MILLER CONSTRUCTION, INC.

P.O. BOX 86 ASCUTNEY BLVD WINDSOR, VERMONT 05089-0086
TELEPHONE (802) 674-5525 / FAX (802) 674-5245

TRANSMITTAL

TO: Kristin M. Higgins, PE Project Manager Vermont Agency of Transportation	DATE	PROJECT NO.
	5/7/2014	Barnard ER BRF 0241 (39)

XX WE ENCLOSE THE FOLLOWING: _____ UNDER SEPARATE COVER WE ARE SENDING THE FOLLOWING

COPIES	NUMBER	DESCRIPTION	CODE
1		Precast Unit Erection Plan Submittal - Rev 1	H

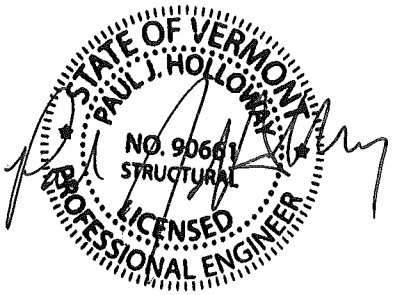
CODE:

A FOR INITIAL APPROVAL
B FOR FINAL APPROVAL
C APPROVED AS NOTED-RESUBMISSION REQUIRED
D APPROVED AS NOTED-RESUBMISSION NOT REQUIRED
E DISAPPROVED-RESUBMIT
F QUOTATION REQUESTED
G APPROVED
H FOR APPROVAL
I AS REQUESTED OR REQUIRED
J FOR USE IN ERECTION
K LETTER FOLLOWS
L FOR FIELD CHECK
M FOR YOUR USE

BY: Paul J. Miller

ERECTION PLAN
PRECAST ABUTMENTS & NEXT BEAMS
for
State of Vermont Project: Barnard ER BRF 0241 (39)

Town of: Barnard, Vermont
County of: Windsor



5/7/14

Prepared By:

Miller Construction, Inc.
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April 17, 2014
Revised May 7, 2014

ERECTION PLAN
FOR
State of Vermont Project: Barnard ER BRF 0241 (39)

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General Project Description and Timetable

The Barnard ER BRF 0241 (39) Project involves the replacement of Bridge 25 which is located in the Town of Barnard on Vermont Route 12 beginning at Mile Post 7.0195 and ending at Mile Post 7.0535.

The new structure comprises of a precast concrete integral abutment substructure and a precast concrete NEXT beam superstructure.

Erection of all precast units is anticipated to occur in Early-Mid July 2014.

Abstract

Abutments

Miller Construction, Inc. shall install the precast abutments and wingwall units being picked from locations as shown on J.P. Carrara & Sons, Inc. approved shop drawings. The crane used shall be a Grove GMK 5120B.

NEXT Beams

Miller Construction, Inc. shall install the precast NEXT beam units being picked from locations as shown on J.P. Carrara & Sons, Inc. approved shop drawings. The cranes used shall be a Grove GMK 5120B and a Link-Belt HTC 86100. Three of the NEXT beams shall be slid across a bent spanning Locust Creek and then shifted into each respective location. The final NEXT beam shall be slid across the bent spanning Locust Creek and then be temporarily staged on the adjacent two NEXT beams prior to being shifted into its respective location (see Attachment 6 for Plan View).

Rigging

Rigging used shall include Endless Round Slings with rated vertical lifting capacities from 40,000 lbs. to 66,000 lbs. (see Attachment 8). 20 Ton Crosby Screw Pin Shackles shall be utilized at precast connection points.

Slider Beam

The slider beam has been designed and fabricated by Miller Construction, Inc. and comprises of two 36 inch girders with lateral support by timber and threaded rod.

All calculations on the slider beam have been checked and verified by Calderwood Engineering.

A buggy on rollers with guide wheels shall transport each NEXT beam within the required crane radius.

The buggy that will support the NEXT Beam as it slides across the slider beam is a fabricated frame made from HP 12 X 74 sections of steel. The NEXT Beam shall bear on a hardwood plank between the NEXT Beam and the buggy, and the assembly will roll on 6 EA 15 Ton, Multi-Ton Skates (see Attachment 7).

Ground Pressures

During NEXT beam erection, the outriggers of the crane at Abutment 2 shall be located a minimum of 9 feet from the back of the abutment in order to minimize surcharge loading on the abutment. The outriggers of the crane at Abutment 1 shall be located on concrete block independent from the abutment in order to minimize surcharge loading on the abutment (see Attachment 4). After erection of NEXT beams, Abutment 1 shall be backfilled.

Concrete block may also be required behind Abutment 2 in order to achieve proper elevation and alignment with the slider beam.

MILLER CONSTRUCTION, INC.

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Crane lift worksheet Crane # 5 (GMK 5120B)

CUSTOMER Miller Construction, Inc.

JOB Barnard BRF 0241 (39) - Heaviest NEXT Beam * 1/2

Amount of equipment weight	73,380 #
Weight of Ball	
Weight of Block	1,800 #
Weight of Spreader	
Weight of Rigging	500 #
Weight of Jib Erected	
Weight of Jib Stowed	1,320 #
Weight of Aux Head	100 #
Weight of Misc	
TOTAL WEIGHT	77,100 #

CHART 82,000 # @ 35 FT.

WORK SITE RADIUS 30 FT. +/-

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Crane lift worksheet Crane # 5 (GMK 5120B)

CUSTOMER Miller Construction, Inc.

JOB Barnard BRF 0241 (39) - Heaviest Abut. Section

Amount of equipment weight	72,880 #
Weight of Ball	
Weight of Block	1,800 #
Weight of Spreader	
Weight of Rigging	500 #
Weight of Jib Erected	
Weight of Jib Stowed	1,320 #
Weight of Aux Head	100 #
Weight of Misc	
TOTAL WEIGHT	76,600 #

CHART 82,000 # @ 35 FT.

