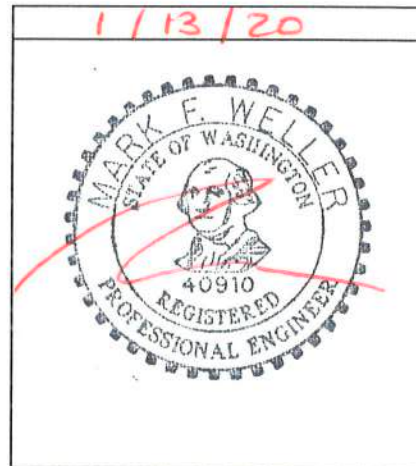


**REVISED STRUCTURAL DESIGN
FOR
THE HEADRICK GARAGE
A NED NELSON ARCHITECT PLAN
MERCER ISLAND, WASHINGTON**

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



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

PROJECT NO.	19-010 R
DATE	01/13/20
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_I = 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" \varnothing x 10", A307 or better, w/ 7" min. Embedment. $V = 1.6 \times 860 = 1376 \# / \text{bolt}$

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.

SW-2 **v = 950 plf** 7/16" OSB, w/ 8d (0.131" Ø) common nails @ 2" o.c. (staggered)
Anchorage (interior walls only) to 4x (min.) BEAM or blkg below:
¼" x 4 ½" SDS SCREWS @ 3" o.c.

NOTE: use min 3" nominal studs @ adjoining panel edges

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 #

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

WIND: PER ASCE 7-10 SECTION 28.6

side/side $F_R =$ 50 SF @ 28.08 psf = 842 # A <30
 0 SF @ 0 psf = 0 # B <30
 242 SF @ 18.72 psf = 2,718 # C <30
 0 SF @ 0 psf = 0 # D <30

Total Roof s/s: $F_R = 3,561$ #

front/back $F_R =$ 50 SF @ 28.08 psf = 842 # A <30
 0 SF @ 0 psf = 0 # B <30
 130 SF @ 18.72 psf = 1,460 # C <30
 0 SF @ 0 psf = 0 # D <30

Total Roof f/b: $F_R = 2,303$ #

WIND: PER ASCE 7-10 SECTION 28.6.4

292 SF @ 16.0 psf = 2,803 #
 0 SF @ 8.0 psf = 0 #
2,803 #

180 SF @ 16.0 psf = 1,728 #
 0 SF @ 8.0 psf = 0 #
1,728 #

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

HORIZONTAL DIAPHRAGM SHEARS / LOAD PATH

ROOF DIAPHRAGM

FRONT: $v = 1780 / 22 = 81$ plf OK

ANCHOR BOLTS

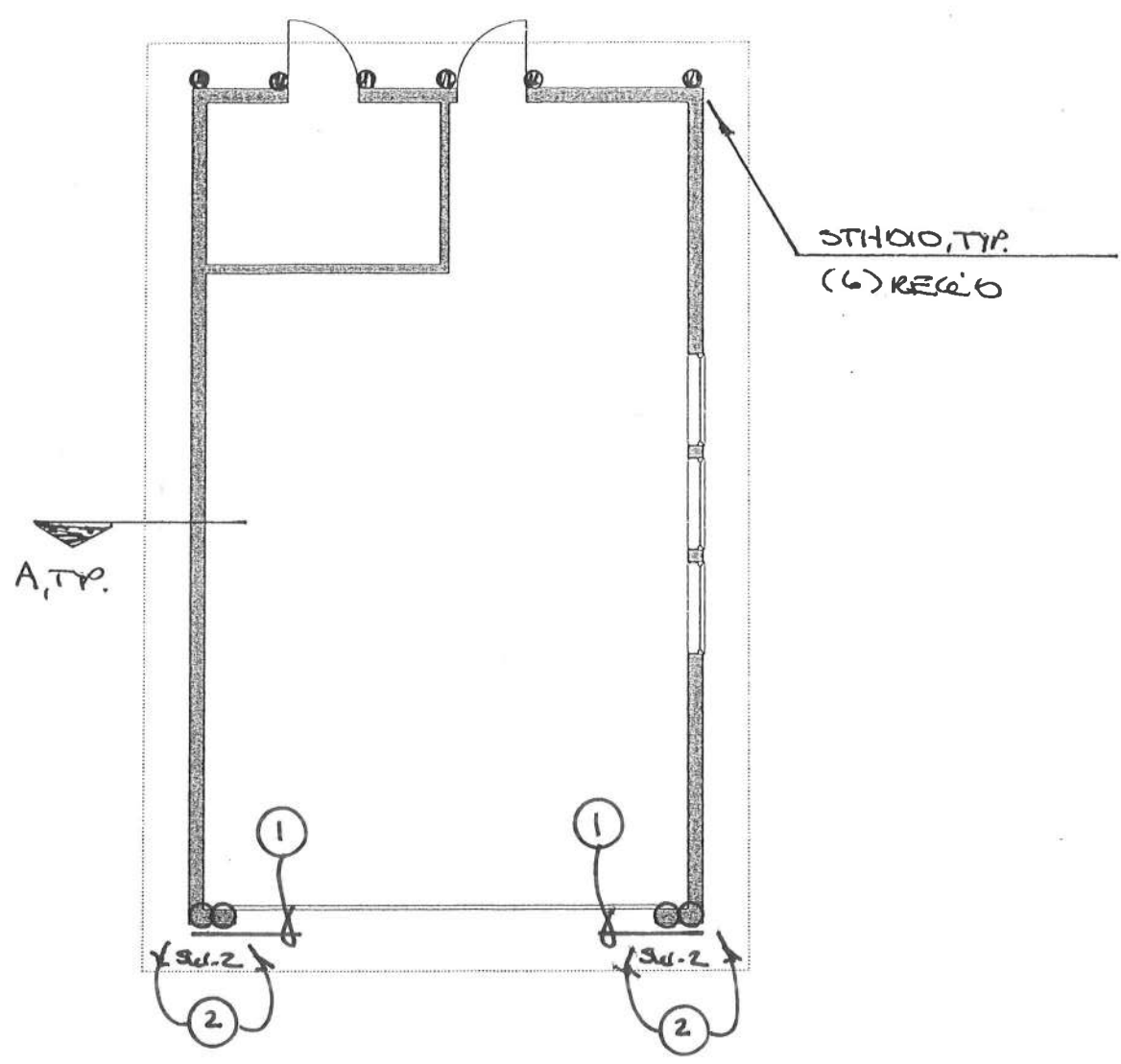
USE 5/8" \emptyset Anchor Bolts @ 5' - 0" o.c. Unless Notes Otherwise (U.N.O.)

