HD Engineering & Design

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SAB Homes

Solaia Plan
2102 SW Red Barn Rd
Lee's Summit, MO

Our firm has been asked to make structural recommendations for the house being built at the address listed above. During the rough in inspection process the AHJ has questioned items. Below is a list of our recommendations along with the corresponding city item.

The Master Bedroom rear hip is bearing on the ceiling vault beam which is made of 1 2X12 and 1 1 3/4"X11 1/4" LVL beam. After reviewing the loads on the vault be our firm recommends approval of the hip load on the vault beam.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted engineering practices. No warranties, either express or implied, are intended or made.

We appreciate the opportunity to be of service to you on this project. If you have any questions regarding this report, please contact us.

STATE OF MISSOURI
CHRIS SAATHOFF
NUMBER 2008001865
06/07/2022
REGISTERED PROFESSIONAL ENGINEER

STRUCTURAL REVIEW
HD ENGINEERING & DESIGN
HD: 42982 DATE: 6/7/2022

11656 W. 75th Street
Shawnee, KS 66214

913-631-2222
service@hdengineers.com

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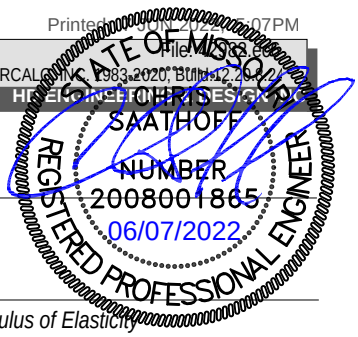
Project Title: 42982 - Solaia 2102 SW Red Barn Rd HFR063 LSN
Engineer:
Project ID:
Project Descr:

Printed: JUN 7 2022, 4:07PM
File: VAULT BEAM #2 REAR.ec6

Wood Beam

Lic. # : KW-06001844

DESCRIPTION: VAULT BEAM #2 REAR



CODE REFERENCES

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

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2018

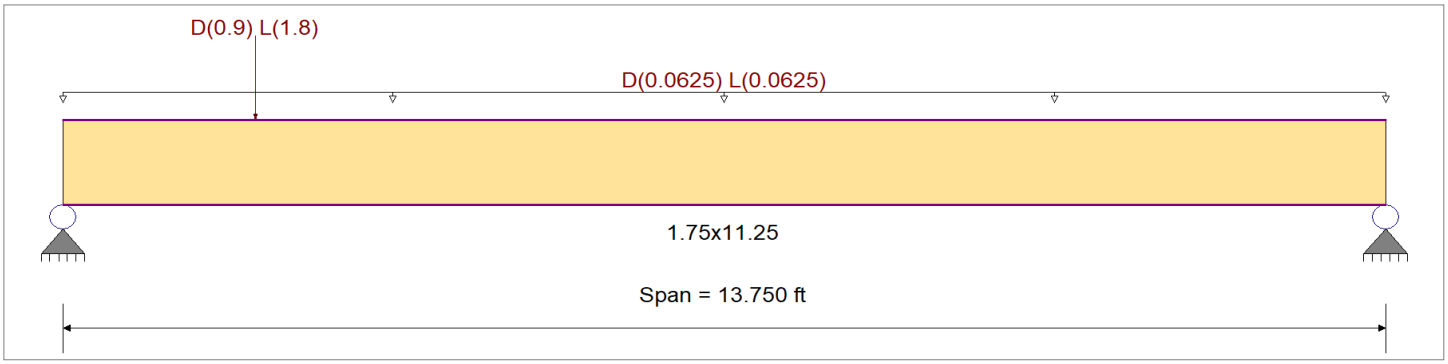
Wood Species : Louisiana Pacific
Wood Grade : SolidStart LVL 2650Fb-1.9E

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2650 psi
Fb -	2650 psi
Fc - Prll	2350 psi
Fc - Perp	750 psi
Fv	285 psi
Ft	1600 psi