WORK SITE RADIUS 30 FT. +/-

MILLER CONSTRUCTION, INC.

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Crane lift worksheet Crane # 10 (HTC 86100)

CUSTOMER Miller Construction, Inc.

JOB Barnard BRF 0241 (39) - Heaviest NEXT Beam * 1/2

Amount of equipment weight	73,380 #
Weight of Ball	360 #
Weight of Block	1,100 #
Weight of Spreader	
Weight of Rigging	500 #
Weight of Jib Erected	
Weight of Jib Stowed	
Weight of Aux Head	100 #
Weight of Misc	
TOTAL WEIGHT	75,440 #

CHART 93,500 # @ 20 FT.

WORK SITE RADIUS 22 FT. +/-

Miller Construction, Inc.
3103 US Route 5 South
P.O. Box 86
Windsor, Vermont 05089
802-674-5525 Fax: 802-674-5245

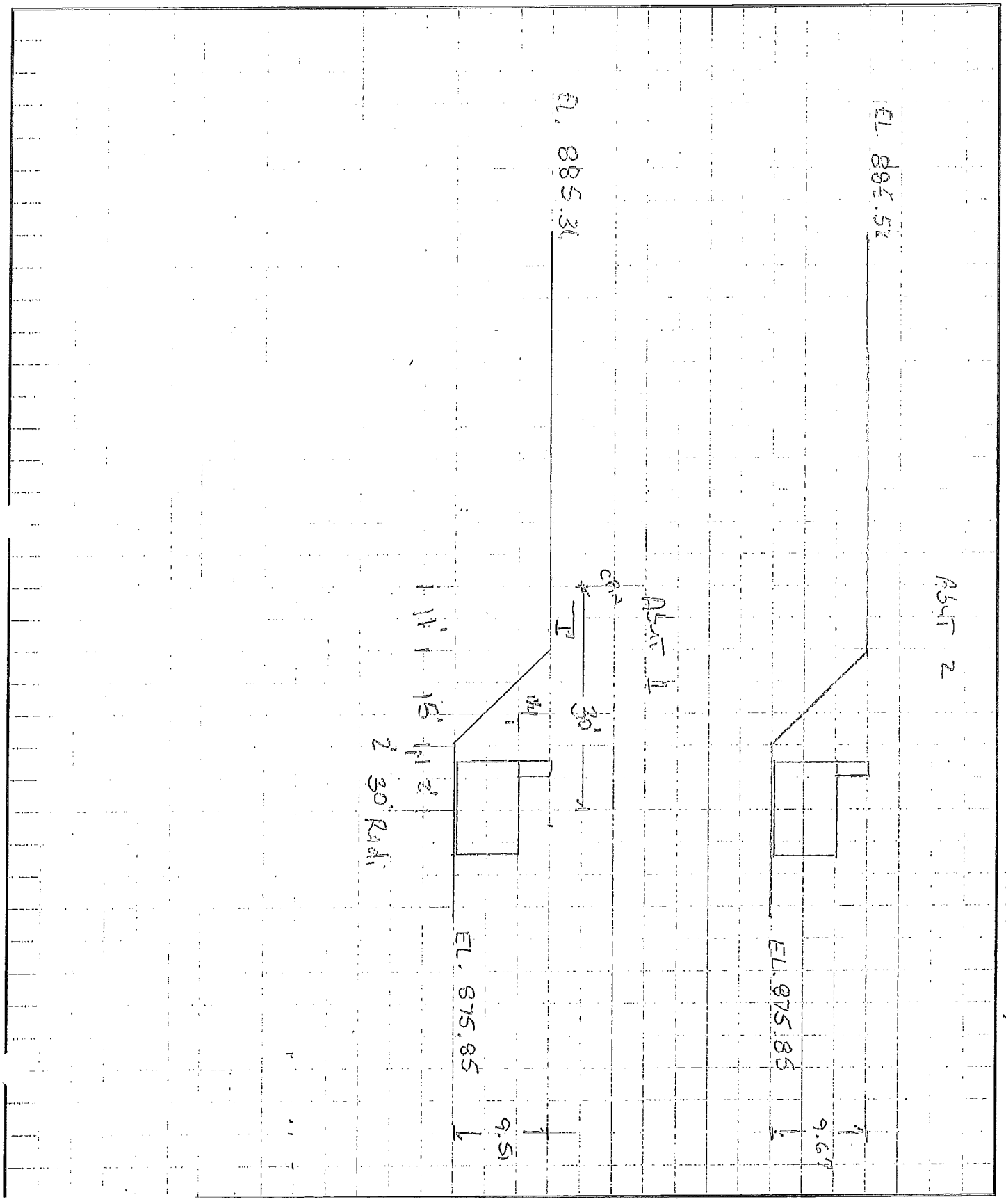
JOB _____

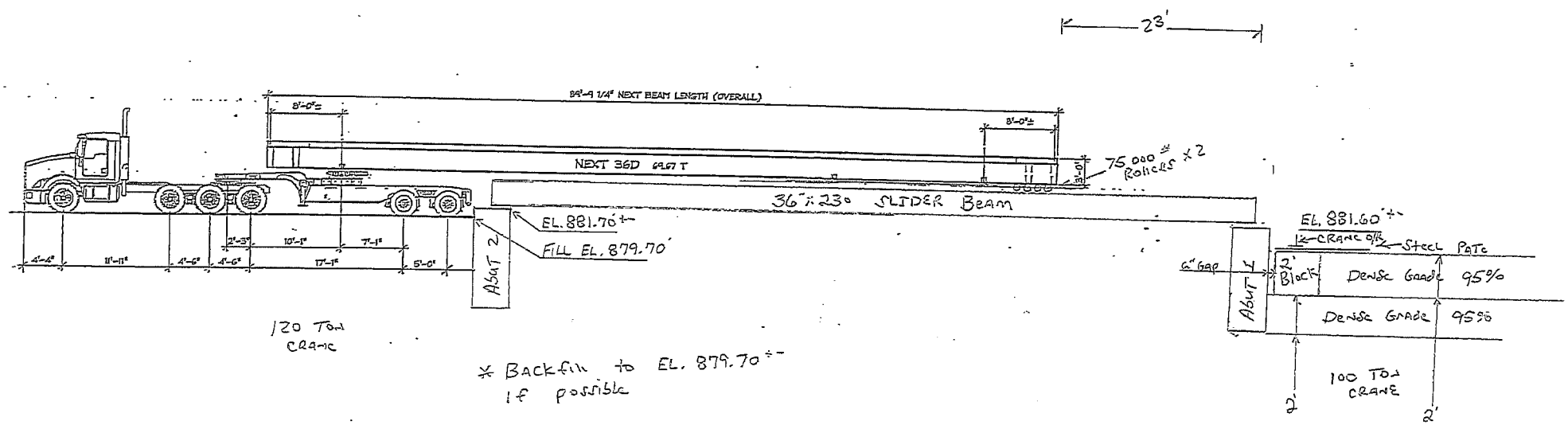
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

