THE KILIAN CORPORATION

Date: 07/11/16

Project: MetroBikeLink - McKinley Realignment

To: Matt Joost/Tony Erwin

Reference: 13 - Pedestrian Truss Superstructure

We are sending you: x **Attached** _____ **Under separate cover**

Copies	Specification Section	Description	Date
PDF		Pedestrian Truss Superstructure Shop Drawings	7/11/16

These are transmitted for action as indicated:

x	**For Approval**	_____	**Approved as Submitted**
x	**For Your Use**	_____	**Approved as Noted**
x	**As Requested**	_____	**Returned for Corrections**
x	**For Review and Comment**		**For Record Only**
_____			

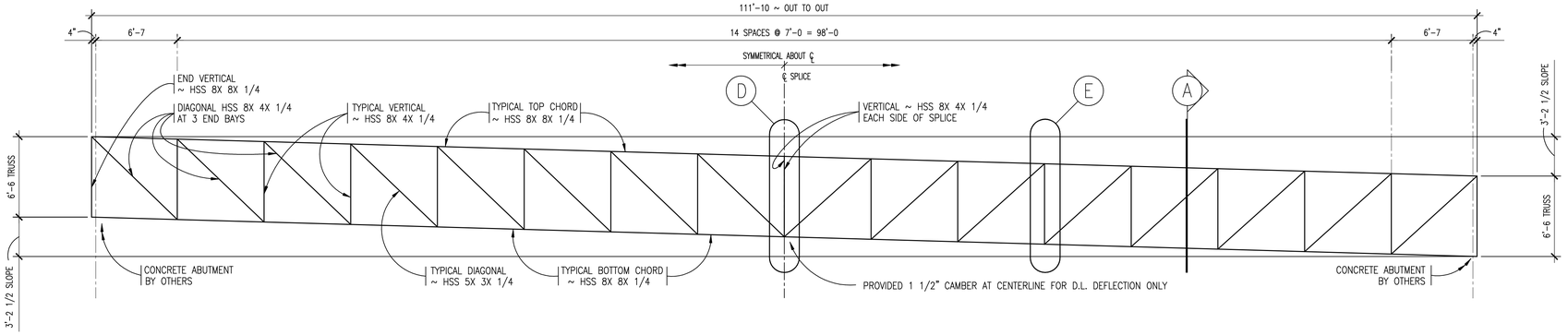
Remarks:

Signed:

Carlos Munguia

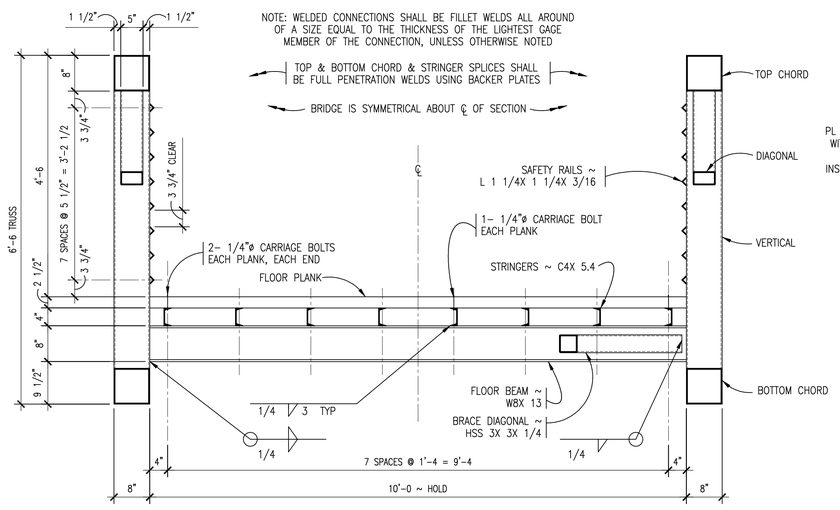
Digitally signed by Carlos Munguia
DN: cn=Carlos Munguia, o=Kilian Corporation, ou, email=carlos.munguia@kiliancorp.com, c=US
Date: 2016.07.11 10:15:43 -05'00'

Carlos Munguia, Project Manager



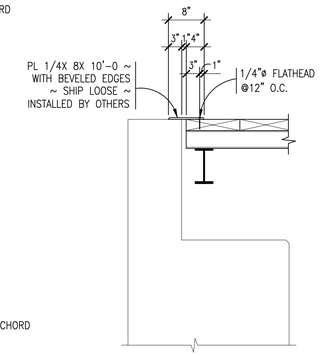
BRIDGE ELEVATION

3/16" = 1'-0"



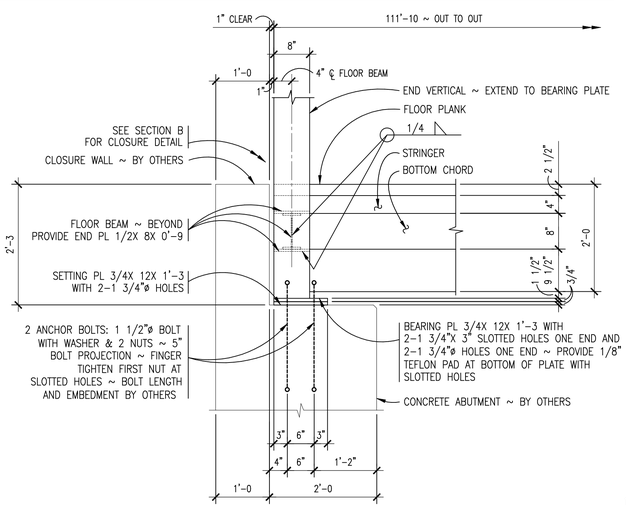
A BRIDGE SECTION

3/4" = 1'-0"



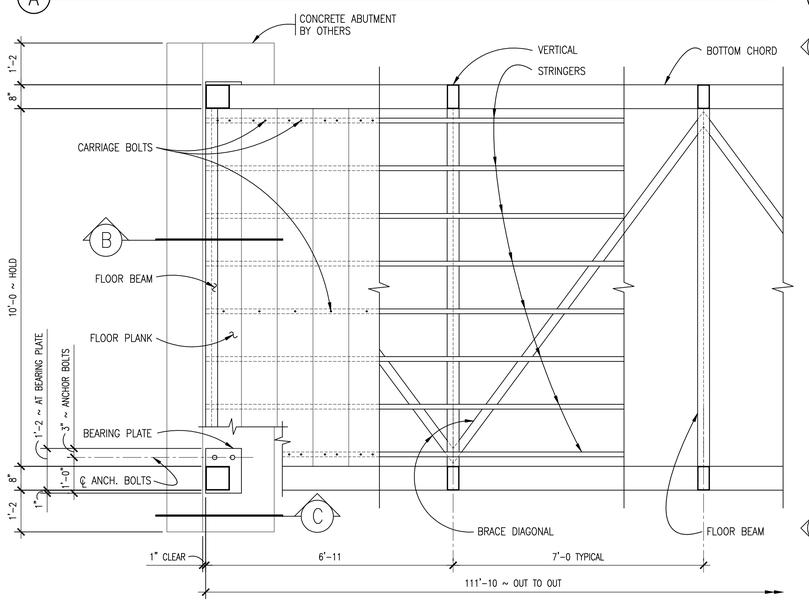
B CLOSURE DETAIL

3/4" = 1'-0"



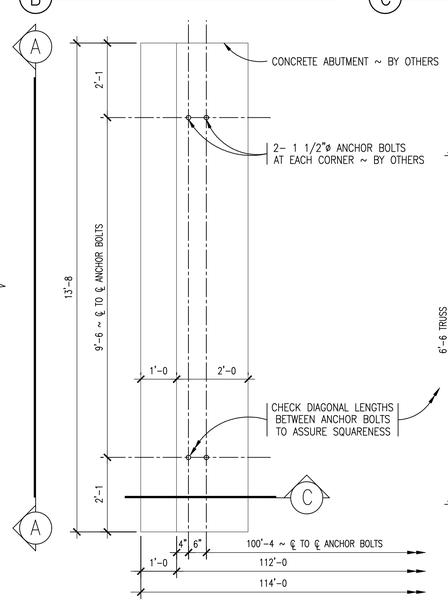
C BEARING DETAIL

3/4" = 1'-0"

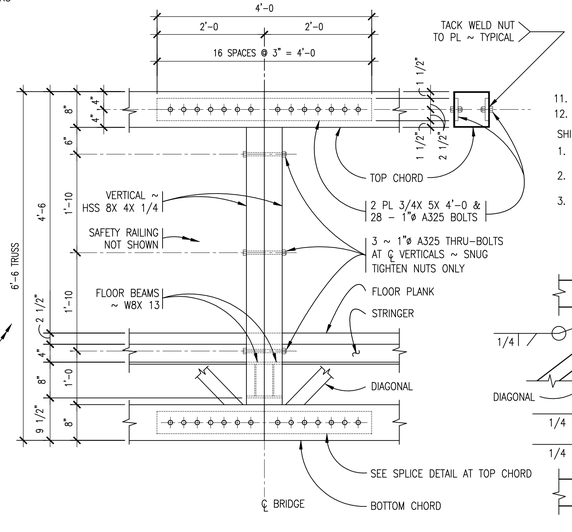


BRIDGE PLAN DECK LEVEL FRAMING LEVEL BRACING LEVEL

1/2" = 1'-0"



