BELL ENGINEERING
CIVIL & ENVIRONMENTAL
17 ECHO COVE WAY-SPOFFORD, NH 03462
(603) 363-9966

MEMO

DATE: May 13, 2016

TO: Renaud Brother Construction

FROM: Ronald K. Bell, PE
Bell Engineering

SUBJECT: Brattleboro BFR 2000 (26) Staging Plan

General Notes:

Under Scaffolding Design Loads:

Dead load: 20 psf
Live load: 50 psf
Lateral load on guard rail: 50 #/ln.ft.

The scaffolding bar joists are 12" deep with a 5/8" bar web and are a 12K1 joist with a safe uniform load of 361 #s/ln ft. At at 4' o.c. the LRFD factored load is 4 x(1.2 x 20 psf + 1.6 x 50 psf) = 416 #/ln ft. This value correlates to a SJI Load table value of 416/(1.65x0.9)=280 #/ln ft >>>> 361#/ln ft: ok

The guard rail posts were analyzed with a horizontal 50#s/ln.ft applied to the top rail. The 2x6 sleepers were analyzed under wet conditions without adding a factor for the flat use (least axis bending to be conservative). A section modulus of the sleepers and the plywood was calculated to show that the net section modulus approximately doubles relative to the independent members. However, the 2x6 sleepers were adequate without accounting for the fastened plywood.

The W8x21 cross beams were at 0.619:1 for the Max. bending stress ration and 0.293:1 for the max. shear stress ratio.

In summary the under bridge shoring is as designed is adequate to safely carry anticipated loads.

STATE OF VERMONT
RONALD K BELL
NO. 9994
PROFESSIONAL ENGINEER

BELL ENGINEERING
CIVIL & ENVIRONMENTAL
17 ECHO COVE WAY-SPOFFORD, NH 03462
(603) 363-9966

Project Title: BRATTLEBORO 2000 (26)
Engineer: RONALD K. BELL, PE
Project Descr: BELOW DECK STAGING
Project ID: 2016-026

Printed: 13 MAY 2016, 11:06AM

Steel Beam

File = C:\Users\Ron\DOCUME~1\ENERCA~1\ELLIOT~2.EC6
ENERCALC, INC. 1983-2013, Build:6.13.8.31, Ver:6.13.12.31

Lic. # : KW-06009396 Licensee : Bell Engineering

Description : TRANSVERSE W8X21 STAGING BEAMS

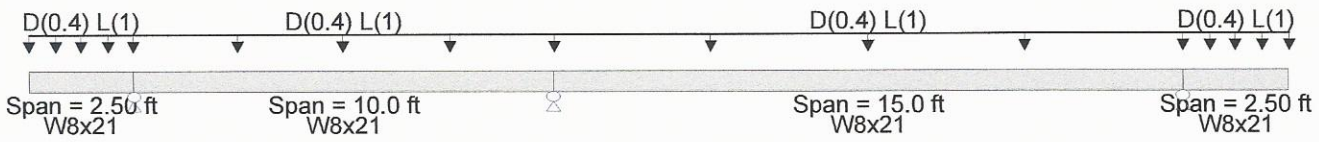
CODE REFERENCES

Calculations per AISC 360-05, IBC 2006, CBC 2007, ASCE 7-05
Load Combination Set : ASCE 7-05

Material Properties

Analysis Method : Load Resistance Factor Design
Beam Bracing : Completely Unbraced
Bending Axis : Major Axis Bending
Load Combination ASCE 7-05

Fy : Steel Yield : 50.0 ksi
E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.020, L = 0.050 ksf, Tributary Width = 20.0 ft, (WORKERS & CONC. DEBRIS)
Load for Span Number 2
Uniform Load : D = 0.020, L = 0.050 ksf, Tributary Width = 20.0 ft
Load for Span Number 3
Uniform Load : D = 0.020, L = 0.050 ksf, Tributary Width = 20.0 ft
Load for Span Number 4
Uniform Load : D = 0.020, L = 0.050 ksf, Tributary Width = 20.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = 0.619 : 1
Section used for this span W8x21
Mu : Applied 42.761 k-ft
Mn * Phi : Allowable 69.130 k-ft
Load Combination +1.20D+0.50Lr+1.60L+1.60H
Location of maximum on span 0.000ft
Span # where maximum occurs Span # 3

