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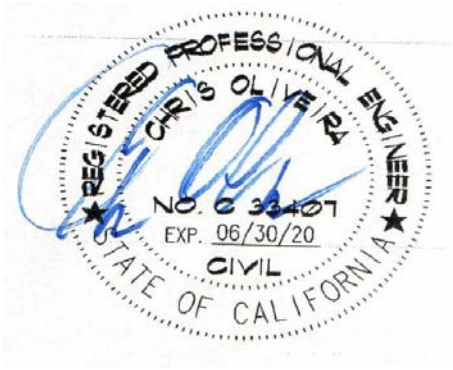
STRUCTURAL CALCULATIONS

RICE RESIDENCE

REVISED FOR PLAN CHECK (30 LB SNOW)

AUGUST 22,2019

2015 IBC 2016 CBC
ASCE 7 - 10
WIND EXPOSURE B
110 MPH
SDC - D
SITE CLASS D



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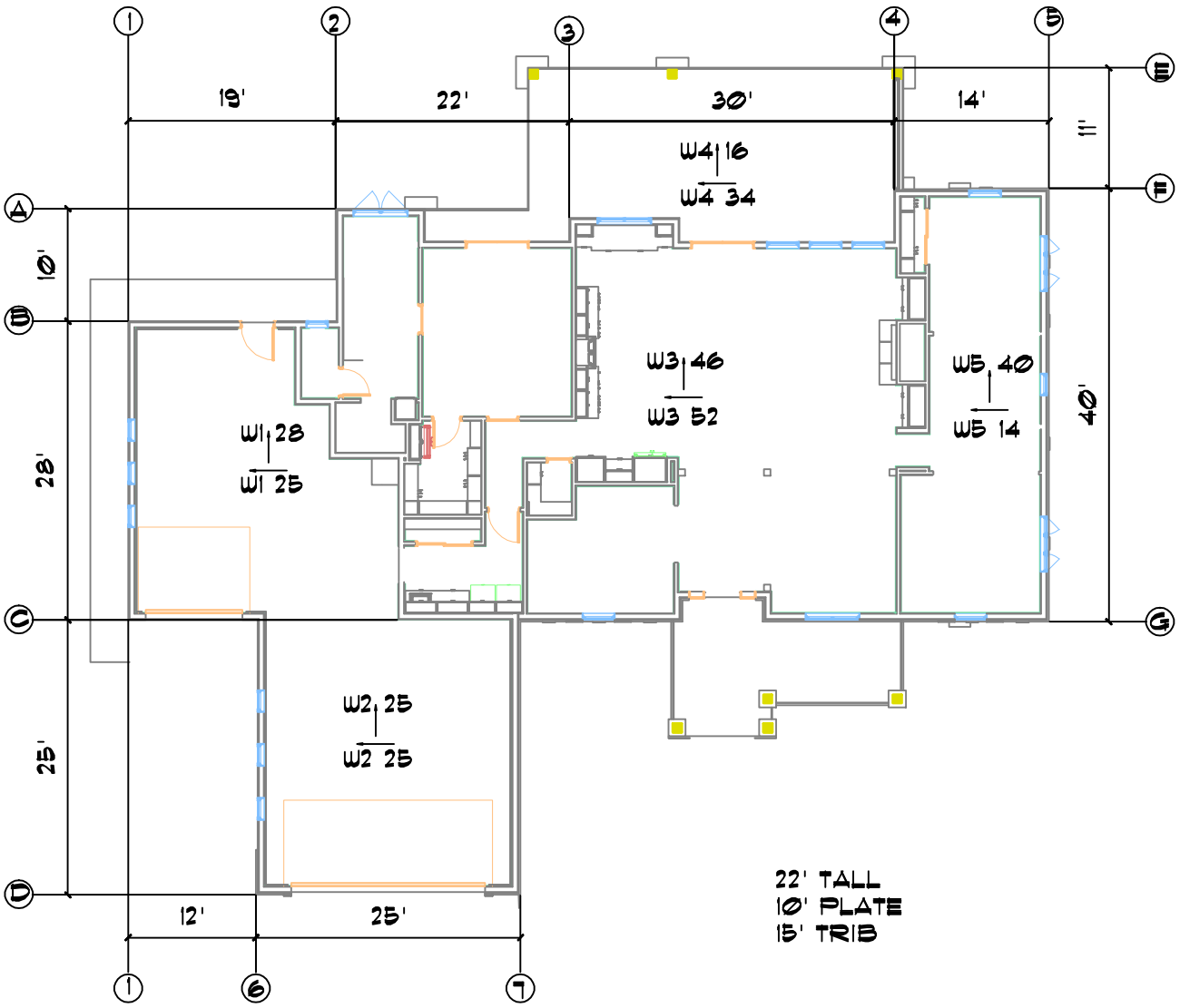
REGISTERED PROFESSIONAL ENGINEER
CHRIS OLIVEIRA
NO. C 33407
EXP. 06/30/20
CIVIL
STATE OF CALIFORNIA



