STRUCTURAL DESIGN

FOR

THE HEADRICK GARAGE

A NED NELSON ARCHITECT PLAN

MERCER ISLAND, WASHINGTON

NOTE: This stamp applies to the members and assemblies described in these calculations only and is only valid if it is a wet stamp.

4/29/19

WELLER CONSULTING
21925 8TH PL W
BOTHELL, WA 98021
(425) 488 - 9868
(425) 486 - 6715 FAX

PROJECT NO.	19-010
DATE	04/29/19
PREPARED BY	Mark Weller, P.E.

DESIGN CRITERIA
PER THE 2015 INTERNATIONAL BUILDING CODE

EARTHQUAKE PER SECTION 1613

Design Per ASCE 7-10
Section 12.8 Equivalent Lateral Force Procedure

Base Shear: $V = C_S * W$

C_S = Seismic Response Coefficient
W = Effective Seismic Weight

Site / Project Specific Design Values:

S_S = 1.45 per USGS
Site Class D (Default)
R = 6.5 from Table 12.2-1

S_1 = 0.56 per USGS
Seismic Design Category D
Risk Category II from Table 1.5-1
I_e = 1.00 from Table 1.5-2

C_S = 0.1487 per Section 12.8.1.1

WIND DESIGN PER SECTION 1609 (Allowable Stress Design)

Design per ASCE 7-10 Section 28.6

Design Wind Pressure: $P_S = \lambda * I_e * K_{ZT} * PS_{30}$

where: λ = Exposure Factor
K_{ZT} = Topographic Factor
I_e = Importance Factor
PS_{30} = Base Design Pressure

Site/Project Specific Values:

Basic Wind Speed = 110 mph (V_{ult})
λ = 1.00 Exposure "B" (<30') "Urban Clustered Area"
K_{ZT} = 1.30
I_e = 1.00
PS_{30} = see ASCE 7-10, Figure 28.6.1

STANDARD DESIGN INFORMATION

The information described below is to be used unless otherwise noted on the plans

WOOD DESIGN per Section 2301, Allowable Strength Design, ANSI/AWC SDPWS 2015 & AF & PA NDS 2015 when applicable; per 2308 Conventional Light-Frame Construction

MINIMUM NAILING REQUIREMENTS per Table 2304.10.1

ANCHOR BOLTS:

5/8" ∅ x 10", A307 or better, w/ 7" min. Embedment. V = 1.6 x 860 = 1376 # / bolt

CONCRETE DESIGN per Chapter 19 & ACI 318-14

Concrete: f'_c = 2500 psi
Rebar: f_y = 40,000 psi

MISCELLANEOUS HARDWARE

SIMPSON Strong-Tie Connectors or equal

SHEAR WALL SCHEDULE

(SEE ANSI / AWC SDPWS-2015 Table 4.3A & Section 4.3.3)

All shear walls to be sheathed from top plate to bottom plate. Block all panel edges.
Nail spacing is for all panel edges. Space nails @ 12" o.c. along intermediate framing members.

SW-6	**v = 350 plf**	7/16" OSB, w/ 8d (0.131" Ø) common nails @ 6" o.c. Anchorage (interior walls only) to SINGLE joist or blkg below: 16d (box) @ 4" o.c.

The shear values above are based upon the use of 8d common nails with a full head, a shank diameter of 0.131", and a minimum penetration of 1.375". From Table 4.3A use 15/32; 8d values with a 0.93 reduction for Hem-Fir & 1.4 increase for wind.

SEISMIC & WIND ANALYSIS # 19-010 THE HEADRICK GARAGE

SEISMIC: PER ASCE 7-10 SECTION 12.8

SEISMIC BASE SHEAR: V = 0.1487 W

Dead Loads:

Roof = 15 psf (horz. framing) & 10 psf (partition) W_R = 792 SF @ (15 + 10) psf = 19,800 #

Vertical Distribution

Level	Weight (w)	Height (h)	w x h	%		
Roof	19,800	15	297,000	**100%**	**V_R =**	**2,061 #**
Total	19,800		297,000		**Total =**	**2,061 #**

WIND: PER ASCE 7-10 SECTION 28.6

side/side	F_R =	56 SF @	28.08	psf =	943 #	A	<30
		0 SF @	0	psf =	0 #	B	<30
		272 SF @	18.72	psf =	3,055 #	C	<30
		0 SF @	0	psf =	0 #	D	<30
		Total Roof s/s:			**F_R = 3,999 #**		
front/back	F_R =	56 SF @	28.08	psf =	943 #	A	<30
		0 SF @	0	psf =	0 #	B	<30
		146 SF @	18.72	psf =	1,640 #	C	<30
		0 SF @	0	psf =	0 #	D	<30
		Total Roof f/b:			**F_R = 2,583 #**		

WIND: PER ASCE 7-10 SECTION 28.6.4

328 SF @	16.0	psf =	3,149 #	
0 SF @	8.0	psf =	0 #	
			3,149 #	
202 SF @	16.0	psf =	1,939 #	
0 SF @	8.0	psf =	0 #	
			1,939 #	

SUMMARY: Wind controls S/S. Seismic controls F/B.

