SCOSS
Standing Committee On Structural Safety

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Gross errors fear in structural timber design (Jan 02)

The Standing Committee on Structural Safety (SCOSS) has recently received a report expressing concern that standards of structural timber design achieved by many designers fall far short of those needed to give assurance of safety. The following cases were described:

1. For non-trussed rafter construction, drawings from consulting engineers often show timbers along the ridge, hips and valleys with rafters at 600mm centres filling the gaps. Commonly these are drawn at 1:200 scale without any details of how the joints are to be formed. Sometimes a rafter size is specified, typically 50*150 SC3.

   A few moments thought and calculation reveals that the principal timbers are unsupported, all the timbers are undersize and that there is insufficient space at the joints to accommodate the required number of nails.

   There appears to be a belief that the site carpenter knows instinctively the magnitude of the forces in a timber structure and can produce joints that will be able to transmit the force arising in the completed structure.

2. Trussed rafters are commonly supported on masonry walls. The guidance in the trussed rafter code BS 5268: Part 3: Annex A can be summarised as requiring buttresses at 9m centres with plasterboard ceilings. Trussed rafters are often specified for buildings with walls much longer than 9m between buttresses and with a suspended ceiling. Consulting engineers typically attempt to pass on responsibility to the trussed rafter designers by means of a brief note on the drawing.

   Of the 150 or so trussed rafter fabricators in the UK only a handful employ designers with structural engineering training; the norm is an ONC in building construction.

   How many buildings actually get the wind girders they require? A recent extreme example was a 42m long building where the wall 'head' lateral movement was not to exceed 10mm - if a wind girder could be designed, was there any way of getting it to the site and installing it? Could the end wall carry the reaction from the girder?

3. Buildings with exposed timber frames or trusses are popular. Leaving aside the erroneous attempts to design the infill timbers, unrecognised torsion in purlins and the ignoring of overall stability, the structural calculations usually comprise a quick resolution of forces and a sizing of the timbers of the trusses and frames. Unfortunately, it is normal to forget that the bottom chord can carry a large shear force due to the top chord not aligning with the wall, that large amounts of timber have to be cut out in forming traditional joints, and that for some roofs wind uplift can result in the 'tie' becoming a strut. The joints are rarely designed by consulting engineers. It seems these joints are often not 'engineered' at all and the structure is completed by carpenter-designed joints of dubious strength.

4. An extreme case of a four-car domestic garage built in the style of the traditional farm cart shed was cited. The key structural elements are frames comprising two posts, a horizontal beam and knee braces. Above the horizontal beam is a pseudo-truss supporting the upper purlins.

   The calculations for this building comprised sizing for the purlins and a few sketches of the frames without construction details. There was nothing in the calculations to justify the adequacy of the frame which, in effect, included a pinned-foot portal frame, nor to engineer the joints. Analysing the frames by computer suggested that there are very serious problems at the post/beam joint and in the joints on the knee braces, particularly under wind sway cases. This building will require extensive strengthening or a major re-build.

   SCOSS is concerned that the cited designs were not properly engineered and did not provide satisfactory levels of safety. In addition, there is concern that Building Control, as operated by different district councils, appears not to have picked up these gross errors.

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