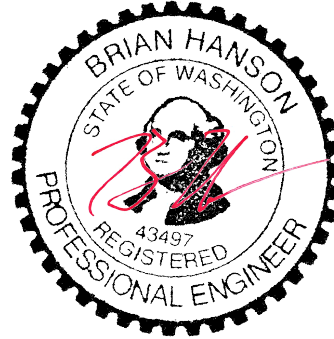May 5, 2022

Brandy Tucker
StruXure Outdoor
9116 E Sprague Avenue, #547
Spokane Valley, WA 99206

Project Number: 22-03-233

Re: StruXure – Baker
        4107 83rd Ave SE
        Mercer Island, WA 98040

5-05-2022

Brandy,

As requested, Eclipse Engineering, P.C. (EEPC) has designed for the existing conditions for the addition of a proposed pergola at the above noted location. The design is based on a virtual site visit dated Monday, March 29, 2022, and are per the latest requirements of the IBC, ASCE-7 and the 2018 SBC.

A 25 psf snow load, A 20 psf roof dead load, 15 psf floor dead load, and 6 psf pergola dead load were implemented in our verification. The homeowner or contractor are to verify that the existing conditions meet the minimum dimensions and verify the assumptions stated hereafter in the enclosed report. Please reference the attached calculations for further information.

Eclipse Engineering, P.C. has designed the existing vertical and lateral components for the area encompassing the proposed pergola only. EEPC takes no responsibility for the connections to existing structure, the existing structure as a whole, the proposed pergola, nor any components not specifically addressed within this report.

Please contact us with any questions you may have. Thank you!
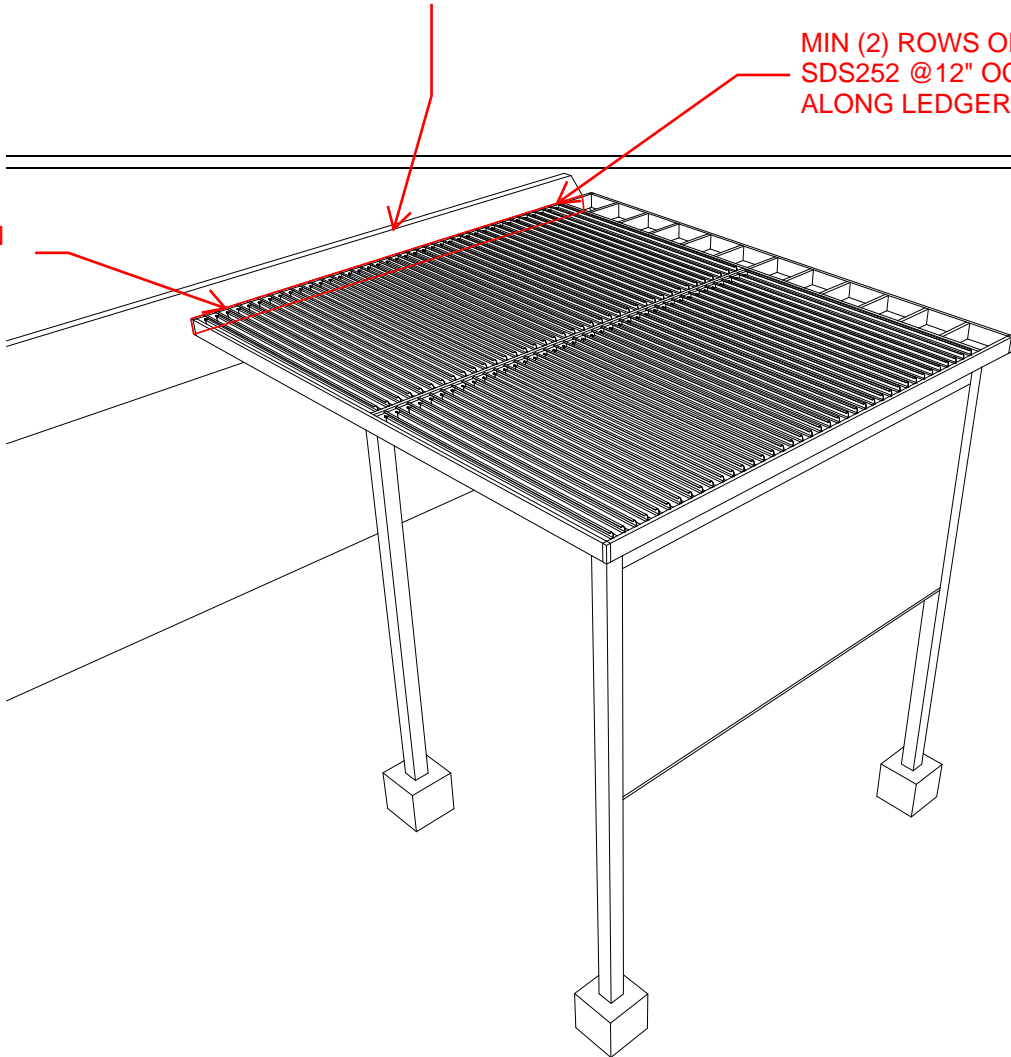
Very Respectfully,

