STRUCTURAL CALCULATION
For
Pro Built Garages
For
Cole Garage
Lateral and Vertical
Design
Project # 2020220
September 17, 2020

Precise Engineering Inc.
1011 Mellen Street * Centralia, WA 98531
(360) 736-1137 * Fax (360) 807-0108
e-mail: preciseengineering@comcast.net

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By
PRECISE ENGINEERING INC.

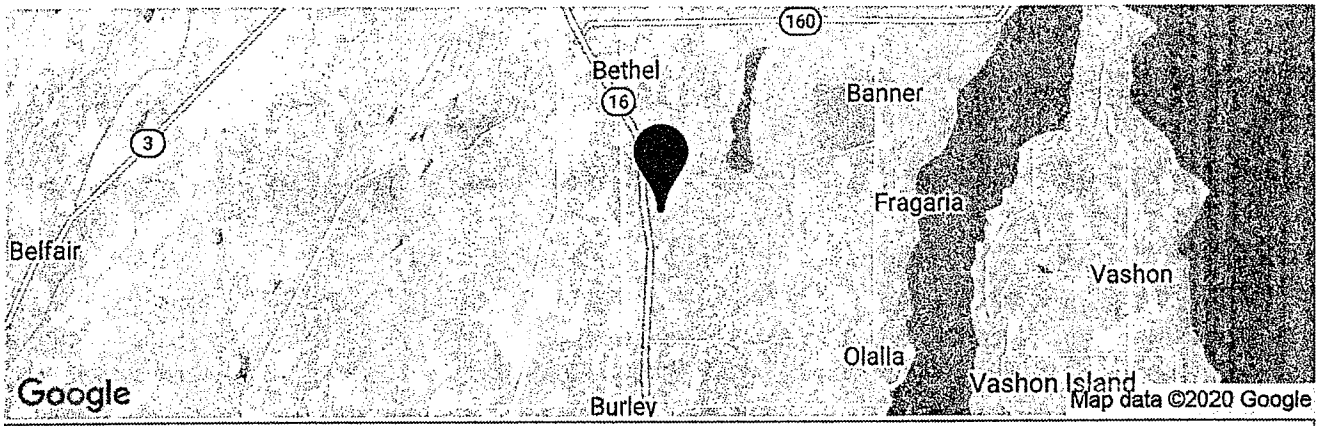
HAROLD HAHNENKRATT, P.E.

11/17/2020

OSHPD

9518 Horizon Ln SE, Port Orchard, WA 98367, USA

Latitude, Longitude: 47.461779, -122.6179895



Date	9/17/2020, 10:41:49 AM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.499	MCE_R ground motion. (for 0.2 second period)
S_1	0.575	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.499	Site-modified spectral acceleration value
S_{M1}	0.863	Site-modified spectral acceleration value
S_{DS}	0.999	Numeric seismic design value at 0.2 second SA
S_{D1}	0.575	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.617	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.617	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.499	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.571	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.005	Factored deterministic acceleration value. (0.2 second)
S1RT	0.575	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.619	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.96	Factored deterministic acceleration value. (1.0 second)
PGAd	1.075	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.954	Mapped value of the risk coefficient at short periods

Permit Number: 20-04524

LATERAL DESIGN

Wind Loading: **Simplified (ASCE 7-10 Chapter 28 Part 2)**

$p_s = \lambda K_{zt} p_{s30}$

ASD $p_s = .6\ \lambda K_{zt} p_{s30}$

Wind Speed 110 mph

Exposure B

Roof Pitch 4:12

Pitch	ps30 Roof	Wall
2:12	-7.2	17.76
3:12	-6.5	19.65
4:12	-5.7	21.5
5:12	-0.5	21.4
6:12	6.87	20.3
>7:12	13.3	19.4

λ= 1

K_{zt} = 1

ps30 = -5.7 (Roof)
21.5 (Wall)

ASD

p_s = -3.4 (Roof)
12.9 (Wall)

Minimum Loading

p_s = 8.0 (Roof)
16.0 (Wall)

(ASD) Minimum Loading

p_s = 4.8 (Roof)
9.6 (Wall)

Seismic Loading: Section 12.4,12.8 ASCE7-10

$E_h = rQ_h$ $Q_h = V$ r=1.3

$V = C_s W$

$C_s = S_{DS}/1.4R$

$E = (1.3S_{DS}/1.4R)W$

S_{DS} 0.999

R = 6.5 (Wood Shear Wall)

R = 1.5 (Cantilever Column)

V= 0.143 Wt. (Wood Shear Wall)

V= 0.618 Wt. (Cantilever Column)

TRUSS NOTES

Shall carry manuf. stamp & be installed & braced to manuf. specs.

