DESIGN OF STEEL BRIDGES
DESIGN TO THE EUROCODES

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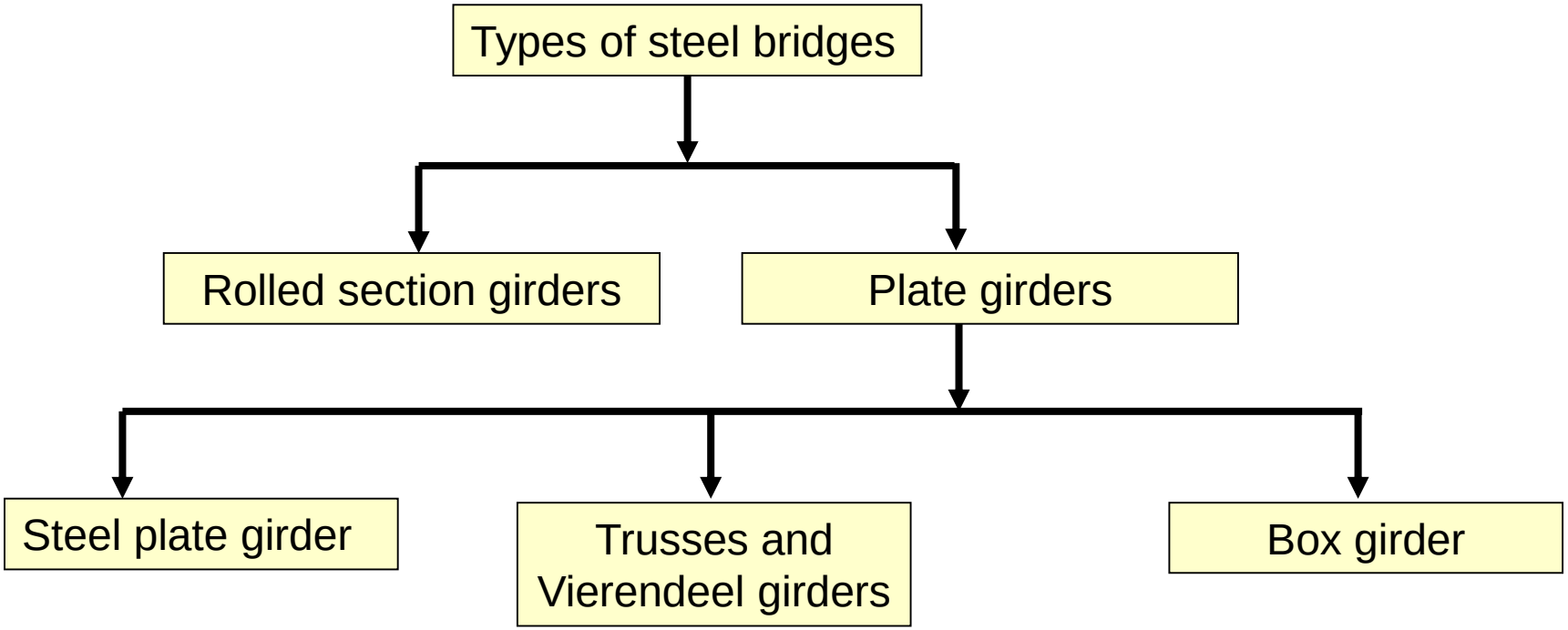
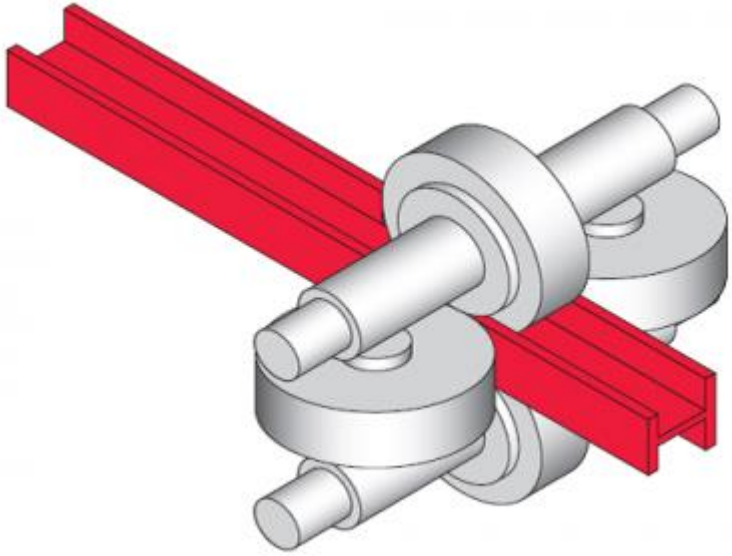
PRESENTATION OUTLINE

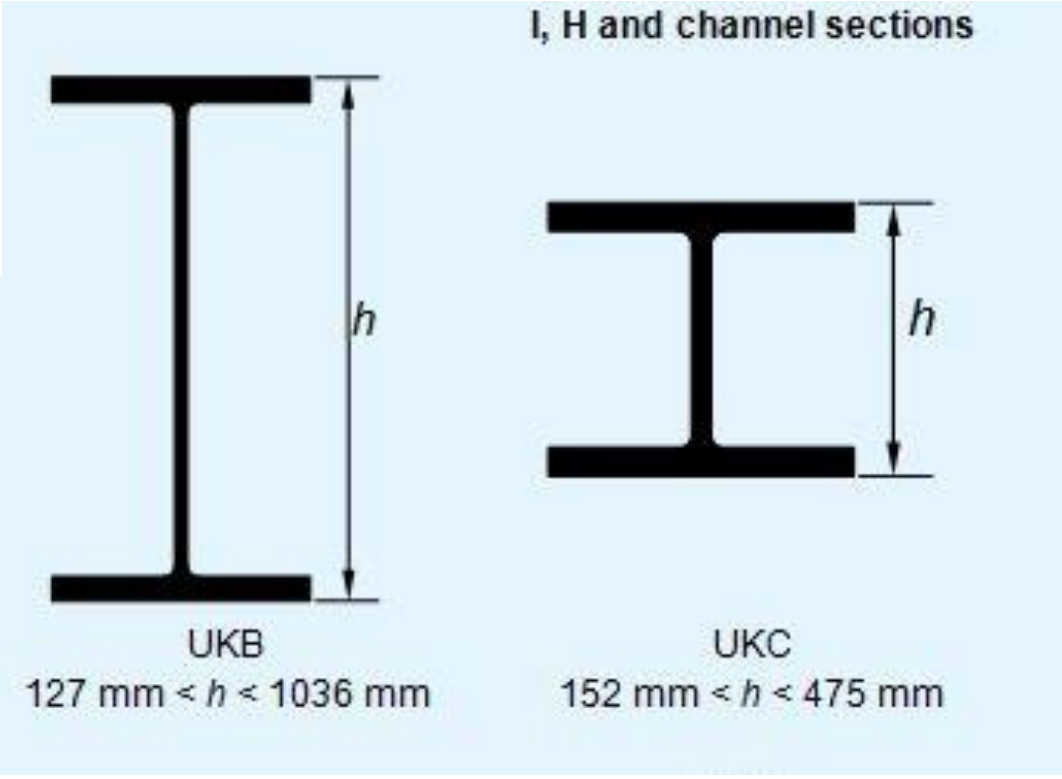
- Introduction
- Rolled section girders
- Plate girders
- Girder splices
- Typical plate girder
- Trusses and Vierendeel girders
- Box girders
- Example design of steel bridges.

