

17th report from SCOSS

The Standing Committee on Structural Safety

July 2009

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Contents

Chairman's foreword.....	3
1 Overview.....	4
2 Update to the 16 th Biennial Report outputs.....	7
3 Review of key topics discussed by the Committee since 2007.....	9
4 Review of the Confidential Reporting on Structural Safety (CROSS) scheme	13
5 Achievements and looking ahead.....	16

Appendices

A Membership of the Committee	17
B Terms of reference	19

Chairman's foreword

There can be no more valid endeavour than striving to reduce the risk of harm to our fellows. The Committee, commonly known as SCOSS, was established in 1976 and is 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.

For 33 years, SCOSS has performed its task diligently, most recently under the chairmanship of my predecessor Kate Priestley, and its recommendations have been a force for good in the industry.

This, the 17th Report of the Committee (published biennially) reflects current areas of concern and we urge relevant bodies in government, industry, academia and the engineering professions to consider these with care. SCOSS is ready and willing to engage with organisations or individuals who are willing to take action to mitigate the concerns raised.

We are encouraged by the progress made by our confidential reporting scheme (CROSS) and believe this has the potential to be an invaluable tool in the prevention of structural failures.

SCOSS 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, whilst respecting its independence of view. I would also like to pay tribute to the efforts of committee members who have given freely of their time. Their intellectual rigour is exemplary. They would welcome comments on their findings.

Gordon Masterton OBE
Chairman

1 Overview

This is the 17th Biennial Report of the Standing Committee on Structural Safety (SCOSS)¹ covering the period May 2007 to May 2009.

The Committee seeks to identify where industry practice may not provide adequate safeguard against failure and to suggest changes in procedures and arrangements for the future. We need to ensure our infrastructure is created and then managed so as to obtain value from our assets.

The two year period since the last Biennial Report has witnessed a wide range of structural safety incidents which stem from a lack of risk management. UK examples include:

- unintended collapse of domestic and commercial buildings
- failure of key components in bridges and tunnels
- fire during the construction phase of timber framed buildings
- construction plant collapses (tower cranes).

It is clear from the literature and elsewhere that structural failure is a world-wide phenomenon. The Institution of Civil Engineers' Fourth International Conference on Forensic Engineering held in December 2008 illustrated numerous examples of failure. A characteristic of this data is that such failures are not the sole province of 'developing' countries. Western Europe and the USA feature widely. The projects themselves are often substantial, utilising well-known industry names.

Structural failure brings economic loss and business disruption but, because of its nature, often results also in human loss. The loss of life that resulted from the collapse of the Minneapolis highway bridge I-35W was also accompanied by severe disruption and cost to local business. As our infrastructure ages and is used more and more to its usable capacity, e.g. vehicles per hour, or to its structural capacity, any significant fault becomes that much more critical.

It is likely that the UK has a safety record amongst the best. However, as our infrastructure is ageing and budgets are limited, we cannot afford to be complacent.

The Committee received a presentation from the Health and Safety Executive at its meeting in January 2009. The HSE speaker summarised as follows:

- performance (in safety management) is improving but still unacceptable
- the refurbishment sector is lagging behind and needs to catch up fast. HSE is increasingly turning its attention towards refurbishment projects and those involved
- real investment is required in competence and skills of all involved
- CDM² is bedding in but HSE considers a step change is required in client and designer performance, assisted by better CDM coordinators.

The Committee would concur with the above.

¹ Sponsored by the Institution of Civil Engineers, the Institution of Structural Engineers and the Health and Safety Executive

² Construction (Design and Management) Regulations

Failures have also occurred in other industries which, although at first glance may not appear to have any relevance to structural safety in the construction industry, can nonetheless provide valuable lessons. These incidents include the Texas BP plant explosion (2006) and the Buncefield Oil Depot explosion and fire (2005). Such examples also conveniently introduce the subject of 'systemic failings'. This was a topic considered at the Forensic Conference mentioned previously [1] and also in Richard Williams' talk at the Prestige Lecture in April 2009 [2], supported by all three SCOSS sponsors, and aptly named 'This will bring the house down'.

In its conclusions, the previous Biennial Report made reference to the importance of safety as a driver for innovation. We made the point that this role is not widely appreciated. The Committee remains of the view that innovation is fundamental to our industry and that it can be a useful way of conveying the 'risk management' message and in raising awareness.