Maximum Shear Stress Ratio = 0.293 : 1
Section used for this span W8x21
Vu : Applied 18.201 k
Vn * Phi : Allowable 62.10 k
Load Combination +1.20D+0.50Lr+1.60L+1.60H
Location of maximum on span 10.000 ft
Span # where maximum occurs Span # 2

Maximum Deflection

Max Downward L+Lr+S Deflection	0.267 in	Ratio =	672
Max Upward L+Lr+S Deflection	-0.143 in	Ratio =	419
Max Downward Total Deflection	0.380 in	Ratio =	474
Max Upward Total Deflection	-0.203 in	Ratio =	295

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D+L	1	0.0129	0.000		0.0000	2.500
	2	0.0000	0.000	D+L	-0.0346	7.755
D+L	3	0.3801	8.265		0.0000	7.755
	4	0.0000	8.265	D+L	-0.2032	2.500

Vertical Reactions - Unfactored

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4	Support 5
Overall MAXimum		8.215	21.833	12.581	
D Only		2.434	6.468	3.727	
L Only		5.781	15.365	8.854	
D+L		8.215	21.833	12.581	

STATE OF VERMONT
RONALD K. BELL
NO. 6996
PROFESSIONAL ENGINEER

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CIVIL & ENVIRONMENTAL
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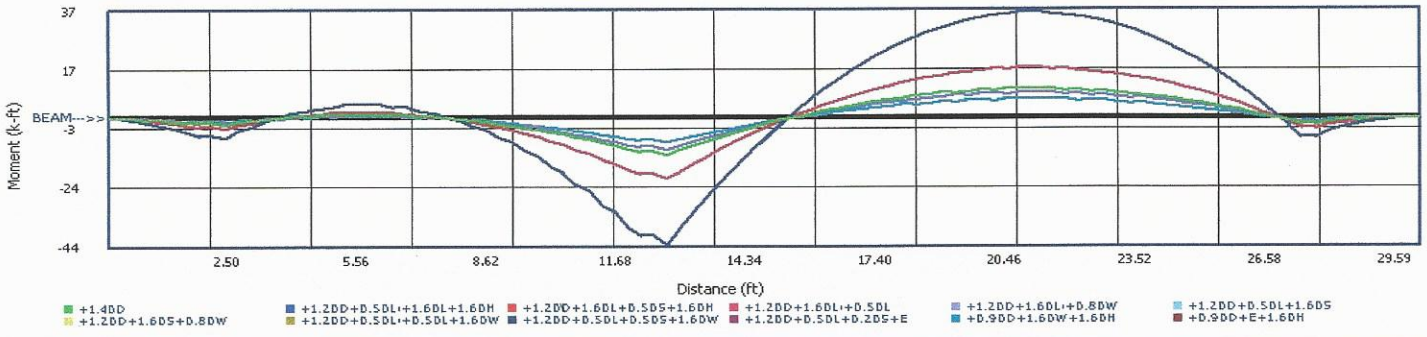
Steel Beam

Lic. # : KW-06009396 — Licensee : Bell Engineering

Description : TRANSVERSE W8X21 STAGING BEAMS

Steel Section Properties : W8x21

Depth	=	8.280	in	I xx	=	75.30	in^4	J	=	0.282 in^4
Web Thick	=	0.250	in	S xx		18.20	in^3	Cw	=	152.00 in^6
Flange Width	=	5.270	in	R xx	=	3.490	in			
Flange Thick	=	0.400	in	Zx	=	20.400	in^3			
Area	=	6.160	in^2	I yy	=	9.770	in^4			
Weight	=	20.969	plf	S yy	=	3.710	in^3	Wno	=	10.400 in^2
Kdesign	=	0.700	in	R yy	=	1.260	in	Sw	=	5.470 in^4
K1	=	0.563	in	Zy	=	5.690	in^3	Qf	=	3.960 in^3
rts	=	1.460	in	rT	=	1.410	in	Qw	=	10.100 in^3
Ycg	=	4.140	in							



