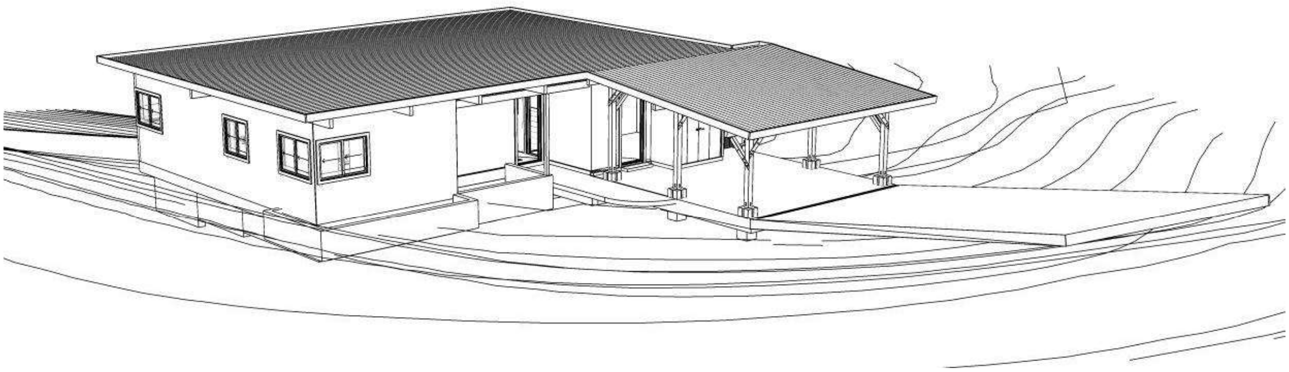
Structural Calculations



August 20, 2021

Residence Remodel

55 Loring Avenue, Mill Valley, CA 94901

Attn: Bryna Holland

re: Thorup Estate

REGISTERED PROFESSIONAL ENGINEER
RODNEY H. HOLLAND
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Contents

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

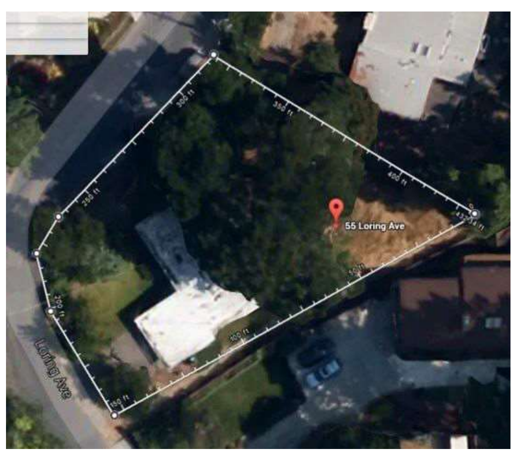
Residence viewed from Loring Drive [Fig: 0101.01]

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



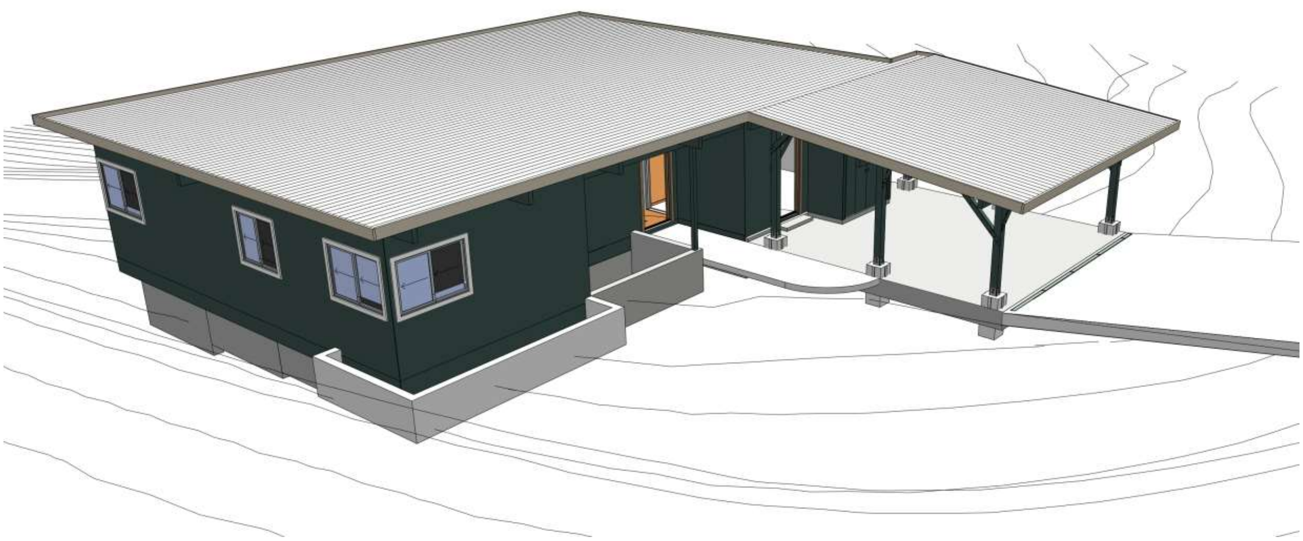
Site map - Marin County web site [Fig: 0101.02]