Growing international interest in the concept of SCOSS (and also the Confidential Reporting on Structural Safety (CROSS) scheme) has become evident over the period. However, although a number of countries are considering adopting the CROSS model, SCOSS appears to remain unique to the UK.

Since the last report of SCOSS in 2007, the construction industry has experienced a sustained boom period within a buoyant economy. It has now entered a down-turn, the intensity of which in some sectors has resulted in a major impact. This is likely to present a severe test in the management of safety risk. That is not to say that organisations or individuals will seek to create explicitly unsafe situations; rather, it is likely to manifest itself in pressure to reduce time and resource, less consideration of the most appropriate procurement routes, or in a temptation for the 'passing-down' of risk to others along the supply chain. This must be resisted. The principles of Sir Michael Latham's seminal report *Constructing the team* [3] must not be discarded, such as: "*Risk can be managed, minimised, shared, transferred or accepted; but it cannot be ignored*".

SCOSS introduced the concept of the '3Ps' in its 15th Biennial Report. This emphasised the wide contribution to safety of **People, Process and Product**. This method of analysis and presentation is adopted again in this Report.

The 17th Biennial Report

This report is designed to be a summary document. The Committee hope that in addition to providing information to industry its style will encourage a wide audience to read it and then search out further information from the SCOSS website, or elsewhere, where this is available.

Chapter 2 provides an update on the matters raised in our last Biennial Report. **Chapter 3** discusses the key issues raised in committee since the last Report and **Chapter 4** considers the reports received by CROSS over the same period. This Report concludes with **Chapter 5** which looks ahead to future challenges. **Appendices A and B** provide supplementary information.

References

- 1 Neale, B.S. ed. *Forensic engineering: from failure to understanding*. London: Thomas Telford, 2009
- 2 Williams, R. *This one will bring the house down: the unexamined role of the manager in failure*. ICE/IStructE/HSE/SCOSS Prestige Lecture. Available at: www.scoss.org.uk/publications.asp [Accessed: 10 June 2009]
- 3 Latham, M. *Constructing the team*. London: HMSO, 1994

2 Update to the 16th Biennial Report outputs

The key issues raised in the 16th Biennial Report were enclosed in the Appendices of that document and are commented on below. The Report also devoted a chapter to CROSS which is discussed in Chapter 4 of this Report.

Overall the Committee is generally pleased with the progress being made although there is always a wish for a greater speed of implementation. In the following text the link below the heading is to the original text. However, where further development has taken place a link is also made within the text to the current version.

Independent Review (through Peer Assist) Report 16, Appendix A

Although independent reviews, of one kind or another, have been adopted by a few clients for some years, e.g. Highways Agency Category 3 checks on highways structures, the Committee has been keen to promote this concept with a different emphasis. As noted in the 16th Biennial Report:

“The Independent Review is not a further layer of bureaucracy; it is designed to be useful to all parties and to assist in reducing risks and adding value to the project at affordable cost to the client” (paragraph 4.2).

One of the distinguishing features of this proposal is that the reviewer should have no liability for the advice given in order that this may be offered with due thought and consideration but without any constraints. The Committee has noted with interest similar schemes in the USA [1].

The Committee has worked on this proposal throughout the period since the last Report. It is now published on the SCOSS website and efforts are being made to encourage clients, consultants and contractors to adopt it.

The documents consist of a guidance note and a draft form of agreement.

Centre of construction excellence Report 16, Appendix B

SCOSS has taken the opportunity to discuss this proposal with a range of individuals over the period. All those consulted have endorsed the concept but the expressed common concern has been related to the availability of a suitable funding vehicle. As noted in the Introduction to this Report, over this same period the industry has moved from prosperity to a severe downturn which now makes such a search more difficult. Some industry led funding is considered to be essential. However, action is in hand to prepare a paper to identify sources of supplementary funding.

This proposal was always going to be a long-term ambition; the Committee will continue to search for opportunities. It believes that the industry would gain significant benefit from a Centre which concentrates on excellence in safety risk and welcomes the Sponsors' endorsement of this concept.

Structural submissions under the Building Regulations Report 16, Appendix C

The Committee expressed concern at two specific issues relating to applications to Building Control under Approved Document A³ (Structure), viz:

- the competency of some applicants undertaking structural designs,
- the quality of the submission itself in terms of its standard, layout, clarity of assumptions and the like.

