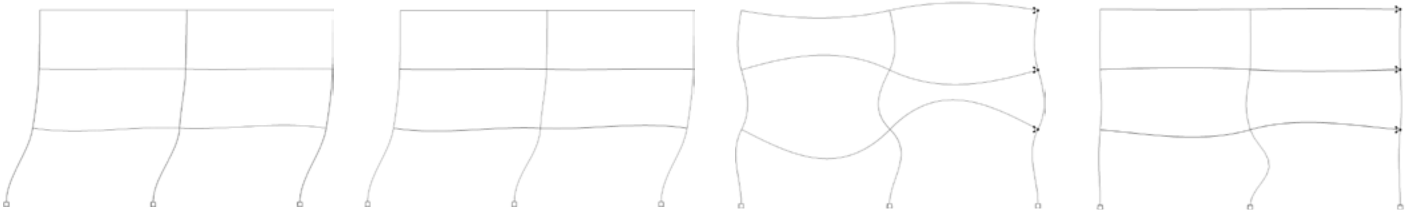

a) Sway frame: 1 Finite element per member: $\alpha_{cr} = 5.94$

a) Sway frame: 10 Finite elements per member: $\alpha_{cr} = 5.87$

c) Non-sway frame: 1 Finite element per member: $\alpha_{cr} = 41.63$

d) Non-sway frame: 10 Finite elements per member: $\alpha_{cr} = 14.81$

Figure 5: Influence of the number of finite elements per member on frame stability[13].

Influence of the number of finite elements on frame stability:

The differences in modelling precision are demonstrated in Figure 5, which shows the different buckling modes and values of α_{cr} for models with 1 and 10 finite elements per member (using Model 4 from worked example 2.1). The non-sway frame has horizontal supports on each floor level.

Calculation of α_{cr} using the Horne method:

For model 4 of worked example 2.1, the calculation of α_{cr} according to clause Section 5.2 of EN 1993-1-1 is shown in Figure 6. The approximate value of 6.61 may be compared with the precise value of 5.87 from Table 4 and 5.86 from Table 5. The approximated value of 6.61 is the same for worked examples 2.1 and 2.2, as the ratio $H_{Ed}/\delta_{H,Ed}$ is identical in the method.

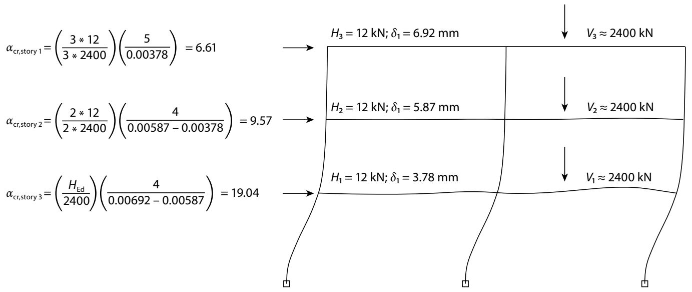

Figure 6: Calculation of α_{cr} with the Horne method (worked example 2.1)[13].

Conclusions

1. Eurocode 3 provides essentially 3 different methods to consider local and global second order effects when verifying members;
2. In practice, local second order effects are usually considered when checking member stability according to section 6.3 of EN 1993-1-1;
3. Local imperfections may need to be considered for global analysis; this may be mandatory according to clause 5.3.2 (6) of EN 1993-1-1; the criteria is more significant for frames with fixed bases where lower α_{cr} can be obtained with slender members;
4. The effective length method considers the effects of global second order effects by increasing the local second order effects; buckling lengths greater than 2*l* may be required;
5. The numerical consideration of global *P-Δ* effects and the approximated consideration of those effects with the amplification factor give very similar results; For member stability verifications according to section 6.3 of EN 1993-1-1, system lengths should be used;
6. The effective length method gives a reasonable answer in comparison to the other two other methods where second order internal forces are calculated. Differences between methods can be up to approximately 0.15 in the utilization factor (conservative or non-conservative); differences are less significant for higher values of α_{cr}.
7. The importance of considering more than 1 finite element per member was demonstrated for struts and frames. At least 3 finite elements are recommended;
8. Horizontal loads have a small influence in the values of α_{cr}.

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AD 429:
Slip factors for alkali-zinc silicate paint

This AD note draws attention to the slip factors for alkali-zinc silicate painted faying surfaces considered in AD 383 which have been updated in the 2018 revision of BS EN 1090-2.

AD 383, which was published in September 2014, discussed the slip factor for surfaces coated with alkali-zinc silicate paint and the significant influence of the coating thickness. The AD referred to forthcoming changes to Table 18 of BS EN 1090-2, expected to reflect concerns about the relationship between the coating thickness and slip factor. In the interim, AD 383 proposed slip factors of 0.3 (if certain recommended practices were followed) or 0.2 as a conservative value.

BS EN 1090-2 was revised in 2018 and slip factors are presented in Table 17. For surfaces coated with alkali-zinc silicate paint, the nominal thickness is now specified as 60 µm, with a dry film thickness between 40 µm and 80 µm.

If the applied coating meets the thickness limits specified in Table 17, a slip factor of 0.4 may be assumed. AD 383 noted that in practice the coating thickness can often exceed 80 µm, so coating procedures will need to be carefully controlled and the dry film thickness measured, to ensure the limits in Table 17 are satisfied. If such control is not practical, then the conservative slip factors quoted in AD 383 may be adopted.

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