CHAPTER 09

Gantry Girder

9.1 Gantry girder and their use

- Gantry cranes are overhead travelling cranes which transport or rather shift heavy machinery, equipments and other heavy jobs from one place to another in an industrial installation.
- These gantry cranes may either be **manually operated overhead travelling crane (MOT)** or the **electrically operated overhead travelling crane (EOT)**. Fig. 9.1 shows a typical gantry girder with its accessories.

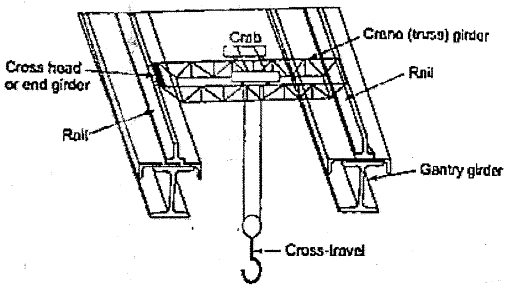


Fig. 9.1 A typical arrangement of gantry girder

- A crane consists of a bridge made up of two parallel trusses. This bridge is called as **crane bridge, crane girder** or the **crab girder** which spans across the bay of the shop/industrial installation and moves longitudinally.
- This longitudinal movement is assisted by the provision of wheels in the crane girder. These wheels roll on rails which are placed centrally on the gantry girder. These gantry girders are laterally unsupported and are thus designed as laterally unsupported beams.

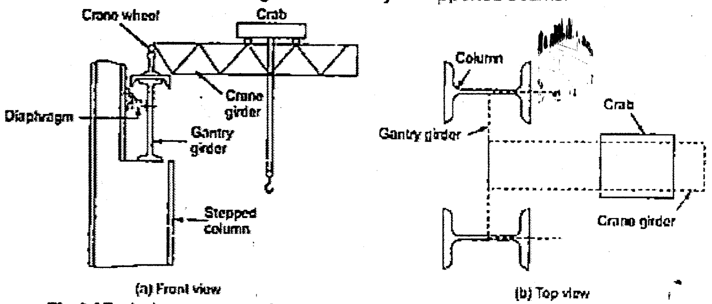


Fig. 9.2 Typical arrangement of crane girder, gantry girder and the supporting column

- The equipment, machinery etc. are lifted from a hook suspended from a trolley that rolls on the crane girder and is controlled by a personnel with in the trolley. Thus the trolley moves on the crane girder along the transverse direction of industrial installation (i.e. along the crane girder) and crane girder itself moves along the longitudinal direction of industrial installation.

Remember: The two movements i.e. the longitudinal and the transverse movement of the gantry and crane girder respectively cannot be made simultaneously.

- As shown in Fig. 9.2 gantry girders are placed at a distance from the face of the supporting column for the required necessary clearances. Thus the gantry girders are either supported on brackets connected to the columns or are place on a stepped column. In order to nullify the effect of lateral loads on gantry girder, diaphragm is provided as shown in Fig. 9.2.

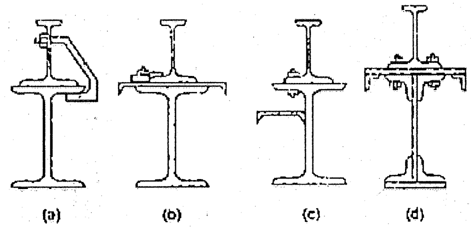


Fig. 9.3 Some typical gantry sections

9.2 Loads for Gantry Girders

In general gantry girders are laterally unsupported beam except at the column locations.

