

DESIGN OF STEEL BRIDGES DESIGN TO THE EUROCODES

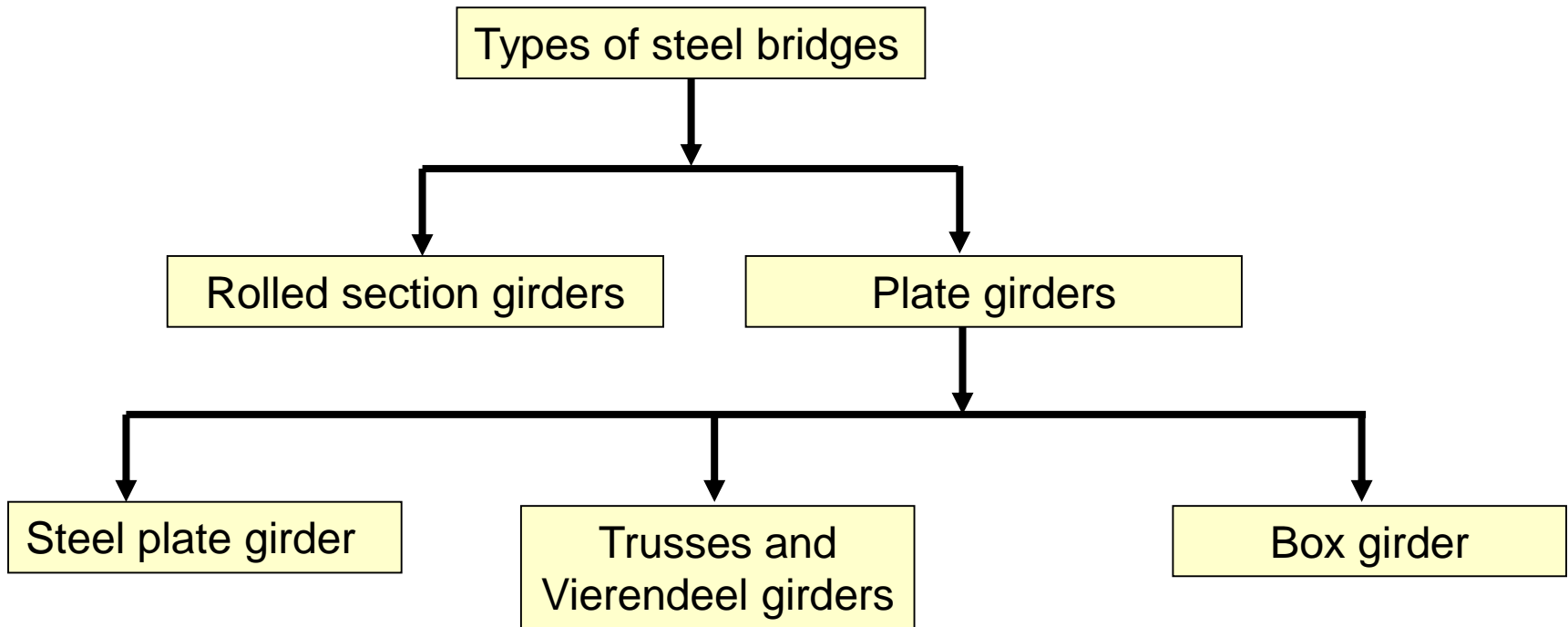


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Shah Alam Selangor.

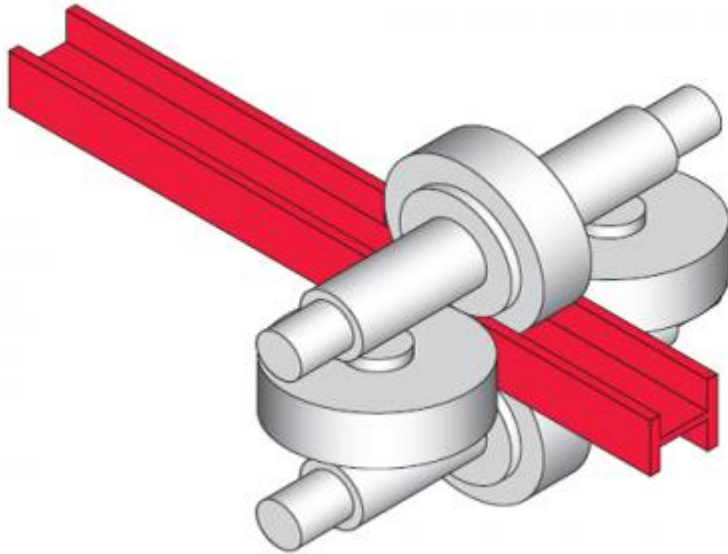
PRESENTATION OUTLINE

- Introduction
- Rolled section girders
- Plate girders
- Girder splices
- Typical plate girder
- Trusses and Vierendeel girders
- Box girders
- Example design of steel bridges.