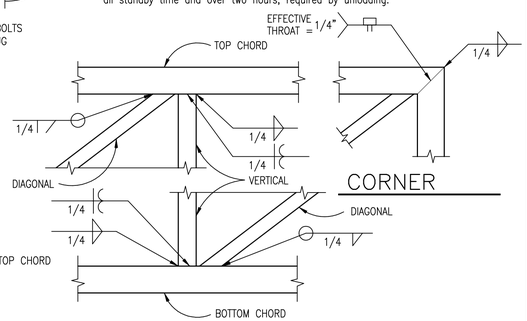
ABUTMENT DETAIL 1/2" = 1'-0"



D SPLICE DETAIL

(OUTSIDE ELEVATION)

3/4" = 1'-0"



E TRUSS WELDS

3/4" = 1'-0"

GENERAL NOTES

1. LIVE LOADS USED IN DESIGN:
   - A. Uniform Live Load ..... 90 psf.
   - B. Vehicle .....17,200 lbs., (12,000 lbs., 5,200 lbs. Axle Distribution)
   - C. Wind ..... 35 psf.
   - D. Seismic ..... AASHTO As=0.28
2. FOUNDATIONS: Designed and provided by others.
3. TIMBER:
   - A. Wood for bridge decking shall be 3x12 treated Southern Yellow Pine conforming to "National Design Specifications for Wood Construction..." by the National Forest Products Association.
     1. All decking shall be stress-graded "No. 1" or better.
     2. All decking shall be treated with Micronized Copper Azole with a minimum retention of 0.23 pcf.
4. METALS:
   - A. All steel shall be high strength low alloy (Fy = 50,000 psi.)
     1. All structural steel tube shapes shall conform to ASTM A847.
     2. All other steel shapes and plates shall conform to ASTM A588 or ASTM A572 – Grade 50.
     3. All anchor bolts shall conform to ASTM A1554-Grade 55 and shall be galvanized. All standard bolts shall conform to ASTM A307. Carriage bolts, washers and nuts shall be zinc rated.
     4. All high strength bolts shall conform to ASTM A325-Type 3. Bolted splice connections are slip-critical. Bolts shall be installed in accordance with RCSC Specification for Structural Joints in the AISC Manual for Steel Construction.
   - B. Structural steel shall be designed, detailed, and fabricated according to AASHTO LRFD Bridge Design Specifications and AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges.
   - C. All steel surfaces shall be cleaned in accordance with Steel Structures Painting Council standard SSPC-SP6-63.
   - D. Paint System: Organic zinc rich Primer/Epoxy/Urethane paint system by Sherman Williams used for painting stringers and floor beams of the Pedestrian Truss Superstructure. The entire system shall be shop applied prior to installing the deck. The color of the final finish coat shall match the Federal Color Standard 595a 20045.
5. WELDED CONNECTIONS:
   - A. All structural steel welds shall conform to the latest provisions of the Structural Welding Code AASHTO/AWS D1.5.
   - B. All welders shall be qualified in accordance with the above AWS Code.
   - C. Welding shall be electric arc process using SMAW and/or FCAW.
   - D. All welded connections are pre-qualified joints per AWS Code unless otherwise detailed.
   - E. All welds of tube shapes shall assure a hermetic connection.
   - F. Minimum filler metal strength shall be Fy = 70 ksi. and minimum fillet weld size shall be 1/4", unless noted on plans. Refer to AISC Manual Section J2 for other minimum requirements.
6. EXCEL Bridge Manufacturing Company is certified for simple steel bridge construction with AISC and for high strength fabrication under the City of Los Angeles License #1582.
7. Inspection shall be provided by Excel Bridge Manufacturing Company's Quality Control Program to include: review of shop drawings, welding procedures, welder qualifications, verification of bridge dimensions and geometry, and visual inspection of welds.
8. EXCEL Bridge Manufacturing Company is responsible for delivery of the fabricated bridge to the job site only. Unloading, erection, and job site safety are the responsibility of others.
9. UNFACTORED BRIDGE REACTIONS in pounds per base plate – (4 per bridge unless noted):

Dead Load	10,600 lbs.
Uniform Live Load	25,200 lbs.
Vehicle Live Load	8,400 lbs.

10. UNFACTORED LATERAL FORCES in pounds per base plate – (2 per bridge):

		FIXED END	EXPANSION END
Wind:	Vertical (windward)	12,000 lbs. (uplift)	12,000 lbs. (uplift)
	Vertical (leeward)	700 lbs. (uplift)	700 lbs. (uplift)
	Transverse	7,300 lbs.	4,400 lbs.
	Longitudinal (Due To Transverse Load)	30,600 lbs.	0 lbs.
Seismic:	Transverse	3,700 lbs.	2,200 lbs.
	Longitudinal (Due To Transverse Load)	15,600 lbs.	0 lbs.
	Longitudinal (Due To Longitudinal Load)	6,000 lbs.	0 lbs.

11. BRIDGE LIFTING WEIGHT: 42,200 lbs.
12. UNIFORM LIVE LOAD DEFLECTION: L/390.

SHIPPING NOTES:

1. Bridges will be shipped on over-the-road trucks. Truck must be unloaded as close as possible to paved streets or roads.
2. Purchaser is responsible for coordinating and supplying unloading cranes, support dunnage, and other necessary items.
3. Standard unloading time is 2 hours per truck. Purchaser will be responsible for all standby time and over two hours, required by unloading.

REGISTERED STRUCTURAL ENGINEER
ROGER T. ALWORTH
081-006549
STATE OF ILLINOIS

JUN 10 2016

MARK	DATE	PURPOSE
		REVISIONS

DESIGN & DRAWN : LEK/BKM
DATE : 04/11/16

VECTOR ENGINEERS
9138 S. STATE STREET, SUITE 101 (801) 990-1775
SANDY, UTAH 84070 (801) 990-1776 FAX

EXCEL
BRIDGE MANUFACTURING CO.

12001 SHOEMAKER AVE.
SANTA FE SPRINGS, CA. 90670
(562) 944-0701
FAX (562) 944-4025
OUTSIDE CA. (800) 548-0054

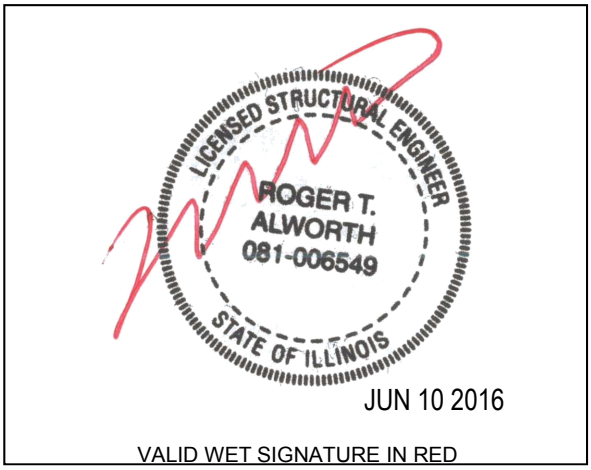
10'-0 WIDE X 112'-0 LONG
PEDESTRIAN BRIDGE
METRO BIKE LINK
BELLEVILLE, IL

EXCEL JOB NO. 16B017

SHEET 1 OF 1

STRUCTURAL CALCULATIONS
for
METRO BIKE LINK
PEDESTRIAN BRIDGE
at
BELLEVILLE, IL

for
EXCEL BRIDGE MANUFACTURING CO. (16B-017)



BY: **ROGER T. ALWORTH, P.E.**
PRINCIPAL

PROJECT #: **U0009-412-161**

DATE: **June 10, 2016**

DESIGNED BY JSP; CHECKED BY WLH

NOTE:
The calculations presented in this package are intended for a single use at the location indicated above, for the client listed above. These calculations shall not be reproduced, reused, "card filed", sold to a third party, or altered in any way without the written authorization of Vector Structural Engineering, LLC and Excel Bridge Manufacturing Co.

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

Job No. 163017

Structural Calculations for
10'-0 wide x 112'-0 long
Pedestrian Bridge
Metro Bike Link
Belleville, IL

Client: Excel Bridge Manufacturing Co.