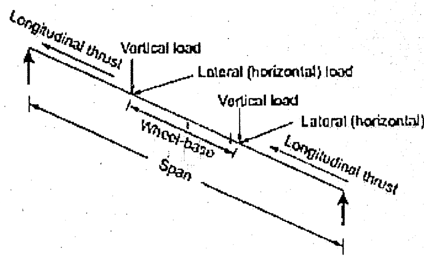


Fig. 9.4 Loads acting on a girder

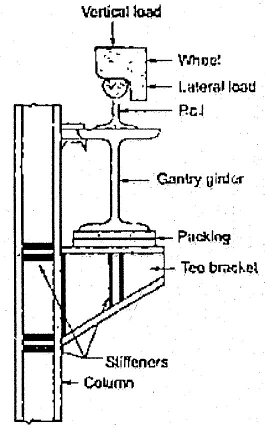


Fig. 9.5 Loads acting on gantry girder supporting light crane

Fig. 9.4 shows the various forces that act on a girder and are summarized below:

(a) Crane girder reaction acting vertically downwards.
(b) Longitudinal thrust due to starting and stopping of the crane acting in the longitudinal direction.
(c) Lateral thrust due to starting and stopping of the crab acting horizontally.

9.2.1 Vertical Loads

- Reaction from the crane girder composing of self-weight of the crane, self-weight of crab and the crane capacity constitute vertical load on the gantry girder.
- The wheels attached to the crane girder transfer this vertical load to the gantry girder.
- Thus design reaction is computed from the maximum crane wheel load and it occurs when the crane is nearest to the gantry girder. Self-weight of the rail also constitute the vertical load.

9.2.2 Lateral Loads / Surge Loads

Lateral loads on crane girders are caused due to the following:

(a) Sudden stopping of the crab and the load when traversing the carb girder.

(b) Crab transferring weights across the shop floor.

The lateral load is assumed to act in the plane of center of gravity of the upper flange. Now this lateral force has a lever arm that produces torque which is quite small and can be neglected safely. It is assumed that tensile flange of the gantry girder does not offer any resistance to the lateral loads.

9.2.3 Longitudinal Loads / Drag Loads

- Starting and stopping of the crane girders produce longitudinal forces on the gantry girders.
- This thrust is produced along the rails.
- Maximum longitudinal force acts when electrically operated crane applies brakes suddenly.
- The frictional resistance developed due to locked wheels is supplied by the rails and in turn gets distributed to the crane columns.

Remember: Lateral and longitudinal forces act the level of rails and thus gantry girders are also subjected to moments due to these forces.

9.2.4 Impact Loads

- The actual stresses produced in gantry girders are more than that produced by usual gradually applied loads, because additional stresses are set up in the gantry girders due to impact loads like the sudden application of brakes to rapidly moving loaded cranes, acceleration, retardation, vibration, slip of slings (hooks) etc.

Table 9.1 Additional loads to be considered for structures subjected to impact loads

Type of Load	Additional Load
(a) Vertical forces transfomed to the rails	
(i) For electric overhead cranes	25% of maximum static wheel load
(ii) For hand operated cranes	10% of maximum static wheel load
(b) Horizontal forces transferred to the rails:	
(i) For electric overhead cranes	10% of the weight of the crab and the weight lifted on the crane
(ii) For hand operated cranes	5% of the weight of the crab and the weight on the crane
(c) Horizontal forces along the rails	5% of the static wheel load

- Thus steel sections which carry quick moving cranes must be heavier than the sections carrying slow moving cranes.
- In quick moving EOT cranes, flexural stresses are increased rapidly from zero to maximum value as the crane moves from support to the center.
- Thus, suitable impact factors are introduced. **IS 875 (Part-II):1987 gives additional loads to be** taken into account for structures subjected to impact loads.

9.2.5 Fatigue Loads

- Moving loads on gantry girders cause fatigue : **Cl. 13.6 of IS 800:2007 enumerates the necessity of fatigue assessment. Accordingly the fatigue assessment is not required to be done unless the** structure is subjected to following loads:

(a) Oscillating loading induced due to crowd for a large number of cycles in life.

(b) Stresses induced due to vibrating machines.

(c) Stresses induced due to wind loading (oscillations) for a large number of cycles in life.

(d) Members that support lifting and/or the rolling loads.

