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.
	4/18/2014	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 0	H

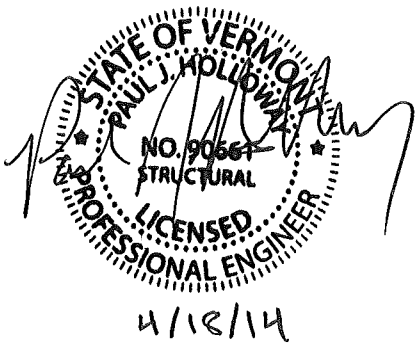
CODE:

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: _____

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

Town of: Barnard, Vermont
County of: Windsor



4/18/14

Prepared By:

Miller Construction, Inc.
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Tel. (802) 674-5525
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April 17, 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).

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.

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
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802-674-5525 Fax: 802-674-5245

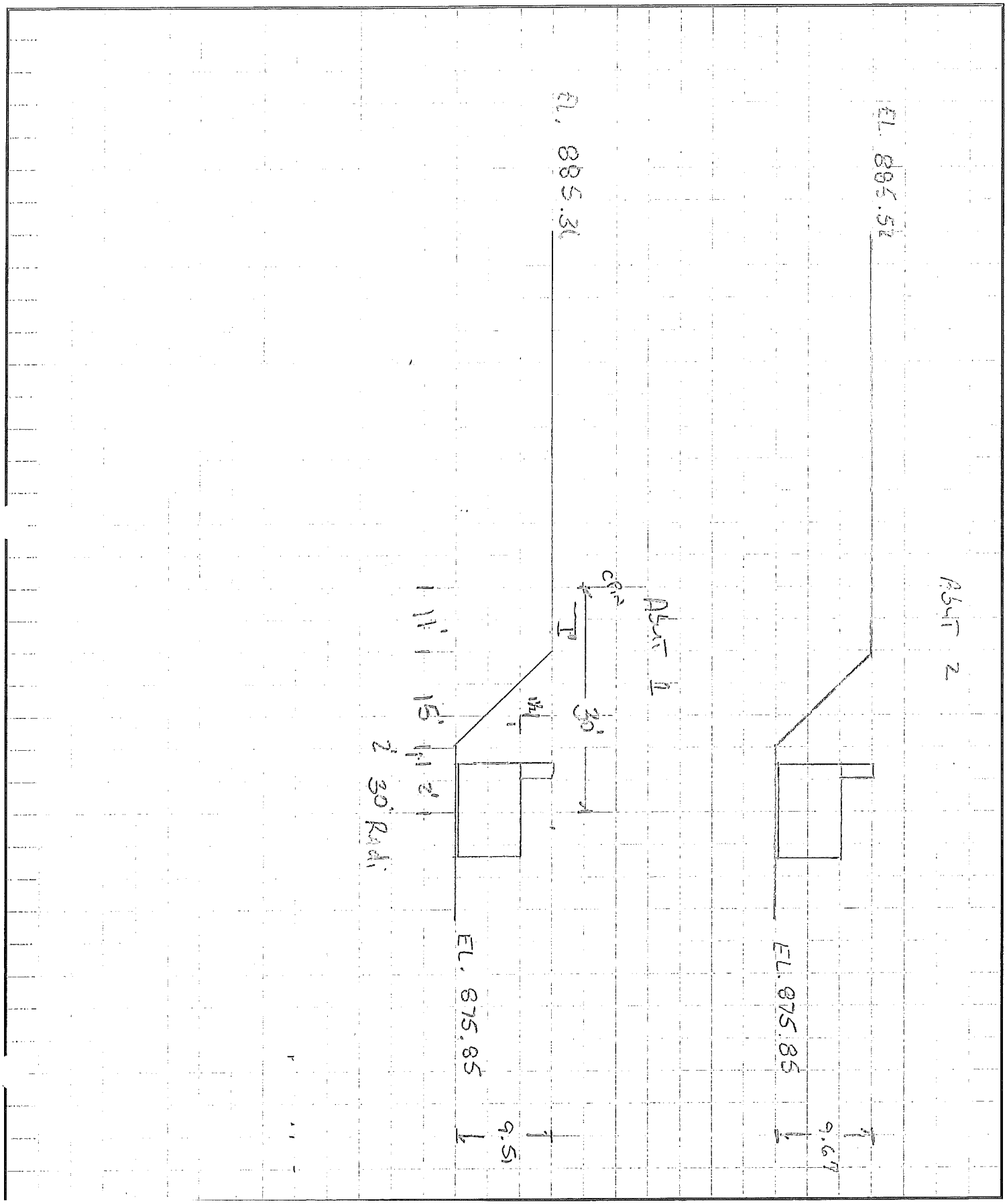
JOB _____

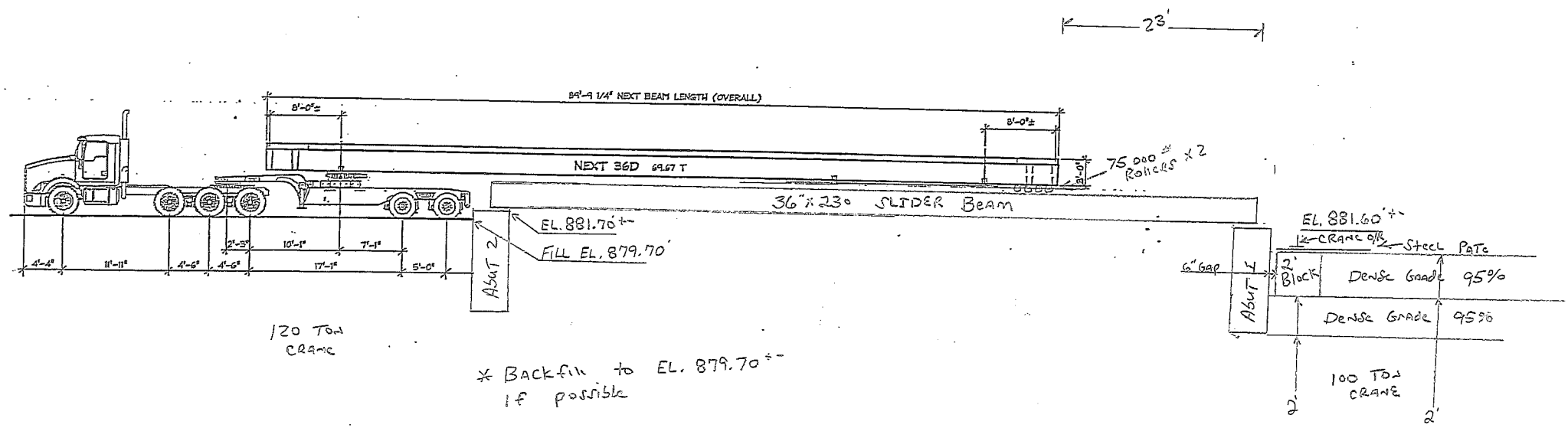
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

