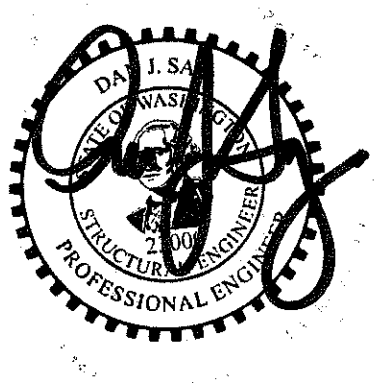
Structural Calculations For:

Arron ADU

Seattle, WA

Architect: S.A.G.E. Designs NW
Architecture Studio
1017 Rose Street
Seattle, WA 98115

17 April, 2015



Project # 1226-2015-01

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Seattle, WA 98121 T 206. 443. 6212 F 206. 443.4870

Seismic Design Loads (ASCE 7-10)

for a Wood Framed Structure

OCCUPANCY CAT.	II	Table 1.5-1			
IMP. FACTOR	1	Table 1.5-2			
SITE CLASS	D	Table 20.3-1	SEISMIC		
R =	3.25	Table 12.2-1	DESIGN CATEGORY	D	11.6.1.1

S_s =	1.555	1996 USGS Latitude/ Longitude (http://eqint.cr.usgs.gov/eq-men/html/lookup-interp.html)
S_1 =	0.54	1996 USGS Latitude/ Longitude (http://eqint.cr.usgs.gov/eq-men/html/lookup-interp.html)
F_a =	1	Table 11.4-1
F_v =	1.6	Table 11.4-2
S_{DS}=	1.036667	
S_{D1}=	0.576	
Cs=	0.318974	Eqn. 12.8-2
Cs_{ASD}=	0.227839	

Vertical Design Loads

ASCE 7-10
IBC 2012

Live Loads

Snow (roof)	25	psf
Live (floor)	40	psf

Soil Bearing

2000 psf

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Design: KMR
Sheet: Criteria 2

Wind Design Loads (ASCE 7-10)

Method 2 - Analytical Procedure

Exposure	B				
V=	110	mph			
K_d=	0.85		Table26.6-1		
ASD=	0.6		2.4.1		
G=	0.85		26.9-10		

Roof Angle =	9	degrees
Ground to top of roof	15	ft
Bottom of roof to top of roof	12	ft
(mean roof height) h=	9	ft

$K_{zt}= (1+K_1K_2K_3)^2 =$ **1.12**

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p
Windward Wall	0.8
Leeward Wall	-0.5
Windward Roof	0
Leeward Roof	-0.6

*Note= Cp values are conservative worst case values

Pressures:

Ht	K_z	q_z	$P_{ww\ walls}$	$P_{lwwalls}$	**P_{walls} (psf)**
0-15	0.57	10.09	6.86	4.29	**11.14**
15-20	0.62	10.97	7.46	4.29	**11.75**
20-25	0.66	11.68	7.94	4.29	**12.23**
25-30	0.7	12.39	8.42	4.29	**12.71**
30-40	0.76	13.45	9.14	4.29	**13.43**

P_{roof} (psf)
5.14

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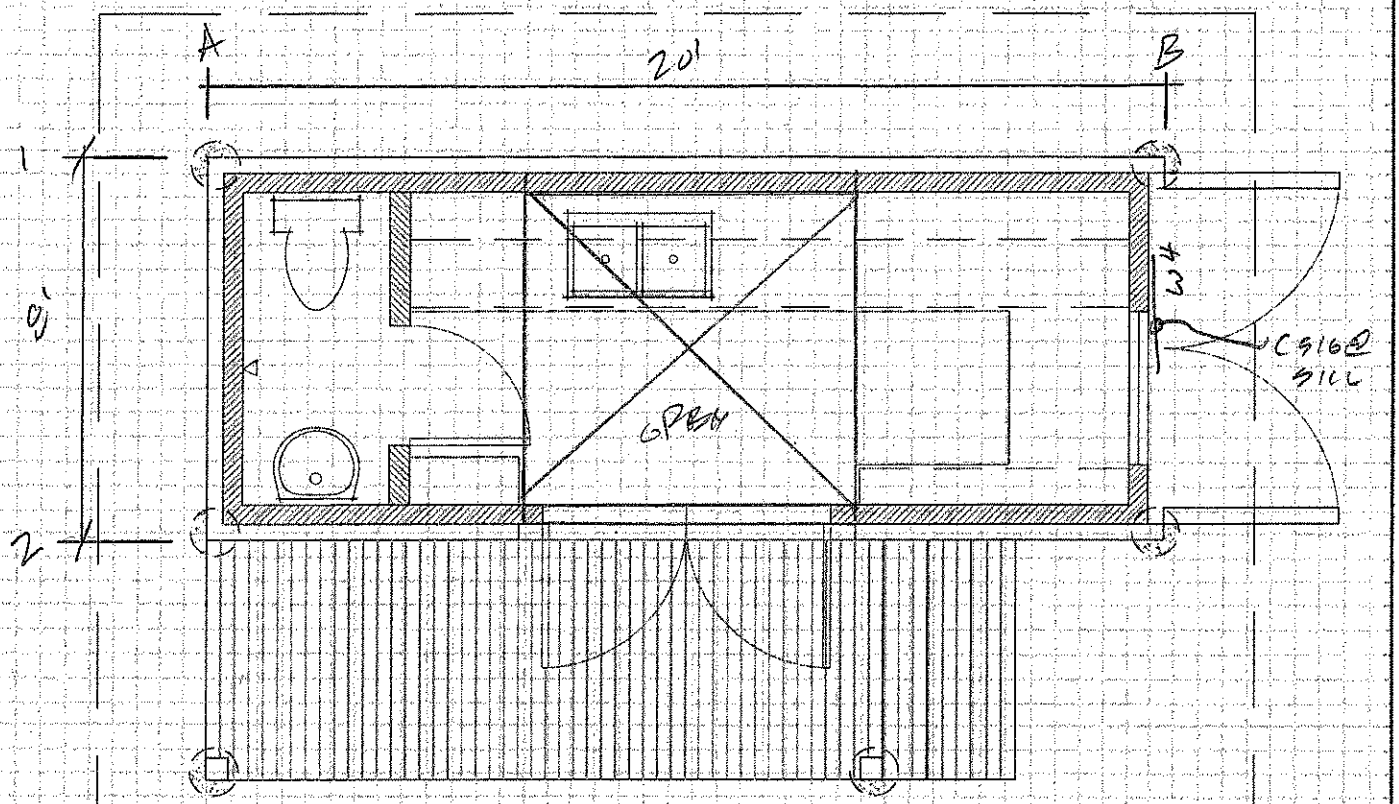

