

Structural-Safety Group Report 2012

December 2012

This report has been downloaded from the Structural Safety website at:
<http://www.structural-safety.org/publications.asp>

ISBN 978-1-906335-22-9

- The Institution of Structural Engineers
- The Institution of Civil Engineers
- Health and Safety Executive

Contents

	Page
Chairman's foreword	3
1 Overview	4
2 Structural Safety Group Outputs.....	5
3 Key topics discussed	7
4 Confidential Reporting on Structural Safety (CROSS)	9
5 Achievements and looking ahead.....	11

Appendices

A Membership of the SCOSS Committee	12
B Terms of reference.....	14

Chairman's foreword

When our predecessors established the Standing Committee on Structural Safety (SCOSS) in 1976, they were recognising that the prevention of structural failures was of great value to engineering and a great service to society. SCOSS was charged, primarily, with giving warnings to relevant bodies where trends in the construction industry - at any stage in the life cycle of a project – may have an adverse effect on structural safety. It springs from the enlightened insight that learning from emerging trends is hugely preferable to learning from the forensic analysis of failures.

For 36 years, SCOSS has performed its task diligently, and its recommendations have been a force for good in the industry. Some of its successes are described in this Report. One of SCOSS's most important achievements was to recognise the value of a confidential reporting scheme and recommending the setting up of CROSS. Its success, and the commonality of purpose with SCOSS, has now led to a more formal grouping of both SCOSS and CROSS – now being jointly promoted as the Structural-Safety Group.

This is the First Report of the Structural-Safety Group. We urge relevant bodies in government, industry, academia and the engineering professions to consider the outputs. The Group is keen to engage with organisations or individuals who are willing to take action to mitigate the concerns raised.

The Group is grateful to its sponsors, the Institutions of Civil Engineers and of Structural Engineers and the Health and Safety Executive for having the foresight to provide resources to support its unique work. We are also indebted to the former secretary of SCOSS, John Carpenter and to our Director of Structural-Safety, Alastair Soane. They have worked tirelessly. I would also like to pay tribute to the efforts of SCOSS committee members and CROSS panel members who have given freely of their time. Their commitment is exemplary.

Gordon Masterton OBE
Chairman

- The Institution of Structural Engineers
- The Institution of Civil Engineers
- Health and Safety Executive

1. Overview

This is the 1st Report on Structural-Safety and covers the period May 2009 to December 2012.

The Standing Committee for Structural Safety (SCOSS) published periodic reports, most recently, the 17th, in July 2009. Since then both SCOSS and Confidential Reporting on Structural Safety (CROSS) have been amalgamated as the Structural-Safety Group. Structural-Safety aims to identify trends in the construction industry - at any stage in the life cycle of a project – that may have an adverse effect on structural safety, and give warnings to relevant bodies, coupled with suggestions for the most appropriate changes required to mitigate the risks.

CROSS is now a respected and trusted scheme and innovative techniques have been developed for dealing with sensitive subjects. Newsletters are widely read and circulated. Confidence, trust, independence, assured confidentiality, and a proven system have proved to be the essential ingredients for success. Many issues have been highlighted which might not otherwise have had formal recognition and important safety considerations have been brought to the attention of engineers, both in the UK and overseas, which may enable lessons to be learned that will reduce structural failures and collapses.

As shown in chapter two the Group has issued Alerts to industry to highlight specific structural safety concerns. These include:

- Tension cable and rod connectors, August 2012
- Temporary stage structures, January 2012
- SCOSS snow load alert, March 2011
- Timber frame buildings in fire situations: the role of the designer, November 2010
- Temporary event structures: 'Saddle Span' type tents, October 2010
- The selection and installation of construction fixings, September 2010
- Snow loading on buildings, March 2010

In addition a number of relevant subjects were identified and expanded upon in Topic Papers. These have covered:

- Major cast metal components, March 2010
- Falsework: full circle, August 2010
- The education base: safety related issues, September 2010
- Assessment and inspection of buildings, September 2010
- The assumptions behind the Eurocodes, September 2010
- FC Twente stadium roof: Learning from the consequences of failure, October 2012

Subjects discussed by the Group are summarised in chapter three whilst a brief description is given in chapter four of the Confidential Reporting system and the issues that have been covered. The final chapter covers some achievements and considers the future.