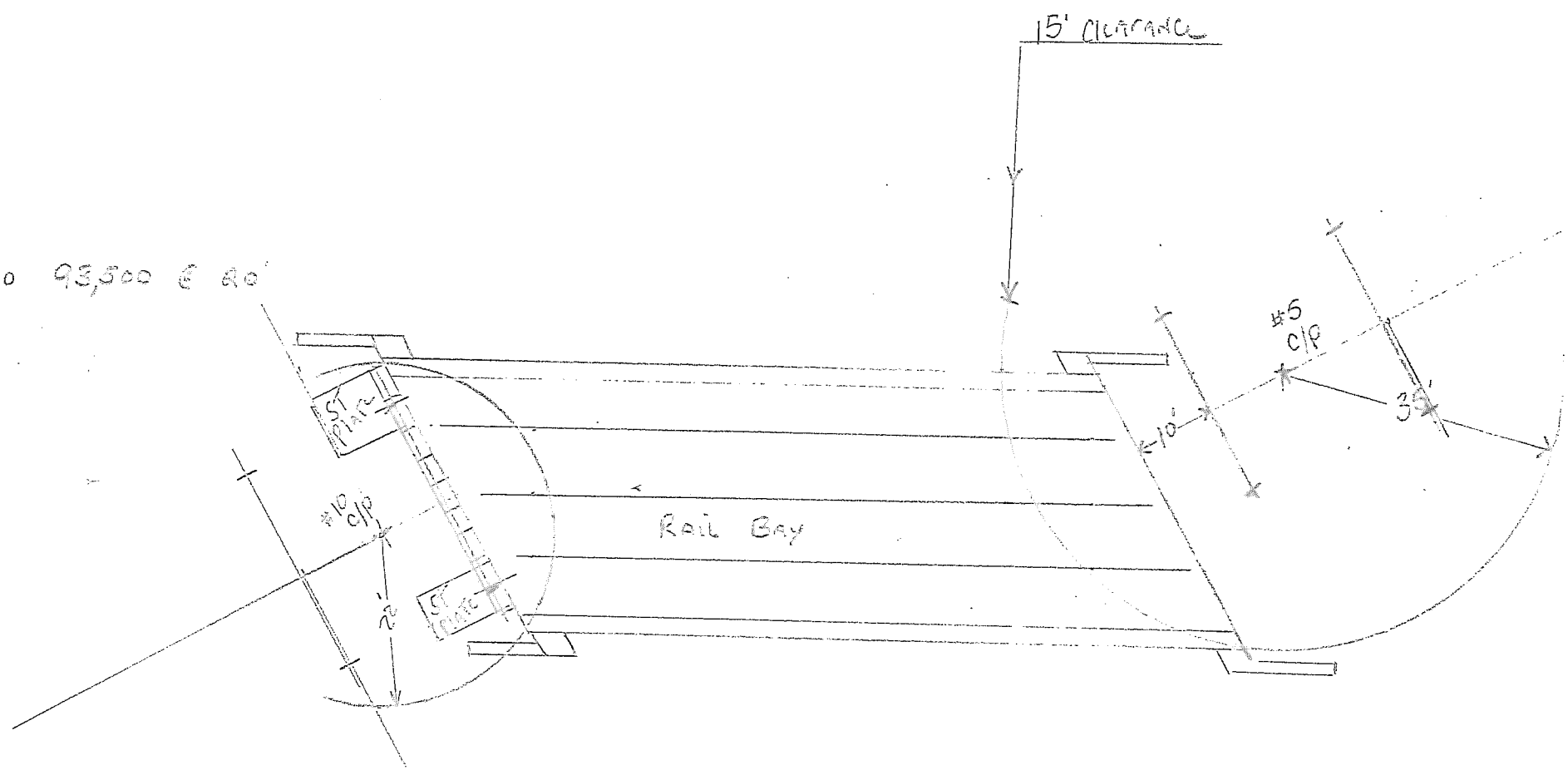
SCALE _____





* Backfill to EL. 879.70'+- if possible

9/10 93,500 @ 60