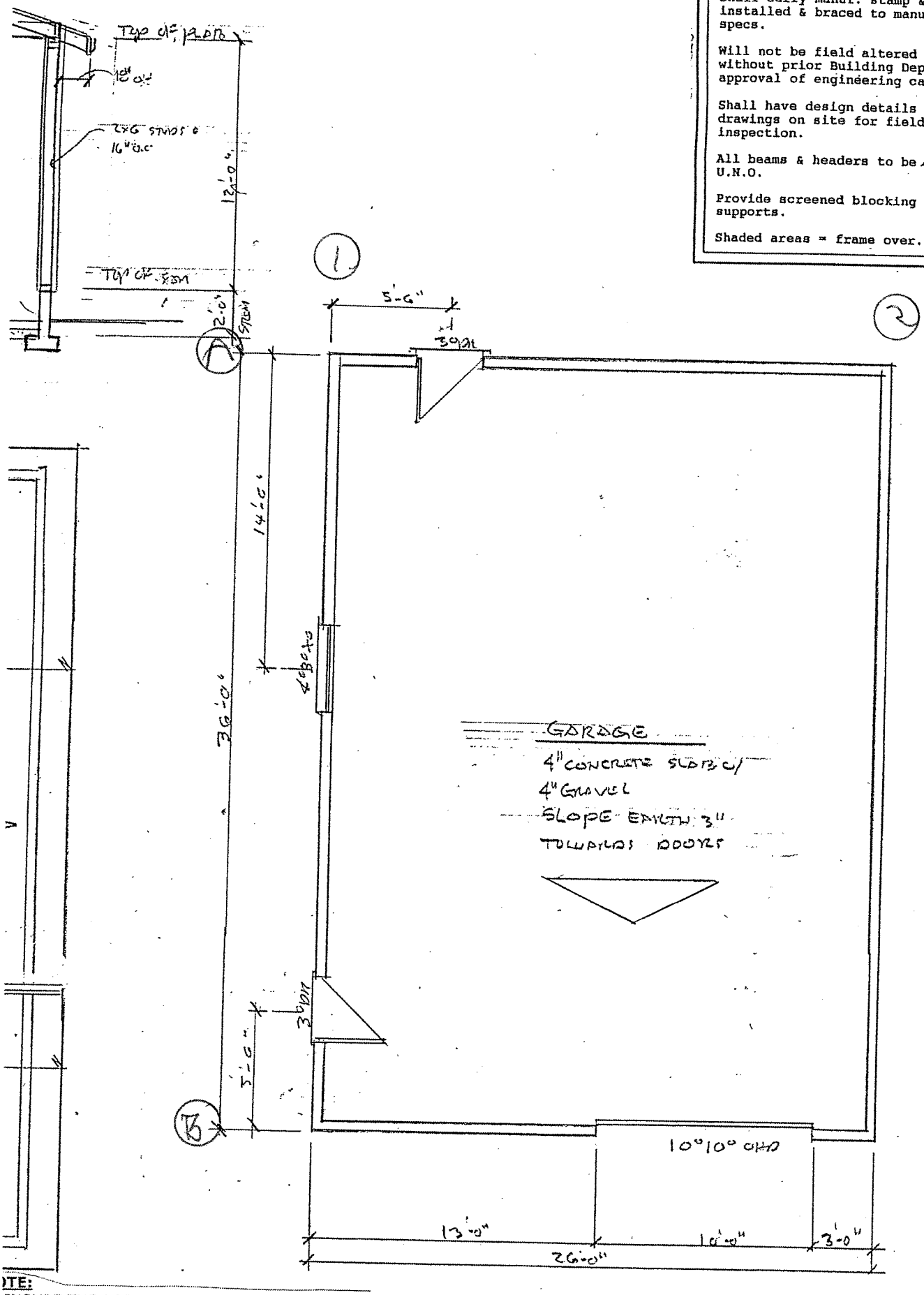
Will not be field altered without prior Building Dept. approval of engineering calcs.

Shall have design details & drawings on site for field inspection.

All beams & headers to be 4 x 8 U.N.O.