$v = 1.6 \times 860 \# / 5 = 275$ plf

FRONT: @ 2' walls; $V = 2 \times 445 = 890 \#$ (1) 5/8" A.B. OK

RESISTING ELEMENT

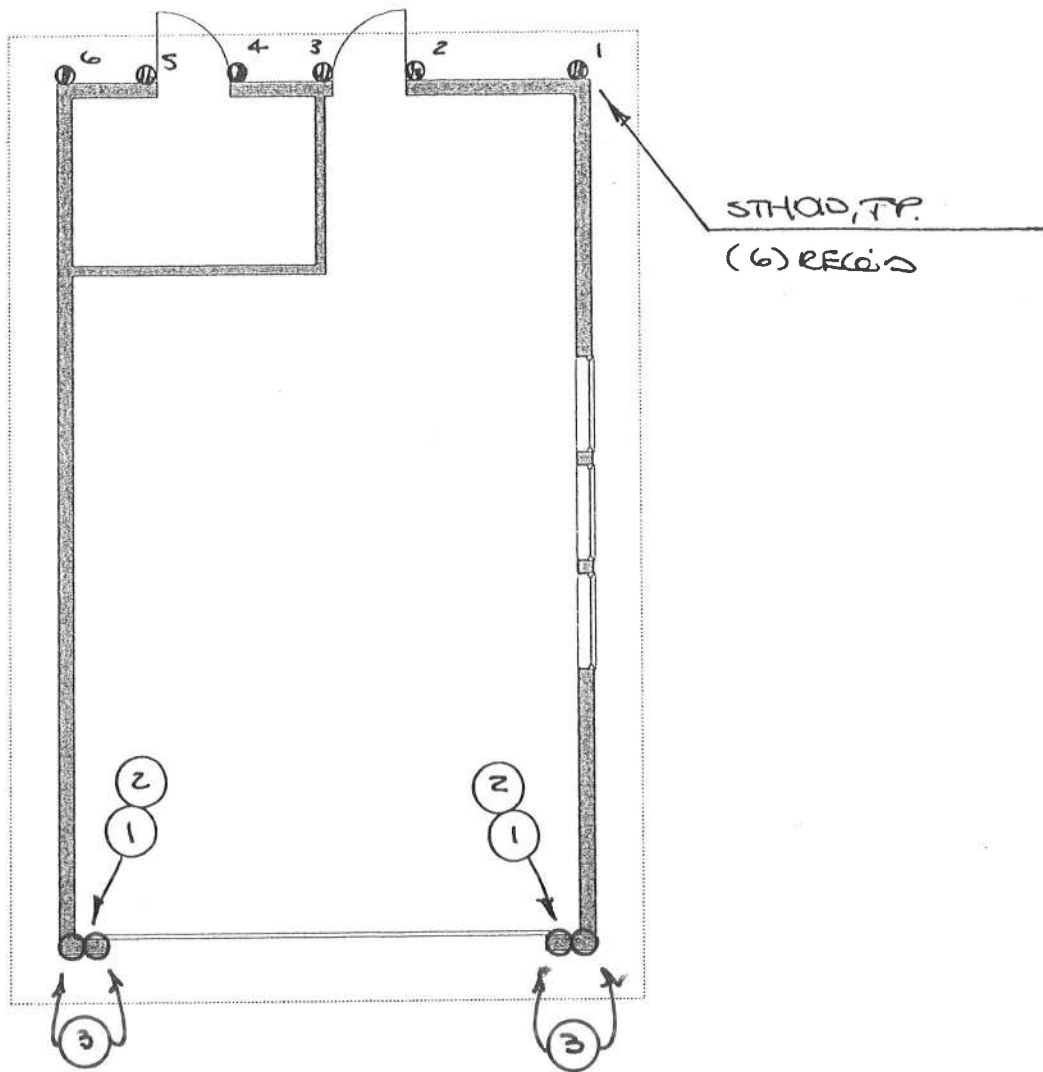
- R_{DL} Dead Load Reaction
- 1 Perpendicular Exterior Wall $T_{MAX} = V_{CORNER} = H_{WALL} \times V_{MIN}$
 - 2 Perpendicular Wall (min) 5 - 16d nails = 5' x 109 plf = 545 #
 - 3 A 35 Framing Anchors = 600 # each
 - 4 CS16 Strap = 1705 #
 - 5 STHD10 or STHD10RJ @ 3400 # (Midwall), 2940 # (Corner), 2175 # (Endwall)
 - 6 HDQ8 @ 7630 #



