate: 5.500 x 5.500 x 0.2500"	30.2	2.145
2 Clip Angles: 1-1/2 x 1-1/2 x 3/16 x 1.281 in	3.6	0.191
Totals:	45.0	2.793

Plate Steel:

Grade: ASTM A36/A36M Fy: 35525 psi Fu: 58000 psi
Steel Design Checks:

Each Side Plate:

Ratio of net area to gross area: 0.625

Tension in plate: T = 75 lbs Resistance Tr = 3399 lbs

Fasteners:

Face Plate:

Bolts: ASTM A307 Fy: 45,000 psi Fu: 60,000 psi

Bolt diameter: 1/2"

1 rows of 1 Bolts = 1 Bolts

Steel Design Checks:

Shear per bolt: V = 75 lbs Resistance: Vr = 1590 lbs

Bearing per bolt: B = 75 lbs Resistance: Br = 2040 lbs

Design Results using NDS 2015:

Load: P = 150 lbs

Lateral capacity: Z' = 1144 lbs Ratio: 0.13

Tension capacity net area Tr = 32646 lbs Ratio: 0.00

Row tear out capacity Rt = 2772 lbs Ratio: 0.05

Horizontal Bearing:

Lateral load: Q = 500 lbs

Max. bearing load: Qr = 500 lbs

Max. bending load: Yr = 576 lbs

Additional Data:

Adjustment factors:

CD	CM	Ct	Cg	Cdelta	Cd	Cst	Cft
1.60	1.00	1.00	1.00	0.50	-	-	1.00

Yield Limit Values (lbs):

Im	Is	II	III	IIIs	IV
3850	2719	-	-	1430	1963