INTRODUCTION



ROLLED SECTION GIRDERS





ROLLED SECTION GIRDERS

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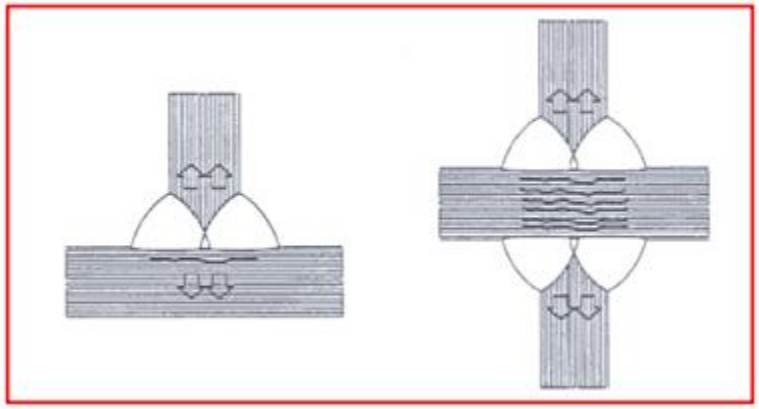
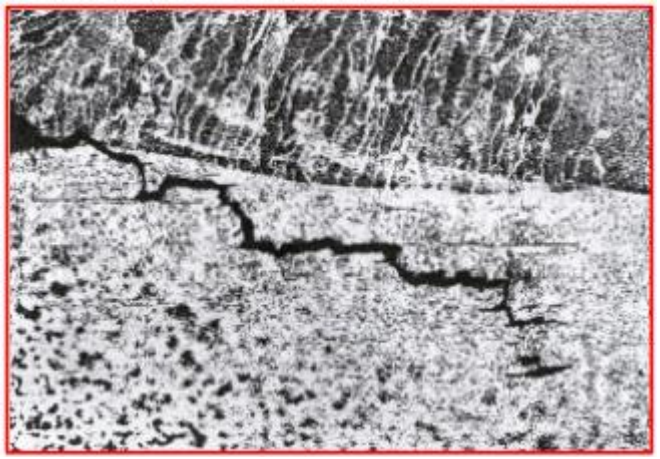
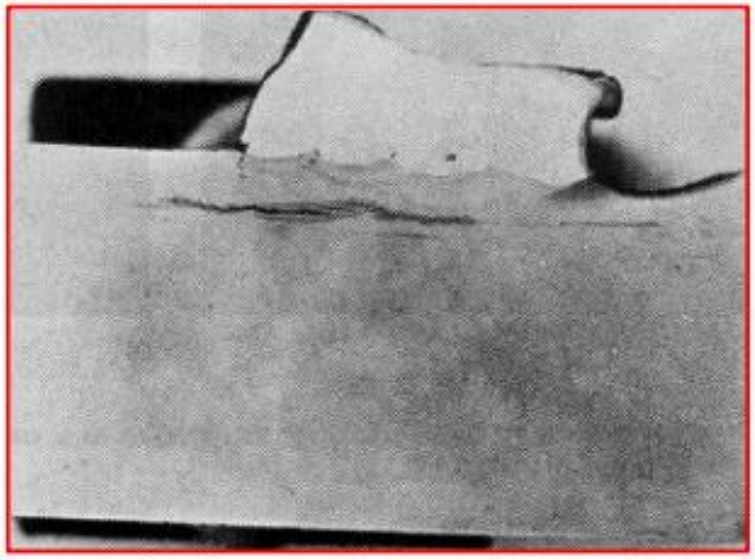






