

AD 560:

Lateral-torsional buckling of unrestrained plate girders

SCI's Advisory Desk sometimes gets asked about the selection of the appropriate lateral-torsional buckling (LTB) curve for welded plate girders, particularly where the section has a large h/b ratio. The purpose of this AD Note is to clarify the application of the general case and the alternative approach for rolled sections or equivalent welded sections given in BS EN 1993-1-1:2005, and to explain which buckling curve should be used for welded I-sections with h/b ratios exceeding the limit given in the UK National Annex.

For unrestrained plate girders, the resistance to LTB must be verified. BS EN 1993-1-1:2005 provides two approaches for determining the LTB resistance. Clause 6.3.2.2 gives the general case, while Clause 6.3.2.3 gives an alternative approach for rolled sections or equivalent welded sections. The latter is commonly referred to as the "special case".

When the special case is used, Clause NA.2.17 of the UK National Annex to BS EN 1993-1-1:2005 specifies $\lambda_{LT,0} = 0.2$ and $\beta = 1.00$ for welded sections. The National Annex also provides recommendations in Table NA.1 for the selection of the appropriate LTB curve for welded doubly symmetric sections.

For the special case, Table NA.1 limits the h/b ratio for welded sections to less than 3.1. For welded doubly symmetric sections with $h/b \leq 2$,

Table 1: Recommendation for the selection of lateral torsional buckling curve for welded doubly symmetric sections using the special case

Cross Section	Limits	Buckling Curve
Welded doubly symmetric sections	$h/b \leq 2$	c
	$2.0 \leq h/b < 3.1$	d

Table 2: Recommendation for the selection of lateral torsional buckling curve for welded sections using the general case

Cross Section	Limits	Buckling Curve
Welded sections	$h/b \leq 2$	c
	$h/b > 2$	d

buckling curve c is recommended, while for $2.0 \leq h/b < 3.1$, buckling curve d is recommended, as shown in Table 1.

For welded I-sections with $h/b > 3.1$, the special case method should not be used. Instead, the general case given in Clause 6.3.2.2 should be used to determine the LTB resistance. When the general case is used, Table 6.4 of BS EN 1993-1-1:2005 recommends buckling curve d for welded sections with $h/b > 2$, as shown in Table 2. Therefore, for welded I-sections with $h/b > 3.1$, the LTB resistance should be determined using the general case with buckling curve d.

Generation 2 of BS EN 1993-1-1:2022 provides two approaches for determining the LTB resistance.

The general case, given in Clause 8.3.2.3(2), is essentially unchanged from the current standard, although it is presented in a slightly different format. The equivalent 'special case' for doubly symmetric I and H-sections, given in Clause 8.3.2.3(3), has changed and will make manual calculations more involved. However, this approach places no restriction on the h/b ratio for welded sections. The UK National Annex will similarly impose no restrictions.

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