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
 318â€”14

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

 AISI
 American Iron and Steel Institute
 25 Massachusetts Avenue, NW Suite 800
 Washington, DC 20001
 AISI S100â€”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
 7â€”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 NDSâ€”2018
 National Design Specification (NDS) for
 Wood Constructionâ€”with 2018 NDS Supplement
 ANSI/AWC SDPWSâ€”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
```

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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
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Math and Text Abbreviations **SECTION 06**

Math

$\mathrm{D} =$ dead load

$\mathrm{DL} =$ dead load

$\mathrm{L} =$ live load

$\mathrm{LL} =$ live load

$\mathrm{E} =$ earthquake load

$\mathrm{F_a} =$ acceleration site coefficient

$\mathrm{F_v} =$ velocity site coefficient

$\mathrm{F_N} =$ normal wind force

$\mathrm{GC_{Ms}} =$ net moment static coefficient

$\mathrm{GC_{Md}} =$ net moment dynamic coefficient

$\mathrm{GC_M} =$ net moment coefficient

$\mathrm{GC_P} =$ net pressure coefficient

$\mathrm{k_{\mathbf{1}}} =$ hazard coefficient

$\mathrm{k_{\mathbf{2}}} =$ terrain and structure coefficient

$\mathrm{k_{\mathbf{3}}} =$ topography coefficient

$\mathrm{Kzt} =$ topographic Factor

$\mathrm{K_z} =$ velocity pressure exposure coefficient

$\mathrm{MRI} =$ mean return interval

$\mathrm{p_d} =$ net design wind pressure on module - Pa

$\mathrm{SDOF} =$ single degree of freedom

$\mathrm{S_s} =$ short period mapped acceleration

$\mathrm{S_{DS}} =$ site design response acceleration

$\mathrm{S_{\mathbf{1}}} =$ 1 second period mapped acceleration

$\mathrm{S_{MS}} =$ short period parameter

$\mathrm{S_{M\mathbf{1}}} =$ 1 second period parameter

$\mathrm{T} =$ fundamental period of structure

$\mathrm{T_{\mathbf{0}}} =$ short period spectral cap

$\mathrm{T_S} =$ long period spectral cap

$\mathrm{V_b} =$ basic wind speed

$\mathrm{V_B} =$ seismic design base shear

$\mathrm{W} =$ wind load

$\mathrm{W} =$ 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	Boundry
CBC	Califiornia Building Code
CRC	Califiornia 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) + l.6(L + H) + 0.5(L
Equation 16-3	1.2(D + F) + l.6(Lr or S or R) + l.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 + l.6H + f2S
Equation 16-6	0.9D+ l.0W+ l.6H
Equation 16-7	0.9(D + F) + 1.0E+ l.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
------	------	------	------
extwalldl1	8.5 psf	0.41 KPa	Total exterior wall unit load

Areas [Table: 0102.07]

variable	value	[value]	description
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

Roof weight [Equ: 0102.01]

$$\mathrm{rfwt}_1 = \mathrm{arearf}_1 \cdot \mathrm{roofdl}_1$$

rfwt1	arearf1	roofdl1
15300.00 lbs [68.06 KN]	1700.00 sf	9.00 psf

Floor weight [Equ: 0102.02]

$$\mathrm{flrwt}_1 = \mathrm{areaflr}_1 \cdot \mathrm{floordl}_1$$

flrwt1	floordl1	areaflr1
12600.00 lbs [56.05 KN]	10.50 psf	1200.00 sf

Partition weight [Equ: 0102.03]

$$\mathrm{partwt}_1 = \mathrm{htwall}_1 \cdot \mathrm{intwalldl}_1 \cdot \mathrm{lenwall}_1$$

partwt1	intwalldl1	htwall1	lenwall1
8910.00 lbs [39.63 KN]	9.00 psf	9.00 ft	110.00 ft

Exterior wall weight [Equ: 0102.04]

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

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]

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

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]

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

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]

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

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

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

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

$$\text{ewalldens}_1 = \frac{\text{extwalldl}_1}{0.5 \cdot \text{IN}}$$

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]

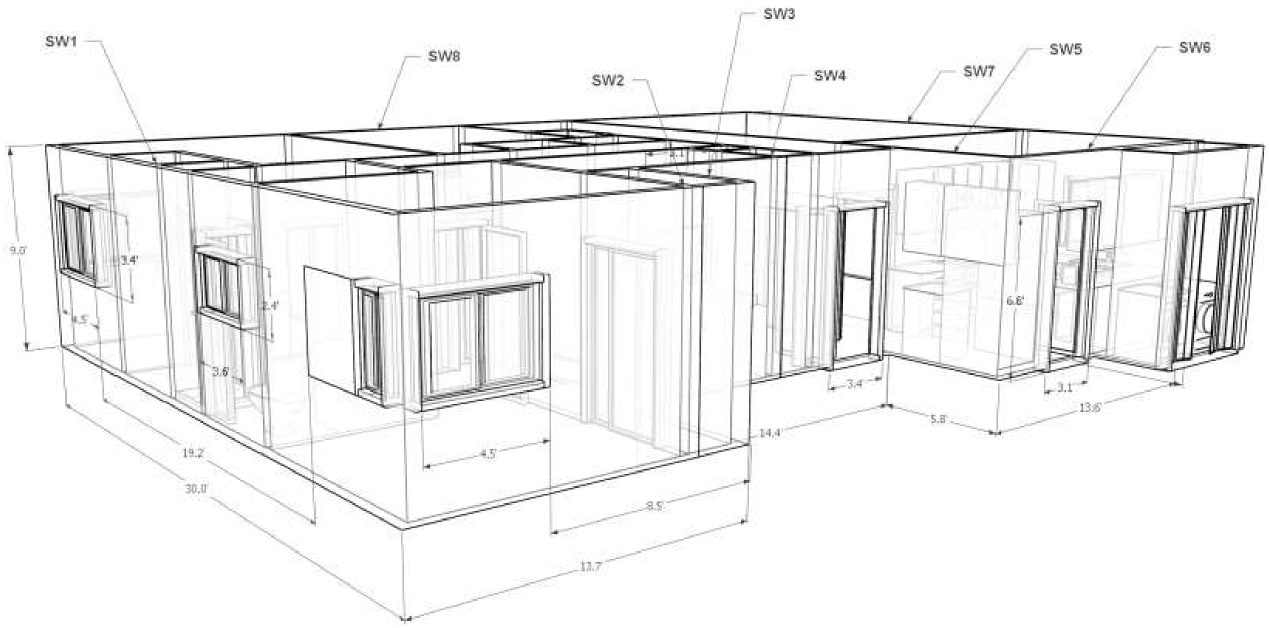
Seismic Design Category	One story or top story of two story	Wall supporting light-framed second story and roof	Wall supporting masonry second story and roof
Townhouses in C	20	25	35
D0 or D1	25	Not Permitted	Not Permitted
D2	30	Not Permitted	Not Permitted

The percent solid wall for each shear wall is:

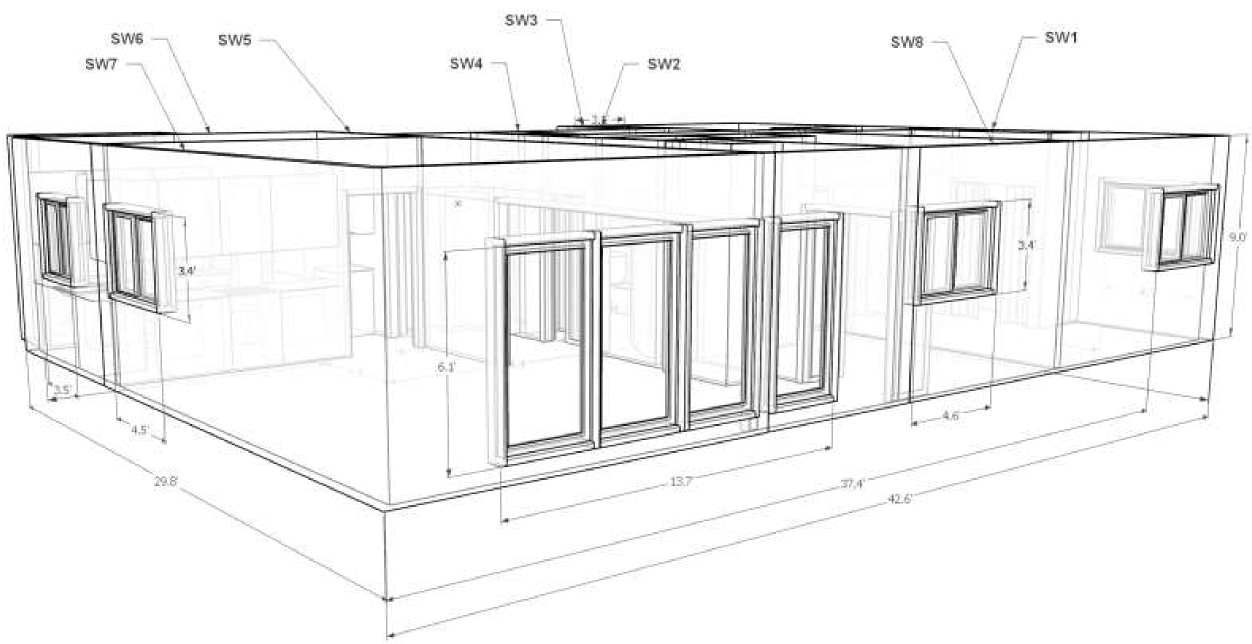
Percent Solid Shearwall [Table: 0201.02]

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.- 1/2 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.
19/32 in.- 1 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.
1/8 in.-1 1/4 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.