LATERAL

20' CONTAINER WT = 5300#

DL = 5300 + 160(20) = 8500#
(160 PSF FINISHES)

$V_S = .23(8500) = 1955^{\#}$

WIND

LINE 1	$V_W = 4(10)(11.14) = 450^{\#}$	$V_S = 980^{\#}$
LINE 2	$V_W = 450^{\#}$	$V_S = 980^{\#}$
LINE A	$V_W = 10(10)(11.14) = 1114^{\#}$	$V_S = 990^{\#}$
LINE B	$V_W = 1114^{\#}$	$V_S = 990^{\#}$

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LINE 1 & 2

$V_S = 980^{\#}$

$v = 980/(6+6) = 82^{\#}/ft$ ⇒ $1N\,9.8" = 67^{\#}/9.8"$

$m = 67(96)/1000 = 6.432"k$ S_x REQ'D $= .27 < 1.44$ ok
36ksi

v@wood $= [160(20)(1/2).23]/4 = 92^{\#}/ft$ W6 OT xLOT CRIT.

LINE A

$V_W = 1115^{\#}$

$v = 1115/7 = 159^{\#}/ft$ ⇒ $130^{\#}/1N\,9.8"$

$m = 130(96)/1000 = 12.5"k$ S_x REQ'D $= .52 < 1.44$ ok
36ksi

LINE B

OPEN DOOR USE WOOD WALL

$V_W = 1115^{\#}$

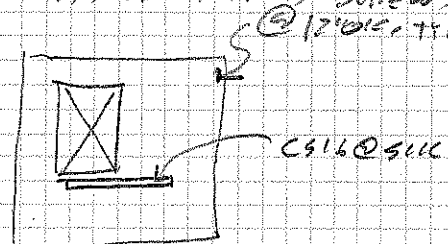
$v = 1115/2.8 = 398^{\#}/ft$ W4 ok

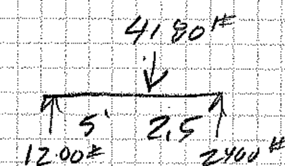
$V_S = 350^{\#}/ft$

UPLIFT $= 398(3.5) = 1393^{\#}$

DOOR HEADER $V_S = 3$ ⇒ $4180^{\#}$

$1400/186 = 7$ 1/4" SELF TAPPING SCREWS @12" O.C. TYP.





$V = 2400^{\#}$
$m = 6000"k$
S_x REQ'D $3.0 < 4.8$ ok
$A = .12" = 4/768$

V @ ROOF DIAP.

