



February 10, 2023

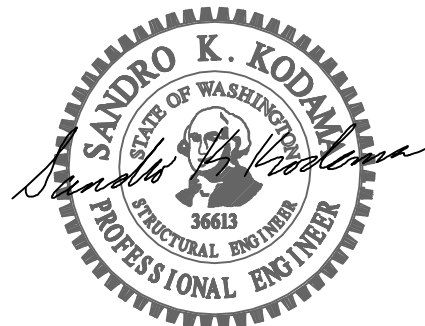
**STRUCTURAL SUPPORT CALCULATIONS**  
(Supplemental Calculations)

**HEADRICK RESIDENCE**  
8822 SE 62<sup>nd</sup> Street  
Mercer Island, WA 98040

Quantum Job Number: 21271.01

*Prepared for:*  
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1021 92<sup>nd</sup> Avenue NE  
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*Prepared by:*  
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# DESIGN CRITERIA

# Residential Building Loads

Snow Load      Roof      **25 psf**

Garage Roof Loads		Comments
Standard Roofing	4.0 psf	
3/4" Plywood Shtg	2.8 psf	
Trusses @ 24" o.c.	3.0 psf	
Insulation	1.0 psf	
Lights, ducts	0.5 psf	
5/8" GWB	2.8 psf	
Miscellaneous	0.9 psf	
Total: <b>15.0 psf</b>		

## Deflection Criteria

Roof	Walls	Floor
Live Load: <b>L/240</b>	<b>L/120</b> *flexible finishes	Live Load: <b>L/360</b>
Total Load: <b>L/240</b>	<b>L/240</b> *brittle finish	Total Load: <b>L/240</b>
	<b>L/240</b> *supporting glass	

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**GRAVITY DESIGN**

Garage Roof			
Member Name	Results	Current Solution	Comments
West Wall Header, 10'-0"	Passed	1 piece(s) 5 1/8" x 9" 24F-V4 DF Glulam	
West Wall Header with Girder Truss, 10'-0"	Passed	1 piece(s) 5 1/8" x 9" 24F-V4 DF Glulam	
Garage Main Floor			
Member Name	Results	Current Solution	Comments
Garage Stud	Passed	1 piece(s) 2 x 6 HF No.2 @ 16" OC	

<p>ForteWEB Software Operator</p> <p>Maxwell Skotheim Quantum Consulting Engineers (206) 957-3906 MSkotheim@quantumce.com</p>	<p>Job Notes</p>
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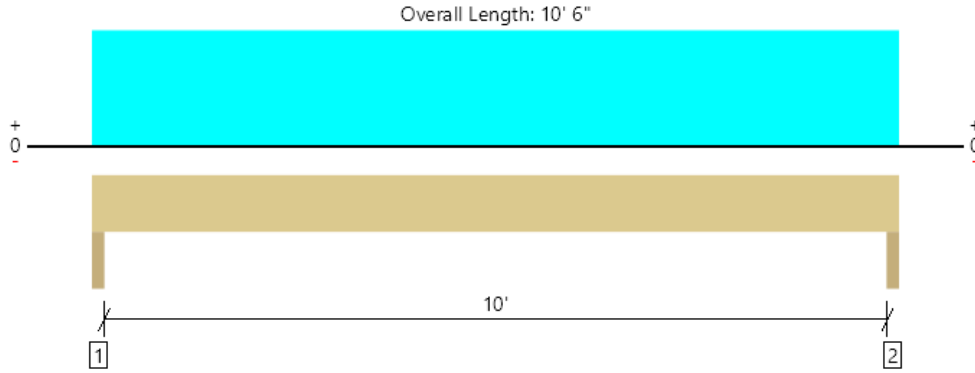


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File Name: 21271.01 - Headrick Residence

Garage Roof, West Wall Header, 10'-0"  
1 piece(s) 5 1/8" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2684 @ 1 1/2"	9994 (3.00")	Passed (27%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2173 @ 1'	9371	Passed (23%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	6714 @ 5' 3"	15913	Passed (42%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.122 @ 5' 3"	0.342	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.227 @ 5' 3"	0.512	Passed (L/543)	--	1.0 D + 1.0 S (All Spans)