Lamella tearing

ROLLED SECTION GIRDERS

PLATE GIRDERS

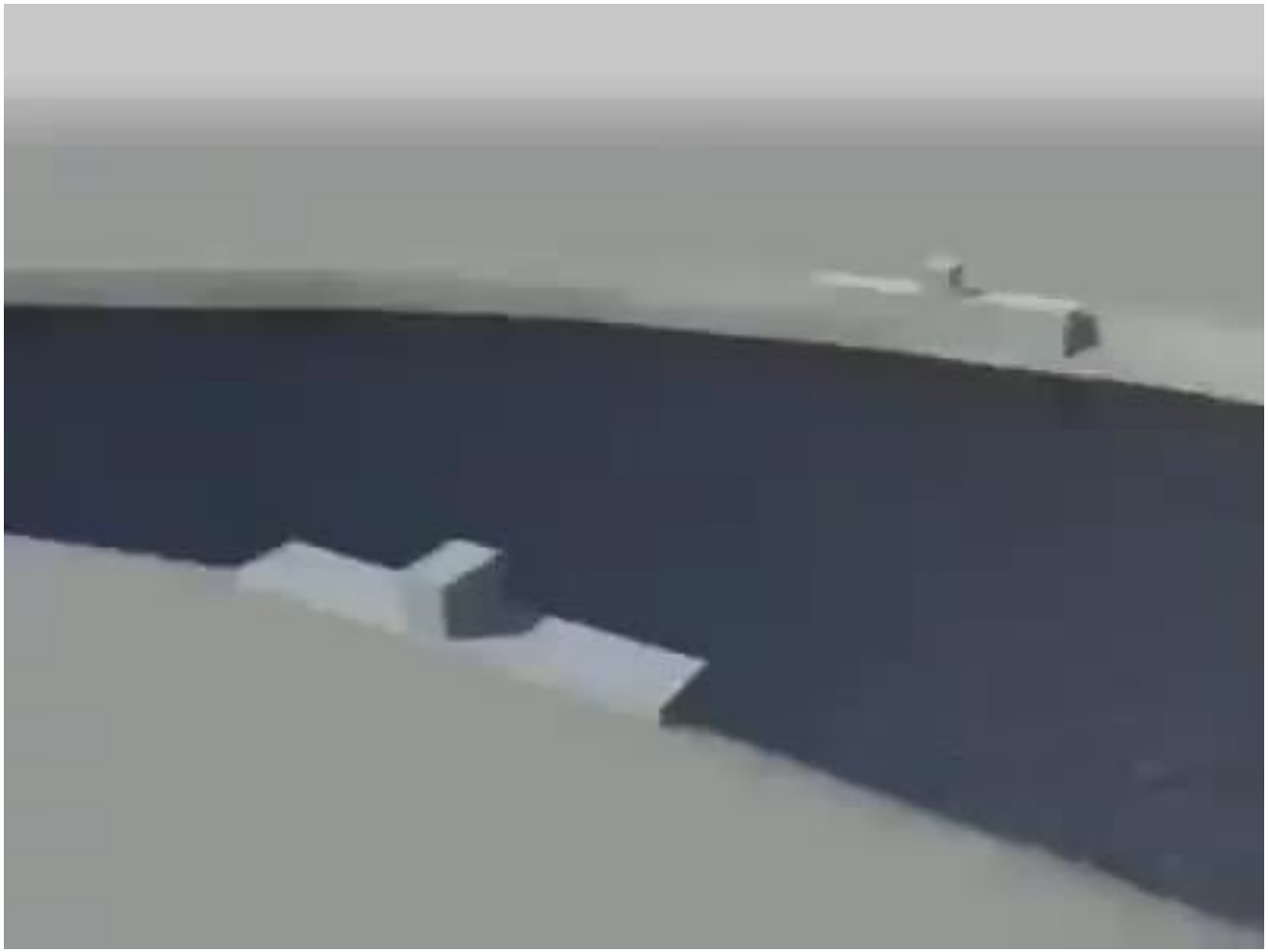


PLATE GIRDERS

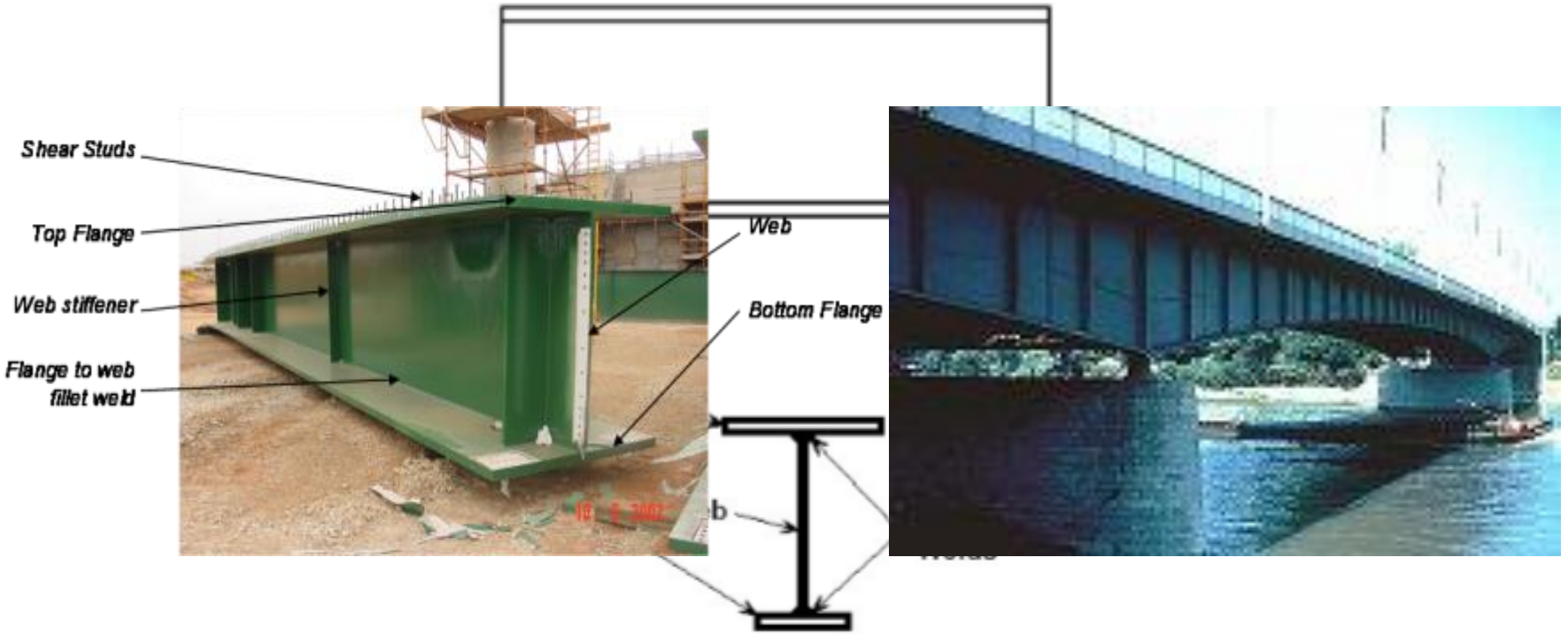


Figure 1: Plate girder overview

PLATE GIRDERS

PROPORTIONS

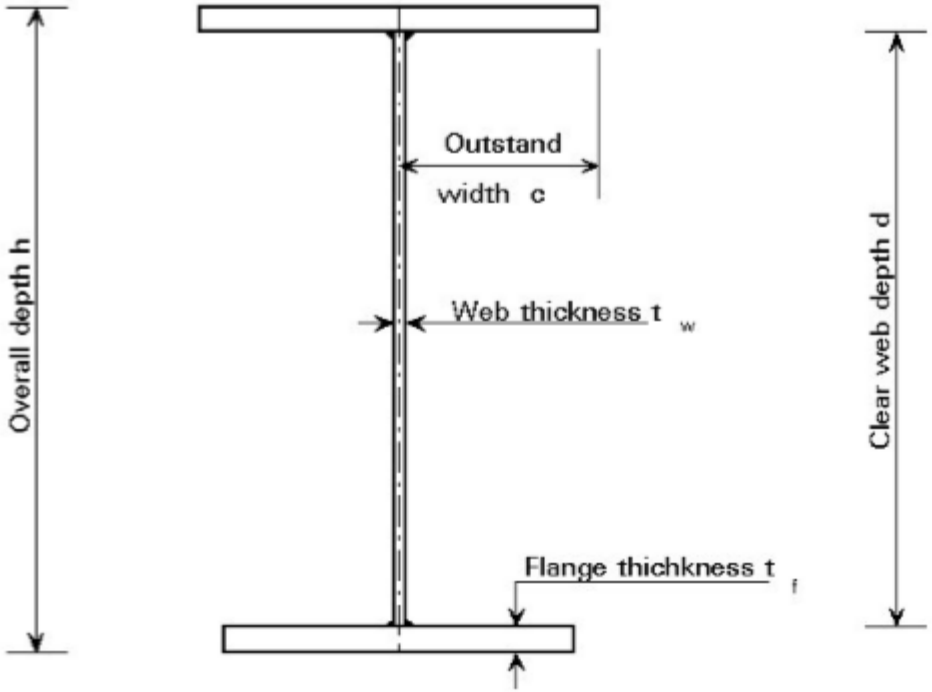
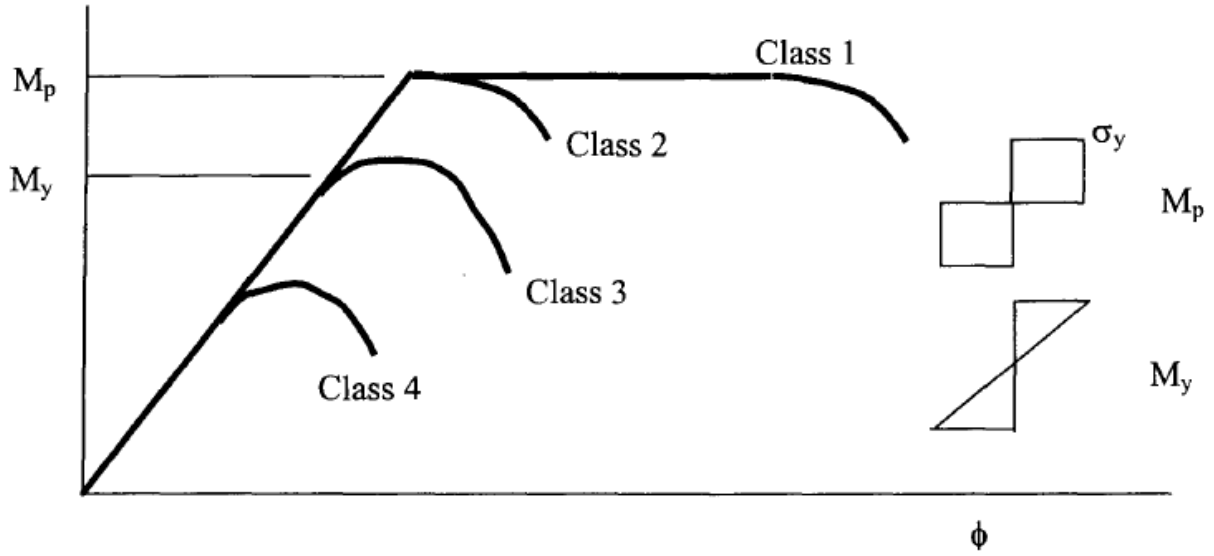


PLATE GIRDERS

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.