This report is a summary and further information can be obtained from the [Structural-Safety](http://www.structural-safety.org) website.

2. Structural-Safety Group Outputs

The Group has produced seven Alerts and six Topic Papers as well quarterly CROSS Newsletters. The Alerts and Topic Papers have been written in response to observed trends in the construction industry, regulations and structural failure events.

Alerts

[*Snow loading on buildings, March 2010*](#)

Winter weather brought heavy snow in many parts of the UK, but particularly in Scotland. A large number of buildings, mainly agricultural, collapsed under the weight of snow (up to 1.2m in some cases) and SCOSS asked for examples of failures to be submitted.

[*The selection and installation of construction fixings, September 2010*](#)

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. There is discussion about robustness and control mechanisms.

[*Temporary event structures: 'Saddle Span' type tents, October 2010*](#)

Prompted by the increased use of complex 'Saddle Span' tent structures and the collapse of one of them, the Alert explains what measures need to be taken to minimise the risk of failure.

[*Timber frame buildings in fire situations-the role of the designer, November 2010*](#)

This explains the need for the structural engineer to consider the temporary condition of a timber frame prior to it receiving some form of fire protection. It came about following a series of arson attacks on timber frame structures leading to complete destruction.

[*SCOSS snow load alert, March 2011*](#)

Following the heavy snow falls in the winters of 2009/10 and 2010/11 in many agricultural buildings in Scotland and the North of England either collapsed or partially collapsed reports were aggregated. Issues of snow load assessment and recommendations are considered.

[*Temporary stage structures, January 2012*](#)

Several catastrophic collapses took place in the USA and elsewhere of temporary stage structures with considerable loss of life. The design, construction, and management issues of temporary stages for outdoor events are summarised.

[*Tension cable and rod connectors, August 2012*](#)

Reports to CROSS highlighted a number of instances where suspension fork connectors for high strength steel bars (cables or rods) acting in tension failed at loads well below the intended design capacity or have been found to be substandard either during construction or in service. Recommendations are given for specifying and assessing such connections.

Topic Papers

[*Falsework: full circle, August 2009*](#)

Falsework was addressed in a paper that updates a similar paper published in 2002. It explains the impact on changes to CDM regulations and new regulations such as Working at Height and the 2008 revision to BS 5975.

[*Major cast metal components, February 2010*](#)

This paper covers the use of cast metal components that are found in bridge and building construction. It highlights the need to consider movement of the structure when designing such cast components as well as the need to understand the importance of thick elements in castings.

[The education base: safety related, September 2010](#)

Guidance and recommendations are given on the teaching of structural safety to raise awareness of risk assessment and management at undergraduate level.

[Assessment and inspection of buildings, September 2010](#)

The issue of deterioration of buildings and how it impacts its reserve strength is discussed. This is especially important in times when there are changes to the use of buildings, which could require significant works in order for them to be able to support changes in imposed loading.

[The assumptions behind the Eurocodes, November 2009](#)

This highlights the impact of the adoption of Eurocodes and how the assumptions within them differ from the now withdrawn British Standards for the design of building and bridge structures. The text was a revised version of Appendix E of the 16th SCOSS Biennial report.

[FC Twente stadium roof: Learning from the consequences of failure, October 2012](#)

Part of the roof of the FC Twente Stadium in Holland collapsed in 2011 as it was being constructed. There are many lessons to be learned from this event and industry must ensure that there are no repeats so the key issues are considered.

Publications

To promote the Group the Chairman has had several articles published in *New Civil Engineer* and has made presentations at international events. The Director has published papers at CECAR5 2010 (Civil engineering Conference Asia region) *International development of CROSS*ⁱ, in *Forensic Engineering* in 2011: *Confidential reporting on structural safety*ⁱⁱ, and has contributed, with members of the SCOSS committee, a series of articles in the *Journal of the Institution of Structural Engineers*.

