▸27

Figure 4: Discontinuous decking with crushed ends (courtesy of Kingspan)

That means that typical UK construction using a 100mm stud with 60mm decking can no longer be designed using the simple k_t approach – a subtlety that may be missed by users of the new code.

With Annex G very likely to be rejected, and the reduction factor rule not applicable to much typical UK practice, where does that leave us? Thankfully there are two options.

- BS EN 1994-1-1:2026 explicitly states that test-based values can be used as an alternative. That means existing SCI guidance such as P405 can continue to be used.
- An alternative Annex G is being developed by Prof Stephen Hicks at the University of Warwick, that should provide more robust results than those given in either part of the code.

When is transverse decking not transverse decking?

The discussion above relates to studs used in conjunction with transverse trapezoidal decking. In many cases (at least in the UK) the decking will be continuous across the beam flange, and the studs will be through deck welded.

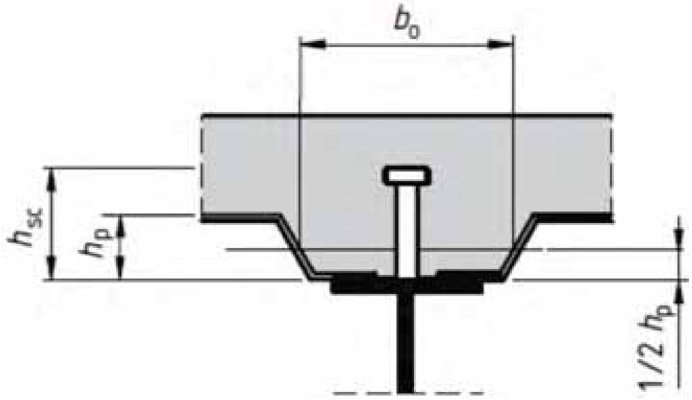

Figure 5: Shear stud in parallel decking (from BS EN 1994-1-1, Figure 6.12)

Making the decking continuous is beneficial because it reduces its deflection under wet concrete, and has process benefits. However continuity is not always the case – separate spans of decking may be used either side of the beam, often with so-called crushed ends (Figure 4). When this approach is adopted it means the detrimental impact of the voids 'ahead' of the studs, that the k_t factor is supposed to reflect, is not present. Depending on the geometry of the crushed ends, flange width and decking depth, the stud may then find itself in a situation more like that of a stud with parallel decking (Figure 5). It may then be appropriate to adopt the parallel decking reduction factor k_l, which often results in no reduction from the solid slab resistance. When using software designers should be aware of this, as some software does not recognise the difference between continuous and discontinuous decking and so penalises the stud resistance. Such penalisation could result in an erroneous failure to satisfy minimum degree of connection.

Conclusion

The shear stud is wonderfully simple, and simply wonderful (in that it can double the resistance of a steel beam and increase the stiffness threefold). But designers should be aware of some complexities and subtleties when designing composite beams. ■

References

1. BS 5950-3.1:1990 Design in composite construction. Code of practice for design of simple and continuous composite beams. BSI, 1990
2. BS EN 1994-1-1:2004 Eurocode 4: Design of composite steel and concrete structures. General rules and rules for buildings BSI, 2004
3. BS EN 1994-1-1:2026 Eurocode 4: Design of composite steel and concrete structures. General rules and rules for buildings BSI, 2026
4. COUCHMAN, G. Minimum degree of shear connection rules for UK construction to Eurocode 4 (P405) SCI, 2015

AD 559: Typographical errors in AD 471

An SCI member has identified typographical errors in AD Note 471. The corrected expressions are given below:

Columns subjected to axial compression:

The strut moment at the splice position between points of inflexion is given as:

$$M_{i,FB,sp} = sin\left(\pi \cdot \frac{x}{L}\right) \cdot M_{i,FB}$$

The term $M_{i,FB}$ should refer to the maximum second-order bending moment due to strut action between the points of inflexion. The correct expression is therefore:

$$M_{i,FB,sp} = sin\left(\pi \cdot \frac{x}{L}\right) \cdot M_{i,FB,max}$$

Unrestrained beams subjected to bending moments:

The second-order moment at the splice position between points of inflexion is given as:

$$M_{z,FB,sp} = sin\left(\pi \cdot \frac{x}{L}\right) \cdot M_{z,LTB,max}$$

The left-hand side of the equation should refer to the second-order moment due to lateral-torsional buckling at the splice position. The correct expression is therefore:

$$M_{z,LTB,sp} = sin\left(\pi \cdot \frac{x}{L}\right) \cdot M_{z,LTB,max}$$

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