This is the fourth review from Structural-Safety and covers the period from January 2017 to December 2018 for work done by SCOSS (Standing Committee for Structural Safety) and CROSS (Confidential Reporting on Structural Safety). It is the 21st review since SCOSS was formed in 1976.
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Chair’s Foreword

The two years 2017-2018 has been a busy period for Structural-Safety. The industry has been shaken by a number of high-profile incidents and tragedies, from Edinburgh Schools and Grenfell Tower in UK to the Morandi Bridge and other events abroad, as well as less publicised incidents that, nonetheless, the industry should see as early warnings of equal potential.

Structural-Safety has been active in all these areas. We have seen rises in the levels of reporting to CROSS and the readership of the SCOSS and CROSS outputs. The engagement of other institutions and of policy makers has made a step change increase. It is clear that many engineers, and those with responsibility for our engineering assets, are taking structural safety seriously; they see that the Structural-Safety model, based on the sharing of knowledge, is central to effective professional practice.

Particularly heartening has been the enthusiastic response of a younger generation to our CROSS Forum events and to the Young Members group in the Committee; we are seeing a sustainable future developing.

Structural-Safety has been taking a more strategic role in UK and globally. Dame Judith Hackitt, in her work post Grenfell, and Prof Peter Hansford, in his report In Plain Sight, both identify the importance of the work that Structural-Safety does and see the necessity for it to increase. Discussions with MHCLG are ongoing to enable this. Overseas, our model is being replicated in Australia, where CROSS-AUS was launched by IStructE President Faith Wainwright in 2018, and in South Africa, USA and Germany. Outputs and learning are being shared, to the benefit of all.

Our greater activity in the past two years has been enabled by increasing support from our sponsors IStructE, ICE and HSE. This has, in particular, facilitated the engagement of Dr Paul McNulty as Senior Engineer, giving great support to our Director Dr Alastair Soane, who has himself increased work scope. Some direct work for MHCLG has helped to increase budget. The pressures on our volunteer SCOSS Committee and CROSS Panel have increased and we all owe a debt to these eminent engineers who give their time and energy, and to the firms and families that support them. To all, together with those that write reports and submit them to us, and our readership and those that act on Structural-Safety outputs, I give my heartfelt thanks.

CHAIR:
Bill Hewlett
1. Overview

This is the fourth review from Structural-Safety and covers the period from January 2017 to December 2018 for work done by SC OSS (Standing Committee for Structural Safety) and CROSS (Confidential Reporting on Structural Safety). It is the 21st review since SC OSS was formed in 1976.

SC OSS is a committee established to maintain a continuing review of building and civil engineering matters affecting the safety of structures. They seek to identify trends where industry practice may not provide adequate safeguard against failure. SC OSS safety alerts are published to raise awareness of any trends identified and to suggest changes in procedures and arrangements for the future. While concentrating on matters relating to the UK, SC OSS maintains an awareness with events worldwide through its contact with other international organisations.

CROSS is a confidential reporting scheme established to capture and share lessons learned from structural safety issues which might not otherwise have had public recognition, with the aim of preventing future failures. Analysis of the reported safety issues can provide insight into how the safety concerns or events occurred and spur the development of measures to improve safety. Reports are welcome from anyone involved in the buildings and civil engineering industry, including structural engineers, civil engineers, designers, contractors, clients, inspectors, maintenance and operation teams, project managers, local authorities, statutory authorities and government.

CROSS is the only independent organisation for collecting and publishing structural safety related reports. A confidential system allows safety issues to be reported while avoiding potential concerns, including being reprimanded or disciplined for actions that led to the safety issue, pressure from co-workers to keep quiet, possibly affecting professional membership, loyalty to client/employer or being concerned about insurance issues.

Several members retired during the last two-year period and their contributions of time and expertise are gratefully acknowledged. New members have taken their places and are warmly welcomed. Indeed, the generous, and voluntary, donation of time by these senior practitioners is the greatest asset of Structural-Safety.

The unfolding of a series of safety incidents over the last two years, including the Grenfell Tower fire, the Liverpool Car Park Fire, the Eindhoven Airport parking building collapse, the collapse of a pedestrian bridge under construction in Miami, and the collapse of a motorway bridge in Genoa have raised debate and heightened the focus on improving safety in the construction industry.

Dame Judith Hackitt was asked by the Secretary of State for the Department for Communities and Local Government (DCLG, now MHCLG) and the Home Secretary to conduct an Independent Review of Building Regulations and Fire Safety, with a particular focus on their application to high-rise residential buildings (HRRBs). Dame Judith published her final report in May 2018, which included over 50 recommendations to improve the safety of buildings and a fundamental shift in the approach to regulation.

At the same time, the ICE commissioned a report from the Government’s former Chief Construction Adviser, Professor Peter Hansford, leading a panel of industry experts, to consider the risks of catastrophic failures in economic infrastructure assets on a general basis and to make recommendations on how the industry can reduce the prospect of future failures. Professor Hansford published his final report in October 2018, and concluded that, while the risk of catastrophic infrastructure failure is low, crucially, the threat is rising. The report makes recommendations that, when implemented, will further reduce the risk of failure in economic infrastructure.

In both Dame Judith’s and Professor Hansford’s reports, the need to capture and disseminate lessons from safety concerns, near misses and incidents in order to improve safety features strongly. Indeed, there are direct recommendations in both reports to achieve this aim of sharing lessons learned by building on the work of Structural-Safety.

CROSS International has been established to promote confidential reporting as an effective method of enhancing structural safety for the benefit of all those involved in the construction industry and the general public anywhere in the world.

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CROSS-AUS for Australasia was launched in Adelaide at ASEC (Australasian Structural Engineering Conference) in September by Faith Wainwright, 2018 President of The Institution of Structural Engineers. CROSS-US for the USA is expected to launch in April 2019, and we are working with the Bundesvereinigung der Prüfingenieure für Bautechnik e.V in Germany with a view to launching CROSS-DE in Germany in late 2019. The CROSS reports for each of the regional CROSS schemes will be stored in one central database, allowing seamless learning between the different regions.

This report is a summary of the work of Structural-Safety and further information can be obtained from the Structural-Safety website. >
2. Publications

Below is a summary of the Structural-Safety publications over the last two years. You can subscribe to the mailing list for email updates from Structural-Safety, including the latest CROSS Newsletters and SCOSS Alerts.

SCOSS Alerts

Effects of Scale - November 2018

This Alert has been prompted by concerns raised about some particularly large structures and is based on evidence made known to SCOSS. The topic is gaining in importance as clients, and their designers, strive to build ‘lighter, bigger, taller and longer’.

The recommendation from SCOSS is that a far better understanding of large structure performance is needed. Large structures being defined as those whose dimensions are such that effects that are not well understood or where secondary effects pose challenges. To assess specific implications will require further research studies. SCOSS wants to promote these and thereafter to disseminate the concerns over scale effects that are determined.