MAIN FLOOR SHEAR WALLS

side/side: V_R = **3,999** # v = **111** plf L_{EFF} = **36.0** ft

Line	L_{TRIB}	V		Length	Shear		Shear Wall Type	H / W Ratio	Seismic Ratio	Redundancy Factor (p)	Height (ft)	M_{OT}	M_R	Uplift (T/C)	Resisting Element Left / Front	Resisting Element Right / Back
REAR	18	1999 #	a	4	127	plf	SW-6	1.75	1.00	1.30	7	7616 #-ft	720 #-ft	1703 #	5	5
			b	4.25	127	plf	SW-6	1.65	1.00	1.30	7	8092 #-ft	813 #-ft	1691 #	5	5
			c	7.5	127	plf	SW-6	2.00	1.00	1.30	15	14281 #-ft	2531 #-ft	1527 #	5	5
				15.75												
FRONT	18	1999 #	a	2	500	plf	SSW18x13	N/A	0.31	1.30	13	12995 #-ft	156 #-ft	6411 #	N/A	N/A
			b	2	500	plf	SSW18x13	N/A	0.31	1.30	13	12995 #-ft	156 #-ft	6411 #	N/A	N/A
TOTAL	**36**	**3,999 #**		4												

front/ back: V_R = **2,680** # v = **122** plf L_{EFF} = **22.0** ft

Line	L_{TRIB}	V		Length	Shear		Shear Wall Type	H / W Ratio	Seismic Ratio	Redundancy Factor (p)	Height (ft)	M_{OT}	M_R	Uplift (T/C)		
LEFT	11	1340 #	a	36	37	plf	SW-6	0.42	1.00	1.30	15	20097 #-ft	58320 #-ft	-1251 #	OK	OK
RIGHT	11	1340 #	a	11.5	58	plf	SW-6	1.30	1.00	1.30	15	10049 #-ft	5951 #-ft	296 #	1	Rdl
			b	11.5	58	plf	SW-6	1.30	1.00	1.30	15	10049 #-ft	5951 #-ft	296 #	Rdl	1
TOTAL	**22**	**2,680 #**		23												

HORIZONTAL DIAPHRAGM SHEARS / LOAD PATH

ROOF DIAPHRAGM
FRONT: v = 1999 / 22 = 91 plf OK

ANCHOR BOLTS
USE 5/8" Ø Anchor Bolts @ 5' - 0" o.c. Unless Notes Otherwise (U.N.O.)
v = 1.6 x 860 # / 5 = 275 plf

OK by inspection

RESISTING ELEMENT

R_{DL} Dead Load Reaction

1 Perpendicular Exterior Wall $T_{MAX} = V_{CORNER} = H_{WALL} \times v_{MIN}$
2 Perpendicular Wall (min) 5 - 16d nails = 5' x 109 plf = 545 #
3 A 35 Framing Anchors = 600 # each
4 CS16 Strap = 1705 #
5 STHD10 or STHD10RJ @ 3400 # (Midwall), 2940 # (Corner), 2175 # (Endwall)

L4

SIMPSON STRONG-TIE COMPANY INC.
(800) 999-5099
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

Job Name: Job #1
Wall Name: Wall Line 1
Application: Garage Front

Design Criteria:

* 2015 International Bldg Code
* Wind
* 2500 psi concrete
* ASD Design Shear = 1999 lbs
* Shearwall Height = 13' to underside of top plates

Selected Strong-Wall® Panel Solution:

Model	Type	W (in)	H (in)	T (in)	Sill Anchor	End Anchor Bolts	Total Axial Load (lbs)	Actual Uplift (lbs)
SSW18x13	Steel	18	153.25	5.5	N/A	2 - 1"	0	11633 lb
SSW18x13	Steel	18	153.25	5.5	N/A	2 - 1"	0	11633 lb

Actual Shear & Drift Distribution:

Model	RR Relative Rigidity	Actual Shear (lbs)		Allowable Shear (lbs)		Actual / Allow Shear	Actual Drift (in)	Drift Limit (in)
SSW18x13	0.50	999	≤	1695	OK	0.59	0.51	0.87
SSW18x13	0.50	999	≤	1695	OK	0.59	0.51	0.87

Notes:

1. Steel Strong-Wall Shearwalls have been evaluated to the 2015 IBC/IRC.
See www.strongtie.com for additional design and installation information.

2. Anchor templates are recommended for proper anchor bolt placement, and are required in some jurisdictions.

3. Check that wall height "H" plus curb height (above slab) will attain
overall rough header opening height (top of driveway slab to bottom of header).

Disclaimer:

LS

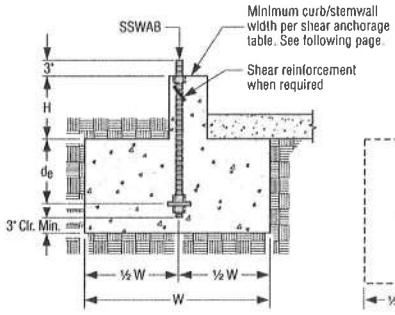
SIMPSON STRONG-TIE COMPANY INC.
(800) 999-5099
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

Job Name: Job #1
Wall Name: Wall Line 1
Application: Garage Front

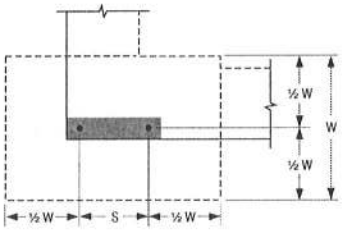
Design Criteria:

* Stemwall - Garage Front
* 2015 International Bldg Code
* Wind
* 2500 psi concrete

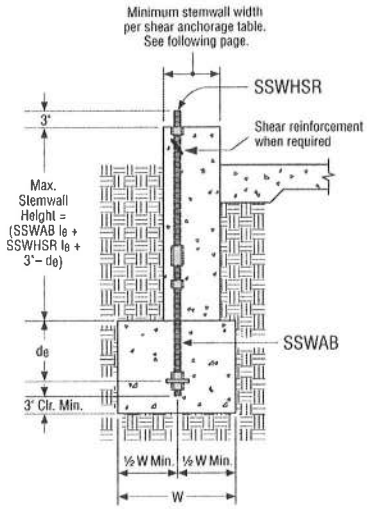
Anchor Solution Details:



Curb or Stemwall Section View



Footing Plan



Section at Stemwall SSWAB and SSWHSR Extension Application

Anchor Solution Assuming Cracked Concrete Design:

Model	W	de	S	Anchor Bolt	Strength
SSW18x13	32	11	12.25	SSWAB1	Standard

Anchor Solution Assuming Uncracked Concrete Design:

Model	W	de	S	Anchor Bolt	Strength
SSW18x13	22	8	12.25	SSWAB1	Standard

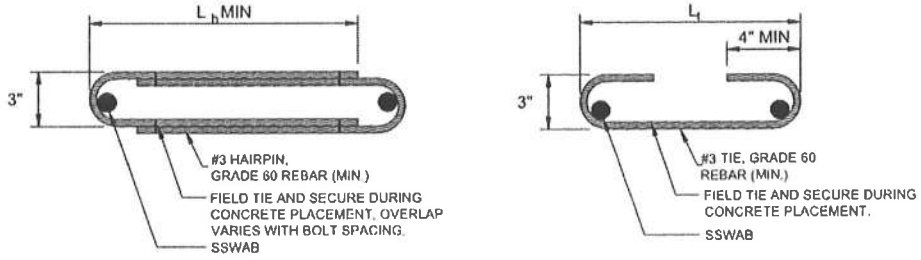
Notes:

1. Anchorage designs conform to ACI 318-14 and 318-11 Appendix D with no supplementary reinforcement for cracked and uncracked concrete as noted.
2. Anchorage strength indicates required grade of SSWAB anchor bolt. Standard (ASTM F1554 Grade 36) or High Strength (HS)(ASTM A449).
3. Wind includes Seismic Design Category A and B.
4. Footing dimensions are for anchorage only. Foundation design (size and reinforcement) by Designer. The registered design professional may specify alternate embedment, footing size or anchor bolt.

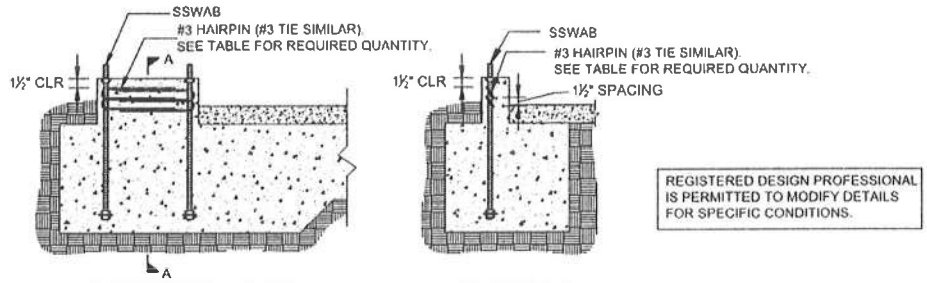
SIMPSON STRONG-TIE COMPANY INC.
(800) 999-5099
5956 W. Las Positas Blvd., Pleasanton, CA 94588.
www.strongtie.com

SIMPSON Strong-Tie®

STEEL STRONG-WALL® SHEAR ANCHORAGE



HAIRPIN SHEAR REINFORCEMENT **TIE SHEAR REINFORCEMENT**



HAIRPIN INSTALLATION
(GARAGE CURB SHOWN. OTHER FOOTING TYPES SIMILAR.)