INTRODUCTION

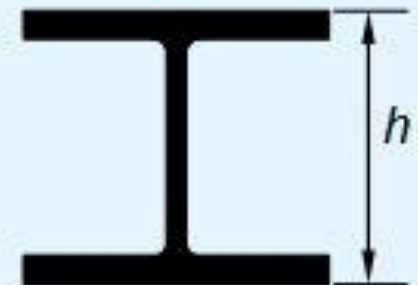


ROLLED SECTION GIRDERS



UKB
 $127 \text{ mm} < h < 1036 \text{ mm}$

I, H and channel sections



UKC
 $152 \text{ mm} < h < 475 \text{ mm}$

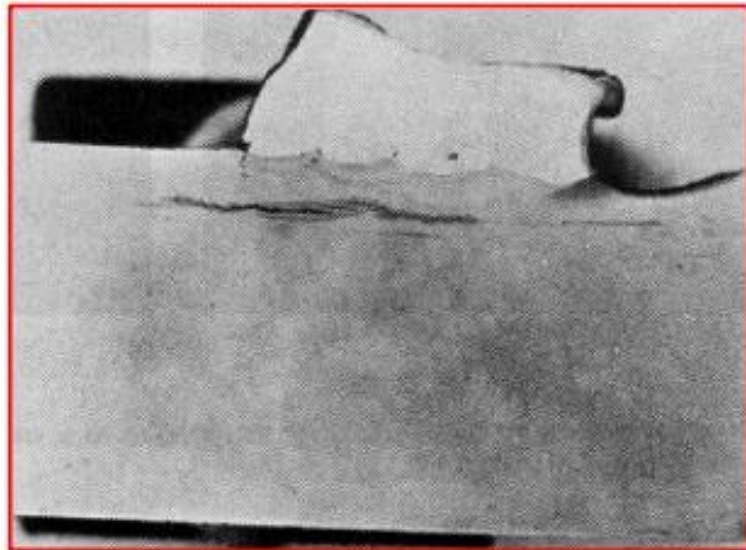
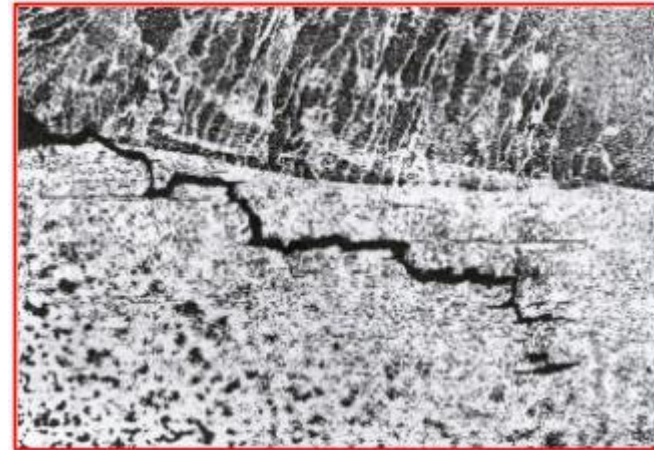
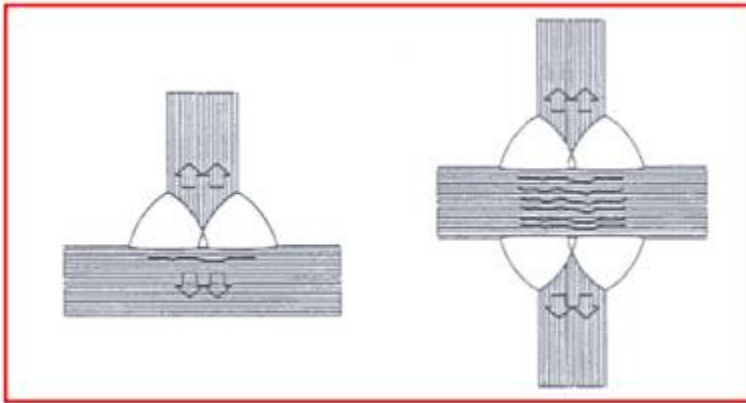
ROLLED SECTION GIRDERS