- ① ADD CS16 BLOCKNG TO DOOR HEADER. SEE DETAIL B
- ② HDQ8, SEE DETAIL C

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

MAIN FLOOR SHEAR WALLS



- ① CONCRETE STEM WALL TO BE 4'-0" MIN ABOVE GARAGE SLAB
- ② 3" x 3" x 1/4" PLATE WASHER SHALL EXTEND TO WITHIN 1/2" OF SHEATHING
- ③ SSTB28 FOR HDQ8 ABOVE, SEE DETAIL C

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

FOUNDATION PLAN



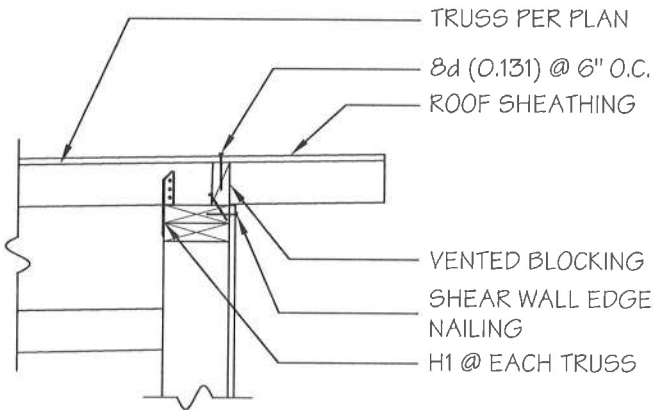
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ENGINEERS, P.C.

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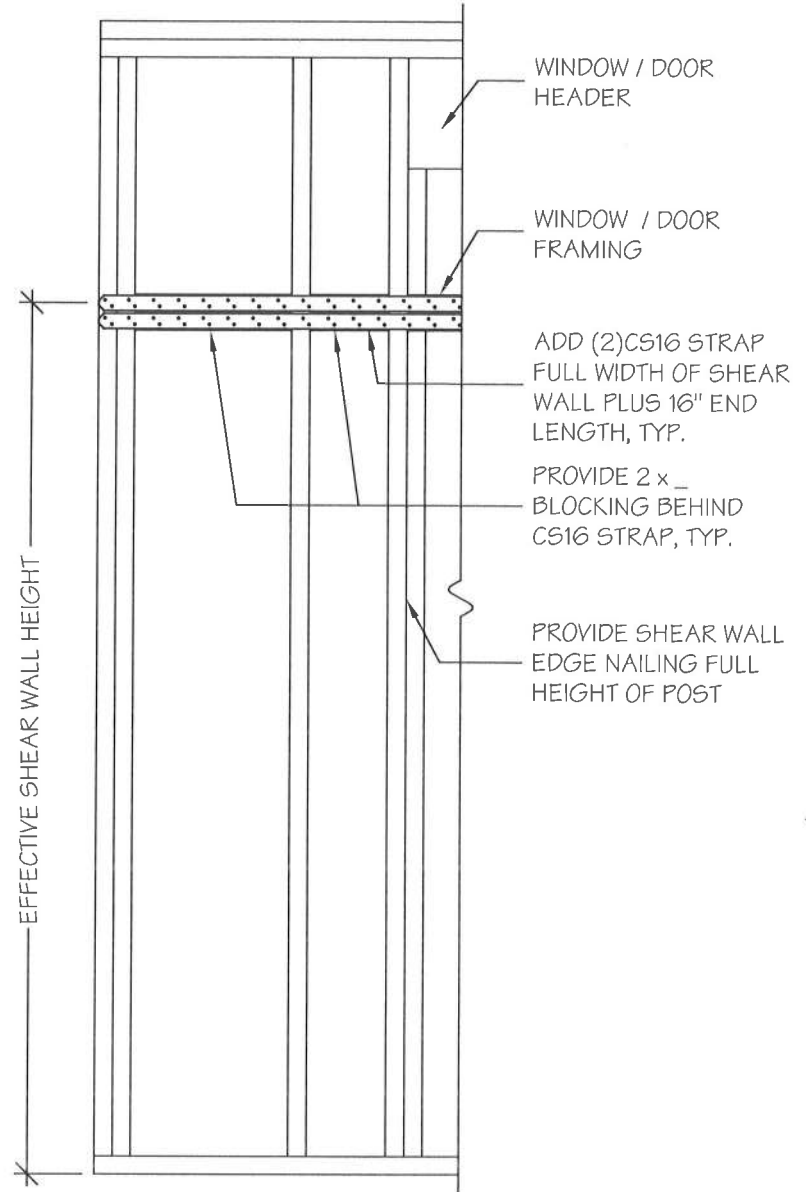
JOB NAME NELSON / HEADRICK