Provide screened blocking over supports.

Shaded areas = frame over.



NOTE:
INSURE THE ACCURACY OF THE DRAWINGS HAS NEVER, IT IS THE RESPONSIBILITY OF THE CHECK AND VERIFY ALL DIMENSIONS AND

FLOOR/FOUNDATION PLAN 1/4"

936 SQ

One Story Wind to Diaphragm

		Wind
Main Plate Height	12	Roof 4.8
		Walls 12.9

Diaphragm

		Roof Ht.	Gable Ht.	Wind Load	Length		Total Load
1-2	Roof	0	3.0	116.1	26.0		3018.6
						SUM	3018.6

		Roof Ht.		Wind Load	Length		Total Load
A-B	Roof	5	0.0	101.4	36.0		3650.4
						SUM	3650.4

V_J

1941

1064

3004

STRUCTURAL

TOP 1121 x 12 = 13572

WALL (26+36)2 x 60 = 7440

WIND CONTROLS

Precise Engineering, Inc
102 Otto Road
Centralia, WA 9531

DIAPHRAGMS

Page
Of

Diaphragm Capacities												
7/16 OSB						15/32 Plywood						
Case 1			Case 2,3,4,5,6,1			Case 1			Case 2,3,4,5,6,1			
8d's			8d's			8d's			8d's			
1.0	Wind	322plf	3.0	Wind	238plf	5.0	Wind	335plf	9.0	Wind	252plf	
2.0	Seismic	230plf	4.0	Seismic	170plf	6.0	Seismic	240plf	10.0	Seismic	180plf	
						10d's			10d's			
						7.0	Wind	357plf	11.0	Wind	265plf	
						8.0	Seismic	255plf	12.0	Seismic	190plf	

Label	Level	Loading (plf)	Width (ft)	Length (ft)	Shear V (lbs)	Shear v (plf)	Dia. Tie		Moment (ft-lbs)	T=C (lbs)	Nailing Requirement
							H1(in)	A35(in)			
1-2	roof	116.1	26.0	36.0	1509.3	41.9	138.8	128.8	9810.5	272.5	3.0
A-B	roof	101.4	36.0	26.0	1825.2	70.2	82.9	76.9	16426.8	631.8	3.0

LOAD TO LINES

Line #	Roof							Level							
							Total							Sub Total	Total
							0							0	0
1	1510						1510							0	1510
							0							0	0
2	1510						1510							0	1510
							0							0	0
							0							0	0
						Sum	3020						Sum	0	3020
							0							0	0
A	1826						1826							0	1826
							0							0	0
B	1826						1826							0	1826
							0							0	0
							0							0	0
						Sum	3652						Sum	0	3652
							0							0	0

JOB:_____
Date:_____By:__
Sheet:_____Page

Holdown		
Callout	Size	Capacity
A	HDU2	3075
	HDU4	4565
	HDU5	5645
	HDU8	7870

Seismic Shear Wall Capacity		
Callout	Size	Capacity
1	8d at 6	260 plf
	8d at 4	380 plf
	8d at 3	490 plf
	8d at 2	640 plf

Seismic Shear Wall Capacity		
Callout	Size	Capacity
	10@6	310 plf
	10d@4	460 plf
	10d@3	600 plf
	10d@2	770 plf

Anchor Bolt Capacity	
1/2" Dia. 2x Sill = 912	x
5/8" Dia. 2x Sill = 1328	
1/2" Dia. 3x Sill = 1120	
5/8" Dia. 3x Sill 1664	

Plate Height	
1st Floor Wall Height =	12
2nd Floor Wall Height =	
3rd Floor Wall Height =	

2:1 Height: Width for full capacity

Wind Shear Wall Capacity		
Callout	Size	Capacity
1	8d at 6	365 plf
	8d at 4	532 plf
	8d at 3	685 plf
	8d at 2	895 plf

Wind Shear Wall Capacity		
Callout	Size	Capacity
	10@6	435 plf
	10d@4	645 plf
	10d@3	840 plf
	10d@2	1077 plf