ROLLED SECTION GIRDERS



ROLLED SECTION GIRDERS



Lamella tearing

ROLLED SECTION GIRDERS



PLATE GIRDERS

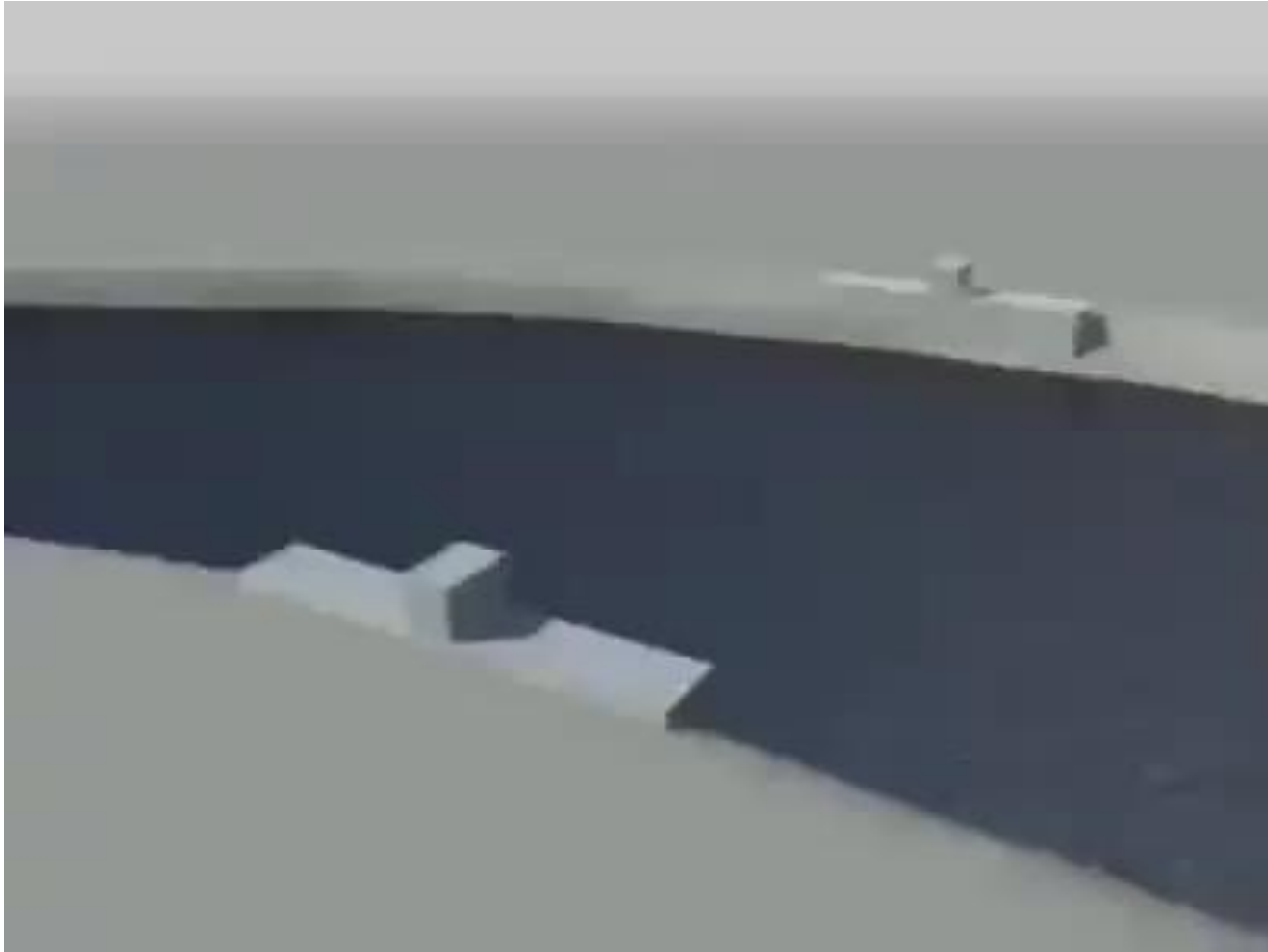


PLATE GIRDERS

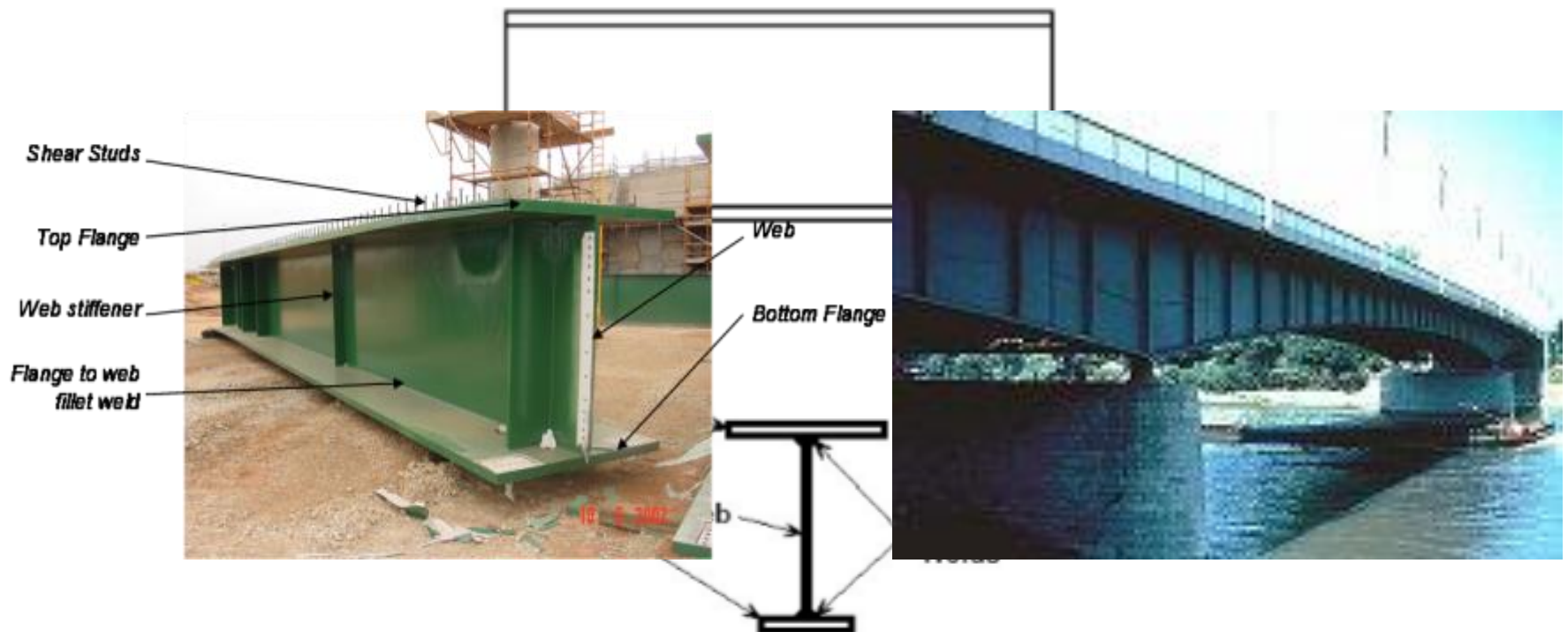


Figure 1: Plate girder overview

PLATE GIRDERS

PROPORTIONS

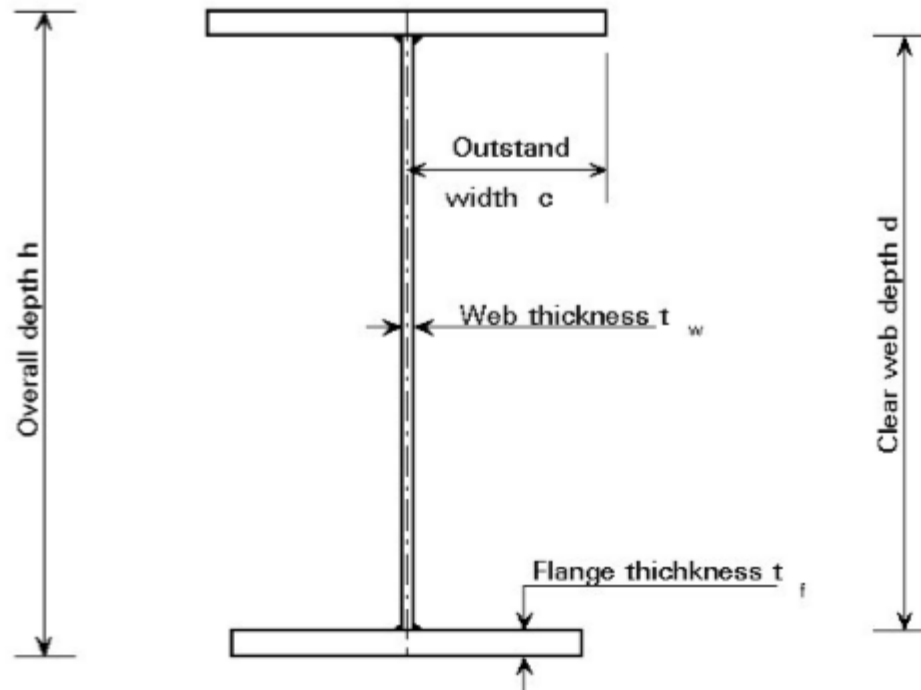
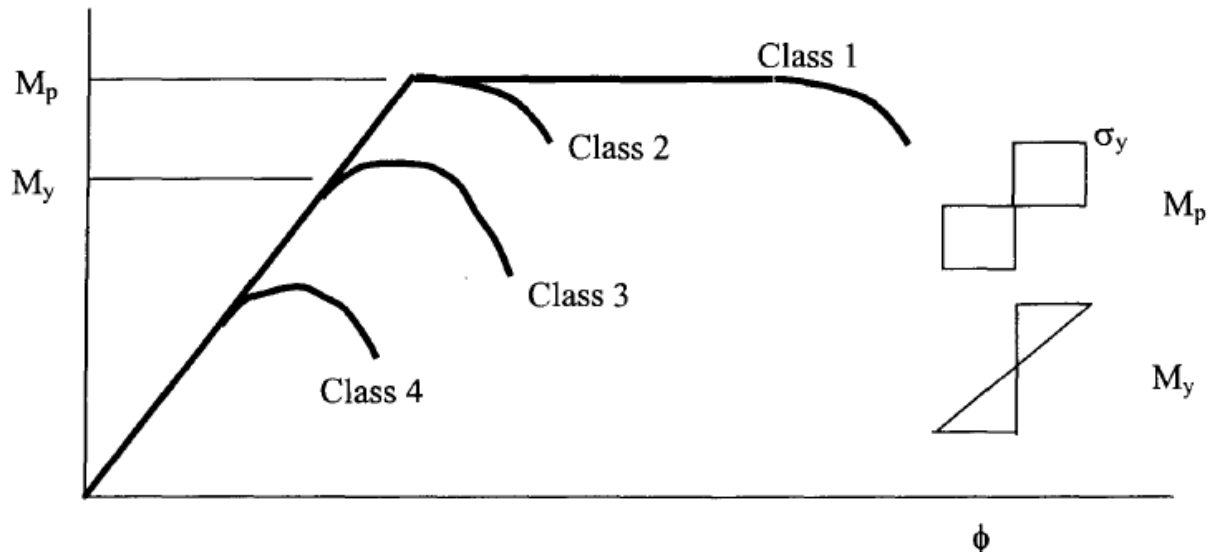