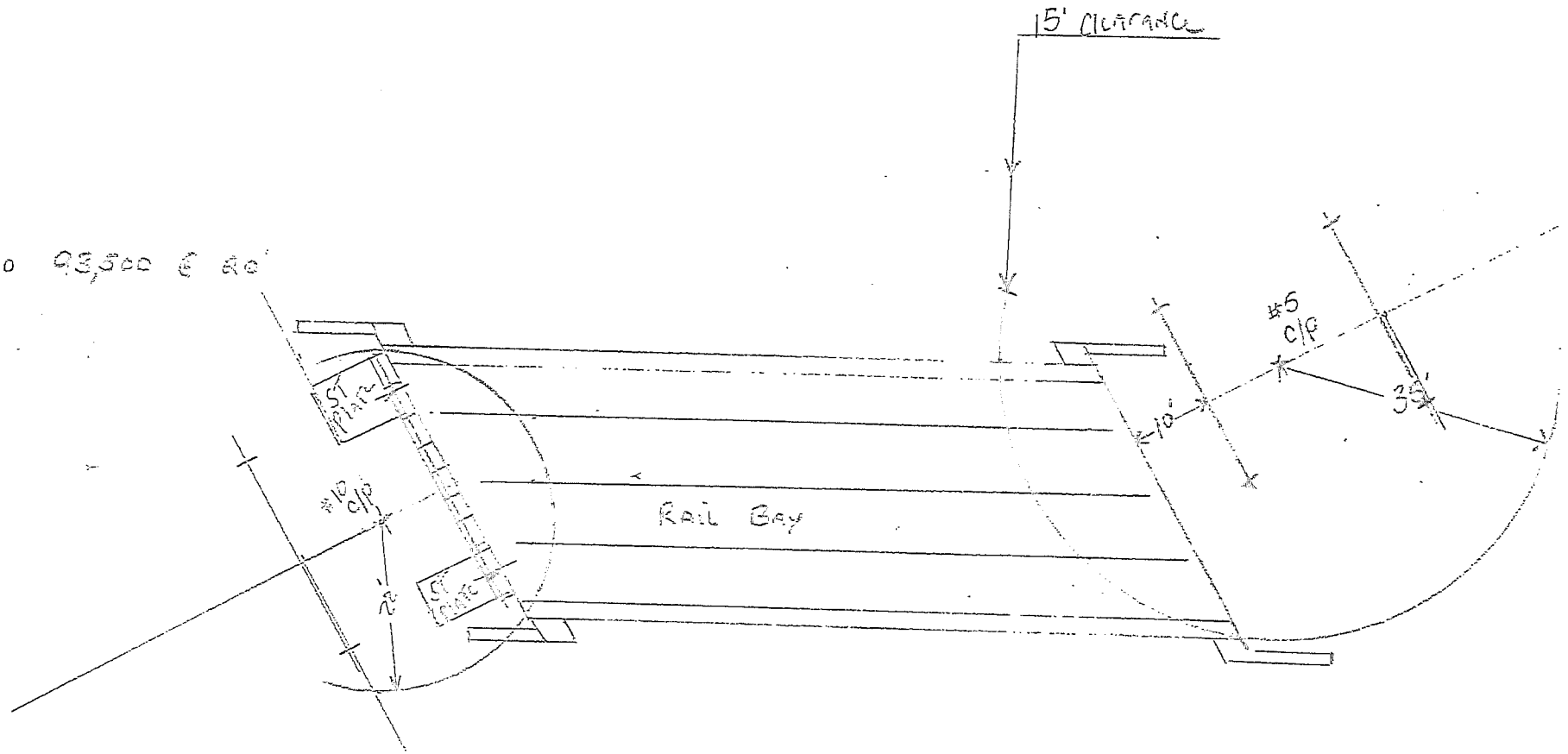
SCALE _____





23'
89'-9 1/4" NEXT BEAM LENGTH (OVERALL)
8'-0"±
8'-0"±
NEXT 36D 69.67 T
3'-0"
75,000# Rollers x 2
36" x 230 SLIDER BEAM
EL. 881.70'±
FILL EL. 879.70'
Abut 2
4'-4"
11'-11"
4'-6"
4'-6"
2'-3"
10'-1"
7'-1"
17'-1"
5'-0"
120 Ton Crane
* Backfill to EL. 879.70'± if possible
EL. 881.60'±
CRANE O/R
Steel Pate
6" Gap
Abut 1
2' Block
Dense Grade 95%
Dense Grade 95%
100 Ton Crane
2'
2'