System : Wall  
Member Type : Header  
Building Use : Residential  
Building Code : IBC 2018  
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 10' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Trimmer - HF	3.00"	3.00"	1.50"	1240	1444	2684	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	1240	1444	2684	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 6" o/c	
Bottom Edge (Lu)	10' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 10' 6"	N/A	11.2	--	
1 - Uniform (PSF)	0 to 10' 6"	11'	15.0	25.0	Roof
2 - Uniform (PLF)	0 to 10' 6"	N/A	60.0	-	Wall Above

**Weyerhaeuser Notes**

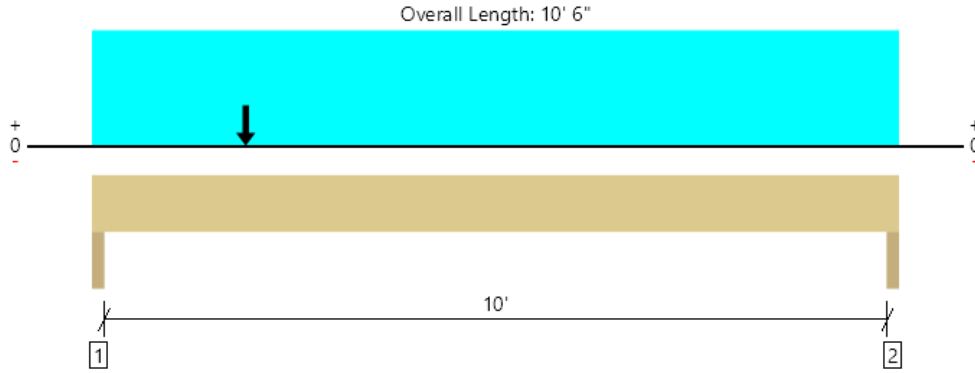
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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
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Garage Roof, West Wall Header with Girder Truss, 10'-0"  
1 piece(s) 5 1/8" x 9" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2833 @ 1 1/2"	9994 (3.00")	Passed (28%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2762 @ 1'	9371	Passed (29%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	5170 @ 2'	15913	Passed (32%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.080 @ 4' 7 3/8"	0.342	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.142 @ 4' 9 1/16"	0.512	Passed (L/863)	--	1.0 D + 1.0 S (All Spans)

System : Wall  
Member Type : Header  
Building Use : Residential  
Building Code : IBC 2018  
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 10' 3".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Trimmer - HF	3.00"	3.00"	1.50"	1068	1765	2833	None
2 - Trimmer - HF	3.00"	3.00"	1.50"	529	395	924	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 6" o/c	
Bottom Edge (Lu)	10' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 10' 6"	N/A	11.2	--	
1 - Uniform (PLF)	0 to 10' 6"	N/A	60.0	-	Wall Above
2 - Point (lb)	2'	N/A	850	2160	Girder Truss

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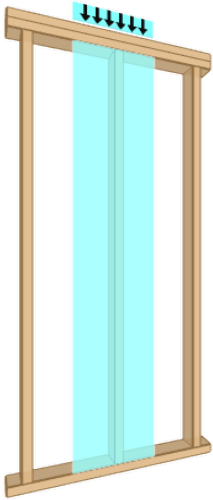


Garage Main Floor, Garage Stud  
1 piece(s) 2 x 6 HF No.2 @ 16" OC

Wall Height: 13'

Member Height: 12' 7 1/2"

O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	28	50	Passed (55%)	--	--
Compression (lbs)	1000	3832	Passed (26%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	1000	4177	Passed (24%)	--	1.0 D + 1.0 L
Lateral Reaction (lbs)	88	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	81	1320	Passed (6%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	276 @ mid-span	1264	Passed (22%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.22 @ mid-span	1.26	Passed (L/704)	--	1.0 D + 0.6 W
Bending/Compression	0.31	1	Passed (31%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 Lr