PLATE GIRDERS

PROPORTIONS



**Moment rotation behaviour of girders
with different classes of cross section.**

Figure: Classification of cross-section

PLATE GIRDERS

TABLE 4 - Compression outstand limit to flanges (BS EN 1993-1-1 Clause 5.5.2)

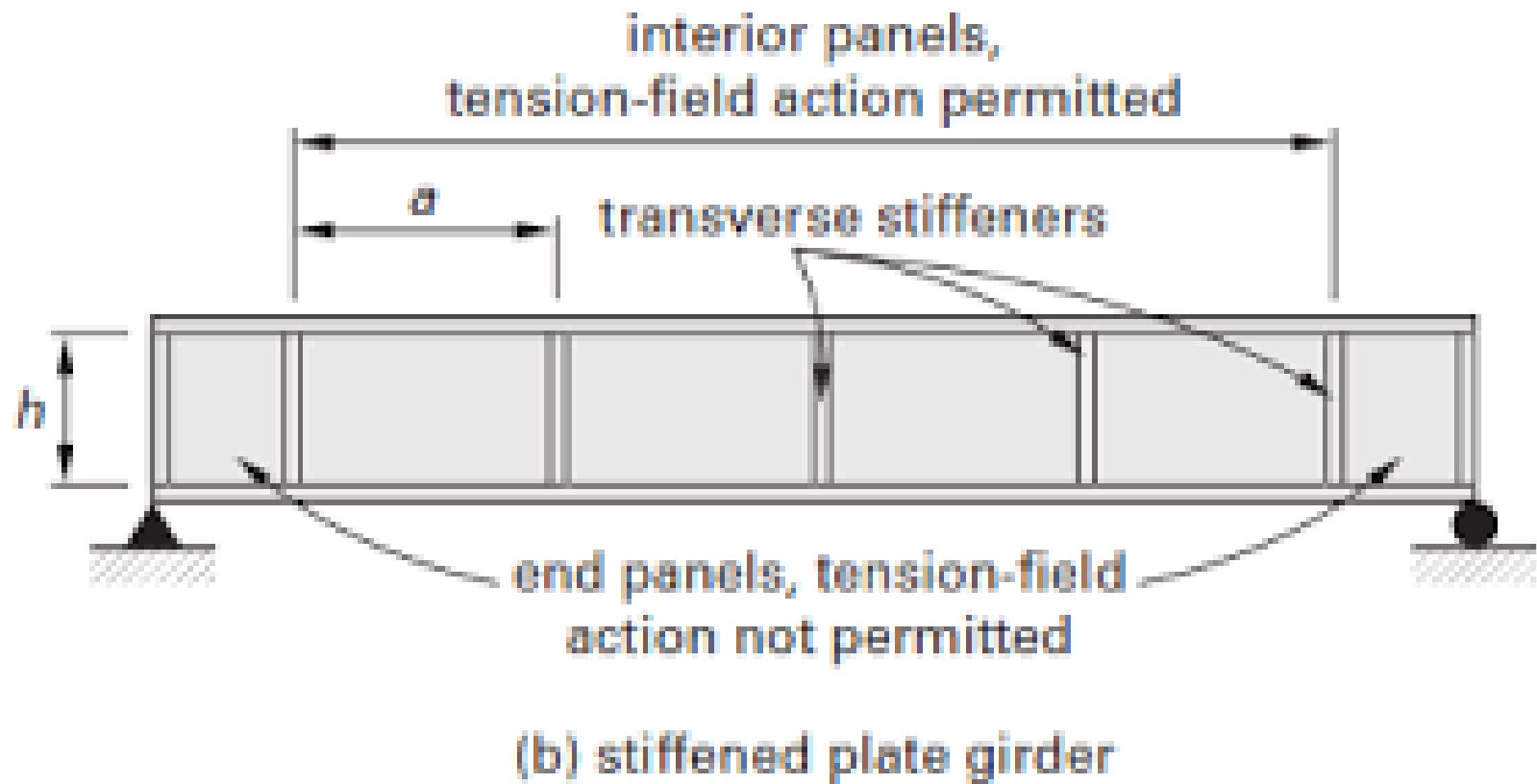
Strength Grade		Flange Thickness (mm)												
		15	20	25	30	35	40	45	50	55	60	65	70	75
S275	Outstand limit (mm)	193	258	322	386	451	515	580	644	708	773	837	902	966
	Typical flange width (mm)	400	500	650	750	900	1050	1150	1300	1400	1550	1650	1800	1950
S355	Outstand limit (mm)	170	227	284	340	397	454	510	567	624	680	737	794	851
	Typical flange width (mm)	350	450	550	700	800	900	1000	1150	1250	1350	1450	1600	1700
S460	Outstand limit (mm)	149	199	249	298	348	398	447	497	547	596	646	696	746
	Typical flange width (mm)	300	400	500	600	700	800	900	1000	1100	1200	1300	1400	1500

Notes:

The above limits are based on 14ϵ times the thickness, where the value of ϵ is based on the yield strength of products up to 16 mm thick. Slightly higher limits would apply if the lower strength of thicker parts were taken into account.