9/10 93,500 @ 60°



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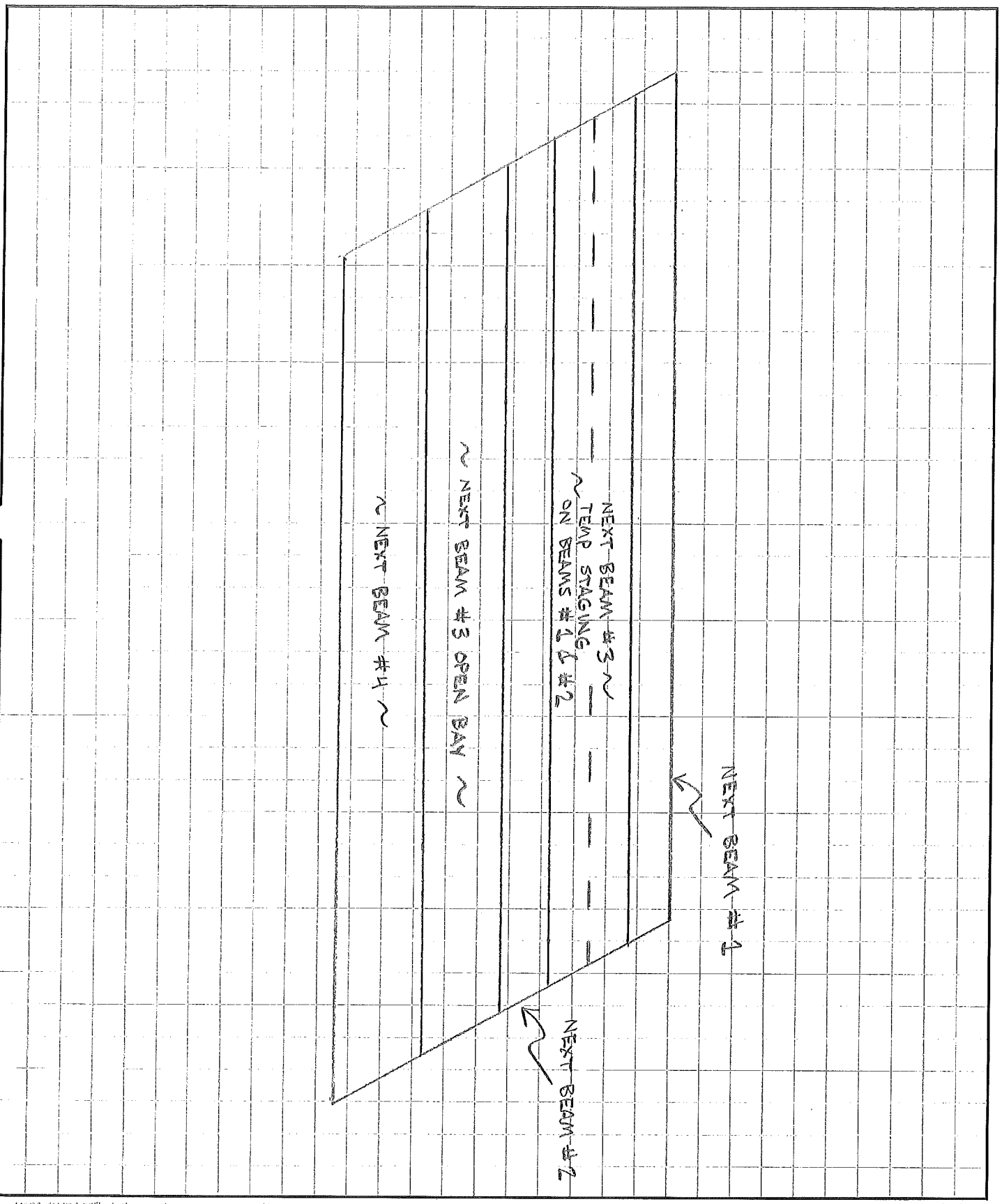
JOB BARNARD ER BRF 0241 (39)

SHEET NO. _____ OF _____

CALCULATED BY PJH DATE 4/19/14

CHECKED BY _____ DATE _____

SCALE N.T.S.



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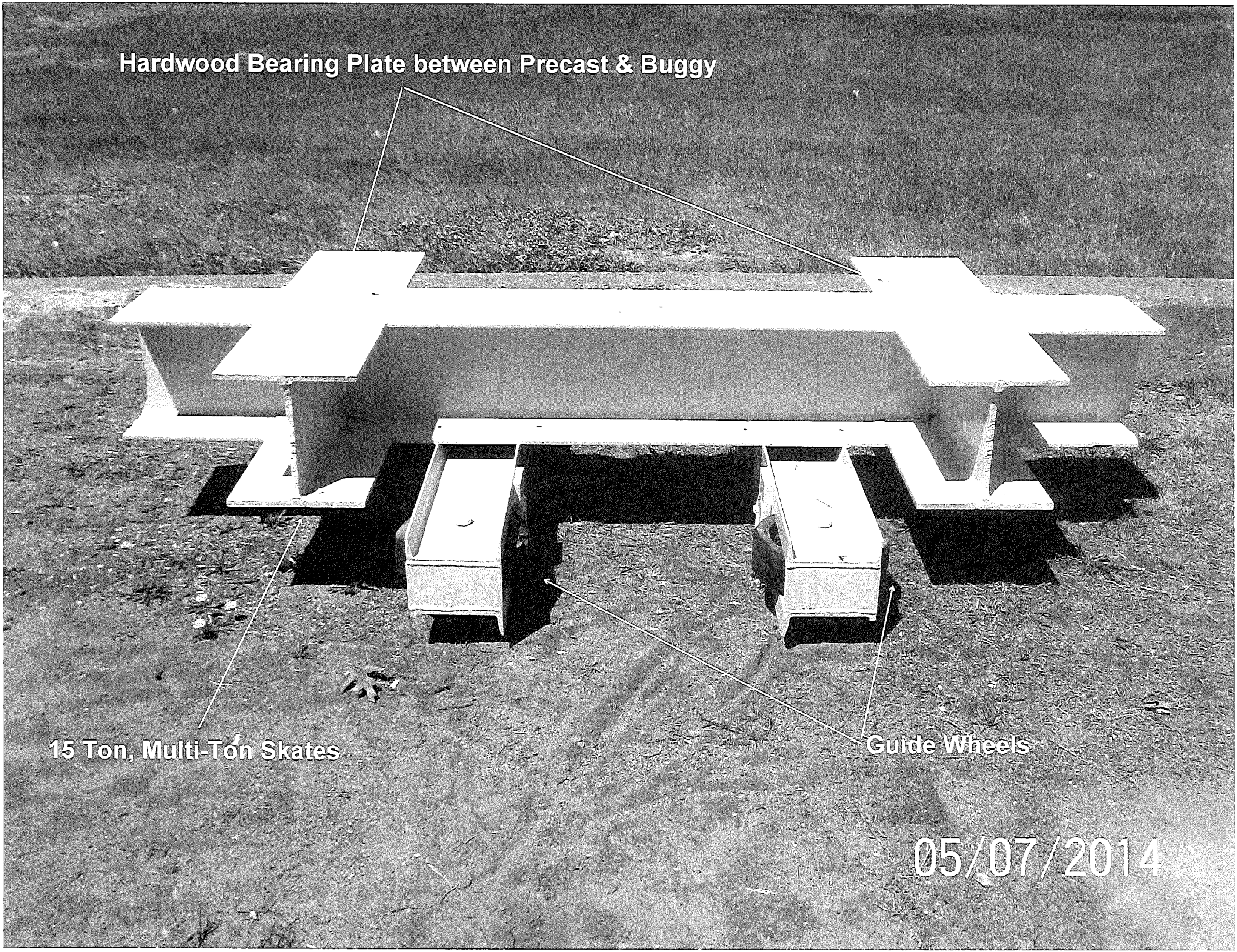
Hardwood Bearing Plate between Precast & Buggy
15 Ton, Multi-Ton Skates
Guide Wheels
05/07/2014