The Committee has noted that these concerns are echoed elsewhere [2]. SCOSS is aware that at least one Building Control Authority (City of London) has adopted the submission frontispiece given in section 4 of Appendix C to the 16th Biennial Report. In addition, the Building Regulations Advisory Committee (BRAC) working group considering revisions to Approved Document A (Structure) has incorporated SCOSS' suggestions relating to both bullet points. These feature in the consultation document due to be issued for public comment in the summer of this year.

Working Engineers' Guide to Robustness and Disproportionate Collapse Report 16, Appendix D

Robustness is an essential element of any structure. Notwithstanding, it is less well understood than other structural characteristics, e.g. strength, and is given less explicit consideration than strength or serviceability in codes of practice. The Committee is pleased to record that:

- as a consequence of its expressed concerns the Institution of Structural Engineers is producing a guide on the subject (*Practical guide to structural robustness and disproportionate collapse in buildings*) [3] and,
- it has made substantial contributions⁴ to the BRAC working group which is charged with the production of a revised Approved Document A (Structure), as noted in the previous item.

Assumptions behind the Eurocodes Report 16, Appendix E

The appendix enclosed a commentary on all six of the key assumptions behind the Eurocodes as given in BS EN1990. The commentary has been updated and is now placed on the SCOSS website. The Committee is pleased to note that it has been utilised by the EN1990 review group as part of its review process. It has also been adopted by ICE as one of their Policy Papers [4].

³ The official guidance to Part A of the Building Regulations.

⁴ The contributions have extended beyond 'robustness' to cover other aspects of Approved Document A that were considered to require improvement or changing.

References

- 1 Structural Engineers Association of California. 'Chapter 4: Project design peer review'. In *Recommended guidelines for the practice of structural engineering in California*. Sacramento, CA: SEAOC, 1992
- 2 Various. 'Verulam' letters over the period in *The Structural Engineer*.
- 3 Institution of Structural Engineers. *Practical guide to structural robustness and disproportionate collapse in buildings* [due late 2009]
- 4 Structural Eurocodes: The importance of the underlying assumptions. Available at: <http://www.ice.org.uk/downloads/Eurocodes%20briefing.pdf> [Accessed: 23 July 2009]

3 Review of key topics discussed by the Committee since 2007

This Chapter describes items of concern discussed since the last Report published in June 2007. It is not exhaustive but concentrates on the key issues. The text is generally limited to a summary; where further detail is available the reader is referred to the website or other source.

The messages which emerges from the work described in this chapter, using the '3Ps' utilised in previous reports by SCOSS, are:

People:	competency, leadership
Process:	review and management of risk to encompass all aspects of the project process
Product:	meeting the necessary holistic requirements

Building Regulations

The Committee has been seeking ways in which the concerns expressed in the 16th Biennial Report (see also Chapter 2) could be taken forward. This has been done by:

- raising the concerns at talks and presentations (and specifically with Building Control officers)
- proposing to the BRAC working group, which is reviewing Approved Document A, that reference should be made to these issues.

It is hoped that both actions will have some beneficial effect.

Forensic engineering

The Committee has added to its schedule of 'Failure Topic Sheets' with summaries of:

- Torres Windsor building fire, Spain.
- de la Concorde overpass bridge collapse, Canada.

These datasheets are intended to provide short summaries of mostly well known failures so that the key learning points are apparent. The text draws on existing published material which is referenced. It is hope that these will be of interest to practitioners and students alike. They complement comprehensive forensic engineering data available elsewhere. The Committee is keen to see the core lessons from failures form part of undergraduate courses as is done, for example, at Warwick University.

SCOSS was a sponsor of the ICE Forensic Engineering Conference held in December 2008. For the first time a workshop was held prior to the conference at which academics from the USA described the work they had done to integrate forensic engineering into engineering undergraduate courses. Those that attended received some excellent teaching material.

Papers were presented at this conference which covered issues related to SCOSS and CROSS [1, 2].

Structural fixings

The Committee has had a long-standing concern regarding the adequacy of some structural fixings. This concern was reinforced by the reports within CROSS Newsletter No 10. These related to the collapse of heavy duty suspended ceilings in cinemas. The Boston 'Big Dig' tunnel also suffered a setback when a number of fixings, which supported reinforced concrete ceiling slabs, failed [3]. The Committee received a presentation from Mark Salmon, consultant to the Construction Fixings Association (CFA) which takes a particular interest in fixings into concrete.