```
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 sdimension 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 l2.3.3A). 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.
```

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[5] Where moisture content of the framing is greater than
19% at time of fabrication, G, 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 CapacitynAdjustment Factor, Co [Table: 0201.06]

Wall Hght - h	Max Opening Hght [1]				
h	h/3	h/2	2h/3	5h/6	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-Hght 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, 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 coefficent [Equ: 0201.01]

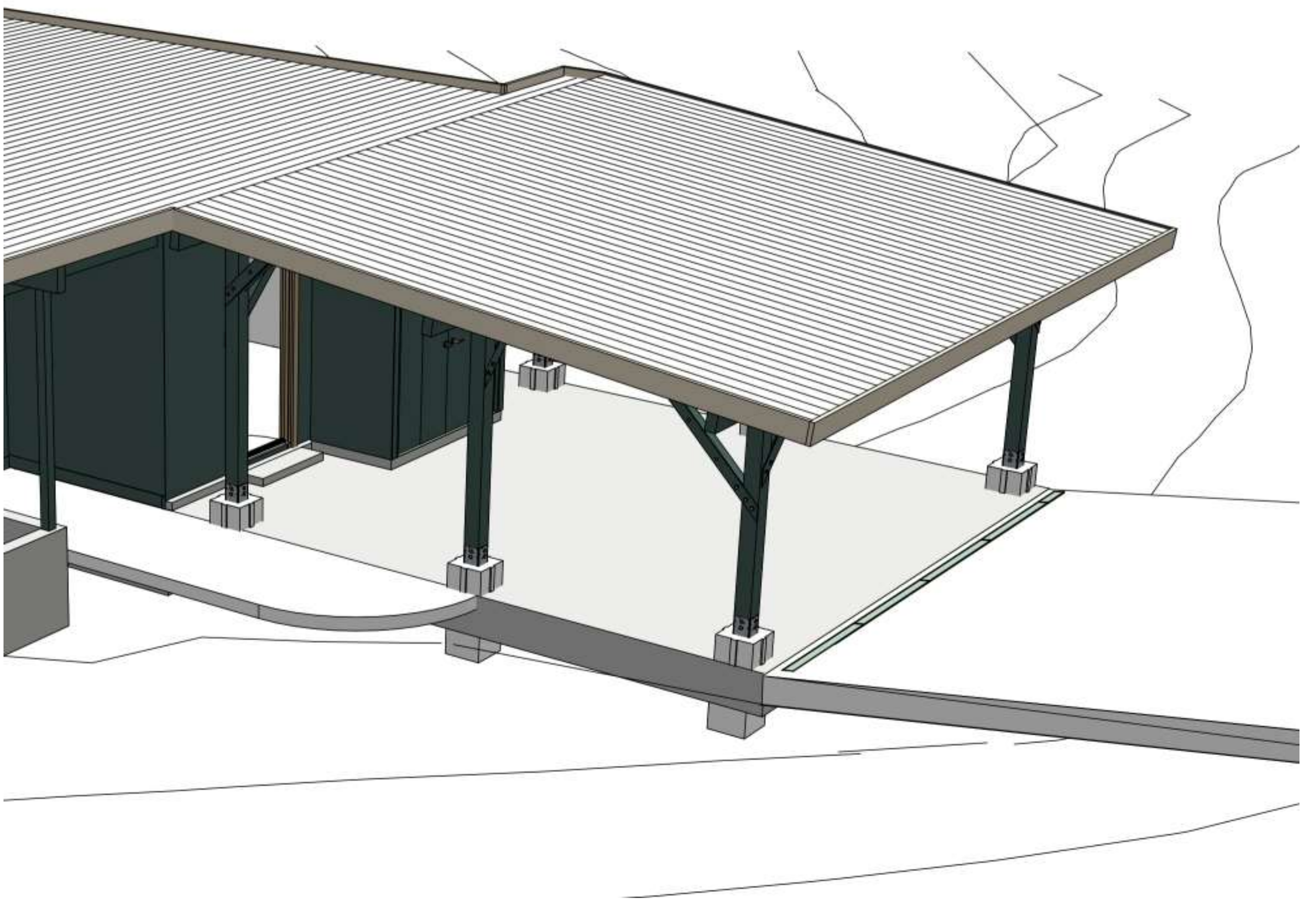
$$\mathrm{C_s} = \frac{\mathrm{SDS}}{\mathrm{R_1}}$$

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.

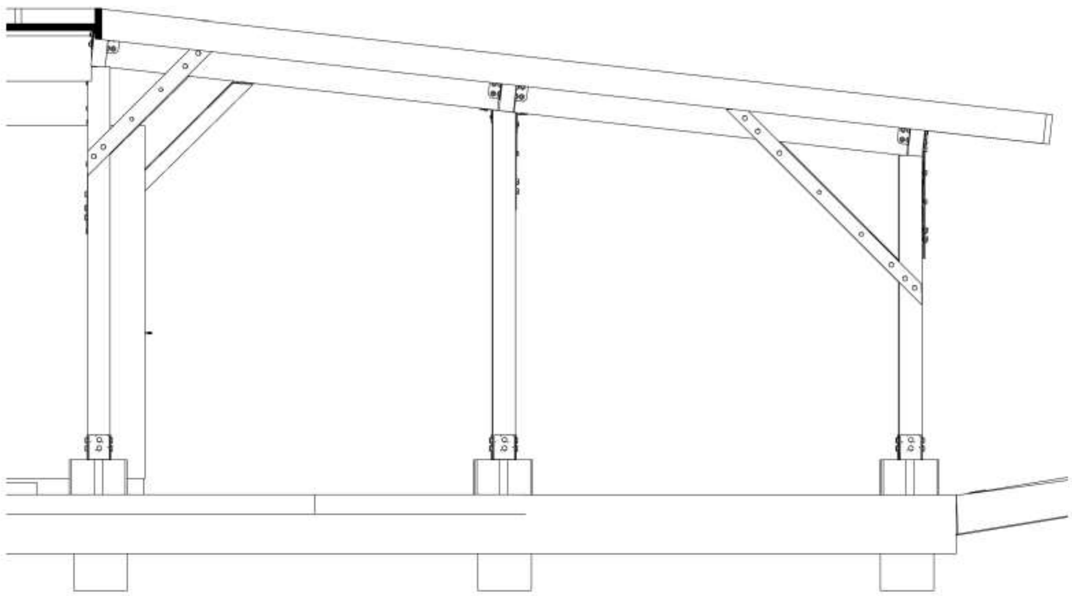


Carport [Fig: 0202.01]

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 postively 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]

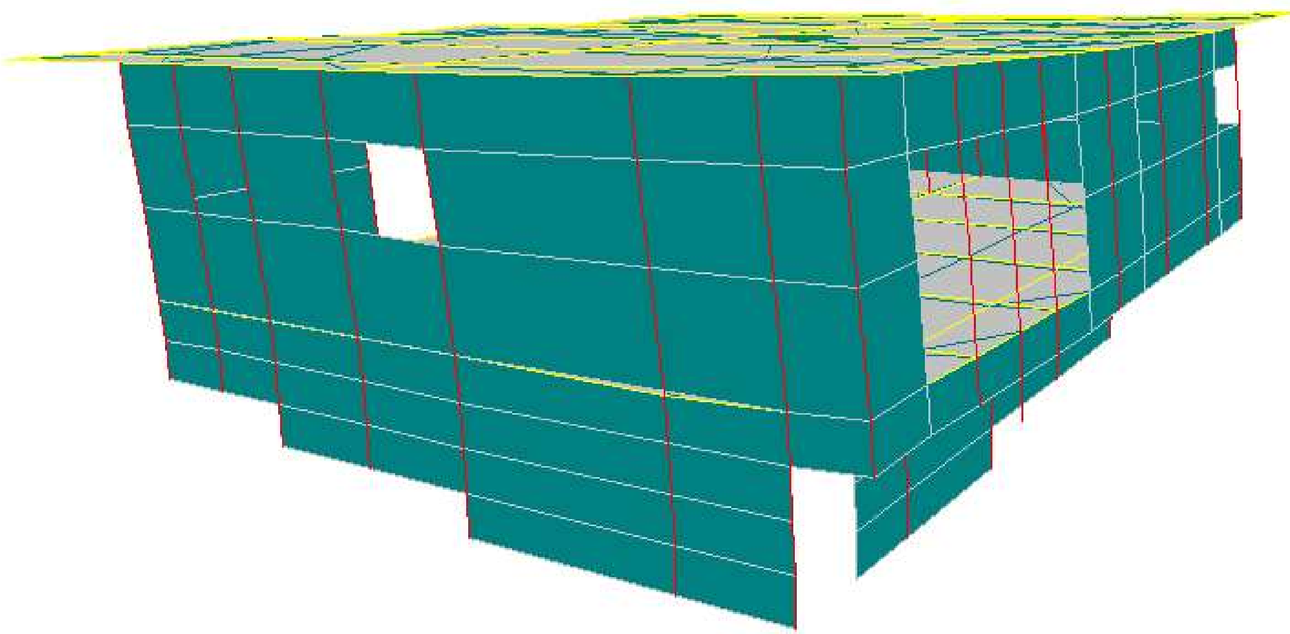
```
==========  =======  =========  ===================
variable      value    [value]  description
==========  =======  =========  ===================
SDS            1.00       1.00  short period design
R1             3.25       3.25  reduction factor
omega          2.00       2.00  overstrength factor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

Seismic coefficent [Equ: 0202.01]