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for this design is 16.67% of applicable member side dimension.
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Hem Fir
Base	2X	Hem Fir

System : Wall  
Member Type : Stud  
Building Code : IBC 2018  
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Lateral Connections				
Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Load	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Point (PLF)	16.00"	150.0	600.0	Roof

Lateral Load	Location	Spacing	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	16.00"	17.3	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (98), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

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**HEADRICK RESIDENCE**

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Mercer Island, WA 98040

Quantum Job Number: 21271.01

**LATERAL DESIGN**

**GARAGE BASE SHEAR:**

**SEISMIC:**

$W = 792 \text{ SF} * 20 \text{ PSF} = 15840 \text{ LB}$

$C_s = 0.179$

$V_e = 15840 * 0.179 = 2835 \text{ LB}$

**WIND:**

**E-W DIRECTION:**

$A = 250 \text{ SF}$

$q = 17.2 \text{ PSF}$

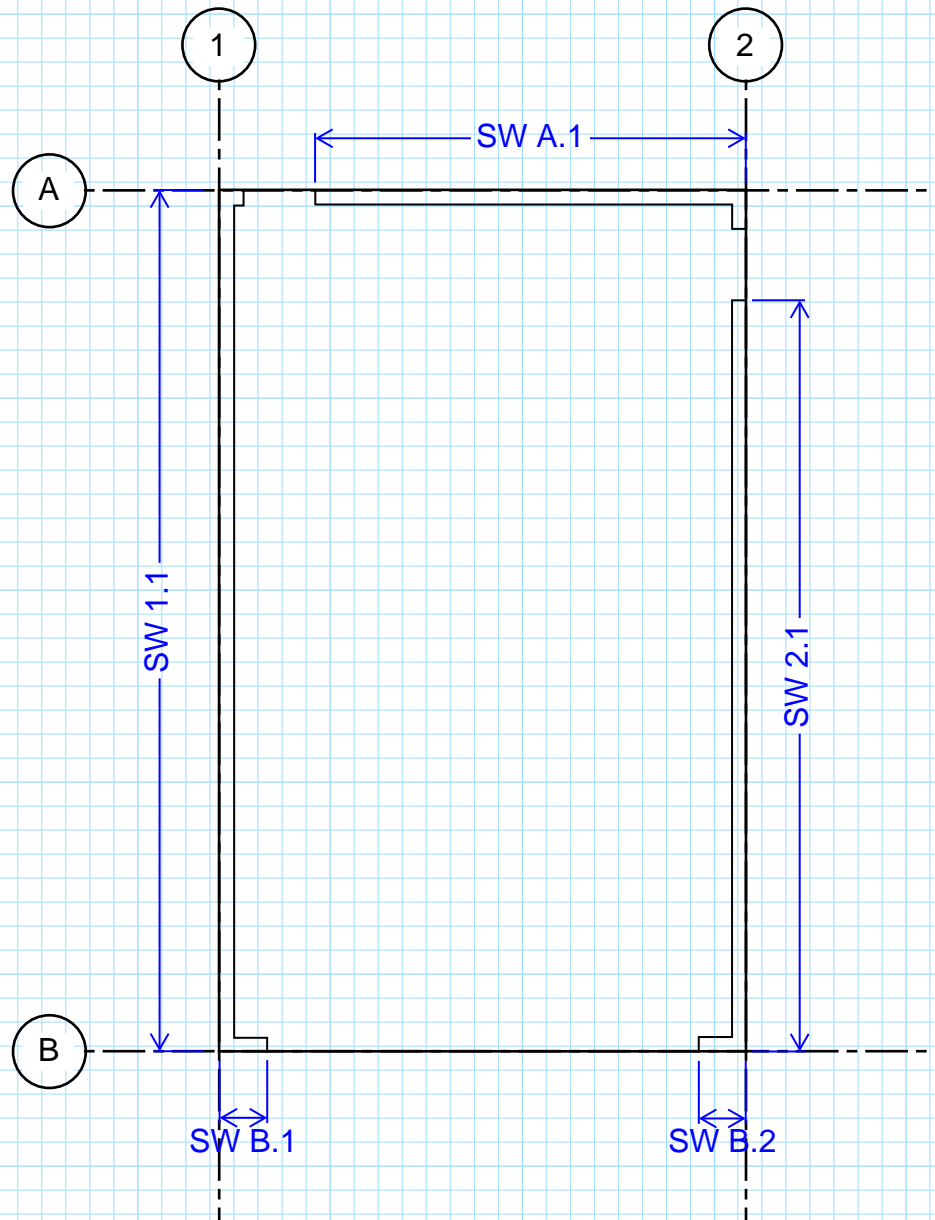
$V_w = 4300 \text{ LB}$

**N--S DIRECTION:**

$A = 152 \text{ SF}$

$q = 16.0 \text{ PSF}$

$V_w = 2432 \text{ LB}$



SHEAR WALL KEY PLAN



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client _____	checked by _____	_____

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Headrick Garage**  
 Floor Level: **Roof (N-S)**


Sds = 1.17  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 12.00

## Shear Wall Line Information

SW Mark	L <sub>sw</sub> (ft)	Wall Pier h <sub>wp</sub> (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory or Base?	h <sub>sw</sub> (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
<b>SW GRID 1</b>	<b>36.00</b>	-	-	-	-	-	-	-	-	-
SW Segment 1.1	36.00	13.00	0.36	HF #2	0.43	Base	13.00	10.0	11.0	15.0
<b>SW GRID 2</b>	<b>31.33</b>	-	-	-	-	-	-	-	-	-
2.1	31.33	13.00	0.41	HF #2	0.43	Base	13.00	10.0	11.0	15.0
