Job Title CIMCO SALES, Puyallup, WA By BTK Date 3-2024 Job No. 2411

Subject ROLL-FORMED STEEL SELECTIVE RACKS Checked Sheet 1 of 3

ANALYSIS & DESIGN OF RACKS CONFORM TO THE 2018 IBC, SEC. 2209, THE 2012 RMI CODE & SEC. 15.5.3 OF ASCE 7-16, USING THE LRFD / ASD METHODS: $\bar{V} = C_s I_p W_s$.

AND $V = 0.70 C_s I_p W_s$.

$I_p = 1.0$ FACILITY IS NOT OPEN TO THE PUBLIC.

$C_s = (2/3)(F_a \times S_s)/R$

$S_s = 1.259$ FOR THE FACILITY ADDRESS.

$F_a = 1.2$ FOR SITE CLASS D - DEFAULT.

$R = 4.0$ TRANSV. (BRACED) DIR. $\bar{V}_T = 0.252 W_s$ & $V_T = 0.176 W_s$.

$R = 6.0$ LONGIT. (MOM.) DIR. $\bar{V}_L = 0.168 W_s$ & $V_L = 0.118 W_s$.

$W_s = 0.67 \times P_{RF} \times P + D + .25\,L$ WHERE $L = 0$.

MAX. RACK LOAD PER LEVEL PER PAIR OF BEAMS SHALL BE 3,000 LBS.

USE 100#/LEVEL FOR RACK DEAD LOAD. $W_s = 3000(2/3) + 100 = 2100$#/LEVEL

FOR P_{RF} USE 1.0 IN BOTH DIRECTIONS. $S_{ds} = 1.007$ $(0.9 - 0.2 S_{ds}) = 0.699$

TRANSV. DIR.: RACK TYPE "A" CONTROL:

$\bar{V}_T = 0.252 \times 3 \times 2.10 = 1.588^k$ @ 144.72" $\Rightarrow \bar{M}_T = 229.82^{k"}$ $a = 44 - 3 = 41"$

SEIS $\bar{R}_s = 5605$# $\bar{T} = 3403$#

MID GRAV $\bar{R}_a = 2202$# $\bar{V} = 794$#/col.

LOAD ON TOP LEVEL ONLY $V_{TT} = 0.781^k$ @ 187" $\Rightarrow \bar{T} = 2479$# & $\bar{V} = 391$#/col.

2-1/2"ϕ x 5 1/2" SIMPSON SB-II WEDGE ANCHORS (3 7/8" EMBED.) PLACED DIAGONALLY PER ICC-ES ESR-3037 WITH SPECIAL INSPECTION.

$\phi N_n = 5162$# $\phi V_n = 7201$# $h_n = 3\,7/8"$, $h_{eff} = 3\,3/8"$, $h_2 = 6"$, $S_x = S_y = 6"$ $C_a = 18"$

(MAX) $\bar{T}/\phi N_n + \bar{V}/\phi V_n = 0.66 + 0.11 = 0.77$ - OK < 1.2

BRACING: MAX. $\bar{V}_T = 1.588^k$

DIAG BRACE $\ell = [(39.25)^2 + (22)^2]^{.50} = 45.00"$

DIAG. BRACE $P = 1.82^k$

BRACES ARE 1 9/16" x 15/16" x 16 GA C-SECTIONS: $A_e = .194$ in^2 MIN $r = .355"$

$kL/r = 126.76$ $(k = 1.0) \Rightarrow \phi_c F_n = 13.51$ ksi;

$P_a = (A_e)(\phi_c F_n) = 2.62^k$ - OK > $\bar{P}$

CONNECTION TO COLUMN: 1-5/16" ϕ A325 (GR 5 EQ.) BEARING BOLT IN DOUBLE SHEAR:

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Basil T. Kattula 3/29/24

$V_A = .0767 \times (.75 \times 54) \times 2 = 6.21^k$ } OK > $\bar{P}$

BOLT BEARING ON 16 GA BRACE: $\phi P_N = 2.88^k$ }

BASE PLATES, SLAB & SOIL: MAX. COLUMN COMP. $P_c = 1.141 \times 0.15 + 0.694 \times 4.50 + 0.7 \times \bar{R}_s = 7.22^k$