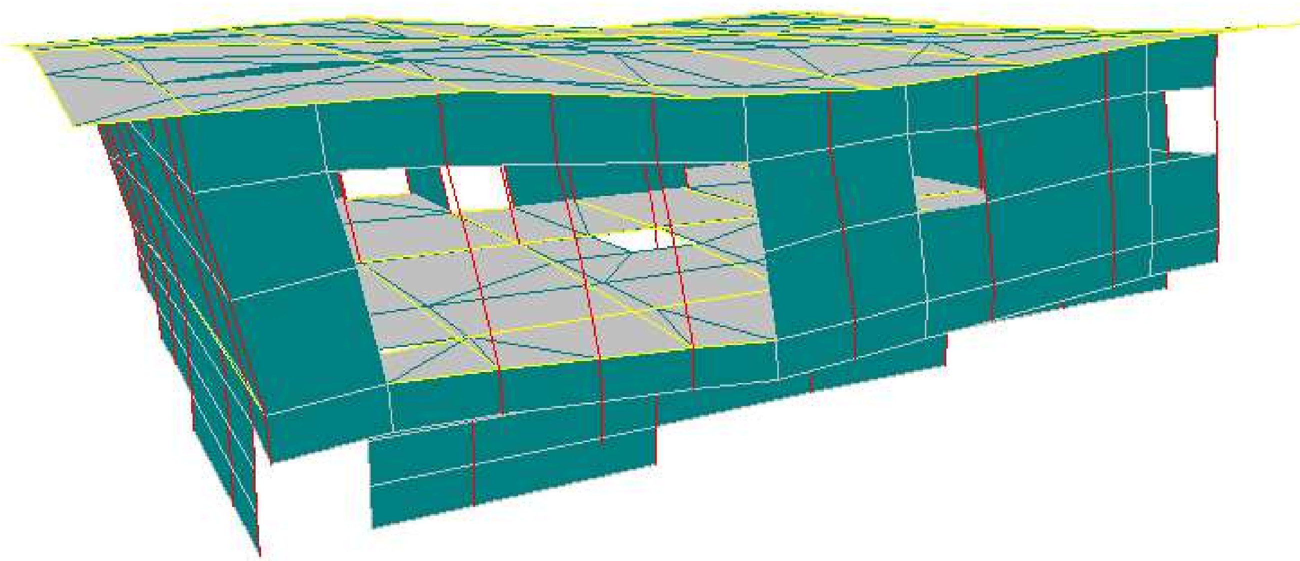
$$C_s = \frac{SDS}{R_1}$$

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

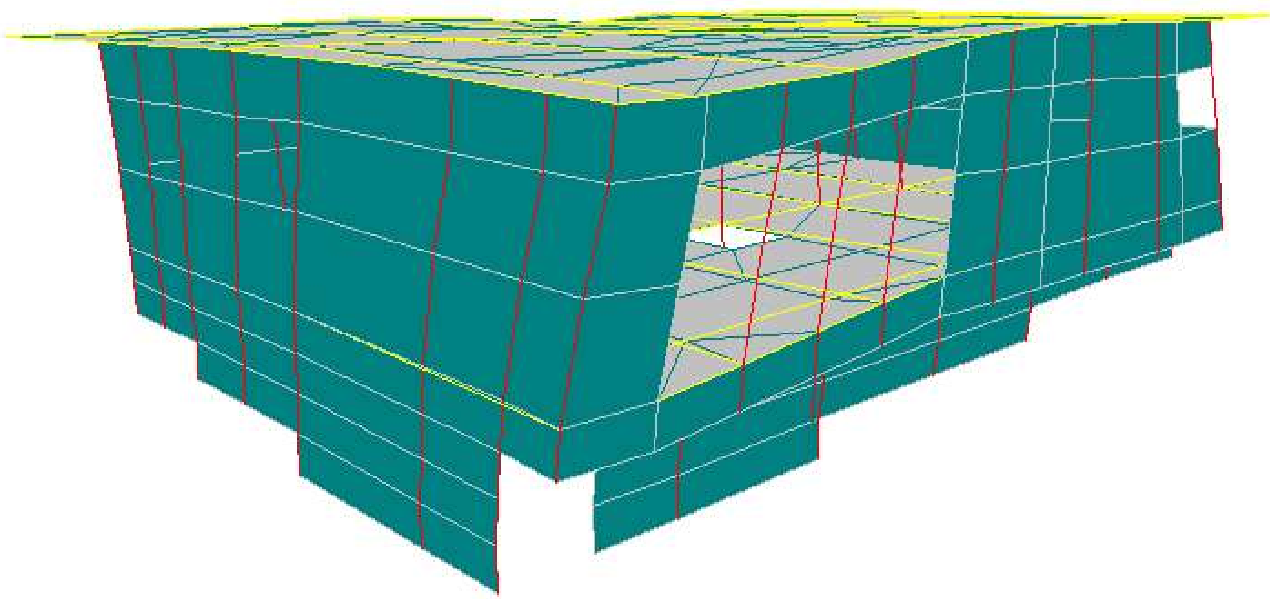
Seismic Demands for Exterior Walls **SECTION 01**



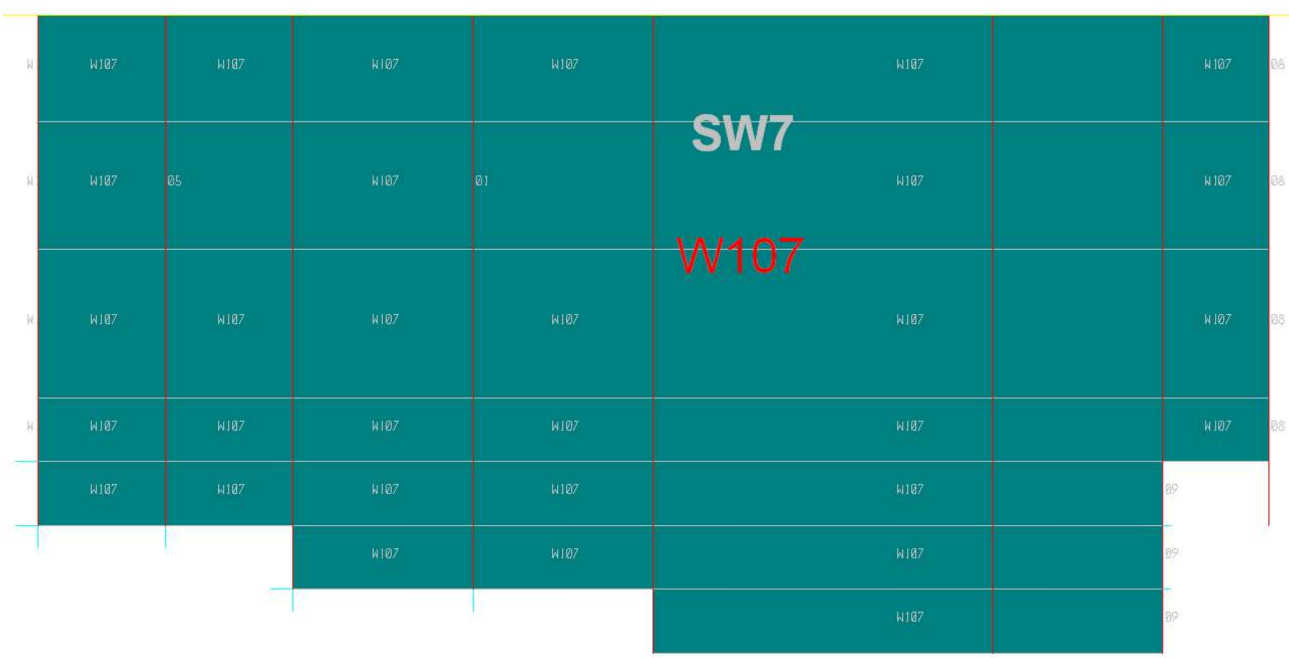
First Mode Deformation (visually amplified) [Fig: 0301.01]