For light and medium duty cranes, fatigue need not to be checked if normal design stress and the shear design stress follows the relation,

$$f \le \frac{27}{\gamma_{mft}} \quad \text{...(9.1)}$$

or if the actual number of stress cycles,

$$N_{sc} < 5\times10^6\left(\frac{27}{\gamma_{mft}\gamma_{mf}}\right)^3 \quad \text{...(9.2)}$$

where γ_{mft} = Partial factor of safety for strength as per **Table 25 of IS 800:2007**

γ_m = Partial factor of safety for material = 1.1

f = Actual fatigue stress range

However for heavy duty cranes, the gantry girder must be checked for fatigue. The fatigue strength of standard details for the normal or shear stress range is given by,

For normal stress range

$$f_f = f_{fn}\sqrt[3]{\frac{5\times10^6}{N_{sc}}} \quad \forall N_{sc} \le 5\times10^6 \quad \text{...(9.3)}$$

$$f_f = f_{fn}\sqrt[5]{\frac{5\times10^6}{N_{sc}}} \quad \forall\ 5\times10^6 \le N_{sc} \le 1\times10^8 \quad \text{...(9.4)}$$

Shear stress range

$$\tau_f = \tau_{fn}\sqrt[5]{\frac{5\times10^6}{N_{sc}}} \quad \text{...(9.5)}$$

where f_f, τ_f = Design normal and shear fatigue stress range of the details respectively for a life cycle of N_{sc}

f_{fn}, τ_{fn} = Normal and shear fatigue strength of the details for 5×10^6 cycles for the detail category

Remember: Computation for fatigue strength should be made at service loads with a load factor of 1.0.

9.3 Specification for Gantry Girders

- Gantry girders are subjected to vertical loads along with horizontal thrust/loads simultaneously.
- Thus the allowable stresses are enhanced by 10% but this enhancement in allowable stresses is not in addition to that allowed for erection loads with or without wind or seismic forces.

Of the two horizontal forces as specified in Table 9.1 only one is considered to act at a time along with the vertical load.

Table 9.2 Vertical Deflection Limits for Gantry Girders

S.No.	Crane Type	Permissible Deflection
1.	Manually operated cranes	$L/500$
2.	Electrically operated cranes of capacity up to 500 kN	$L/750$
3.	Electrically operated cranes of capacity exceeding 500 kN	$L/1000$
4.	Other moving loads like the charging cars etc.	$L/600$

L = Span of the gantry girder

9.4 Procedure for the Design of Gantry Girders

- In case of rolled sections subjected to lateral loads, the suitable section is arrived at by trial and error procedure.
- However in the design of gantry girders, the lateral load is assumed to be resisted entirely by the compression flange provided the lateral load is applied at the level of compression flange.

Do You Know

Why it is assumed that lateral load on gantry girder at the level of compression flange is assumed to be resisted entirely by the compression flange?

This is so because if tension flange is to resist the lateral load applied at the level of compression flange then the tension flange must be pushed sideways by the web. But the lateral stiffness of the web is very small when compared to lateral stiffness of compression flange. Thus the resistance from the tension flange is ignored altogether.

- In order to arrive at a suitable gantry section which can safely resist the combination of vertical and lateral/longitudinal loads, several trial sections may have to be checked which in turn increases the time and effort. To overcome this, the section is first checked for vertical loads assuming it to be laterally supported. If the said girder section is safe in bending (due to vertical loads) then other checks for bending strength as laterally unsupported beam and combinations of loads are applied.

The following steps are followed for the design of gantry girders:

Step-1. Assessment of design wheel load.

The most severe case of loading occurs when the crane and its load are drawn near to the column i.e., when the crab is closest to the gantry girder. This distance is the minimum distance of the crane hook from the gantry girder. This position of crab gives maximum reaction on the gantry girder. The vertical reaction of the crane girder is transmitted through its two steel wheels on to the gantry girder and this gives the maximum wheel load equal to half of this reaction. This maximum wheel load has to be further increased for impact consideration as given in Table 9.1.