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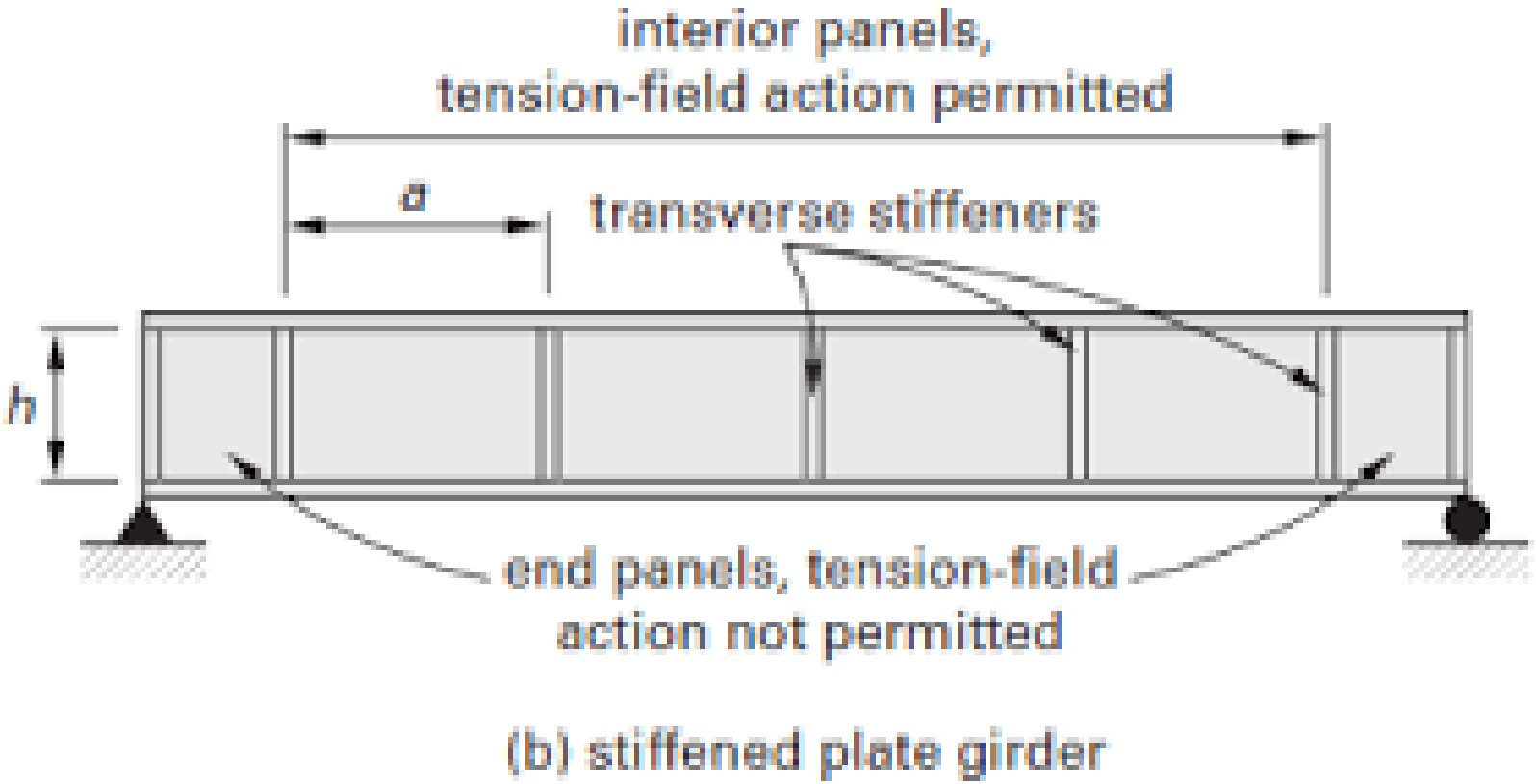
PLATE GIRDERS



(b) stiffened plate girder

1.0 GENERAL CONSIDERATION

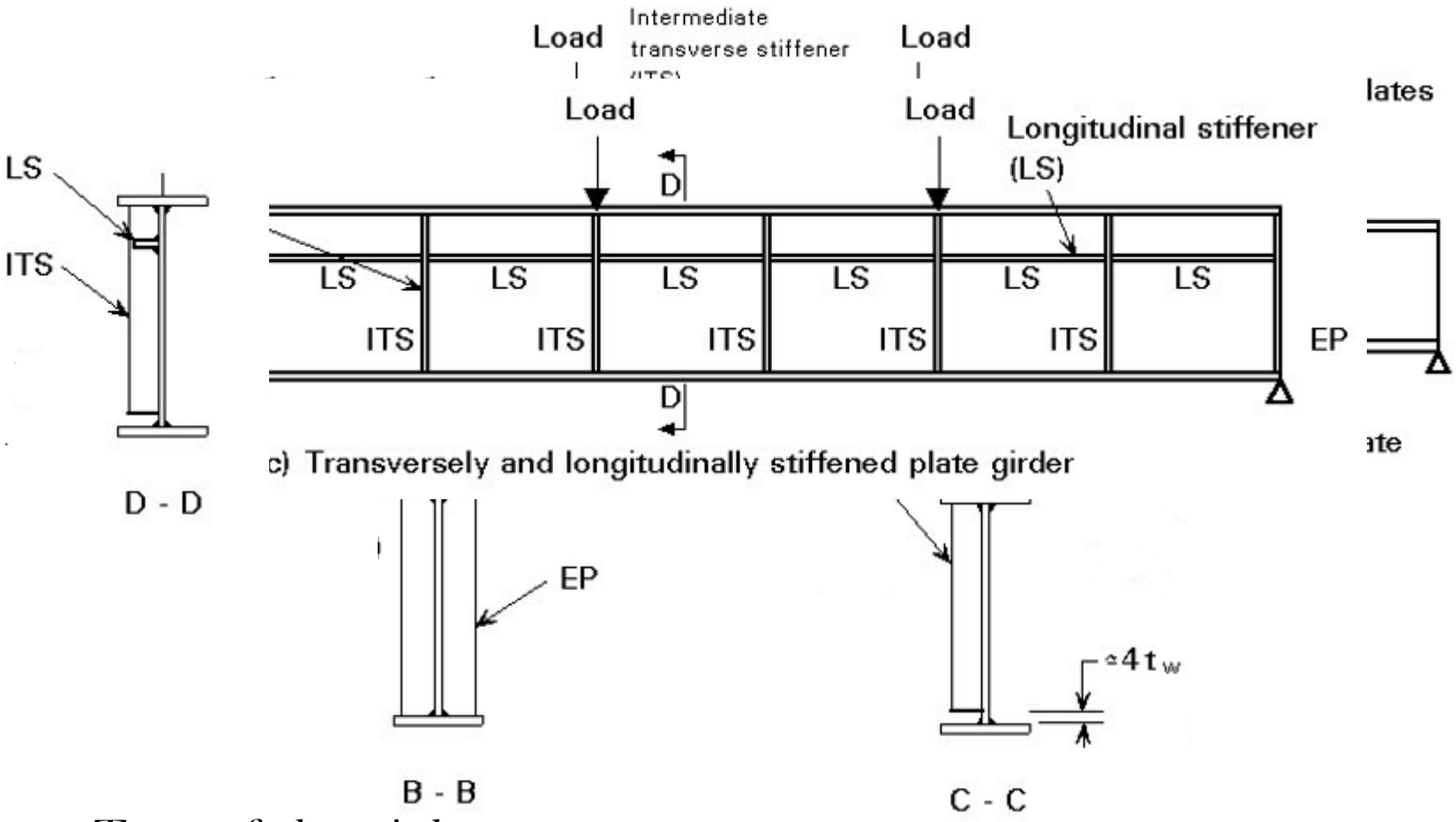
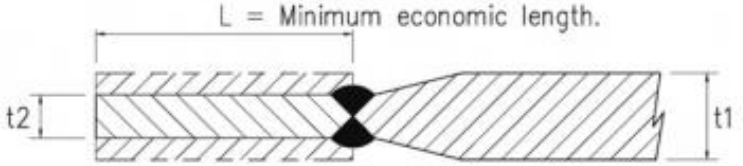