The topic is gaining in importance as clients, and their designers, strive to build ‘lighter, bigger, taller and longer’

Building a Safer Future - July 2018

This Alert is a summary of selected parts of the Independent Review of Building Regulations and Fire Safety: Final Report that are relevant to structural and civil engineers. The report should be read in full to appreciate all the facts and the implications, and to absorb the wealth of information and the recommendations made by Dame Judith Hackitt.

The report proposes a fundamental shift in the approach to regulation, being one from prescription to one of the professions looking at buildings as a whole and demonstrating them to be safe. Although there has been much public focus on the Grenfell Tower fire and the role of cladding in that incident, the Hackitt report takes a much broader view tackling the basic challenge of making HRRBs (and by implication other buildings) safer overall. Significant effort will be required by government and industry to assess and comment on the many implications.

Fire in Multi-Storey Car Parks - February 2018

The severe fire at the Liverpool Echo Arena MSCP on 31 December 2017 gutted the seven-storey building and up to 1,400 cars were destroyed. Fires in car parks are not uncommon; however, the Liverpool fire was unprecedented in scale because, unusually, the initial fire in one car rapidly spread to other cars.

This Alert is to draw attention to the fact that similar events could occur again, and all those in the car parking business must be aware of the risks. The building had a substantial reinforced concrete frame which withstood the fire although there were collapses of some of the concrete floor slabs. In other circumstances, the consequences could be far worse, and, in the light of the need to protect life and property from fire, all possibilities of major fires in buildings must be maintained at an acceptable level. This includes considering the potential effects on neighbouring buildings.

Figure 1: Fire on separate levels
Image courtesy of Merseyside Fire & Rescue Services (MRFS)

Figure 2: Disintegration of floor slab
Image courtesy of Merseyside Fire & Rescue Services (MRFS)
Hazard identification for structural design - September 2017

This Alert, which is a reproduction of part of The Institution of Structural Engineers’ Manual for the systematic risk assessment of high-risk structures against disproportionate collapse[1], is aimed at those involved in identifying and managing hazards associated with a structural design, including principal designers, designers (permanent and temporary works), clients, principal contractors, contractors and external stakeholders. It was published to emphasise the need for care by all engaged in design work.

Inquiry into the construction of Edinburgh Schools - February 2017

This Alert is based upon the Report of the Independent Inquiry into the Construction of Edinburgh Schools, published in February 2017. It deals with the aftermath of the collapse of part the outer skin of a cavity wall at Oxgangs Primary School Edinburgh in January 2016 under high winds. Nine tonnes of masonry fell onto an area used by pupils and other pedestrians.

Fortunately, there was nobody in the vicinity at the time. As is often the case with structural failures, the margin between a near miss and a catastrophe is wafer thin. This wide ranging and comprehensive report concerns investigations into defects in the construction of the external walls of 16 other schools in Edinburgh, resulting in the enforced closure of all 17 schools for a period of several months.

Sudden loss of ground support - July 2017

In March 2017, the Press reported that Pinner Primary school in London had to close, perhaps permanently, because of chalk mines discovered beneath it. Parts of the mine roofs collapsed, putting the stability of the school at risk. This is not a one off. SCOSS has logged several incidents of unstable ground below structures where voids have opened-up; so far without loss of life, but pictures of the incidents show that safety could easily have been severely compromised.

Nine tonnes of masonry fell onto an area used by pupils and other pedestrians

This Alert deals with only with structural safety aspects. A fundamental aspect, as illustrated by many previous failures, is for the Design Team to know that what they thought was being built, was actually built.
**Structural stability/integrity of steel frame buildings in their temporary and permanent condition - February 2017**

There are occasional collapses of steel frame structures during construction and this Alert is to draw attention to matters which need to be borne in mind by designers, fabricators, and contractors. CROSS has had several reports about concerns which could have led to failure as well as actual failures.

An example of a significant failure which took place is the catastrophic collapse of the City Gates Church steel framed building in London on 31 January 2012.

(a) 15 days before collapse

(b) Collapsed structure

Figure 6: City Gates Church building collapse
CROSS Newsletters

Newsletter 45 - January 2017

Summary of editorial
Relationships with the Temporary Works Forum have been strengthened as a result of Structural-Safety becoming an Invited Member. We look forward to sharing information on improving safety in this area. New contacts have been made with CABE, the Chartered Association of Building Engineers, who have become a supporter, and many of whose members become involved with the safety of buildings during construction. On an international front a meeting has been held with AQC, Agence Qualité Construction, based in Paris on future co-operation.

Mathew Syeed of the Times recently interviewed Captain Chesley Sullenberger, the pilot who landed an Airbus A320 on the Hudson River in 2009, saving the lives of 155 crew and passengers after an engine failure. He talked about how the impressive safety record in aviation is based upon constant learning from accidents and near-miss events, a method, he said, which other industries would do well to follow.

He also talked about how he had trained his brain to think calmly under stress, even as his blood pressure shot up and perception narrowed. Most striking, however, was his sense of duty. He walked the plane twice, even as it was filling with water, to ensure everyone had got out, and refused to do TV interviews, despite feverish media interest, until everyone had been accounted for. Aviation safety was the model for establishing CROSS and it is heartening to be reminded of how methods of constantly learning from others can, in a very practical way, help to save lives.

CROSS reports
612 Number of near misses and the regulatory regime
614 Columns missing due to 3D modelling
581 Requirement for CDM Safety Files to be transferred
610 High mast light poles at all UK sites
579 Further report on freezing of water in hollow sections
575 Scaffold overturn
599 Heritage balustrade

Figure 7: Report 626 - Partial failure of PC tank unit on installation

Newsletter 46 - April 2017

Summary of editorial
Two Alerts have been issued by SCOSS recently; Structural stability/integrity of steel frame buildings in their temporary and permanent condition > and Inquiry into the construction of Edinburgh Schools >. Both highlight problems with the quality of construction and the lack of supervision on site. Six of the seven reports in this issue relate to quality issues and it has been a common theme in CROSS reports. The trend is disturbing, and it is only by chance, good luck and timing, that there were not multiple casualties.

Six of the seven reports in this issue relate to quality issues and it has been a common theme in CROSS reports

If there had been large scale fatalities, then public outcry and government intervention would have meant that instead of these events being near misses, they would have become weapons with which to attack the construction industry. A much better attitude to safety must be cultivated by clients, designers, constructors and supervisors to protect themselves and the public. The urgent need to restore Resident Engineers and Clerks of Works to sites must be recognised. These and other critical recommendations are given in Report of the Independent Inquiry into the Construction of Edinburgh Schools which makes for sobering, but essential, reading for all involved in the safety of buildings.
Summary of editorial

In humanitarian, social and engineering terms, the catalyst for profound change is often a catastrophe whose name is remembered for years to come. Grenfell Tower will become one such tragedy and the ramifications of the fire will resonate into the future. The heartfelt sympathy of everyone goes to the families and friends of the victims who died, those who were so grievously wounded, and those whose futures will have been so damaged.