JOB NUMBER 19-010 PREPARED BY MW

DATE 1 / 13 / 20 SHEET NO. 66 OF



DETAIL A



DETAIL B



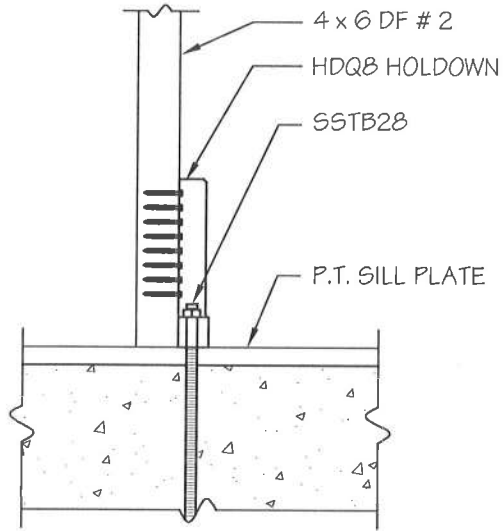
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JOB NUMBER 19-010 PREPARED BY MW

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DETAIL C

ROOF FRAMING PLAN NOTES

DESIGN LOADS:

ROOF DL = 15 PSF
LL = 60 PSF

ENGINEERED TRUSSES BY TRUSS MANUFACTURER

NOTE: PROVIDE (2) 2 X POST @ ALL HIP MASTERS
& GIRDER TRUSSES U.N.O

RAFTERS: 1 3/4 x 7 1/4 LVL @ 12" O.C.

NOTE: PROVIDE HU7 HANGERS @
ALL FLUSH FRAMED ENDS

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 18 GLB (24F-V4)

H2: 5 1/8 x 9 GLB (24F-V4)

COLUMNS:

C1: 2 x 6 HF # 2 TRIMMER W/ (2) 2 x 6 KING

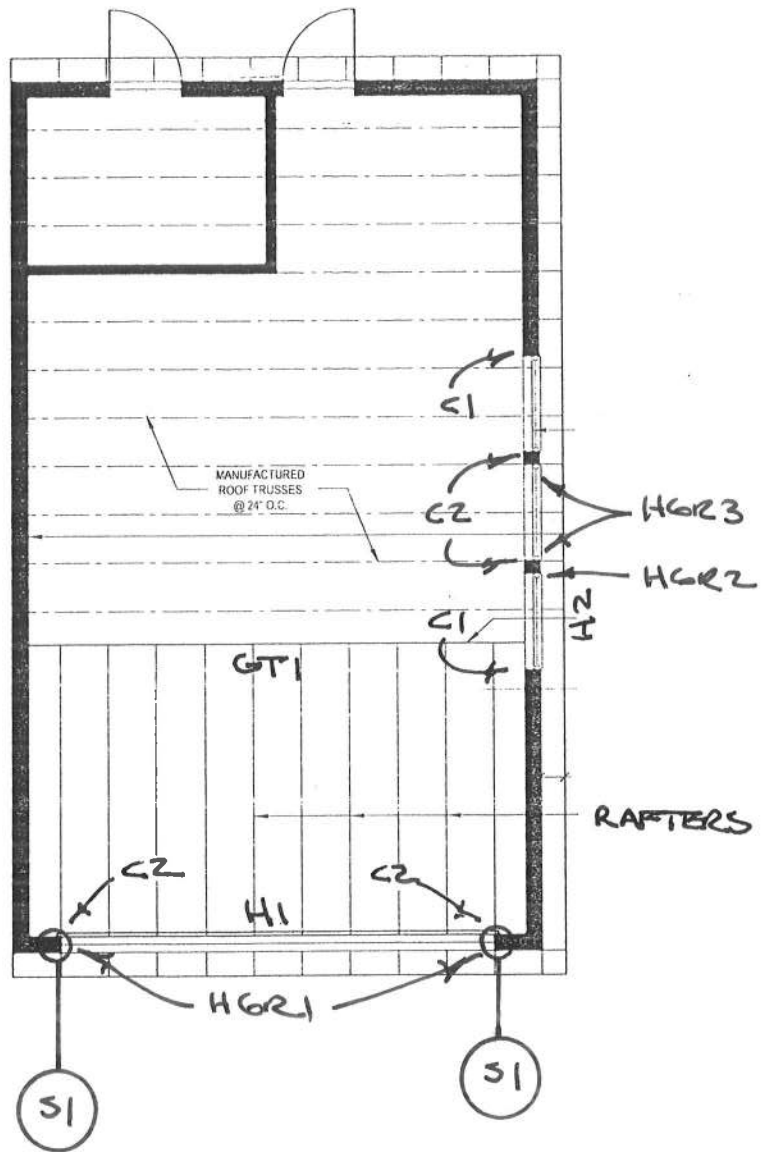
C2: 6 x 6 DF # 2 KING

HANGERS:

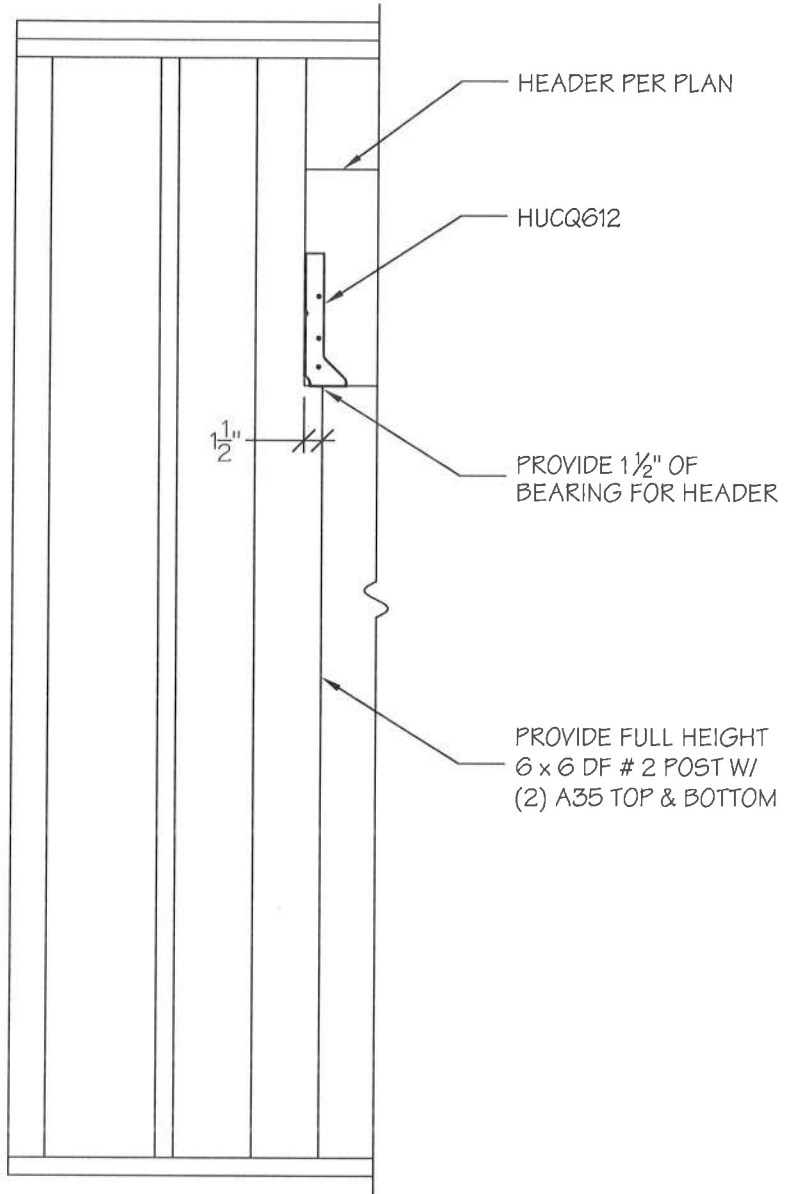
HGR1: HUCQ612

HGR2: HUCQ610

HGR3: HUC410



ROOF FRAMING PLAN



DETAIL S1



THE HEADRICK GARAGE

ROOF FRAMING

GT1 (FOR REACTIONS ONLY)

Date: 10/31/19

<u>Selection</u>	5-1/8x 16-1/2 GLB 24F-V4 DF/DF	Lu = 0.0 Ft
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<u>Conditions</u>	NDS 2015
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Min Bearing Area R1= 8.3 in² R2= 8.3 in² (1.5) DL Defl= 0.26 in Recom Camber= 0.39 in

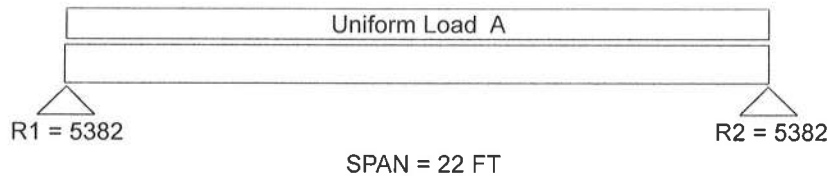
<u>Data</u>	Beam Span	22.0 ft	Reaction 1 LL	4125 #	Reaction 2 LL	4125 #
	Beam Wt per ft	20.55 #	Reaction 1 TL	5382 #	Reaction 2 TL	5382 #
	Bm Wt Included	452 #	Maximum V	5382 #		
	Max Moment	29603 #	Max V (Reduced)	4710 #		
	TL Max Defl	L / 240	TL Actual Defl	L / 317		
	LL Max Defl	L / 360	LL Actual Defl	L / 462		

