Erection Plan Support Calculations
BRF-0281(25)

Fairfield, Vermont

CEE 38-mi-15

Prepared for:
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By:
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Fairfield, Vermont
Erection Plan

Calculations by: TEPA
Checked by: GM

TH 1 (South Road) Bridge 14
Fairfield BRO 0281(25)

Location:
Town of Fairfield in Franklin County on TH 1 (South Road) over the Fairfield River. Approximately 2.5 miles south of intersection with VT 36.

References:
-Standard Specifications for Highway Bridges (SSHB)
-Manual of Steel Construction: Allowable Stress Design, Ninth Ed. (ASD)
-National Design Specifications for Wood Construction (NDS)

Check crane mat capacity for HL150 loaded with FA-AB1 at max radius

Use crane mats to distrubte load
Assume (3) 4'x20'x1' crane mats stacked
Place crane mats on fill

Most Loaded outrigger (Rear): $P := 141\ kip$ from BeamBoy, conservative

$D := 3\ ft$

$B := 4\ ft$

$L := 20\ ft$

$\gamma_{wood} := 50\ pcf$ dense hardwood

$P_{dead} := D \cdot B \cdot L \cdot \gamma_{wood} = 12\ kip$

$w := \frac{\langle P + P_{dead} \rangle}{(L \cdot B)} = 1.913\ ksf$

$w_{allow} := 5\ ksf$ from Table 4.11.4.1.4-1, SSHB

From available Boring B-1: Soils are sand with some silts, compact, trace gravel (Fill material).

$FS := \frac{w_{allow}}{w} = 2.614$

$check = \text{“Okay for construction”}$

If excavated down to clayey silt layer (10 foot depth according to B-1), fill a bearing platform for crane mat with coarse fill and compact.

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Now check crane mat moment capacity:

-Model as a canteliever support @ center of crane mat
-Analyze on a per foot basis

$$M_B := w \cdot \frac{L}{2} \cdot \frac{\left(\frac{L}{2}\right)}{2} \cdot 1\ ft = \left(1.148 \cdot 10^3\right)\ in \cdot kip$$

Calculate capacity:

$F_b := 1150\ psi$ Mixed oak No. 1, NDS
$C_D := 1.25$ for construction loads
$C_M := 1.0$
$C_t := 1.0$
$C_L := 1.0$
$C_V := 1.0$
$C_r := 1.0$
$F'_b := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_V \cdot C_r$ Table 4.3.1, NDS
$B := 1\ ft$
$H := 1\ ft$

$S_x := 3 \cdot \frac{B \cdot H^2}{6}$ (3) mats stacked on top of each other.

$M_y := S_x \cdot F'_b$

$M_y = \left(1.242 \cdot 10^3\right)\ in \cdot kip$

$FS := \frac{M_y}{M_B} = 1.082$

$check =$ "Okay for construction"

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Crane Mat Set-up for HC-125

-Use 20'x4'x1' crane mats
-7 mats long x 1 mat wide x 2 mats deep

$B := 20\ ft$
$L := 28\ ft$
$D := 2\ ft$

$P_{dead} := B \cdot L \cdot D \cdot \gamma_{wood} = 56\ kip$

$W_{crane} := 213.03\ kip$ Total, from Manual

$W_{AB} := 69.08\ kip$

$L_{track} := 24.63\ ft$ From Manual

$w := \frac{(P_{dead} + W_{crane} + W_{AB})}{(B \cdot L)} = 0.604\ ksf$ Assume crane mats distribute load evenly to soil

Check soil capcity: $FS := \frac{w_{allow}}{w} = 8.281$

$check =$ "Okay for construction"

Now check crane mat moment capacity:

-Model as a continuous beam supported at ends (conservative)
-Analyze on a per foot basis

$M_B := \frac{w \cdot L^2}{8} \cdot 1\ ft = 710.031\ in \cdot kip$

Calculate capacity:

$F_b := 1150\ psi$ Mixed oak No. 1, NDS
$C_D := 1.25$ for construction loads
$C_M := 1.0$
$C_t := 1.0$
$C_L := 1.0$
$C_V := 1.0$
$C_r := 1.0$
$F'_b := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_V \cdot C_r$ Table 4.3.1 NDS
$B := 1\ ft$

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$H := 1\ ft$

$S_x := 2 \cdot \frac{B \cdot H^2}{6}$ (2) mats stacked on top of each other.

$M_y := S_x \cdot F'_b$

$M_y = 828\ in \cdot kip$

$M_y = 828\ in \cdot kip$

$FS := \frac{M_y}{M_B} = 1.166$

$check =$ "Okay for construction"

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Deadman Push-pull System Calulations:

By inspection, HP 14x73 okay in tension/compression

$M_{res} := 69.08\ kip \cdot 1.5\ ft$

$P_f := \frac{M_{res}}{4.9167\ ft} = 21.075\ kip$ Required loading to adjust abutment.

Use: (2) HP 14x73 Bolted together and buried. (2) HP 14x73 beams connect deadman to lifting eyes on abutments.

Check deadman stability:

$H := 27.2\ in$ $\gamma := 115\ pcf$ Say: $\phi := 25\ deg$

$k_p := 4.5$

$R := 0.574$ Figure 5.5.2D, SSHB

$k_p := k_p \cdot R = 2.583$

$P_p := \frac{\left(k_p \cdot \gamma \cdot H^2\right)}{2} = 763.076\ plf$

$L_{DM} := 32\ ft$ same as the abutment length for ease of construction.

$P_{allow} := P_p \cdot L_{DM} = 24.418\ kip$

$FS := \frac{P_{allow}}{P_f} = 1.159$

$check = \text{“Okay for construction”}$

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Design Bolted Connection for Deadman:

$P_p := P_f$ passive pressure only resists as much as needed.

$V_{bolt} := P_f$ model system as a centeliever beam @ bolted connection

$M_{bolt} := P_p \cdot \left(\frac{2}{3}\right) \cdot H = 382.162\ kip \cdot in$

Two HP beams attached to deadman:

$V_{bolt} := \frac{V_{bolt}}{2} = 10.538\ kip$

$M_{bolt} := \frac{M_{bolt}}{2} = 191.081\ in \cdot kip$

Use (4) bolts spaced @ 6" O.C., 7/8" A325

$V_{one_bolt} := \frac{V_{bolt}}{4} = 2.634\ kip$ Shear per bolt. All four bolts resist shear

$T_{bolt} := \frac{M_{bolt}}{6\ in} = 31.847\ kip$

$T_{one_bolt} := \frac{T_{bolt}}{2} = 15.923\ kip$ Tension per bolt. Two bolts resist moment in tension

$V_{allow} := 12.6\ kip$ Table I-D, A325, 7/8" dia., Connection type N, standard hole, single shear. ASD

$T_{allow} := 26.5\ kip$ Table I-A, A325, 7/8" dia. ASD

$FS := \frac{V_{allow}}{V_{one_bolt}} = 4.783$

$check = \text{“Okay for construction”}$

$FS := \frac{T_{allow}}{T_{one_bolt}} = 1.664$

$check = \text{“Okay for construction”}$

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Check if shackle okay for shear block failure:

$t_{flange} := 0.505\ in$

$d_{hole} := 1\ in$

$P_{shear} := \frac{P_f}{2} = 10.538\ kip$ assume 90 degree pull, 1 shackle per deadman leg.

Try: Bolt 2.5" from edge of

Use ASD Table I-G

$A_v := 2.5\ in \cdot t_{flange} = 1.263\ in^2$

$F_u := 65\ ksi$

$A_t := 0\ in^2$

$R_{BS} := 0.3 \cdot A_v \cdot F_u + 0.5\ A_t \cdot F_u$ ("From AISC ASD Sect. J4")

$R_{BS} = 24.619\ kip$

$FS := \frac{R_{BS}}{P_{shear}} = 2.336$

$check =$ "Okay for construction"

BEAMBOY V2.2 REPORT

HL-150 W/ FA-AB2

LOAD CONFIGURATION

Point Loads

A: 69100 lb., x=0 ft.
B: 20800 lb., x=62 ft.
C: 8750 lb., x=59.9 ft.

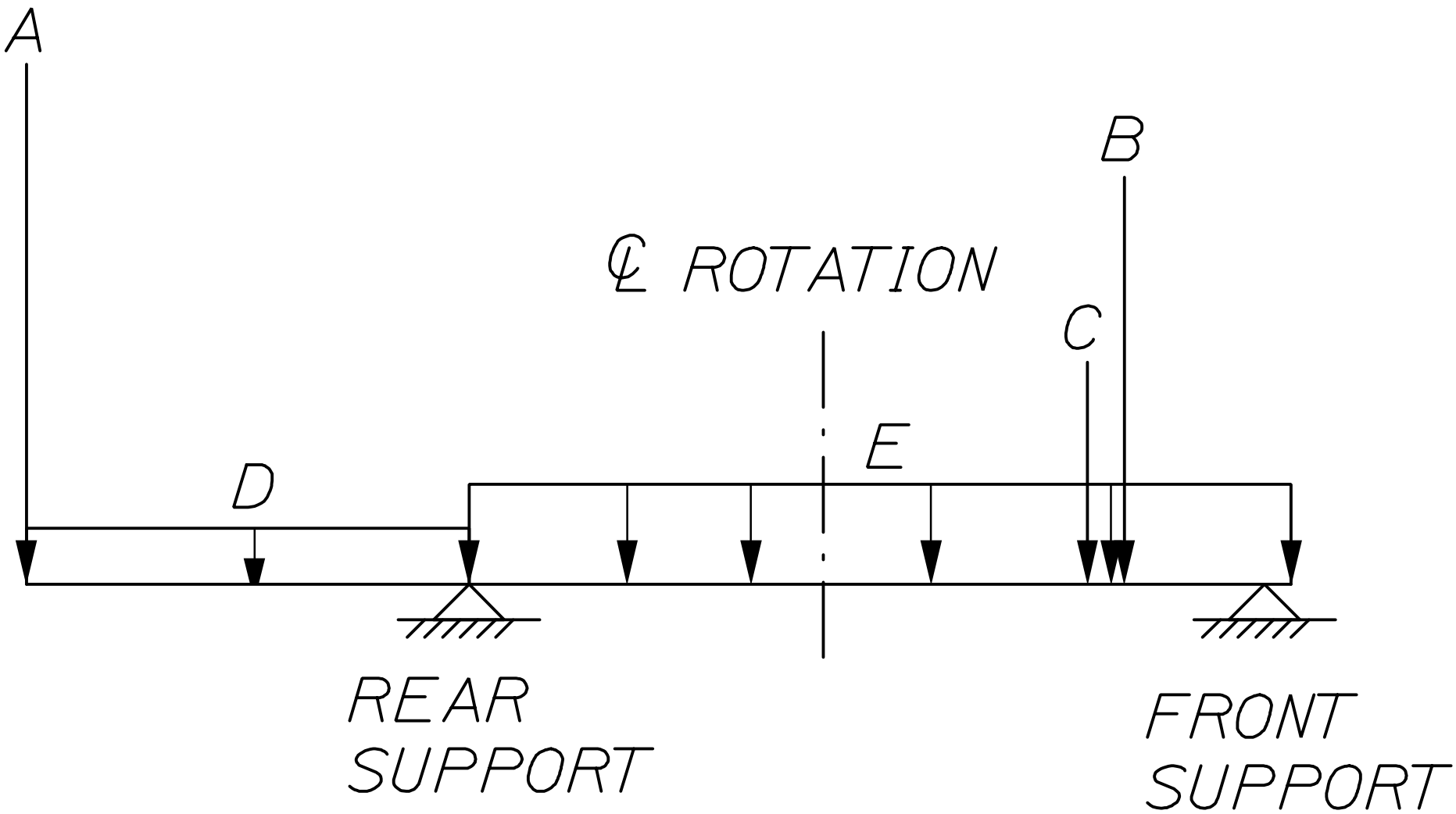
Distributed Loads

D: Start=146 lb./ft., x=0 ft.; End=146 lb./ft., x=25 ft.
E: Start=1020 lb./ft., x=25 ft.; End=1020 lb./ft., x=71.4 ft.

Supports

Rear Support: 25 ft., Reaction=141000 lb.
Front Support: 69.9 ft., Reaction=8950 lb.

4/24/2015


A
B
℄ ROTATION
C
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D
REAR
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SUPPORT