SHEAR WALLS

Wall	Lev.	V	Walls Availiable								Total Wall	Short Wall	Wall Height	Short Walll v	v	Wall Type	__ dia #	AB Spac.	Uplift	Wall Sect.	Wt. Down	Net Uplift	Total Uplift	Holdown
			1	2	3	4	5	6	7	8														
1	Rf	1510.0	12.5	12.5							25.0	12.5	12.0	53	60.4	1.0		48.0	724.8	12.5	256.0	-875.2	-875.2	none
2	Rf	1510.0	36.0								36.0	36.0	12.0	35	41.9	1.0		48.0	503.3	36.0	256.0	-4104.7	-4104.7	none
A	Rf	1826.0	19.0								19.0	19.0	12.0	82	96.1	1.0		48.0	1153.3	19.0	156.0	-328.7	-328.7	none
B	Rf	1826.0	13.0								13.0	13.0	12.0	124	140.5	1.0		48.0	1685.5	13.0	156.0	671.5	671.5	A

TYPICAL SHEAR WALL NOTES

Use 1/2" dia. by 10" Anchor Bolts (AB's) with single plates and 1/2" dia. by 12" AB's with double and 3x plates spaced as shown on the drawings. AB's shall have 7" of embedment into footing, shall be centered in the stud wall, and shall project through the bottom plate of the wall and have a 3x3/x1/4 plate washer. There shall be a minimum of two bolts per piece of sill located not more than 12 inches or less than 4 inches end of each piece. Anchor bolts to be galvanized per the below requirement (Fasteners in contact with pressure treated lumber). At existing foundation use 1/2" diameter Simpson Titen HG bolts with minimum of 4" embedment into the existing concrete.

All wall sheathing shall be 1/2" CDX plywood, 5/8" T1-11 siding, or 7/16" OSB with exterior exposure glue and span rated "SR 24/0" or better. All free sheathing edges shall be blocked with 2x4 or 2x6 flat blocking except where noted on the drawings or below.

All nails shall be 8d or 10d common (8d common nails must be 0.131 inch diameter, Senco KC27 Nails are equivalent. If 10d common nails are called for the diameter must be 0.148 inches, Senco MD23 Nails are equivalent). Nail size and spacing at all sheathing edges shall be as required below or as in the drawings. Nail spacings shall be 12" o.c. for all field nailing except as noted.

Hold downs are Simpson "Strong Tie" and shall be installed per the manufacture's recommendation. Equivalent hold downs by United Steel Products Company "Kant-Sag" that have ICBO approval can be substituted in place of Simpson hold downs. All floor systems must be blocked solid below member that the hold down is attached to. This block should be equal to or larger than the member the hold down is attached to and be placed as a "squash block".

All double and triple studs shall glued and nailed together with 10d's at 3" o.c. for each layer.
All 4x studs are to be #2 DF and all 6x studs are to be #1 DF when used for hold downs and shear walls.

FASTENERS IN CONTACT WITH PRESSURE TREATED LUMBER

All fasteners including nuts and washers in contract with pressure treated lumber shall be hot-dipped zinc coated galvanized steel, stainless steel, silicon bronze or copper. Fasteners other than nails, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc coated steel in accordance with ASTM B 695, Class 55 minimum. Fasteners exposed to weather must meet the requirements of the pressure treating manufacture's minimum. IN ADDITON, the contractor shall coordinate connector/fastener coating requirements with recommendations from connector/fastener manufacturer and type of pressure treating chemical and retention being used. See Section 2304.10.5 of the 2015 IBC for additional information.

ALL WALL STUDS AND ROOF TRUSS TOP CHORDS AND SECONDARY FRAMING LUMBER SHALL BE DOUG-FIR #2 OR BETTER.

NOTE: MST STRAPS attaches to (2) 2x or 4x studs in wall above and below unless noted otherwise. Nail all holes with 16d sinkers.

Double studs may be use as a substitute for 3x nominal framing call out below. Studs MUST be glued and nailed together with (2) lines of 10d's at 3" on center staggered.

Horizontal blocking for shear walls nailed with 8d's shall be minimum of 2x flat and shear walls nailed with 10d's shall be minimum of 3x flat.

SHEAR WALL SCHEDULE

sheathing nailed with 8d's at 6" on center all edges.

HOLD DOWN SCHEDULE

It is the responsibility of the contractor to locate hold down anchor bolt to accommodate all structural framing. Anchor bolt to be located nearest the corner or opening at the end of the shear wall. All foundation vents to be a minimum of 12" off centerline of the anchor bolt on either side. Holdown stud to be coordinated with shear wall panel edge framing requirements. Larger stud size controls

* For holdown anchor bolt embedment greater that foundation depth, thicken footing for 2'-0" either side of holdown anchor bolt to a depth that provides for 3" clear below the bottom of the anchor bolt. Provide (2) additional #4 x 3'-0" pieces of longitudinal rebar at this location.