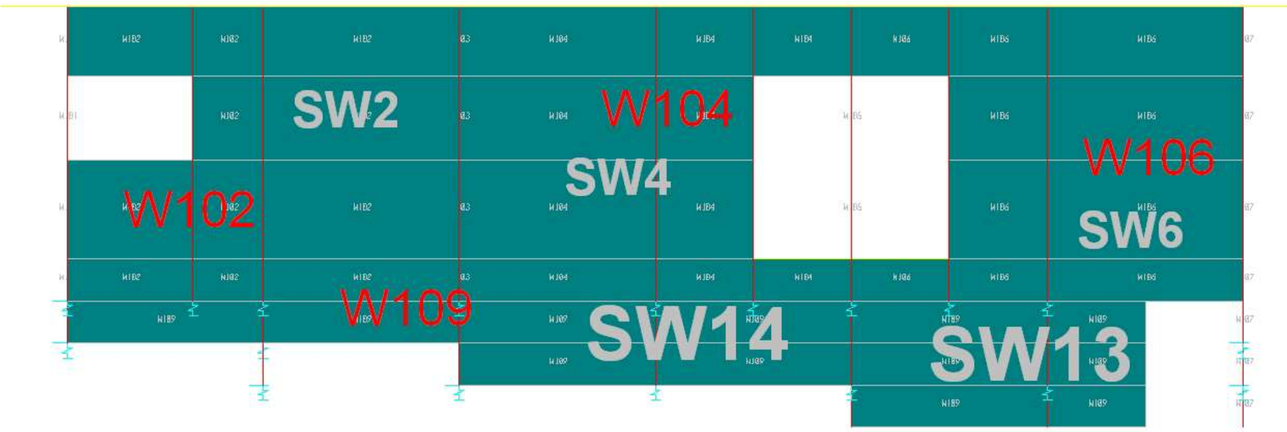
Second Mode Deformation (visually amplified) [Fig: 0301.02]



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 LTYP       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      LOCAL      LOCAL      LOCAL      LOCAL      LOCAL
              X-TRAN     Y-TRAN     Z-TRAN    XX-ROTN    YY-ROTN    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      MAJOR      MINOR      MINOR      AXIAL  TORSIONAL
              MOMENT      SHEAR     MOMENT      SHEAR      FORCE     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           FREQUENCY       CIRCULAR/FREQ
NUMBER                   (TIME)  (CYCLES/UNIT TIME) (RADIANS/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 NUMBER	X-TRANS DIRECTION	Y-TRANS DIRECTION	Z-ROTN 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
               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
```

ETABS Force and Displacement Summary [Table: 0301.04]