Date: April 2016

JOB 16B017 10x112 BR

SHEET NO. 1 OF

CALCULATED BY LEK DATE 3/31/16

CHECKED BY DATE

Loading — LRFD AASHTO Design

1. Uniform live load = 90 psf
2. Vehicle - 17,200# [5200# front & 12000# rear @ 10'-0 apart]
3. Wind - 35 psf
4. Seismic - $A_s = 0.28g$

Floor Deck

3x12 Southern Yellow Pine "No. 2"

$A = 28.1$ $\quad F_v = C_{LE} C_M C_t C_\lambda F_v = (3.33)(.97)(.80)(.80)(0.175) = 0.36$

$S = 11.72$ $\quad F_b = C_{LE} C_M C_F C_{fu} C_i C_\lambda F_b = 2.94(1.0)(1.0)(1.20)(.8)(.8)(1.50) = 3.27$

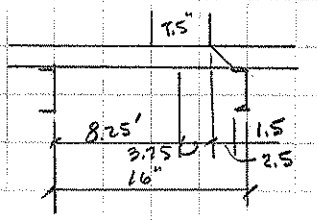
$WT = 10$ psf

Vehicle - rear wheel $= \frac{1}{2}(12.0) = 6.0^k$

front wheel $= \frac{1}{2}(5.2) = 2.6^k$

tire width $= 6.0/.8 = 7.5"$ $\quad w = 6.0/7.5 = 0.8$ k/i

tire length $= 6.4(1.175) = 11.2$ (one plank)



Max. $V_u = 1.75(6.0) \times \frac{8.25}{16} = 5.41$

$F_v = 2(5.41)/28.1 = 0.385 > .36$ 6% low say OK

Max. $M_u = \frac{1}{2}(1.75)(6)(8) - \frac{1}{2}(1.75)(.8)(3.75)^2 = 32.2$

$F_b = 32.2/.85(11.72) = 3.23 < 3.27$

Use 3x12 SYP with 1'-4 span

Stringer

Span = 16 sp. @ 7'-0 = 112'-0

Vehicle $M = .80\left[\frac{1}{4}(4)(7.0)\right] = 5.6^{k'}$

$M_u = 1.75(5.6) = 9.8^{k'}$ $\quad D.F. = 1.33/6.7 = 0.20$ $\quad$ Use 3 stringers

Try C4x5.4 $\quad S = 1.93$

$M_u = \frac{1}{3} f_b S = 12\left(\frac{9.8}{3}\right) + \frac{1}{3}(.6)(50)(1.93) = 58.5$

$\phi M_{mc} = 1.0(50)(1.93) = 96.5 > 58.5$ OK

Use C4x5.4 stringers @ 1'-4 o.c.

USGS Design Maps Summary Report

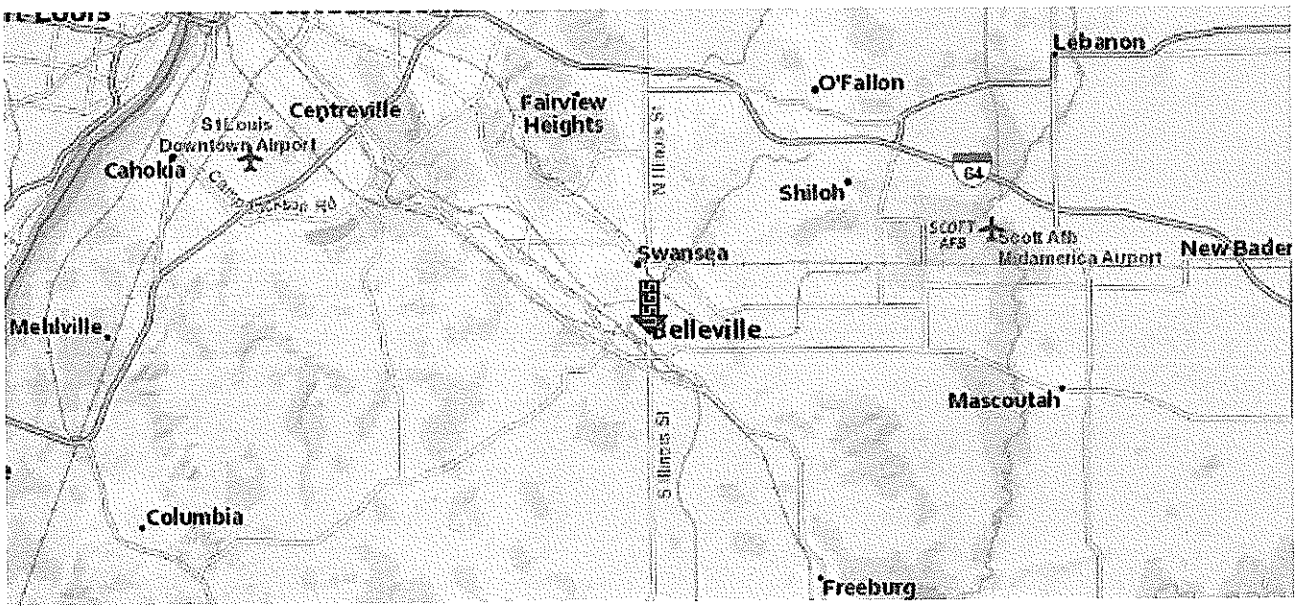
User-Specified Input

Report Title 16B017
Thu March 31, 2016 19:22:33 UTC

Building Code Reference Document 2009 AASHTO Guide Specifications for LRFD Seismic Bridge Design
(which utilizes USGS hazard data available in 2002)

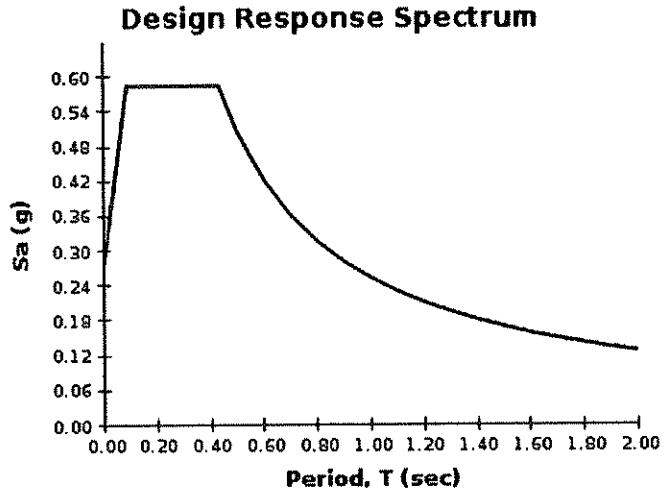
Site Coordinates 38.52006°N, 89.9842°W

Site Soil Classification Site Class D – "Stiff Soil"



USGS-Provided Output

PGA =	0.197 g	**A_s =**	0.277 g
S_s =	0.394 g	**S_{DS} =**	0.584 g
S_1 =	0.107 g	**S_{D1} =**	0.253 g



JOB 16D017 10x112 BR

SHEET NO. 3 OF

CALCULATED BY LEK DATE 3/31/16

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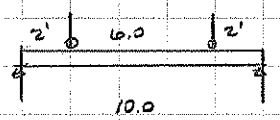
FLOOR BEAM



DL.W: DECK 7.0 (10 PSF) = 70 PLF

STRINGERS (7.0)(5.44)/1.33 = 28

BEAM = 13

111 PLF x 1.25 = 139

LL W = 7 (90 PSF) 630 x 1.75 = 1103

741 x 1.68 = 1242

R_u = 6.2

M_u = 15.5

FOR LL Δ = L/360 I REQ'D = 14.6

OR

w_{DL} = 0.14

P_u = 1.75(6.0) = 10.5

R_u = 11.2 } ⇐ CONTROLS

M_u = 22.8 }

TRY W8x13 S = 9.91 I = 39.6

$M_u + \frac{1}{3} fS = 12(22.8) + \frac{1}{3}(.6)(50)(9.91) = 373$

$\phi M_{ns} = 1.0(50)(9.91) = 469 > 373$ OK

ASSUME W8x13 FLOOR BEAM

SIMPLE SPAN BEAM WITH CANTILEVER END(S)

BEAM SPAN LENGTH (FT) = 10.0000

LOADING: W (KLF), P (KIP), x & a (FT)

w = 1.2400 x = 0.0000 a = 10.0000

REACTION AT LEFT SUPPORT (KIP) = 6.2000
REACTION AT RIGHT SUPPORT (KIP) = 6.2000

MOMENT AT CENTER OF BEAM (K-FT) = 15.5000

EI(DEFT) AT CENTER OF BEAM (K-FT^3) = 161.4583

****** A992 STEEL BEAM ******
Fb (KSI) = 33 E (KSI) = 29000

SECTION MODULAS REQUIRED (IN^3):
S AT CENTER OF BEAM = 5.6364

MOMENT OF INERTIA REQUIRED (IN^4):
AT CENTER OF BEAM
I FOR L/240 = 19.2414
I FOR L/360 = 28.8621 $\times \frac{1}{1.68} \times \frac{630}{741} = 14.6$

SIMPLE SPAN BEAM WITH CANTILEVER END(S)

BEAM SPAN LENGTH (FT) = 10.0000

LOADING: W (KLF), P (KIP), x & a (FT)

w = 0.1400 x = 0.0000 a = 10.0000

P = 10.5000 x = 2.0000

P = 10.5000 x = 8.0000

REACTION AT LEFT SUPPORT (KIP) = 11.2000
REACTION AT RIGHT SUPPORT (KIP) = 11.2000

MOMENT AT CENTER OF BEAM (K-FT) = 22.7500

EI(DEFT) AT CENTER OF BEAM (K-FT^3) = 266.7292

JOB 168017 — 10 x 112 Br

SHEET NO. 5 OF

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Truss Analysis

DEAD LOAD: DECK $\frac{1}{2}(10)(10\ PSF)$ = 50 PLF

STEEL (ASSUMED) = 140

D.L = 190 x 7.0 = 1330 #/PANEL

UNIF. LL = $\frac{1}{2}(10)(90\ PSF)$ = 450 x 7.0 = 3150

T.L = 640 PLF 4480 #/PANEL

$L.F = [1.25(190) + 1.75(450)]/640 = 1.58$

VEHICLE LOAD - 6" + 2.6" AT 10' AWAY (1.4 PANELS)