<b>SW GRID</b>	<b>0.00</b>	-	-	-	-	-	-	-	-	-
<b>SW GRID</b>	<b>0.00</b>	-	-	-	-	-	-	-	-	-

## Shear Wall Loads and Summary

SW Mark	EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holddown
<b>SW GRID 1</b>	1420	1220	-	-	-	-	-	-
SW Segment 1.10	1420	1220	10620	280	280	SW-6	2	No HD
<b>SW GRID 2</b>	1420	1220	-	-	-	-	-	-
2.10	1420	1220	9243	280	280	SW-6	2	No HD
<b>SW GRID</b>	-	-	-	-	-	-	-	-
<b>SW GRID</b>	-	-	-	-	-	-	-	-

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	Client: Ned Nelson	Designer: MKS	Sheet: 1
	Checked By:		

# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Headrick Garage**  
 Floor Level: **Roof (N-S)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, $G_s$ (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

\*\*See SDPWS Table 4.3A Note 2


## Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
1.10	39	1.00	42	34	36	42	SW-6	416	OK	Seismic
2.10	45	1.00	49	39	42	49	SW-6	416	OK	Seismic

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input $M_{OT}$ Lever Arm (ft)
1.10	36.00	35.63	1.05%	No	
2.10	31.33	30.96	1.21%	No	

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		Designer: MKS	Sheet: 3
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# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Headrick Garage**  
 Floor Level: **Roof (E-W)**


Sds = 1.17  
 Depth of Floor Framing & Plates (Clearspan) at Interstory (in) = 12.00

## Shear Wall Line Information

SW Mark	L <sub>sw</sub> (ft)	Wall Pier h <sub>wp</sub> (ft)	Aspect Ratio	Wall Framing Species	Specific Gravity G	Interstory or Base?	h <sub>sw</sub> (ft)	Wall Wt. (psf)	Roof/Floor Trib. (ft)	Roof/Floor Wt. (psf)
<b>SW GRID A</b>	<b>18.00</b>	-	-	-	-	-	-	-	-	-
SW Segment A.1	18.00	13.00	0.72	HF #2	0.43	Base	13.00	10.0	2.0	15.0
<b>SW GRID B</b>	<b>4.00</b>	-	-	-	-	-	-	-	-	-
B.1	2.00	4.00	2.00	HF #2	0.43	Base	4.00	10.0	2.0	15.0
B.2	2.00	4.00	2.00	HF #2	0.43	Base	4.00	10.0	2.0	15.0
<b>SW GRID</b>	<b>0.00</b>	-	-	-	-	-	-	-	-	-
<b>SW GRID</b>	<b>0.00</b>	-	-	-	-	-	-	-	-	-