```
LOAD CASE DEFINITION DATA
LOAD LTYP       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      LOCAL      LOCAL      LOCAL      LOCAL      LOCAL
              X-TRAN     Y-TRAN     Z-TRAN    XX-ROTN    YY-ROTN    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      MAJOR      MINOR      MINOR      AXIAL  TORSIONAL
              MOMENT      SHEAR     MOMENT      SHEAR      FORCE     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                 PERIOD          FREQUENCY       CIRCULAR/FREQ
NUMBER                 (TIME)  (CYCLES/UNIT TIME) (RADIANS/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: 0301.06]

```
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	h/3	h/2	2h/3	5h/6	h
8’ Wall	2’-8”	4’-0”	5’-4”	6’-8”	8’-0”
10’ Wall	3’-4”	6-0”	6’-8”	8’-4”	10’-0”
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, ai,
```

```
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

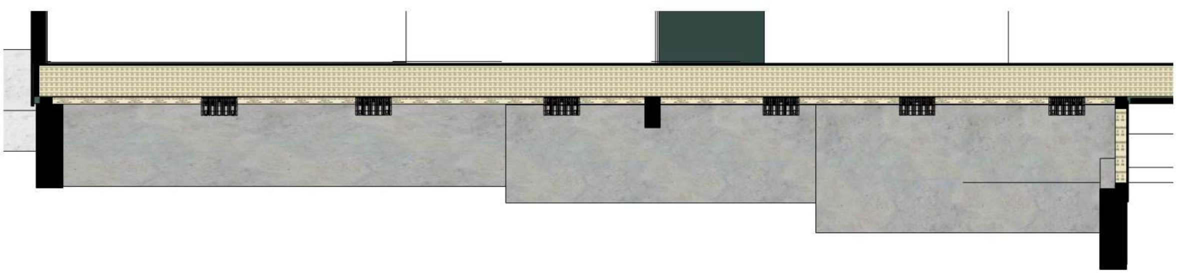
D-C ratios are shown for 6" oc boundary nails and estimated DC ratios if the existing 12" oc nailing is taken to have half the capacity. If the capacity is reduced by half to account for the 12" oc boundary nailing the shear walls have the capacity to meet the design loads.

First Floor D-C Ratio [Table: 0301.10]

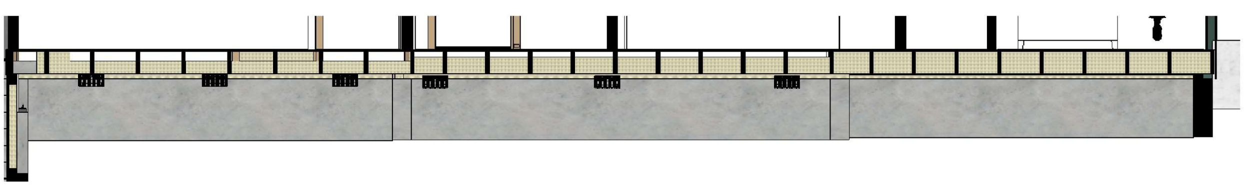
Label	Type	Vd (lbs)	Vc (lbs)	D-C (6”)	D-C (12”)
SW1	wall	4000	12948	0.3	0.6
SW2	wall	1500	6198	0.25	0.5
SW3	wall	-	-	-	-
SW4	wall	1500	5990	0.25	0.5
SW5	wall	-	-	-	-
SW6	wall	1500	6365	0.25	0.5
SW7	wall	4000	13572	0.3	0.6
SW8	wall	4000	12012	0.3	0.6

Seismic D-C ratios for Foundation Walls **SECTION 03**

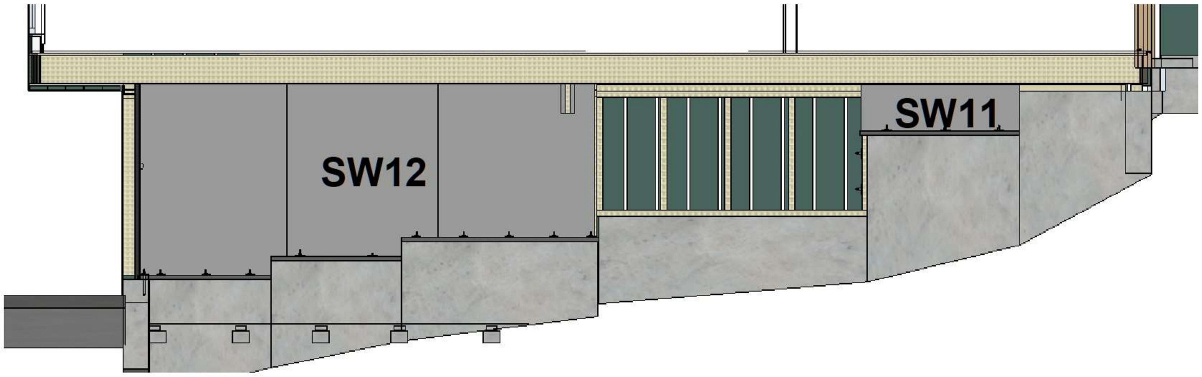
Foundation retrofits included Simpson retrofit foundation plates (URFP) and plywood shear walls with boundary nailing at 4" oc (see table 0201.05). The URFP capacity is 1500 lbs and the shear wall capacity is 960 plf.



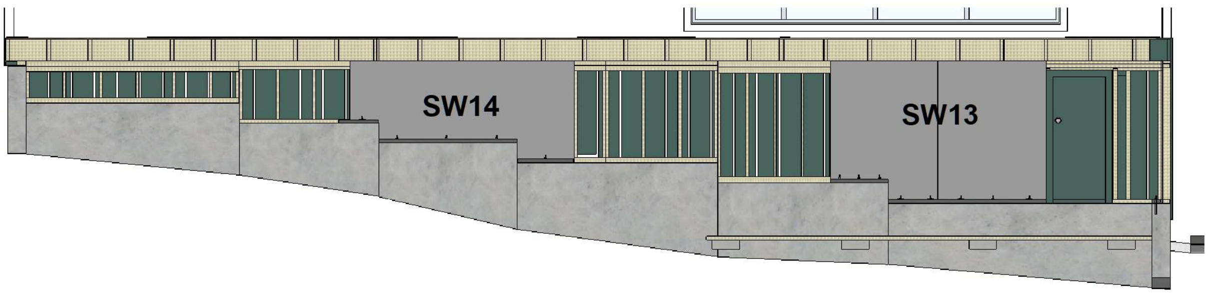
SW1 - North Elevation URFP [Fig: 0301.08]



SW4, SW6 - West Elevation URFP [Fig: 0301.09]



SW11, SW12 - South Elevation [Fig: 0301.10]

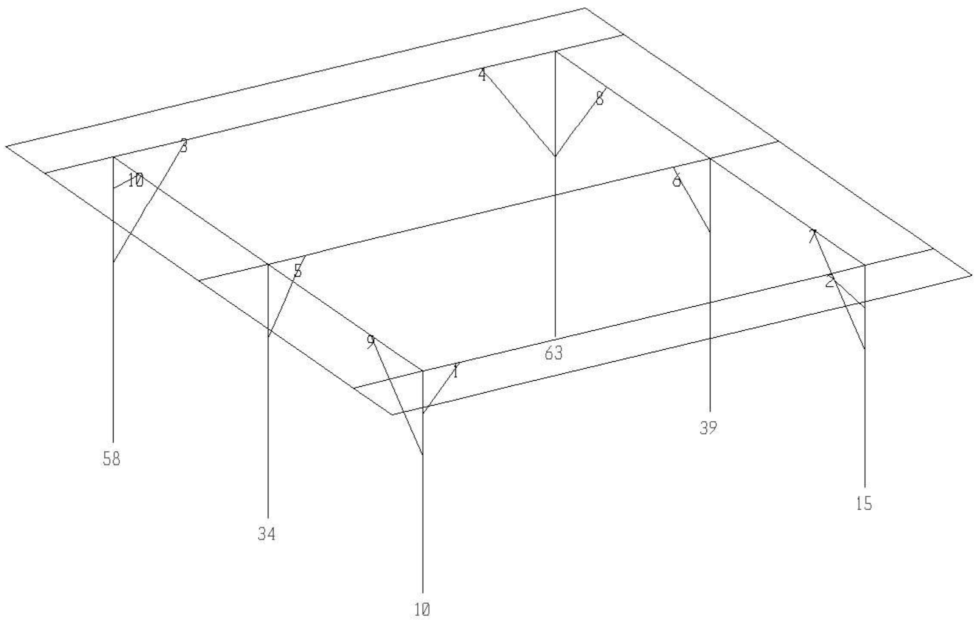


SW13, SW14 - East Elevation [Fig: 0301.11]

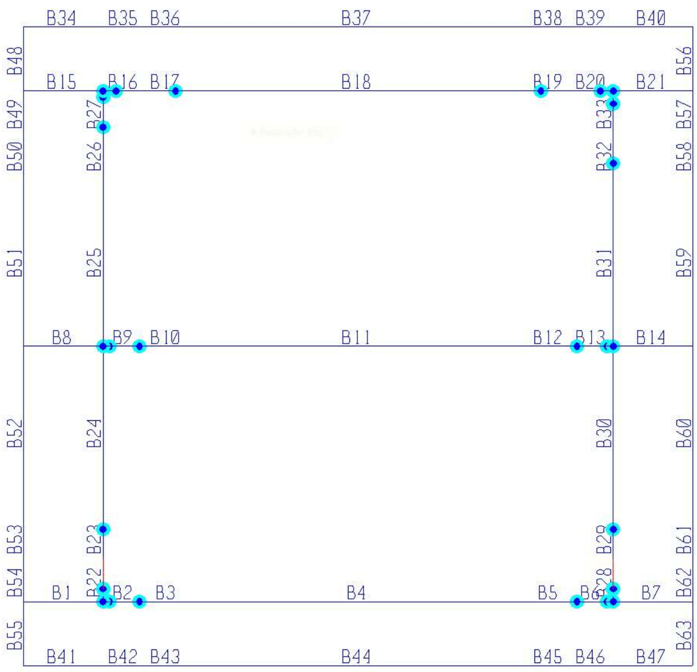
Foundation D-C Ratio [Table: 0301.11]

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

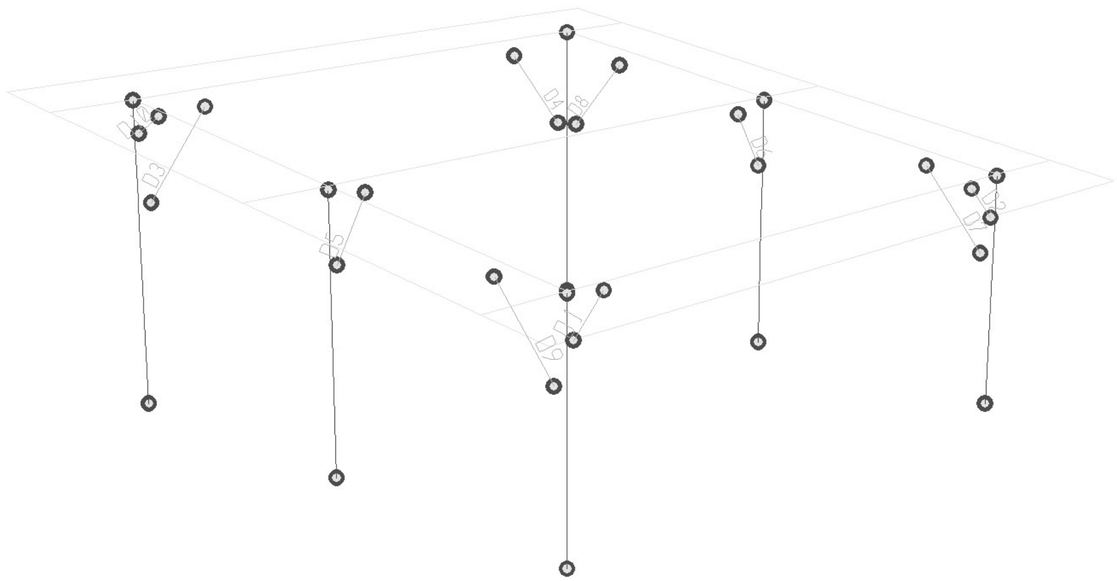
Seismic Demands for Carport Braces and Beam Connections **SECTION 01**



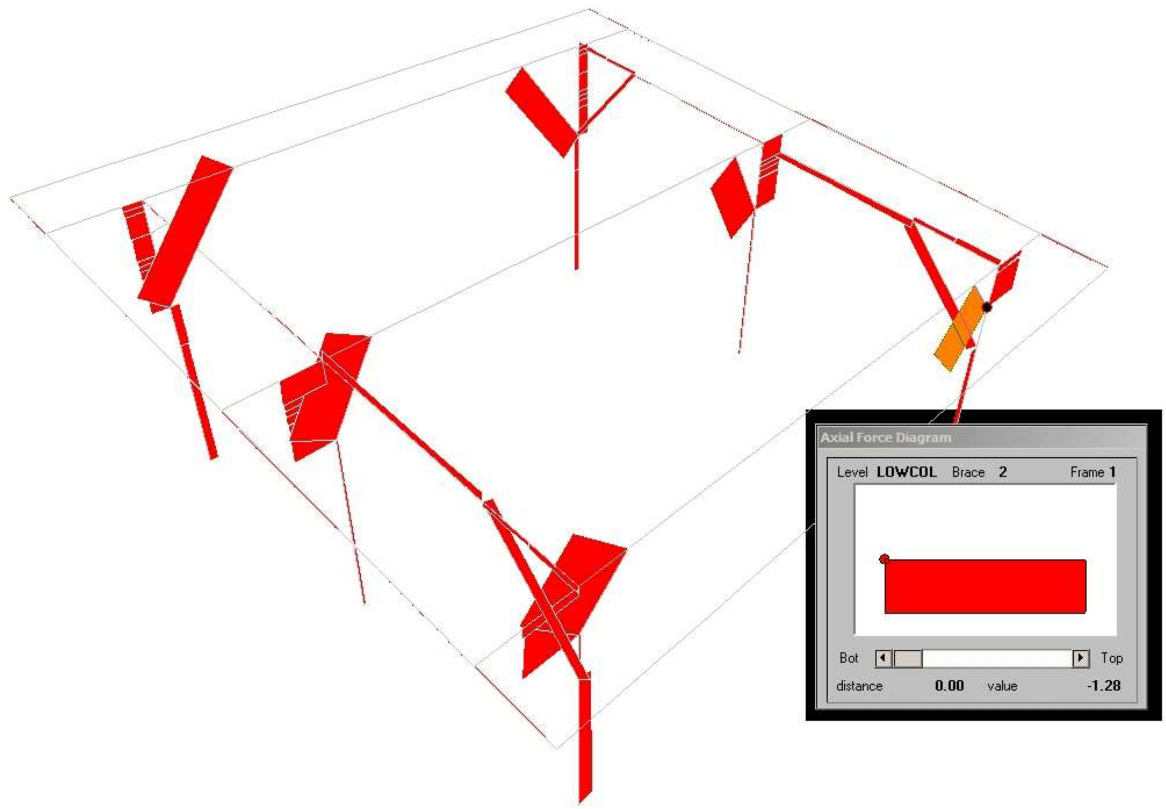
Column and Brace Numbers [Fig: 0302.01]



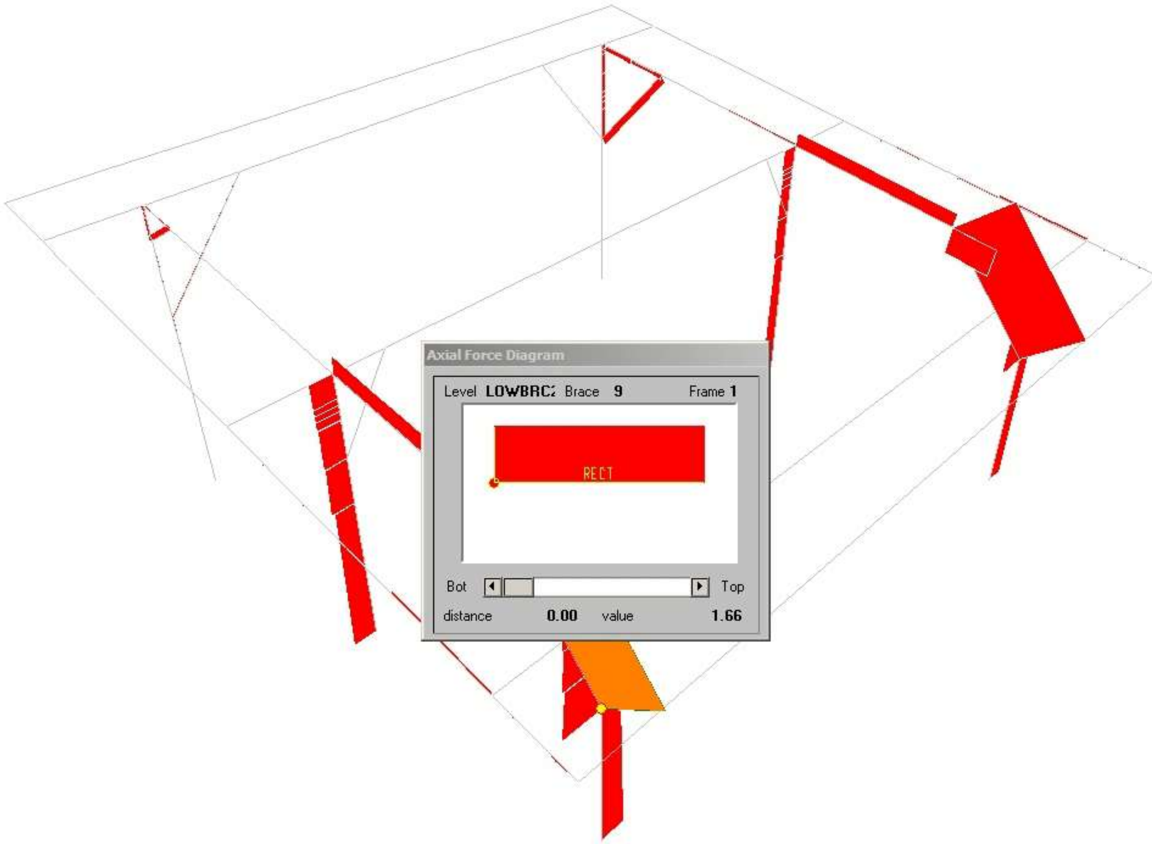
Beam Numbers [Fig: 0302.02]



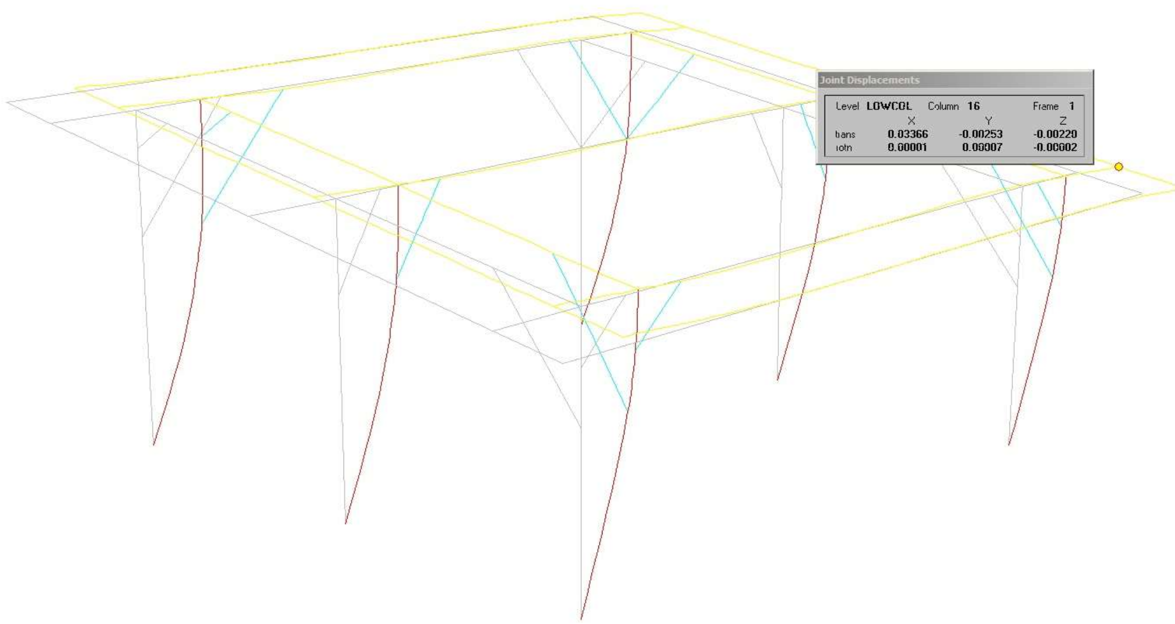
Element Pin Connections [Fig: 0302.03]



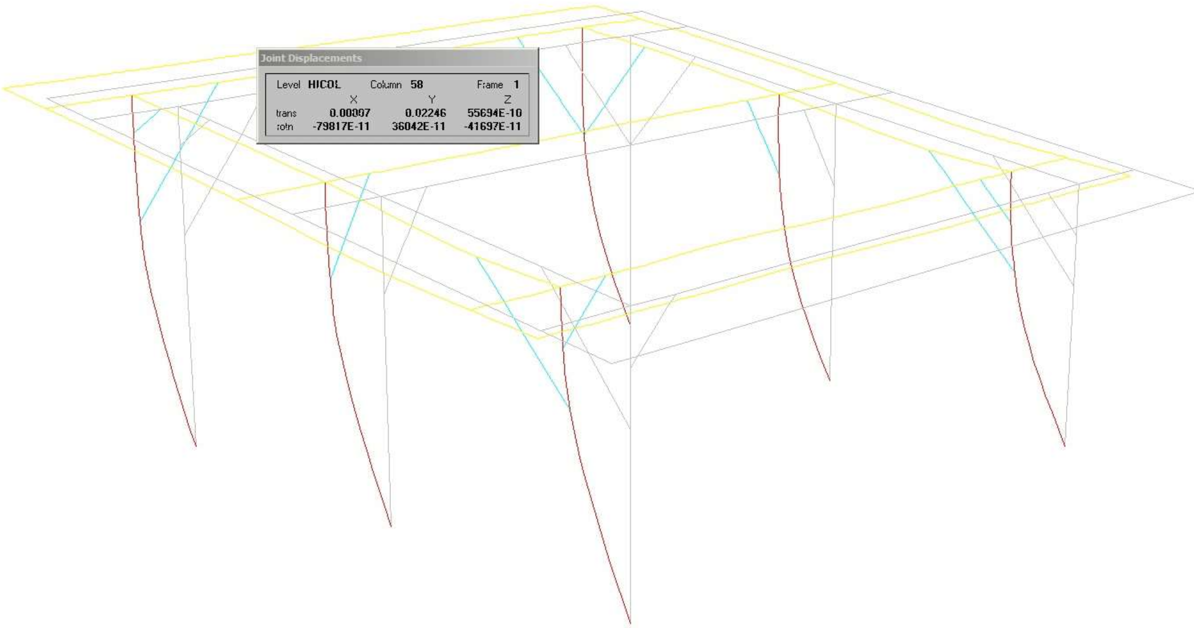
Axial Forces - Transverse Seismic [Fig: 0302.04]



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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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    POISSONS        UNIT        UNIT    COEFF OF
            MODULUS       RATIO      WEIGHT        MASS   EXPANSION
   1    O  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     THICK
   1  RECT                1     5.500     5.500     0.000     0.000
SECTION PROPERTY REDUCTION FACTORS FOR  COLUMNS
            TORSION       MAJOR       MINOR
   ID             J           I           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           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     THICK
   1  RECT                1    11.250     0.000     3.500     0.000     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   MAT    FLOOR    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
F R A M E   C O N T R O L   I N F O R M A T I O N
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     FLOOR
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
                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
```