USE 1/2" CDX OR SIPS

V WORST CASE = AB $= 1115/8 = 140^{\#}/ft$ ok

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FOOTINGS

P = 1114/2 = 560#

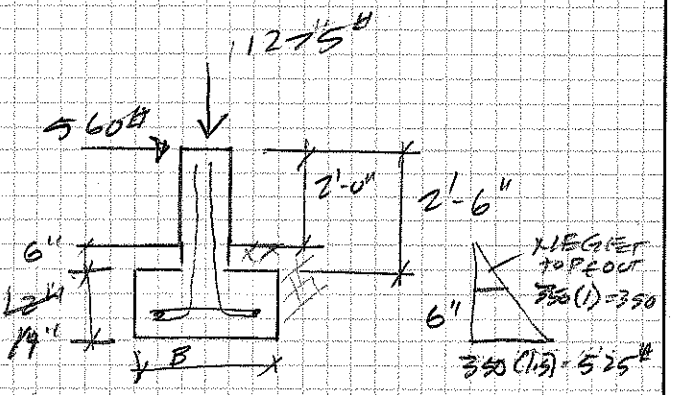
DDL = 8500(¼) = 2125# (.6) = 1275#

$$q_{MAX} = \frac{1275}{B^2} + \frac{6(560(2.5))}{B^3}$$

$$= \frac{1275}{B^2} + \frac{8400}{B^3} = 2000$$

B = 1.17 ⇒ USE 2' ⇒ SB = 1366# OK

PASSIVE [350(.5) + 175(½)] 2 = 525# ⇒ USE 14" DEEP #G, 505# OK



12" FOOTING

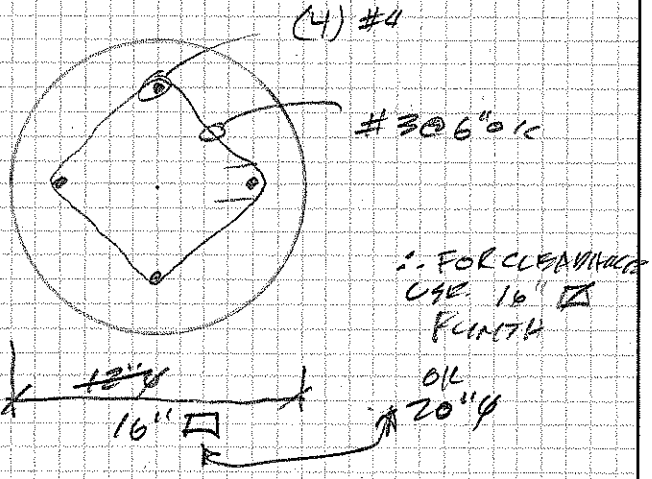
CHECK ⓒ

M = 1400(1.6) = 2240'# = 26.9"K

b = 6" d = 9" (1) #4

$$a = \frac{.2(60)}{.85(2.9)6} = .94$$

$$\phi M_n = .9(60)(.2)(9 - .94/2) = 92.12"K \text{ OK}$$



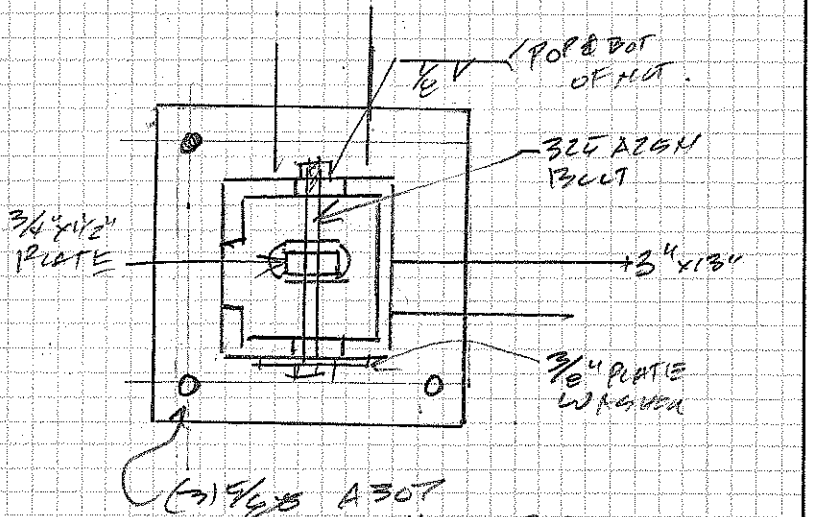
ATTACHMENT

UP

V = 560(1.6) = 892#

UPLIFT = 1115#(1.6) = 1784#

5/8" ϕ A307 THREADED ROD EPOXY W/ 6" EMBED.