Figure : Types of plate girder

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.

$$L\ (m) = \frac{r \times 10^3}{7.85t/m^3\,(t1-t2)} \qquad \text{where } r = \frac{\text{Cost/m weld}}{\text{Cost/tonne of steel}}$$



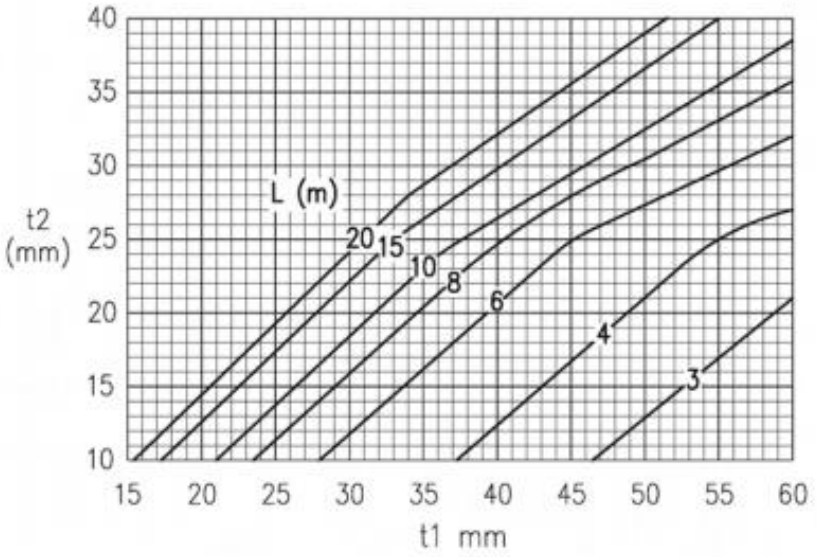


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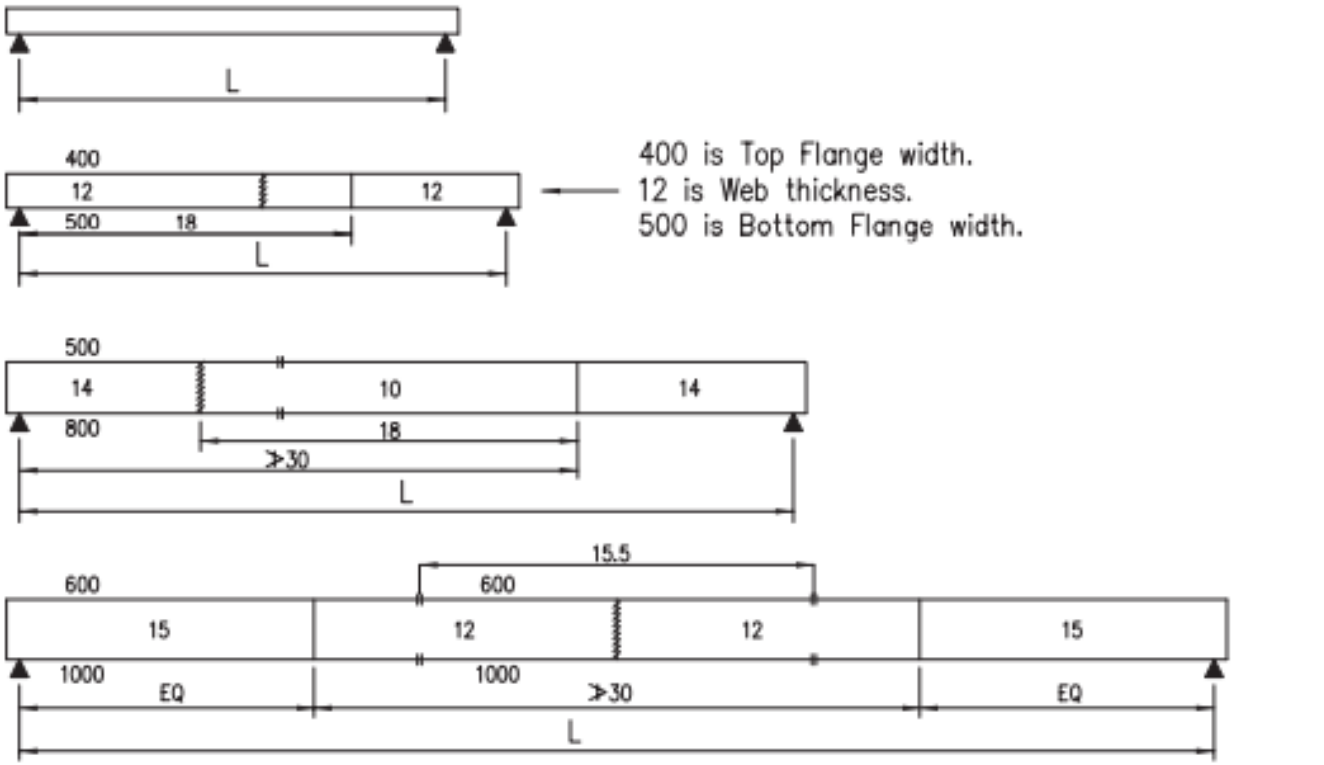
PLATE GIRDERS