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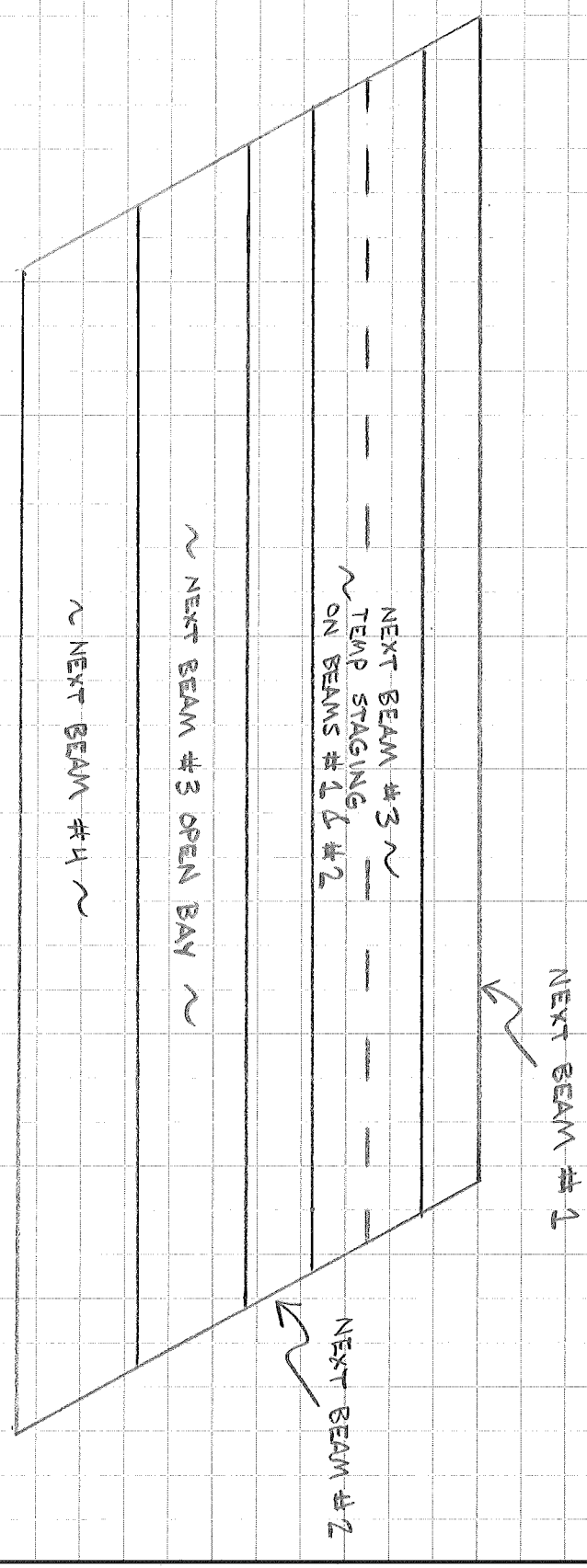
JOB BARNARD ER BRF 0241 (39)