LAYOUT			PAGE 1
No Scale	5/30/19	C.O.	

Rice

residence

These calculations were prepared by Chris Oliveira

CalcSet Version 2.0 www.CalcSet.com

File: C:\calcset\Rice paradise 8 20 19C.xls August 22, 2019

CHRIS OLIVEIRA AND ASSOCIATES	project	*Rice residence*	
	by	*CO*	no.
	date	*6/1/19*	*1*

DESIGN LOADS

Roof Load	*Roofing……..*	*10.8*		
	Sheathing…… ……..	*1.6*		
	Framing…… ……..	*4.3*		
	Insulation…… ……..	*1.6*		
	Ceiling…….. ……..	*2.2*		
	Miscellaneous…… ……..	*2.2*		
	(DL has been factored for roof slope)			
	DL	***22.7***	*psf*	
	snow	***30.0***	*psf*	*(5:12)*
Floor Load	*Flooring…… ……..*	*10.0*		
	Sheathing…… ……..	*2.3*		
	Framing…… ……..	*2.0*		
	Insulation…… ……..	*1.0*		
	Ceiling…….. ……..	*1.0*		
	Miscellaneous…….(Mech, Elect, etc)……	*1.0*		
	DL	***17.3***	*psf*	
	LL	***40.0***	*psf*	

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	2

DESIGN LOADS

Wall Load	Ext Finish	10.0
	Int Finish	2.2
	Framing	1.7
	Insulation	0.5
	Misc	0.6
	DL	**15.0** psf

ASD

ON THE TENSION SIDE OF OVERTURNING, USE 12.4.3

E = rho Qe - (.6 - .14Sds)D

MODIFICATION FOR D = 0.52286

WHEN Vs GOVERNS

LATERAL

SEISMIC

V = Cs W *12.8.1.1 - page 71*

Cs = Sds / (R / Ie) X RHO

RHO = 1.3

Sds = 0.551 *FROM THE USGS WEBSITE*

R = 6.5

Ie = IMPORTANCE FACTOR - *TABLE 1.5-2 FOR RISK CATEGORY II = 1*

MULTIPLY BY 0.7 FOR ASD CONVERSION

Cs = 0.1102

*q = .00256 * Kz * K zt * K d * V squared* *eq 27.3-1 page 204*

Kd = wind directionality - 26.6 - table 26.6-1 *USE 0.85*

Kz - vel press coeff - table 27.3.1 *USE 0.66*

	B	C
25	0.66	0.94

K zt= 1 *NO TOPO EFFECTS*

V = velocity = 110 *V squared = 12100*

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	4

LATERAL

qz = 17.3775 psf

p = q (G Cpf - Gcpi) PSF EQ 28.4-1 PAGE 240

G Cf - EXTERNAL PRESS COEFF 0.56 TABLE 28.4-1

ZONE 1

7:12 30.25

G Cpi - INTERNAL PRESSURE COEFF - TABLE 26.11-1 USE -0.18

MULTIPLY BY 0.6 FOR ASD CONVERSION

p = 12.8594 PSF

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	5

LATERAL

North / South

W(1): Wind = (12.9)(15')= 194 plf
Seismic = 0.1102[22.7(28')+15(5')(2)] = 87 plf

W(2): Wind = (12.9)(10')= 129 plf
Seismic = 0.1102[22.7(25')+15(5')(2)] = 79 plf

W(3): Wind = (12.9)(10')= 129 plf
Seismic = 0.1102[22.7(46')+15(5')(2)] = 132 plf