ⁱ Soane A. and Fordyce M. (2010). International Development of Cross. *Proceedings of 5th Civil Engineering Conference in the Asian Region and Australasian Structural Engineering Conference 2010*, Sydney, 496-501

ⁱⁱ Soane A. Confidential reporting on structural safety. *ICE Journal of Forensic Engineering*, Vol 164 Issue 4, Nov 2011, London

3. Topics discussed

The following is a summary of key items of concern discussed since the last SCOSS report.

Risk Management

The Group elected to explore the issues surrounding the concepts behind risk management. This was especially directed at undergraduates and Topic Papers would be developed for this subject.

Reservoir Construction

Problems associated with the design and maintenance of reservoir structures were considered and a meeting was held with the Environment Agency to discuss measures that can improve incident reporting to them and to suggest how a risk based approach could be used for the monitoring.

Structural fixings

Evidence from CROSS on fixing failures was given to the committee who produced BS 8539:2012 *Code of practice for the selection and installation of post-installed anchors in concrete and masonry*. Structural-Safety also participated in the preparation and publication of "[The selection and installation of anchors for suspended ceilings](#)" by the Association of interior Specialists and the Construction Fixings Association in 2012. These examples demonstrate how one of the objectives of the Group; to progress from reported concerns to changes in guidance, are achieved.

Non-Linear Analysis

The relation between complex computer analysis and hand calculations has been of concern for many years. There is some evidence to show that structural analysis by computer gives rise to the risk of not fully understanding the behaviour of structures with the possibility of misunderstandings leading to failure. CROSS published reports on this in [Newsletter No 22](#) April 2011.

Terraces

The impact of alterations to terraced housing was discussed on the basis of the effects of such changes can have on the overall structure. This issue has been raised by Building Control Officers who regularly encounter projects that make significant changes to key stability elements of terraced residential blocks.

Information flow for graduates

A review was undertaken on raising the profile of the Group to graduate engineers. The use of social networking methods such as Twitter, Facebook and LinkedIn was reviewed and it was agreed that Twitter (<https://twitter.com/structsafe>) would be an appropriate method promoting greater knowledge about the Group.

Highways Agency

The Highways Agency has issued two IANs (Interim Advice Note) requiring their supply chain to incorporate CROSS procedures into their work and this is a major step forward in introducing infrastructure contractors to the scheme.

Building Regulations

Liaison has continued with the Communities and Local Government (CLG) on the development of Approved Document A of the Building Regulations. Input was given on references to Eurocodes, issues of robustness, and other matters.

Robustness

The 16th SCOSS report noted that not all Structural Engineers are as familiar with the concepts of robustness as they might be. The committee therefore fully supported the IStructE work in producing the report: [Practical guide to structural robustness and disproportionate collapse in buildings \(2010\)](#). Further work on robustness is underway.

Major hazards & risk management in construction

Structural-Safety contributed to the CIRIA study which culminated in the publication in 2011 of their report: *Major hazards & risk management in construction*, after a two year study with Loughborough University and funded by the HSE. The report outlines eight key issues which need to be addressed by the construction industry in its widest sense.

Multi-storey car parks

Support has been given to the British Parking Association (BPA) in their campaign to raise awareness of problems with aging multi-storey concrete car parks. Reports on deterioration have been received by CROSS and used by BPA in their publication [Liability for Car Park Maintenance](#) (2011) and also in a submission they have made to government.

Temporary Works forum

The recently established Temporary Works form (TWf) has links with Structural-Safety which endorses its aims to:

- Become a leading authority in temporary works
- Engage with design engineers to get away from the 'not my problem' attitude on Temporary Works

- The Institution of Structural Engineers
- The Institution of Civil Engineers
- Health and Safety Executive

4. Confidential Reporting on Structural Safety (CROSS)

Background

Confidential Reporting on Structural Safety was established by SCOSS in 2005 to improve structural safety and reduce failures by using confidential reports to highlight lessons that have been learnt, to generate feedback and to influence change. Reports sent to CROSS are completely confidential and separate from SCOSS, and neither personal details nor information that could be used to identify a project or product are used.

Figure 1 shows the origin of the reports with the majority coming from senior figures in consulting firms. Processes for handling reports are given on the [Structural-Safety](#) web site. Figure 2 shows the stages from which reports are generated with around half, construction and temporary works, coming from events on site.