SCOSS issued an Alert related to fixings in September 2008 [5]. The CFA is in discussions with BSI regarding a new code, and the Health and Safety Authority in the Republic of Ireland is due to publish a guide on the design and installation of fixings.

Independent review through peer assist

As noted in Chapter 2, further work has been undertaken on this topic resulting in a Guidance Note and Draft Form of Agreement. The next stage is to encourage clients, consultants and contractors to adopt its philosophy.

Materials

The Committee received an interesting presentation from Neil Sandberg of Sandberg LLP in October 2008. The subsequent discussion encompassed the following:

- *cast and forged metal components*: a conclusion from the discussion was that there was a need for guidance on the procurement of these items. This is in production at the time of writing, and
- *learning the lessons*: a review of the range of material failures occurring within the industry reinforced the need for feedback and dissemination of informative material. Although it was recognised that a scheme existed to do this (CROSS), it was also acknowledged that for various reasons feedback was limited. Specifically the Committee identified confidentiality clauses in settlement agreements as being a major impediment.

Robustness

The Committee has discussed robustness of structures on a number of occasions. Although matters relating to strength and serviceability are taught at university, robustness does not appear to receive the same attention; perhaps because it is less tangible and is not explicitly covered in code formulae. As noted in the guide [6]:

“In previous times, when buildings and their components were sized by rule of thumb, a measure of robustness tended to be built in, albeit not always successfully. In modern times, our building methods have become more complex, so robustness has ceased to be an attribute taken for granted and a need has arisen to consider it more explicitly. That need is still evolving as the construction industry develops ever more sophisticated and structurally efficient products, and as pressures intensify to build ever more quickly.”

The proposed guide on robustness and disproportionate collapse is described in Chapter 2 and many of the specific concerns expressed by the Committee and others are encapsulated in the guide. It is hoped that, if referenced to the revised Approved Document A, it will be widely consulted.

Temporary TV screen structures

SCOSS has worked closely with HSE to consider the issues associated with the design, procurement and operation of large external TV screens. This led to the production of a report in 2008 and which is available on the SCOSS website. The report identified a number of concerns which could impact upon the safety of the public.

It is anticipated that the use of temporary structures for outdoor events will increase and will be particularly evident during the World Cup in 2010 and for the Olympics in 2012. The report, which has been widely publicised in the events industry, is intended to raise awareness and standards. It also represents a good example of close collaboration with one of our Sponsors (HSE), the Institution of Structural Engineers' Advisory Group on Temporary Structures (AGOTS) and the events industry.

Tower cranes

Tower cranes are substantial moving structures. In recent times a number have suffered partial or total collapse during use or when being extended resulting in fatalities. At the Committee meeting in July 2008, Tim Watson, a consultant and expert witness in this field, presented a résumé of concerns relating to these items of plant. The points made included:

- since 2000, 22 serious tower crane incidents were identified by the speaker, using a web search. Of these, 7 had occurred in the UK and 5 in the USA. Of these 22 failures, 7 failed in-service, 5 during climbing operations, 5 during dismantling and 5 from other causes
- key points identified as causes included competencies, supervision and failure to follow procedures. One failure in Liverpool revealed a potential deficiency in the crane specification (this has been reviewed by HSE [7]).

It was noted that:

- the use of NDT is determined by the competent person rather than by a blanket requirement (as for the entertainment rides industry)
- there should be a log book with all cranes; it is understood that this is not always provided
- the entertainment rides industry requires designers to identify fatigue critical locations so as to aid inspection; there is no equivalent for cranes
- new cranes are subject to planned preventative maintenance
- inspections may be in-house; it was noted that the entertainment rides industry required independent inspections
- crane design life may be ascertained from the British Standard; however as crane components, e.g. tower sections, can be interchanged estimating actual life is difficult
- cranes, or parts of, change ownership.

It appears that the insurance industry is reluctant to link performance and standards with premiums. It was noted that a range of advice was available through the Construction Plant Association.

The Strategic Forum has produced best practice guidance on tower cranes [8] as a means of raising awareness and standards and HSE is consulting on the formation of a statutory register of tower cranes.