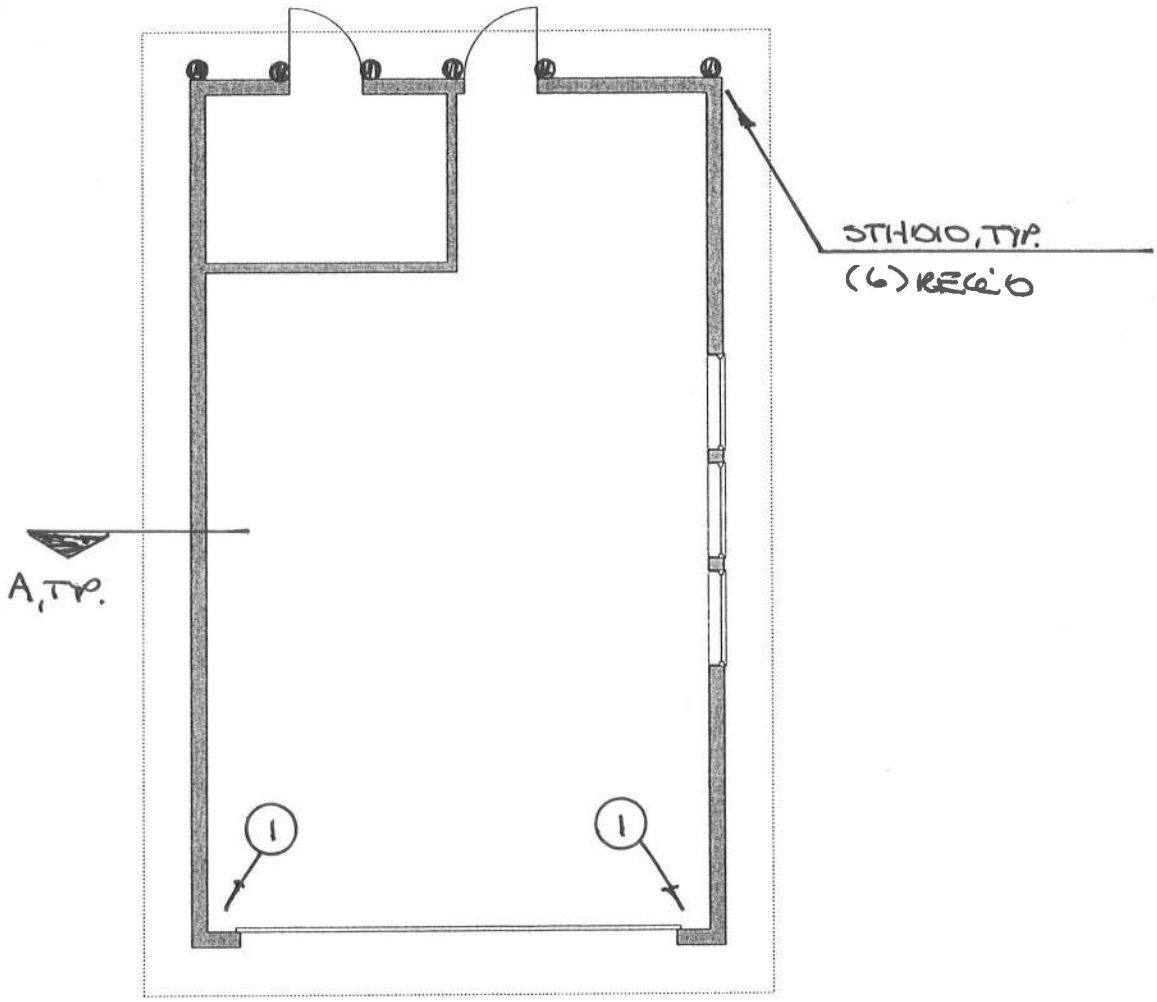
SECTION A-A

STEEL STRONG-WALL SHEAR ANCHORAGE

MODEL	SEISMIC[3]			WIND[4]					
	L_t OR L_h (in.)	SHEAR REINFORCEMENT	MIN. CURB / STEMWALL WIDTH (in.)	SHEAR REINFORCEMENT	MIN. CURB / STEMWALL WIDTH (in.)	ASD ALLOWABLE SHEAR LOAD V (lbs)[5]			
						6" MIN CURB / STEMWALL		8" MIN CURB / STEMWALL	
						UNCRACKED	CRACKED	UNCRACKED	CRACKED
SSW12	9	(1) #3 TIE	6	NONE REQUIRED	-	1230	880	1440	1030
SSW15	12	(2) #3 TIES	6	NONE REQUIRED	-	1590	1135	1810	1295
SSW18	14	(1) #3 HAIRPIN	8[6]	(1) #3 HAIRPIN	8	HAIRPIN REINFORCEMENT ACHIEVES MAXIMUM ALLOWABLE SHEAR LOAD OF THE STEEL STRONG-WALL PANEL			
SSW21	15	(2) #3 HAIRPIN	8[6]	(1) #3 HAIRPIN	8				
SSW24	17	(2) #3 HAIRPIN	8[6]	(1) #3 HAIRPIN	8				

NOTES:
1. SHEAR ANCHORAGE DESIGNS CONFORM TO ACI 318-14 AND ACI 318-11 AND ASSUME MINIMUM f'c=2,500 PSI CONCRETE. SEE DETAILS 1/SSW1 TO 3/SSW1 FOR TENSION ANCHORAGE.
2. SHEAR REINFORCEMENT IS NOT REQUIRED FOR PANELS INSTALLED ON A WOOD FLOOR, INTERIOR FOUNDATION APPLICATIONS (PANEL INSTALLED AWAY FROM EDGE OF CONCRETE), OR BRACED WALL PANEL APPLICATIONS.
3. SEISMIC INDICATES SEISMIC DESIGN CATEGORY C THROUGH F. DETACHED 1 AND 2 FAMILY DWELLINGS IN SDC C MAY USE WIND ANCHORAGE SOLUTIONS.
4. WIND INCLUDES SEISMIC DESIGN CATEGORY A AND B.
5. MINIMUM CURB/STEMWALL WIDTH IS 6" WHEN STANDARD STRENGTH SSWAB IS USED.
6. USE (1) #3 TIE FOR SSW12 AND SSW15 WHEN THE STEEL STRONG-WALL PANEL DESIGN SHEAR FORCE EXCEEDS THE TABULATED ANCHORAGE ALLOWABLE SHEAR LOAD.
7. CONCRETE EDGE DISTANCE FOR ANCHORS MUST COMPLY WITH ACI 318-14 SECTION 17.7.2 AND ACI 318-11 D.8.2.