SHEET NO. _____ OF _____

CALCULATED BY PJH DATE 4/17/14

CHECKED BY _____ DATE _____

SCALE N.T.S.



Reorder From NEBS CUSTOM printing service 1-800-288-6327 NEBS, Inc. Groton, MA 01471 www.nebs.com Ref. No: G 016202306

Beam Erection – Supporting Comps

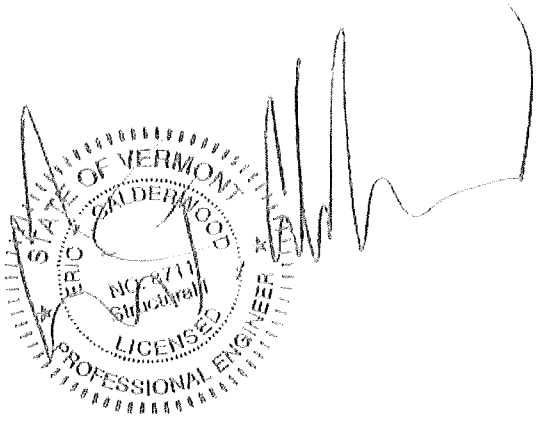
For

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 2/19
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

W36 x 230 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

& $M_n = M_p = F_y Z_x$

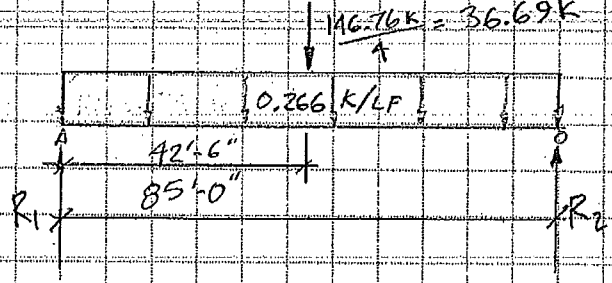
$M_n = 33$ ksi $* 963$ IN^3 $= 31,779$ K-IN

$M_A = \frac{M_n}{\Omega} = \frac{(31,779\text{ K-IN})}{1.67} = 19,029.3$ 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 $* 1.15 = 0.266$ KLF

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

$= 29.65$ 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.

$V_u = 36.69\text{k} + 0.266 * 85\text{ ft}/2 = 47.995$ KIPS
(WITH SLIDING SLED @ ℄ BRG EITHER END)

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

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

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

$66.4 > 48.03$ ∴ $C_v = 1.0$

$V_n = 0.60\,(33\text{ ksi}) * (36.5\text{in}) * (0.76\text{in}) * 1.0 = 549.25$ 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

SAY $N = k$

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

$k = 2.21\,in$ ∴ $R_N = (2.5(2.21\,in) + 2.21\,in)(33\,ksi)(0.76\,in)$

$R_N = 193.99$ KIPS $\Omega = 1.5$

∴ $R_A = 193.99\,K / 1.5 = 129.33$ KIPS

$R_u = 48$ KIPS << R_A ∴ LOCAL WEB YIELDING OK

✓ WEB CRIPPLING (J10-4) J-3

USE $N = k = 2.21\,in$

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

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

$R_N = 293.496$ 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
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SCALE

✓ SIDESWAY WEB BUCKLING J-4

$h/t_w = (36.5_{IN} - 2.21_{IN} * 2) / 0.76_{IN} = 32.08$

$l/b_f = 120_{IN} / 16.5_{IN} = 7.27$

$(h/t_w)/(l/b_f) = 32.08/7.27 = 4.41$

COMPRESSION FLANGE IS NOT RESTRAINED AGAINST ROTATION

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

✓ BRACING FORCE REQ'D

RULE OF THUMB: 2% FORCE IN COMPRESSION FLANGE

APPENDIX D (C-A-6-4b)

$P_{br} = 0.01 * M_u (C_t) C_d / h_o = 0.01 * ((1019.9_{K-FT}) * 12^{IN}/_{FT}) (2.0)(2.0) / 36.5"$