References

- 1 Carpenter, J., Powderham, A. and Williams, R. 'Systemic failure in civil engineering: its causes and avoidance'. *Forensic engineering: from failure to understanding*. London: Thomas Telford, 2009, pp81-90
- 2 Soane, A. 'Development of CROSS – confidential reporting on structural safety'. *Forensic engineering: from failure to understanding*. London: Thomas Telford, 2009, pp61-70
- 3 Fixing Failures. Case Study 1: Collapse of a concrete ceiling on Interstate 90 Connection Tunnel in Boston. July 2006. Available at: www.fixingscfa.co.uk/articles.asp [Accessed: 9 June 2009]
- 4 Construction Fixings Association website. Available at: www.fixingscfa.co.uk [Accessed: 9 June 2009]
- 5 Institution of Structural Engineers. *Practical guide to structural robustness and disproportionate collapse in buildings* [due late 2009]
- 6 The selection and installation of construction fixings. Available at: www.scoss.org.uk/publications.asp [Accessed: 9 June 2009]
- 7 Liverpool city centre crane collapse, 15 January 2007. Available at: www.hse.gov.uk/construction/liveissues/liverpool.htm [Accessed: 9 June 2009]
- 8 UK safe crane campaign: reassuring the UK. Available at: www.strategicforum.org.uk/towercranes.shtml [Accessed: 9 June 2009]

4 Review of the Confidential Reporting on Structural Safety (CROSS) scheme

Background

In the 16th Biennial Report the Committee was able to report on 2 years' worth of experience and to analyse the results available at that time. The scheme has now been in operation for just under 4 years. It has received some 160 reports and published 14 Newsletters.

The scheme is well established and recognised around the world. A number of countries have expressed interest in setting up their own reporting scheme. The European Union is actively reviewing whether to develop an EU framework with particular reference to defects reporting. It is believed that repairing defects in new buildings amounts to a significant proportion of total expenditure. The Fire and Rescue Service is commencing the design of a reporting scheme modelled on CROSS.

During the period the report for the Scottish Building Standards Agency (now the Scottish Buildings Division), commonly known as the SCOTCROSS report, was completed [1]. This considered some 1,200 items received over a two year period.

It was agreed with the Sponsors during this period that the CROSS scheme should move from its 'pilot' status to that of a permanent facility. It was considered essential that as part of this change the website should be replaced by one that reflected contemporary quality, usability standards and flexibility. This has now been completed and the website is available to users. The key changes are:

- high presentational quality
- fully searchable database of reports
- designed to accommodate data in a variety of formats
- flexible architecture
- simple registration for new subscribers.

CROSS has received financial support from a number of sources, viz:

- Department of Communities and Local Government (which also specifically substantially funded the website upgrade)
- Health and Safety Executive
- Institution of Civil Engineers
- Institution of Structural Engineers
- Scottish Building Standards Agency (for the SCOTCROSS project).

Despite this welcome support, and some expression of support for the future, a long-term funding mechanism has yet to be confirmed. This is being actively sought at the time of writing.

Feedback and lessons learned

The Committee has analysed all the reports by project phase. This revealed that the prime contribution to the failure of the problem was attributable as follows:

- Design 25%
- Construction 47%
- Operation 25%
- Other 3%

We have also considered the reports in relation to the **3Ps** approach as used in the 16th Biennial Report i.e. People, Process and Product. This indicates some familiar themes.

People

- the necessity to ensure that those involved are competent or under adequate supervision

Process

This is the category with the widest range of issues. The reports clearly demonstrate the importance of:

- good communication
- clarity of purpose
- identification of hazard and risk
- whole-life thinking

Product

- That the product is fit for its intended use having regard to loads, installation, use (and foreseeable abuse), tolerance and the like.

Achievements

As a consequence of running the CROSS scheme:

- advice is given through the Newsletters and elsewhere on good practice
- changes have been made to components by suppliers
- a SCOSS fixings alert was issued to the industry
- the SCOTCROSS project has been used by the Scottish Executive
- a SCOSS/CROSS presentation was made to the government committee reviewing the structural aspects of the Building Regulations (Approved Document A)
- a number of the reports are used as case studies for teaching purposes within universities.

Commentary

The reports received and illustrated in the Newsletters provide graphic example of real problems experienced by others. They cover a wide spectrum of situations and hence are valuable learning tools. However, underlying these specific examples are common root causes of failure, as indicated in the '3Ps' summary above, which have featured in previous Biennial Reports.