HDU2 attaches to concrete foundation with a Simpson SSTB 16. *HDU2* attaches to double 2x studs or 4x or 6x stud with (6) Simpson SDS 1/4 X 3 Wood Screws in wall above.

STRUCTURAL NOTES

General Notes:

These structural notes supplement the drawings. Any discrepancy found among the drawings, these notes, and the site conditions shall be reported to the Engineer, who shall correct such discrepancy in writing. Any work done by the Contractor after discovery of such discrepancy shall be done at the Contractor's risk.

The Contractor shall verify and coordinate the dimensions among all drawings prior to proceeding with any work or fabrication. The Contractor shall coordinate between the architectural drawings and the structural drawings. The architectural dimensions are taken to be correct when in conflict with the structural drawings. The Contractor is responsible for all bracing and shoring during construction.

All construction shall conform to the applicable portions of the latest edition of the International Building Code except where noted

Design Criteria:

1.	Live Load	=	Slab on Grade
		=	30 PSF (Snow)
2.	Dead Load	=	15 PSF (Roof)
		=	10 PSF (Walls)
		=	150 PCF (Concrete)
3.	Wind	=	2015 IBC Exposure B @ 110 mph
4.	Earthquake	=	2015 IBC
	Site Class	=	D
	Design Cat.	=	D
	Use Group	=	I
	R	=	6.5
	C_d	=	4
	W_o	=	3
6.	Soil	=	1500 PSF, Assumed bearing capacity

Concrete & Reinforcing Steel:

1. All concrete work shall be per the 2015 IBC Chapter 19.

2. All reinforcing shall be ASTM A615 Grade 60 except as shown on the plans.

3. Concrete shall be in accordance with ASTM 150.
f'c = 2500 PSI @ 28 day
slump = 4" maximum, 6% Air entrained for exterior slabs. In order to minimize shrinkage cracks recommend that the w/c ratio be under 0.5.

4. Garage slab and exterior slabs to have minimum of 6x6 W1.4x1.4 WWF with vapor barrier. This is at the owner's option to reduce slab cracking. Crack control joints the responsibility of the contractor. . Recommend a maximum of 16'x16' grid or as required by geometry.

Steel:

1. Anchor bolts shall be ASTM A307 and will have a 3x3x1/4" plate washer.

Carpentry:

1. 2X structural framing shall be #2 Douglas Fir.
   4x structural members shall be #2 Douglas Fir.
   6X members shall be #1 Douglas Fir.

2. Roof trusses shall be by a pre-approved manufacturer and constructed according to the specifications of the Truss Plate Institute. Truss shop drawings must be stamped by a licensed engineer and be on site at the time of construction. Preliminary truss drawings must be reviewed prior to construction. It is the truss manufacturer's responsibility to inform the engineer of record of any changes from the preliminary truss lay-out.

   Truss manufactures are responsible for all bracing of the trusses including end wall bracing and all other bracing between the building and the trusses unless specifically shown otherwise on the drawings. Contractor to coordinate bracing with engineer of record as required.

4. Sheathing at roof shall be laid with face grain perpendicular to supports and end joints staggered 4'-0" on center. Provide 1/8" space at panel edges as required by panel manufacturers. Roof sheathing shall be nailed 6" o.c. edges and 12" o.c field with 10d's unless otherwise noted on the drawings.

5. Block and nail all horizontal panel edges at designated shear walls.

6. All fasteners in contact with pressure treated lumber will meet the below requirements.

   All fasteners including nuts and washers in contract with pressure treated lumber shall be hot-dipped zinc coated galvanized steel, stainless steel, silicon bronze or copper. Fasteners other than nails, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc coated steel in accordance with ASTM B 695, Class 55 minimum. Fasteners exposed to weather must meet the requirements of the pressure treating manufacture's minimum. IN ADDITON, the contractor shall coordinate connector/fastener coating requirements with recommendations from connector/fastener manufacturer and type of pressure treating chemical and retention being used. See Section 2304.10.5 of the 2015 IBC for additional information.

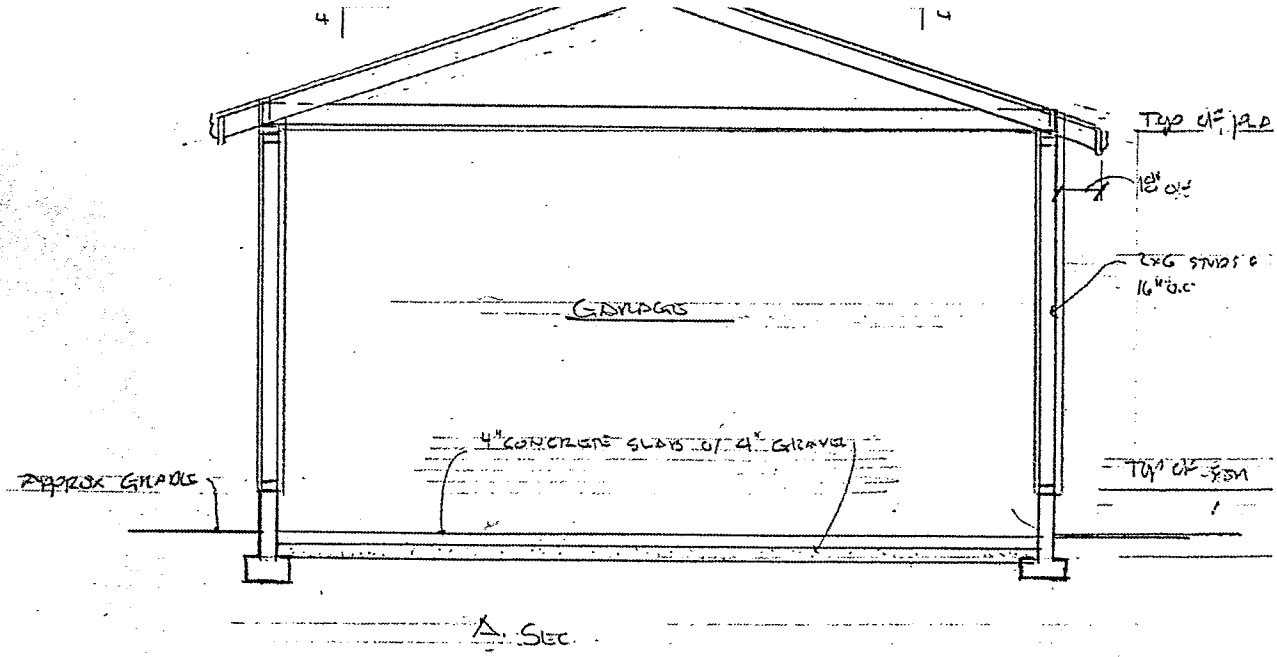
Hardware:

All connection hardware shall be Simpson "Strong Tie". Connection hardware exposed to the weather or soil shall be treated as in steel above.

CAUTION:

PLACE TRUSSES PER MANUFACTURER'S RECOMMENDATIONS AND BRACE PER TRUSS COMPANY RECCOMENDATIONS. CONTRACTOR IS RESPONSIBLE FOR ALL TEMPORARY BRACING AND SHORING REQUIRED FOR PLACING TRUSSES. NOTE THESE DRAWINGS DO NOT INCLUDE ANY TEMPORARY SHORING OR BRACING. PRECISE ENGINEERING RECCOMENDS ALL SHORING AND BRACING BE DESIGNED AND DETAILED BY A LISENCED ENGINEER.

CONTRACTOR TO FIELD VERIFY ALL CONDITIONS AND ALL ELEVATIONS.