Other tragic fires such as Bradford Football Stadium (1985), Kings Cross Underground (1987), and Piper Alpha (1988), resulted in changes to stadium design and construction, underground railways, and offshore platforms respectively. Their names remind us of the event but not of the human cost. Fifty-one years ago, a small gas explosion at high level on the Ronan Point block of apartments triggered a disproportionate and progressive collapse. Eventually this resulted in changes to Building Regulations in the UK and elsewhere, changes to the approaches to structural robustness, and new generations of safer towers. A form of failure not previously encountered led to a transformation by learning from a disaster.

The same must happen with Grenfell Tower where performance across a range of issues has clearly not been as intended, with consequences that have so horrified the public and experts alike. The full implications will not be known for some time. It is of course essential that as much as possible of the forensic evidence will be collected and preserved. Importantly the announcement of a Public Inquiry means that evidence and recommendations will be in the public domain and not, as is often the case with collapse investigations, hidden behind non-disclosure agreements.

Newsletter 48 - October 2017

Summary of editorial

It was announced by the Secretary of State for the Department of Communities and Local Government (DCLG) on 5 September that SCOSS have been asked for advice on matters relating to the safety of tall residential buildings. Fire resilience is the main concern but there have been worrying reports of instances of fixing failures in external insulation panels that have emerged recently. In this Newsletter, there is a report on thin stone claddings and inadequate fixings. More attention must be paid to claddings of all types and their fixings and it is clearly insufficient simply for CROSS and SCOSS to issue warnings.

There needs to be a regime with a tougher and more rigorous approach to the recognition of risk amongst all parties involved in the design and installation of large, heavy, and possibly inflammable, panels on the outsides of buildings. It may be that regulations need to be introduced to force those parts of the industry who are not complying to do so.

Other matters reported in this issue include fire safety risks and the dilemma of how to deal with these if a client refuses to act, inadequate design and construction issues, and...
the question is posed as to whether some current buildings have structures which are inherently vulnerable to future modifications.

More attention must be paid to claddings of all types and their fixings and it is clearly insufficient simply for CROSS and SCOSS to issue warnings.

**CROSS reports**
- 689 Fire safety risks during technical due diligence survey
- 632 Risky new buildings?
- 644 Inadequate end bearings for transfer beams
- 646 Unconnected connection
- 627 Cantilever signal base failure - holding down bolts in bending
- 648 Thin stone cladding problems
- 630 Multi-storey car park foundations

**Newsletter 49 - January 2018**

**Summary of editorial**
The Independent Review of Building Regulations and Fire Safety Interim Report by Dame Judith Hackitt in December 2017 focuses on the future by learning from the past. She said that the whole system of regulation is not fit for purpose leaving room for those who want to take shortcuts to do so. Strong words which will resonate with CROSS readers because, for 12 years, we have gathered reports about safety concerns and events in construction demonstrating the dire condition of parts of our industry.

Dame Judith collected evidence from 250 sources, and we were amongst them with information obtained from responses to a recent survey of The Institution of Structural Engineers’ Members and Fellows, from reports sent to CROSS, from SCOSS Biennial Reports over many years, and from the views of the SCOSS Committee and the CROSS Panel.

We recommended that high-risk buildings should require a documented report justifying their overall fire safety as part of the Building Regulation submission and that the competency of those charged with managing fire safety throughout the life of a building needs to be addressed. We said that both designers and contractors, including major subcontractors, should be better regulated to improve the quality of construction.

Such concerns and similar views from many others, all led Dame Judith to state that she intends to create a better system for the future which will be easier to work with, deliver better solutions, and rebuild confidence.

**We recommended that high-risk buildings should require a documented report justifying their overall fire safety as part of the Building Regulation submission and that the competency of those charged with managing fire safety throughout the life of a building needs to be addressed**

In the January 2017 Newsletter, when commenting on Report 612 Number of near misses and the regulatory regime, the CROSS panel commented “There is certainly the possibility of another mega failure that will serve as a wake-up call. But that will...”
be too late for those involved”. This was written about structural collapse rather than fire, but the underlying causes are generic and the Grenfell Tower fire is a tragic example.

CROSS can help with the rebuilding process by getting more evidence from reporters and using this to emphasise the cultural changes that are needed to protect the public and to repair the reputation of parts of our industry.

CROSS reports
706 General fire safety in residential blocks
707 Fire safety in high rise residential blocks - service ducts
713 The role of District Surveyors
694 Dangerous balcony construction
693 Stability of existing structures impacting construction sites
690 Concern about foundations to telecomms masts
635 Incomplete casting of composite brick/concrete parapets
703 Inadequate structural design for domestic properties

CROSS reports
726 Combustible insulation in rainscreen cladding
736 Building extension causes snow drifting failure
665 Lack of masonry wall ties
735 Inadequate design of cantilever glass barriers
683 Corrosion causes collapse of steel floodlight mast at football club
740 Common use of S235 cold rolled steel instead of S355 hot rolled steel
634 Contractor installs incorrect steel grade
678 Architect conducts structural design of sway frame for domestic project

The most important component of CROSS is the commitment of those who report their safety concerns or event descriptions to us.
Summary of editorial

The Independent Review of Building Regulations and Fire Safety Final Report from Dame Judith Hackitt sets out a vision for a cultural change in building safety. It recommends a model of risk ownership, with clear responsibilities for the Client, Designer, Contractor and Owner to demonstrate the delivery and maintenance of safe buildings. This is initially for HRRBs (Higher Risk Residential Buildings) but many of the changes will affect all buildings in due course.

Confidential reporting was recognised in the report as a model for obtaining safety information. To quote “there is a steady flow of incident reporting to CROSS from structural engineers, indicating its relevance, but it relies on a skilled professional to recognise the issue and report it”. For all buildings, other than HRRBs, continues the report, the current CROSS scheme should be extended and strengthened to cover all engineering safety concerns and should be subject to formal review and reporting at least annually.

There are many other recommendations and within these there is scope for influence from Structural-Safety, including CROSS and SCOSS, on not just technical competence, but to help provide the leadership that is required within the construction industry and fire safety sector to drive the shift in culture.

In this CROSS Newsletter are reports reflecting some of the issues highlighted in the Hackitt Report; responsibilities on site, design and construction concerns, and responsibilities for existing structures.