Reference

- 1 Confidential reporting on structural safety for Scottish buildings. Available at: www.sbsa.gov.uk/pdfs/SCOTCROSS_REPORT.pdf [Accessed: 9 June 2009]

5 Achievements and looking ahead

Achievements

The Committee has achieved some beneficial goals, viz:

- a continued profile as a body which helps industry to understand and manage risk
- keeping structural safety risk in the mind of the structural engineer
- the publication of practical guidance and warnings
- obtaining the agreement of others to take action
- the on-going use and benefits of CROSS.

The above has been supplemented by active work to publicise the importance of systemic risk management.

It is believed that all the above complement and support the key strategies of the Sponsors.

Looking ahead

The 16th Biennial Report looked ahead to the challenges likely to be facing the industry in the future. These have not changed in the time since the previous report was published other than in recognising the fact that they now have to be faced, in the short-term at least, within a severe downturn.

The Eurocodes will have finally 'arrived' when next year many British Standards are formally withdrawn. This milestone remains both a major opportunity and a challenge. Other significant influences include the increasing amount of refurbishment work and the development of off-site fabrication.

Two specific items of concern drawn to the Committee's attention are:

- the responsibilities of structural engineers in relation to the design of temporary works and accommodation of temporary loads.
- the perception that the competence of graduates in respect of structural analysis and the understanding of structural behaviour has declined significantly.

The Committee will consider these over the coming months.

The '3Ps' reminds us that risk can stem from a wide range of factors: in particular, a lack of investment in training or provision of inadequate supervision and review will directly impact upon the risk profile of individual projects and the industry overall.

Appendix A - Membership of the Committee

Chairmen

Gordon Masterton OBE DTech BA MSc DIC FEng FRSE FICE FStructE FIES MCIWEM, Vice President, Jacobs. [From October 2008]

Kate Priestley MBA CQSW HFIHEEM FRSA, Chair of the Leadership Centre for Local Government, previously Chief Executive, Inventures. [Until September 2008]

Members

Stuart Alexander MA CEng FStructE FICE MIMgt, Group Technical Coordinator, WSP Group. [From October 2005]

Brian Bell MA MSc DIC CEng FICE FStructE, Director, Brian Bell Associates. [From October 2008]

Professor Marios Chryssanthopoulos BSc MS PhD DIC CEng FICE FStructE, Professor of Structural Systems, School of Engineering, University of Surrey. [From October 2003]

Angus Cormie BSc CEng FICE FStructE FIES, Technical Services Manager, Ogilvie Construction. [From October 2007]

Dr Graham Couchman MA PhD CEng MICE, Director, SCI. [From November 2007]

Amrit Ghose BA BAI MSc CEng CEnv FICE, Regional Director Transportation Structures, Faber Maunsell. [From October 2006]

Richard Hennessy BEng(Hons) CEng MStructE MICE, Knowledge Manager – Structures Discipline Development Group, Buro Happold. [From November 2007]

Dr Alistair Hitchcock (co-opted member) BEng EngD CEng MICE, Project Manager, Mott MacDonald. [From July 2007]

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

Adrian Judge BA CEng MICE MIHT, Retired, formerly Director, Jacksons Civil Engineering. [Until October 2007]

John Lane BSc CEng FICE, Structures Engineer, Rail Safety & Standards Board. [Until October 2008]

Joe Locke MBE FEng MSc CEng FStructE FweldI, formerly Director, William Hare & Co. [Until October 2008]

David Mackenzie BE MS CEng FStructE MIHKE MASCE, Partner, Flint & Neill Partnership. [Until October 2007]

Dr Allan Mann FEng PhD BSc(Eng) CEng FStructE MICE, Senior Consultant, Jacobs. [From October 2003]

Trevor Nicholls CEng MICE, Partner, Construction & Engineering Practice Group of K & L Gates LLP. [From October 2004]

Alan Powderham FREng BSc(Hons) CEng FIStructE FICE, Director, Transportation, Mott MacDonald. [From October 2005]

John Rushton BEng(Hons) MSc CEng MIStructE MICE, Partner, Peter Brett Associates. [Until October 2007]

Ian G Smith BSc(Hons) CEng MIStructE MICE, Chief Engineer, Design and Engineering Solutions, Atkins. [From October 2007]

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

Faith Wainwright FREng BA(Hons) FIStructE FICE, Director, Arup. [Until October 2007]

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

Secretary

John Carpenter BSc CEng FIStructE FICE CFIOSH, Consultant. [From 2002]

Appendix B - Terms of reference

The terms of reference of SCOSS 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.