3 PANEL OF UNIF LL = $3(3.150) = 9.45^{k} > 8.6^{k}$ UNIF. LL CONTROLS TRUSS DESIGN

Assumed Members		A	I
Top & Bot Chords	HSS 8x8x1/4	7.10	70.7
Vertical	HSS 8x4x1/4	5.24	14.4
Diagonal	HSS 5x3x1/4	3.37	4.8

Truss Height

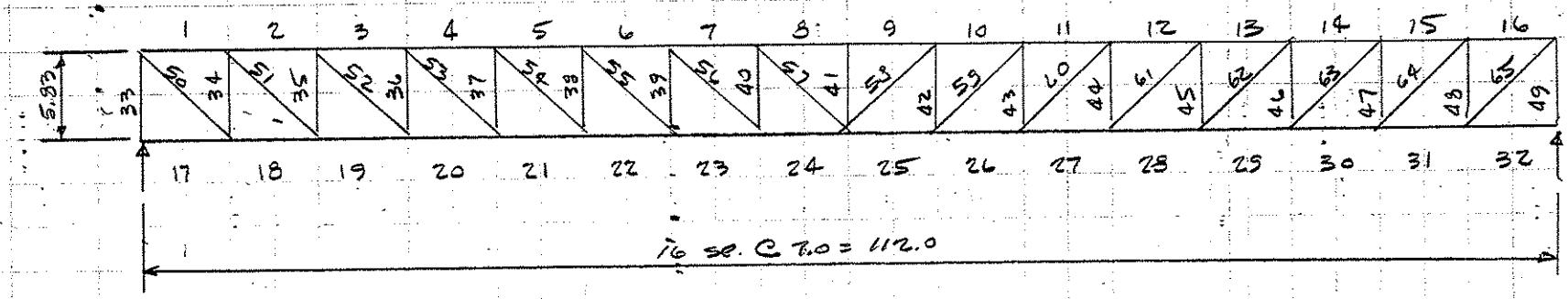
Bridge seat = 2'-3 use 2'-0 to bottom chord

4'-6 above deck

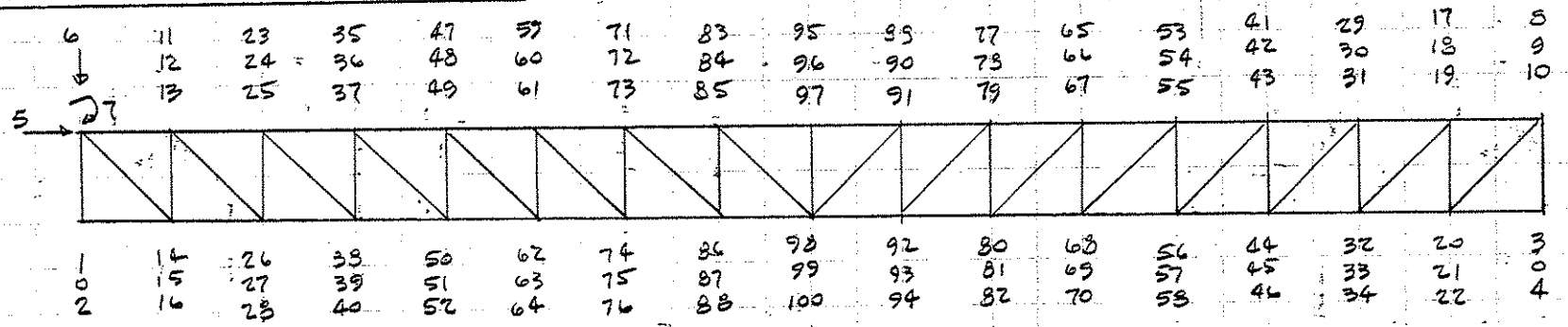
6'-6 truss

℄ to ℄ = 6.5 - .67' = 5.83'

Truss Member Nos.



Code Numbers (Displacements)



NO. OF MEMBERS = 65

NO. OF EQUATIONS = 100

BAND WIDTH = 23

MOD OF ELASTICITY = 29000 KSI

LOADING : UNIFORM - CODE NO. 15, 21, 27, 33, 39, 45, 51, 57, 63, 69, 75, 81, 87, 93, 99

P = 4.48^K

16 PANELS

JOB 1690017 10/12 BLC

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JOB 16B017 10x112 Bz

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CHECKED BY DATE

TOP CHORD LATERAL SUPPORT - AASHTO GUIDE SPECS FOR DESIGN OF PED. BRIDGES

FLOOR BEAM SPAN: $b = 10(12) + 8 = 128$

EFFECTIVE HEIGHT OF VERTICAL: $h = 54 - 4 + 2.5 + 4.0 + 4.0 = 60.5$

FLOOR BEAM W8x13 $I_b = 39.6$

VERTICAL HSS 8x4x1/4 $I_c = 42.5$

$$C = \frac{E}{h^2\left[\frac{h}{3I_c} + \frac{b}{2I_b}\right]} = \frac{29000}{(60.5)^2\left[\frac{60.5}{3(42.5)} + \frac{128}{2(39.6)}\right]} = 3.79$$

CHORD PANEL LENGTH $l = 84$

MAX. TOP CHORD COMPRESSION $P = 171$ FROM COMPUTER ANALYSIS, MEMBERS 8 & 9

$P_u = 1.58(171) = 270$

$$Cl/P_c = 3.79(84)/1.33(270) = 0.886$$

FOR $n = 16$ $\quad 1/K = 0.60 + 0.05\left[\frac{0.886 - .808}{0.940 - .808}\right] = 0.63 \Rightarrow K = 1.59$

TOP CHORD DESIGN

$P_u = 1.58(171) = 270^K$

$M_u = 1.58(4.45)(12) = 84^{K''}$

HSS 8x8x1/4 $\quad A = 7.10 \quad S = 17.7 \quad r = 3.15$

$$\frac{Kl}{r_x} = \frac{1.59(84)}{3.15} = 42 \qquad \lambda = 0.000175(42)^2 = 0.31$$

$P_r = 0.90(0.66)^{.31}(50)(7.10) = 312$ $\quad P_u/P_r = 270/312 = 0.87$

$M_r = 1.0(50)(17.7) = 885$ $\quad M_u/M_r = 84/885 = 0.10$

EQ. 6.9.2.2-2 $= 0.87 + \frac{8}{9}(0.10) = 0.96 < 1.0$ OK

USE HSS 8x8x1/4 TOP CHORD

JOB 168017 10x112 BR

SHEET NO. 8 OF

CALCULATED BY LEK DATE 3/31/16

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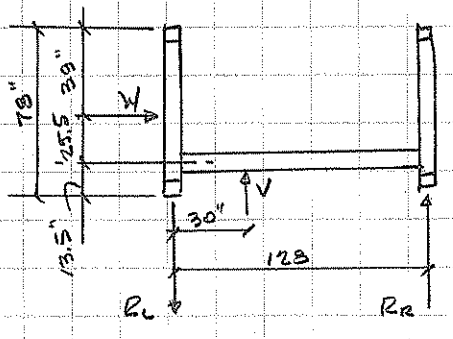
HORIZ. TRUSS LOAD



WIND: $W = 35\ PSF \times 78/12 = 208\ PLF$

$V = 20\ PSF \times 11.33 = 227$

$R_L = \frac{1}{128}[208(125.5) + 227(128-30)] = 215$ UPLIFT

$R_R = 227 - 215 = 12$ PLF UPLIFT

MAX. T & B CHORD FORCES

BOT CHORD $T = \frac{1}{8}(112)^2/128 \times 12 \times .208 = 30.6$

TOP CHORD $C = \frac{1}{8}(112)^2/5.83 \times .215 = 57.8$

STRENGTH III = $1.25D + 1.40W = 1.25(171)\frac{190}{640} + 1.4(57.8) = 144 < 270$

WIND DOES NOT CONTROL

END REACTION (WINDWARD) $= \frac{1}{2}(112)(215) = 12{,}000^{\#}$/BEARING (UP)

(LEEWARD) $= \frac{1}{2}(112)(12) = 700^{\#}$/BEARING (UP)

TRANSVERSE - FIXED END $= \frac{5}{8}(112)(208) = 14{,}600^{\#} = 7{,}300^{\#}$/BEARING

EXP END $= \frac{3}{8}(112)(208) = 8700 = 4400^{\#}$/BEARING

LONGITUDINAL - FIXED END $= \frac{1}{8}(112)^2(208)/10.67 = 30{,}600^{\#}$/BEARING

(DUE TO TRANSVERSE LOAD)

SEISMIC: $V = A_s W = 0.28(2)(190) = 106\ PLF < 208$ WIND CONTROLS

TRANSVERSE - FIXED END $= \frac{5}{8}(112)(106) = 7400 = 3700^{\#}$/BEARING

EXP. END $= \frac{3}{8}(112)(106) = 4400 = 2200^{\#}$/BEARING

LONGITUDINAL - FIXED END $= \frac{1}{8}(112)^2(106)/10.67 = 15600^{\#}$/BEARING

(DUE TO TRANSV. LOAD)