Ref: BCSA publication No. 51/10

PLATE GIRDERS



1.0 GENERAL CONSIDERATION

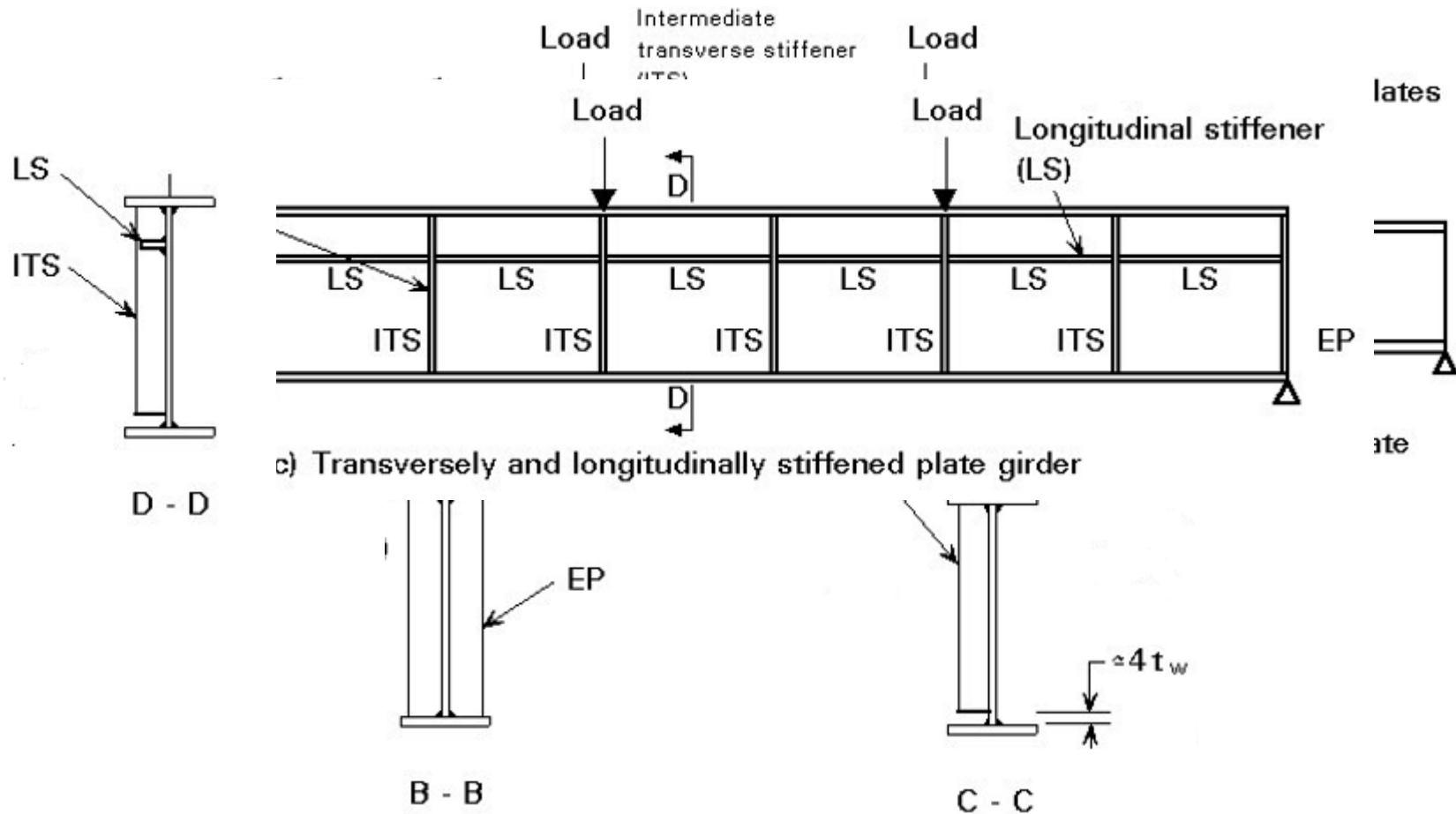


Figure : Types of plate girder

PLATE GIRDERS

The Figure gives an indication of the minimum length (L) for which a selected thickness change will be economic for flanges and webs of girders. Below this length it will be more economic to continue the thicker plate (t₁). Please note that the costs/metre of weld used to derive the figure below do not include the costs associated with the grinding of butts.

$$L \text{ (m)} = \frac{r \times 10^3}{7.85t/m^3(t_1 - t_2)} \quad \text{where } r = \frac{\text{Cost/m weld}}{\text{Cost/tonne of steel}}$$

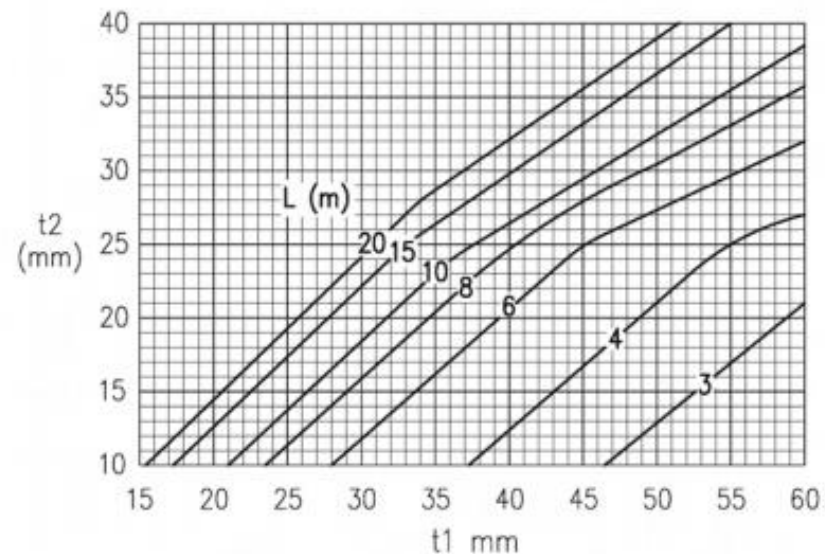
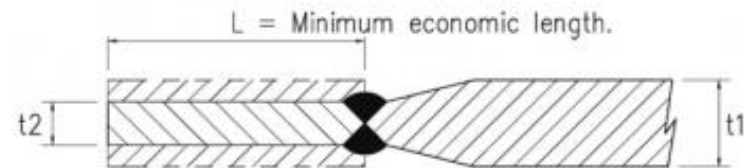
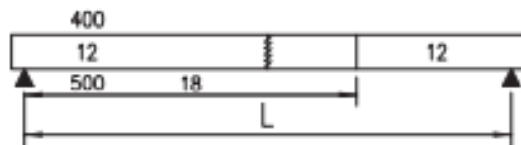
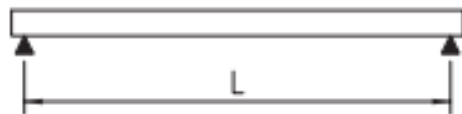
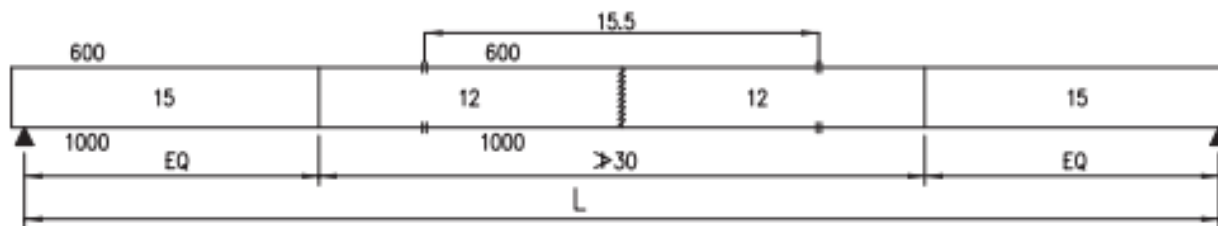
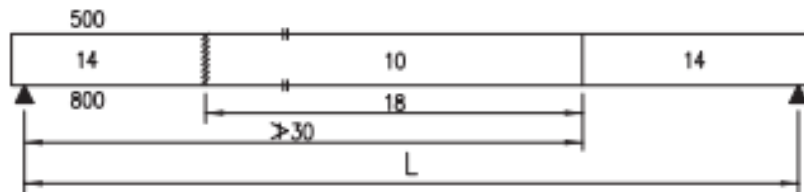