Eclipse Engineering, P.C.
Sean Smith, EIT
Staff Engineer

STRUXURE END MOUNT (BY OTHERS) SHALL BE SECURED THROUGH PT LEDGER INTO EXSITING ROOF RAFTER, MIN ROOF RAFTER SIZE OF 2X8

NOTE: CONTRACTOR TO VERIFY ROOF SHEATHING END NAILING MIN 8d @ 6" OC

MIN (2) ROWS OF SDS252 @12" OC ALONG LEDGER

MIN PT 2X10 LEDGER, MIN LENGTH OF 264"

SKETCH 1

EXISTING WALL WHERE PERGOLA IS TO BE ATTACHED

WALL LINE 1, AS PER CALCULATIONS (PERGOLA ALSO TO BE PARTIALLY ATTACHED)

MISSOULA, MT
PH: (406) 721-5733

WHITEFISH, MT
PH: (406) 552-1442

SPOKANE, WA
PH: (509) 921-7731

BEND, OR
PH: (541) 389-9659

PORTLAND, OR
PH: (503) 395-1229

LOCATION ON NEW LEDGER W/MIN LENGTH OF 264"

CONTRACTOR TO VERIFY MIN 6X12 BEAMS

MISSOULA, MT
PH: (406) 721-5733

WHITEFISH, MT
PH: (406) 552-1442

SPOKANE, WA
PH: (509) 921-7731

BEND, OR
PH: (541) 389-9659

PORTLAND, OR
PH: (503) 395-1229

PROPOSED PERGOLA LAYOUT

NEW RAILING TO MATCH EXISTING

EXISTING RAILING

RE-DO EXISTING IMPERVIOUS DECK

EXISTING STAIRS TO BE RELOCATED

STRUXURE END MOUNT (BY OTHERS) SHALL BE SECURED THROUGH PT LEDGER INTO EXISITING ROOF RAFTER, MIN ROOF RAFTER SIZE OF 2X8, REF SKETCH 1 FOR FURTHER REQUIREMENTS

NOTE: CONTRACTOR TO VERIFY ROOF SHEATHING END NAILING MIN 8d @ 6" OC

NOTE: CONTRACTOR TO VERIFY 2X BLOCKING BETWEEN ROOF RAFTERS @ MIN 32" OC SPACING FROM EXTERIOR WALL TO EXISTING SHEAR WALL

EXSITING ROOF LINE

MIN PT 2X10 LEDGER

EXISTING EXTERIOR WALL

LINE 1 (ASSUMED EXISTING SHEAR LINE)

CONTRACTOR TO VERIFY 6X12 BEAM SIZE, TYP

EXISTING

EXISTING DINING

EXISTING ROOF OVERHANG

ASSUMED EXISTING SHEAR LINE

EXISTING GUEST

EXISTING KITCHEN

EXISTING ROOF BEAM

EXISTING ROOF RIDGE BEAM

EXISTING ROOF OVERHANG

EXISTING GARAGE

MAIN FLOOR PLAN
SCALE: 1/4" = 1'-0"

+36" HANDRAIL
+36" GUARD RAIL

WALL LEGEND
EXISTING WALLS TO REMAIN
EXISTING WALLS TO BE REMOVED
NEW WALLS - 2X4 STUDS @ 16" O.C. W/ 1/2" GWB EA SIDE
NEW WALLS - 2X6 STUDS @ 16" O.C. W/ 1/2" GWB EA. SIDE + 3 1/2" BATT INSULATION

Governing Conditions

$S_{DS} := 1.135$ Spectral response acceleration parameter at short periods

$R := 6.5$ Seismic Force-Resisting for Wood Framed Shear Wall

$I_E := 1$ Importance Factor

$\rho := 1.3$ Redundancy Factor

$$C_s := \frac{S_{DS} \cdot \rho}{\left(\dfrac{R}{I_E}\right)} \cdot 0.7 = 0.159$$ ASD Seismic Factor

Existing Loading

$w_{house} := 43 \ ft$ Width of Diaphragm $DL_{wall} := 15 \ psf$ Dead Load of Existing Wall

$l_{house} := 95 \ ft$ Length of Diaphragm $DL_{roof} := 15 \ psf$ Dead Load of Existing Roof