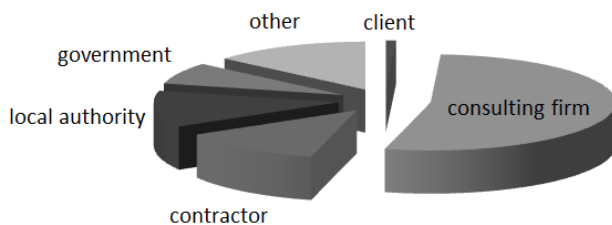


Fig 1 Source of reports

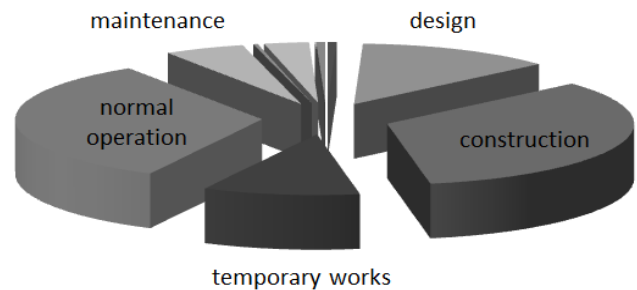


Fig 2 Source of concern

Twenty eight CROSS Newsletters have now been published incorporating de-identified confidential reports received on various structural safety matters.

Following the creation of the new website that combines both SCOSS and CROSS to reflect the creation of the Structural-Safety Group, the aims that were set out by the 17th SCOSS Biennial report have been met, namely:

- improved presentational quality
- fully searchable and functioning database of reports
- simplified registration for new subscribers.

Topics that have given rise to reports include those shown in Table 1 and further details can be found in the data base of reports on the web site.

Table 1

Topics from Confidential Reporting

Adequacy of termination connectors	Foundations	Responsibility for change
Adhesive anchorages	Free standing walls	Retaining wall collapses
Balconies	Freezing effects	Scaffolds
Balustrades	Generic design for steelwork	Shear studs
Bridges	Grades of steel	Site hoardings
Building control	Forged certificates	Snow loading
Building Regulations	Lack of control on sites	Software
CDM	Lack of experience	Solar panels
CE marking	Large panel tower blocks	Stability
Ceiling collapses	Lightweight metal frames	Steelwork connections
Crane failures	Liquid Metal Assisted Cracking	Structural steel
Defective components	Local authority resources	Temporary bracing
Demolition	Masonry failures	Temporary stage structures
Design responsibilities	Modifications to existing structures	Temporary works
Documentation	Multi-storey car parks	Timber design
Falsework	Progressive collapse	Timber roofs
Fire risk	Proprietary suspension forks	Wind damage
Forged certificates	Quality assurance	Wind loading

5. Achievements and looking ahead

As previous SCOSS reports have said recommendations are directed at Influencers and at Practitioners. Influencers are defined as individuals or organisations able to influence or directly bring about change including for example: Government Departments and Agencies, Institutions, BSI and Higher Education centres. Practitioners are defined as all those who practice structural or civil engineering or who manage the process. The recommendations for Influencers are in some cases different to the recommendations for Practitioners but should be of benefit to both. The same applies today.

Since the 2009 report, the extent of awareness about failures has increased as a result of the publications from Structural-Safety. In particular the reports about the precursors of failure have been widely read by the several thousand subscribers to the Newsletters, the readers of the electronic Bulletins issued by the Institutions, and the articles published in the IStructE Journal and NCE. Some organisations distribute the Newsletters or place them on their intranets which further extends the readership.

Achievements in the last three years include:

- successfully merging SCOSS and CROSS to create the Structural-Safety Group
- progress in establishing CROSS as a trusted method of reporting structural safety concerns
- Publishing Newsletters, Alerts, Topic Papers, technical papers and journal articles
- reacting to current affairs within the construction industry that impact on structural safety
- creating a new website to improve the Group's engagement with its intended audience
- influencing changes to guidance and standards
- expanding the number of subscribers to the web site and of readers to publications
- Increasing the number of confidential reports that have been submitted.