PLATE GIRDERS

SIMPLY SUPPORTED



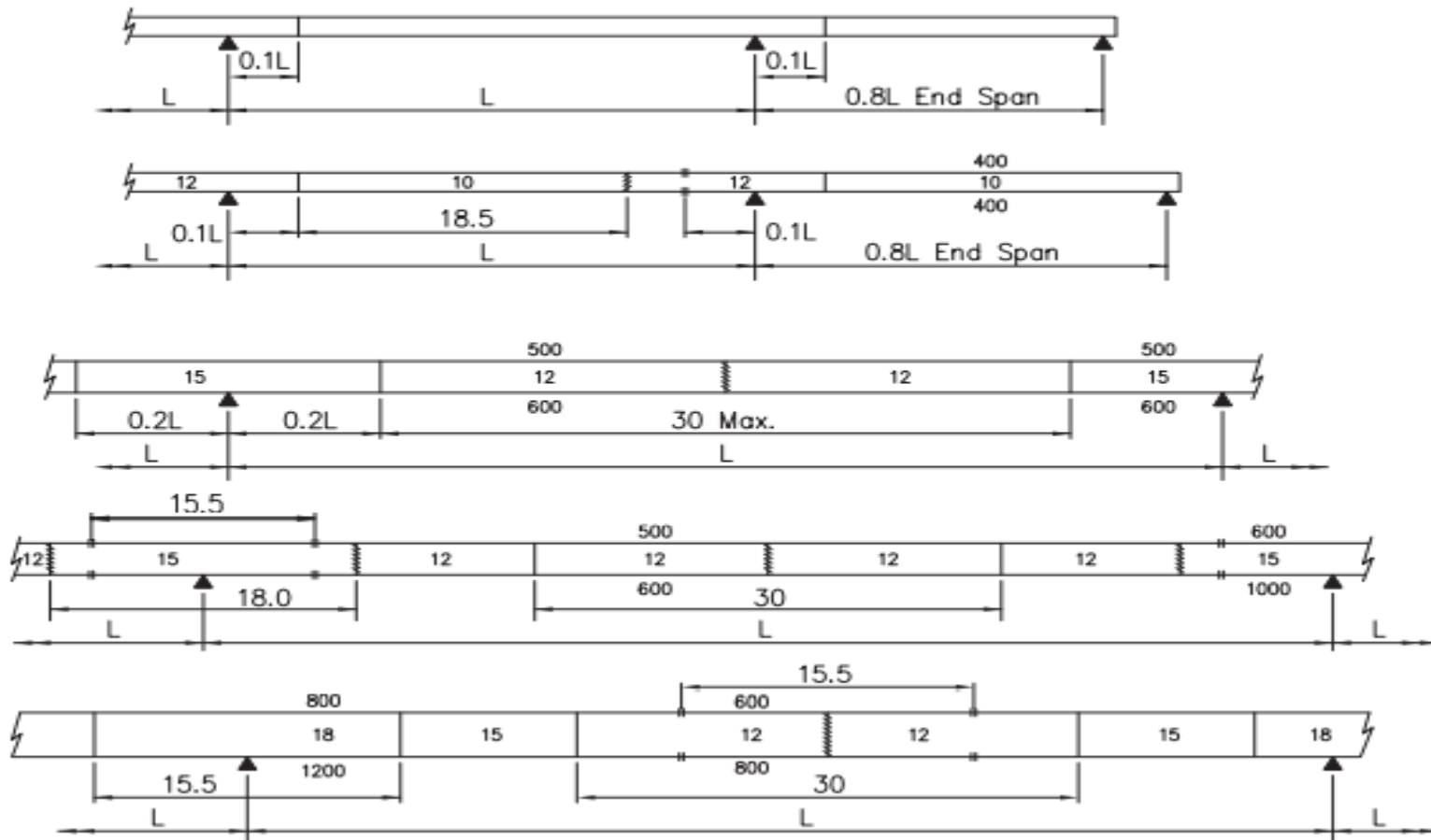
400 is Top Flange width.
12 is Web thickness.
500 is Bottom Flange width.



SPAN RANGE L(m)	GIRDER DEPTH (m)
≥ 30	1.0
30 to 40	1.0 to 1.6
40 to 60	1.6 to 2.7

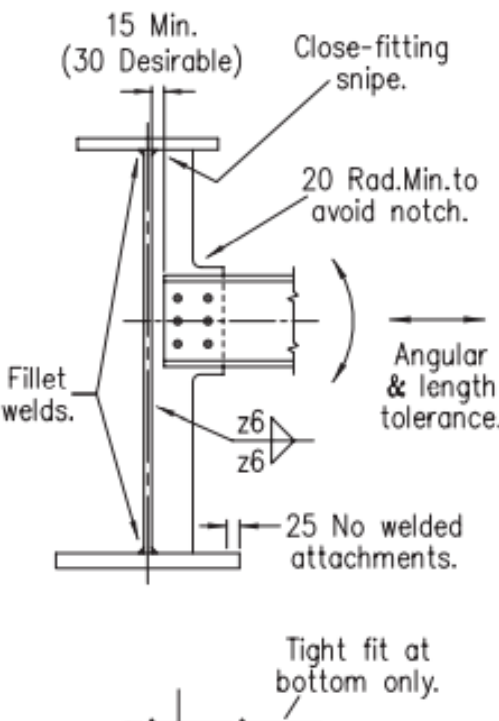
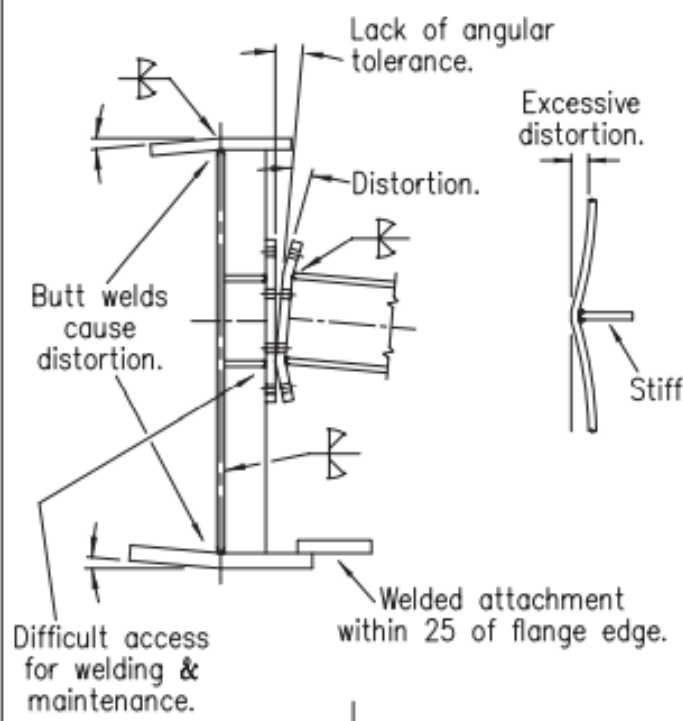
PLATE GIRDERS