Step-2. Determination of maximum flexural moment due to vertical loads.

Step-3. Determination of maximum shear force.

Determine the maximum shear force due to the wheel loads and dead loads from the gantry and the rails. When only one crane is running on the girder then shear force on the gantry is the maximum when one of the wheel loads is at the support.

Step-4. Determination of lateral forces acting on the girder and corresponding maximum BM and SF.

Step-5. Determination of required plastic section modulus.

After having determined the maximum bending moment, determine the plastic section modulus required as:

$$M_p = Z_p f_y \qquad \text{...(9.6)}$$

where $\quad Z_p = A\bar{y}$,

Now since the gantry girders are laterally unsupported and thus a trial section can be taken as 40 to 50% in excess of M_u/f_y

In gantry girders, generally an I-section with channel section at the top (i.e. on the compression flange) is provided. The economical depth of gantry girder is not less than 1/12[th] of the span and the width should be between 1/40 to 1/50 of the span in order to ensure that excessive lateral deflection is not there.

Based on above, select a suitable section from IS Handbook No. 1.

Step-6. Classification of section.

In general the girder section should be plastic i.e. both the flanges and the web should be plastic.

Step-7. Determination of moment capacity of the girder.

In the event when lateral support is provided throughout the compression flange level of the gantry girder (by providing catwalk etc.), the trial section must be checked for the moment capacity which must exceed the maximum bending moment coming on the girder. This check is made as per the following expression.

$$M_{dz} = Z_{pz}\frac{f_y}{\gamma_{m0}} \le 1.2\frac{Z_{ez}f_y}{\gamma_{m0}} \qquad \text{...(9.7)}$$

Apart from that, the top flange should also be checked for bending about both the axes by using the following interaction expression.

$$\frac{M_z}{M_{dz}} + \frac{M_{y,f}}{M_{dy,f}} \le 1 \qquad \text{...(9.8)}$$

where $\quad M_z$ = Maximum bending moment about strong axis i.e. about z-z axis

$M_{y,f}$ = Maximum moment about y-y axis due to lateral load

M_{dz} = Design bending strength of the section about z-z axis

$M_{dy,f}$ = Design bending strength of the compression flange about y-y axis

Step-8. Check for buckling resistance of the girder.

Compute the elastic critical moment from the following expression which is valid only for I-section beams.

$$M_{cr} = c_1\frac{\pi^2 EI_y h_f}{2L_{LT}^2}\sqrt{\left[1+\frac{1}{20}\left(\frac{KL/r_y}{h_f/t_f}\right)^2\right]} \qquad \text{...(9.9)}$$

The design bending strength of the section is determined as,

$$M_{dz} = \beta_b Z_{pz} f_{bd} > M_z \qquad \text{...(9.10)}$$

This section is then checked for biaxial bending from the following expression.

$$\frac{M_z}{M_{dz}} + \frac{M_y}{M_{dy}} \leq 1 \quad \text{...(9.11)}$$

Step-9. Check the shear capacity of the section.

Compute the shear capacity of the section as:

$$\text{Shear capacity} = \frac{A_v f_{yw}}{\sqrt{3}\,\gamma_{m0}} > \text{Maximum shear force} \quad \text{...(9.12)}$$

Step-10. Check for buckling of the web.

Check the buckling resistance of the web as,

$$\text{Buckling resistance} = (b_1 + 2n_1)t_w f_{cd} > \text{Maximum wheel load} \quad \text{...(9.13)}$$

where b_1 = Wheel diameter

n_1 = Dispersion length under the wheel with angle of dispersion being assumed as 45°

Step-11. Check for bearing stiffeners.

Check the girder section for bearing stiffeners and provide the same if required.

Step-12. Connection design.

Design the rivets/bolts or the welds that connects the channel section to the I-section.

Step-13. Deflection check.

Check the deflection of the gantry girder under service loads at a position where the center of gravity of wheel loads coincides with the mid-span. This deflection is given by,

$$\delta_{cd} = WL^3 \frac{\left(\frac{3a}{4L} - \frac{a^3}{L^3}\right)}{6EI}, \quad \text{where } L = \text{Span of the girder} \quad \text{...(9.14)}$$

$$a = \frac{L - c}{2}, \quad c = \text{Wheel base}$$

The calculated deflection must be less than the permissible deflection as given in Table 9.2.

Step-14. Check the girder for fatigue strength as per **Section 9.2.5.**

Step-15. Design the suitable bracket if required.

Design the bracket and its connection with the column. For bolted connections, no slip bolts are preferred. A pair of bracket plates, one on each flange of the I-section column connected with a diaphragm is provided to make the seat for the gantry girder.

Example 9.1 A trend overhead crane is to be designed for the following data:

Crane capacity = 52 kN

Spacing of columns is longitudinal direction = 5.8 m

C/C distance of gantry girder = 10 m

Wheel base = 3 m

Edge distance = 1

Self weight of crane girder = 45 kN/m

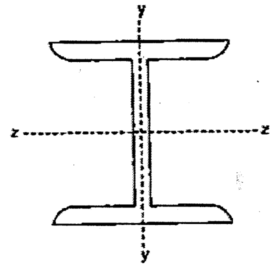
Weight of trolley = 11 kN

USE Fe 410.

Solution:

Try ISMB 400 @ 61.6 kg/m as a trial section

Properties of ISMB 400 are as given below:



Overall depth,	D = 400 mm
Sectional areas,	A = 7846 mm²
Flange width,	b_f = 140 mm
Flange thickness,	t_f = 16 mm
Web thickness,	t_w = 8.9 mm
Web depth,	d = 334.4 mm
Moment of inertia,	I_{zz} = 20458.4 × 10⁴ mm⁴
	I_{yy} = 422.1 × 10⁴ mm⁴
Radii of gyration,	r_{zz} = 161.5 mm
	r_{yy} = 28.2 mm
Section modulus,	Z_{zz} = 1022.9 × 10³ mm³ } Elastic modulus
	Z_{yy} = 88.9 × 10³ mm³ } Elastic modulus
	Z_p = 1176.18 × 10³ mm³
	Shape factor = 1.15

Section Classification

Flange $\quad \frac{b_f}{t_f} = \left(\frac{b_f/2}{t_f}\right)\frac{70}{16} = 4.375 < 9.4\,\epsilon \quad$ where $\epsilon = \sqrt{\frac{250}{f_y}} = \sqrt{\frac{250}{250}} = 1$

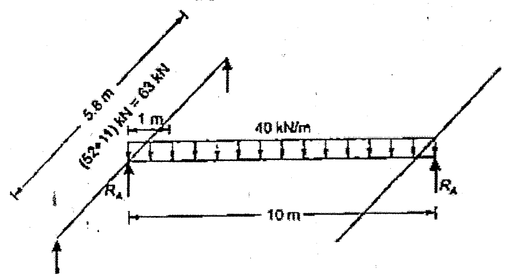
Web, $\quad \frac{d}{t_w} = \frac{334.4}{8.9} = 37.573 < 83.9\,\epsilon = 83.9$

Thus section is plastic.

Shear Capacity

Design shear strength of the section

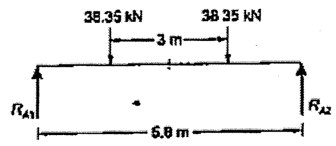
$$f_{dw} = \frac{f_{yw} A_v}{\sqrt{3}\,\gamma_{m0}} = \frac{250 \times (400 \times 8.9)}{\sqrt{3} \times 1.1} \text{ N} = 467.13 \text{ kN}$$



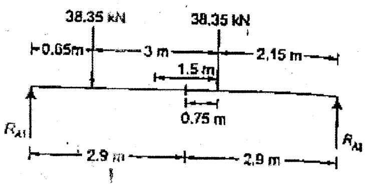
$$R_A = \frac{40}{2} + \frac{63 \times 9}{10} = 76.7 \text{ kN}$$

This section will be carried equally by the two wheels of crane

$$= \frac{76.7}{2} = 38.35 \text{ kN}$$



For rolling point load, maximum BM will be obtained when centre of span bisects the CG of load group and the point load under consideration.