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+1.2DD+D.SDL+1.6DL+1.6DH
+1.2DD+1.6DL+D.SDS+1.6DH
+1.2DD+1.6DL+D.SDL
+1.2DD+1.6DL+D.8DW
+1.2DD+D.SDL+1.6DS
+1.2DD+1.6DS+D.8DW
+1.2DD+D.SDL+D.SDL+1.6DW
+1.2DD+D.SDL+D.SDS+1.6DW
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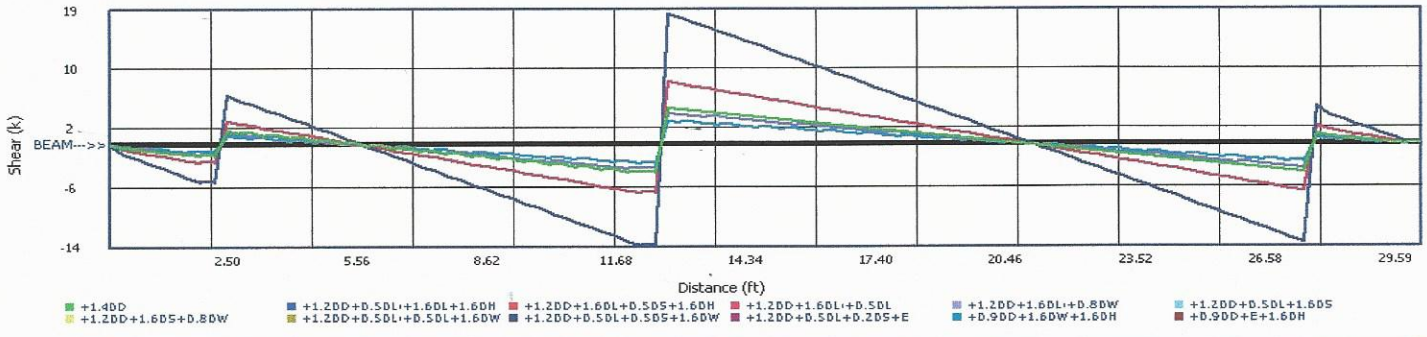
+D.9DD+1.6DW+1.6DH
+D.9DD+E+1.6DH



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+1.2DD+D.SDL+1.6DL+1.6DH
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+1.2DD+1.6DL+D.8DW
+1.2DD+D.SDL+1.6DS
+1.2DD+1.6DS+D.8DW
+1.2DD+D.SDL+D.SDL+1.6DW
+1.2DD+D.SDL+D.SDS+1.6DW
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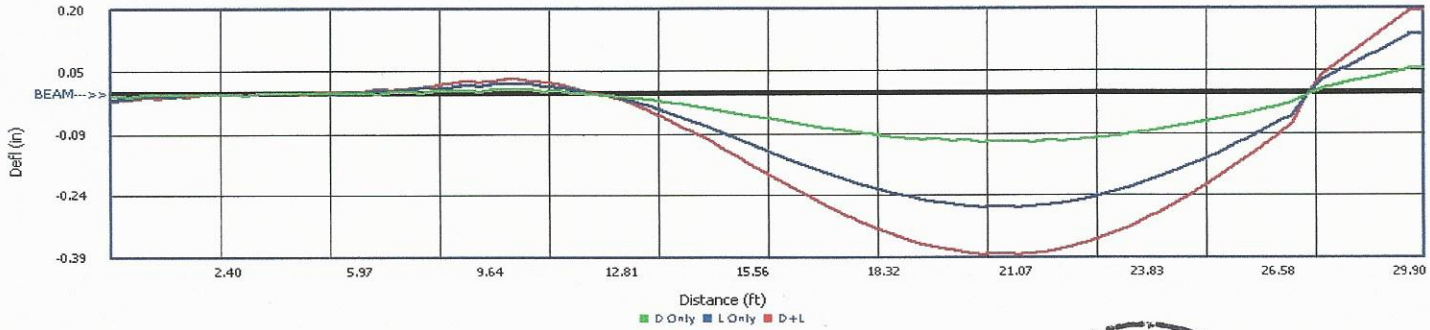

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NO. 6994
PROFESSIONAL ENGINEER

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CIVIL & ENVIRONMENTAL
17 ECHO COVE WAY-SPOFFORD, NH 03462
(603) 363-9966

Project Title: BRATTLEBORO BRF 2000 (26)
Engineer: RON BELL
Project Descr: BELOW DECK STAGING
Project ID: 2015-055-

Printed: 13 MAY 2016, 10:42AM

Wood Beam

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ENERCALC, INC. 1983-2013, Build:6.13.8.31, Ver:6.13.12.31