The Independent Review of Building Regulations and Fire Safety Final Report from Dame Judith Hackitt sets out a vision for a cultural change in building safety

CROSS reports

447 Fatal wall collapse at school due to ‘wall climbing’
669 Light Gauge Steel Framing and responsibilities on site
734 Glass smoke screens and structural safety
662 Tower crane foundation design error
704 Who takes responsibility for preventing a failure?
723 No responsibility for damaged footbridge
776 Split responsibility for collapsed boundary wall adjacent to railway
727 Questionable tension bracing arrangement
756 Collapse of domestic glass balustrade due to inadequate fixings

Figure 10: Report 669 - Light Gauge Steel Framing and responsibilities on site
Newsletter 52 - October 2018

Summary of editorial
Safety in buildings and infrastructure assets is in the headlines both within the industry and in the wider press. The harrowing nature of the Grenfell Tower fire continues to be revealed as firefighters and responders give their evidence to the Public Inquiry. The catastrophic collapse of the viaduct in Genoa has now focused attention on ageing infrastructures everywhere.

CROSS is expanding internationally and after several years of effort, CROSS-AUS for Australasia was launched in Adelaide at ASEC (Australasian Structural Engineering Conference) in September by Faith Wainwright, 2018 President of The Institution of Structural Engineers. There is a segment of the CROSS website devoted to this and the call is out for reports from the region. Congratulations to our colleagues in Australia for getting this initiative under way. CROSS-AUS reports will be on the same database as CROSS-UK reports so information on problems, and solutions, can be shared by all who look at the website. Plans for schemes in other countries to join the network are under way.

In this Newsletter are reports demonstrating deficiencies and near misses on projects large and small. The bearings on a major new bridge have caused concern. A support post for a street sign fractured, sadly causing a fatality. There have been several reported collapses, and a grey area has been identified whereby walls were removed in a multi-storey building without permission having been obtained.

CROSS reports
781 Quality of design and construction of a major bridge structure
793 Street sign collapse causes fatality
778 Casting, transporting and installing precast concrete kerbs
692 Collapse of lifting tackle connected by threaded bar
782 Collapse of glass balustrade from feature staircase in public building
714 Unsafe removal of some internal walls
742 Add-on roof truss failure

External Publications

The Structural Engineer
3. SCOSS Topics Log

The Structural-Safety Group, comprising of SCOSS and CROSS members, meets four times per year to consider structural safety matters arising from publicly available information and from confidential CROSS reports.

The CROSS reports discussed at the meetings may not yet be published, but the reports are anonymised by the CROSS Designated Persons before they are passed to the CROSS Panel to review. The CROSS Designated Persons are the Director of Structural-Safety, Alastair Soane, and Senior Engineer, Paul McNulty. Their profiles can be found on the People page > of our website.

A SCOSS Topics Log is maintained of structural safety matters of interest to SCOSS. A summary of the items on the SCOSS Topics Log which were discussed over the past two years are presented in Table 1.

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| High strength steel & large diameter bolts | **Background:** Problems with certain high strength steel were noted, including the failure of some large diameter bolts.  
**Action:** Relevant stakeholders are aware of the issue. SCOSS Alert is in preparation. |
| Foundations for freestanding cantilever structures | **Background:** Issues with foundations for freestanding cantilever structures were discussed, including reinforcement detailing, misunderstanding of the flow of forces in the foundations and lack of coordination between the anchor designer and the foundation designer.  
**Action:** Relevant stakeholders are aware of the issue. SCOSS Alert is in preparation. |
| Barton Bridge collapse | **Background:** A new bridge deck collapsed next to the Barton Bridge during a planned text on 16 May 2016.  
**Action:** When the HSE investigation is concluded, SCOSS will then consider what further action can be taken so that others can learn from this incident. |
| Didcot Power Station collapse | **Background:** A boiler house at the station collapsed in February 2016, killing 4 people.  
**Action:** When the HSE investigation is concluded, SCOSS will then consider what further action can be taken so that others can learn from this incident. |
| Wall collapse at Birmingham recycling centre | **Background:** A wall collapsed at a metal recycling plant in July 2016, killing 5 people.  
**Action:** When the HSE investigation is concluded, SCOSS will then consider what further action can be taken so that others can learn from this incident. |
| Great Yarmouth reinforcement cage collapse | **Background:** A reinforcement cage being constructed as part of the foundations for a large Pressure Test Facility (PTF) collapsed in January 2011, killing 4 people.  
**Action:** The TWf published a Safety Bulletin on Stability of Reinforcement Prior to Concreting >. SCOSS are liaising with the TWf and the HSE to consider what further action can be taken so that others can learn from this incident. |
## Table 1 continued: SCOSS Topics Log summary (continued overleaf)

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| Safety of concrete car parks                         | **Background:** Several safety incidents in concrete car parks have been noted, including the partial collapse of a multi-storey car park in the UK and the Eindhoven Airport parking building collapse.  
**Action:** Relevant stakeholders are aware of the issue. SCOSS work is ongoing.                                                                                      |
| Sudden loss of ground support                       | **Background:** Several incidents of unstable ground below structures where voids have appeared was noted.  
**Action:** [SCOSS Alert](#) was published in July 2017.                                                                                                                   |
| Collapse of steel frame in Ilford                    | **Background:** The City Gates Church building in London catastrophically collapsed during construction in 2012.  
**Action:** [SCOSS Alert](#) was published in February 2017.                                                                                                                   |
| Lifting eyes in precast concrete components          | **Background:** Several CROSS reports have been received on this topic.  
**Action:** Relevant stakeholders are aware of the issue. SCOSS Alert is in preparation.                                                                                                                                |
| Installation of gas in tall timber buildings         | **Background:** Concern was expressed about the structural robustness of tall timber buildings with mains gas installed.  
**Action:** IStructE are to arrange a meeting with key stakeholders in due course.                                                                                                                                         |
| Hazard identification                                | **Background:** SCOSS felt that those involved in identifying and managing hazards associated with a structural design should be reminded about the need for care when engaged in design work.  
**Action:** [SCOSS Alert](#) was published in September 2017. The SCOSS Alert contained Extracts from the IStructE’s *Manual for the Systematic Risk Assessment of High-Risk Structures against Disproportionate Collapse*. |
| Balconies                                            | **Background:** Several safety incidents with balconies have been noted, both from publicly available information and CROSS reports.  
**Action:** Relevant stakeholders are aware of the issue. SCOSS Alert is in preparation.                                                                                                                                   |
| Ungrooved prestressed tendons                        | **Background:** This topic was raised following the Morandi Bridge collapse. Many post-tensioned structures were constructed in the UK in the 1960s, some of which used ungrooved prestressing in plastic ducts.  
**Action:** SCOSS to liaise with key stakeholders on this topic.                                                                                                             |
### Topic Comments

