SCOSS
Standing Committee on Structural Safety
ALERT

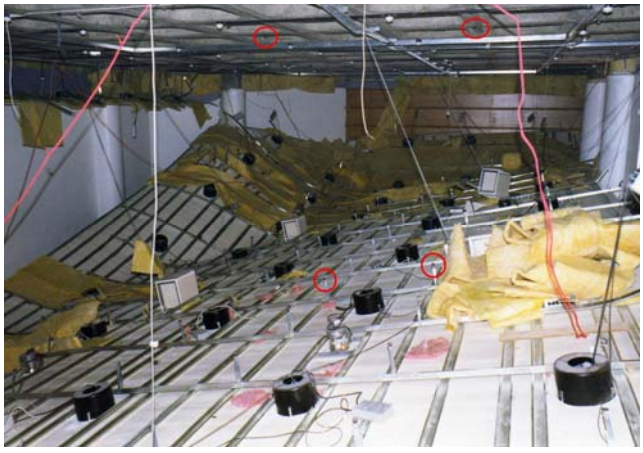
SC/08/048A
Sept08

THE SELECTION AND INSTALLATION OF CONSTRUCTION FIXINGS

Background

SCOSS has been concerned for some time at the use of structural fixings where these so called 'minor' items have not received the attention they deserve given their safety critical nature. The Committee is aware of a number of failures which had the potential for multiple fatalities. The Boston 'Big Dig' fixings failure was a tragic event concerning the fatal collapse of relatively small (but safety critical) ceiling slabs on a very large project [1]. The Swiss swimming pool roof collapse involving several fatalities, which occurred as a result of fixing failure (incorrect material specification), is a reminder from the past of the extreme consequences [2].

The Construction Fixings Association (CFA) reported in 2004 that a significant percentage of specified fixings were changed without due authority. The 15th Biennial report from SCOSS [3] also highlighted a number of concerns. CROSS Newsletter No 10 has four examples of ceiling failures all of which originated through failure of the fixings [4]. Earlier CROSS Newsletters had examples of other fixing failures including blind bolts (CROSS Newsletter 06).The CFA has recently issued relevant guidance on the selection and installation of fixings [5].



The collapse of a suspended ceiling resulting from the failure of fixings

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These failures arose as a result of a number of shortcomings. This Alert is written to draw attention to this situation. It applies specifically to fixings which are not formally 'approved' via a recognised accreditation route e.g. British Standard or European Technical Approval (ETA) which covers the fitness for purpose and installation, inspection and testing regimes.

The Building Regulations (England and Wales), Approved Document A Structure, specifically mentions the use of approved anchors for cladding fixings (Section 3 Wall Cladding). However, the general emphasis of the text is on the proven performance of the fixing in the relevant material and of the attendant risks. Determining whether the fixing is 'redundant' or 'non-redundant' is identified as a key element of safe design.
There is no specific reference to fixings in the Northern Ireland or Scottish Technical Standards, though of course through the use of the Structural Engineers Register (SER) route in Scotland a Chartered Engineer, as Certifier of Design, is taking responsibility for all structural elements.

Structural robustness issues
Key structural robustness issues include:

- Having sufficient redundancy in the system such that one isolated failure does not result in the excessive overloading of other fixings leading to progressive collapse.
- Choosing the appropriate material specification where this is relevant to load patterns, substrate condition or corrosion control due to environmental conditions.
- Noting that fixings working in shear usually have a greater robustness against certain short-comings compared to fixings working in pure tension.

Suggested control mechanisms
Safety critical fixings should be identified at the design stage. Those which might pose safety risks if not properly controlled should be specifically considered. The selected fixings should be safeguarded by:

1. Clear allocation of responsibility for:
    a. selection and design by competent persons,
    b. supervision of installation by trained personnel,
    c. proof testing of installed fixings where appropriate.

2. Selecting fixings with due regard to the practicalities of installation, the nature of and condition of the substrate and the operational conditions, including special loading conditions which may arise during installation, erection or commissioning.

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3. Discussion with manufacturers and taking good practice advice such as that on the CFA website (www.fixingscfa.co.uk). Understanding the difference between safe working loads defined by the manufacturers and partial safety factors applied to ultimate loads[1].

4. Identifying the significant risks associated with the fixings in the pre-construction data required by the Construction (Design and Management) Regulations 2007 (regardless of the duration of the project).

5. Utilising fixings with recognised approvals e.g. ETAs (European Technical Approvals) or equivalent national approvals; selecting them according to the appropriate design method, and specifying the installation method to accord with the approval document. Where non-approved fixings are considered ensuring a similar standard of validation of the suitability is provided.

6. Implementing a proof testing regime, when appropriate, in accordance with manufacturers' advice and CFA guidance[2].

7. Ensuring that if changes are made appropriate procedures are followed and that they involve competent persons acting with the same level of rigour as for the fixings originally specified.

References

1	See http://www.fixingscfa.co.uk/articles.asp (accessed on 21 July 2008)
2	Mentioned, amongst others, by N R Baddoo, C P Cutler The Structural Engineer, Vol 82 No 9, 4 May 2004 p26
3	15th Biennial Report at www.scoss.org.uk/publications.asp Paragraph 4.3.19 et seq. (accessed on 21 July 2008)
4	Confidential Reporting on Structural Safety (CROSS) at www.scoss.org.uk/cross (accessed on 21 July 2008) This will access the CROSS Newsletters
5	CFA article (anon) 'Fixing suppliers call for code of practice to avoid failures' in The Structural Engineer, Vol 86 No 9, 6 May 2008, page 9.

[1] Recognising also that the failure path, and hence capacity, may relate to the parent member itself as noted in BS EN 1992-1-1:2004; Cl 6.2.1(9) and BS8110-1:1997; Cl 3.4.5.11.

[2] Strictly this is not required for a fixing correctly specified and installed. ETAs are designed to avoid this need. However there may be circumstances where a test is considered prudent, where the fixing is not of an approved type, or as a means of encouraging contractual compliance.