$h_{house} := 10 \ ft$ Height of House $l_1 := 16.25 \ ft$ Total Length of Line 1

$trib_1 := 12 \ ft$ Trib width for Line 1

$A := w_{house} \cdot l_{house} = 4085 \ ft^2$ Existing Diaphragm Area

$R := DL_{roof} \cdot A = 61.275 \ kip$ Dead Load of Exsiting Roof

$$W := DL_{wall} \cdot \frac{h_{house}}{2} \cdot \left(2 \cdot l_{house} + 2 \cdot w_{house}\right) = 20.7 \ kip$$ Dead Load of Exsiting Walls

$$E_e := C_s \cdot \frac{(R + W)}{w_{house}} = 0.303 \ klf$$ Seismic Load acting on Diaphragm

$Line_{1E} := E_e \cdot trib_1 = 3.635 \ kip$ Existing Load on Line 1
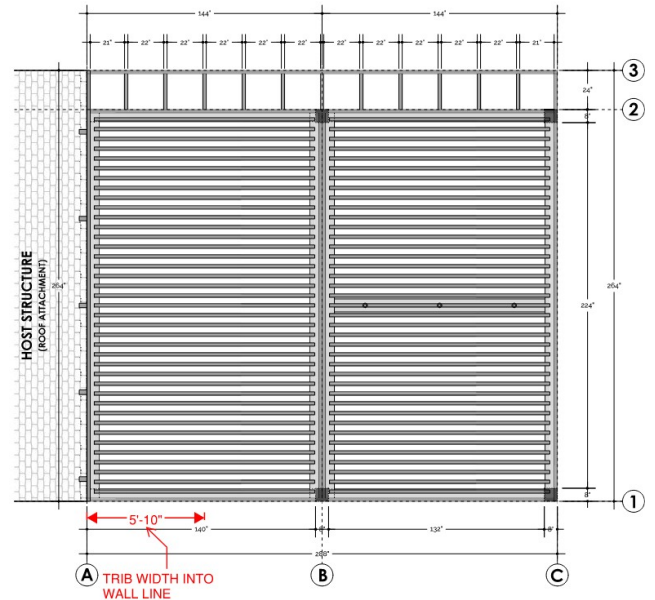
New Loading (Struxure Pergola)

$DL_s := 6 \ psf$ Dead Load of Struxure Pergola

$l_{new} := 280 \ in$ Total Length of Pergola

$w_{new} := 264 \ in$ Total Width of Pergola

$trib_w := 70 \ in$ Trib of Pergola acting on Line 1

NOTE: PER PAGE 33 0F 58 OF PROVIDED STAMPED CALS (BY OTHERS),
TRIB LENGTH BASED ON ASSUMED FIXED BASE POST CONNECTIONS

$W_s := DL_s \cdot w_{new} \cdot l_{new} = 3080 \ lbf$ Total Struxure Diaphgram Weight

$E_s := \dfrac{(C_s \cdot W_s)}{l_{new}} = 20.975 \ plf$ Seismic Load acting on Struxure Diaphragm

$Line_{1N} := E_s \cdot trib_w = 122.353 \ lbf$ New Seismic Load acting on Line 1

Existing 10% Check

$Line_{1E} \cdot 0.1 = 363.511 \ lbf$ 10% of Existing Load in Line 1

$$Result := \mathbf{if}\left(Line_{1N} \leq Line_{1E} \cdot 0.1, \text{"Okay"}, \text{"NG"}\right) = \text{"Okay"}$$

$\dfrac{Line_{1N}}{w_{new}} = 5.562 \ plf$ New Distributed Load acting on Ledger

Title Block Line 1
You can change this area
using the "Settings" menu item
and then using the "Printing &
Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

DESCRIPTION: Roof Beam

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Stress Design	Fb +	1,350.0 psi	E : Modulus of Elasticity
Load Combination ASCE 7-16	Fb -	1,350.0 psi	Ebend- xx 1,600.0 ksi
	Fc - Prll	925.0 psi	Eminbend - xx 580.0 ksi
Wood Species : Douglas Fir-Larch	Fc - Perp	625.0 psi	
Wood Grade : No.1	Fv	170.0 psi	
	Ft	675.0 psi	Density 31.210 pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling			

D(0.4) S(1.6)

D(0.170) S(0.2125)

