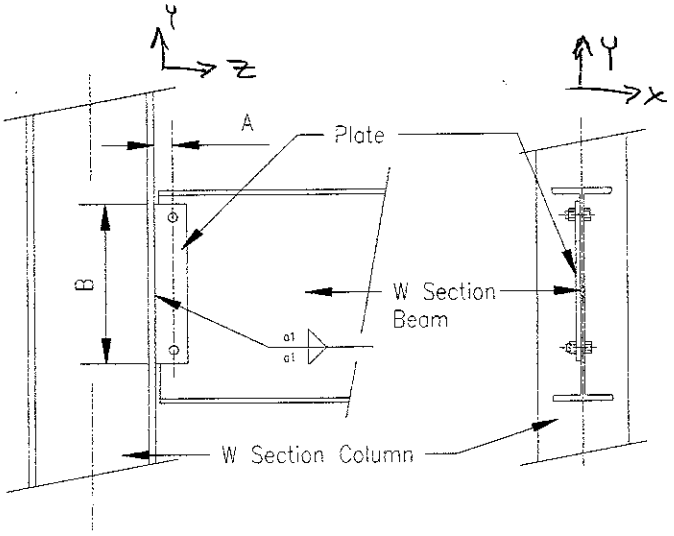
Example Problem 5.5



Given: A connection plate is welded to the face of a W section column flange and is bolted to the web of a W section beam as shown. The weld electrode is F7. A = 2 inches and B is to 9 inches. The weld size, a1, is 1/4 inch. The beam reaction transferred by the connection plate is 3 parts dead load and 5 parts live load.

Wanted:

a) Determine the maximum beam reaction based on weld strength of the fillet welds that connect the plate to the W section. Use LRFD and express your result in terms of comparable service level loads.

b) Repeat the problem using the coefficients on SCM pg 8-66.

Solution:

DETERMINE THE COMPOSITE LOAD FACTORS:

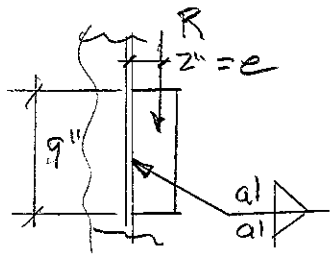
LC2 CONTROLS FOR BOTH LRFD & ASD. ← CLF

LRFD: $P_u = 1.2(3/8) + 1.6(5/8) = 1.45\ P_{s,eq}$

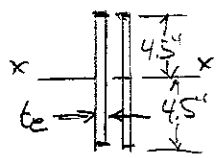
ASD: $P_a = 1(3/8) + 1(5/8) = 1.00\ P_{s,eq}$

PART a) FIND MAX STRESS WHEN P_s/K THE SCALE TO FIND CAPACITY:

$R = 1K$; $M = (1^K)(2") = 2"K$



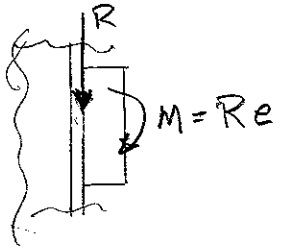
WELD SECTION PROPERTIES:



$t_e = .707(1/4") = .177\ in$

$A_w = 2 t_e l = 2(.177)(9") = 3.18\ in^2$

$I_x = 2\frac{t_e l^3}{12} = \frac{(.177")(9")^3}{6} = 21.5\ in^4$



PROB 5.5 (CONTINUED)

TRANSLATION STRESS:

$$f_y = \frac{R}{A_w} = \frac{1^K}{3.18 IN^2} = .314 \text{ KSI}$$

DIRECTION IS IN +Y DIRECTION

MAX BENDING STRESS:

$$f_z = \frac{Mc}{I} = \frac{(2^{IK})(4.5'')}{21.5 IN^4} = .524 \text{ KSI}$$

DIRECTION IS IN +Z DIRECTION

VECTOR SUM:

$$f_w = \sqrt{(.3 KSI)^2 + (.524)^2} = 0.524 \text{ KSI}$$

WELD CAPACITY

$$F_w = .6 F_{EXX} = .6(70 \text{ KSI}) = 42 \text{ KSI}$$

$$\frac{R_N}{F_w} = \frac{1K}{f_w}$$

$$R_N = \left(\frac{42 \text{ KSI}}{.524 \text{ KSI}}\right)(1K) = \underline{80.17 K}$$

LRFD

$\phi R_N = .75(80.17^K) = 60.13^K$

CLF = 1.45

$R_{S,EQ} = \frac{60.13}{1.45} = 41.47^K$

$R_{S,EQ} = 41.47^K$

ASD

$R_N/\Omega = \frac{80.17^K}{2.0} = 40.09^K$

CLF = 1.0

$R_{S,EQ} = \frac{40.09}{1.0} = 40.09^K$

$R_{S,EQ} = 40.09^K$

ANSWER (a)

PROBLEM 5.5 (CONTINUED)

PART (b): SEE INSTRUCTION ON SCM pg 8-66

$k=0$; $C_1=1$; $D=4$

$a = \frac{2''}{9''} = .222$

FIND "C" BY INTERPOLATION

a	C
0.200	3.51
0.222	3.42 ← C
0.250	3.31

$R_N = CC_1Dl = (3.42)(1)(4)(9)$

$R_N = 123.2^K$

LRFD

$\phi R_N = .75(123.2^K) = 92.37^K$

CLF = 1.45

$R_{S,EQ} = \frac{92.37^K}{1.45}$

$R_{S,EQ} = 63.70^K$

ANSWER (b)

ASD

$R_N/\Omega = \frac{123.2^K}{2.0} = 61.58^K$

CLF = 1.0

$R_{S,EQ} = \frac{61.58^K}{1.0}$

$R_{S,EQ} = 61.58^K$