E : Modulus of Elasticity

Ebend- xx	1900 ksi
Eminbend - xx	980 ksi
Density	28.72 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.010, L = 0.010 ksf, Tributary Width = 6.250 ft, (CEILING)
Point Load : D = 0.90, L = 1.80 k @ 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.769 : 1	Maximum Shear Stress Ratio	=	0.816 : 1
Section used for this span		1.75x11.25	Section used for this span		1.75x11.25
fb: Actual	=	2,038.58 psi	fv: Actual	=	232.67 psi
Fb: Allowable	=	2,650.00 psi	Fv: Allowable	=	285.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	3.714 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.313 in	Ratio =	527 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.533 in	Ratio =	309 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	Moment Values fb	Moment Values F'b	Shear Values V	Shear Values fv	Shear Values F'v
D Only													0.00	0.00	0.00	0.00
Length = 13.750 ft	1	0.343	0.339	0.90	1.000	1.00	1.00	1.00	1.00	1.00	2.51	817.30	2385.00	1.14	87.03	256.50
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 13.750 ft	1	0.769	0.816	1.00	1.000	1.00	1.00	1.00	1.00	1.00	6.27	2,038.58	2650.00	3.05	232.67	285.00
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 13.750 ft	1	0.523	0.551	1.25	1.000	1.00	1.00	1.00	1.00	1.00	5.32	1,730.87	3312.50	2.58	196.26	356.25
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 13.750 ft	1	0.116	0.115	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.51	490.38	4240.00	0.69	52.22	456.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.5331	6.423		0.0000	0.000

Wood Beam

DESCRIPTION: VAULT BEAM #2 REAR

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	3.167	1.252
Overall MINimum	1.968	0.692
D Only	1.199	0.561
+D+L	3.167	1.252
+D+0.750L	2.675	1.079
+0.60D	0.719	0.336
L Only	1.968	0.692

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Project Title: 42982 - Solaia 2102 SW Red Barn Rd HFR063 LSN
Engineer:
Project ID:
Project Descr:

Printed: 6 JUN 2022, 5:56PM
File: 42982.ecd

Wood Beam

Lic. # : KW-06001844

HDR ENGINEERING, INC

DESCRIPTION: VAULT BEAM #1

CODE REFERENCES

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

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2018

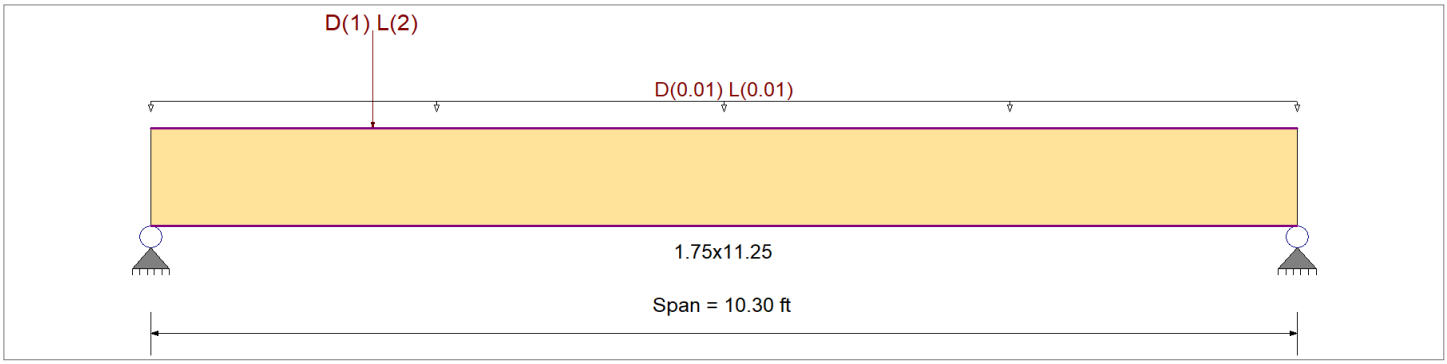
Wood Species : Louisiana Pacific
Wood Grade : SolidStart LVL 2650Fb-1.9E

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2650 psi
Fb -	2650 psi
Fc - Prll	2350 psi
Fc - Perp	750 psi
Fv	285 psi
Ft	1600 psi