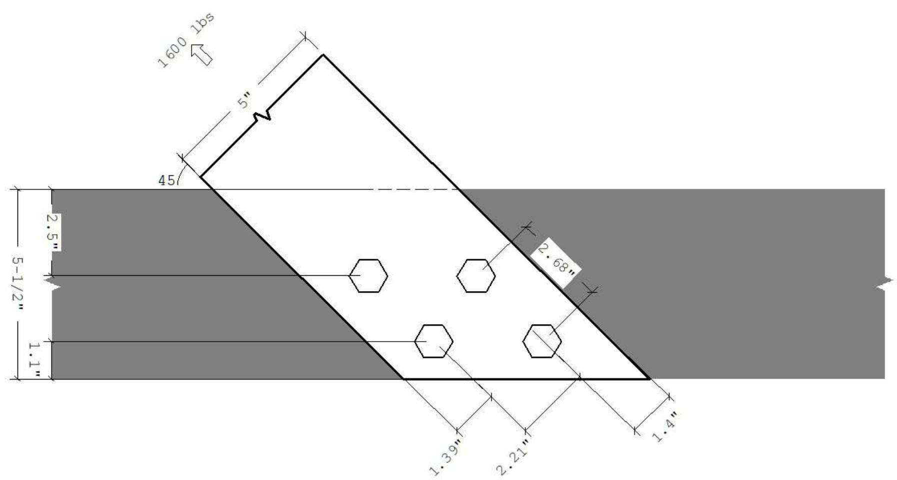
```
LOWBC2       Y     0.00000   0.00000   0.00000   0.00004   0.00038   0.00000
LOWBC2    ROTZ     0.00000   0.00000   0.00000   0.00000   0.00000   0.00000

STRUCTURAL TIME PERIODS AND FREQUENCIES
MODE                  PERIOD           FREQUENCY       CIRCULAR/FREQ
NUMBER                  (TIME)  (CYCLES/UNIT TIME) (RADIANS/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.



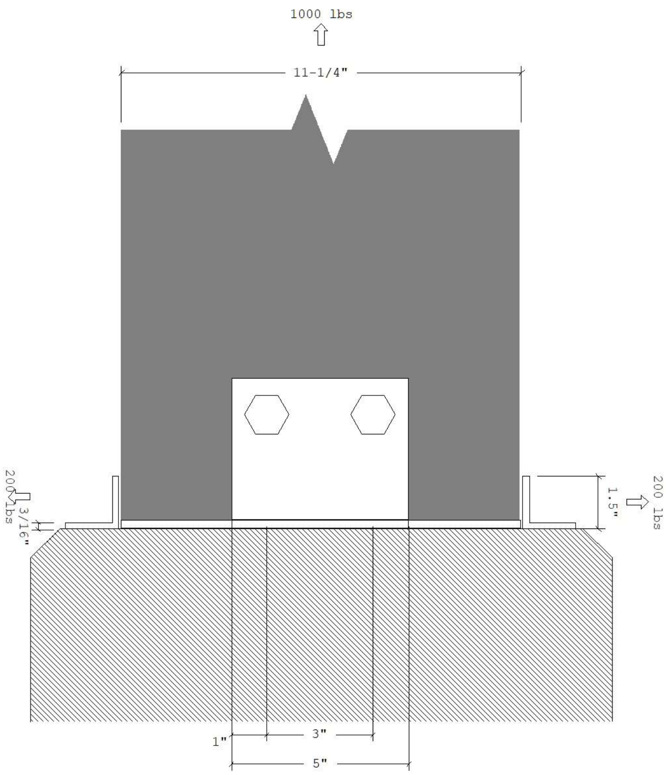
Brace plate reinforcement (two-bolt rows shown - one row analyzed) [Fig: 0302.08]