Lic. # : KW-06009396 Licensee : Bell Engineering

Description : 2X6 SCAFFOLDING PLANK

CODE REFERENCES

Calculations per NDS 2005, IBC 2006, CBC 2007, ASCE 7-05
Load Combination Set : ASCE 7-05

Material Properties

Analysis Method : Load Resistance Factor D
Load Combination ASCE 7-05

Wood Species : Mixed Southern Pine
Wood Grade : No.2: 2" - 4" Thick : 6" Wide

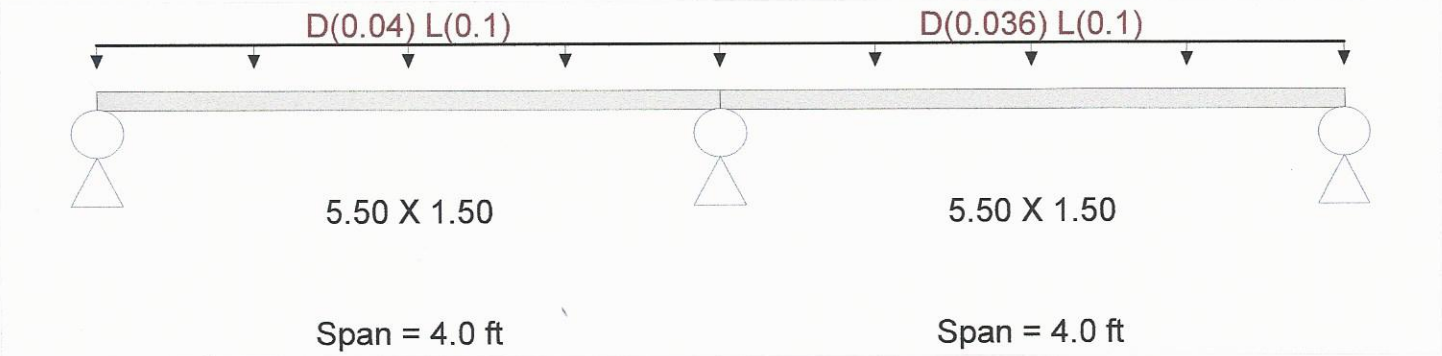
Beam Bracing : Beam is Fully Braced against lateral-torsion buckling

Fb - Tension	1,150.0 psi
Fb - Compr	1,150.0 psi
Fc - Prll	1,550.0 psi
Fc - Perp	565.0 psi
Fv	175.0 psi
Ft	675.0 psi

E : Modulus of Elasticity

Ebend- xx	1,400.0 ksi
Eminbend - xx	510.0 ksi
Density	32.860 pcf

Repetitive Member Stress Increase



Applied Loads

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

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.020, L = 0.050 ksf, Tributary Width = 2.0 ft
Load for Span Number 2
Uniform Load : D = 0.0180, L = 0.050 ksf, Tributary Width = 2.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.996 : 1	Maximum Shear Stress Ratio	=	0.248 : 1
Section used for this span		5.50 X 1.50	Section used for this span		5.50 X 1.50
fb : Actual	=	2,418.72 psi	fv : Actual	=	91.08 psi
FB : Allowable	=	2,428.11 psi	Fv : Allowable	=	366.66 psi
Load Combination		+1.20D+0.50Lr+1.60L+1.60H	Load Combination		+1.20D+0.50Lr+1.60L+1.60H
Location of maximum on span	=	4.000 ft	Location of maximum on span	=	3.888 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward L+Lr+S Deflection	0.112 in	Ratio =	429
Max Upward L+Lr+S Deflection	0.000 in	Ratio =	0 <240
Max Downward Total Deflection	0.162 in	Ratio =	296
Max Upward Total Deflection	-0.000 in	Ratio =	245407

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D+L	1	0.1616	1.698		0.0000	0.045
D+L	2	0.1495	2.324	D Only	0.0002	0.045

Vertical Reactions - Unfactored

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	0.214	0.699	0.206
D Only	0.064	0.199	0.056
L Only	0.150	0.500	0.150
D+L	0.214	0.699	0.206