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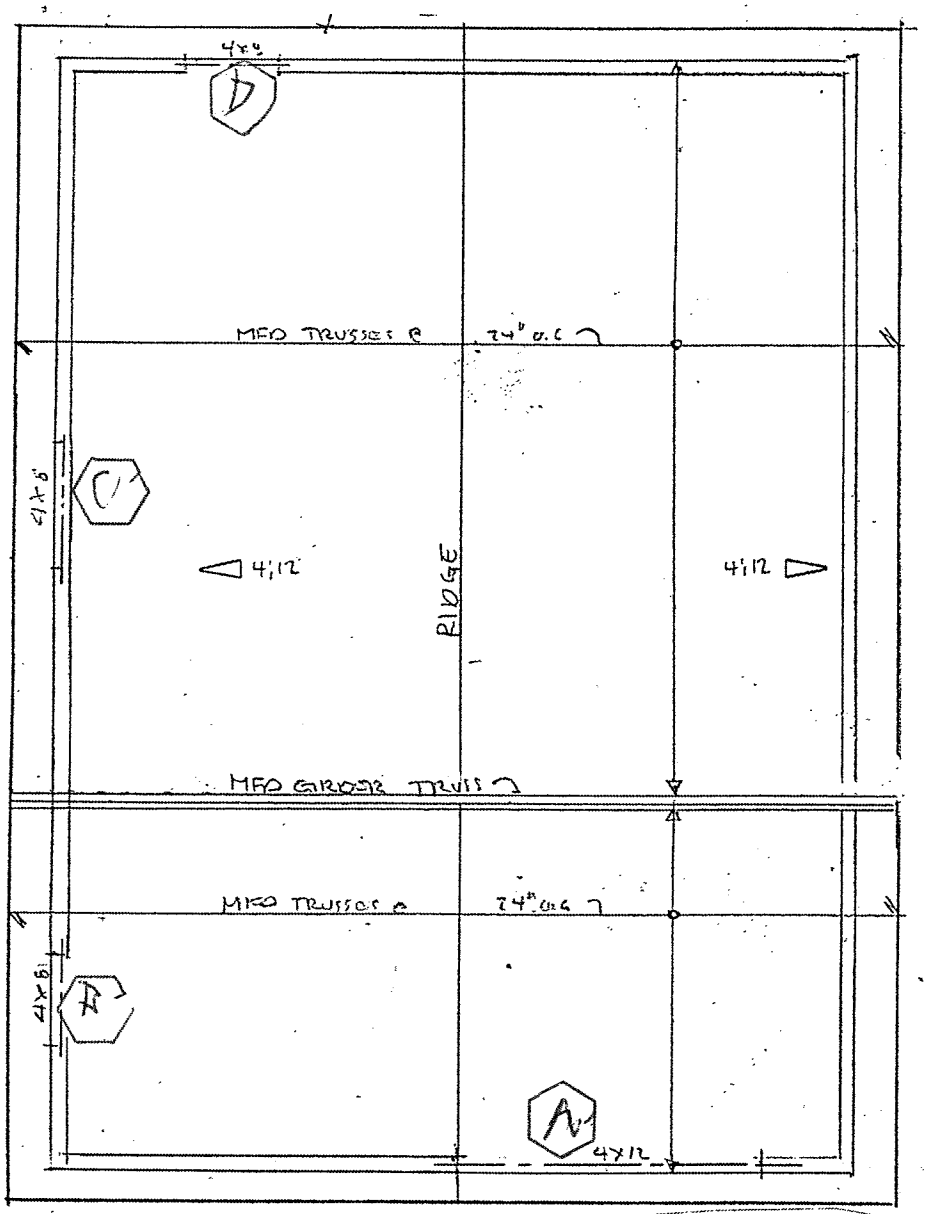


ROOF PLAN - 1/4"

CONTRACTOR NOTE:
EVERY EFFORT TO INSURE THE ACCURACY
BEEN TAKEN. HOWEVER, IT IS THE RESPO
CONTRACTOR TO CHECK AND VERIFY ALL
CONDITIONS.

Permit Number: 20-04524

Multiple Simple Beam

Description :

Wood Beam Design : A

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **4x10, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir - Larch				Wood Grade : No.2				
Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

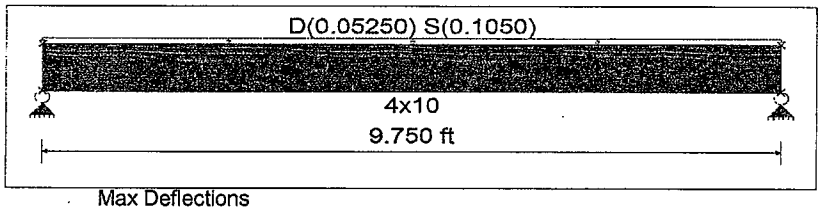
Unif Load: D = 0.0150, S = 0.030 k/ft, Trib= 3.50 ft

Design Summary

Max fb/Fb Ratio = **0.370** : 1
fb : Actual : 449.97 psi at 4.875 ft in Span # 1
Fb : Allowable : 1,217.32 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.146** : 1
fv : Actual : 30.12 psi at 9.003 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.26			0.51			
Right Support	0.26			0.51			



Max Deflections

Transient Downward	0.058 in	Total Downward	0.087 in
Ratio	2013	Ratio	1342
	LC: S Only		LC: +D+S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : B