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| Grenfell Tower fire & high-rise residential buildings       | **Background:** A series of events, including the Grenfell Tower fire, materials falling from a building in Glasgow, the temporary evacuation in London of the Chalcots Estate and the discovery of structural safety issues with four buildings at the Ledbury Estate, Southwark, prompted the Secretary of State for DCLG (now MHCLG) and the Home Secretary to instruct Dame Judith Hackitt to conduct an Independent Review of Building Regulations and Fire Safety with a particular focus on their application to high-rise residential buildings.  
**Action:** [SCOSS Alert >](#) was published in July 2018 to summarise the Hackitt report for structural and civil engineers. Structural-Safety is working with the IStructE, ICE and government departments to examine ways of adopting the recommendations from both the Hackitt and ICE In Plain Sight reports into the construction industry. |
| Liverpool ECHO Arena car park fire                          | **Background:** There was a severe fire at the Liverpool Echo Arena multi-storey car park on 31 December 2017, which gutted the seven-storey building and over 1,300 cars were destroyed.  
**Action:** [SCOSS Alert >](#) was published in February 2018. SCOSS are participating in a Working Group on fire risks in car parks set up by the British Parking Association (BPA). |
| Effects of scale                                            | **Background:** Concerns were raised about some particular large structures which prompted wider thinking about safety issues related to scale.  
**Action:** [SCOSS Alert >](#) was published in November 2018. |
| Incorrect substitution of steel grades                     | **Background:** Several CROSS reports have been received on this topic.  
**Action:** SCOSS to liaise with key stakeholders on this topic. |
| Masonry wall collapse at Oxgangs Primary School            | **Background:** The outer leaf of a cavity wall collapsed at the Oxgangs Primary School on 29 January 2016 during high winds.  
**Action:** [SCOSS Alert >](#) was published in February 2017. |
4. CROSS reports

Introduction

CROSS receives reports on structural safety issues from those involved in the buildings and civil engineering industry, including structural engineers, civil engineers, designers, contractors, clients, inspectors, maintenance and operation teams, project managers, local authorities, statutory authorities and government. Reports are also welcome from others who have an interest in structural safety.

Reports can be on structural failures and collapses, or safety concerns about the design, construction or use of structures. Reports relating to near misses or observations relating to failures or collapses which have not been uncovered through formal investigation are also welcomed. Reports do not have to be about current activities so long as they are relevant. Small scale events are important as they can be the precursors to more major failures. No concern is too small to be reported and conversely nothing is too large. Reports might relate to a specific experience or it could be based on a series of experiences indicating a trend.

The reports along with expert comments from the CROSS Panel, are then published to share lessons learned from structural safety issues with a view to helping prevent future failures by providing insight into how safety issues occur and spurring the development of safety improvement measures.

Data analysis

The number of reports received increases yearly as shown in Figure 11, where the black line indicates the actual number of reports and the red line is a polynomial trend line. Most reports originate from the UK, but a few come from other countries.
CROSS reports are categorised in accordance with a defined taxonomy, which allows the CROSS Panel to identify and quantify safety trends. Each CROSS report will discuss a safety issue, either a concern or an event, so firstly, the lifecycle stage for the underlying cause of the safety issue is categorised. The four main lifecycle stage categories are design, construction, operation and demolition. This is the stage of the underlying cause of the safety issue. For example, a near miss during construction that was caused by inadequate design would be categorised in the design lifecycle stage.

Each of the four main lifecycle stage categories have subcategories which specify the underlying cause in more detail. In all categorisation, the most significant underlying causes are given priority.

A summary of statistics from the categorisation of CROSS reports are presented in Figures 12 to 14. Figure 12 presents the lifecycle stage for the underlying cause of the safety issue. Figures 13 and 14 then present the specific underlying cause for the design and construction lifecycle stages.

Definitions are given on each chart of the categorisation used and generally these have been the same since the CROSS system was started. The percentages of each category reflect the information available to CROSS but may not be representative of conditions across the sectors because confidential reports are voluntary.

Definitions

Design
The pre-construction process carried out by the Principal Designer and other designers.

Construction
The construction process carried out by the Principal Contractor and other contractors.

Operation
The period from completion of construction, over the life of the asset, to the end of use of the asset.

Demolition
The de-construction of the asset.

Definitions

Inadequate design principles
Errors in the permanent works design or analysis principles.

Inadequate detailed design
Errors in the permanent works design or analysis detailing, including fixings/connections design.

Specifying unsuitable materials
The designer specified a material or component which was not suitable for its proposed use.

Design conflicts with regulations
The design directly conflicts with the regulations.

Poor communication
Poor communication between designers, resulting in a lack of clarity over responsibility for design elements.

Inadequate quality assurance
The quality assurance for the permanent works design was insufficient.

Figure 12: Lifecycle stage for the underlying cause of the safety issue

Figure 13: Underlying cause of the safety issue - design stage
Definitions

**Inadequate competency**
The contractor did not have the required skills, knowledge or experience to carry out the work in a way that secures health and safety.

**Inadequate quality assurance**
The contractor’s quality assurance for the construction was inadequate.

**Poor communication**
Poor communication between contractors, designers and other contractors, resulting in a lack of clarity over responsibility on site.

**Unapproved changes**
The contractor made a change to the design without seeking approval from the designer, including installing a material or component which was not specified in the design.

**Inadequate temporary works**
The temporary works were either not adequately designed or were not installed in accordance with the design.
5. Key items of work

CROSS International

The problems of structural safety issues are of almost universal concern and since the establishment of CROSS in 2005, there has been growing interest from outside the UK, and many reports have originated from other countries. CROSS International has been established to promote confidential reporting as an effective method of enhancing structural safety for the benefit of all those involved in the construction industry and the general public anywhere in the world.

CROSS-AUS for Australasia was launched in Adelaide at ASEC (Australasian Structural Engineering Conference) in September 2018 by Faith Wainwright, President of The Institution of Structural Engineers.

CROSS-US for the USA will be launched in April 2019 under the direction of Glenn Bell, IStructE Board member and incoming President of SEI (Structural Engineering Institution).

We are working with the Bundesvereinigung der Prüfingenieure für Bautechnik e.V.in Germany with a view to launching CROSS-DE in Germany in late 2019.

The CROSS reports for each of the regional CROSS schemes will be stored in one central database, allowing seamless learning between the different regions.

CROSS International has been established to promote confidential reporting as an effective method of enhancing structural safety for the benefit of all those involved in the construction industry and the general public anywhere in the world.

The Independent Review of Fire Safety and Building Regulations

Evidence from Structural-Safety was provided to Dame Judith Hackitt’s team, and in the Independent Review of Building Regulations and Fire Safety: Final Report there were several references to the work of Structural-Safety.

Recommendation 1.4 from the final report was:

a. A system of mandatory occurrence reporting to the JCA similar to that employed by the Civil Aviation Authority should be set up for HRRBs. The requirement to report should be for key identified dutyholders on a no-blame basis. The outputs of these reports (and statistical analysis of this data) should be publicly available. Non-reporting should be regarded as non-compliance and sanctions applied appropriately.

b. It would be appropriate for the JCA to be a prescribed person under PIDA.

c. For all other buildings the current CROSS scheme should be extended and strengthened to cover all engineering safety concerns and should be subject to formal review and reporting at least annually.

