APPENDIX D

DESIGN EXAMPLE

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Data : $\sigma_{sy} = 2600$ kg/cm^2, $\sigma_u = 200$ kg/cm^2,

$m = 13$, $N = 1$, $Z = 1$, $P_u = 40{,}000$ kg.,

$e_x = 10$ cm, $e_y = 36$ cm.

A) Design based on "Ultimate Strength Design Handbook" (54).

Use section of 20 cm x 46 cm with effective depth of 40 cm.

(Notation as in reference mentioned)

$\therefore \frac{d}{b} = \frac{46}{20} = 2.30$

$$\frac{P_u}{\sigma_u bd} = \frac{40{,}000}{200 \times 20 \times 46}$$

$$= 0.218$$

Assume $r = 1.0 \times 10^{-4}$

$b/d = 1.26$ (chart 6.1, (54))

$\therefore \Phi = 2.52$

$N = 0.20$ (chart 6.2, (54))

$\theta = \tan^{-1} \Phi \cdot \frac{ex}{ey} = 2.52 \times 10/36$

$= 35^0$

$$\therefore M_{fy} = \frac{M_y \cdot \sec \theta}{1 - N \cdot \sin^2 2\theta}$$

$= 0.2100$

Referring to chart 3.2, (54); $r = 1.4 \times 10^{-4}$

Keeping $r = 1.2 \times 10^{-4}$, total area of steel shall be calculated as

$$= 200 \times 1.2 \times 10^{-4} \times 20 \times 46$$

$$= 22.0 \text{ sq. cm.}$$

$$\therefore \quad A_s = A_c = 11.0 \text{ Sq. cm.}$$

(B) Design based on interaction curve of present study.

$$P_{u,} = \frac{P}{\sigma_u \, bd_y}$$

$$= 0.25$$

$$\tan \alpha_1 = 10 / 36 = 0.28$$

$$\alpha_1 = 15.7^{\circ}$$

From the relation of α_1 and θ, we get

$$\theta = 45^{\circ}$$

Again $\tan \theta = 2g_o / b$

$$= 2 f n . R \quad \text{(Equation 4.42)}$$

Selecting $f = 0.75$ and $n = 0.332$, referring to graph 67, for $D'_y = 0.4$, $D'_x = 0$, $P_{u,} = 0.25$, we get $mp = 0.17$, $M_{u,} = 0.170$.

$$p = A_s / bd_y$$

$$\therefore \quad A_s = A_c = 10.5 \text{ sq. cm.}$$