$\therefore \quad R_{A2}(5.8) = 38.35(0.65) + 38.35(3.65)$

$\Rightarrow \quad R_{A2} = 28.43\text{ kN}$

$\therefore \quad R_{A1} = 38.35 + 38.35 - R_{A1}$

$= 48.27\text{ kN}$

$\therefore \quad \text{Maximum BM} = R_{A2}(2.15) = 28.43\,(2.15)$

$= 61.12\text{ kNm}$

Increase this moment by 10% for impact.

$\therefore \quad M = 1.1 \times 61.12 = 67.132\text{ kNm}$

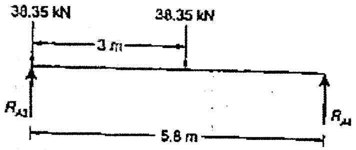
Let self weight of gantry girder and rail = 1.2 kNm

$\therefore$ Maximum BM due to self weight of gantry girder and rail

$$= 1.2 \times \frac{5.8^2}{8} = 5.046\text{ kNm}$$

$\therefore \quad \text{Total BM} = 67.232 + 5.046$

$= 72.278\text{ kNm}$



For maximum SF, the arrangement of rolling point loads is as shown.

$$\therefore \quad R_{A3} = \frac{38.35(2.8) + 38.35(5.8)}{5.8} = 56.86\text{ kN}$$

$\therefore \quad R_{A4} = 38.35 + 38.35 - 56.86 = 19.84\text{ kN}$

$\therefore \quad \text{Max. SF} = 56.86\text{ kN}$

Thus max. SF (= 56.86 kN) $\gg$ Design shear strength of section (ϕ_{dw} = 467.13 kN) (OK)

Torsional Buckling Check

$$\frac{t_f}{t_w} = \frac{16}{8.9} = 1.798 < 2$$

For plastic section, $\beta_{LT} = 1.2$

$$\therefore \text{ Elastic critical moment, } M_{cr} = \frac{\beta_{LT}\pi^2 DEI_y}{2(KL)^2}\left[1 + \frac{1}{20}\left\{\frac{\frac{KL}{r_y}}{\frac{D}{t_f}}\right\}^2\right]^{1/2}$$

$$= \frac{1.2\pi^2(400) \times 2 \times 10^5 (422.1 \times 10^4)}{2 \times (5800)^2}\left[1 + \frac{1}{20}\left(\frac{28.2}{400/16}\right)^2\right]^{1/2}$$

$$\lambda_{LT} = \sqrt{\frac{\beta_b Z_p f_y}{M_{cr}}}$$ Where $\beta_b = 1$ or plastic section

$$= \sqrt{\frac{1 \times 1176.18 \times 10^3 \times 250}{124.46 \times 10^6}} = 1.537$$

$$\therefore \quad \chi_{LT} = \frac{1}{\phi_{LT}\left[\phi_{LT}^2 - \lambda_{LT}^2\right]^{1/2}} \qquad \text{Where } \phi_{LT} = 0.5\left[1 + \alpha_{LT}(\lambda_{LT} - 0.2) + \lambda_{LT}^2\right]$$

$$= 0.5\left(1 + 0.21(1.537 - 0.2) + 1.537^2\right) = 1.822$$

$$= \frac{1}{1.822\left[1.822^2 - 1.537^2\right]^{1/2}} = 0.36$$

$$\therefore \text{ Design stress, } \quad f_{bd} = \frac{\chi_{LT} f_y}{\gamma_{m0}} = \frac{0.36 \times 250}{1.1} = 81.82\text{ N/mm}^2$$