Structural-Safety are working with and providing advice to MHCLG on the implementation of this and other recommendations from the final report.

ICE In Plain Sight

Structural-Safety worked with and provided evidence to Professor Peter Hansford’s team. The In Plain Sight: assuring the whole-life safety of infrastructure - Final report contains a group of recommendations centred around lesson sharing, where the ICE was encouraged to work with other infrastructure organisations to further consider how the sector shares information from safety reviews, accidents, failures and near misses.

Recommendation 2 from the final report was:

Work with professional bodies to scope, sponsor and find funding for a sector-wide organisation to review, comment on and disseminate lessons from concerns, near misses and catastrophic incidents, building on the work of Structural-Safety.

The ICE is one of the sponsoring organisations of Structural-Safety, and as such are working with Structural-Safety to bring these recommendations forward.
Project work with MHCLG

Following the publication of the Hackitt Report we are engaged with MHCLG in looking at areas where the expertise and experience of members will be of benefit.

Weather damage reporting

During the past two years there has been a request for reports on damage to buildings caused by weather events. So far, the response has been very limited, and it is not known whether this is because buildings are standing up well to severe weather, or that there is damage which is not being reported. The programme will continue.

CROSS Forum events

In 2017, Structural-Safety decided to run two CROSS Forum events every year as a further method to disseminate learning from CROSS reports. The events are designed to ensure that the engineering principles and learning from CROSS reports are drawn out, discussed, and that the audience participates in identifying the relevance to their work and how the lessons learnt can be applied.

Thus far, we have run four successful CROSS Forum events at the ICE and IStructE headquarters in London, with the first CROSS Forum event of 2019 to be hosted in Edinburgh in May. The Structural-Safety Young Members are responsible for leading the CROSS Forum events.

All-Party Parliamentary Group (AAPG) on Working at Height

Structural-Safety provided evidence to the AAPG on Working at Height with regards to the potential use of confidential reporting techniques to address the lack of empirical data, knowledge and understanding of the root causes of falls from height. The Inquiry report recognises that having comprehensive information and data can inform the policies of government and businesses, the guidance issued by associations, and the regulations developed by regulators.

Recommendation 2 from the Inquiry report was:

The appointment of an independent body that allows confidential, enhanced and digital reporting of all near misses and accidents that do not qualify for RIDDOR reporting. The data collected by this independent body will be shared with government and industry to inform health and safety policy.

Highways England Structural Safety Reporting Standard

Highways England are planning to publish a Design Manual for Roads and Bridges (DMRB) Standard on Structural Safety Reporting in 2019. Structural-Safety worked with Highways England to develop the Standard and the procedures include reporting of structural safety concerns and events to CROSS.
Industry engagement

External conferences/events

Wider trends: The Quality of Building, Alastair Soane, Structural-Safety, London, UK
IStructE - Beyond Edinburgh Schools Conference, 14 July 2017, London, UK

CROSS International, Alastair Soane, Structural-Safety, London, UK
39th IABSE Symposium - Engineering the Future, 21-23 September 2017, Vancouver, Canada

Structural Stability During Refurbishment, Paul Mc Nulty, Structural-Safety, London, UK
CIRIA - C740 Structural Stability During Refurbishment launch event, 28 November 2017, London, UK

Safety best practice, Paul Mc Nulty, Structural-Safety, London, UK
CIRAS - Best Practice in Safety Reporting event, 15 December 2017, London, UK

Benefiting from Confidential Reporting on Structural Safety, Paul Mc Nulty, Structural-Safety, London, UK
IStructE Chester and North Wales Regional Group, 01 February 2018, Chester, UK

SEI Congress, April 2018, Fort Worth, Texas, USA

Benefiting from Sharing Lessons Learned, Paul Mc Nulty, Structural-Safety, London, UK
Structures in Fire Forum (StiFF), 19 April 2018, London, UK

Benefiting from Confidential Reporting on Structural Safety, Paul Mc Nulty, Structural-Safety, London, UK
IStructE Midland Counties Regional Group, 24 April 2018, Birmingham, UK

Structural-Safety: SCOSS and CROSS, Paul Mc Nulty, Structural-Safety, London, UK
AQC Construction Quality Meeting, 22 May 2018, Paris, France

Confidential Reporting on Structural Safety, Paul Mc Nulty, Structural-Safety, London, UK
SAICE UK Presidential Visit, 18 June 2018, London, UK

Temporary Works Forum (TWF) meeting, 20 June 2018, London, UK

Changes to Building Regulations, Alastair Soane, Structural-Safety, London, UK
IStructE - Small Practitioners Conference, 26 June 2018, London, UK

Benefiting from Confidential Reporting on Structural Safety, Paul Mc Nulty, Structural-Safety, London, UK
IStructE Surrey Regional Group, 10 September 2018, Surrey, UK

Grenfell Tower Fire: The consequences for Regulation, Alastair Soane, Structural-Safety, London, UK
IStructE Scotland Regional Group, 11 September 2018, Glasgow, UK

The Hackitt Report: What the industry must learn from the disaster at Grenfell Tower, Alastair Soane and Paul Mc Nulty, Structural-Safety, London, UK
ICE Bristol City Club, 02 October 2018, Bristol, UK

Get It Right Initiative & Structural-Safety, Alastair Soane, Structural-Safety, London, UK
Get it Right Initiative (GIRI) meeting, 15 October 2018, London, UK

Structural-Safety: learning lessons from structural failures, Paul Mc Nulty, Structural-Safety, London, UK
IStructE Bedfordshire and Adjoining Counties Regional Group, 18 October 2018, Cambridge, UK

Structural Failures: Learning from Mistakes, Paul Mc Nulty, Structural-Safety, London, UK
IStructE London Young Members’ Group, 24 October 2018, London, UK

Grenfell Tower Fire: The consequences for Regulation, Alastair Soane, Structural-Safety, London, UK
IStructE Dublin Regional Group, 13 November 2018, Dublin, Ireland

Liverpool Arena Car Park Fire, Alastair Soane, Structural-Safety, London, UK
British Parking Association meeting, 16 November 2018, Liverpool, UK

Structural-Safety: learning lessons from structural failures, Paul Mc Nulty, Structural-Safety, London, UK
IStructE Northern Counties Regional Group, 20 November 2018, Middlesbrough, UK

Grenfell Tower Fire: The consequences for Regulation, Alastair Soane, Structural-Safety, London, UK
IStructE East Midlands, 21 November 2018, Derby, UK
The overarching aim of the work that Structural-Safety does through SCOSS and CROSS is to influence change in the industry that results in improved safety. This is not always easy to measure. For example, when someone reads a CROSS report and applies the lessons learnt from the report to the projects they work on, this results in improved safety, but is rarely reported back to CROSS.