L7

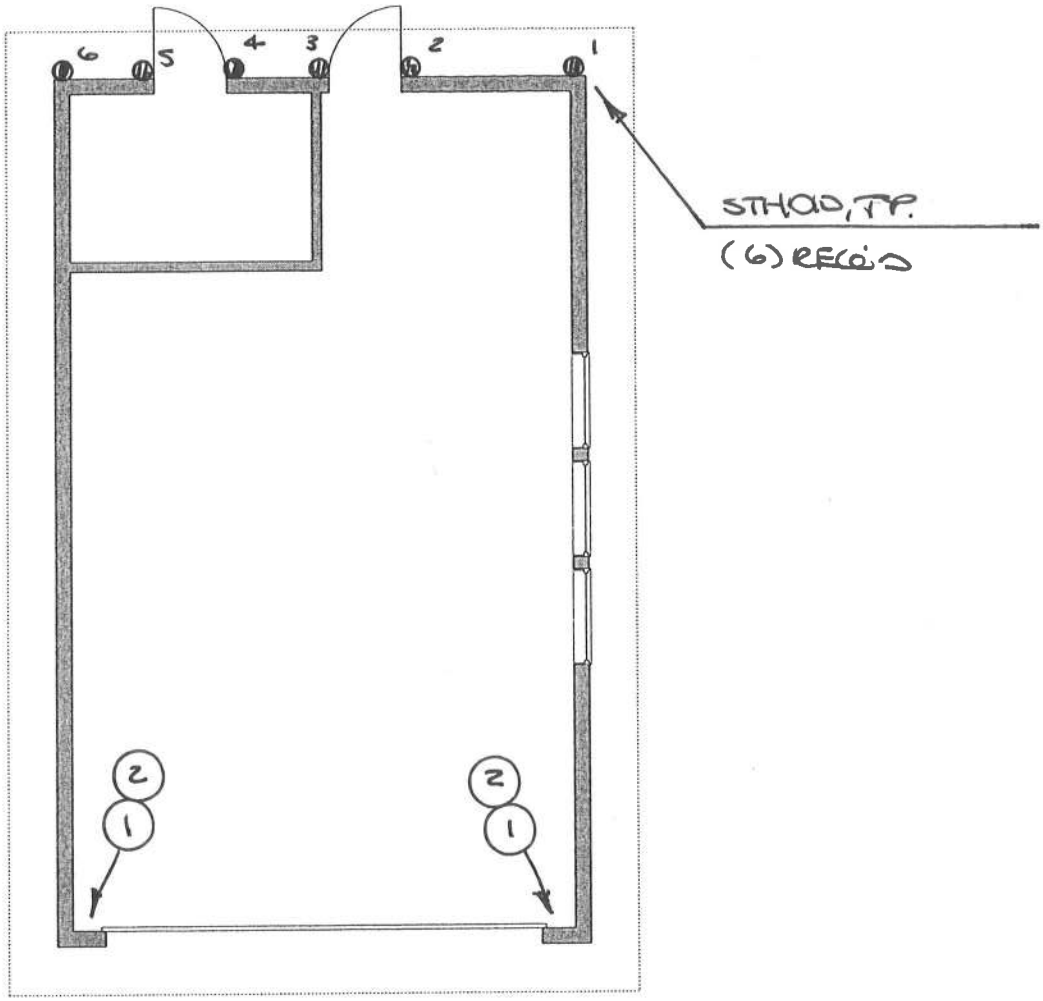


(1) PROVIDE SIMPSON SSW18x13 STRONGWALL

NOTE: ALL EXTERIOR WALLS TO BE SW-6 U.N.O.

MAIN FLOOR SHEAR WALLS

L8



(1) RAISE CONCRETE STEMWALL 2'-0" (+/-) TO ENSURE SSW18x13 STRONGWALL WILL CONNECT DIRECTLY TO UNDERSIDE OF DOUBLE TOP PLATES

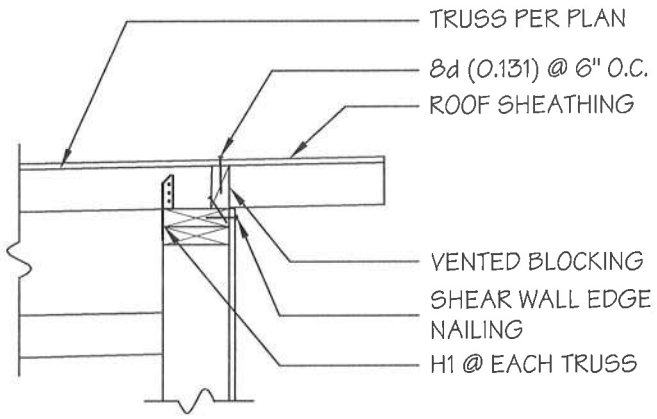
(2) PROVIDE ANCHORAGE & REINFORCEMTN PER SIMPSON'S REQUIREMENTS FOR SSW18 x 13 STRONG WALL ABOVE

NOTE: USE 5/8" Ø ANCHOR BOLTS W/ 3" x 3" x 1/4" WASHERS @ 5'-0" O.C. U.N.O

FOUNDATION PLAN

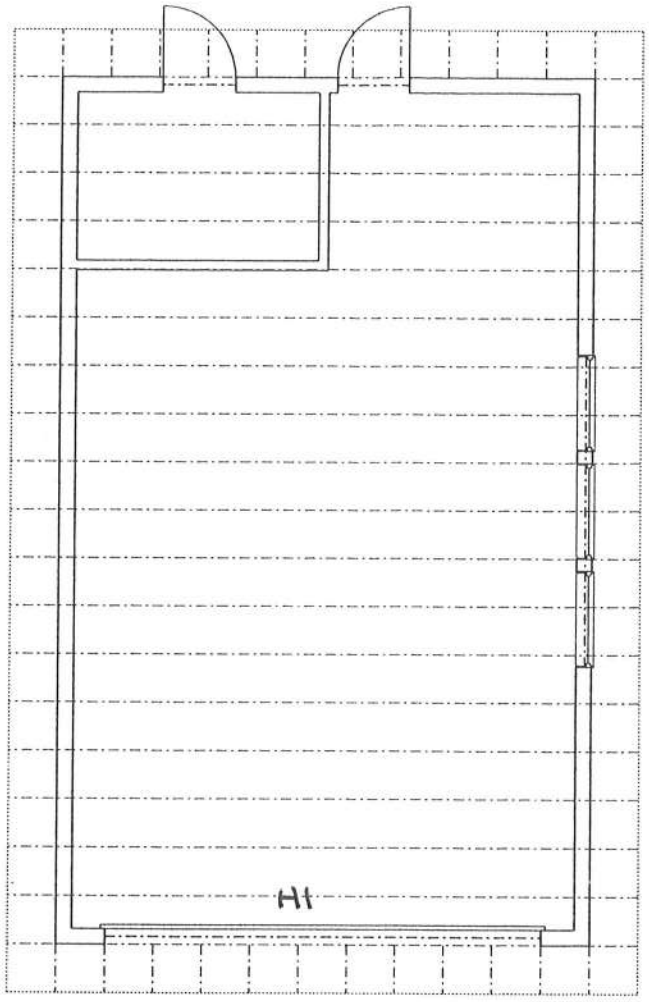
WC WELLER CONSULTING ENGINEERS, P.C.
21925 8TH PL W • BOTHELL, WA 98021
PH. (425) 488 - 9868 • FAX (425) 486 - 6715