LONGITUDINAL - FIXED END $= 112(106) = 11{,}900 = 6000^{\#}$/BEARING

(DUE TO LONG. LOAD)

ANCHOR BOLTS - F1554 GR 55

1 1/2"ϕ $R_r = 0.75(.33)(1.77)(75) = 37.8 \times 2 = 75.6$

$T_r = 0.80(.76)(1.77)(75) = 80.7 \times 2 = 161$

WIND: $1.4\left[\frac{R_u}{R_r} + \frac{T_u}{T_r}\right] = 1.4\left[\frac{7.3 + 30.6}{75.6} + \frac{12.0}{161}\right] = 0.81 < 1.0$ OK

EQ. $1.0\left[R_u/R_r\right] = 1.0\left[15.6 + 3.7\right]/75.6 = 0.26 < 1.0$ OK

USE 2 - 1 1/2"ϕ F1554 - GR 55 BOLTS

JOB 168017 10x 112 BR

SHEET NO. 9 OF

CALCULATED BY LEK DATE 4/4/16

CHECKED BY DATE

BRACE DIAGONAL

BRACE LENGTH $\ell = [(10)^2 + (7)^2]^{1/2} = 12.2' = 146$

$V_{MAX} = 14.6$ MAX TORC $= 14.6(12.2)/10 = 17.8^K$ $C_u = 17.8(1.4) = 24.9$

HSS 3x3x1/4 $A = 2.44$ $r = 1.11$

$kl/r = 146/1.11 = 132$ $\lambda = 0.000175(132)^2 = 3.03 > 2.25$

$P_r = 0.88(50)(2.44)/3.03 = 35.4$

$P_u/P_r = 24.9/35.4 = 0.70 < 1.0$ OK

USE HSS 3x3x1/4 BRACE DIAGONAL 1/4" WELD $V_r = 5.94(4)(3) = 53.5 > 24.9$

BOTTOM CHORD

$P_u = 1.58(168) = 265^K$ (T) FROM COMPUTER ANALYSIS, MEMBERS 24 & 25

$M_u = 1.58(4.44)(12) = 84^{K''}$

HSS 8x8x1/4 $A = 7.10$ $S = 17.7$

$P_r = 0.95(50)(7.10) = 337$ $P_u/P_r = 265/337 = 0.79$

$M_r = 1.0(50)(17.7) = 885$ $M_u/M_r = 84/885 = 0.10$

EQ. 6.8.2.3-2 $= 0.79 + \frac{8}{9}(.10) = 0.87 < 1.0$ OK

USE HSS 8x8x1/4 BOTTOM CHORD

DIAGONAL

$P_u = 1.58(49.6) = 78.4^K$ (T) FROM COMPUTER ANALYSIS, MEMBERS 50 & 65

$M_u = 1.58(0.21)(12) = 4^{K''}$

HSS 5x3x1/4 $A = 3.37$ $S = 3.20$

$P_r = .95(50)(3.37) = 160$ $P_u/P_r = 78.4/160 = 0.49$

$M_r = (1.0)(50)(3.20) = 160$ $M_u/M_r = 4/160 = 0.03$

EQ. 6.8.2.3-2 $= 0.49 + \frac{8}{9}(.03) = 0.52 < 1.0$ OK

USE HSS 5x3x1/4 DIAGONAL

JOB 168017 10x112 BR

SHEET NO. 10 OF

CALCULATED BY LEK DATE 4/4/16

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DIAGONAL TO CHORD CONNECTION

$\beta = 5/8 = 0.62$ $\quad 1-\beta = 0.38$ $\quad \tan\theta = \frac{62}{80} = 0.78 \Rightarrow \theta = 38°$ $\quad \eta = {}^{4}/_{\sin\theta}/_{B} = {}^{3}/_{\sin 38}/_{8} = 0.61$

CHORD PLASTIFICATION

$\phi P_n \sin\theta = 78.4 \sin 38° = 48.3$

$$\phi F_y t^2 \left[\frac{2\eta}{1-\beta} + \frac{4}{(1-\beta)^{.5}}\right] Q_f = 1.0(50)(.25)^2 \left[\frac{2(.61)}{.38} + \frac{4}{(.38)^{.5}}\right](1.0) = 30.1 < 48.3 \text{ N.G.}$$

MEMBERS 53 & 62 $\quad P_n = 1.58(30.3) = 47.9$

$P_n \sin\theta = 47.9(\sin 38)° = 29.5 < 30.1$ OK

USE HSS 8x4x1/4 DIAGONAL FOR 3 BAYS EACH END

WELD - $P_n F_{tl}$ WHERE $F_z = .60(70)\left[1.0 + .5 \sin^{1.5} 38°\right] = 52.1$

$l = 2\left[3 - 1.2(.25)\right]/\sin 38° + 2\left[5 - 1.2(.25)\right] = 8.8 + 9.4 = 18.2$

$t_w = .707(.25) = 0.18$

$P_n = 52.1(18.2)(.18) = 171$

$P_n/\Omega = 171/2 = 85 > 78.4$ ok USE 1/4" WELD

JOB 16B017 10x112 Br

SHEET NO. 11 OF

CALCULATED BY LEK DATE 4/4/16

CHECKED BY DATE

VERTICAL DESIGN

LATERAL FORCE C = 0.01/K × TOP CHORD COMPRESSION

0.01/K = 0.01/1.58 = 0.0063

D: C = 0.0063(171)(190/640) = 0.32 M_x = 0.32(60.5) = 19 k" × 1.25 = 24 k"

LL: C = 0.0063(270) = 1.70 M_x = 1.70(60.5) = 103 k"

WIND: C = 0.0063(1.4)(58) = 0.51 M_x = 0.51(60.5) + ½(1.4)(7)(.035)[60.5/12]²(12) = 83

STRENGTH III: M_{xu} = 24 + 83 = 107 > 103 USE M_{xu} = 107 k"

P_u = 1.58(27.7) = 43.8 k (c) FROM COMPUTER ANALYSIS, MEMBERS 34 & 48

M_y = 1.58(3.31)(12) = 63 k"

HSS 8x4x1/4 A = 5.24 S_x = 10.6 S_y = 7.21

r_x = 2.85 r_y = 1.66

$\frac{kl_x}{r_x} = \frac{1.58(60.5)}{2.85} = 34$

$\frac{kl_y}{r_y} = \frac{60.5}{1.66} = 36$ $\lambda = 0.000175(36)^2 = 0.23$

$P_r = 0.90(.66)^{.23}(50)(5.24) = 214$ $P_u/P_r = 43.8/214 = 0.20$

$M_{rx} = 1.0(50)(10.6) = 530$ $M_{ux}/M_{rx} = 107(530) = 0.20$

$M_{ry} = 1.0(50)(7.21) = 360$ $M_{uy}/M_{ry} = 63/360 = 0.18$

EQ. 6.9.2.2-2 = 0.20 + 8/9 [.20 + .18] = 0.54 < 1.0 OK

USE HSS 8x4x1/4 INTERIOR VERTICAL ←

HSS 8x8x1/4 END VERTICAL

WELD - A = 2(8+4) = 24 S_y = 8(4) + ⅓(4)³ = 37

$\frac{P}{A} + \frac{M}{S} = \frac{43.8}{24} + \frac{63}{37} = 3.53 < 5.94$ 1/4" WELD

JOB 16B017 10x172 BR

SHEET NO. 12 OF

CALCULATED BY LEK DATE 4/4/16

CHECKED BY DATE

FLOOR BEAM DESIGN

CONSERVATIVELY ADD MAX. MOMENTS FROM TRUSS VERTICALS TO BENDING MOMENTS OF

D+L LOADS : FROM SHT. 3 D+L M = 12(15.5) = 186

SHT. 11 Mx = 107

293 k'

$M_u + \frac{1}{3}ff = 293 + \frac{1}{3}(.6)(50)(9.91) = 295 < 469$ OK

USE W8X13 FLOOR BEAM

WELD - $A = 2(4+6) = 20$ $S = 4(8) + \frac{1}{3}(6)^2 = 44$

$P/A + M/S = 11.2/20 + 107/44 = 2.99 < 5.94$ 1/4" WELD

DEFLECTION

FROM COMPUTER ANALYSIS, CODE 99 : TL, $\Delta = 0.41$

LL $\Delta = 0.41(450)/640 = 0.29 = L/390 < L/360$ OK

DL = 0.12

VIBRATIONS

$f = .18\sqrt{g/DL\Delta} = .18\sqrt{32.2/.12} = 2.95$ Hz < 3.0 2% LOW OK

CAMBER

SLOPED BRIDGE - OFF SET DL Δ ONLY = 0.12' = 1.44"