E : Modulus of Elasticity

Ebend- xx	1900 ksi
Eminbend - xx	980 ksi
Density	28.72 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Uniform Load : D = 0.010, L = 0.010 ksf, Tributary Width = 1.0 ft, (CEILNG)
Point Load : D = 1.0, L = 2.0 k @ 2.0 ft, (POINT LOAD)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.612 : 1	Maximum Shear Stress Ratio	=	0.669 : 1
Section used for this span		1.75x11.25	Section used for this span		1.75x11.25
fb: Actual	=	1,620.65 psi	fv: Actual	=	190.66 psi
Fb: Allowable	=	2,650.00 psi	Fv: Allowable	=	285.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	2.030 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.120 in	Ratio =	1032 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.183 in	Ratio =	676 >=180
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	Moment Values fb	Moment Values F'b	Shear Values V	Shear Values fv	Shear Values F'v
D Only					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.30 ft	1	0.230	0.252	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.69	549.31	2385.00	0.85	64.63	256.50
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.30 ft	1	0.612	0.669	1.00	1.000	1.00	1.00	1.00	1.00	1.00	4.99	1,620.65	2650.00	2.50	190.66	285.00
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.30 ft	1	0.408	0.447	1.25	1.000	1.00	1.00	1.00	1.00	1.00	4.16	1,352.81	3312.50	2.09	159.15	356.25
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 10.30 ft	1	0.078	0.085	1.60	1.000	1.00	1.00	1.00	1.00	1.00	1.01	329.59	4240.00	0.51	38.78	456.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.1827	4.549		0.0000	0.000

Wood Beam

DESCRIPTION: VAULT BEAM #1

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	2.520	0.686
Overall MINimum	1.663	0.440
D Only	0.857	0.246
+D+L	2.520	0.686
+D+0.750L	2.105	0.576
+0.60D	0.514	0.147
L Only	1.663	0.440

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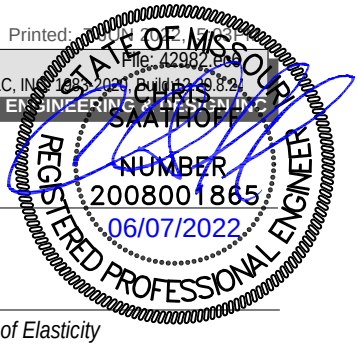
Project Title: 42982 - Solaia 2102 SW Red Barn Rd HFR063 LSN
Engineer:
Project ID:
Project Descr:

Printed: 7 JUL 2022, 7:03
File: 42982.ecw

Wood Beam

Lic. # : KW-06001844 HD ENGINEERING & DESIGN, INC.

DESCRIPTION: HIP



CODE REFERENCES

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

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2018

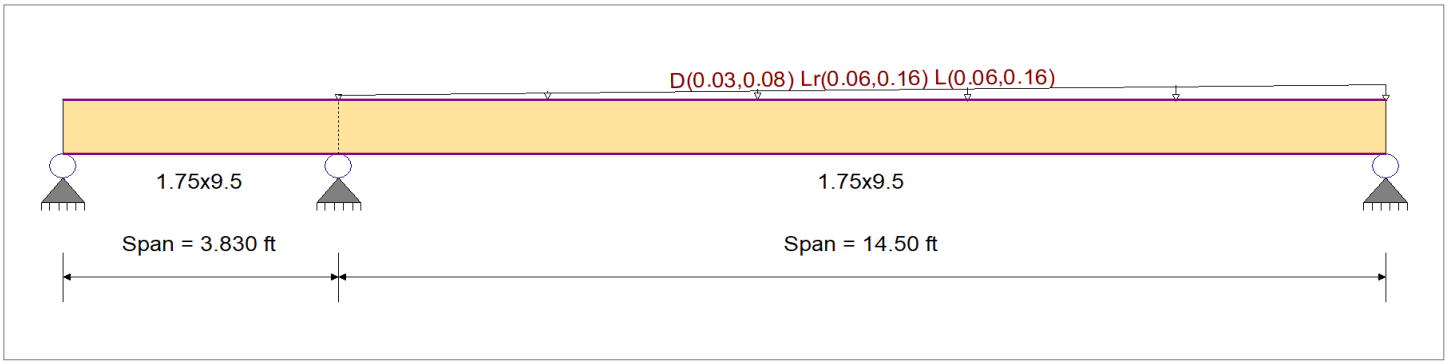
Wood Species : Louisiana Pacific
Wood Grade : SolidStart LVL 2650Fb-1.9E

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	2,650.0 psi
Fb -	2,650.0 psi
Fc - Prll	2,350.0 psi
Fc - Perp	750.0 psi
Fv	285.0 psi
Ft	1,600.0 psi