JOB NAME NELSON / HEADRICK
JOB NUMBER 19-010 PREPARED BY MW
DATE 4 / 9 / 19 SHEET NO. 9 OF ____



DETAIL A

V1



DESIGN LOADS:

ROOF DL = 15 PSF
LL = 60 PSF

ENGINEERED TRUSSES BY TRUSS MANUFACTURER

HEADERS: 4 x 10 DF # 2 U.N.O.

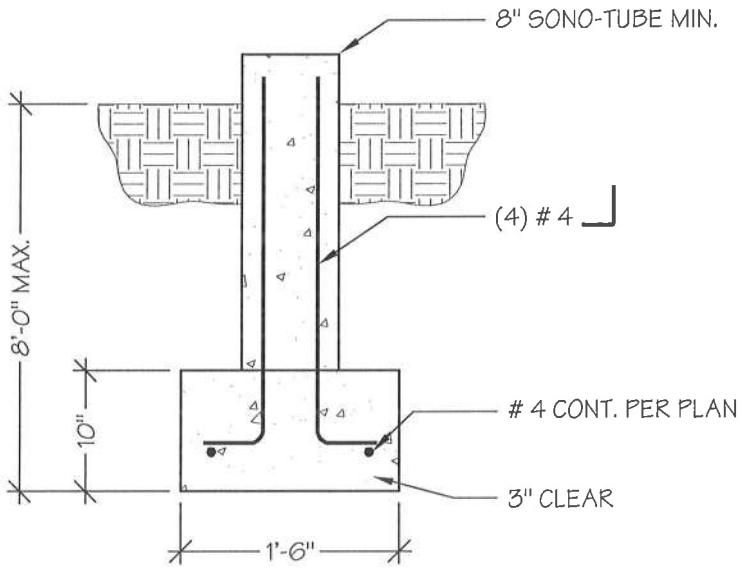
NOTE: PROVIDE (1) 2 X TRIMMER
@ ALL HEADERS U.N.O

H1: 5 1/8 x 12 GLB (24F-V4)

ROOF FRAMING PLAN

WC WELLER CONSULTING ENGINEERS, P.C.
21925 8TH PL W • BOTHELL, WA 98021
PH. (425) 488 - 9868 • FAX (425) 486 - 6715

JOB NAME NELSON / HEADRICK
JOB NUMBER 19-010 PREPARED BY MW
DATE 4 / 9 / 19 SHEET NO. V2 OF ____



TYPICAL SONO-TUBE TO SPREAD FOOTING CONNECTION DETAIL

V3

BeamChek v2018 licensed to: Weller Consulting Engineers, P.C. Reg # 5234-65779

NELSON / HEADRICK — ROOF FRAMING

TYPICAL HEADER — Date: 4/09/19

Selection **4x 10 DF-L #2** — Lu = 0.0 Ft

Conditions NDS 2015

Min Bearing Area R1= 3.5 in² R2= 3.5 in² (1.5) DL Defl= <0.01 in.

Data

Beam Span	4.5 ft	Reaction 1 LL	1755 #	Reaction 2 LL	1755 #
Beam Wt per ft	7.87 #	Reaction 1 TL	2211 #	Reaction 2 TL	2211 #
Bm Wt Included	35 #	Maximum V	2211 #		
Max Moment	2488 '#	Max V (Reduced)	1454 #		
TL Max Defl	L / 240	TL Actual Defl	L / >1000		
LL Max Defl	L / 360	LL Actual Defl	L / >1000		

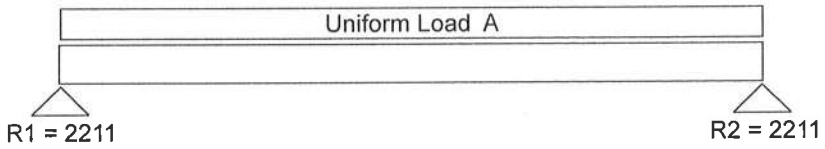
Attributes

	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	49.91	32.38	0.03	0.02
Critical	27.64	12.12	0.23	0.15
Status	OK	OK	OK	OK
Ratio	55%	37%	12%	13%

Values / *Adjustments*

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	900	180	1.6	625
Adjusted Values	1080	180	1.6	625
CF Size Factor	1.200			
Cd Duration	1.00	1.00		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00
Cl Stability	1.0000	Rb = 0.00	Le = 0.00 Ft	

Loads Uniform LL: 780 Uniform TL: 975 = A



SPAN = 4.5 FT

Uniform and partial uniform loads are lbs per lineal ft.