USE 1 1/2" CAMBER

EXPANSION / CONTRACTION

$\Delta = 0.0000065(120°)(1/12)(12) = 1.05"$ TOTAL

USE 1" CLEAR EACH END

3" SLOTTED HOLES

JOB 16D017 10x112 BR

SHEET NO. 13 OF

CALCULATED BY LEK DATE 4/4/16

CHECKED BY DATE

MATERIAL SUMMARY

MEMBER	TYPE & SIZE	WT (PLF)	LENGTH (FT)	NO. OF PIECES	TOTAL WT.
TOP & BOT. CHORDS	HSS 8x8x1/4	25.82	112	4	11567
VERTICAL - ENDS	DO	25.82	6.0	2(2)	620
- INT.	HSS 8x4x1/4	19.02	5.2	2(16)	3165
DIAGONAL - 3 BAYS	DO	19.02	8.5	2(3)	970
- TYP.	HSS 5x3x1/4	12.21	8.5	2(13)	2698
BRACE DIAGONAL	HSS 3x3x1/4	8.81	12.2	16	1720
STRINGERS	C4x5.4	5.4	112	8	4838
FLOOR BEAM	W8x13	13.0	10	18	2340
SAFETY RAIL	L1/4x1/4x3/16	1.48	112	2(3)	2552
BEARING PL	PL 3/8x12	30.6	1.25	4	153
CONTINGENCY					277
				SUBTOTAL*	31,000
				3x DECK (10PSF)(10)(112) =	11,200
				BRIDGE WT. =	42200
				UNIF. LL (90 PSF)(10)(112) =	100,800
				T.L. =	143,000

DL./TRUSS = 42,200/2(112) = 188 PLF < 190 PLF USED IN DESIGN 99%

T.L./TRUSS = 143,000/2(112) = 638 PLF < 640 PLF USED IN DESIGN

D.L./BEARING = 42,200/4 = 10,600#

L.L./BEARING = 100,800/4 = 25,200#

VEHICLE/BEARING = $6000 + 2600\left[\frac{112-10}{112}\right] = 8400$#

JOB 16B017 10x112 Br

SHEET NO. 14 OF

CALCULATED BY LEIC DATE 4/4/16

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Top & Bot Chord Splices

$P_u = 270$

FOR 1"ϕ A325 BOLTS $R_n = 0.75(.38)(.7854)(120) = 26.9^k$/BOLT

NO. OF BOLTS REQ'D = 270/26.9 = 10.0

TRY 14 - 1"ϕ BOLTS $R_u = 270/14 = 19.3^k$

BEARING ON 1/4" MAT'L $R_n = 2.4(1.0)(.25)(65) = 39 > 19.3$ OK

HSS 8x8x1/4 GROSS $A = 7.10$ $P_r = .95(50)(7.10) = 337 > 270$

NET $A = 7.10 - (1.06)(.25)(2) = 6.57$ $P_r = .80(65)(6.57) = 342 > 270$

TRY 2 - 3/4"x5" SPLICE PL

GROSS $A = 2(.75)(5) = 7.50$ $P_r = .95(50)(7.50) = 356 > 270$

NET $A = 7.50 - 1.06(.75)(2) = 5.91$ $P_r = .80(65)(5.91) = 307 > 270$

CHECK PL FOR COMPRESSION

$r = .29t = .29(.75) = 0.22$

$\ell/r = 6/.22 = 27$ $\lambda = 0.000175(27)^2 = .13$

$P_r = (.90)(.66)^{.13}(50)(7.5) = 355 > 270$

USE 14 - 1"ϕ A325 BOLTS (28 TOTAL)

2 SPLICE PL 3/4 x 5

Shear Splice

MAX. SHEAR OCCURS WITH LL ON 1/2 OF BRIDGE

$V_u = 1.75(25.2) = 44.1$

USE 3 - 1"ϕ A325 BOLTS

JOB 160017 10x112 Bay

SHEET NO. _____ OF _____ 15

CALCULATED BY LEK DATE 3/31/16

CHECKED BY _____ DATE _____

16 PANELS

PROGRAM ENTRY

MEMBER	X	Y	A	I	CODE NO.
1	70	0	7.10	70.7	5 6 7 11 12 13
2					11 12 13 23 24 25
3					23 24 25 35 36 37
4					35 36 37 47 48 49
5					47 48 49 59 60 61
6					59 60 61 71 72 73
7					71 72 73 83 84 85
8					83 84 85 95 96 97
9					95 96 97 89 90 91
10					89 90 91 77 78 79
11					77 78 79 65 66 67
12					65 66 67 53 54 55
13					53 54 55 41 42 43
14					41 42 43 29 30 31
15					29 30 31 17 18 19 14
16	7.0	0	7.10	70.7	17 18 19 8 9 10 11
17	7.0	0	7.10	70.7	1 0 2 14 15 16 16
18					14 15 16 26 27 28
19					26 27 28 38 39 40
20					38 39 40 50 51 52
21					50 51 52 62 63 64
22					62 63 64 74 75 76
23					74 75 76 86 87 88
24					86 87 88 98 99 100
25					98 99 100 92 93 94
26					92 93 94 80 81 82
27					80 81 82 68 69 70
28					68 69 70 56 57 58
29					56 57 58 44 45 46
30					44 45 46 32 33 34
31					32 33 34 20 21 22
32	7.0	0	7.10	70.7	20 21 22 3 0 4 23

CHORD TOP

CHORD BOT

JOB 16B-017 10X112 BA

SHEET NO. _____ OF _____ 16

CALCULATED BY LEIC DATE 3/31/16

CHECKED BY _____ DATE _____

16 PANELS

PROGRAM ENTRY

	MEMBER	X	Y	A	I	CODE NO.
VERTICAL	33	0	- 5.83	5.24	14.4	5 6 7 1 0 2
	34					11 12 13 14 15 16
	35					23 — 28
	36					35 — 40
	37					47 — 52
	38					59 — 64
	39					71 — 76
	40					83 — 88
	41					95 — 100
	42					89 — 94
	43					77 — 82
	44					65 — 70
	45					53 — 58
	46					41 — 46
	47					29 — 34
	48					17 — 22
	49	0	- 5.83	5.24	14.4	8 9 10 3 0 4
DIAGONAL	50	7.0	-5.83	3.37	4.8	5 6 7 14 15 16
	51					11 12 13 26 27 28
	52					23 24 25 38 39 40
	53					35 36 37 50 51 52
	54					47 48 49 62 63 64
	55					59 60 61 74 75 76
	56					71 72 73 86 87 88
	57		- 5.83			83 84 85 98 99 100
	58		+ 5.83			98 99 100 89 90 91
	59					92 93 94 77 78 79
	60					80 81 82 65 66 67
	61					68 69 70 53 54 55
	62					56 57 58 41 42 43
	63					44 45 46 29 30 31
	64					32 33 34 17 18 19
	65	7.0	+ 5.83	3.37	4.8	20 21 22 3 9 10

TWO-DIMENSIONAL PLANE TRUSS ANALYSIS

NUMBER OF MEMBERS = 65
NUMBER OF EQUATIONS = 100
BAND WIDTH = 23
MODULAS OF ELASTICITY = 29000 KSI

MEMBER PROPERTIES AND CODE NUMBERS

MEMBER NO. *** 1 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 5 6 7 11 12 13

MEMBER NO. *** 2 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 11 12 13 23 24 25

MEMBER NO. *** 3 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 23 24 25 35 36 37

MEMBER NO. *** 4 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 35 36 37 47 48 49

MEMBER NO. *** 5 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 47 48 49 59 60 61

MEMBER NO. *** 6 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 59 60 61 71 72 73

MEMBER NO. *** 7 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 71 72 73 83 84 85

MEMBER NO. *** 8 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 83 84 85 95 96 97

MEMBER NO. *** 9 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 95 96 97 89 90 91

MEMBER NO. *** 10 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 89 90 91 77 78 79

MEMBER NO. *** 11 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 77 78 79 65 66 67

MEMBER NO. *** 12 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 65 66 67 53 54 55

MEMBER NO. *** 13 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 53 54 55 41 42 43

MEMBER NO. *** 14 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 41 42 43 29 30 31

MEMBER NO. *** 15 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 29 30 31 17 18 19

MEMBER NO. *** 16 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 17 18 19 8 9 10

MEMBER NO. *** 17 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 1 0 2 14 15 16

MEMBER NO. *** 18 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 14 15 16 26 27 28

MEMBER NO. *** 19 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 26 27 28 38 39 40

MEMBER NO. *** 20 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 38 39 40 50 51 52

MEMBER NO. *** 21 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 50 51 52 62 63 64

MEMBER NO. *** 22 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 62 63 64 74 75 76

MEMBER NO. *** 23 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 74 75 76 86 87 88

MEMBER NO. *** 24 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 86 87 88 98 99 100

MEMBER NO. *** 25 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 98 99 100 92 93 94

MEMBER NO. *** 26 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 92 93 94 80 81 82

MEMBER NO. *** 27 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 80 81 82 68 69 70

MEMBER NO. *** 28 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 68 69 70 56 57 58

MEMBER NO. *** 29 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 56 57 58 44 45 46

MEMBER NO. *** 30 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 44 45 46 32 33 34

MEMBER NO. *** 31 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 32 33 34 20 21 22

MEMBER NO. *** 32 *** X = 7.00', Y = 0.00', SPAN = 7.00'
AREA = 7.10 in^2, I = 70.70 in^4, CODE NUMBERS: 20 21 22 3 0 4

MEMBER NO. *** 33 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 5 6 7 1 0 2

MEMBER NO. *** 34 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 11 12 13 14 15 16

MEMBER NO. *** 35 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 23 24 25 26 27 28

MEMBER NO. *** 36 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 35 36 37 38 39 40

MEMBER NO. *** 37 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 47 48 49 50 51 52