$C_t = 2.0$ $C_d = 2.0$

$P_{br} = 13.41$ KIPS

AVE STRESS IN COMP. FLANGE $= \left[\frac{1019.9 (12^{IN}/_{FT})}{854_{IN^3}} + \frac{10,199 (12) * 16.99_{IN}}{15600_{IN^4}} \right] * 1/2$

$= 13.83$ KSI $2\% P_u = 0.02 * 13.83_{KSI} * 1.26_{IN} * 16.5_{IN} = 5.75$ K

USE 13.41 KIPS BRACING FORCE REQ'D

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JOB BARNARD
SHEET NO. 6 OF 9
CALCULATED BY PJH DATE 2/14
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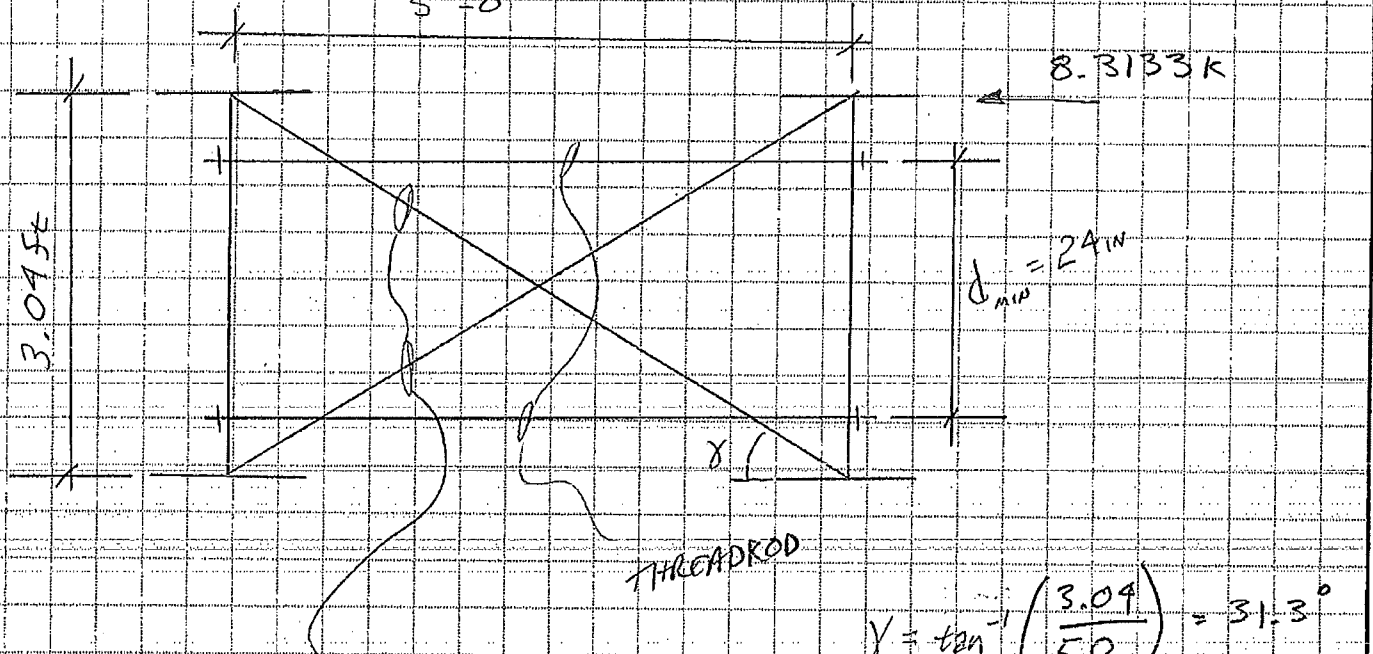
SCALE

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"



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

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

P_n 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

$\frac{1 + F_{cE}/F_c^*}{2C} = 1.3821$ $\frac{F_{cE}/F_c^*}{C} = 1.5142$

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SHEET NO. 8 OF 9
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SCALE

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

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

$$\therefore F'_{c\perp} = C_P F_c^* = 0.7528 * 880\,psi = 662.5\,psi$$

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

$$15,900\,lbs \geq 9,730\,lbs \quad \therefore\ 0.K.$$

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) $\quad P_n = F_y A_g \quad P_n = \frac{F_y A_g}{1.67}$

USING A36 THREADROD $7/8"\phi \quad A_g = 0.60\,in^2$

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

✓ RUPTURE $\quad F_u = 58\,ksi \quad A_e = 0.429\,in^2$ (UNC THREADS)

$\Omega_t = 2.00$ (FOR RUPTURE)

$$P_{ALL} = \frac{58ksi * 0.429\,in^2}{2.0} = 12.441\,KIPS \quad (GOVERNS)$$

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JOB BARNARD
SHEET NO. 9 OF 9
CALCULATED BY PJH DATE 2/14
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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 * 18) = 0.222 ksi

= 222 psi

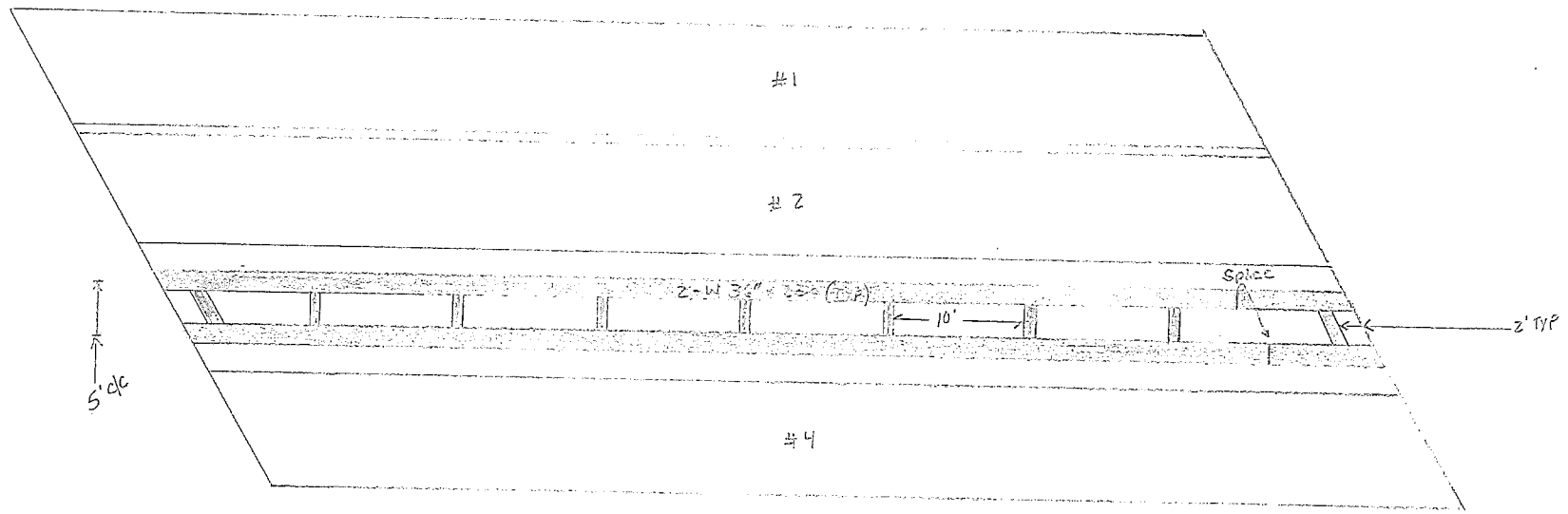
ALLOWABLE BEARING PRESSURE ON CONCRETE

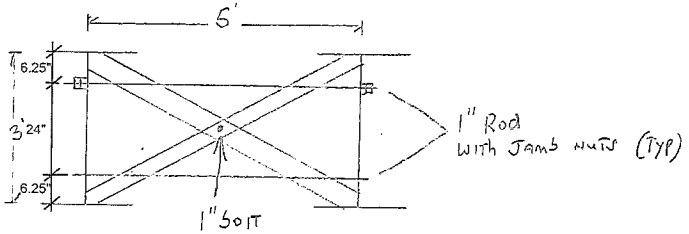
PER AASHTO 17TH EDITION ASD

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

222 psi << 1500 psi ∴ O.K.

Barnard
Sloga Beam

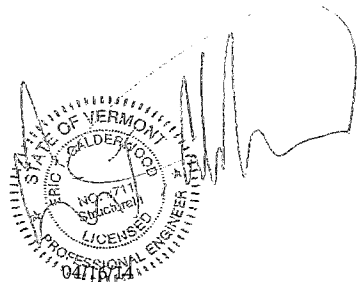




5.83'
Diagonal
4x6 Lumber

threadrod = grade 36ksi or greater

Timber = spf #2 or btr

20 - 1" FLAT WASHERS (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 +-