W(4): Wind = (12.9)(5')= 65 plf
Seismic = 0.1102[22.7(16')] = 40 plf

W(5): Wind = (12.9)(10')= 129 plf
Seismic = 0.1102[22.7(40')+15(5')(2)] = 117 plf

Line 1 :
Vw = (194plf)(9.5') = **1843** lb
Vs = (87plf)(9.5') = **827** lb
W1

Line 2 :
Vw = (194plf)(12.5')+(129plf)(11') = **3844** lb
Vs = (87plf)(12.5')+(132plf)(11') = **2540** lb
W1 W3

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	6

LATERAL

Line 3 :

Vw = (129plf)(26') = **3354** lb

Vs = (132plf)(26')+(40plf)(17') = **4112** lb
W3 W4

Line 4 :

Vw = (129plf)(15')+(129plf)(7') = **2838** lb

Vs = (132plf)(15')+(40plf)(17')+(117plf)(7') = **3479** lb
W3 W4 W5

Line 5 :

Vw = (129plf)(7') = **903** lb

Vs = (117plf)(7') = **819** lb
W5

Line 6 :

Vw = (129plf)(12.5') = **1613** lb

Vs = (79plf)(12.5')+(87plf)(9.5') = **1814** lb
W2 W1

Line 7 :

Vw = (129plf)(12.5') = **1613** lb

Vs = (79plf)(12.5') = **988** lb
W2

Line 1 :

V_{wind} = 1843 lb

$V_{seismic}$ = 827 + 0.1102[(15 psf)(10')(16')] = 1091 lb

$$v_{walls} = \frac{1843}{8+8} = 115 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 6"oc (260 plf)

Use 1/2" values for 3/8" plywood

[5/8 dia AB @ 60"oc (298 plf)]

Uplift Analysis (8' Wall)

M_{OT} = (115plf)(8')(10') = 9200 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(10')](8')(8'/2) = 5137 ft-lb

$$T_{up} = \frac{9200 - 5137}{8} = 508 \text{ lb}$$

Simpson HDU2
(3075 lb)

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	7

LATERAL

Line 2 :

V_{wind} = 3844 lb

$V_{seismic}$ = 2540 + 0.1102[(15 psf)(10')(10')] = 2705 lb

$$v_{walls} = \frac{3844}{10} = 384 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 3"oc (490 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 32"oc (558 plf)]

Uplift Analysis (10' Wall)

M_{OT} = (384plf)(10')(10') = 38400 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(10')](10')(10'/2) = 8027 ft-lb

$$T_{up} = \frac{38400 - 8027}{10} = 3037 \text{ lb}$$

Simpson HDU2
(3075 lb)

Line 3 :

V_{wind} = 3354 lb

$V_{seismic}$ = 4112 + 0.1102[(15 psf)(14')(24')] = 4667 lb

$$v_{walls} = \frac{4667}{8+16} = 194 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 6"oc (260 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 60"oc (298 plf)]

Uplift Analysis (8' Wall)

M_{OT} = (194plf)(8')(14') = 21728 ft-lb

M_{RES} = 0.9[(11.868922psf)(4')+(7.8429psf)(14')](8')(8'/2) = 4530 ft-lb

$$T_{up} = \frac{21728 - 4530}{8} = 2150 \text{ lb}$$

Simpson HDU2
(3075 lb)

ON THE TENSION SIDE OF OVERTURNING, USE 12.4.3

E = rho Qe - (.6 - .14Sds)D

MODIFICATION FOR D = 0.52286

WHEN Vs GOVERNS

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	8

LATERAL

Line 4 :

V_{wind} = 2838 lb

$V_{seismic}$ = 3479 + 0.1102[(15 psf)(14')(25')] = 4058 lb

$$v_{walls} = \frac{4058}{6+7+12} = 162 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 6"oc (260 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 60"oc (298 plf)]

Uplift Analysis (6' Wall)