## Shear Wall Loads and Summary

SW Mark	EQ (lb) Wall (ULT)	Wind (lb) Wall (ULT)	Wall DL (lb)	Wall DL (lb) End 1	Wall DL (lb) End 2	Shear Wall Type	MIN. # of End Studs	Holddown
<b>SW GRID A</b>	1420	2150	-	-	-	-	-	-
SW Segment A.1	1420	2150	2880	560	560	SW-6	2	No HD
<b>SW GRID B</b>	1420	2150	-	-	-	-	-	-
B.1	710	1075	140	560	560	SW-6	2	HDU2 (3075DF,2215HF)
B.2	710	1075	140	560	560	SW-6	2	HDU2 (3075DF,2215HF)
<b>SW GRID</b>	-	-	-	-	-	-	-	-
<b>SW GRID</b>	-	-	-	-	-	-	-	-

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# LIGHT FRAMED WOOD SHEATHED PANEL SHEAR WALL DESIGN

Per IBC 2018, ASCE 7-16, SDPWS 2015 & NDS 2018

Structure: **Headrick Garage**  
 Floor Level: **Roof (E-W)**

## Shear Wall Schedule (LRFD)

$\phi_p = 0.8$

Shear Wall Type	Sheathing Grade, Sheathing Thickness, & Nail Size	Panel Edge Nail Spacing (in)	Nominal Seismic SW Capacity (plf)	LRFD Seismic SW Capacity (plf)	Nominal Wind SW Capacity (plf)	LRFD Wind SW Capacity (plf)	Sheathing Shear Stiffness, $G_s$ (lb/in)
SW-6	APA Rated, 7/16", 8d Common	6	520	416	730	584	10
SW-4	APA Rated, 7/16", 8d Common	4	760	608	1065	852	13
SW-3	APA Rated, 7/16", 8d Common	3	980	784	1370	1096	15
SW-2	APA Rated, 7/16", 8d Common	2	1280	1024	1790	1432	20
2SW-4	APA Rated, 7/16", 8d Common	4	1520	1216	2130	1704	26
2SW-3	APA Rated, 7/16", 8d Common	3	1960	1568	2740	2192	30
2SW-2	APA Rated, 7/16", 8d Common	2	2560	2048	3580	2864	40

\*\*See SDPWS Table 4.3A Note 2

## Determine Shear Wall Type (LRFD)

SW Segment Mark	Seismic Shear (plf)	Aspect Ratio Reduction	Adjusted Seismic Shear (plf)	Wind Shear (plf)	Adjusted Wind Shear (plf)	Controlling Shear (plf)	Shear Wall Type	Shear Wall Capacity (plf)	Check	Controlling Shear
A.1	79	1.00	85	119	128	128	SW-6	584	OK	Wind
B.1	355	1.00	382	538	578	578	SW-6	584	OK	Wind
B.2	355	1.00	382	538	578	578	SW-6	584	OK	Wind

\*NOTE: CONTROLLING SHEAR IS BASED ON THE DIFFERENCE IN SHEAR WALL CAPACITY BETWEEN WIND & EQ

## Determine Shear Wall Overturning Moment Lever Arm

SW Segment Mark	Wall Length Lever Arm (ft)	Calculated Lever Arm (ft)	% Different	Override Wall Length	User Input $M_{OT}$ Lever Arm (ft)
A.1	18.00	17.63	2.13%	No	
B.1	2.00	1.52	31.96%	No	
B.2	2.00	1.52	31.96%	No	

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Project: Headrick Garage

Date: 2/10/23

Job No: 21271.01

Designer: MKS

Sheet: 3

Client: Ned Nelson

Checked By:

