2·5. Proportioning of components

The approximate depth of the girder is usually taken as 1/8 to 1/12 of the effective span L.

2·5·1. Depth of Girder

For higher loads— $\frac{L}{12}$

For midium loads— $\frac{L}{10}$

For heavy loads— $\frac{L}{8}$

The economical depth of the girder can be obtained from the expression

$$d = K \sqrt[3]{M/f_b}$$

Where, M = Maximum bending moment

f_b = Maximum bending stress permissible for a laterally supported girder = 1500 kg/cm^2

K = Parameter = 5 for welded girder = 5.5 for rivetted girder.

2·5·2. Width of Girder

The width of the girder should be within the limits of $L/40$ to $L/45$. The maximum width given by this rule may be exceeded provided the flange plates are adequately stiffened.

2·6. Minimum self weight

To obtain the minimum weight of steel in plate girder design, several different depths should be used in a variety of preliminary designs to determine the trend of weight with respect to variations in plate girder depth.

If longitudinal stiffners are used, the web depth-thickness ratio may be increased above 200, but in short span plate girders used in building construction use of longitudinal stiffners introduces considerable complexity in the framing.

If a very long span girder of 30 m or more is required, then the possibility of economy through the use of longitudinal stiffners should be investigated. Such stiffners are commonly used in continuous span highway bridge girders.

The self weight of welded plate girders can be estimated from the expressions

(*i*) $w = 3M/f_b d$, where w = weight in kg/m, M = Bending moment in cm kg, f_b = Allowable bending stress in kg/cm^2, d = Depth of girder in cm.

(*ii*) $w = W/300$ where, W = total superimposed load on the girder in kg, and w = Weight in kg/m.

The weight can also be estimated at within close enough design limits by estimating the weights of flange plates with angles if used and web plates and adding the following percentages for weights of stiffners and other details.

web. The stiffners shall extend from flange to flange and may be joggled over the vertical legs of the flange angles.

2·18. Web Panel Dimensions

In no case shall the greater unsupported clear dimensions of a web panel exceed 270 t_w nor the lesser unsupported clear dimensions of the same panel exceed 180 t_w, where t_w=thickness of the web plate.

2·19. Outstand of the Stiffners

For sections other than flats, the outstand of all stiffners from the web shall not be more than 16 t.

For flats outstand shall not be greater than 12 t.

Where t=thickness of flat or section.

2·20. Bearing Siffner

The function of the bearing stiffner is to transmit concentration of load so as to avoid local bending failure of the flange and local crippling or buckling of the web.

Selection of stiffnerss is usually made on basis of local permissible contact bearing pressures of 1890 kg/cm^2 at the points of bearing contact between the outstanding parts of the bearing stiffners and the flanges.

Welds or rivets shall be used to transfer the total load from the bearing stiffners to the web.

The bearing stiffner together with the web plate shall be designed as a column with an equivalent reduced slenderness ratio.

Effective length=0.7 actual length.

The area of the section which resists compression is the pair of stiffners together with a length of web on each side of the centre line of the stiffners where available = 20 times the web thickness.

The bearing stiffners at the support points should project as nearly as possible to the outer edges of the flanges.

In the case of riveted bearing stiffners filler plates shall be used.

2·21. Longitudinal Stiffners

In addition to the vartical intermediate stiffners, bearing stiffners shall be provided if $t<d/200$, one horizontal stiffner shall be placed on the web at a distance from the compression.

Flange = 2/5 of the distance from the compression flange to the neutral axis when the thickness of the web is

$$< \frac{t_w}{250}$$

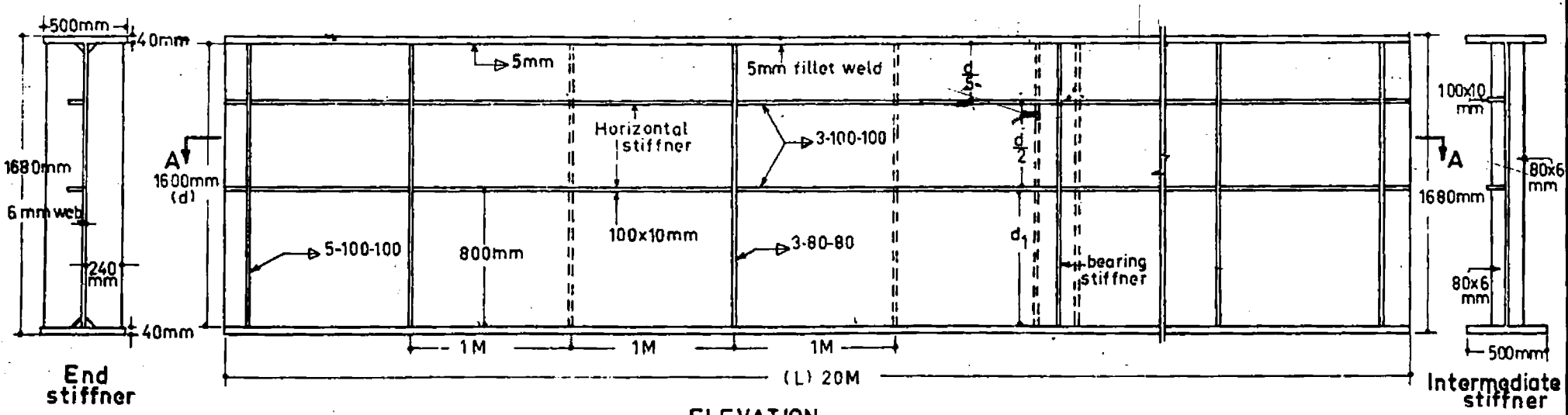
These stiffners shall be designed so that $I \leqslant 4c_1 t^3$

when $d/t > 250$, a second horizontal stiffner shall be placed at neutral axis.

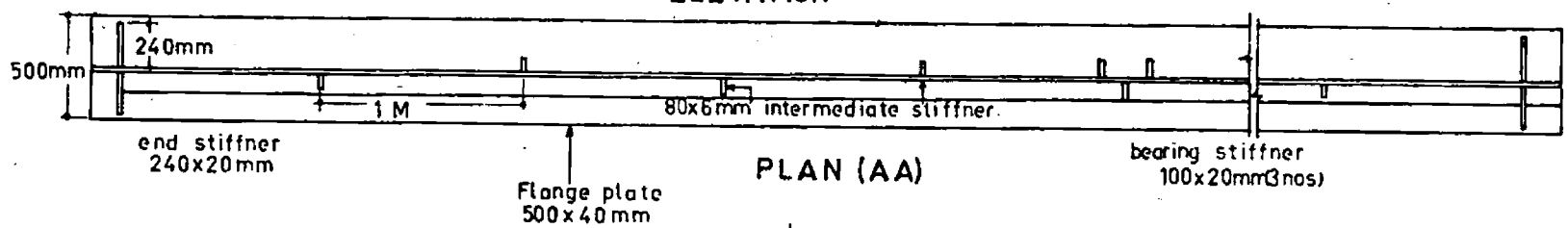
In this case $I \leqslant dt^3$.

Horizontal web stiffners shall extend between vertical stiffners but need not be continuous over them.

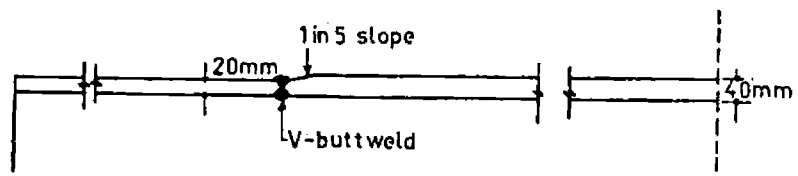
WELDED PLATE GIRDER FOR A MULTI STORY DEPARTMENTAL STORE - 20M SPAN



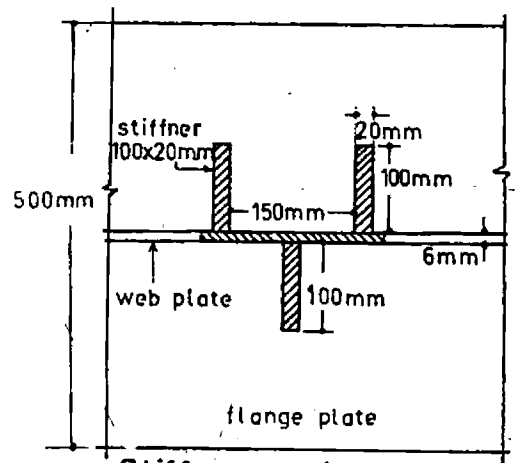
ELEVATION



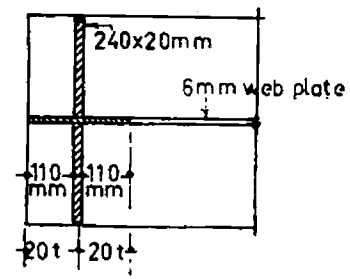
PLAN (AA)



Flange plate curtailment



Stiffner - under concentrated load



End bearing stiffner

For spans greater than 15 m on rigid piers or abutments, bearings which will permit angular deflection of the girder ends shall be provided at one end, there shall be a rocker, roller or other effective type of expansion bearings.

1·12·7. Struts

Effective length of compression member=0·7 L where L= length of strut

For battened struts effective length be increased by 10%.