Introduction

A plate girder is an I-beam built up from plates using bolting or welding.
(a) bolted without cover plates  (b) bolted with cover plates  (c) welded girder
(d) box girder

(e) girder with side plates
Step-1 : Loading

Assume self weight of girder

\[ \frac{\text{Total factored load}}{200} \text{ kN/m} \]

total u.d.l.,

\[ w = \text{u.d.l. (D.L. + L.L.)} + \text{Self weight of girder} \]

Step - 2 : S.F. and B.M. calculations

Step - 3 : Section Selection

determine the optimum depth of girder by relation,

\[ d = \left( \frac{M_k}{f_y} \right)^{0.33} \]

\[ k = \frac{d}{t_w} \]

For \( \frac{d}{t_w} \leq 67 \varepsilon \) .... no end stiffner &

intermediate transverse stiffners are required.

For \( \frac{d}{t_w} \geq 100 \varepsilon \) .... intermediate transverse

stiffners are not required. Only end stiffners are

required.
Area of flange required,

\[ A_f = \frac{M}{f_y \times d} \cdot \gamma_{mo} \]

For flange to be plastic, for welded section

\[ \frac{b}{t_f} = 8.4 \varepsilon \] (Table - 2, code P.18)

Step - 4 : Check for minimum web thickness requirements

As per IS : 800 - 2007, cl. 8.6.1.1, P. 63
Step - 5 : Check for moment capacity

\[ M_d = \frac{\beta_b \cdot Z_p \cdot f_y}{\gamma_m o} \]

\( \beta_b = 1 \) for plastic and semicompact sections

\( Z_p = \) plastic section modulus of flanges only

\( = \) B.M. of flanges at equal area axis (z-z axis)

\( M_d \) should be greater than factored moment \( M \).

Step - 6 : Check for shear capacity of web

\[ V_d = \frac{A_v \cdot f_{yw}}{\sqrt{3} \cdot \gamma_m o} \]

\( 0.6 \ V_d \geq V \) must be satisfied.

Step - 7 : Check for shear buckling of web using simple post-critical method

\( V_n = V_{cr} \)

(cl. 8.4.2.2 (a))
\[ V_{cr} = A_v \cdot \tau_b \]

If \( V_{cr} > V \) .... Intermediate transverse stiffners are not required

If \( V_{cr} < V \) .... Intermediate transverse stiffners are required to improve the buckling strength of slender web.

Step - 8 : Check for Anchor forces in the end panel : 

This check is required when intermediate transverse stiffners are provided.

Step - 9 : Design of end bearing stiffner

Step - 10 : Design of intermediate transverse stiffners, if required.

Step - 11 : Design of connection between web plate and flange

Step - 12 : Design of connection between stiffners and web.