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the world's best slings

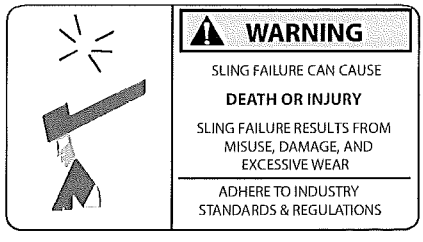
www.liftex.com
(800) 299-0900

ENDLESS ROUNDSLING CAPACITY CHART

	Part Number	Vertical	Choker	Basket	Minimum Length	Approx. Diameter	Approx. WT / FT
PURPLE	ENR1	2600	2100	5200	3′	.625″	0.3 LB
GREEN	ENR2	5300	4200	10600	3′	.875″	0.4 LB
	ENR3	8400	6700	16800	3′	1.125″	0.5 LB
	ENR4	10600	8500	21200	3′	1.125″	0.6 LB
RED	ENR5	13200	10600	26400	3′	1.375″	0.8 LB
WHITE	ENR6	16800	13400	33600	6′	1.375″	0.9 LB
BLUE	ENR7	21200	17000	42400	6′	1.625″	1.3 LB
ORANGE	ENR8	25000	20000	50000	6′	1.750″	1.6 LB
ORANGE	ENR9	31000	24800	62000	6′	2.125″	2.0 LB
** ORANGE	ENR10	40000	32000	80000	6′	2.350″	2.6 LB
ORANGE	ENR11	53000	42400	106000	8′	3.150″	3.4 LB
** ORANGE	ENR12	66000	52800	132000	8′	3.950″	4.3 LB
ORANGE	ENR13	90000	72000	180000	8′	4.800″	5.9 LB

**Before ordering slings that are going to be used in a chemically active environment, contact Liftex ® Customer Service, to recommend the right sling for the right usage.*

***Chemically Active Environments can affect the** strength of webbing slings in varying degrees, ranging from little to total degradation.*



Beam Erection – Supporting Comps

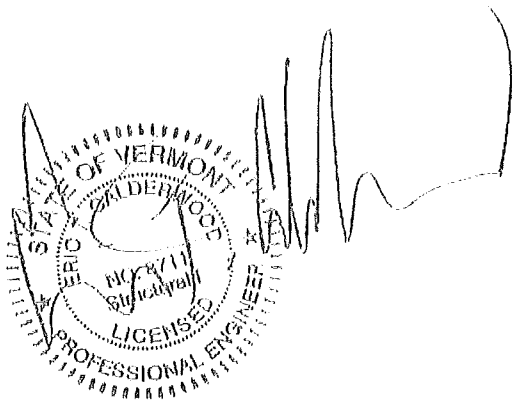
For

Vermont Rte 12 over Locust Creek

In

Barnard, Vermont

CEE 034-br-14
VTrans ER BRF 0241 (39)



Prepared for:

Miller Construction, Inc

By:
Calderwood Engineering etc
April 16th, 2014

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JOB BARNARD ER BRF 0291 (39)
SHEET NO. 1 OF 9
CALCULATED BY PJH DATE 2/14
CHECKED BY ETC DATE 4/14
SCALE

MAX. LOAD EXTERION NEXT BEAM

= 73.38 TONS = 146.760 KIPS

℄ BRG TO ℄ BRG = 85 Ft

EXISTING STEEL GRADE ASSUME GRADE 33 KSI

SAY DOLLY WEIGHT = 500 lbs +/-

EXISTING STEEL = W36 x 231

USE AISC 13TH EDITION ASD DESIGN

$\Omega_{BENDING}$ = 1.67 (ASD)

Ω_{SHEAR} = 1.50 (ASD)

ϕ_b = 0.9 (LRFD)

ϕ_v = 1.0 (LRFD)

PROVIDE BRACING @ 10 Ft CENTERS

l_b = 120 INCHES

W36x230 BEAM IS COMPACT BY DEFINITION

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JOB BARNARD
SHEET NO. 2 OF 9
CALCULATED BY PJH DATE 2/14
CHECKED BY ETC DATE 4/14
SCALE