CONTINUOUS

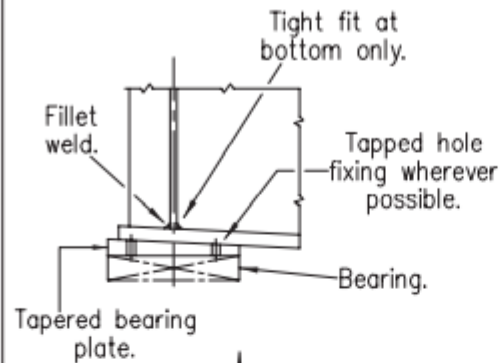


SPAN RANGE L (m)	GIRDER DEPTH (m)
>25	to 1.0
25 to 30	1.0
30 to 45	1.8
45 to 52	1.8 to 2.2
52 to 70	2.2 to 3.3

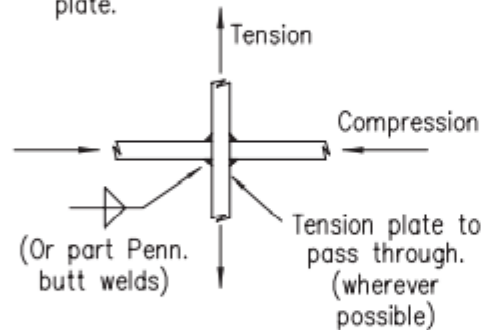
PLATE GIRDERS

DETAIL	DO	DON'T
TRANSVERSE CONNECTIONS & STIFFENERS.		

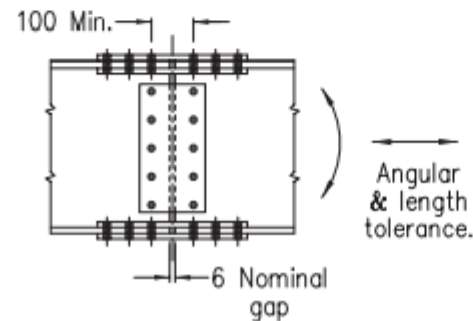
BEARING STIFFENERS & PLATES.



CRUCIFORM DETAILS.

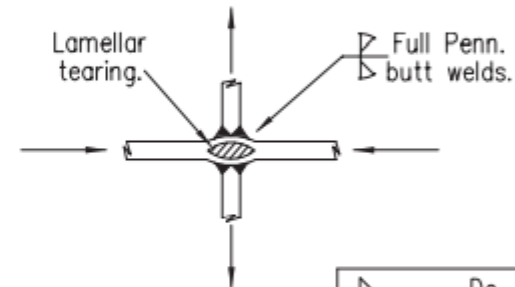
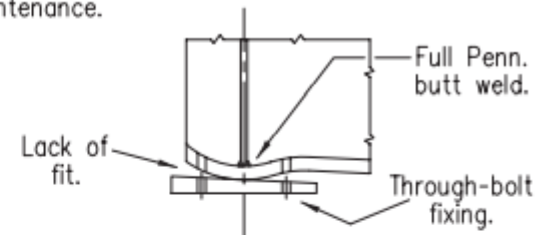


SPLICES.

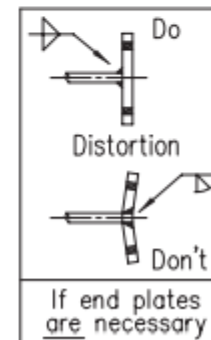
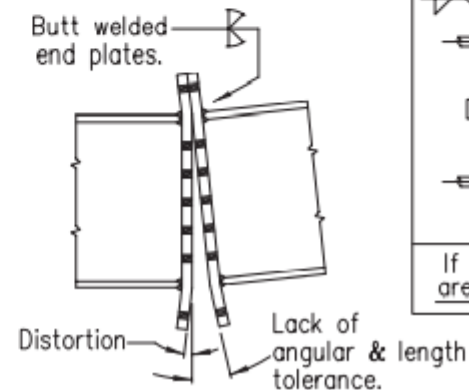


Difficult access for welding & maintenance.

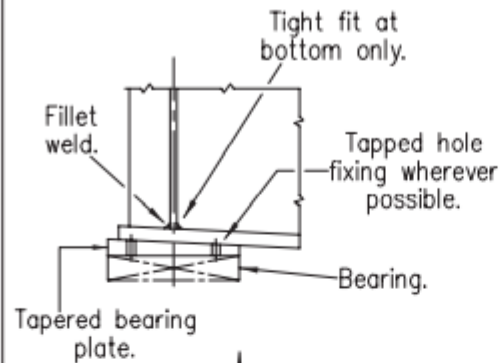
Welded attachment within 25 of flange edge.



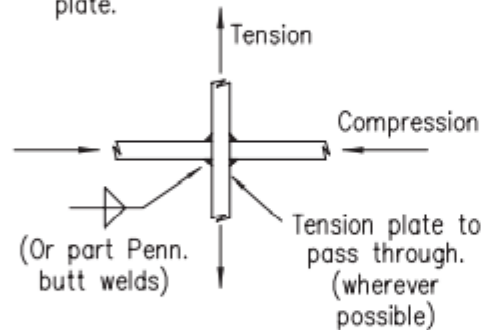
Butt welded end plates.



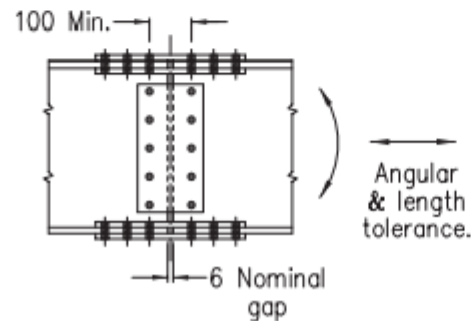
BEARING STIFFENERS & PLATES.



CRUCIFORM DETAILS.