M_{OT} = (162plf)(6')(14') = 13608 ft-lb

M_{RES} = 0.9[(11.868922psf)(4')+(7.8429psf)(14')](6')(6'/2) = 2548 ft-lb

$$T_{up} = \frac{13608 - 2548}{6} = 1843 \text{ lb}$$

Simpson HDU2
(3075 lb)

ON THE TENSION SIDE OF OVERTURNING, USE 12.4.3

E = rho Qe - (.6 - .14Sds)D

MODIFICATION FOR D = 0.52286

WHEN Vs GOVERNS

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	9

LATERAL

Line 5 :

V_{wind} = 903 lb

$V_{seismic}$ = 819 + 0.1102[(15 psf)(10')(17')] = 1100 lb

$$v_{walls} = \frac{1100}{7+10} = 65 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 6"oc (260 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 60"oc (298 plf)]

Uplift Analysis (17' Wall)

M_{OT} = (65plf)(17')(10') = 11050 ft-lb

M_{RES} = 2/3[(11.868922psf)(6')+(7.8429psf)(10')](17')(17'/2 = 14416 ft-lb

$$T_{up} = \frac{11050 - 14416}{40} = 0 \text{ lb}$$

No Holdowns Reqd

PERFORATED WALL

ON THE TENSION SIDE OF OVERTURNING, USE 12.4.3

E = rho Qe - (.6 - .14Sds)D

MODIFICATION FOR D = 0.52286

WHEN Vs GOVERNS

FOR RATIOS GREATER THAN 2:1: H = 10

Bs = 7

$$1.25 - 0.125 \times \frac{10}{7} = 1.07143$$

ADJUSTED SHEARWALL = 1.07143 X 260 = 278.571 > 65

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	10

LATERAL

Line 6 :

V_{wind} = 1613 lb

$V_{seismic}$ = 1814 + 0.1102[(15 psf)(10')(12')] = 2012 lb

$$v_{walls} = \frac{2012}{6+6} = 168 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 6"oc (260 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 60"oc (298 plf)]

Uplift Analysis (6' Wall)

M_{OT} = (168plf)(6')(10') = 10080 ft-lb

M_{RES} = 0.9[(11.868922psf)(12')+(7.8429psf)(10')](6')(6'/2) 3578 ft-lb

$$T_{up} = \frac{10080 - 3578}{6} = 1084 \text{ lb}$$

Simpson HDU2
(3075 lb)

ON THE TENSION SIDE OF OVERTURNING, USE 12.4.3

E = rho Qe - (.6 - .14Sds)D

MODIFICATION FOR D = 0.52286

WHEN Vs GOVERNS

Line 7 :

V_{wind} = 1613 lb

$V_{seismic}$ = 988 + 0.1102[(15 psf)(10')(24')] = 1385 lb

$$v_{walls} = \frac{1613}{24} = 67 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 6"oc (260 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 60"oc (298 plf)]

Uplift Analysis (24' Wall)

M_{OT} = (67plf)(24')(10') = 16080 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(10')](24')(24'/2) = 46234 ft-lb

$$T_{up} = \frac{16080 - 46234}{24} = 0 \text{ lb}$$

No Holdowns Reqd

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	11

LATERAL

East / West

W(1): Wind = (12.9)(15')= 194 plf
Seismic = 0.1102[22.7(25')+15(5')(2)] = 79 plf

W(2): Wind = (12.9)(15')= 194 plf
Seismic = 0.1102[22.7(25')+15(5')(2)] = 79 plf

W(3): Wind = (12.9)(15')= 194 plf
Seismic = 0.1102[22.7(52')+15(5')(2)] = 147 plf

W(4): Wind = (12.9)(5')= 65 plf
Seismic = 0.1102[22.7(34')] = 85 plf

W(5): Wind = (12.9)(15')= 194 plf
Seismic = 0.1102[22.7(14')+15(5')(2)] = 52 plf

Line A : Vw = (194plf)(23') = **4462** lb
Vs = (147plf)(23') = **3381** lb
W3

Line B : Vw = (194plf)(14') = **2716** lb
Vs = (79plf)(14') = **1106** lb
W1

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	12

LATERAL

Line C :

Vw = (194plf)(14')+(194plf)(12.5') = **5141** lb

Vs = (79plf)(14')+(79plf)(12.5') = **2094** lb

W1 W2

Line D :