```
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        IIIm      IIIs      IV
      2868      1510      1304      1593       812      1128
```

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

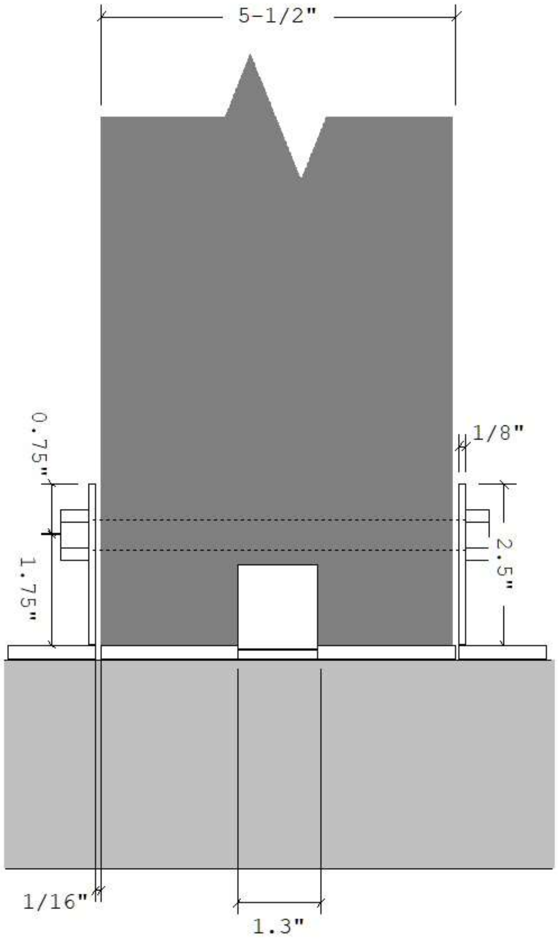
Beam to beam angle connections provide a load path for drag forces and loss of bearing if columns shift in an earthquake.




```
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 <= 100 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 lbs   Resistance Tr = 12238 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        IIIm      IIIs      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        IIIm      IIIs      IV
      3850      2719      -          -        1430      1963
```