BASE PLATES ARE 8"x8"-3/8" $\Rightarrow A_p = 64.00\ in^2$

$f_p = 0.113$ ksi - ok < Allow. $f_p = .7 \times f_c' = 2.10$ ksi

BASE PLATE $m = (f_p)(2.5)^2/2 = 0.353\ k"/"$

$F_b = .75\ F_y = 27$ ksi $\Rightarrow$ REQD $t = 0.280"$ - ok < ACTUAL $t = 3/8"$

6" THICK CONCRETE SLAB WITH $f_c' = 3{,}000$ psi

SLAB ALLOW. $f_t = (5)(\phi)(f_c')^{.5}/U = 117$ psi

SLAB $M_a = 0.117 \times 72/12 = 0.702\ k'/'$

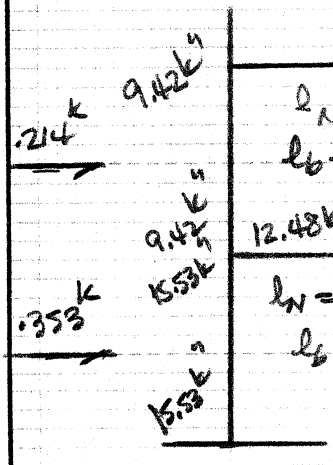
$0.702 = p(a)^2/2$ USING ALLOW. $p = 1.50$ ksf $\Rightarrow a = 11.61'$

SOIL BEARING $A_b = (2a + 6.0 + 8.0)^2/144 = 9.620\ FT^2$

$P_a = (A_b)(\text{ALLOW. } p) = 14.43^k$ - ok > MAX (P_c).

LONGIT. DIR.: RACKS TYPE "B" CONTROL $\Rightarrow$

$\bar{V}_L = .168 \times 2 \times 2.10/2 = 0.353^k$/col. $\Rightarrow F_1 = .139^k$, $F_2 = .214^k$



BEAMS ARE 15 GA THICK WITH A 4" FACE, 6" / 3-PIN BRACKETS & STD WELDS:

$I_x = 1.687\ in^4$ $l = 102"$

$S_x = 0.792\ in^3$ $M_A = 26.136\ k"$

USING A $k_T = 200\ k"/R \Rightarrow G = 5.879$

STRENGTH W = 2310 #/BEAM <— CONTROLS

(L/180) DEFL W = 2360 #/BEAM

AND IS OK > MAX REQD $W = 0.88(3000/2) + 50 + 188 = 1558$ #/BEAM

BEAM GRAVITY END $M = WL/12G = 2.25\ k"$

BEAM MAX TOTAL END $M = 0.7 \times 12.48 + WL/12G = 10.99\ k"$ - OK

< BRACKET $M_a = 17.37\ k"$

COLUMNS: ARE $3" \times 3" \times 0.108"$ C-SECTIONS WITH INTERMEDIATE STIFFENERS AND 0.40" RETURN LIPS:

$A_G = 0.999\ in^2$ $I_x = 1.391\ in^4$ $r_x = 1.180"$ $r_o = 2.988"$ $C_w = 2.074\ in^6$

$A_e = 0.752\ in^2$ $S_{xe} = 0.794\ in^3$ $r_y = 1.019"$ $\beta = .273$ $J = .00391\ in^4$

$k_x = 1.7$ $l_x = 88"$

$k_y = 1.0$ $l_y = 44"$

$k_t = .8$ $l_t = 44"$

$\Phi_c F_n = 10.91$ ksi

COL $\bar{P} = 1.401 \times 0.10 + 0.981 \times 3.0 = 3.08^k \Rightarrow \bar{f}_a = 4.10$ ksi

COL $\bar{M} = 15.53\ k"$ $\Rightarrow \bar{f}_{bx} = 19.56$ ksi & $F_b = .9 F_y = 49.50$ ksi

$P_{EL} = 18.10^k \Rightarrow \alpha_x = 0.83$ AND $C_{mx} = 0.85$

$CSR = 0.38 + 0.40 = 0.78$ – ok < 1.0

TRANSV. DIR.: MAX. COL. COMP. $\bar{P}_c = 3.08 +$ SEIS $\bar{R}_a$

SEIS $\bar{R}_a = 4.41^k \Rightarrow \bar{P}_c = 7.49^k \Rightarrow \bar{f}_a = 9.96$ ksi

$\bar{F}_a / (\Phi_c F_n) = 0.91$ – ok < 1.0