<u>Attributes</u>	Section (in ³)	Shear (in ²)	TL Defl (in)	LL Defl
Actual	232.55	84.56	0.83	0.57
Critical	153.51	29.43	1.10	0.73
Status	OK	OK	OK	OK
Ratio	66%	35%	76%	78%

<u>Values</u>		Fb (psi)	Fv (psi)	E (psi x mil)	Fc _⊥ (psi)
Reference Values		2400	240	1.8	650
Adjusted Values		2314	240	1.8	650

<u>Adjustments</u>	Cv Volume	0.964			
	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: 375 Uniform TL: 469 = A



Uniform and partial uniform loads are lbs per lineal ft.

THE HEADRICK GARAGE

ROOF FRAMING

TYPICAL RAFTER

Date: 10/31/19

Selection 1-3/4x 7-1/4 1.9E TJ Microllam LVL Lu = 0.0 Ft

Conditions NDS 2015

Min Bearing Area R1= 0.7 in² R2= 0.7 in² (1.5) DL Defl= 0.14 in

Data

Beam Span	12.5 ft	Reaction 1 LL	375 #	Reaction 2 LL	375 #
Beam Wt per ft	3.26 #	Reaction 1 TL	489 #	Reaction 2 TL	489 #
Bm Wt Included	41 #	Maximum V	489 #		
Max Moment	1529 #	Max V (Reduced)	442 #		
TL Max Defl	L / 240	TL Actual Defl	L / 330		
LL Max Defl	L / 360	LL Actual Defl	L / 481		

Attributes

	Section (in ³)	Shear (in ²)	TL Defl (in)	LL Defl
Actual	15.33	12.69	0.45	0.31
Critical	6.59	2.33	0.63	0.42
Status	OK	OK	OK	OK
Ratio	43%	18%	73%	75%

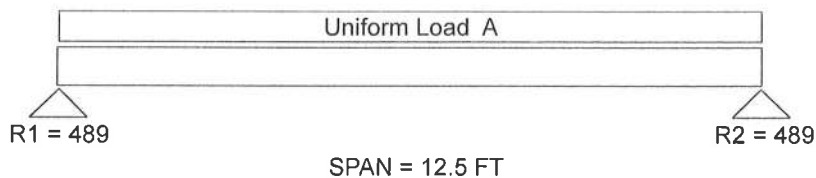
Values

	Fb (psi)	Fv (psi)	E (psi x mil)	Fc _⊥ (psi)
Reference Values	2600	285	1.9	750
Adjusted Values	2784	285	1.9	750

Adjustments

CF Size Factor	1.071			
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
CI Stability	1.0000	Rb = 0.00	Le = 0.00 Ft	

Loads Uniform LL: 60 Uniform TL: 75 = A



Uniform and partial uniform loads are lbs per lineal ft.



THE HEADRICK GARAGE

ROOF FRAMING

TYPICAL HEADER

Date: 1/11/20

<u>Selection</u>	4x 10 DF-L #2	Lu = 0.0 Ft
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<u>Conditions</u>	NDS 2015	
	Min Bearing Area R1= 3.5 in ² R2= 3.5 in ² (1.5) DL Defl= <0.01 in.	

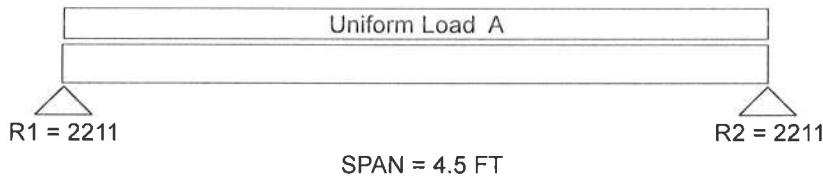
<u>Data</u>	Beam Span	4.5 ft	Reaction 1 LL	1755 #	Reaction 2 LL	1755 #
	Beam Wt per ft	7.87 #	Reaction 1 TL	2211 #	Reaction 2 TL	2211 #
	Bm Wt Included	35 #	Maximum V	2211 #		
	Max Moment	2488 #'	Max V (Reduced)	1454 #		
	TL Max Defl	L / 240	TL Actual Defl	L / >1000		
	LL Max Defl	L / 360	LL Actual Defl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

<u>Attributes</u>	Section (in ³)	Shear (in ²)	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%

<u>Values</u>		Fb (psi)	Fv (psi)	E (psi x mil)	Fc.L (psi)
Reference Values		900	180	1.6	625
Adjusted Values		1080	180	1.6	625

<u>Adjustments</u>	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
	CI Stability	1.0000	Rb = 0.00	Le = 0.00 Ft	

Loads Uniform LL: 780 Uniform TL: 975 = A



Uniform and partial uniform loads are lbs per lineal ft.