SIMPLY SUPPORTED



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

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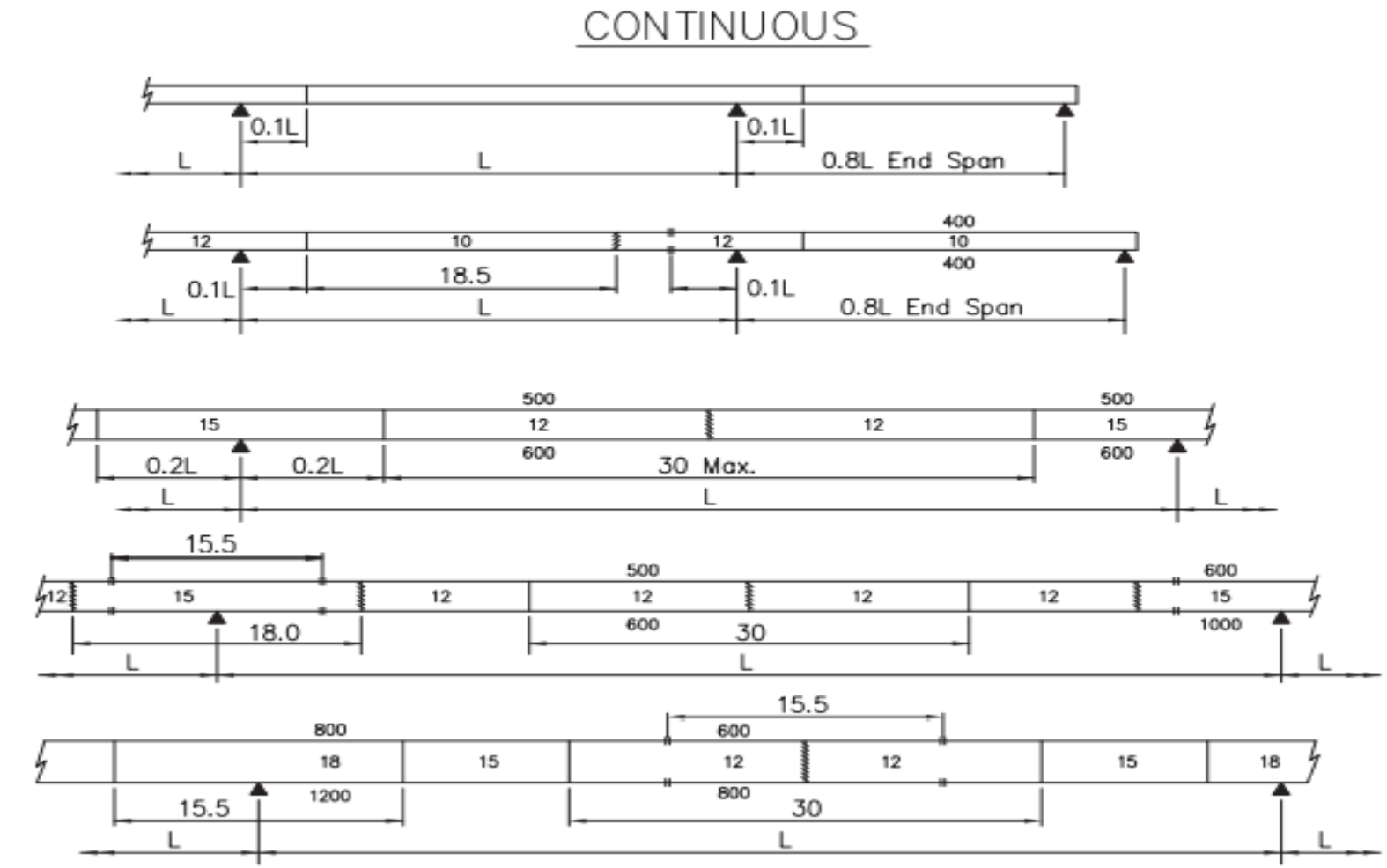
PLATE GIRDERS



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

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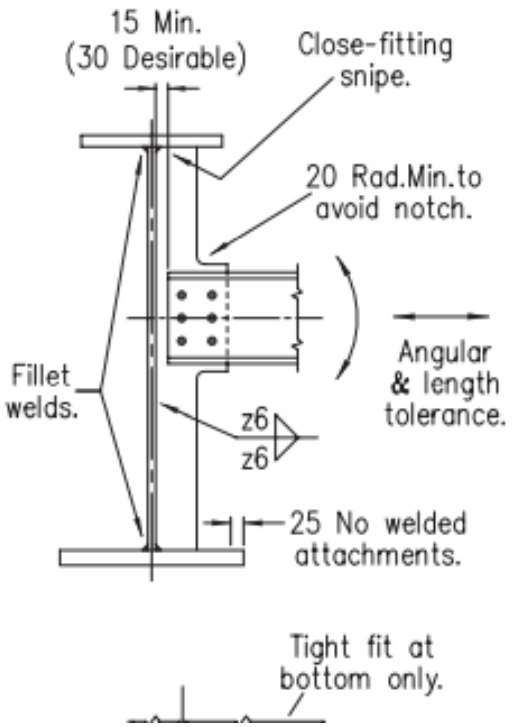
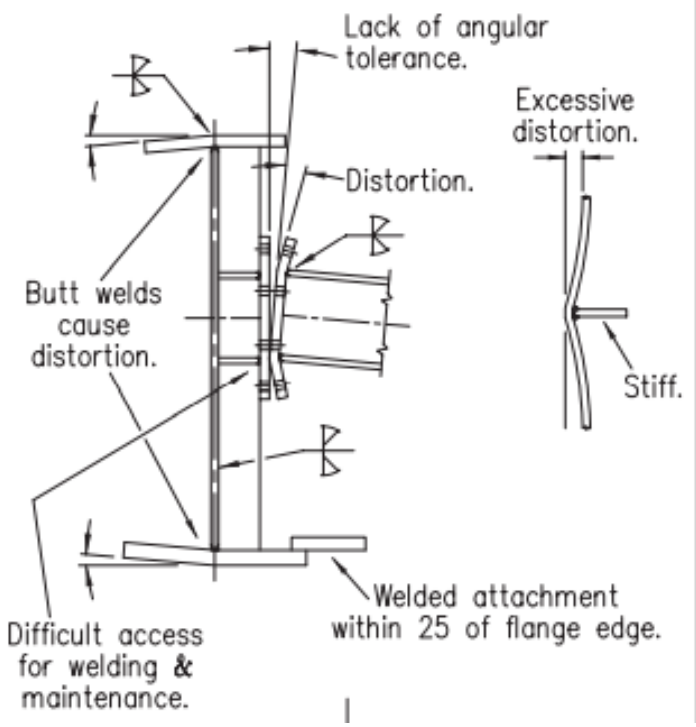
PLATE GIRDERS

DETAIL	DO	DON'T
TRANSVERSE CONNECTIONS & STIFFENERS.		

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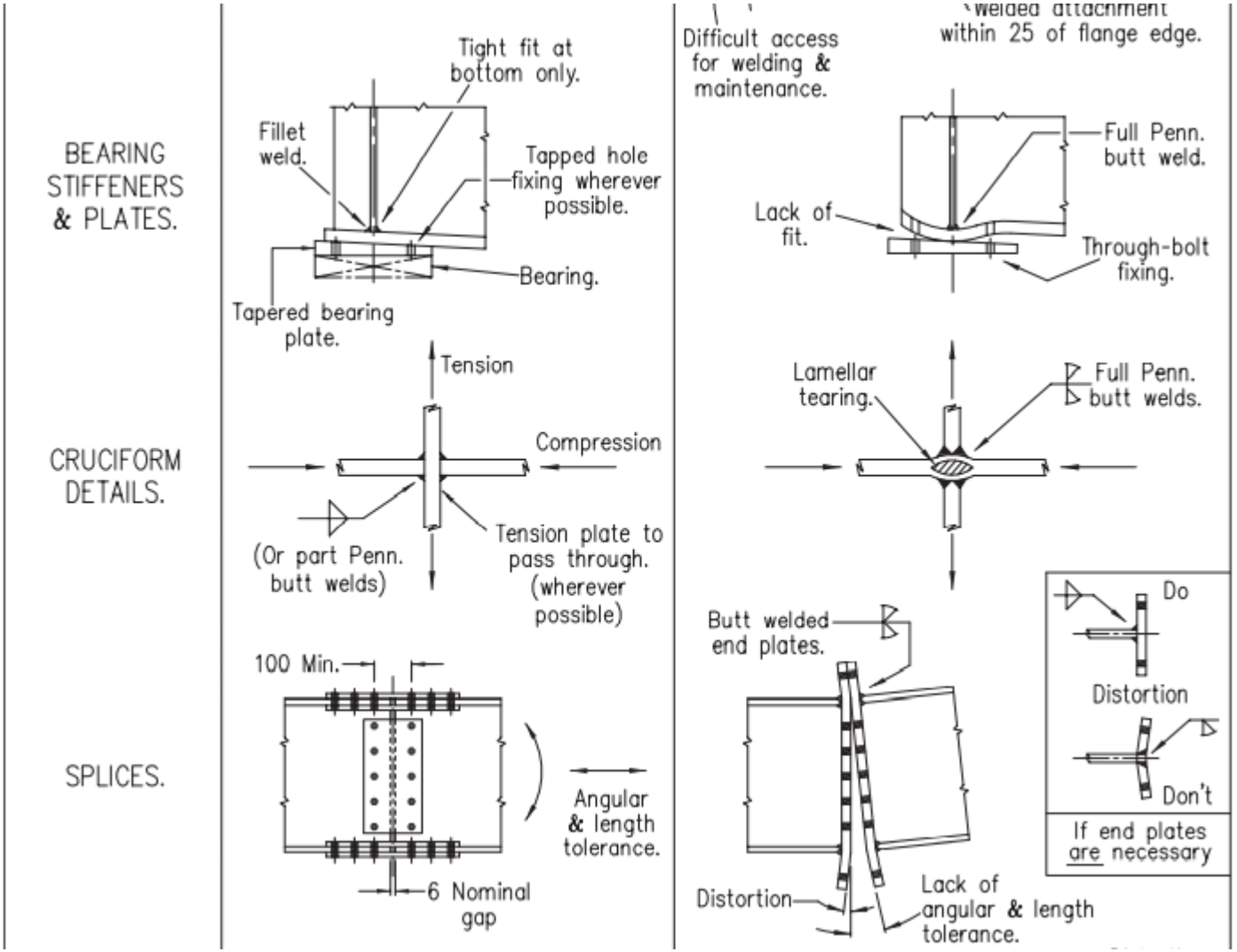

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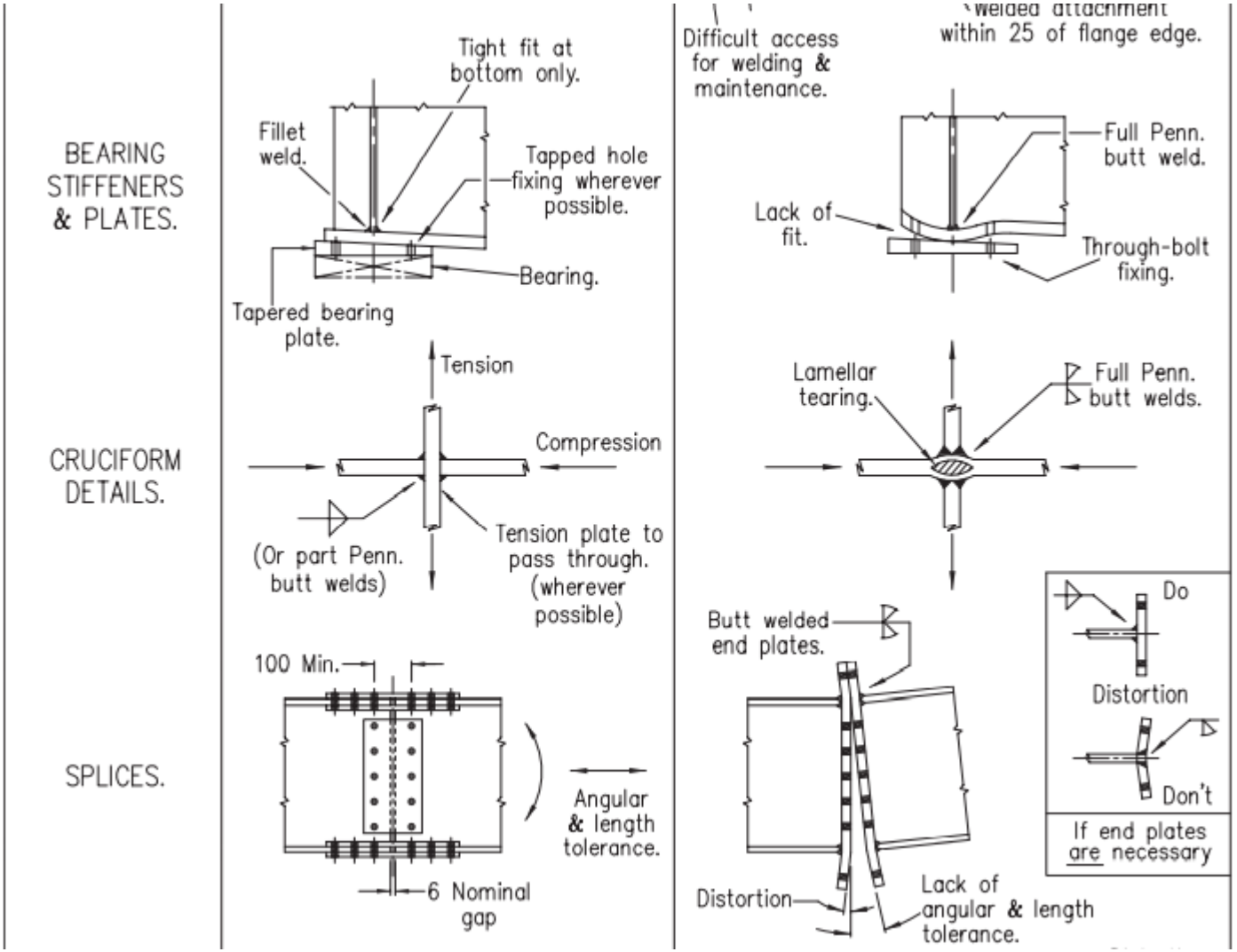