There is however evidence that firms, including major asset owners, use CROSS reports and Newsletters to keep their managers and staff informed and apply the lessons to their projects.

The website is available to all and significant reports are published in quarterly Newsletters whilst some may be incorporated in Safety Alerts issued by SCOSS (Standing Committee on Structural Safety). Social media is used to promote awareness. Presentations are given regularly to professional groups, to firms and to universities. Articles are also published in journals and there are contributions to national and international conferences. There are CROSS Forum events for early careers engineers to present and discuss CROSS reports.

### Table 2: Impact of Structural-Safety (continued overleaf)

<table>
<thead>
<tr>
<th>Topic</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Independent Review of Fire Safety and Building Regulations by Dame Judith Hackitt Published May 2018</td>
<td>Evidence from Structural-Safety[^1][^2] was provided and in the final report there were several references to the work of Structural-Safety. It was recommended that CROSS be expanded.</td>
</tr>
<tr>
<td>Bridge Owners Forum</td>
<td>This group represents the owners of all large bridges in the UK and interacts regularly with Structural-Safety (SCOSS and CROSS) on matters concerning new and existing structures.</td>
</tr>
<tr>
<td>CIRIA Stability of Buildings During Refurbishment</td>
<td>CIRIA publication C740 Structural stability of buildings during refurbishment &gt; (2017) used various CROSS reports as case studies.</td>
</tr>
<tr>
<td>Disseminating lessons learned from HSE investigations</td>
<td>CROSS have a relationship with the HSE to confidentially disseminate lessons learned from structural safety incidents which the HSE have investigated. Examples include CROSS reports 793 Street sign collapse causes fatality &gt; and 447 Fatal wall collapse at school due to ‘wall climbing’ &gt;.</td>
</tr>
</tbody>
</table>
### Topic Outcome

**Fixings and fasteners**
Many CROSS reports on fixings failures have been received over the years

Case studies from CROSS were used to influence the work of several organisations including:
- CFA (Construction Fixings Association) guidance
- New British Standard [3]
- Highways England Guidance on Fixings 2019
- CIRIA (Construction Industry Research and Information Association) Guidance 2019:
  - General fixings - guidance on selection and while-life management (C777)
  - Management of safety-critical fixings - guidance for the management and design of safety-critical fixings (C778)

**Highways England**
Structural Safety Reporting Procedure

Highways England have produced a new system, to be introduced in 2019, for reporting of failures throughout their supply chain. This has been modelled in part on CROSS to whom relevant reports will be sent. Previously Highways England would not have shared this information and now recognise the importance of doing so.

**ICE In Plain Sight**
Report by Prof. Peter Hansford from The Institution of Civil Engineers (October 2018)

Evidence was provided to this review and the following recommendation was made in the [final report >](#):

> “Work with professional bodies to scope, sponsor and find funding for a sector-wide organisation to review, comment on and disseminate lessons from concerns, near misses and catastrophic incidents, building on the work of Structural-Safety”

**Inspection, maintenance and deterioration**
A recurring theme for both CROSS and SCOSS

The information from CROSS and SCOSS has been used by IStructE in guidance publications for structural engineers.

**Integration of CROSS reports with BIM**

CROSS are working with the [Discovering Safety Programme >](#) to integrate CROSS reports into a register which will be used to inform health and safety decisions on construction projects through BIM.

**LABC (Local Authority Building Control)**

CROSS Newsletters and SCOSS Alerts are circulated by LABC to their members to encourage reporting and to help with learning from the material published.

**Network Rail**
Network Rail interacts with CROSS to enhance safety

Network Rail’s Lead Discipline Engineers from all their regions meet to discuss each CROSS Newsletter. They then cascade the findings to their teams of over 300 building and civil engineers.

**Multi-storey car park structures**
CROSS Reports and media reports have highlighted problems with older generation MSCPs, including collapses

This evidence was used to influence guidance in publications by ICE on the maintenance of existing structures, IStructE on the design of new car parks, MHCLG (as ODPM) on existing car parks, and the British Parking Association in their advice to members.

**Multi-storey car park fires**
Information obtained by SCOSS from the major fire in Liverpool which destroyed over 1,300 vehicles (December 2017)

BPA (British Parking Association) have set up a group to give advice to designers and owners about the risks of fire. The [SCOSS Alert >](#) giving advice for new and existing MSCPs is the only available information on the topic and has been widely circulated by the Fire & Rescue Service and Local Authorities.
<table>
<thead>
<tr>
<th>Topic</th>
<th>Outcome</th>
</tr>
</thead>
</table>
| **Risk appreciation and assessments**  
Another recurring theme from CROSS reports                   | Guidance published by IStructE [4][5] which is widely used across the industry to design for robustness in compliance with Regulation A3 was prompted by CROSS reports and a recommendation in the 16th SCOSS Biennial Report > (Appendix D).                                                                                     |
| **Structural Engineers Registration (SER) Scotland**       | The CROSS Newsletter is discussed at all SER Scottish Registration Board meetings. The reports which feature in the Newsletters are related to findings that are regularly found at the audits which SER conduct of the certificates generated by their Approved Certifiers. The Newsletters are therefore used by the auditors to make clear to the auditees the potential consequences of certain findings.  |
| **Temporary structures**  
CROSS is represented on AGOTS (Advisory Group on Temporary Structures) and information used by them included reports | AGOTS publication Temporary demountable structures: Guidance on procurement, design and use (Fourth Edition) > (2017) is the recognised standard for the entertainment industry. Also, a SCOSS Alert on Temporary Structures > was used for checking London Olympics temporary stands in 2012. |
| **Temporary works**  
There has been concern since the publication of the BRAGG report (1975) that the design of temporary works on construction sites has not been well implemented | With support from SCOSS, the Temporary Works Forum (TWf) > was established in 2010. This is the most important body in the UK for dealing with safety and other aspects of temporary works which form a major component of all construction projects. TWf is expanding and now has a branch in Hong Kong. |
| **Working with Professional Institutions**                 | CROSS is working with the IStructE (30,000 members) and the ICE (100,000 members) to ensure that their members are using CROSS reports to stay abreast of structural safety matters. IStructE have recently updated their CPD website pages as a priority and are in the process of updating their guidance documents. The ICE have similar plans in place as a result of the recommendations from their In Plain Sight report >. |
7. Looking ahead

The events of the last two years have raised debate and heightened the focus on improving safety in the construction industry. As part of this, the industry must improve its ability to capture and disseminate lessons from safety concerns, near misses and incidents in order to improve safety.

There is appetite amongst government and industry to make this happen and Structural-Safety (SCOSS and CROSS) welcome the opportunity to expand and strengthen our existing operations. Indeed, we are working with MHCLG and other industry bodies to make this happen.