Looking ahead there have been expressions of interest from national organisations in countries outside the UK about becoming involved. Similar types of failure occur around the world although these vary enormously in scope and frequency. Every day people are killed and injured by the collapse of buildings somewhere and almost certainly these causes have previously been experienced elsewhere. If the lessons from failures are to be learned then information about them must be published as widely as possible. Education is the key at every level from tool box talks on site to CPD for professional engineers and the committed involvement of organisations is crucial.

A global data base of lessons that could be passed on, and shared between countries, could help to prevent loss of life and the destruction of property and assets from structural collapses. Discussions are being held with several national organisations about a framework that might be developed for international co-operation.

Appendix A - Membership of SCOSS committee

Chair

Gordon Masterton OBE DTech(Hon) BA MSc DIC FREng FRSE FICE FISTructE FIES MCIWEM, Vice President, Jacobs. [From October 2008]

Members

Stuart Alexander MA CEng FISTructE FICE MIMgt, Group Technical Coordinator, WSP Group [From October 2005 to September 2011]

Prof Colin Bailey BEng PhD CEng FICE MISTructE MIFireE, Faculty of Engineering and Physical Sciences, the University of Manchester [From January 2010]

Brian Bell MA MSc DIC CEng FICE FISTructE, Director, Bell Johnson Ltd [From October 2008]

Angus Cormie BSc CEng FICE FISTructE FIES, Director, Cairnhill Structures [From October 2007]

Dr Graham Couchman MA PhD CEng MICE, Director, SCI [From November 2007 to May 2011]

Amrit Ghose BA BAI MSc CEng CEnv FICE, Regional Director Transportation, AECOM [From October 2006 to December 2012]

Bill Hewlett, MA CEng FICE, Director Costain [From January 2011]

Dr Tony Jones BEng PhD CEng FICE, Associate Director, Arup [From October 2007 to October 2012]

John Rees BEng ACGI MSc DIC CEng MICE, Flint & Neill [From January 2011]

Ian G Smith BSc(Hons) CEng MISTructE MICE, Chief Engineer, Design and Engineering Solutions, Atkins [From October 2007 to March 2010]

Richard Snell BSc (Hons) FICE FRAE FISTructE, Consultant, formerly BP Exploration [From October 2008]

Neil Tutt MPhil CEng FISTructE, Jenkins and Potter [From January 2010 to January 2012]

Phil Wright BEng MSc CEng MICE MCIOSH DipH&S, HM Principal Specialist Inspector (Construction Engineering), Health and Safety Executive [From October 2003]

Legal Advisor

James Pratt LLB (Hons), Senior Associate, Pinsent Masons [from June 2012]

Structural-Safety

Incorporating SCOSS and CROSS

Co-opted members

Helene Wehrmann MEng CEng MICE, Arup [From January 2011]

Roger Faires MEng IEng AMIStructE, Richard F Gill and Associates [From January 2011]

Director Structural-Safety

Alastair Soane BSc PhD CEng FICE FIStructE [From 2005]

Secretary

John Carpenter BSc CEng FIStructE FICE CFIOSH, Consultant [From 2002 to December 2010]

Structural-Safety aims to identify in advance those trends and developments which might contribute to an increasing risk to structural safety. Sponsored by:

- The Institution of Structural Engineers
- The Institution of Civil Engineers
- Health and Safety Executive

Email: structures@structural-safety.org

Website: www.structural-safety.org

Appendix B - Terms of reference

The terms of reference of the Structural Safety Group are to:

- Consider both current practice and likely development from the standpoint of structural safety.
- Be aware of trends and innovations in design, construction and maintenance from the standpoint of safety.
- Consider whether unacceptable risk exists or might arise in the future and, if believed so, to give warning to relevant bodies.
- Consider whether further research and development appears desirable from the standpoint of structural safety.
- Disseminate the findings of the Committee by a biennial published report and by other appropriate means.
- Avoid duplicating the work of the Health & Safety Executive, of the Institution of Civil Engineers and of the Institution of Structural Engineers.
- Report to the Presidents of the Institutions of Civil and Structural Engineers annually and from time to time on specific issues.