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Project: AARON

Date: 4/7/15

Proj. No.: 1226-15-1

Design: KM

Sheet: 6

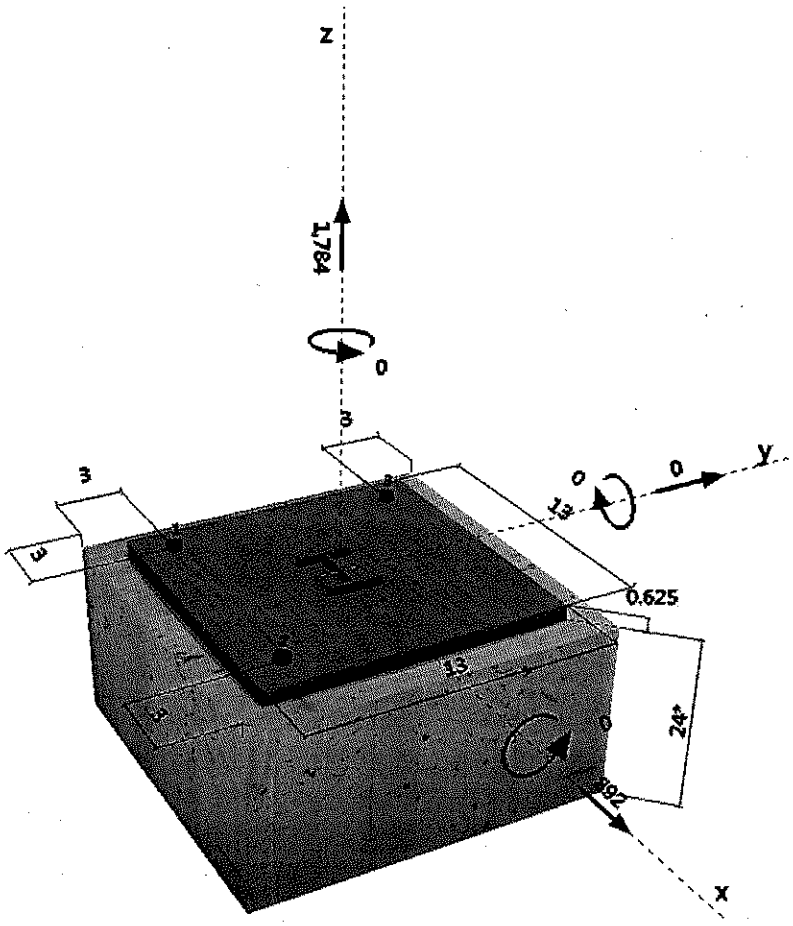
Company:		Page:	1
Specifier:		Project:	
Address:		Sub-Project I Pos. No.:	
Phone I Fax:		Date:	4/7/2015
E-Mail:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**HIT-HY 200 + HAS B7 5/8**
Effective embedment depth:	$h_{ef,act}$ = 6.000 in. ($h_{ef,limit}$ = - in.)
Material:	ASTM A 193 Grade B7
Evaluation Service Report:	ESR-3187
Issued I Valid:	1/1/2015 | 3/1/2016
Proof:	Design method ACI 318 / AC308
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.625 in.
Anchor plate:	l_x x l_y x t = 13.000 in. x 13.000 in. x 0.625 in.; (Recommended plate thickness: not calculated)
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 24.000 in., Temp. short/long: 32/32 °F
Installation:	hammer drilled hole, Installation condition: Dry
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: > No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

Geometry [in.] & Loading [lb, in.lb]



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Specifier:		Project:	
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2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Concrete Breakout Strength	1852	3420	55 / -	OK
Shear	Concrete edge failure in direction x+	895	1373	- / 66	OK

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	0.542	0.652	5/3	86	OK

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

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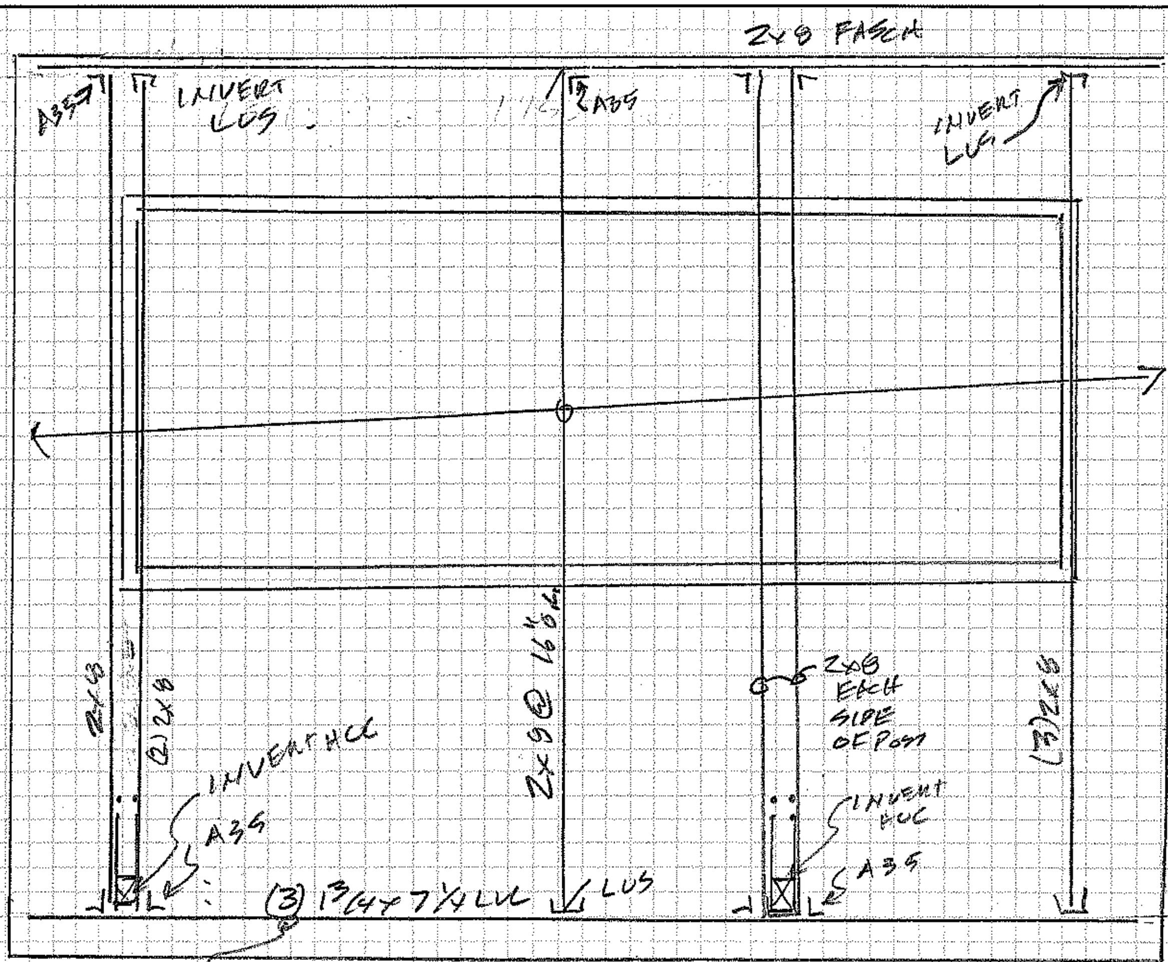