$L_p = 1.76\, r_y \sqrt{E/F_y}$ (F2-5 AISC 13TH)

$L_p = 1.76\,(3.71)\sqrt{29000/33} = 193.57$ IN

$L_b = 120$ IN $\leq L_p$ ∴ LATERAL TORSIONAL BUCKLING IS NOT AN ISSUE

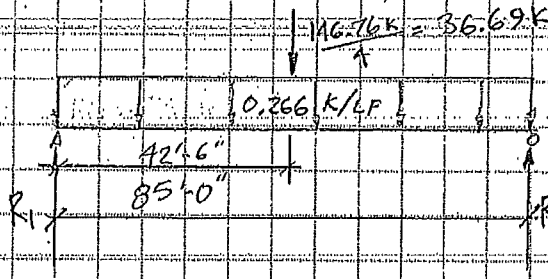
& $M_n = M_p = F_y Z_x$

$M_n = 33$ KSI $* 963$ IN$^3 = 31,779$ K-IN

$M_A = \frac{M_n}{\Omega} = \frac{(31,779\ \text{K-IN})}{1.67} = 19,029.3$ K-IN

$= 1585.8$ K-FT

1/4 NEXT BM CARRIED BY EACH BEAM (1/2 CARRIED BY TRUCK HALF BY SLIDING BEAM ASSEMBLY)



$\omega = 0.231$ K/FT $* 1.15 = 0.266$ K/LF

$R_1 = R_2 = \frac{36.69\text{K} + 0.266 * 85'}{2}$

$= 29.65$ KIPS

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JOB BARNARD
SHEET NO. 3 OF 9
CALCULATED BY PJH DATE 2/14
CHECKED BY ETC DATE 4/14
SCALE

$$M_u = \frac{29.65\text{K} + 29.65\text{K} - 42.5 * 0.266\text{ KLF}}{2} * 42.5\text{ ft} = 1019.9\text{ k-ft}$$

$M_{u\,(SVC\ LOAD)} = 1019.9$ K-FT

$M_{n\,(ASD)} = 1585.8$ K-FT

$M_R >> M_u$ ∴ O.K.

$V_u = 36.69\text{K} + 0.266 * 85.54/2 = 47.995$ KIPS
(WITH SLIDING SLED @ ℄ BRG EITHER END)

$V_n = 0.6\, F_y\, A_w\, C_v$ (G2-1)

$h/t_w = 36.5\text{in} / 0.76\text{in} = 48.03$

$2.24\sqrt{E/F_y} = 2.24 * \sqrt{29000/33} = 66.4$

$66.4 > 48.03$ ∴ $C_v = 1.0$

$V_n = 0.60\,(33\text{ k-s.i.}) * (36.5\text{ in}) * (0.76\text{ in}) * 1.0 = 549.25$ KIPS

$V_{u\,(SVC)} << V_A = \frac{549.25\text{ K}}{1.5} = 366.2$ KIPS ∴ O.K.

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JOB BARNARD
SHEET NO. 4 OF 9
CALCULATED BY PJH DATE 2/14
CHECKED BY ETC DATE 4/14
SCALE

✓ WEB LOCAL YIELDING (J10-3) J-2

STAY N = K

$R_N = (2.5K + N)(F_{yw})(t_w)$

K = 2.21 in ∴ $R_N = (2.5(2.21\text{in}) + 2.21\text{in})(33\text{ksi})(0.76\text{in})$

R_N = 193.99 kips $\Omega = 1.5$

∴ $R_A = 193.99\text{K} / 1.5 = 129.33$ kips

R_u = 48 kips << R_A ∴ LOCAL WEB YIELDING OK

✓ WEB CRIPPLING (J10-4) J-3

USE N = K = 2.21 in

$$R_N \text{ (@ END OF MEMBER)} = 0.4 t_w^2 \left[1 + 3\left(\frac{N}{d}\right)\left(\frac{t_w}{t_f}\right)^{1.5}\right]\sqrt{\frac{E F_{yw} t_f}{t_w}}$$

$$R_N = 0.4(0.76\text{in})^2\left[1 + 3*\left[\frac{2.21\text{in}}{36.5\text{in}} * \left(\frac{0.760\text{in}}{1.26\text{in}}\right)^{1.5}\right]\right]\sqrt{\frac{29000 * 33\text{ksi} * 1.26\text{in}}{0.76\text{in}}}$$

R_N = 293.496 kips $R_A = R_N/\Omega$ $\Omega = 2.00$

R_A = 293.5K / 2.0 = 146.7 kips >> R_u ∴ OK

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JOB BARNARD
SHEET NO. 5 OF 9
CALCULATED BY PJH DATE 2/14
CHECKED BY ETC DATE 4/14
SCALE

✓ SIDESWAY WEB BUCKLING J-4

$h/t_w = (36.5\,in - 2.21\,in * 2) / 0.76\,in = 32.08$

$l/b_{fc} = 120\,in / 16.5\,in = 7.27$

$(h/t_w)/(l/b_{fc}) = 32.08/7.27 = 4.41$

COMPRESSION FLANGE IS NOT RESTRAINED AGAINST ROTATION

$(h/t_w)/(l/b_{fc}) = 4.41 \geq 1.7$ ∴ SIDESWAY WEB BUCKLING IS NOT A CONCERN

✓ BRACING FORCE REQ'D

RULE OF THUMB: 2% FORCE IN COMPRESSION FLANGE

APPENDIX D (C-A-6-46)

$P_{br} = 0.01 * M_u (C_t) C_d / h_o = 0.01 * (1019.9\,k\text{-}ft * 12\,in/ft)(2.0)(2.0)/36.5\,in$

$C_t = 2.0 \quad C_d = 2.0$

$P_{br} = 13.91$ KIPS

AVE STRESS IN COMP. FLANGE $= \left[\frac{1019.9\,(12\,in/ft)}{85\,in^3} + \frac{1019.9\,(12)*16.99\,in}{15600\,in^4}\right] * 1/2$