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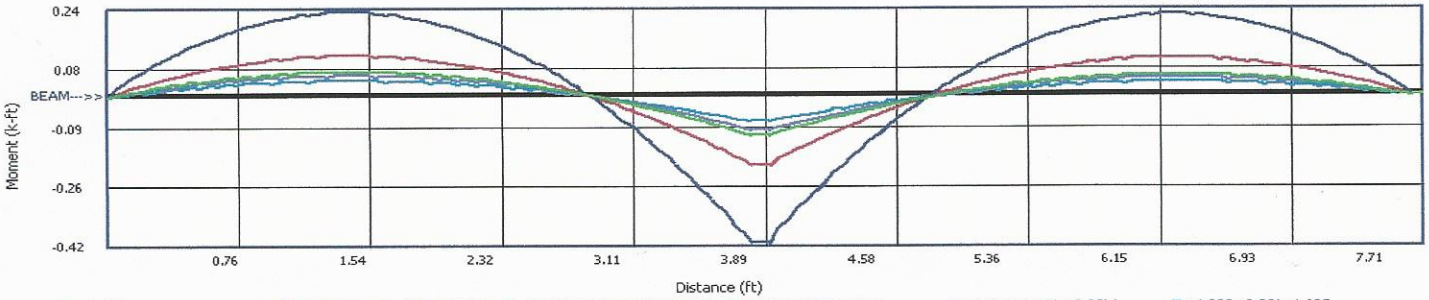

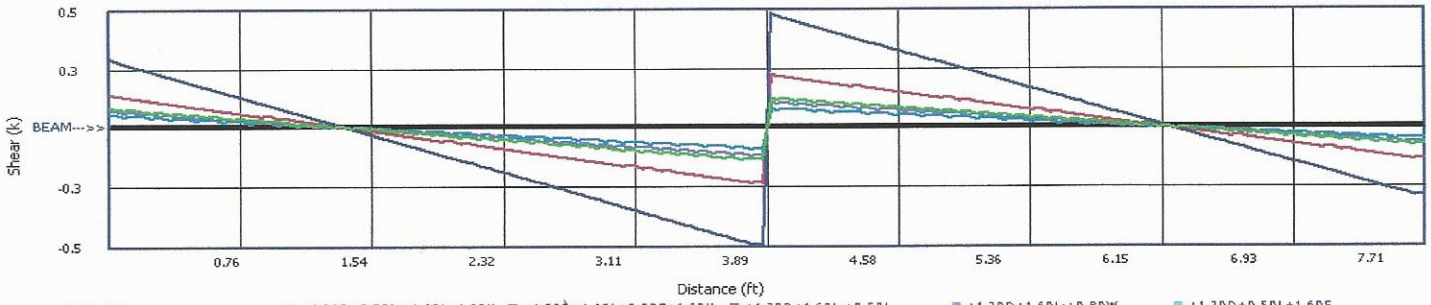

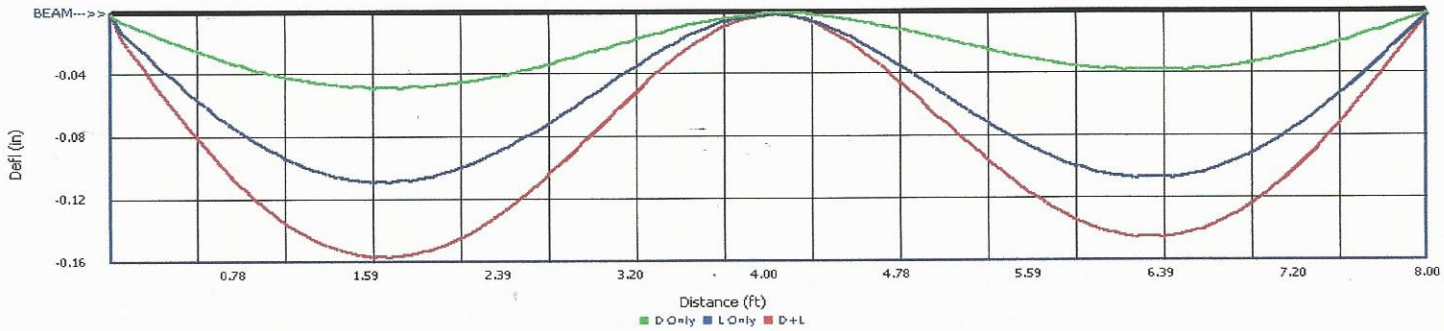

STATE OF VERMONT
RONALD K BELL
NO. 6984
PROFESSIONAL ENGINEER

BELL ENGINEERING
CIVIL & ENVIRONMENTAL
17 ECHO COVE WAY-SPOFFORD, NH 03462
(603) 363-9966

Project Title: BRATTLEBORO BRF 2000 (26)
Engineer: RON BELL
Project Descr: BELOW DECK STAGING
Project ID: 2015-055-