E : Modulus of Elasticity

Ebend- xx	1,900.0 ksi
Eminbend - xx	980.0 ksi
Density	28.720 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 2
Varying Uniform Load : D= 0.030->0.080, Lr= 0.060->0.160, L= 0.060->0.160 k/ft, Extent = 0.0 -->> 14.50 ft, Trib Width = 1.0 ft, (RAFTERS)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.614 : 1	Maximum Shear Stress Ratio	=	0.398 : 1
Section used for this span		1.75x9.5	Section used for this span		1.75x9.5
fb: Actual	=	2,033.07 psi	fv: Actual	=	141.63 psi
Fb: Allowable	=	3,312.50 psi	Fv: Allowable	=	356.25 psi
Load Combination		+D+0.750Lr+0.750L	Load Combination		+D+0.750Lr+0.750L
Location of maximum on span	=	0.000 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 2

Maximum Deflection

Max Downward Transient Deflection	0.254 in	Ratio =	684	>=240
Max Upward Transient Deflection	-0.015 in	Ratio =	3112	>=240
Max Downward Total Deflection	0.508 in	Ratio =	342	>=180
Max Upward Total Deflection	-0.030 in	Ratio =	1556	>=180

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 3.809 ft	1	0.212	0.109	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.11	505.06	2385.00	0.31	27.85	256.50
Length = 14.521 ft	2	0.213	0.138	0.90	1.000	1.00	1.00	1.00	1.00	1.00	1.11	508.27	2385.00	0.39	35.41	256.50
+D+L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 3.809 ft	1	0.572	0.293	1.00	1.000	1.00	1.00	1.00	1.00	1.00	3.32	1,515.17	2650.00	0.93	83.54	285.00
Length = 14.521 ft	2	0.575	0.373	1.00	1.000	1.00	1.00	1.00	1.00	1.00	3.34	1,524.80	2650.00	1.18	106.22	285.00
+D+Lr					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 3.809 ft	1	0.457	0.234	1.25	1.000	1.00	1.00	1.00	1.00	1.00	3.32	1,515.17	3312.50	0.93	83.54	356.25
Length = 14.521 ft	2	0.460	0.298	1.25	1.000	1.00	1.00	1.00	1.00	1.00	3.34	1,524.80	3312.50	1.18	106.22	356.25
+D+0.750Lr+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 3.809 ft	1	0.610	0.313	1.25	1.000	1.00	1.00	1.00	1.00	1.00	4.43	2,020.23	3312.50	1.23	111.38	356.25
Length = 14.521 ft	2	0.614	0.398	1.25	1.000	1.00	1.00	1.00	1.00	1.00	4.46	2,033.07	3312.50	1.57	141.63	356.25

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Project Title: 42982 - Solaia 2102 SW Red Barn Rd HFR063 LSN
Engineer:
Project ID:
Project Descr:

Printed: 7 JUN 2022, 5:03PM

Wood Beam

File: 42982.ec6

Lic. # : KW-06001844

HD ENGINEERING & DESIGN INC

DESCRIPTION: HIP

Load Combination / Segment Length	Span #	Max Stress Ratios M	Max Stress Ratios V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	Moment Values M	Moment Values fb	Moment Values F'b	Shear Values V	Shear Values fv	Shear Values F'v
+D+0.750L					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 3.809 ft	1	0.414	0.212	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.77	1,262.64	3047.50	0.77	69.61	327.75
Length = 14.521 ft	2	0.417	0.270	1.15	1.000	1.00	1.00	1.00	1.00	1.00	2.79	1,270.67	3047.50	0.98	88.52	327.75
+0.60D					1.000	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 3.809 ft	1	0.071	0.037	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.66	303.03	4240.00	0.19	16.71	456.00
Length = 14.521 ft	2	0.072	0.047	1.60	1.000	1.00	1.00	1.00	1.00	1.00	0.67	304.96	4240.00	0.24	21.24	456.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
	1	0.0000	0.000	+D+0.750Lr+0.750L	-0.0295	2.225
+D+0.750Lr+0.750L	2	0.5081	8.182		0.0000	2.225

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	-1.088	2.979	1.529
Overall MINimum	-0.272	1.489	0.765
D Only	-0.272	0.745	0.382
+D+L	-0.816	2.234	1.147
+D+Lr	-0.816	2.234	1.147
+D+0.750Lr+0.750L	-1.088	2.979	1.529
+D+0.750L	-0.680	1.862	0.956
+0.60D	-0.163	0.447	0.229
Lr Only	-0.544	1.489	0.765
L Only	-0.544	1.489	0.765