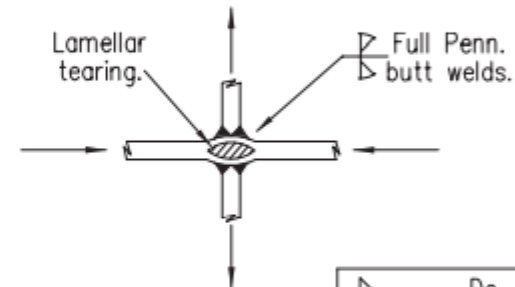
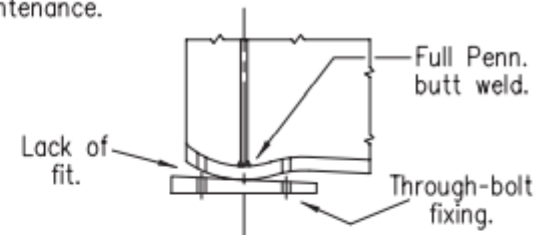


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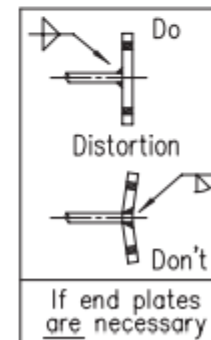
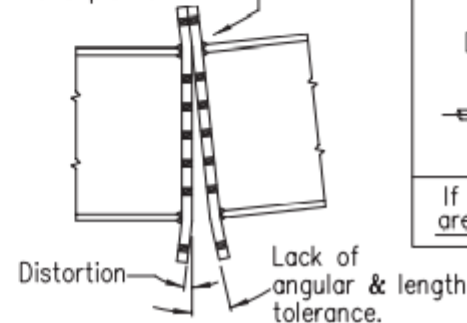


Difficult access
for welding &
maintenance.

Welded attachment
within 25 of flange edge.

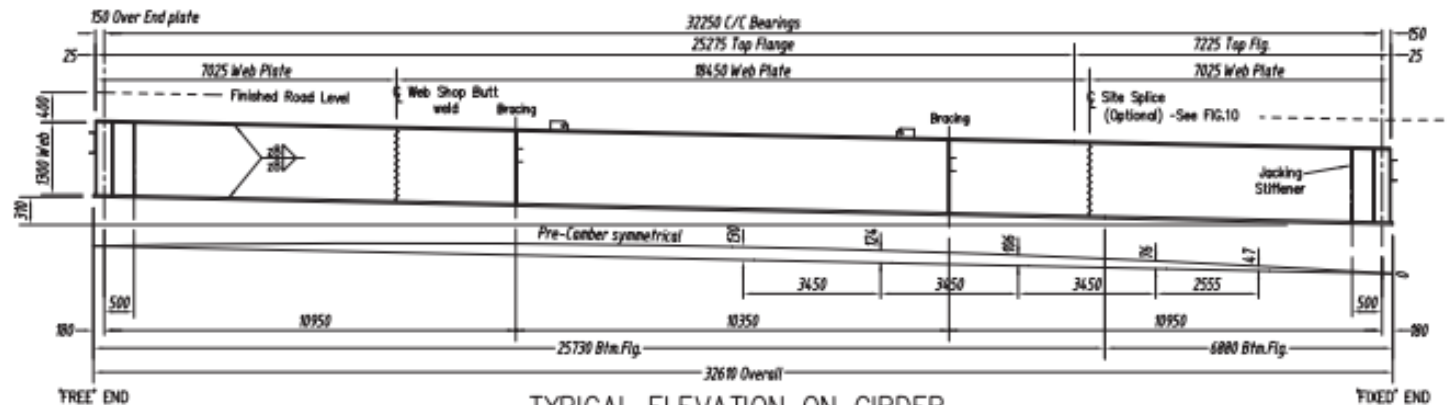


Butt welded
end plates.

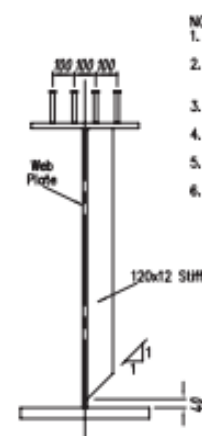
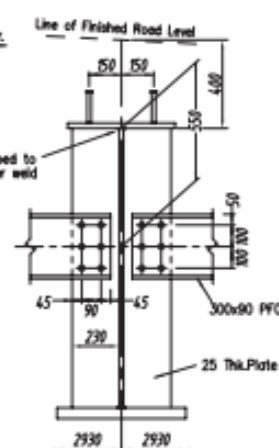
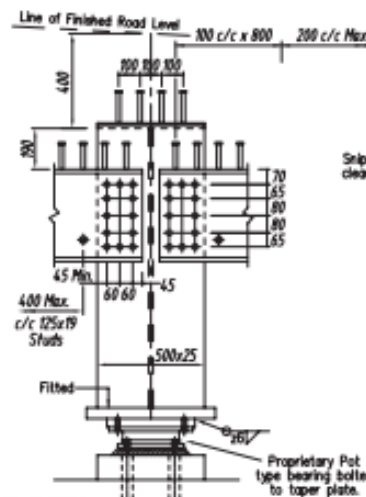
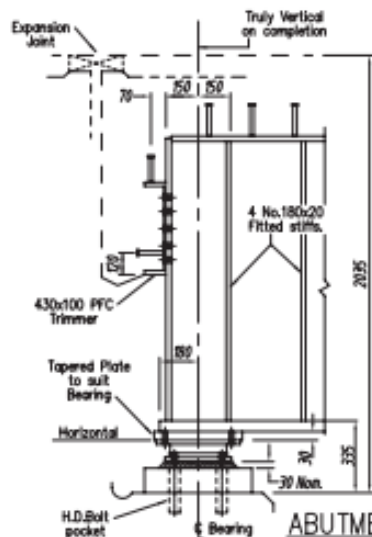


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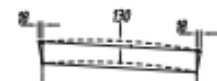
TYPICAL SINGLE SPAN PLATE GIRDER



TOP FLG.	500x25				500x20 (S355J0)	
WEB	1300x20		1300x15			1315x20
BTM.FLG.	600x50				600x40	
SHEAR STUDS	4 AT 200 CRS.	4 AT 300 CRS.	2 AT 300 CRS		4 AT 300 CRS.	4 AT
	8100	8100	12000		8100	200 CRS.



- NOTES:-
1. All steel Grade S355J2+N unless stated otherwise.
 2. All joints to be welded with continuous welds on both sides. Size 6mm Fillet welds unless stated otherwise.
 3. All bolts to be M24 Pre-Loaded type HR to BS EN 14399-3 unless stated otherwise.
 4. Cambers shown do not take account of fabrication effects & weld shrinkage.
 5. Camber shape shall approximate to a parabolic curve.
 6. All shear studs 19 Dia x 150 long unless stated otherwise.



PRECAMBER AT MID-SPAN	
GIRDER WEIGHT	21
SLAB ETC.	42
FINISHES	15
SHRINKAGE	15
FINAL PRECAMBER	15
TOTAL	128
SPECIFIED PRECAMBER	130

INTERMEDIATE STIFFENERS
(IF REQ'D) (For Edge Girders stiff.
to be on inside face)

TRUSSES AND VIERENDEEL GIRDER



STEEL BOX GIRDER



Open top box girders curved in plan
Fossdyke Bridge, Lincoln



Variable depth trapezoidal closed top box girders
River Nene Viaduct, Peterborough