$= 13.83\,ksi$ $\quad 2\%\,P_u = 0.02 * 13.83\,ksi * 1.26\,in * 16.5\,in = 5.75\,k$

USE 13.91 KIPS BRACING FORCE REQ'D

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JOB BARNARD
SHEET NO. 6 OF 9
CALCULATED BY RJH DATE 2/14
CHECKED BY ETC DATE 4/14
SCALE

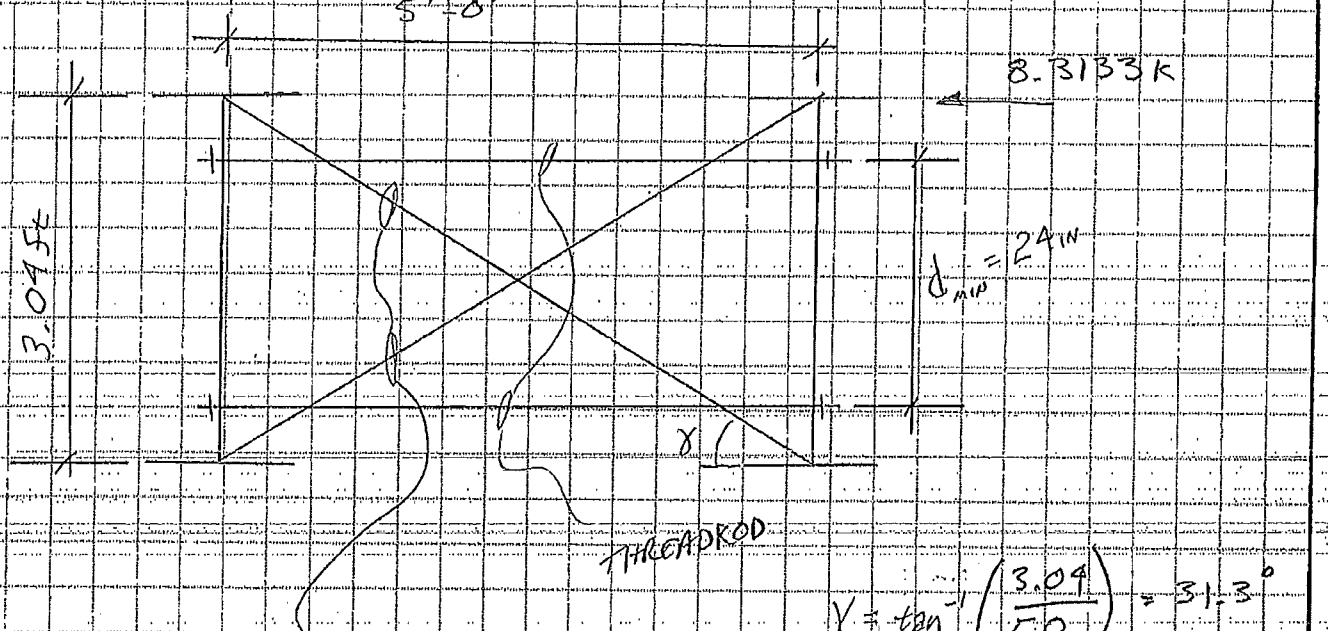
L_B REQ'D = 193.57 IN
L_B PROV = 120 IN

} BRACING FORCE MAY BE REDUCED TO ACCOUNT FOR CLOSER SPACING PROVIDED.

∴ BRACING FORCE REQ'D @ 120 IN

= 13.41 KIPS * 120 IN / 193.57 IN = 8.3133 K / X-FRAME

SPACING OF GIRDERS = SPACING OF STEMS OF NEXT BM = 5'-0"



$\gamma = \tan^{-1}\left(\frac{3.04}{5.0}\right) = 31.3^\circ$

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JOB BARNARD
SHEET NO. 7 OF 9
CALCULATED BY PJH DATE 2/14
CHECKED BY EJC DATE 4/19
SCALE

P_u IN BRACING = 8,313.3 lbs * 1 / cos 31.3° = 9,730 lbs

$F_{c\perp} = 9730 \text{ lbs} / (4 \text{ in} * 6 \text{ in}) = 405.4 \text{ psi}$

$l_e = \sqrt{(3.04)^2 + (5)^2} = 5.852 \text{ ft} = 70.22 \text{ in}$

$F_{c\perp} = 1000 \text{ psi}$ (NDS - ASD 2005)

$C_F = 1.1$ $C_D = 1.0$ (FOR CONSERVATISM)

$C_M = 0.80$

$F'_c = 1000 \text{ psi} * 1.1 * 0.80 * 1.0 = 880 \text{ psi}$

$l_e/d = 70.22 \text{ in} / 4 \text{ in} = 17.56$

$F_{cE} = \frac{0.822 \, E_{min}}{(l_e/d)^2} = \frac{0.822 * 400{,}000 \text{ psi}}{(17.56)^2} = 1066 \text{ psi}$

$c = 0.80$ FOR SAWN LUMBER

$\frac{1 + F_{cE}/F_c^*}{2c} = 1.3821$ $\quad \sqrt{\left(\frac{1 + F_{cE}/F_c^*}{2c}\right)^2 - \frac{F_{cE}/F_c^*}{c}} = 1.5142$

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JOB BARNARD
SHEET NO. 8 OF 9
CALCULATED BY PJH DATE 2/14
CHECKED BY EJC DATE 4/14
SCALE

$$C_P = \frac{1+F_{cE}/F_c^*}{2c} - \sqrt{\left(\frac{1+F_{cE}/F_c^*}{2c}\right)^2 - \frac{F_{cE}/F_c^*}{c}} \qquad (3.7-1)$$

$$C_P = 1.3821 - \sqrt{(1.3821)^2 - 1.5142} = 0.7528$$

$$F'_{c\perp} = C_P F_c^* = 0.7528 * 680 psi = 662.5 psi$$

$$P_{ALLOWABLE} = 662.5 * 4in * 6in = 15,900 lbs$$

$15,900 lbs \geq 9,730 lbs \quad \therefore 0.5\%$

THREADROD MUST BE CAPABLE OF RESISTING $8,313.3 lbs * \frac{36.5 - 6.25 in}{24 in} = 10,251.35 lbs$