MEMBER NO. *** 38 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 59 60 61 62 63 64

MEMBER NO. *** 39 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 71 72 73 74 75 76

MEMBER NO. *** 40 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 83 84 85 86 87 88

MEMBER NO. *** 41 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 95 96 97 98 99 100

MEMBER NO. *** 42 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 89 90 91 92 93 94

MEMBER NO. *** 43 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 77 78 79 80 81 82

MEMBER NO. *** 44 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 65 66 67 68 69 70

MEMBER NO. *** 45 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 53 54 55 56 57 58

MEMBER NO. *** 46 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 41 42 43 44 45 46

MEMBER NO. *** 47 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 29 30 31 32 33 34

MEMBER NO. *** 48 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 17 18 19 20 21 22

MEMBER NO. *** 49 *** X = 0.00', Y = -5.83', SPAN = 5.83'
AREA = 5.24 in^2, I = 14.40 in^4, CODE NUMBERS: 8 9 10 3 0 4

MEMBER NO. *** 50 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 5 6 7 14 15 16

MEMBER NO. *** 51 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 11 12 13 26 27 28

MEMBER NO. *** 52 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 23 24 25 38 39 40

MEMBER NO. *** 53 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 35 36 37 50 51 52

MEMBER NO. *** 54 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 47 48 49 62 63 64

MEMBER NO. *** 55 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 59 60 61 74 75 76

MEMBER NO. *** 56 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 71 72 73 86 87 88

MEMBER NO. *** 57 *** X = 7.00', Y = -5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 83 84 85 98 99 100

MEMBER NO. *** 58 *** X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 98 99 100 89 90 91

MEMBER NO. *** 59 *** X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 92 93 94 77 78 79

MEMBER NO. *** 60 *** X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4, CODE NUMBERS: 80 81 82 65 66 67

```
MEMBER NO. *** 61 ***  X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4,   CODE NUMBERS: 68 69 70 53 54 55

MEMBER NO. *** 62 ***  X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4,   CODE NUMBERS: 56 57 58 41 42 43

MEMBER NO. *** 63 ***  X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4,   CODE NUMBERS: 44 45 46 29 30 31

MEMBER NO. *** 64 ***  X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4,   CODE NUMBERS: 32 33 34 17 18 19

MEMBER NO. *** 65 ***  X = 7.00', Y = 5.83', SPAN = 9.11'
AREA = 3.37 in^2, I = 4.80 in^4,   CODE NUMBERS: 20 21 22 8 9 10
```

LOADS:	CODE NO.	FORCE (K OR K-FT)
	15	4.48
	21	4.48
	27	4.48
	33	4.48
	39	4.48
	45	4.48
	51	4.48
	57	4.48
	63	4.48
	69	4.48
	75	4.48
	81	4.48
	87	4.48
	93	4.48
	99	4.48

MEM. NO.	FEM(L) K-FT	FEM(R) K-FT

LOAD MATRIX (K OR K-FT)

1	0.00	2	0.00	3	0.00
4	0.00	5	0.00	6	0.00
7	0.00	8	0.00	9	0.00
10	0.00	11	0.00	12	0.00
13	0.00	14	0.00	15	4.48
16	0.00	17	0.00	18	0.00
19	0.00	20	0.00	21	4.48
22	0.00	23	0.00	24	0.00
25	0.00	26	0.00	27	4.48
28	0.00	29	0.00	30	0.00
31	0.00	32	0.00	33	4.48
34	0.00	35	0.00	36	0.00
37	0.00	38	0.00	39	4.48
40	0.00	41	0.00	42	0.00
43	0.00	44	0.00	45	4.48
46	0.00	47	0.00	48	0.00
49	0.00	50	0.00	51	4.48
52	0.00	53	0.00	54	0.00
55	0.00	56	0.00	57	4.48
58	0.00	59	0.00	60	0.00
61	0.00	62	0.00	63	4.48
64	0.00	65	0.00	66	0.00
67	0.00	68	0.00	69	4.48
70	0.00	71	0.00	72	0.00
73	0.00	74	0.00	75	4.48
76	0.00	77	0.00	78	0.00
79	0.00	80	0.00	81	4.48
82	0.00	83	0.00	84	0.00
85	0.00	86	0.00	87	4.48
88	0.00	89	0.00	90	0.00
91	0.00	92	0.00	93	4.48
94	0.00	95	0.00	96	0.00
97	0.00	98	0.00	99	4.48
100	0.00				

DEFLECTIONS AND ROTATIONS (FT OR RADIANS)

1	.02741	2	.01157	3	-.02859
4	-.01158	5	-.0342	6	1.25E-03
7	.01152	8	.03303	9	1.25E-03
10	-.01153	11	-.03287	12	.08348
13	.01142	14	.02738	15	.08242
16	.01145	17	.0317	18	.08348
19	-.01143	20	-.02855	21	.08242
22	-.01146	23	-.03035	24	.16148
25	.01055	26	.02601	27	.16057
28	.01058	29	.02918	30	.16148
31	-.01056	32	-.02718	33	.16057
34	-.01059	35	-.02683	36	.23222
37	9.36E-03	38	.02346	39	.23148
40	9.39E-03	41	.02566	42	.23222
43	-9.37E-03	44	-.02463	45	.23148
46	-9.4E-03	47	-.0225	48	.29333
49	7.85E-03	50	.01991	51	.29276
52	7.89E-03	53	.02132	54	.29333
55	-7.86E-03	56	-.02109	57	.29276
58	-7.9E-03	59	-.01752	60	.34286
61	6.1E-03	62	.01555	63	.34246
64	6.14E-03	65	.01635	66	.34286
67	-6.11E-03	68	-.01673	69	.34246
70	-6.15E-03	71	-.01209	72	.37929
73	4.16E-03	74	.01056	75	.37904
76	4.2E-03	77	.01092	78	.37929
79	-4.17E-03	80	-.01174	81	.37904
82	-4.21E-03	83	-6.39E-03	84	.40151
85	2.09E-03	86	5.12E-03	87	.40143
88	2.13E-03	89	5.21E-03	90	.40151
91	-2.1E-03	92	-6.3E-03	93	.40143
94	-2.14E-03	95	-5.9E-04	96	.40896
97	-1E-05	98	-5.9E-04	99	.40896
100	-1E-05				

DL $\Delta = \frac{190}{690}(.41) = 0.12$

MEMBER FORCES (K OR K-FT)

PRINTER MALFUNCTION

MEMBER NO. *** 1 ***				
BEAM: P. (L) =	0.95	-39.18	V. (L) =	0.95
M. (L) =	3.52	-3.11	M. (R) =	3.52
MEMBER NO. *** 2 ***				
BEAM: P. (L) =	0.53	-74.10	V. (L) =	
M. (L) =	3.63	-0.09	M. (R) =	
MEMBER NO. *** 3 ***				
BEAM: P. (L) =	0.50	-103.48	V. (L) =	
M. (L) =	4.18	0.65	M. (R) =	
MEMBER NO. *** 4 ***				
BEAM: P. (L) =	0.41	-127.57	V. (L) =	
M. (L) =	4.50	1.63	M. (R) =	
MEMBER NO. *** 5 ***				
BEAM: P. (L) =	0.33	-146.32	V. (L) =	
M. (L) =	4.71	2.42	M. (R) =	
MEMBER NO. *** 6 ***				
BEAM: P. (L) =	0.24	-159.74	V. (L) =	
M. (L) =	4.79	3.11	M. (R) =	

