AD 500:
Tolerance at cantilever tips

Although BS EN 1090-2 and the National Structural Steelwork Specification (NSSS 7th) include a permitted deviation at the tip of a pre-set cantilever, this AD note recommends that the only reliable way of achieving a consistent alignment of several cantilevering elements is by including provision for adjustment.

The NSSS and EN contain identical tolerances (9.6.20 and Table B.16(5) respectively) for the "deviation Δ from intended pre-set *f* at end of an erected cantilever of length *L*". The NSSS limit is *L*/200, which is the Class 1 limit in the EN,

It is presumed that the intended pre-set is to allow for the inevitable deflection of the cantilever, or perhaps to deliberately provide an inclined member (for example, supporting a canopy with a drainage fall back towards the building). The pre-set could be zero, or negative (a fall away from the supporting structure) and would normally be provided by cutting the supported end of the member at a small angle.

The assessment of this permitted deviation is fraught with difficulties. The clause limits the deviation "of an erected cantilever", which means the deflected position is to be assessed. This is a departure from the normal concept that deviations are measured at fixed points such as connections, excluding the effects of gravity. This principle is seen most clearly in the assessment of a truss camber (7.6.1 in the NSSS) which is supposed to exclude the effects of gravity by being measured with the component lying on its side. It may be difficult to do this with some trusses, but the principle is clear.

The position of the cantilever tip after erection depends on a number of uncertain contributions:

- The calculated deflection will assume some stiffness of the connection to the supporting structure, and some stiffness of the supporting structure. Both are unlikely to be as assumed. Any continuity – such as back spans – in the supporting structure will modify the calculated deflection. Any difference in the arrangement at different frames will have an impact on the cantilever tip positions.
- The loading on the cantilever and the supporting structure will affect the position of the tip. If the cantilever tip position is to be verified after erection, which is usually the case and is the requirement in the NSSS, the frame designer should specify the loading condition of the supporting frame and cantilever and the corresponding required position of the cantilever tip.
- The accuracy of the cut angle at the cantilever support and the fit-up between components. A very small difference in the angle of cut can lead to a large difference in tip position.
- The temperature when the measurements are taken. Thermal movement of any back spans or equivalent elements will affect the plumb of the cantilever support and the position of the cantilever tip.
- If cantilevers are connected to an unrestrained beam, the twist will vary along the beam length, leading to variability in the cantilever tip position.

It may be tempting to propose that where possible, each cantilever be connected to its supporting member and the accuracy of the fabrication be measured when the components are lying on their side and unaffected by gravity. However, experience suggests that the positions of the tips of a series of erected cantilevers (such as supporting a canopy) will still not align.

Best practice with cantilever members is to build in provision for adjustment, either with thin shims at the support, or by adjustment at the tip to allow supported members (such as a facia detail at the canopy tips) to be aligned. Expecting good alignment without adjustment is generally unrealistic.

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A milestone in advisory desk notes

The issue of AD 500 marks a significant achievement in the provision of technical advice to the steel construction industry. Advice was issued from 1988 within SCI's own journal. When New Steel Construction was initiated in 1992 the advisory desk note was already at number 126, so about 20 were issued per year over that initial period. BS 5950 was relatively "new" at the time, so perhaps there was plenty of advice needed. Since 1992 advisory desk notes have become less frequent (around 12 per year) but hopefully still relevant and helpful.

AD 001, which was issued in April 1988 is entitled "guidance on compactness" and is really about the classification limits which must have seemed quite new at the time. The introduction to the AD refers to the "many" queries on the subject. AD 002 commences a theme which reoccurs in AD 006 and continues to the present time – correcting mistakes and other errors in the codes (and sometimes in SCI publications!).

Different writing styles can be seen over the years – some more formal and some rather more conversational. AD 003 refers to "Pundits of BS 449" – an expert in their field frequently called upon to give their opinion. AD 008 refers to "unnecessary beefing up", which would probably appear as "over-conservatism" these days.

Presumably AD 100 was also a significant milestone around 1990. AD 100 looks backwards to BS 449 and the clauses covering separators and diaphragms. Advice on withdrawn (but still used) design standards is another theme which continues to the present time.

Looking forward to the next 500, the wholesale revisions to the Eurocode suite will no doubt inspire plenty of AD notes. Most AD notes are prompted by questions sent to the SCI's advisory team, so SCI members are encouraged to keep the enquiries flowing.

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