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **4x8, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir - Larch				Wood Grade : No.2				
Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

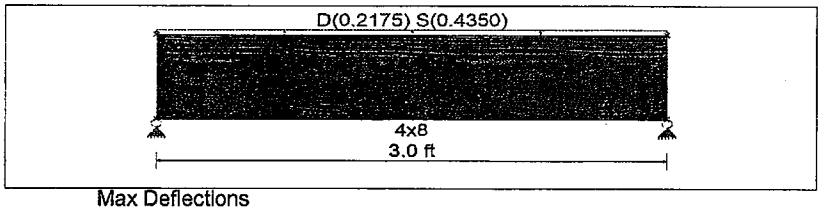
Unif Load: D = 0.0150, S = 0.030 k/ft, Trib= 14.50 ft

Design Summary

Max fb/Fb Ratio = **0.215** : 1
fb : Actual : 287.29 psi at 1.500 ft in Span # 1
Fb : Allowable : 1,339.32 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.168** : 1
fv : Actual : 34.71 psi at 2.400 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.33			0.65			
Right Support	0.33			0.65			



Max Deflections

Transient Downward	0.004 in	Total Downward	0.007 in
Ratio	8032	Ratio	5355
	LC: S Only		LC: +D+S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Wood Beam Design : c

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **4x8, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir - Larch				Wood Grade : No.2				
Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

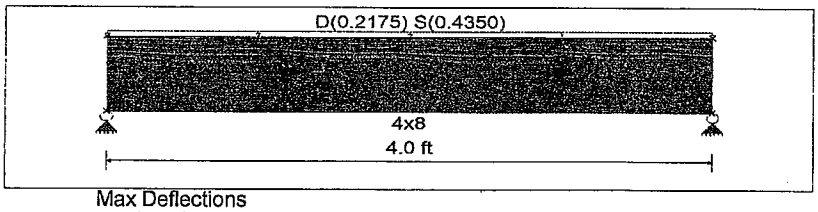
Unif Load: D = 0.0150, S = 0.030 k/ft, Trib= 14.50 ft

Design Summary

Max fb/Fb Ratio = **0.382** : 1
fb : Actual : 510.74 psi at 2.000 ft in Span # 1
Fb : Allowable : 1,337.03 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.261** : 1
fv : Actual : 54.00 psi at 0.000 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.44			0.87			
Right Support	0.44			0.87			



Max Deflections

Transient Downward	0.014 in	Total Downward	0.021 in
Ratio	3388	Ratio	2259
	LC: S Only		LC: +D+S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : d

Calculations per NDS 2015, IBC 2015, CBC 2016, ASCE 7-10

BEAM Size : **4x8, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-10 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir - Larch				Wood Grade : No.2				
Fb - Tension	900.0 psi	Fc - Prll	1,350.0 psi	Fv	180.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	900.0 psi	Fc - Perp	625.0 psi	Ft	575.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

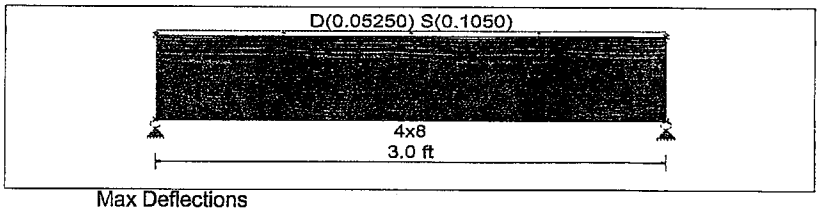
Unif Load: D = 0.0150, S = 0.030 k/ft, Trib= 3.50 ft

Design Summary

Max fb/Fb Ratio = **0.052** : 1
fb : Actual : 69.35 psi at 1.500 ft in Span # 1
Fb : Allowable : 1,339.32 psi
Load Comb : +D+S+H

Max fv/FvRatio = **0.040** : 1
fv : Actual : 8.38 psi at 2.400 ft in Span # 1
Fv : Allowable : 207.00 psi
Load Comb : +D+S+H

Max Reactions (k)	D	L	Lr	S	W	E	H
Left Support	0.08			0.16			
Right Support	0.08			0.16			



Max Deflections

Transient Downward	0.001 in	Total Downward	0.002 in
Ratio	9999	Ratio	9999
	LC: S Only		LC: +D+S+H
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC: