

AD 392: Frame stability tool on www.steelconstruction.info

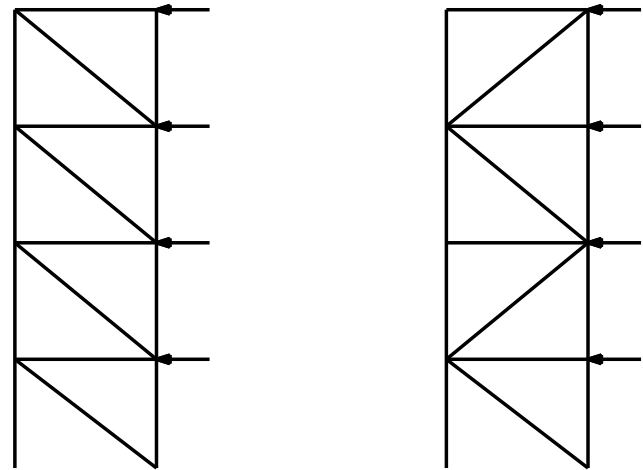
This Advisory Desk note gives background information on the frame stability tool, recently added to www.steelconstruction.info. The tool determines α_{cr} in accordance with BS EN 1993-1-1, 2005 clause 5.2.1(4)B.

The frame stability tool is an analysis program that calculates the lateral deflections of a vertical truss with point loads applied at the nodes. It is no different to any other analysis software; for a given set of loads, geometry and members, the results should be identical.

Bracing layout. The program assumes that the bracing is arranged as a **Pratt truss**, as shown in Figure 1(a), with all the lateral loads applied at the “far” end of the horizontal members, which is a conservative assumption. The deflections of this form of truss are larger than a **Warren arrangement**, shown in Figure 1(b). With the Pratt truss, all the horizontal members carry axial force, which increases towards the base.

Loading. The program requires the user to provide the lateral and vertical loading associated with the bracing system – generally any structure will have two or more bracing systems. The single bracing system analysed in the tool will therefore carry only part of the lateral load and part of the vertical load. **Wind load** is assumed to be distributed uniformly over the full height of the bracing and is converted into point loads applied at the nodes. In complex buildings with bracing systems of differing stiffness, it will be necessary to determine the proportion of load carried by each bracing system.

Equivalent horizontal forces. These have been calculated as 1/200 of the vertical loads. The α_n and α_m factors given in BS EN 1993-1-1 clause 5.3.2 have been set to 1.0, which is conservative. This conservatism has no significant impact on the calculation of α_{cr} . It may be advantageous to include α_n and α_m when calculating the ultimate forces in the bracing system, since factors less than 1.0 will reduce the contribution of the EHF.



(a) Pratt truss
(assumed in frame stability tool)

(b) Warren truss

Figure 1: Bracing arrangements

Combinations of actions. The stability tool considers combinations of actions using expression 6.10 of BS EN 1990. Two combinations are considered – firstly imposed vertical load leading and secondly wind load leading. From Table NA.A1.1 of the UK **National Annex**, ψ_0 is taken as 0.7 for vertical loads and 0.5 for the lateral loads.

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