

Design procedure for Gantry girder ②

- 1) Determination of maximum wheel load:
- 2) Determination of maximum Bending moment in the gantry girder due to vertical load
- 3) Determination of max. shear force due to wheel load, dead load from the gantry girder and rails.
- 4) Calculation of lateral forces on the girder and max BM & SF.
- 5) Determination of plastic section modulus of trial section

$$M_D = 2pfy$$

Gantry girder is laterally unsupported beam.

∴ trial section may be

$$Z_{p\text{ req}} = \frac{(1.4 \text{ to } 1.5) M_u}{f_y}$$

Economic depth of girder $> \frac{1}{12} \times \text{span}$.

Width of flange = $\frac{1}{40}$ to $\frac{1}{30}$ of span.

(12)

Selecting suitable section from IS handbook.

calculating properties of section such as Z_{ez} , Z_{ey} , Z_{pz} , Z_{py} .

b) Classification of section:

Flange and web are classified as plastic.

$$\therefore \frac{b}{t_f} < 8.4 \epsilon_s \quad \& \quad \frac{d}{t_w} < 84 \epsilon_s$$

i) Check for moment capacity:

$$M_{dz} = \frac{B_b Z_{pz} f_y}{\gamma_{mo}} \leq 1.2 \frac{Z_{ez} f_y}{\gamma_{mo}}$$

Design BM $>$ Applied BM.

ii) Check for local moment capacity:

$$M_{dy} = \frac{Z_{py} f_y}{\gamma_{mo}} \leq \frac{1.2 Z_{ey} f_y}{\gamma_{mo}}$$

Check for combined local moment capacity of girder.

$$\frac{M_z}{M_{dz}} + \frac{M_y}{M_{dy}} \leq 1.$$

9) check for buckling resistance:

[cl: 8.2.2.1 (52) IS-800]

$$M_{cr} = \frac{\pi^2 EI_y h_f}{2 L_{LT}^2} \left[1 + \frac{1}{20} \left(\frac{L_{LT}/r_y}{h_f/b_f} \right)^2 \right]^{0.5}$$

10) check for shear capacity

[cl: 8.4.1 (59) IS-800]

$$V_h = \frac{A_w f_y}{\gamma_{mo}} > \text{max S.F.}$$

11) check for buckling under wheel load.

Buckling resistance

$$= (b_1 + n_1) t_w f_{cd} > \text{max wheel load}$$

where,

b_1 - diameter of wheel

n_1 - dispersion length of wheel.

12) check for bearing:

13) Design of connections:

14) check for deflection:

$$\delta_{cal} = \frac{W L^3 \left(\frac{3a}{4L} - \frac{a^3}{L^3} \right)}{6EI}$$

where.

L - span of girder

$$a = \frac{L - c}{2}$$

c - wheel base

$$f_{cal} < f_{permissible}$$

15) Check for fatigue strength

16) Design of connections with column.