From an international viewpoint, we continue to press on with the expansion of CROSS into different regions around the world. CROSS International has been established to promote confidential reporting as an effective method of enhancing structural safety for the benefit of all those involved in the construction industry and the general public anywhere in the world.

CROSS-AUS for Australasia was launched in Adelaide at ASEC (Australasian Structural Engineering Conference) in September by Faith Wainwright, 2018 President of The Institution of Structural Engineers. CROSS-US for the USA is expected to launch in April 2019, and we are working with the Bundesvereinigung der Prüfingenieure für Bautechnik e.V. in Germany with a view to launching CROSS-DE in Germany in late 2019. The CROSS reports for each of the regional CROSS schemes will be stored in one central database, allowing seamless learning between the different regions.

Work undertaken in the past two years has stretched the capacity of both staff and volunteers so enquiries are being made with the sponsors as to how additional resources may be acquired. It is satisfying that there is a growing demand for advice and recommendations on safety, and that there is a steady flow of CROSS reports.

The industry must improve its ability to capture and disseminate lessons from safety concerns, near misses and incidents in order to improve safety

8. Recommendations

Table 3: Recommendations from Structural-Safety

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Action By</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Promote a better understanding of safety and risk</td>
<td>Structural-Safety, IStructE, ICE, HSE</td>
</tr>
<tr>
<td>2 Investigate an SER type registration scheme for designers</td>
<td>IStructE, ICE, industry</td>
</tr>
<tr>
<td>3 Categorise buildings for design, checking, construction and through life management</td>
<td>IStructE, Structural-Safety, MHCLG</td>
</tr>
<tr>
<td>4 Develop risk-based assessment methods for high rise and complex buildings, including for major refurbishments</td>
<td>Structural-Safety, IStructE, ICE, MHCLG</td>
</tr>
<tr>
<td>5 Expand CROSS to become a confidential reporting system for Fire Safety in addition to Structural Safety</td>
<td>Structural-Safety, IFE, MHCLG</td>
</tr>
<tr>
<td>6 Review the need for requirements to operate high-rise residential and complex buildings</td>
<td>MHCLG, industry</td>
</tr>
<tr>
<td>7 Press for legislation for early release of safety-critical information</td>
<td>MHCLG with input from Structural-Safety, HSE, IStructE and ICE</td>
</tr>
<tr>
<td>8 Set up a confidential reporting system for resident/occupier reporting along the lines of ASRS and CIRAS</td>
<td>MHCLG</td>
</tr>
<tr>
<td>9 Promote a better understanding of the performance of large structures</td>
<td>IStructE, ICE, industry</td>
</tr>
<tr>
<td>10 Promote a better understanding of the fire risk in Multi-Storey Car Parks (MSCPs)</td>
<td>MHCLG, regulators, industry</td>
</tr>
</tbody>
</table>
9. References

1. Independent Review - Building Regulations and Fire Safety, Structural-Safety - Submission of Evidence (SC 17 37.11), October 2017
2. Independent Review - Building Regulations and Fire Safety (SC 18 35.6), Call to Action - Response from Structural-Safety, March 2018
3. BS 8539:2012 Code of Practice for the selection and installation of post-installed anchors in concrete and masonry, BSI, October 2012
4. Practical guide to structural robustness and disproportionate collapse in buildings, The Institution of Structural Engineers, October 2010
5. Manual for the systematic risk assessment of high-risk structures against disproportionate collapse, The Institution of Structural Engineers, October 2013
Appendix A - Structural-Safety members

Full profiles for each of the members of Structural-Safety can be found on the people page of the website.

**SCOSS Chair**
Bill Hewlett MA FICE CEng FIET, Director, Costain, [from 2016]

**Structural-Safety Director**
Alastair Soane BSc PhD CEng FICE FIstructE, [from 2005]

**Structural-Safety Senior Engineer**
Paul Mc Nulty MEng PhD CEng MICE, [from 2017]

**SCOSS Members**
Luke Bisby BEng MSc PhD CEng FIstructE, Professor of Fire and Structures and Head of Research Institute, The University of Edinburgh [from 2015]
Steve Brunswick BSc CEng FICE FCIOB, Consultant, formerly Carillion Group [from 2017]
David Cormie Meng (Hons) CEng CEnv FIstructE FICE M.ASCE, Associate Director, Arup [from 2012]
Steve Parncutt BEng (Hons) CEng MICE, HM Principal Specialist Inspector (Construction), Health and Safety Executive [from 2014]
John Rees BEng ACGI MSc DIC CEng FICE, Director, COWI [from 2011]
Richard Snell BSc (Hons) FICE FREng FIstructE, Consultant, formerly BP Exploration [from 2008]
John Wolstenholme BEng Hon FIstructE MICE MIEng, Principal Nuclear Safety Inspector, Office of Nuclear Regulation (ONR) [from 2018]

**CROSS Panel Members**
Thomas Aldridge MA DipArch RIBA RIAS, Principal Construction Professional, Ministry of Housing, Communities and Local Government [from 2018]
Luke Bisby BEng MSc PhD FIstructE PEng (Ontario) FIFireE, Professor of Fire and Structures and Head of Research Institute, The University of Edinburgh [from 2015]
Tony Jones PhD CEng FICE FIstructE, Principal Structural Engineer, MPA The Concrete Centre [from 2005]
David MacKenzie FREng BE MS CEng FIstructE MASCE MHKIE, Executive Director, COWI [from 2005]
Allan Mann BSc PhD CEng FREng FIstructE, Consultant, formerly Jacobs UK [from 2005]
Vladislava Palan MEng CEng MICE, Principal Structures Advisor, Highways England [from 2016]

Steve Parncutt BEng (Hons) CEng MICE, HM Principal Specialist Inspector (Construction), Health and Safety Executive [from 2014]
Mark Pundsack BEng CEng MIstructE MRICS MInstLM, Joint District Surveyor, City of London [from 2012]
John Rushton BEng MSc CEng MICE MIstructE, Partner - Buildings, PBA now part of Stantec [from 2005]
Michael Webster BEng MSc PhD DIC CEng MICE MIstructE, Director, MPV R&R [from 2017]
Steve Williams BEng CEng MICE MIstructE AMAPM Infrastructure Projects Programme Engineering Manager (Buildings and Civils), Network Rail [from 2016]

**Legal Advisor**
Christopher Leadbetter Senior Associate, Clyde & Co LLP [from 2016]

**Young Members**
Aidan Cahill BEng Hons GMICE, Design Engineer, Blyth & Blyth [from 2018]
Asif Huq MEng GMICE, Graduate Civil Engineer, Transport Scotland [from 2018]
Victoria Tinney MEng GMICE, Structural Engineer, Price & Myers [from 2018]