LAMINATE w/ (2) ¼"x3½" SDS @ 24" o.c. EACH SIDE

OPTIONAL STICK FRAME ROOF.

JOIST

w=(8+12.5)2 = 70

20#/ft 70#/ft
↑ 9' ↑ 5'
-30# 540#

V= 350#
m= 1225'#
fb= 800 psi
fv= 42 psi
Δ= .42" = L/226

2x8 @ 24" o.c.

FRONT STRUCTURAL FASCIA

w=(10+12.5)4=

40#/ft 190#/ft
↑ 14' ↑ 8'

@ CANT.
V= 1120#
m= 4480'#
fb= 1166 psi
fv= 41 psi
Δ= 1" = L/190

(3) 1¾x7¼ LVL.

FOR A C JOIST
(3) 2x8
Δ= .7" = L/240
w/ 8' ?
105#/ft

BACK STRUCTURAL FASCIA

w=(10+25)9=315

90 315
↑ 8' ↑ 3'

V= 725#
m= 833'#
256# 1185#
fb= 760 psi
fv= 74 psi
Δ= .05 = L/...

2x8

SUPPORTING JOIST

20 70 ↓408
↑ 8' ↑ 2'
-234# 1792#

V= 1328#
m= 2516'#
fb= 1199 psi
fv= 89 psi
Δ= .24" = L/216

(2) 2x8

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STL ROOF FOR STORAGE LOADS

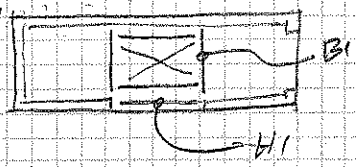
STORAGE LOAD = 20 PSF ⇒ 32 PSF
DEAD LOAD = 12 PSF

SPAN = 7.5' Simple span. $w = 32(8.26/12) = 22$ #/ft

$V = 82$#
$m = 154$"#/ft $= 1.46$" k.
S_x REQD $= .108 < 1.6$ OK

(E). 2" CAMBER

$\Delta = .62" = 7/144 \Rightarrow$ w/ FINISHES $= 1.18(90)^4/384(29,000)(.087) = .12" = 1/743$ OK



H1 CHECK FOR OUT OF PLANE @ VERT

$P_{VERT} = 984/2 = 492$ #/ft
SPAN: 7'
$V = 1722$#
$m = 3013$"#
S_x REQD $= 1.52 < 7.29$
$\Delta = .27" = 1/626$
W8X10 HSS
$V = 1722$#
$m = 3014$"#
$f_{cy} = 67$ KSI
$E = 66$ KSI
$\Delta = .14" = 1/503$

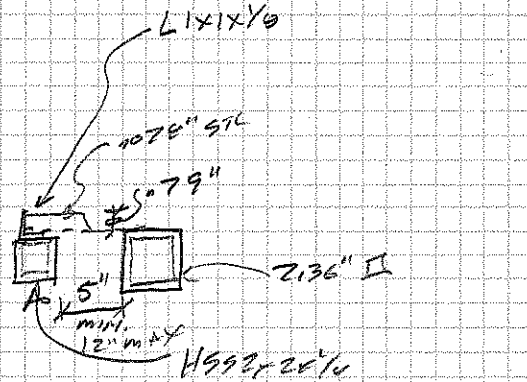
TOP RAIL SECTION.
(E) TOP RAIL HSS
ADD HSS ⇒ (3) 2x2

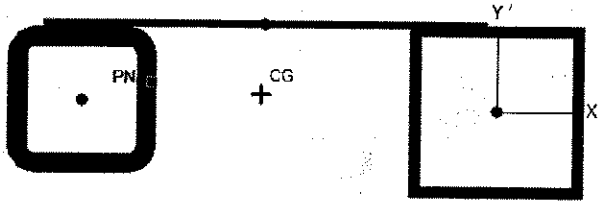
FOR LATERAL TRANSFER

$m = 112(20)^2/8 = 5575$"# $= 6.7$" k.
S_x REQD $= 2.61 < 5.21$

BEAM B1

$w = 30(7) = 60$ #/ft
SPAN $= 7.5'$
$V = 225$#
$m = 422.$"#
S_x REQD $= .221 < 1.247$
$\Delta = .15" = 1/450$
HSS2x2x1/4 OK