V4

BeamChek v2018 licensed to: Weller Consulting Engineers, P.C. Reg # 5234-65779

NELSON / HEADRICK — ROOF FRAMING

H1 — Date: 4/09/19

Selection **5-1/8x 12 GLB 24F-V4 DF/DF** — Lu = 0.0 Ft

Conditions NDS 2015

Min Bearing Area R1= 3.3 in² R2= 3.3 in² (1.5) DL Defl= 0.35 in Recom Camber= 0.53 in

Data

Beam Span	18.5 ft	Reaction 1 LL	1110 #	Reaction 2 LL	1110 #
Beam Wt per ft	14.94 #	Reaction 1 TL	2173 #	Reaction 2 TL	2173 #
Bm Wt Included	276 #	Maximum V	2173 #		
Max Moment	10051 '#	Max V (Reduced)	1938 #		
TL Max Defl	L / 240	TL Actual Defl	L / 375		
LL Max Defl	L / 360	LL Actual Defl	L / 934		

Attributes

	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	123.00	61.50	0.59	0.24
Critical	50.26	12.11	0.93	0.62
Status	OK	OK	OK	OK
Ratio	41%	20%	64%	39%

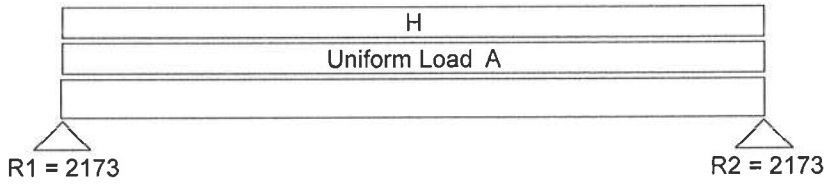
Values / *Adjustments*

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	2400	240	1.8	650
Adjusted Values	2400	240	1.8	650
Cv Volume	1.000			
Cd Duration	1.00	1.00		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Cm Wet Use	1.00	1.00	1.00	1.00

Cl Stability 1.0000 Rb = 0.00 Le = 0.00 Ft

Loads Uniform LL: 120 Uniform TL: 150 = A

	Par Unif TL	Start	End
	H = 70	0	18.5



SPAN = 18.5 FT

Uniform and partial uniform loads are lbs per lineal ft.

V5

BeamChek v2018 licensed to: Weller Consulting Engineers, P.C. Reg # 5234-65779

NELSON / HEADRICK — DECK FRAMING

TYPICAL BEAM — Date: 4/12/19

Selection **PT 4x 10 HF #2** — Lu = 0.0 Ft

Conditions NDS 2015, Incised

Min Bearing Area R1= 3.2 in² R2= 3.2 in² (1.5) DL Defl= 0.04 in

Data

Beam Span	9.0 ft	Reaction 1 LL	1080 #	Reaction 2 LL	1080 #
Beam Wt per ft	7.87 #	Reaction 1 TL	1295 #	Reaction 2 TL	1295 #
Bm Wt Included	71 #	Maximum V	1295 #		
Max Moment	2915 '#	Max V (Reduced)	1074 #		
TL Max Defl	L / 240	TL Actual Defl	L / 670		
LL Max Defl	L / 360	LL Actual Defl	L / 870		

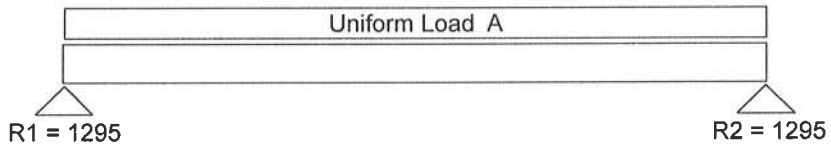
Attributes

	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	49.91	32.38	0.16	0.12
Critical	42.86	13.42	0.45	0.30
Status	OK	OK	OK	OK
Ratio	86%	41%	36%	41%

Values / *Adjustments*

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	850	150	1.3	405
Adjusted Values	816	120	1.2	405
CF Size Factor	1.200			
Cd Duration	1.00	1.00		
Cr Repetitive	1.00			
Ch Shear Stress		N/A		
Ci Incised	0.80	0.80	0.95	1.00
Cl Stability	1.0000	Rb = 0.00	Le = 0.00 Ft	

Loads Uniform LL: 240 Uniform TL: 280 = A



SPAN = 9 FT

Uniform and partial uniform loads are lbs per lineal ft.

V6

BeamChek v2018 licensed to: Weller Consulting Engineers, P.C. Reg # 5234-65779

NELSON / HEADRICK — DECK FRAMING

TYPICAL DECK JOIST — Date: 4/12/19

Selection **PT 2x 8 HF #2 @ 16 in oc** — Lu = 0.0 Ft

Conditions NDS 2015, Repetitive Use, Incised

Min Bearing Area R1= 0.9 in² R2= 0.9 in² (1.5) DL Defl= 0.03 in

Data

Beam Span	8.0 ft	Reaction 1 LL	320 #	Reaction 2 LL	320 #
Beam Wt per ft	0 #	Reaction 1 TL	373 #	Reaction 2 TL	373 #
Bm Wt Included	0 #	Maximum V	373 #		
Max Moment	747 '#	Max V (Reduced)	317 #		
TL Max Defl	L / 240	TL Actual Defl	L / 614		
LL Max Defl	L / 360	LL Actual Defl	L / 767		

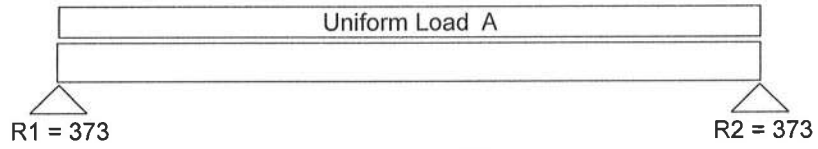
Attributes

	Section (in³)	Shear (in²)	TL Defl (in)	LL Defl
Actual	13.14	10.88	0.16	0.13
Critical	9.55	3.96	0.40	0.27
Status	OK	OK	OK	OK
Ratio	73%	36%	39%	47%