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ENERCALC, INC. 1983-2013, Build:6.13.8.31, Ver:6.13.12.31

Wood Beam

Lic. # : KW-06009396 — Licensee : Bell Engineering

Description : SCAFFOLDING GUARD RAIL- (2) 2X10

CODE REFERENCES

Calculations per NDS 2005, IBC 2006, CBC 2007, ASCE 7-05
Load Combination Set : ASCE 7-05

Material Properties

Analysis Method : Load Resistance Factor D
Load Combination ASCE 7-05

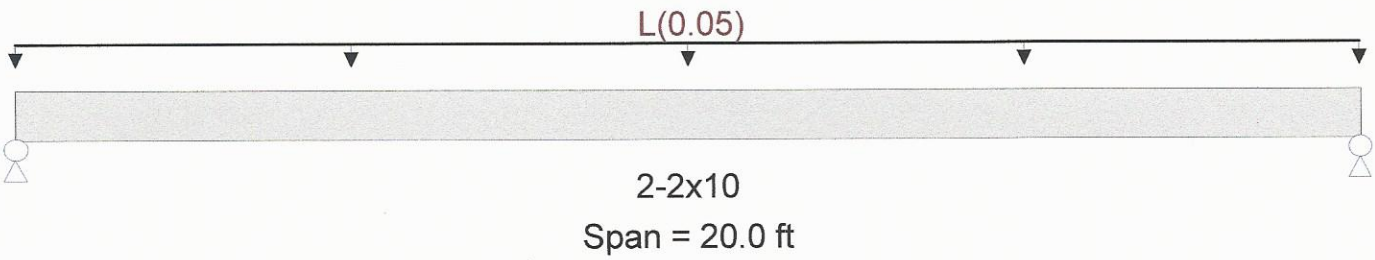
Wood Species : Eastern Softwood
Wood Grade : No.1

Beam Bracing : Completely Unbraced

Fb - Tension	775.0 psi
Fb - Compr	775.0 psi
Fc - Prll	1,000.0 psi
Fc - Perp	335.0 psi
Fv	140.0 psi
Ft	350.0 psi

E : Modulus of Elasticity

Ebend- xx	1,100.0 ksi
Eminbend - xx	400.0 ksi
Density	23.190 pcf



Applied Loads

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

Uniform Load : L = 0.050 , Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.733 : 1	Maximum Shear Stress Ratio	=	0.137 : 1
Section used for this span		2-2x10	Section used for this span		2-2x10
fb : Actual	=	1,121.99 psi	fv : Actual	=	40.09 psi
FB : Allowable	=	1,529.67 psi	Fv : Allowable	=	293.33 psi
Load Combination		+1.20D+0.50Lr+1.60L+1.60H	Load Combination		+1.20D+0.50Lr+1.60L+1.60H
Location of maximum on span	=	10.000 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 L+Lr+S Deflection	0.832 in	Ratio =	288
Max Upward L+Lr+S Deflection	0.000 in	Ratio =	0 <240
Max Downward Total Deflection	0.832 in	Ratio =	288
Max Upward Total Deflection	0.000 in	Ratio =	0 <180

Overall Maximum Deflections - Unfactored Loads

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D+L	1	0.8318	10.073		0.0000	0.000

Vertical Reactions - Unfactored

Support notation : Far left is #1 — Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	0.500	0.500
L Only	0.500	0.500
D+L	0.500	0.500

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NO. 6504
PROFESSIONAL ENGINEER