Overall Properties

Name: Shape1	Sy left: 7.420 in^3
Area: 3.330 in^2	Sy right: 5.781 in^3
CG: (-3.201,0.229)	rx: 0.838 in
Ix: 2.337 in^4	ry: 2.758 in
Iy: 25.34 in^4	rp: 2.883 in
Ixy: -0.470 in^4	r1: 2.759 in
Ipolar: 27.67 in^4	r2: 0.836 in
I1: 25.34 in^4	Zx: 2.523 in^3
I2: 2.327 in^4	Zy: 8.160 in^3
Theta: 88.83 deg	PNA: (-4.676,0.383)
Sx top: 2.346 in^3	J: 2.857 in^4
Sx bottom: 1.657 in^3	

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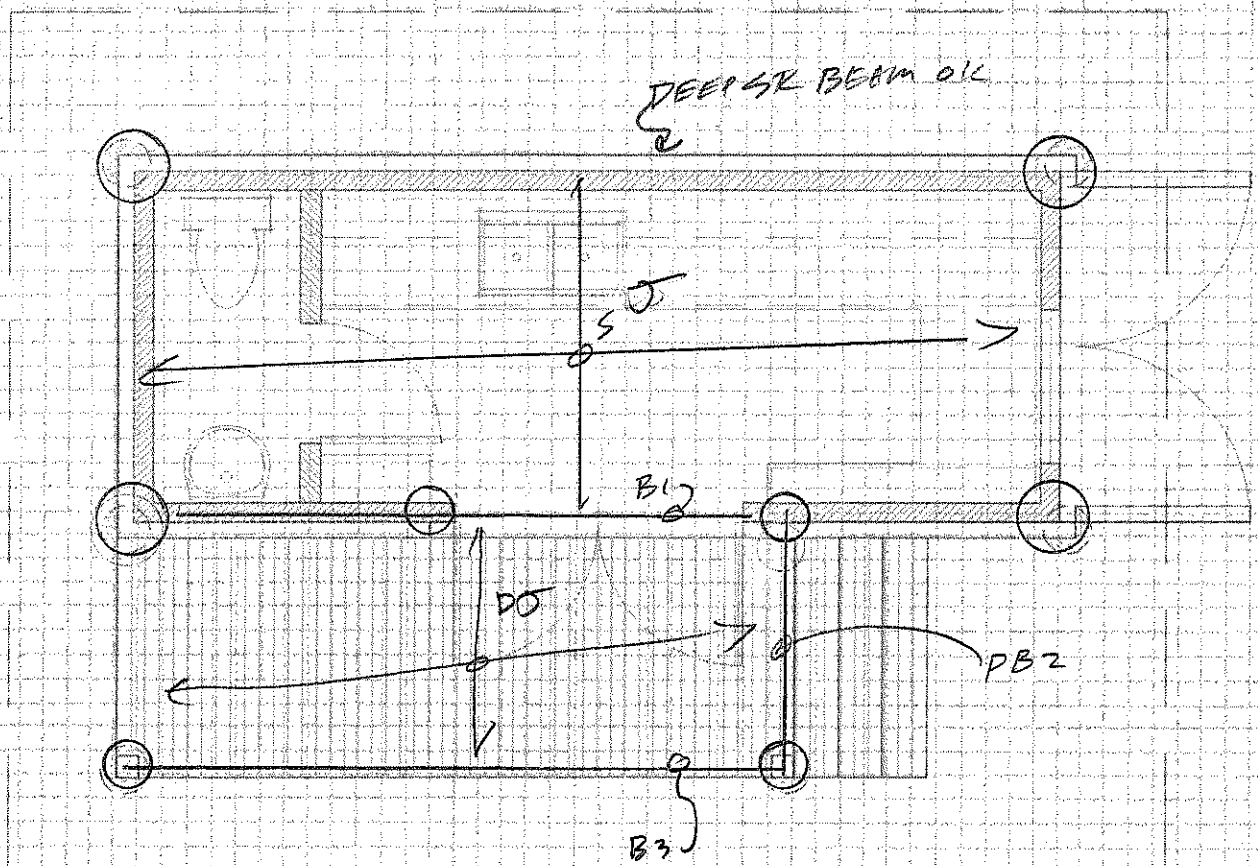

JOIST J1

@ 15" O/C.
W = 50 (15/12) = 63 #/FT
SPAN = 8'
V = 252 #
M = 504 #
S_x REQD = .24 < 1.61 OK
Δ = .05" = L/1841

FLOOR JOIST @ 15" O/C

DECK LEDGER / BEAM B1 (BOTTOM RAIL)

