Sliding Beam Design Support Calculations

Enosburg, Vermont

CEE 070-br-14

Prepared for:
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By:
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JOB ENOSBURG SLIDER
SHEET NO. 1 OF 5
CALCULATED BY ETC DATE 7/14
CHECKED BY DATE
SCALE

ENOSBURG:

SLIDING BEAM

UNDER CARRIAGE OF 65,000 lb. EXCAVATOR

(ASSUME SELF WEIGHT OF UNDERCARRIAGE IS 20,000 lbs (CONSERVATIVE)

MAXIMUM NEXT BEAM WEIGHT

= 67.7 TONS = 135400 lbs

REACTION @ CARRIAGE = 67,700 lbs

(SAY 70,000 lbs)

LOAD @ MIDSPAN OF SLIDER BEAM

ASSEMBLY = 90,000 lbs = 90 KIPS

= 45 KIPS / BEAM

SLIDER BEAM SELF WEIGHT =

W33x201 BEAMS

SELF WEIGHT = 1.15 * 0.201 KLF = 0.231 KLF

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JOB: ENOSBURG
SHEET NO. 2 OF 5
CALCULATED BY: ETC DATE: 7/14
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$L = 69\ ft$

$M_u = 45\ kips * 1/2 * \frac{69\ ft}{2} + 0.231\ klf * 69\ ft^2/8$

$M_u = 913.72\ kip\text{-}ft = 10{,}964.69\ k\text{-}in$

$f_b = 10{,}964.69\ k\text{-}in / 684\ in^3 = 16.03\ ksi$

ASSUME STEEL IS ASTM A7 1900 OR LATER

$F_y = 30\ ksi$ (MINIMUM)

SECTION IS COMPACT

$L_c = \frac{76 * 15.745\ in}{\sqrt{30\ ksi}} = 218.5\ in = 18.21\ ft$

$l_b = 16\ ft \leq L_c$ ∴

$F_b = 0.66 * F_y = 0.66 * 30\ ksi = 19.8\ ksi >> 16.0\ ksi$

∴ O.K.

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JOB ENOSBURG
SHEET NO. 3 OF 5
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MAX SHEAR

O.A. LENGTH

$= 0.231 * 73'/2 + 45K = 53.43 \text{ KIPS}$

depth = 33.68 in WEB = 0.715 in

$f_v = 53.43 \text{ KIPS} / (33.68'' * 0.715'') = 2.219 \text{ ksi}$

$F_v = 0.4 F_y = 0.4 * 30 \text{ ksi} = 12 \text{ ksi} \geq 2.218 \therefore \text{o.k.}$

✓ SIDESWAY WEB BUCKLING

$d_c/t_w = \dfrac{(33.68 \text{ in} - 2 * 1.9375'')}{0.715 \text{ in}} = 41.69$

$\ell/b_f = 16 \text{ ft} * 12 \text{ in/ft} / 15.745 \text{ in} = 12.19$

$(d_c/t_w)/(\ell/b_f) = 41.69/12.19 = 3.42 \gg 1.7$

∴ SIDESWAY WEB BUCKLING IS NOT POSSIBLE

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✓ WEB CRIPPLING (USE $N = 1.9375_{IN}$)

$$R \geq 34\,(0.715_{IN})^2 \left[1 + 3 * \frac{1.9375_{IN}}{33.68_{IN}} * \left(\frac{0.715_{IN}}{1.15_{IN}}\right)^{1.5}\right] * \sqrt{30 * 1.15/0.715} = 130.95 \text{ KIPS} >> 53.45\text{K}$$

∴ OK

SLIDING BEAM IS O.K. FOR ANTICIPATED LOADING

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JOB: ENOS BURG
SHEET NO. 5 OF 5
CALCULATED BY: ETC DATE: 7/14
CHECKED BY: DATE:
SCALE:

✓ (3) HP 12x74[5] OVER UNDER CARRIAGE

REACTION @ EACH SIDE =

35,000 lbs EACH

$M_u \leq 35K * (2'-6")$ NEGLECTING WIDTH OF CARRIAGE

$M_u = 1050$ K-IN

$f_b = 1050 \text{ K-IN} / (3)(93.8 \text{ in}^3) = 3.73$ KSI

SAY (3) HP 12x74 ARE O.K. LIKELY

(3) HP 8x36 WOULD BE OK

W/O ISSUE

SAY SHEAR OK BY INSPECTION