Values / *Adjustments*

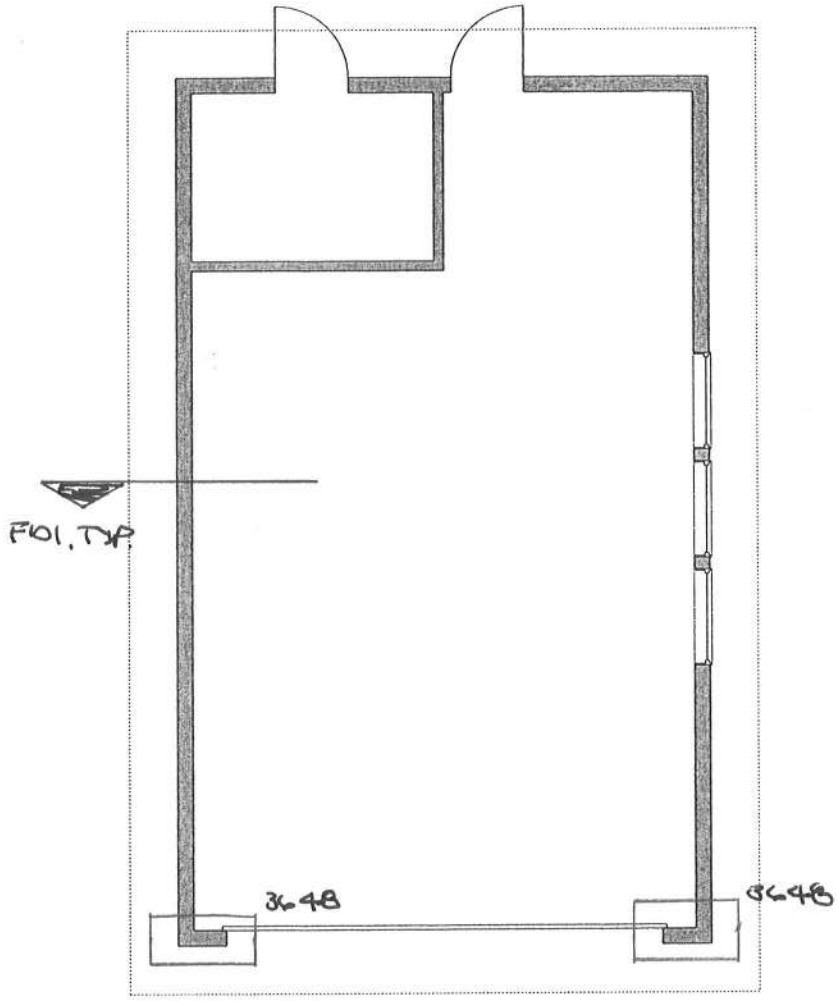
	Fb (psi)	Fv (psi)	E (psi x mil)	Fc⊥ (psi)
Reference Values	850	150	1.3	405
Adjusted Values	938	120	1.2	405
CF Size Factor	1.200			
Cd Duration	1.00	1.00		
Cr Repetitive	1.15			
Ch Shear Stress		N/A		
Ci Incised	0.80	0.80	0.95	1.00
Cl Stability	1.0000	Rb = 0.00	Le = 0.00 Ft	

Loads Uniform LL: 80 Uniform TL: 93 = A



SPAN = 8 FT

Uniform and partial uniform loads are lbs per lineal ft.

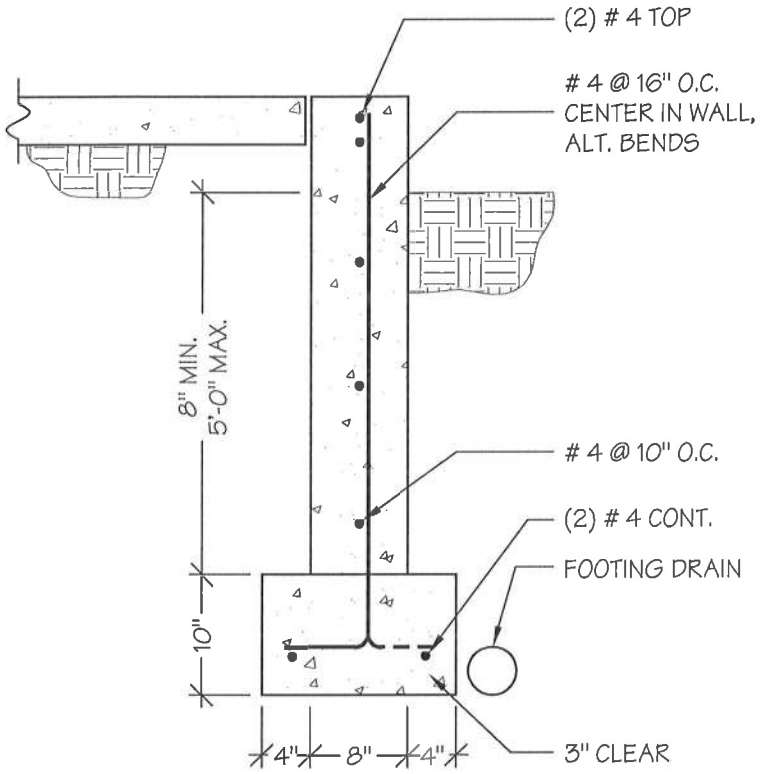


SPREAD FOOTING SCHEDULE			
#	WIDTH	DEPTH	REINFORCEMENT
3648	3' - 0" x 4' - 0"	14"	# 4 @ 12" O.C. EACH WAY

FOUNDATION PLAN

WC WELLER CONSULTING ENGINEERS, P.C.
21925 8TH PL W • BOTHELL, WA 98021
PH. (425) 488 - 9868 • FAX (425) 486 - 6715

JOB NAME NELSON / HEADRICK
JOB NUMBER 19-010 PREPARED BY MW
DATE 4 / 9 / 19 SHEET NO. F2 OF ____



DETAIL FD1