THE HEADRICK GARAGE

ROOF FRAMING

H2

Date: 1/11/20

<u>Selection</u>	5-1/8x 9 GLB 24F-V4 DF/DF	Lu = 0.0 Ft
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<u>Conditions</u>	NDS 2015
	Min Bearing Area R1= 8.0 in ² R2= 5.5 in ² (1.5) DL Defl= 0.01 in Recom Camber= 0.02 in

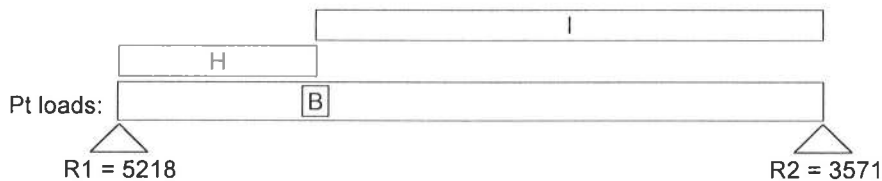
<u>Data</u>	Beam Span	4.5 ft	Reaction 1 LL	4024 #	Reaction 2 LL	2786 #
	Beam Wt per ft	11.21 #	Reaction 1 TL	5218 #	Reaction 2 TL	3571 #
	Bm Wt Included	50 #	Maximum V	5218 #		
	Max Moment	6398 #'	Max V (Reduced)	5097 #		
	TL Max Defl	L / 240	TL Actual Defl	L / >1000		
	LL Max Defl	L / 360	LL Actual Defl	L / >1000		

<u>Attributes</u>	Section (in ³)	Shear (in ²)	TL Defl (in)	LL Defl
Actual	69.19	46.13	0.04	0.03
Critical	31.99	31.86	0.23	0.15
Status	OK	OK	OK	OK
Ratio	46%	69%	20%	20%

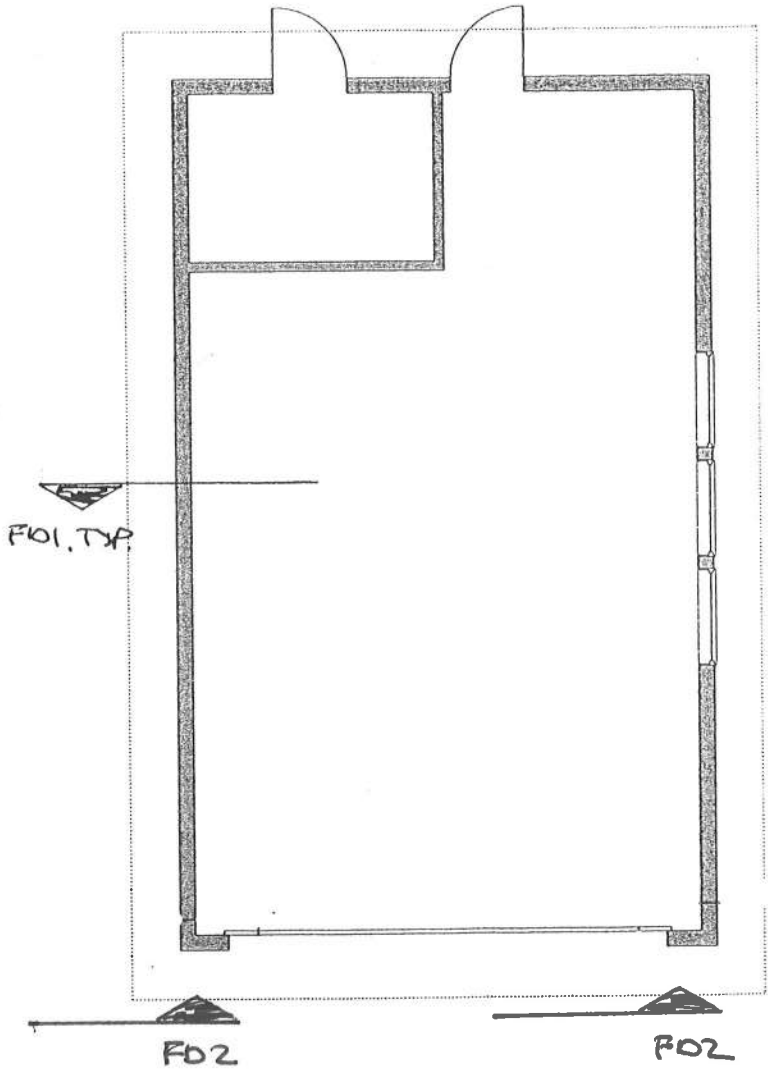
<u>Values</u>	Fb (psi)	Fv (psi)	E (psi x mil)	Fc _L (psi)
Reference Values	2400	240	1.8	650
Adjusted Values	2400	240	1.8	650

<u>Adjustments</u>	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
	CI Stability	1.0000	Rb = 0.00	Le = 0.00 Ft

<u>Loads</u>	Point LL	Point TL	Distance	Par Unif LL	Par Unif TL	Start	End
	4125	B = 5382	1.25	120	H = 150	0	1.25
				780	I = 975	1.25	4.5



Uniform and partial uniform loads are lbs per lineal ft.