W1 = 50 (6) = 300 #/FT
W2 = 492/300 = 792 #/FT
P = 1722 #
V = 5140 LB
M = 16632 "
S_x REQD = 8.35
Δ = .18" = 7/8"

1722 #
W = 300 #/FT
792 #/FT
7'
6'
3426 #
13'
5140 #

BOTTOM RAIL DOES NOT HAVE CAPACITY

ADD FOOTING EACH SIDE OF OPENING

FOR 300 #/FT & 7' SPAN
V = 1050 LB
M = 1838 LB
S_x REQD < .92
Δ = .06" = 1/13

BOTTOM RAIL OK

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DECK JOIST DJ

W = 4.8(16/12) = 64#/FT
SPAN = 5'

V = 1600#
M = 200 '#
fb = 317 PSI
fv = 24 PSI
Δ = .03" = L/1802

P.T. 2x6 @ 16" o.c.

BEAM DB2

W = 50(3) = 150#/FT
SPAN = 6'

V = 375#
M = 420 '#
fb = 320 PSI
fv = 24 PSI
Δ = .03" = L/1294

P.T. 4x6

BEAM B3

W = (48) 3 = 144#/FT
SPAN = 14'

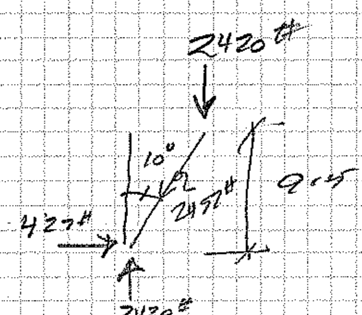
V = 1008#
M = 3528 '#
fb = 848 PSI
fv = 42 PSI
Δ = .42" = L/405

P.T. 4x10

HUC HANGERS
o.c.w/ 5/8 NAILS

DECK POST

TAN 10° = X/2420
X = 427#
427(1.6)/1.15 = 592# < 765#
1/2" P.B.
765# BASE
4x6 P.T.



STORAGE HEADER

SPAN = 5' MAX.
W = 250#/FT

V = 625#
M = 781 '#
fb = 620 PSI
fv = 46 PSI
Δ = .05" = L/1135

(2) 2x6

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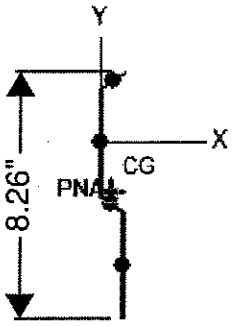


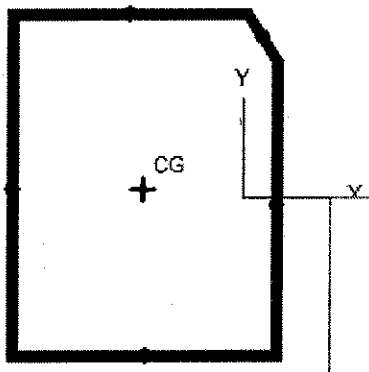
ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	I2: 0.043 in^4
Area: 0.719 in^2	Theta: 5.776 deg
CG: (0.372,-1.660)	Sx top: 1.061 in^3
Ix: 4.306 in^4	Sx bottom: 0.993 in^3
Iy: 0.087 in^4	Sy: 0.191 in^3
Ixy: -0.431 in^4	rx: 2.447 in
Ipolar: 4.393 in^4	ry: 0.348 in
I1: 4.350 in^4	rp: 2.472 in

ROOF SECTION



ShapeBuilder 2.0

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Fri. March 13, 2015

Overall Properties

Name: Shape1	I2: 9.202 in^4
Area: 3.007 in^2	Theta: 1.778 deg
CG: (-1.584,0.137)	Sx top: 4.811 in^3
Ix: 13.72 in^4	Sx bottom: 5.013 in^3
Iy: 9.207 in^4	Sy left: 4.348 in^3
Ixy: -0.140 in^4	Sy right: 4.161 in^3
Ipolar: 22.92 in^4	rx: 2.136 in
I1: 13.72 in^4	ry: 1.750 in

DOOR HEADER SECTION

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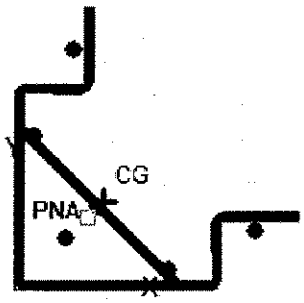
Project: Aaron

4/6/15 Date
1226 2015-01 Proj. No.
KMR Design
13 Sheet



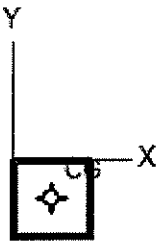
ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	Sy left: 12.23 in^3
Area: 6.139 in^2	Sy right: 5.626 in^3
CG: (2.600,2.600)	rx: 2.276 in
Ix: 31.79 in^4	ry: 2.276 in
Iy: 31.79 in^4	rp: 3.218 in
Ixy: -11.72 in^4	r1: 2.662 in
Ipolar: 63.58 in^4	r2: 1.808 in
I1: 43.51 in^4	Zx: 11.30 in^3
I2: 20.07 in^4	Zy: 11.30 in^3
Theta: 45 deg	PNA: (2.104,2.104)
Sx top: 5.626 in^3	J: 0.114 in^4
Sx bottom: 12.23 in^3	