$\therefore$ Moment capacity, $\quad M_d = \beta_b Z_p f_{bd} = 1 \times 1176.18 \times 10^3 \times 81.82\text{ Nmm} = 96.23\text{ kNm}$

Lateral loads

Lateral loads are taken as 2.5% of crane capacity + self weight of trolley

$$= (52 + 11)\frac{2.5}{100} = 1.575\text{ kN}$$

$$\therefore \quad \text{Lateral load per wheel} = \frac{1.575}{2} = 0.7875\text{ kN}$$

$\therefore$ Max. BM due to lateral load by proportionally

$$= \frac{61.12}{38.35} \times 0.7875 = 1.255\text{ kNm}$$

Factored longitudinal moment = $1.5 \times 72.278 = 108.42$ kNm

Factored lateral moment = $1.5 \times 1.255 = 1.88$ kNm

Design lateral BM capacity of the section

$$= \frac{\frac{Z_{py} f_y}{\gamma_{m0}} = \left(\frac{Z_{ey}}{1}\right)(\text{shape factor}) f_y}{\gamma_{m0}}$$

$$= \frac{\left(\frac{88.9 \times 10^3}{2}\right)(1.15)250}{1.1}\text{ Nmm} = 11.62\text{ kNm}$$

$$\therefore \left(\frac{M}{M_d}\right)_{\text{longitudinal}} + \left(\frac{M}{M_d}\right)_{\text{lateral}} = \left(\frac{108.42}{97.65}\right) + \left(\frac{1.88}{11.62}\right) = 1.27 > 1$$ (Unsafe)

Thus section needs to be modified.

Try ISMB 500 @ 86.9 kg/m. Section proportions are as given below:

Overall depth,	$D = 500$ mm
Sectional area,	$A = 110.74 \times 100\text{ mm}^2$
Flange width,	$b_f = 180$ mm
Flange thickness,	$t_f = 17.2$ mm
Web thickness,	$t_w = 10.2$ mm
Web depth,	$d = 424.1$ mm
Moment of inertia,	$I_{zz} = 45218.3 \times 10^4\text{ mm}^4$
	$I_{yy} = 1369.8 \times 10^4\text{ mm}^4$

Radii of gyration, $r_{zz} = 202.1$ mm

$r_{yy} = 35.2$ mm

Section modulus, $Z_{zz} = 1808.7 \times 10^3$ mm³

$Z_{yy} = 152.2 \times 10^3$ mm³ } Elastic modulus

$Z_p = 2074.67 \times 10^3$ mm³

Shape factor = 1.1471

Section classification

Flange $$\frac{b}{t_f} = \left(\frac{b_f/2}{t_f}\right) = \frac{(180/2)}{17.2} = 5.23 < 9.4\epsilon$$

Web $$\frac{d}{t_w} = \frac{424.1}{10.2} = 41.58 < 83.9\epsilon$$

Thus section is plastic.

Shear capacity

Design shear capcity of the section

$$F_{dw} = \frac{f_{yw}A_v}{\sqrt{3}\gamma_{m0}} = \frac{250 \times (500 \times 10.2)}{\sqrt{3} \times 1.1} \text{ N} = 669.2 \text{ kN}$$

$\gg$ Max. SF (= 56.86 kN) (OK)

Torsional buckling check

$$\frac{t_f}{t_w} = \frac{17.2}{10.2} = 1.686 < 2$$

For plastic section, $\beta_{LT} = 1.2$

$\therefore$ Elastic critical moment, $$M_{cr} = \frac{\beta_{LT}\pi^2 DEI_y}{2(KL)^2}\left[1 + \frac{1}{20}\left(\frac{KL/r_y}{D/t_f}\right)^2\right]^{1/2}$$

$$= \frac{1.2\pi^2(500) \times 2 \times 10^5 \times (1369.8 \times 10^4)}{2(5800)^2}\left[1 + \frac{1}{20}\left(\frac{5800/35.2}{500/17.2}\right)^2\right]^{1/2}$$