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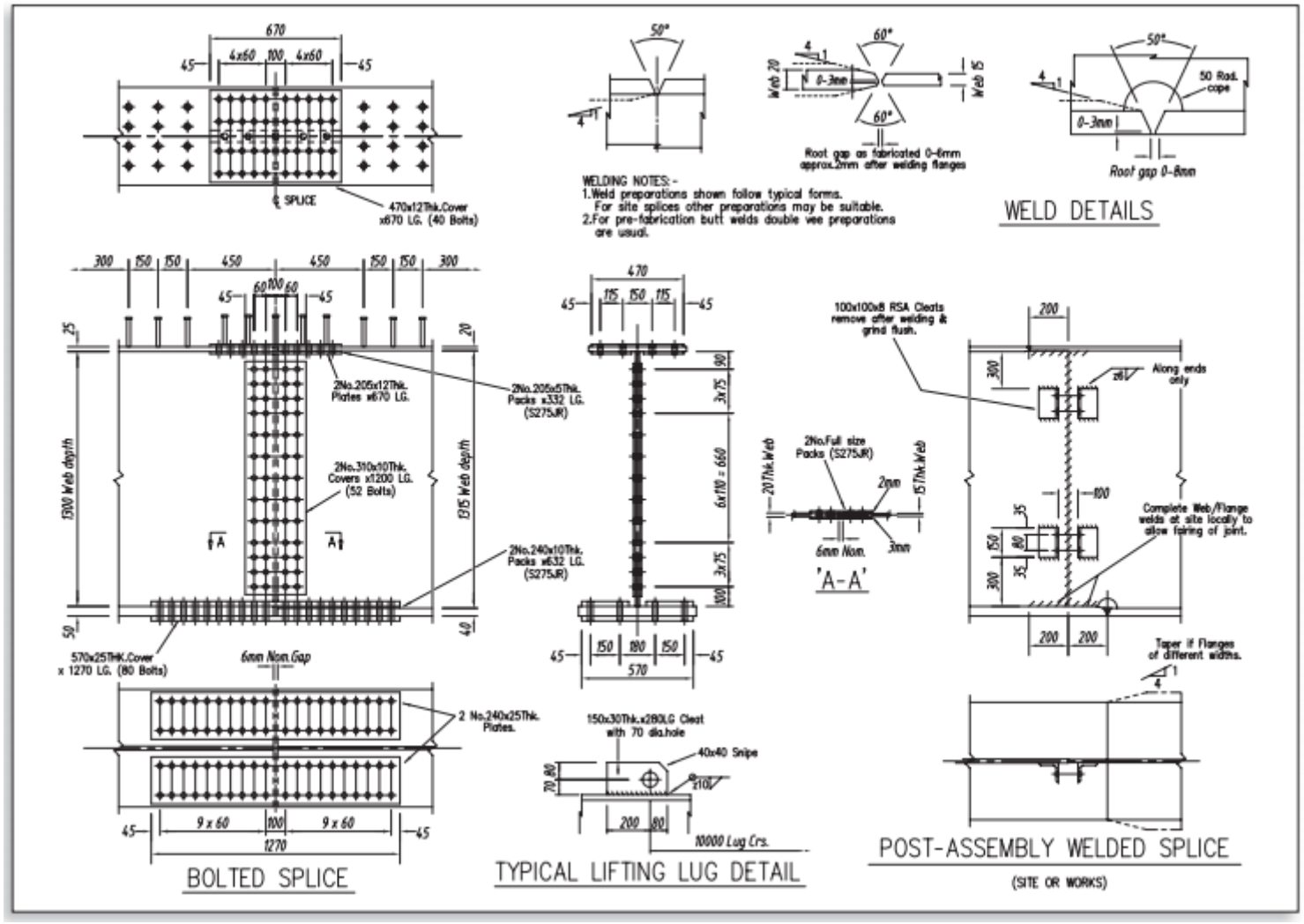
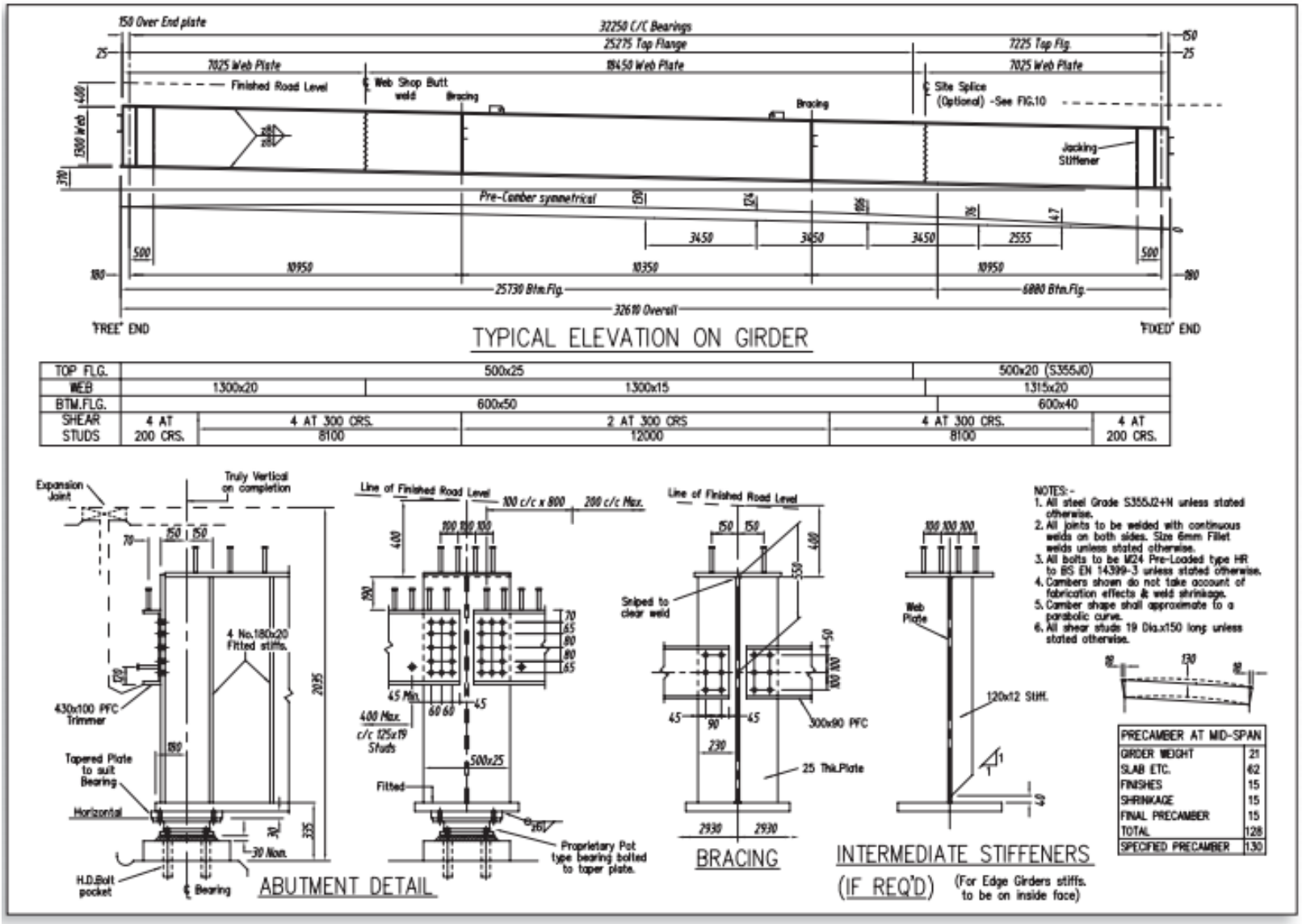
GIRDER SPLICES



TYPICAL SINGLE SPAN PLATE GIRDER



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