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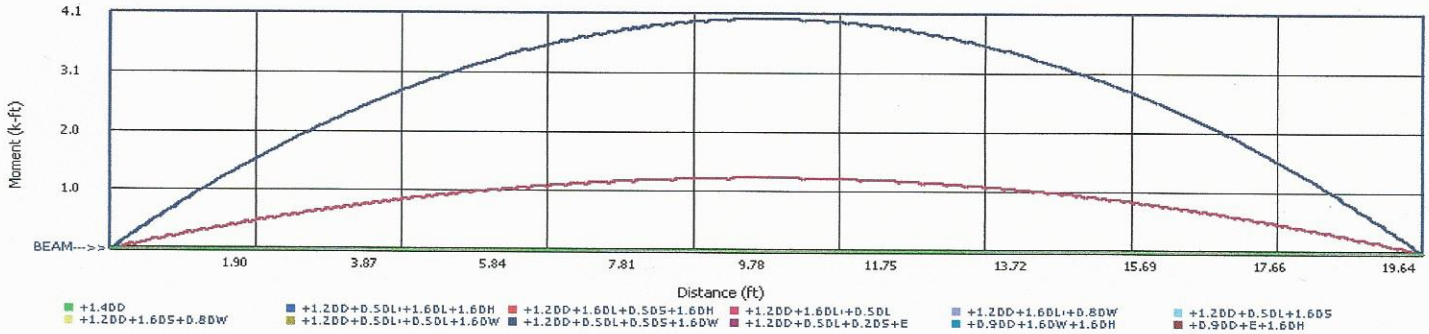

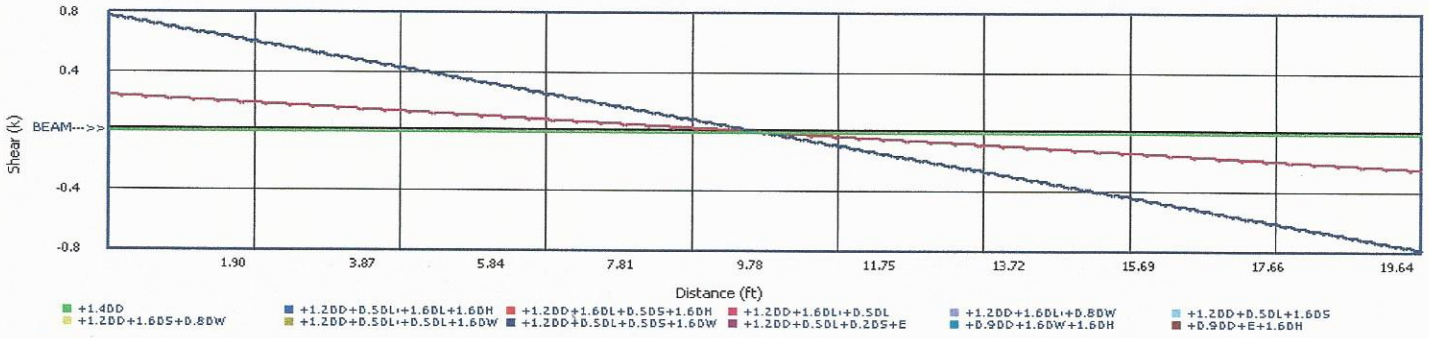

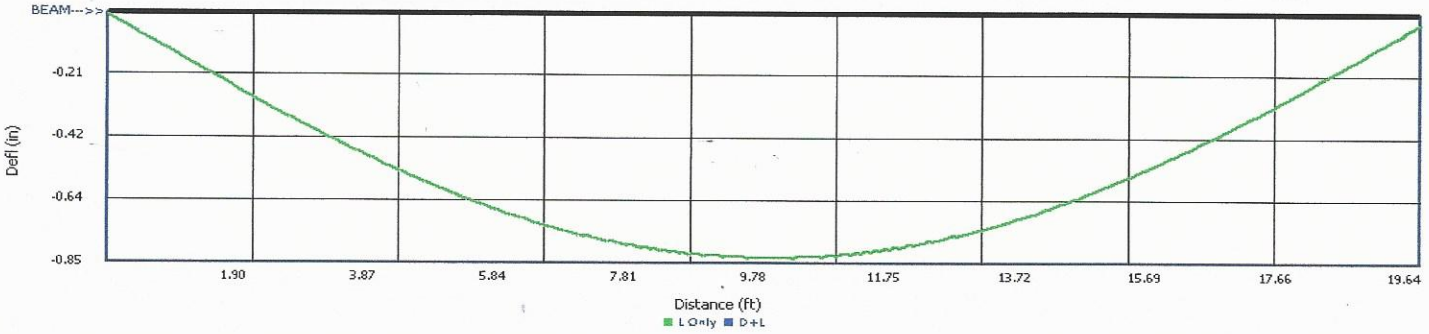

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