Vw = (194plf)(12.5') = **2425** lb

Vs = (79plf)(12.5') = **988** lb

W2

Line F :

Vw = (65plf)(11')+(194plf)(20') = **4595** lb

Vs = (85plf)(11')+(52plf)(20') = **1975** lb

W4 W5

ROTATION OF FLEXIBLE DIAPHRAGM AT W4 TRANSFERS ALL LATERAL LOADS TO LINE F

Line G :

Vw = (194plf)(20') = **3880** lb

Vs = (52plf)(20')+(147plf)(23') = **4421** lb

W5 W3

Line A :

V_{wind} = 4462 lb

$V_{seismic}$ = 3381 + 0.1102[(15 psf)(10')(16')] = 3645 lb

$$v_{walls} = \frac{4462}{4+4+4+4} = 279 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 4"oc (380 plf)

Use 1/2" values for 3/8" plywood

[5/8 dia AB @ 16"oc (1116 plf)]

SHEAR BOTH SIDES

Uplift Analysis (4' Wall)

M_{OT} = (279plf)(4')(2)(10') = 22320 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(10')](4')(4'/2) = 1284 ft-lb

$$T_{up} = \frac{22320 - 1284}{4} = 5259 \text{ lb}$$

Simpson HDU5
(5645 lb)

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	13

LATERAL

FOR RATIOS GREATER THAN 2:1: H = 10

Bs = 4

$$1.25 - 0.125 \times \frac{10}{4} = 0.9375$$

ADJUSTED SHEARWALL = 0.9375 X 380 = 356.25 > 279

Line B :

V_{wind} = 2716 lb

$V_{seismic}$ = 1106 + 0.1102[(15 psf)(10')(10')] = 1271 lb

$$v_{walls} = \frac{2716}{10} = 272 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 4"oc (380 plf)

Use 1/2" values for 3/8" plywood

[5/8 dia AB @ 48"oc (372 plf)]

Uplift Analysis (10' Wall)

M_{OT} = (272plf)(10')(10') = 27200 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(10')](10')(10'/2) = 8027 ft-lb

$$T_{up} = \frac{27200 - 8027}{10} = 1917 \text{ lb}$$

Simpson HDU2
(3075 lb)

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	14

LATERAL

Line C :

V_{wind} = 5141 lb

$V_{seismic}$ = 2094 + 0.1102[(15 psf)(10')(16')] = 2358 lb

$$v_{walls} = \frac{5141}{16} = 321 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 4"oc (380 plf)

Use 1/2" values for 3/8" plywood

[5/8 dia AB @ 48"oc (372 plf)]

Uplift Analysis (16' Wall)

M_{OT} = (321plf)(16')(10') = 51360 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(10')](16')(16'/2) = 20548 ft-lb

$$T_{up} = \frac{51360 - 20548}{16} = 1926 \text{ lb}$$

Simpson HDU2
(3075 lb)

Line D :

V_{wind} = 2425 lb

$V_{seismic}$ = 988 + 0.1102[(15 psf)(10')(6')] = 1087 lb

$$v_{walls} = \frac{2425}{3+3} = 404 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 3"oc (490 plf)

Use 1/2" values for 3/8" plywood

[5/8 dia AB @ 32"oc (558 plf)]

Uplift Analysis (3' Wall)

M_{OT} = (404plf)(3')(8') = 9696 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(8')](3')(3'/2) = 632 ft-lb

$$T_{up} = \frac{9696 - 632}{3} = 3021 \text{ lb}$$

Simpson HDU2
(3075 lb)

SEE CONTNUOUS HEADER

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	15

LATERAL

Line F :

V_{wind} = 4595 lb

$V_{seismic}$ = 1975 + 0.1102[(15 psf)(10')(12')] = 2173 lb

$$v_{walls} = \frac{4595}{6+6} = 383 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 3"oc (490 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 16"oc (1116 plf)]

SHEAR BOTH SIDES

Uplift Analysis (6' Wall)

M_{OT} = (383plf)(6')(2)(10') = 45960 ft-lb

M_{RES} = 2/3[(22.7psf)(4')+(15psf)(10')](6')(6'/2) = 2890 ft-lb

$$T_{up} = \frac{45960 - 2890}{6} = 7178 \text{ lb}$$

Simpson HDU8
(7870 lb)