MEMBER NO. *** 7 ***
BEAM: P. (L) = 0.15 -167.82 V. (L) =
M. (L) = 4.73 3.67 M. (R) =

MEMBER NO. *** 8 ***
BEAM: P. (L) = 0.05 -170.57 V. (L) =
M. (L) = 4.45 4.09 M. (R) =

MEMBER NO. *** 9 ***
BEAM: P. (L) = -0.05 -170.57 V. (L) =
M. (L) = 4.09 4.45 M. (R) =

MEMBER NO. *** 10 ***
BEAM: P. (L) = -0.15 -167.82 V. (L) =
M. (L) = 3.67 4.73 M. (R) =

MEMBER NO. *** 11 ***
BEAM: P. (L) = -0.24 -159.74 V. (L) =
M. (L) = 3.11 4.79 M. (R) =

MEMBER NO. *** 12 ***
BEAM: P. (L) = -0.33 -146.32 V. (L) =
M. (L) = 2.42 4.71 M. (R) =

MEMBER NO. *** 13 ***
BEAM: P. (L) = -0.41 -127.57 V. (L) =
M. (L) = 1.63 4.50 M. (R) =

MEMBER NO. *** 14 ***
BEAM: P. (L) = -0.50 -103.48 V. (L) =
M. (L) = 0.65 4.18 M. (R) =

MEMBER NO. *** 15 ***
BEAM: P. (L) = -0.53 -74.10 V. (L) =
M. (L) = -0.09 3.63 M. (R) =

MEMBER NO. *** 16 ***
BEAM: P. (L) = -0.95 -39.18 V. (L) =
M. (L) = -3.11 3.52 M. (R) =

MEMBER NO. *** 17 ***
BEAM: P. (L) = 0.92 1.00 V. (L) =
M. (L) = 3.46 -2.95 M. (R) =

MEMBER NO. *** 18 ***
BEAM: P. (L) = 0.52 40.31 V. (L) =
M. (L) = 3.57 -0.04 M. (R) =

MEMBER NO. *** 19 ***
BEAM: P. (L) = 0.48 75.02 V. (L) =
M. (L) = 4.09 0.72 M. (R) =

MEMBER NO. *** 20 ***
BEAM: P. (L) = 0.38 104.26 V. (L) =
M. (L) = 4.38 1.75 M. (R) =

MEMBER NO. *** 21 ***
BEAM: P. (L) = 0.29 128.19 V. (L) =
M. (L) = 4.56 2.57 M. (R) =

MEMBER NO. *** 22 ***
BEAM: P. (L) = 0.19 146.78 V. (L) =
M. (L) = 4.63 3.27 M. (R) =

MEMBER NO. *** 23 ***				
BEAM:	P. (L) =	0.10	160.04	V. (L) =
	M. (L) =	4.55	3.84	M. (R) =
MEMBER NO. *** 24 ***				
BEAM:	P. (L) =	0.02	167.97	V. (L) =
	M. (L) =	4.44	4.26	M. (R) =
MEMBER NO. *** 25 ***				
BEAM:	P. (L) =	-0.02	167.97	V. (L) =
	M. (L) =	4.26	4.44	M. (R) =
MEMBER NO. *** 26 ***				
BEAM:	P. (L) =	-0.10	160.04	V. (L) =
	M. (L) =	3.84	4.55	M. (R) =
MEMBER NO. *** 27 ***				
BEAM:	P. (L) =	-0.19	146.78	V. (L) =
	M. (L) =	3.27	4.63	M. (R) =
MEMBER NO. *** 28 ***				
BEAM:	P. (L) =	-0.29	128.19	V. (L) =
	M. (L) =	2.57	4.56	M. (R) =
MEMBER NO. *** 29 ***				
BEAM:	P. (L) =	-0.38	104.26	V. (L) =
	M. (L) =	1.75	4.38	M. (R) =
MEMBER NO. *** 30 ***				
BEAM:	P. (L) =	-0.48	75.02	V. (L) =
	M. (L) =	0.72	4.09	M. (R) =
MEMBER NO. *** 31 ***				
BEAM:	P. (L) =	-0.52	40.31	V. (L) =
	M. (L) =	-0.04	3.57	M. (R) =
MEMBER NO. *** 32 ***				
BEAM:	P. (L) =	-0.92	1.00	V. (L) =
	M. (L) =	-2.95	3.46	M. (R) =
MEMBER NO. *** 33 ***				
BEAM:	P. (L) =	-1.00	-32.68	V. (L) =
	M. (L) =	-2.95	2.90	M. (R) =
MEMBER NO. *** 34 ***				
BEAM:	P. (L) =	-1.13	-27.66	V. (L) =
	M. (L) =	-3.31	3.28	M. (R) =
MEMBER NO. *** 35 ***				
BEAM:	P. (L) =	-0.92	-23.63	V. (L) =
	M. (L) =	-2.70	2.68	M. (R) =
MEMBER NO. *** 36 ***				
BEAM:	P. (L) =	-0.78	-19.28	V. (L) =
	M. (L) =	-2.28	2.24	M. (R) =
MEMBER NO. *** 37 ***				
BEAM:	P. (L) =	-0.62	-14.98	V. (L) =
	M. (L) =	-1.82	1.78	M. (R) =
MEMBER NO. *** 38 ***				
BEAM:	P. (L) =	-0.46	-10.68	V. (L) =
	M. (L) =	-1.36	1.32	M. (R) =

MEMBER NO. *** 39 ***				
BEAM:	P. (L) =	-0.30	-6.38	V. (L) =
	M. (L) =	-0.90	0.86	M. (R) =
MEMBER NO. *** 40 ***				
BEAM:	P. (L) =	-0.15	-2.06	V. (L) =
	M. (L) =	-0.45	0.41	M. (R) =
MEMBER NO. *** 41 ***				
BEAM:	P. (L) =	0.00	0.10	V. (L) =
	M. (L) =	0.00	0.00	M. (R) =
MEMBER NO. *** 42 ***				
BEAM:	P. (L) =	0.15	-2.06	V. (L) =
	M. (L) =	0.45	-0.41	M. (R) =
MEMBER NO. *** 43 ***				
BEAM:	P. (L) =	0.30	-6.38	V. (L) =
	M. (L) =	0.90	-0.86	M. (R) =
MEMBER NO. *** 44 ***				
BEAM:	P. (L) =	0.46	-10.68	V. (L) =
	M. (L) =	1.36	-1.32	M. (R) =
MEMBER NO. *** 45 ***				
BEAM:	P. (L) =	0.62	-14.98	V. (L) =
	M. (L) =	1.82	-1.78	M. (R) =
MEMBER NO. *** 46 ***				
BEAM:	P. (L) =	0.78	-19.28	V. (L) =
	M. (L) =	2.28	-2.24	M. (R) =
MEMBER NO. *** 47 ***				
BEAM:	P. (L) =	0.92	-23.63	V. (L) =
	M. (L) =	2.70	-2.68	M. (R) =
MEMBER NO. *** 48 ***				
BEAM:	P. (L) =	1.13	-27.66	V. (L) =
	M. (L) =	3.31	-3.28	M. (R) =
MEMBER NO. *** 49 ***				
BEAM:	P. (L) =	1.00	-32.68	V. (L) =
	M. (L) =	2.95	-2.90	M. (R) =
MEMBER NO. *** 50 ***				
BEAM:	P. (L) =	-0.04	49.64	V. (L) =
	M. (L) =	-0.19	0.21	M. (R) =
MEMBER NO. *** 51 ***				
BEAM:	P. (L) =	-0.05	43.93	V. (L) =
	M. (L) =	-0.14	0.32	M. (R) =
MEMBER NO. *** 52 ***				
BEAM:	P. (L) =	-0.04	37.01	V. (L) =
	M. (L) =	-0.06	0.31	M. (R) =
MEMBER NO. *** 53 ***				
BEAM:	P. (L) =	-0.03	30.31	V. (L) =
	M. (L) =	0.00	0.31	M. (R) =
MEMBER NO. *** 54 ***				
BEAM:	P. (L) =	-0.03	23.58	V. (L) =
	M. (L) =	0.07	0.30	M. (R) =

MEMBER NO. *** 55 ***
BEAM: P. (L) = -0.02 16.84 V. (L) =
M. (L) = 0.12 0.28 M. (R) =

MEMBER NO. *** 56 ***
BEAM: P. (L) = -0.01 10.12 V. (L) =
M. (L) = 0.17 0.26 M. (R) =

MEMBER NO. *** 57 ***
BEAM: P. (L) = 0.00 3.38 V. (L) =
M. (L) = 0.21 0.23 M. (R) =

MEMBER NO. *** 58 ***
BEAM: P. (L) = 0.00 3.38 V. (L) =
M. (L) = 0.23 0.21 M. (R) =

MEMBER NO. *** 59 ***
BEAM: P. (L) = 0.01 10.12 V. (L) =
M. (L) = 0.26 0.17 M. (R) =

MEMBER NO. *** 60 ***
BEAM: P. (L) = 0.02 16.84 V. (L) =
M. (L) = 0.28 0.12 M. (R) =

MEMBER NO. *** 61 ***
BEAM: P. (L) = 0.03 23.58 V. (L) =
M. (L) = 0.30 0.07 M. (R) =

MEMBER NO. *** 62 ***
BEAM: P. (L) = 0.03 30.31 V. (L) =
M. (L) = 0.31 0.00 M. (R) =

MEMBER NO. *** 63 ***
BEAM: P. (L) = 0.04 37.01 V. (L) =
M. (L) = 0.31 -0.06 M. (R) =

MEMBER NO. *** 64 ***
BEAM: P. (L) = 0.05 43.93 V. (L) =
M. (L) = 0.32 -0.14 M. (R) =

MEMBER NO. *** 65 ***
BEAM: P. (L) = 0.04 49.64 V. (L) =
M. (L) = 0.21 -0.19 M. (R) =

STATICS CHECK

1 - 0.00, 2 - 0.00, 3 - 0.00, 4 - 0.00, 5 - 0.00,
6 - 0.00, 7 - 0.00, 8 - 0.00, 9 - 0.00, 10 - 0.00,
11 - 0.00, 12 - 0.00, 13 - 0.00, 14 - 0.00, 15 - 0.00,
16 - 0.00, 17 - 0.00, 18 - 0.00, 19 - 0.00, 20 - 0.00,
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71 - 0.00, 72 - 0.00, 73 - 0.00, 74 - 0.00, 75 - 0.00,
76 - 0.00, 77 - 0.00, 78 - 0.00, 79 - 0.00, 80 - 0.00,
81 - 0.00, 82 - 0.00, 83 - 0.00, 84 - 0.00, 85 - 0.00,
86 - 0.00, 87 - 0.00, 88 - 0.00, 89 - 0.00, 90 - 0.00,
91 - 0.00, 92 - 0.00, 93 - 0.00, 94 - 0.00, 95 - 0.00,
96 - 0.00, 97 - 0.00, 98 - 0.00, 99 - 0.00, 100 - 0.00,