FOUNDATION PLAN



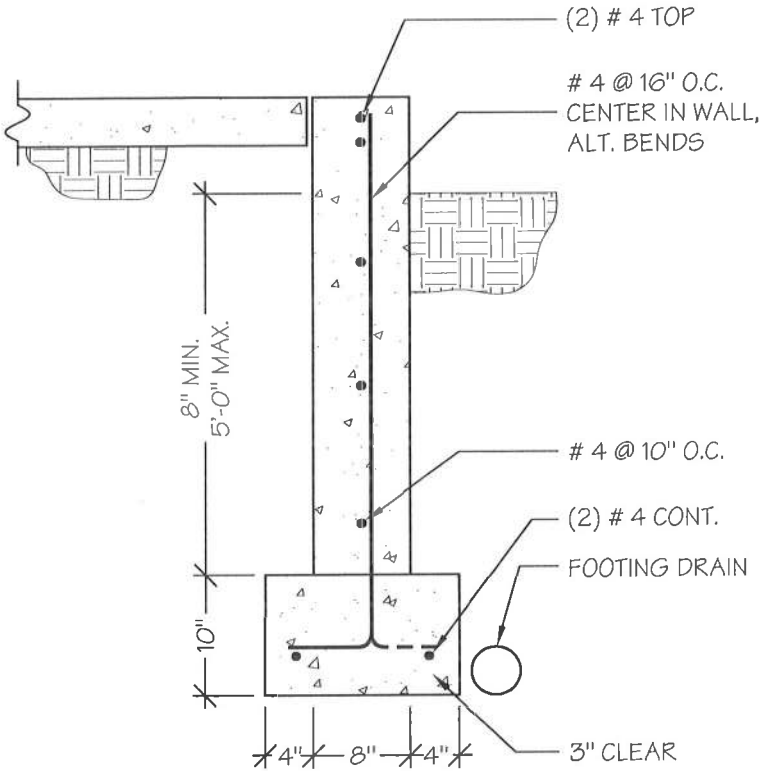
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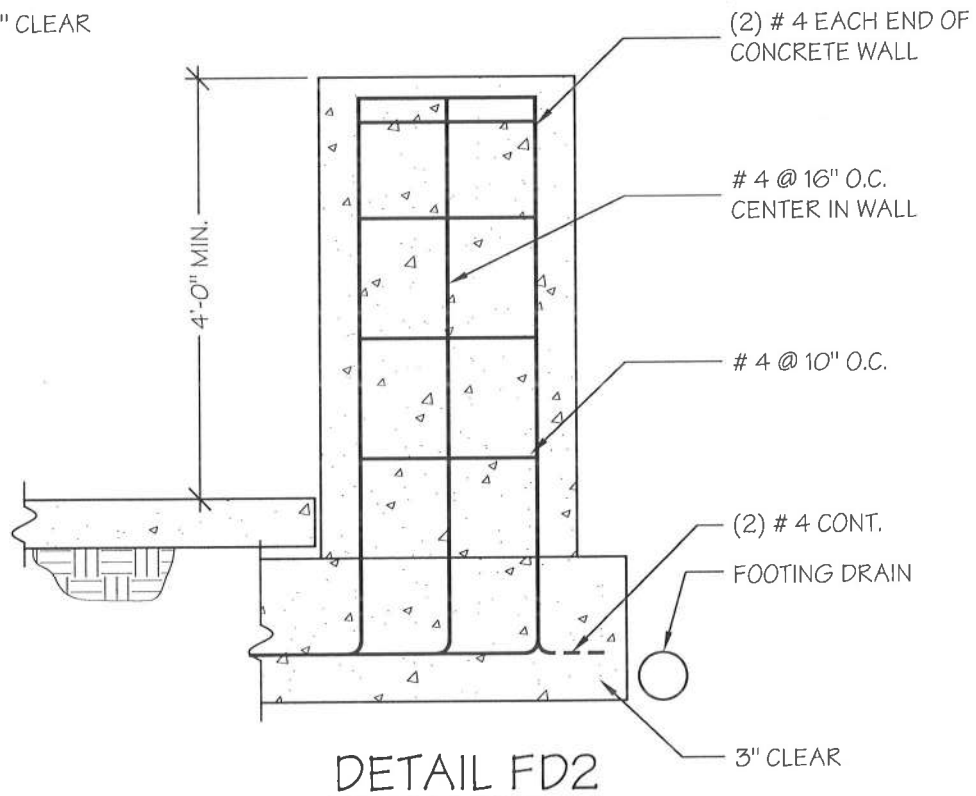
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JOB NUMBER 19-010 PREPARED BY MW

DATE 1 / 13 / 20 SHEET NO. F2 OF



DETAIL FD1



DETAIL FD2