Line G :

V_{wind} = 3880 lb

$V_{seismic}$ = 4421 + 0.1102[(15 psf)(10')(34')] = 4983 lb

$$v_{walls} = \frac{4983}{5+5+8+16} = 147 \text{ plf}$$

3/8" CDX Plywood
w / 8d @ 4"oc (380 plf)

Use 1/2" values for 3/8" plywood [5/8 dia AB @ 48"oc (372 plf)]

Uplift Analysis (5' Wall)

M_{OT} = (147plf)(5')(10') = 7350 ft-lb

M_{RES} = 0.9[(11.868922psf)(4')+(7.8429psf)(10')](5')(5'/2) = 1416 ft-lb

$$T_{up} = \frac{7350 - 1416}{5} = 1187 \text{ lb}$$

Simpson HDU2
(3075 lb)

ON THE TENSION SIDE OF OVERTURNING, USE 12.4.3

E = rho Qe - (.6 - .14Sds)D

MODIFICATION FOR D = 0.52286

WHEN Vs GOVERNS

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	16

LATERAL

ROOF DIAPHRAGM W3

w = 194 plf

$$v_{diaph} = \frac{(194\ plf)(52'/2)}{46'} = 110\ plf$$

1/2" CDX Plywood
w / 8d @ 6"oc (240 plf)
(Case 1 w / 2x Framing)

$$F_{chord} = \frac{(194\ plf)(52')^2}{8(46')} = 1425\ lb$$

15 - 16d Plate Splice
(1575 lb)

LATERAL: USE ROTATION OF FLEXIBLE DIAPHRAGM TO TRANSFER WIND LOAD BACK TO MAIN DIAPHRGM
SDPWS FIG 4A PAGE 14

CHECK ROTATIONAL FORCES:

UNIT SHEAR (WIND) = 85 DIAPHRAGM WIDTH= 14

W4 SEISMIC DIAPHRAGM DEPTH 34

M = w * l sq /2 = 8330

T = C = 245

V rotation = 7.20588 LBS < OK

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	17

VERTICAL

FLOOR JOIST

$L =$ 10.0 ft

$C(D) =$ 1.00

$C(F) =$ 1.10

$w =$ (17.3D + 40L)(1.33') + 4 = **80** plf

$V = wL/2 =$ 400 lb

$M = \frac{wL^2}{8} =$ 1000 ft-lb

$A_{req} = \frac{1.5V}{F'_v} =$ 6.3 in^2

$S_{req} = \frac{M(12''/')}{F'_b} =$ 12.5 in^3

$I_{req} = \frac{5\ wL^4}{384\ E\Delta} =$ 33.8 in^4

DF No. 2

F_v	= 95	F'_v	= 95
F_b	= 875	F'_b	= 963
E	= 1600000	Δ: L / 360	

2x10 DF No. 2
A = 13.9, S = 21.4, I = 98.9

FLOOR GIRDERS

$L =$ 5.0 ft

$C(D) =$ 1.00

$C(F) =$ 1.30

$w =$ (17.3D + 40L)(10') + 7 = **580** plf

$V = wL/2 =$ 1450 lb

$M = \frac{wL^2}{8} =$ 1813 ft-lb

$A_{req} = \frac{1.5V}{F'_v} =$ 22.9 in^2

$S_{req} = \frac{M(12''/')}{F'_b} =$ 19.1 in^3

$I_{req} = \frac{5\ wL^4}{384\ E\Delta} =$ 30.6 in^4

DF No. 2

F_v	= 95	F'_v	= 95
F_b	= 875	F'_b	= 1138
E	= 1600000	Δ: L / 360	

4x8 DF No. 2
A = 25.4, S = 30.7, I = 111

CHRIS OLIVEIRA AND ASSOCIATES	project	Rice residence	
	by	CO	no.
	date	6/1/19	18

VERTICAL

Spread Footing

P = [](') = 2900 lb

$$A_{REQ} = \frac{2900\ lb}{1500\ psf} = 1.93\ ft^2$$

2'-0" square x 12" deep
w / 3 - #4 Bars Each Way