CORNER SECTION



ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	Sy: 0.796 in^3
Area: 1.126 in^2	rx: 0.913 in
CG: (1.180,-1.180)	ry: 0.913 in
Ix: 0.940 in^4	rp: 1.292 in
Iy: 0.940 in^4	Zx: 0.944 in^3
Ixy: 0 in^4	Zy: 0.944 in^3
Ipolar: 1.879 in^4	J: 1.405 in^4
Sx: 0.796 in^3	

TOP RAIL SECTION

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Project: Aaron

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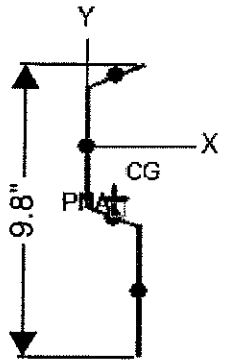
Sheet



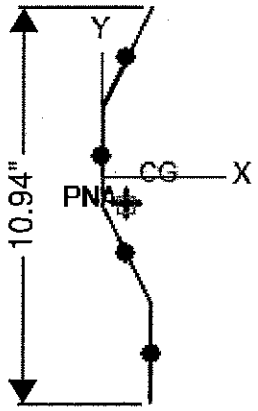
ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	I2: 0.332 in^4
Area: 0.963 in^2	Theta: 10.14 deg
CG: (0.896,-1.678)	Sx top: 1.713 in^3
Ix: 7.537 in^4	Sx bottom: 1.447 in^3
Iy: 0.563 in^4	Sy left: 0.602 in^3
Ixy: -1.289 in^4	Sy right: 0.585 in^3
Ipolar: 8.100 in^4	rx: 2.798 in
I1: 7.768 in^4	ry: 0.765 in

END WALL



ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	I2: 0.183 in^4
Area: 0.759 in^2	Theta: 5.218 deg
CG: (0.717,-0.732)	Sx top: 1.451 in^3
Ix: 8.130 in^4	Sx bottom: 1.411 in^3
Iy: 0.249 in^4	Sy left: 0.336 in^3
Ixy: -0.726 in^4	Sy right: 0.335 in^3
Ipolar: 8.379 in^4	rx: 3.274 in
I1: 8.196 in^4	ry: 0.573 in

SIDE WALL

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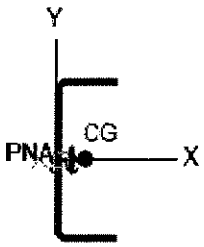


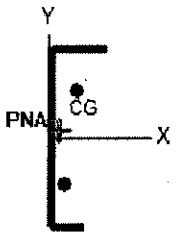
ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	rx: 1.783 in
Area: 1.208 in^2	ry: 0.523 in
CG: (0.441,0)	r0: 2.063 in
Ix: 3.841 in^4	Zx: 1.948 in^3
Iy: 0.330 in^4	Zy: 0.450 in^3
Ixy: 0 in^4	PNA: (0.135,0)
Ipolar: 4.171 in^4	J: 0.010 in^4
Sx: 1.617 in^3	Cw: 1.249 in^6
Sy left: 0.748 in^3	SC: (-0.456,0)
Sy right: 0.252 in^3	

FLOOR JOIST SECTION



ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	Sy left: 1.108 in^3
Area: 1.765 in^2	Sy right: 0.247 in^3
CG: (9.100,6.806)	rx: 56.90 mm
Ix: 8.856 in^4	ry: 12.05 mm
Iy: 0.397 in^4	rp: 58.16 mm
Ixy: 0.575 in^4	r1: 57.02 mm
Ipolar: 9.253 in^4	r2: 11.44 mm
I1: 8.895 in^4	Zx: 3.523 in^3
I2: 0.358 in^4	Zy: 0.505 in^3
Theta: 176.1 deg	PNA: (3.626,10)
Sx top: 3.073 in^3	J: 0.023 in^4
Sx bottom: 2.591 in^3	

BOTTOM RAIL SECTION

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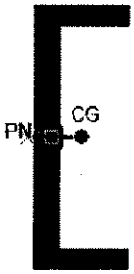
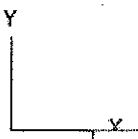
Sheet





ShapeBuilder 2.0

Swenson Say Faget
Fri. March 13, 2015

Overall Properties

Name: Shape1	Sy left: 1.025 in^3
Area: 2.528 in^2	Sy right: 0.397 in^3
CG: (-2.534,0.162)	rx: 1.575 in
Ix: 6.270 in^4	ry: 0.422 in
Iy: 0.451 in^4	r0: 1.731 in
Ixy: 0 in^4	Zx: 3.572 in^3
Ipolar: 6.721 in^4	Zy: 0.755 in^3
Sx: 2.805 in^3	PNA: (-2.692,0.162)

DOOR JAMB SECTION

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