$P_{T\,ALL} \geq 10.25$ KIPS

$\Omega_t = 1.67$ (YIELD) $P_1 = F_y A_g \qquad P_1 = \frac{F_y A_g}{1.67}$

USING A36 THREADROD 7/8" ϕ $A_g = 0.60 in^2$

$$P_{ALL} = \frac{36 ksi * 0.60 in^2}{1.67} = 12.96 \text{ KIPS}$$

✓ RUPTURE $F_u = 58 ksi \quad A_c = 0.129 in^2$ (UNC THREADS)

$\Omega_t = 2.00$ (FOR RUPTURE)

$$P_{ALL} = \frac{58 ksi * 0.129 in^2}{2.0} = 12.441 \text{ KIPS (GOVERNS)}$$

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JOB BARNARD
SHEET NO. 9 OF 9
CALCULATED BY PJW DATE 2/14
CHECKED BY ETC DATE 4/14
SCALE

12.44 KIPS ≥ 10.25 KIPS ∴ O.K.

√ CONCRETE BEARING STRESS f'_c = 5,000 psi

USE 12 x 18 PL

MAX REACTION = 48 K / (12 x 18) = 0.222 ksi

= 222 psi

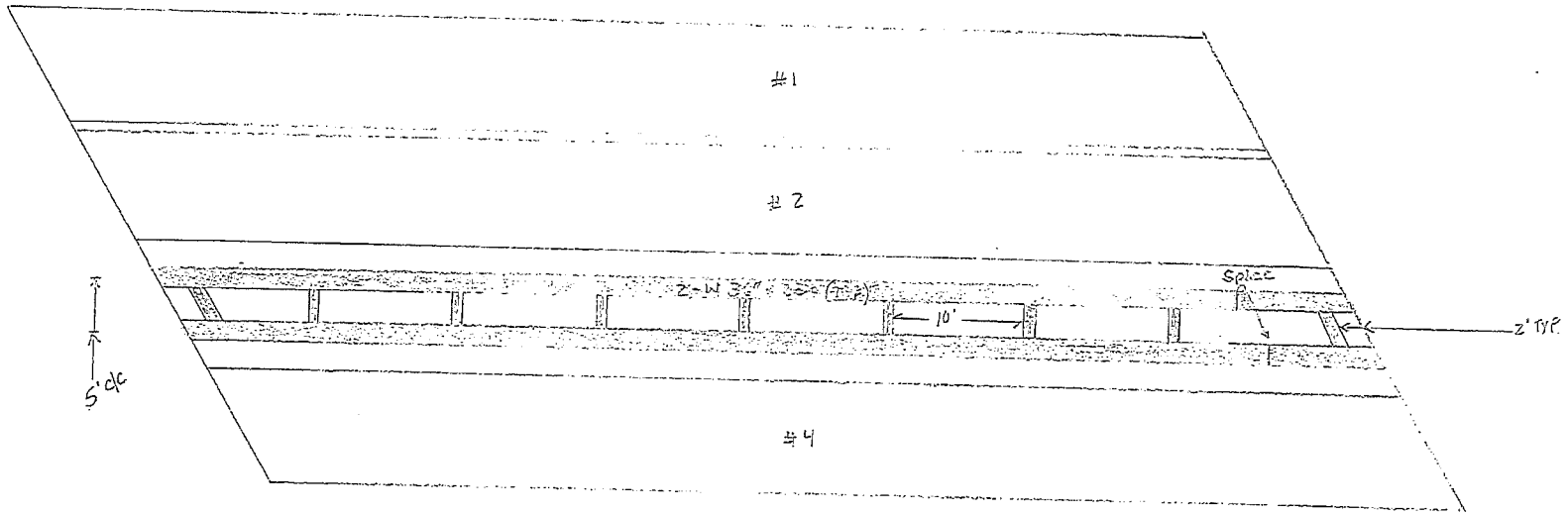
ALLOWABLE BEARING PRESSURE ON CONCRETE

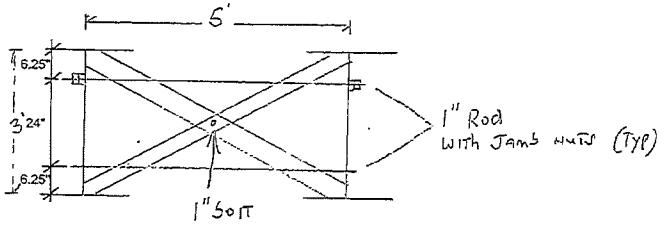
PER AASHTO 17TH EDITION ASD

= 0.3 f'_c = 0.3 * 5,000 psi = 1500 psi ALLOWED

222 psi << 1500 psi ∴ O.K.

Barnard
Slider Beam

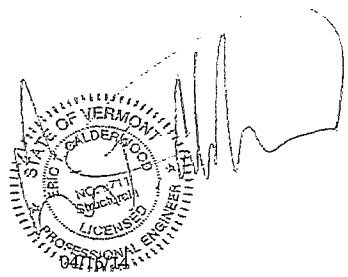




5.83'
Diagonal
4x6 Lumber

threadrod = grade
36ksi or greater

Timber = spf #2 or btr

20 - 1" FLAT WASHER (EXTRAS)
65 - 1" NUTS (EXTRAS)
20 - 1"x6" THREADED ROD (EXTRAS)
20 - 4"x6"x6' FOR DIAG BRACING (EXTRAS)
10 - 1"x12" BOLTS/NUTS (EXTRAS)

Girder WT: 19,780 ea +-