$= 389.23$ kNm

$$\lambda_{LT} = \sqrt{\frac{\beta_b Z_p f_y}{M_{cr}}} = \sqrt{\frac{1 \times 2074.67 \times 10^3 \times 250}{389.29 \times 10^6}} = 1.154$$

$\therefore$ $\phi_{LT} = 0.5[1 + 0.21(1.154 - 0.2) + 1.154^2]$

> 1.266

$\therefore$ $$\chi_{LT} = \frac{1}{1.266 + (1.266^2 - 1.154^2)^{1/2}} = 0.56$$

$\therefore$ Design stress $$f_{bd} = \frac{\chi_{LT} f_y}{\gamma_{m0}} = \frac{0.56 \times 250}{1.1} = 127.27 \text{ N/mm}^2$$

$\therefore$ Moment capacity, $M_d = \beta_b Z_p f_{bd} = 1 \times 2074.67 \times 10^3 \times 127.27$ Nmm = 264 kNm

Design lateral BM capacity of section

$$= \frac{Z_{py} f_y}{\gamma_{m0}} = \frac{\frac{Z_{ey}}{2}(\text{shape factor}) f_y}{\gamma_{m0}} = \frac{\left(\frac{152.2 \times 10^3}{2}\right)(1.1471)250}{1.1} \text{ Nmm} = 19.84 \text{ kNm}$$

$$\therefore \left(\frac{M}{M_d}\right)_{longitudinal} + \left(\frac{M}{M_d}\right)_{lateral} = \left(\frac{108.42}{264}\right) + \left(\frac{1.88}{19.84}\right) = 0.411 + 0.095 = 0.506 < 1 \quad \text{(OK)}$$

Thus provide ISMB 500 as section gantry girder.

Objective Brain Teasers

Q.1 The deflection in gantry girder should not exceed ______ when they carry moving loads.
(a) L/600 (b) L/500
(c) L/250 (d) L/800

Q.2 A crane girder spans in between:
(a) adjacent columns
(b) bottom chord members of adjacent roof truss
(c) opposite columns across the workshop
(d) Purlins of the roof truss

Q.3 Gantry girders are designed for the following types of loads:
(i) Gravity loads (ii) Lateral loads
(iii) Wind loads (iv) Longitudinal loads
The correct one(s) is (are):
(a) (i) and (iii) (b) (i), (ii) and (iii)
(c) (ii) and (iv) (d) (i), (ii) and (iv)

Q.4 Gantry girders are designed as:
(i) Laterally unsupported beam
(ii) Laterally supported beam
(iii) most severe combination of vertical loads and either of lateral and longitudinal loads
The correct statements of the above are:
(a) (ii) and (iii) (b) (i) and (iii)
(c) (i) only (d) Data insufficient

Q.5 For manually operated cranes, the maximum permissible deflection in gantry girder is:
(a) Span/250 (b) Span/600
(c) Span/500 (d) Span/300

Q.6 Lateral load acting at the level of compression flange of gantry girder is resisted by
(a) Tension flange (b) Compression flange
(c) Web (d) All of the above

Q.7 Allowable stresses in gantry girder is
(a) reduced by 10%
(b) enhanced by 10%
(c) not changed
(d) dependent on type of gantry girder

Answers

1. (a) 2. (c) 3. (d) 4. (b) 5. (c)
6. (b) 7. (b)

Conventional Practice Questions

Q.1 Desgin a gantry girder for an EOT crane to be used in an industrial building with the following data:

Crane capacity	= 125 kN
Crab weight	= 30 kN
Weight of the crane	= 155 kN
Min. clearance of crane hook and gantry girder	= 1 m
Wheel base	= 3 m
C/C distance between gantries	= 20 m
C/C distance between gantry columns	= 7 m

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