6x12   6x12

Span = 20.0 ft   Span = 4.0 ft
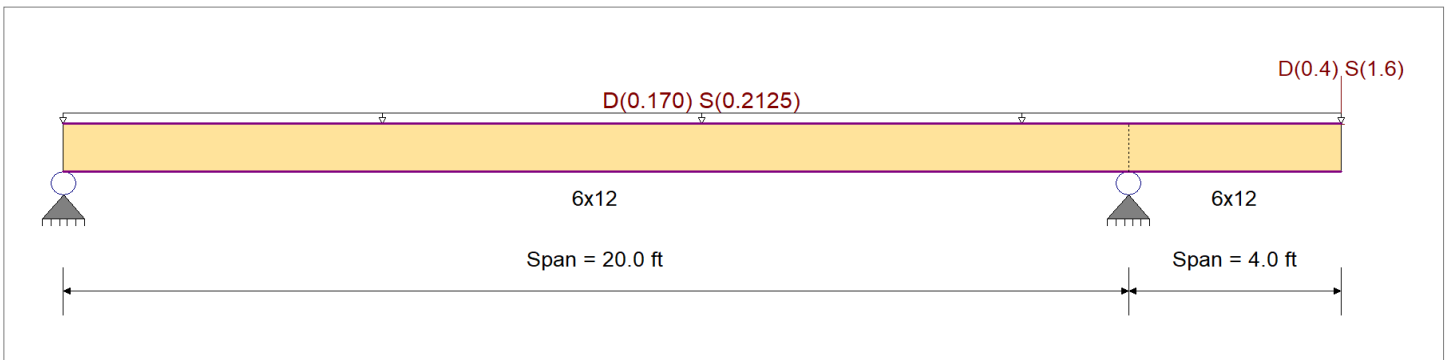
Applied Loads

Service loads entered. Load Factors will be applied for calculations

Loads on all spans...
   Uniform Load on ALL spans : D = 0.020, S = 0.0250 ksf, Tributary Width = 8.50 ft
Load for Span Number 2
   Point Load : D = 0.40, S = 1.60 k @ 4.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.892** 1	Maximum Shear Stress Ratio	=	**0.490** : 1	
Section used for this span		**6x12**	Section used for this span		**6x12**	
fb: Actual	=	1,385.24 psi	fv: Actual	=	95.72 psi	
Fb: Allowable	=	1,552.50 psi	Fv: Allowable	=	195.50 psi	
Load Combination		+D+S	Load Combination		+D+S	
Location of maximum on span	=	8.603 ft	Location of maximum on span	=	19.106 ft	
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1	

Maximum Deflection
   Max Downward Transient Deflection   0.381 in Ratio =   629 >=360
   Max Upward Transient Deflection   -0.041 in Ratio =   2332 >=360
   Max Downward Total Deflection   0.819 in Ratio =   293 >=240
   Max Upward Total Deflection   -0.248 in Ratio =   386 >=240

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	M	fb	F'b	V	fv	F'v
D Only													0.00	0.00	0.00	0.00
Length = 20.0 ft	1	0.577	0.263	0.90	1.000	1.00	1.00	1.00	1.00	1.00	7.08	701.25	1215.00	1.70	40.22	153.00
Length = 4.0 ft	2	0.241	0.263	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.96	293.00	1215.00	0.92	40.22	153.00
+D+S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 20.0 ft	1	0.892	0.490	1.15	1.000	1.00	1.00	1.00	1.00	1.00	13.99	1,385.24	1552.50	4.04	95.72	195.50
Length = 4.0 ft	2	0.705	0.490	1.15	1.000	1.00	1.00	1.00	1.00	1.00	11.06	1,094.79	1552.50	3.17	95.72	195.50
+D+0.750S					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 20.0 ft	1	0.782	0.419	1.15	1.000	1.00	1.00	1.00	1.00	1.00	12.26	1,213.66	1552.50	3.45	81.84	195.50
Length = 4.0 ft	2	0.576	0.419	1.15	1.000	1.00	1.00	1.00	1.00	1.00	9.03	894.34	1552.50	2.61	81.84	195.50
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 20.0 ft	1	0.195	0.089	1.60	1.000	1.00	1.00	1.00	1.00	1.00	4.25	420.75	2160.00	1.02	24.13	272.00

Title Block Line 1
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Title Block" selection.
Title Block Line 6

Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 5 MAY 2022, 12:00PM

Wood Beam

DESCRIPTION: Roof Beam

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L		M	fb	F'b	V	fv	F'v
Length = 4.0 ft	2	0.081	0.089	1.60	1.000	1.00	1.00	1.00	1.00	1.00		1.78	175.80	2160.00	0.55	24.13	272.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.8189	9.385		0.0000	0.000
	2	0.0000	9.385	+D+S	-0.2485	4.000

Vertical Reactions

Support notation : Far left is #1   Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	3.272	7.908	
Overall MINimum	1.720	4.980	
D Only	1.552	2.928	
+D+S	3.272	7.908	
+D+0.750S	2.842	6.663	
+0.60D	0.931	1.757	
S Only	1.720	4.980	