CROSS UK
COLLABORATIVE REPORTING FOR SAFER STRUCTURES

The Institution of Structural Engineers

ice

The Institution of Fire Engineers

CROSS Newsletter

CROSS-UK Newsletter 62 | **August 2021**

Composite deck boards in common access balconies

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Share knowledge to help create a safer built environment

Editorial

In her review "Building a Safer Future", Dame Judith Hackitt recommended that CROSS should be strengthened and extended. This is our first newsletter reflecting the work that has been completed to deliver that recommendation. Our new website is the front end of CROSS activity, a new digital platform that supports the processing of reports and assists those seeking trusted independent safety information. Alastair Soane announced in the last newsletter that CROSS has a new name – Collaborative Reporting for Safer Structures, reflecting the extension of scope to include fire safety.

I must start by paying tribute to Alastair, Paul Mc Nulty and their colleagues in the structural safety world who had the vision to set up CROSS, providing a platform for fire safety to get a head start. Events around the world serve to remind us of the importance of our safety systems and how we must strive to maintain them, ensuring that we have a space to report occurrences and concerns so that lessons are learned. This space is now occupied by the broader CROSS.

We have received a number of fire related reports since the new site was launched in March and an increased number of structural reports. The range of issues is immense. As the world continues to suffer tragedies such as the Surfside apartment block collapse in Miami and the wildfires across Europe and the USA, the need for CROSS is increasing. The impact of climate change and the actions taken to try to minimise it clearly has significant implications for both structural and fire safety. Extreme weather events may reflect the outcome of climate change, the drive to devise new renewable energy sources, use less carbon in construction, improve insulation are amongst the many issues that CROSS subscribers will need to keep abreast of as the world strives to do better for future generations.

The progress of the Building Safety Bill is being closely monitored, this being the Government's primary route to deliver Dame Judith's recommendations. Reports of proceedings at the Grenfell Tower Inquiry are difficult reading, exposing issues around products, competence and control over design, construction and building management. The measures set out in the Bill should result in improvements in those areas, for buildings in scope, at least. It is pleasing to note that the Bill includes recognition that a voluntary occurrence reporting process, as provided by CROSS, is part of the new regime.

Safety reports are the engine behind CROSS, the fuel is provided by you. By that I mean people that submit reports, read them, and then put into practice the lessons learned. Please help us build the CROSS network, encourage others to read the content of this newsletter, and act on the information appropriately.

Neil Gibbins
Lead Fire Safety Consultant

Contents

Composite deck boards in common access balconies

CROSS Safety Report Report ID: 1048

A reporter informs CROSS that decking boards formed of a composite material contributed to external fire development in a block of flats and rendered the means of escape and firefighting access unusable.

The report relates to buildings where the access to flats is by means of an external walkway, often referred to as a common access balcony, common balcony, or a balcony/deck approach.

Key Learning Outcomes

For designers, architects and fire engineers:

- External walkways providing access to flats should not contribute to fire spread over an external wall and should also be protected to maintain safe escape and firefighting access
- They must be constructed from materials that will resist fire spread, have imperforate floors, and provide at least the same fire resistance for loadbearing capacity as floors in the rest of the building to ensure stability in a fire for sufficient time to allow the safe egress of flat occupiers and access for firefighters
- Further recommendations, including measures to control smoke spread along external walkways, are provided in **BS9991:2015>**
- External walkways in such buildings are also referred to as common access balconies or decks

R Full Report

A reporter has shared information regarding a fire in a block of flats expressing concern about the use of composite decking to form the floor of the external, open sided, walkways.

Access to individual flats via a shared, external, open sided walkway is a common arrangement. In most instances the external walkway is the only means of access to a final exit, therefore the risk of fire, heat or smoke affecting the use of the walkway must be minimised.

In the instance covered by this report, the floor of the external walkway was constructed from composite decking material. This material became involved in the fire, contributing to the spread of fire, which removed the sole means of escape for occupants of flats opening onto the walkway and the floors above and also created difficulties for firefighter access.

C Expert Panel Comments

This is of concern as current statutory and additional guidance is very clear as to what is required when providing a common balcony or

News

Designing a Safer Built Environment: A complete guide to the management of design risk>

This book addresses long-standing uncertainties and challenges faced by designers, highlighted by recent events such as the Grenfell Tower fire, by providing a clear methodology for design risk management. The author, John Carpenter, is a past Secretary to SCOSS, during which time the CROSS scheme was launched.

Building Safety Bill>

The Building Safety Bill, published on 5 July 2021, will create lasting generational change and set out a clear pathway for the future on how residential buildings should be constructed and maintained.

The key to structural safety may be collaborative reporting>

As the June 24 collapse of the Champlain Towers South condominium building in Surfside, Florida, sends society in search of answers, one structural engineering safeguard already in place may lie in the power of collaborative reporting.

Reporting to CROSS

Your report will make a difference. It will help us to create positive change and improve safety.

Find out more >

external approach, also referred to as a walkway and access balcony or deck. This is provided in **Approved Document B, British Standard (BS) 9991 Fire safety in the design, management and use of residential buildings – Code of practice>** and supported with additional information in **BS 8579:2020 Guide to the design of balconies and terraces>**. Section 7.3 of BS 9991 gives guidance on the design of an external balcony/deck approach to flats. Item a) states that '*the structure, including the floor, should be protected by 30 min fire-resisting construction (integrity and insulation).*' Whatever type of floor construction is used for the balcony should therefore meet that standard.

It is imperative that a common balcony or external approach that provides a means of access from one part of a building to another has an appropriate level of fire resistance. This route may be required as a means of escape for occupants and access for firefighters. This is fundamental to the generally adopted stay put strategy for blocks of flats and highlights the interaction of the functional requirements of the Building Regulations (as amended), and the aforementioned guidance in support of meeting those requirements.

It is imperative that a common balcony or external approach which provides a means of access from one part of a building to another has an appropriate level of fire resistance. This route may be required as a means of escape for occupants and access for firefighters.

In this instance the reporter has not shared the actual composition of the boards, however any materials proposed to be used to form part of a common balcony or external approach, need to be confirmed as appropriate for use to meet the above requirements. For existing premises that will be in scope of **The Regulatory Reform (Fire Safety) Order 2005>** as clarified through the **Fire Safety Act 2021>**, the risk posed by any such common balcony will need to be assessed as part of the premises fire risk assessment, where any doubt exists regarding applicability of the legislation then independent legal advice should be obtained.

Submit Report

Submit Feedback

More CROSS reports

In addition to the reports included in this newsletter, the following CROSS reports have also been published since our last newsletter:

Fire exit chained closed due to COVID-19 concerns (report ID 975)>

A key pad operated fire exit was chained closed to prevent the spread of COVID-19.

Failure of beams in listed building (report ID 1016)>

Conversion and refurbishment work on a listed building led to structural failures of beams and subsequent difficulties in resolving safety matters between the various agencies involved.

Risks associated with steel gates (report ID 1021)>

A reporter has noticed recurring defects with large gates in residential apartment complexes, including at least three where there were serious incidents, one involving a fatality.

Problem when launching a prestressed beam (report ID 1027)>

When lowered onto its elastomeric bearings, a 40m span post-tensioned 'I' beam started to move towards the outer edge of the pier cap.

Visit:
www.cross-safety.org/uk

Email:
team.uk@cross-safety.org

Brick slips falling from height

CROSS Safety Report Report ID: 1017

A reporter describes cases of brick slips falling from height due to adhesive failures and considers that there is a danger to the public.

Key Learning Outcomes

For building owners:

- CROSS is very keen to hear about other cases of brick slip failures

For designers:

- Consider the likely life-span of the materials and components used on facades
- Some adhesives used may not adequately give the required robustness and longevity

For the construction team:

- Manufacturer's instructions for the selection and application of adhesives must be followed
- Ensure that adhesives are correctly applied
- Do not substitute products without the approval of the designer

R Full Report

A reporter has been examining failures in brick slip systems and has found the same issues in several projects. They are all in the UK but unrelated and were completed around the mid 2010s. It has been found that the adhesive holding the brick slips to backing boards is failing and slips are falling to the ground.

A brick slip falling from any height could cause injuries and possibly a fatality. In the cases in point, the buildings are over 3 storeys and all are adjacent to busy streets.

In one of the buildings, a number of brick slips at a considerable height above ground had de-bonded from the composite board substrate and were lying on an adjacent roof. It was clear that the adhesive bond between the composite board and slips had failed. Possible causes are:

- Adhesive layer is applied too thinly or inconsistently
- Adhesive may be inappropriate for the job

In one of the buildings, a number of brick slips at a considerable height above ground had de-bonded from the composite board substrate and were lying on an adjacent roof

On another building, with several areas of failure apparent, inspection identified that in almost all cases, failure of the adhesive bond between the brick slip and adhesive had occurred. A contributory cause may be that composite backing boards are bowing.

Failure modes in adhesively bonded brick slip systems

This, and other investigative work by the reporter's firm has identified failure modes in adhesively bonded brick slip systems due to deterioration of the adhesive and/or its interfaces. For example, many adhesives including epoxies are known to lose their ductility over time, meaning that they become brittle with age and have less capacity to accommodate movement of the system components.

Brick slips are porous, allowing moisture and air to the interface between the adhesive and the slip. Hydrolysis and oxidation are just two of the mechanisms that can deteriorate adhesive bonds over time.

In such cases, it is important to determine whether the adhesive has been correctly specified as being adequate for its intended purpose in order to comply with the Building Regulations.

Impact of ban on combustible products

An additional complication is the UK Government ban on combustible products for new work on residential buildings over 18m in height as adhesives are generally combustible. This means that any remedial works will need to comply.

It is the reporter's view that if they are aware of several failures there must be many more actual or potential future failures out there, and steps need to be taken to identify buildings where adhesively fixed brick slips are incorporated and carry out structural inspections.

In the cases considered here, one has been reclad with a mechanically fixed system and the other two have temporary protection around the failed areas pending further investigation.

C Expert Panel Comments

This report is of concern because there must be very many buildings with brickwork cladding that incorporate brick slips; some attached by mechanical means and some with adhesives. The practice goes back many years and a variety of systems were used. Some will have been more robust and successful than others and some of the suppliers no longer exist so records are sparse or non-existent.

> **This report is of concern because there must be very many buildings with brickwork cladding that incorporate brick slips; some attached by mechanical means and some with adhesives**

It is known that in the past there might not have been enough testing of brick slip systems but developments in recent years have improved their general quality.

Components and materials do fall off buildings and there are fatalities and injuries. In 2007/8 the Scottish Government commissioned CROSS to investigate falls of material and 1,200 cases were recorded, mostly from older buildings, with 40% associated with masonry. There were several reports of injuries due to pedestrians being struck. In addition, CROSS had had many reports about falling objects.

CROSS publication on resin adhesives

CROSS has also published reports and Alerts on problems with resin adhesives in relation to tension systems: **Tension systems and post-drilled resin fixings>** which, although not the same as brick slip failures, points to some long-term consequences from the inappropriate use of some adhesives. Specifiers and designers should assure themselves of the appropriate longevity of products.

Call to share information about brick slip issues

The reporter makes a good point in that if they know of a number of incidents, then others must know of far more. Additional information is needed in order to assess the level of potential risk so reports are requested from anyone who has experience of brick slips falling or becoming loose.

> **Additional information is needed in order to assess the level of potential risk so reports are requested from anyone who has experience of brick slips falling or becoming loose**

A useful reference on the subject is Alexis Harrison's article **Are brick slip cladding systems safe?>**.

Submit Report

Submit Feedback

Cross-laminated timber (CLT) in multi-storey buildings

CROSS Feature Article

The **CROSS-UK Fire Safety Expert Panel** share their views about the interpretation and application of the Building Act 1984 with regards to the use of cross-laminated timber (CLT) in multi-storey buildings.

In **report 966>**, the reporter presented concerns about the fire safety of multi-storey buildings comprised of CLT. CROSS has subsequently received additional comments on this report which have highlighted the associated need for improved understanding of both the law and related technical matters by architects and engineers.

One commentor noted that many architects and engineers currently believe that compliance with the Approved Documents can be assumed to guarantee compliance with Building Regulations. This observation aligns with the findings of Dame Judith Hackitt's **Independent Review of Building Regulations and Fire Safety>** – that '*the cumulative impact of the Approved Documents changes an outcome based system of regulation to one that is often inferred by users to be prescriptive'* [Paragraph 1.28].

Approved Document B> (2019) includes explanatory text to explicitly remind readers about their responsibilities. It states that *'those with responsibility for meeting the requirements of the regulations will need to consider for themselves whether following the guidance in the approved documents is likely to meet those requirements in the particular circumstances of their case'* [Page i].

> **'those with responsibility for meeting the requirements of the regulations will need to consider for themselves whether following the guidance in the approved documents is likely to meet those requirements in the particular circumstances of their case'**

The importance of The Building Act 1984

Key questions are "*if I follow Approved Document B, will the building be safe and will I have complied with the law?*". **The Building Act 1984>** [Section 7], which underpins the issuing of the Approved Documents by the Secretary of State, states that:

A failure on the part of a person to comply with an approved document does not of itself render him liable to any civil or criminal proceedings; but if, in any proceedings whether civil or criminal, it is alleged that a person has at any time contravened a provision of building regulations–

(a) a failure to comply with a document that at that time was approved for the purposes of that provision may be relied upon as tending to establish liability, and

(b) proof of compliance with such a document may be relied on as tending to negative liability.

Compliance with the Approved Documents may tend to show compliance with the law, but this is not absolute. In the instance of the use of cross-laminated timber in multi-storey buildings, designers and engineers should be aware of the caveat set out in the introductory paragraphs of each of the **Approved Documents>**. For Approved Document B, which was last updated in 2020, these introductory paragraphs include:

What is an approved document?

The Secretary of State has approved a series of documents that give practical guidance about how to meet the requirements of the Building Regulations 2010 for England. These approved documents give guidance on each of the technical parts of the regulations and on regulation 7 (see the back of this document). The approved documents provide guidance for common building situations.

It is the responsibility of those carrying out building works to meet the requirements of the Buildings Regulations 2010. Although it is ultimately for the courts to determine whether those requirements have been met, the approved documents provide practical guidance on potential ways to achieve compliance with the requirements of the regulations in England.

Although approved documents cover common building situations, compliance with the guidance set out in the approved documents does not provide a guarantee of compliance with the requirements of the regulations because the approved documents cannot cater for all circumstances, variations and innovations. Those with responsibility for meeting the requirements of the regulations will need to consider for themselves whether following the guidance in the approved documents is likely to meet those requirements in the particular circumstances of their case. Manual to the Building Regulations

Manual to the Building Regulations

Chapter 7 of the **Manual to the Building Regulations>** states that:

The approved documents provide guidance for common building situations. They may not provide appropriate guidance if the case is unusual in terms of its design, setting, use, scale or technology. Non-standard conditions may include any of the following:

a. difficult ground conditions

b. buildings with unusual occupancies or high levels of complexity

c. very large or very tall buildings

d. large timber buildings

e. some buildings that incorporate modern construction methods.

The full list of the approved documents and what they cover is given in Table 1.1 in Chapter 1. The approved documents will be relevant in many common building situations. Anyone using the approved documents should have sufficient knowledge and skills to understand the guidance and correctly apply it to the building work. This is important because simply following the guidance does not guarantee that your building work will comply with the legal requirements of the Building Regulations.

Is the use of CLT in multi-storey buildings a "common building situation"?

It is the opinion of the CROSS-UK Fire Safety Expert Panel that the use of CLT in multi-storey buildings is not a "*common building situation*" as defined in the Approved Documents as they are currently published. CLT is a relatively new technology, particularly in relation to the standard recommendations in Approved Document B for structural fire resistance that were developed decades ago. It therefore cannot be automatically assumed that for these types of buildings, the guidance of ADB is sufficient to ensure compliance with Building Regulations.

It is the opinion of the CROSS-UK Fire Safety Expert Panel that the use of CLT in multi-storey buildings is not a "common building situation" as defined in the Approved Documents as they are currently published

Lack of understanding of fire resistance periods

One commentor on report 966 highlighted a problematic but common misconception that the periods of fire resistance cited, for example, in Approved Document B represent the period of time that an element of construction would remain stable in a real fire. There is a common misconception that, for example, if an element of construction is rated to achieve a fire resistance of 60 minutes – then it will perform adequately in a real fire situation for 60 minutes (but not necessarily any longer). However, this assumption is false – since real fires subject the building elements to different thermal and mechanical conditions from those that may occur during a standardised 'fire resistance' test within an accredited fire testing laboratory.

Similarly, the duration of a real fire is limited primarily (but not entirely) by the fuel load, whereas a fire resistance testing furnace has an effectively unlimited supply of fuel which is deployed so as to ensure that the furnace follows the standardised temperature versus time curve recommended within the relevant testing standards. For buildings where the primary structural materials are non-combustible and where the height and use result in the need for high fire resistance ratings, it is therefore possible, or even likely, that the fuel within the building may 'burnout' before structural failure occurs.

As noted in report 966, this idea is the original basis for the longer fire resistance standards specified in Approved Document B, for example for multi-storey residential buildings – and is commonly referred to within the fire engineering community as 'design for burnout'. However, this concept breaks down in situations where the structural frame is itself combustible, and in such cases it is considered inappropriate to rely blindly on the historical fire resistance design framework – or indeed on the required periods of fire resistance quoted within, for example, Approved Document B.

Further reading

There is a wealth of literature on this topic, some of which the Expert Panel have assembled below for the information of CROSS readers. Of particular note for designers of mass timber buildings is the STA 'compliance road map' guidance.

The Building Act 1984>

Approved Document B, Volumes 1 and 2, 2019>

Compliance Road-map for the Structural Fire Safety Design of Mass Timber Buildings in England, SFPE Europe Magazine, 2020>
Structural timber buildings fire safety in use guidance, Volume 6 - Mass timber structures; Building Regulation compliance B3(1), STA fire safety research and guidance project Version v1.1, October 2020>

Fire Resistance and Burnout Resistance of Timber Columns. Fire Safety Journal, 2021>

The Rise and Rise of Fire Resistance, Fire Safety Journal, 2020>

We Need to Talk about Timber: Fire Safety Design in Tall Buildings, The Structural Engineer, 2020>

Fire compartmentation detailing issues

CROSS Safety Report Report ID: 1039

Two reports have been received concerning fire compartmentation detailing issues; one on the incorrect installation of fire batts and the other on the incorrect use of intumescent material.

Key Learning Outcomes

For designers, contractors and specialist installers:

- Preventing the spread of heat and smoke between compartments is a core element of a fire safety strategy
- Many services may need to pass through compartments; proprietary products are deployed to make good any voids created
- It is critical that the products deployed to make good any voids created are used in accordance with the manufacturer's specifications. These reports indicate that it is commonplace for such products to be used in a manner that would render them ineffective in a fire situation.

For building owners and other persons responsible for commissioning mechanical and electrical work:

- It is imperative that those responsible for managing buildings or specifying works understand that fire compartmentation might be affected by work such as replacing or adding cables, pipes or conduit
- When engineers or installers create voids between compartments temporary arrangements may be required whilst the work is in process and the voids must be made good on completion of the work to the standard required for the compartment

R Full Report

Two reports have been received concerning fire compartmentation detailing issues; one on the incorrect installation of fire batts used to seal service penetrations in fire-rated compartment walls and the other on the incorrect use of an intumescent material used to seal service penetrations in floors.

One reporter is a local authority building surveyor who, from 2019 to the present, has been asked to assess fire compartmentation in newly-built and refurbished existing buildings owned by the authority. The other reporter is a construction supervisor.

Incorrect installation of fire batts

On inspection of several new builds and existing buildings, the reporter has identified fire batts that have been incorrectly installed. They say that the defective installations are endemic and not isolated occurrences. Figure 1 shows single thickness batts that have been cut to fit around services and into openings.

Figure 1: single thickness batts cut to fit around services and into openings

The joints between batts and between the structure and the batts have been sealed on one side only. The manufacturer's installation recommendations call for cut or exposed batt edges to be sealed and for joints in both faces to be sealed with intumescent mastic. In all cases, the installer was a specialist contractor with third party accreditation.

The reporter says that incorrect installation of these products compromises the integrity of fire compartmentation. Consequently, the compartments are unlikely to provide the designed level of fire protection.

The reporter says that incorrect installation of these products compromises the integrity of fire compartmentation. Consequently, the compartments are unlikely to provide the designed level of fire protection.

Incompatibility between intumescent material and insulation

100mm core holes were drilled between floor slab levels, within the dedicated cupboard forming the new riser. The copper pipework was installed immediately after the core holes were complete. Temporary works included the fire foam filling between the slab level core and the copper pipework by an approved accredited sub-contractor.

One day later, the temporary works were removed allowing the proprietary pipe insulation to be fitted to the copper pipework. The sub-contractor then applied the permanent fire stopping intumescent sealant on the same day the lagging was installed, assuming that this resulted in the restoration of the fire compartmentation.

A day after the permanent fire stopping intumescent sealant was applied, the reporter, as part of their continued design review and installation inspections between the main contractor and the fire stopping contractor, identified that the insulation wasn't compliant with the intumescent material installation datasheet.

The installation design had specified a Class 0 lagging, but the intumescent material detail is only compliant with specified insulation, not the one used. The issue is that in the event of a fire, the sealant expands which would distort the (initially fitted) Class 0 insulation, whereas the specified material is rigid and the integrity would be maintained.

The issue is that in the event of a fire, the sealant expands which would distort the (initially fitted) Class 0 insulation, whereas the specified material is rigid and the integrity would be maintained

The design was therefore updated to include a compliant lagging. The sub-contractor removed the initial Class 0 insulation and replaced it with compliant material and then sealed the opening with the intumescent sealant in a single visit.

Underlying causes include poor training and lack of checking

The reporters say that the following are the underlying causes of these safety issues:

- Some installers are poorly trained and do not understand the correct installation of the products. Improved training and education of the workforce are required.
- Main contractors and clients rely on specialist contractors for installation and expertise without adequate checks on workmanship and adherence to technical requirements. Where there is a lack of in-house or third-party checks on correct installation, these defects may not be identified, leaving fire protection incomplete. More rigorous inspection is required.

C Expert Panel Comments

These are very common situations. Fire stopping is often carried out by people without the correct competence who then use the wrong methods or materials (or combination of materials). Workstreams are already underway to try and address this, by raising the competence requirements for managers of residential buildings (so that they know how to ensure that only competent people carry out the works) and of the people carrying out the work.

Retaining evidence of fire stopping works

Fire resisting compartmentation issues are, unfortunately, regularly identified by Fire and Rescue Services during audits and are a regular fire safety deficiency and issue recorded in letters and legal notices to Responsible Persons.

Responsible Persons and those that manage or have control of premises, under **The Regulatory Reform (Fire Safety) Order 2005>** or other fire safety law outside of England and Wales, should ensure they not only use installers that are certified by a certification scheme for fire-stopping that has UKAS accreditation but they also ensure they receive and

retain evidence and records of the fire stopping works to inform and support their fire risk assessment. This will assist when premises are audited by the enforcing authority.

In most cases a fire engineer is unlikely to be involved in this level of detail, but it does highlight the need for suitable levels of oversight.

Competence of specialists

Surveys commonly identify the use of proprietary fire stopping products/systems that are installed outside the bounds of application given by the manufacturer's specification. To the untrained eye, these alleged defects in fire stopping are not always obvious, so highlights the importance of competency for this specialist area of expertise.

These are very common situations, particularly where there are multi-service penetrations. Some contractors are moving away from large openings with multiple services, to single openings for each service which makes the provision of a fully tested system easier. It is easier to design and implement this on complicated schemes, where BIM is used. Of course, none of this deals with incompetence, but sometimes the overall design can make it easier for the installer to meet the tested system.

It is concerning that these defects have originated (in all cases) from specialist contractors with third-party certification. This report highlights the need for appropriate training and education for those carrying out this specialist area of work and the potential need for independent inspection of work by a competent person.

This report highlights the need for appropriate training and education for those carrying out this specialist area of work and the potential need for independent inspection of work by a competent person

Submit Report

Submit Feedback

Structural corrosion in a swimming pool building causes concern

CROSS Safety Report Report ID: 1004

A survey showed severe corrosion of previously repaired steelwork columns adjacent to a public swimming pool.

Key Learning Outcomes

For architects and designers:

- Swimming pool environments are corrosive, thus steelwork and other structural elements must be appropriately protected

For owners:

- Swimming pool buildings must be regular inspected for evidence of structural deterioration and action taken as necessary

For civil and structural design engineers:

- Design and detailing must recognise the risks from corrosion in swimming pool buildings
- Structural elements and connections must be accessible in future for surveys

R Full Report

This report is from a structural engineer who was commissioned to conduct a visual inspection of a swimming pool building. Their concern is about the stability of the structural steel frame within the pool hall which has undergone numerous repairs to the steelwork over the years.

A problem, according to the reporter, is the state of repairs made to the steel columns. Some of these have had significant corrosion close to the poolside level. An ultrasonic testing report showed that the columns had a considerable loss of section due to corrosion.

The reporter's firm conducted intrusive opening up works that involved breaking out parts of the concrete floor slab around the bases of the columns. It was discovered that the repair plates had not been welded to the columns in these locations. This, in the opinion of the reporter, would render the repairs ineffective in providing any structural remediation i.e. an alternative load path for the columns around the corroded area.

The survey findings were reported to the owner along with a recommendation that the building is unsafe, that it would be uneconomic to repair, and should be demolished. It is understood that the building is now no longer in use.

This, in the opinion of the reporter, would render the repairs ineffective in providing any structural remediation i.e. an alternative load path for the columns around the corroded area

C Expert Panel Comments

All structures deteriorate over time and swimming pool environments promote corrosion. Corrosion of steelwork and other structural elements around swimming pools is a common problem and there have been collapses of pool roof structures. Other CROSS reports indicate worrying degrees of deterioration in such structures.

Experience suggests that where corrosion is extensive there may well be hidden areas that are badly affected, and these may govern structural capacity. Hence intrusive investigations are advisable.

Submit Report

Submit Feedback

Safety of structures in the climate emergency

CROSS Theme Page

Following the recent publication of the IPCC report on Climate Change, we would like to remind readers of the **Theme Page>** available on the CROSS website surrounding keeping structures safe in the climate emergency.

In the race to achieve zero emissions, we must ensure our structures remain safe as we develop and implement any climate-motivated innovation or change of approach.

In 2019, engineering consultancies around the world began to respond to government declarations of a climate emergency by declaring their own Climate and Biodiversity Emergency, which CROSS supports. One of the commitments of the organisations signed up to in the declarations is to share knowledge and research on an open source basis.

Knowledge hub

The knowledge hub for this Theme Page presents safety information from CROSS and third party organisations related to the climate emergency. CROSS are interested in sharing safety information on this topic, including safety information related to:

- designing, constructing and managing structures in response to the climate emergency
- designing with new and emerging materials
- the design and construction of leaner, lower-material structures e.g. through the use of reduced loading, decreased factors of safety, advanced analysis methods etc.
- the impact of climate change on existing structures, including how structures are adapted and managed to combat the effects of climate change
- designing and constructing new structures to combat the effects of climate change
- the reuse and life extension of existing structures
- the use of off-site manufacture and modern methods of construction (MMC)
- designing and constructing structures for a longer design life and/or to be more adaptable

From CROSS

The risk of collapse of multi-storey CLT buildings during a fire>

A reporter presents concerns about the fire safety of multi-storey buildings comprised of cross-laminated timber (CLT) structures.

29 March 2021 Report ID: 966 Region: CROSS-UK

CROSS Safety Report

Structures at risk from scour and erosion>

Following some recent structural failures, a reporter is concerned that asset owners may not fully realise risks associated with scour and erosion.

1 January 2020 Report ID: 617 Region: CROSS-UK

CROSS Safety Report

From third party organisations

Structural fire safety when responding to the climate emergency>

Luke Bisby urges structural engineers to improve their understanding of 'fire resistance' as the profession looks to innovate rapidly in response to climate change.

1 February 2021

Publisher: The Institution of Structural Engineers

Third party content

Structural safety when designing lean in the climate emergency>

The IStructE Safety, Health and Wellbeing Panel considers the safety implications when aspiring to a lean design.

4 January 2021

Publisher: The Institution of Structural Engineers

Third party content

For full list of further reading please **visit the Theme Page on the website>**

Specification issue with steel hollow sections

CROSS Safety Report Report ID: 1006

A reporter raises concerns after their structural engineer had failed to specify the steel grade used in the design for hollow sections on two projects.

Key Learning Outcomes

For architects and designers:

- There are different grades of steel for different purposes and it is important to make the appropriate selection and then to include that within the material specification

For civil and structural design engineers:

- As for architects and designers, the correct grade for purpose must be chosen

For the construction team:

- Beware of substitutions offered that do not comply with the designer's specification. In case of doubt, ask.

R Full Report

The reporter is from a consulting firm. They found out that their structural engineer had failed to specify the sub-grade used in the design for hollow sections on two projects. A review was carried out to establish the impact of this on structural safety.

Project 1 – CHS sections used as props

CHS sections were used as props in temporary works. The utilisation of the CHS sections was 60% for hot formed steel members. The reporter's firm had not however clearly communicated the requirements to use hot-formed sections in design documents or drawings. A check found that the sections were still safe if cold formed sections were used. This would have been very costly if revised utilisations would have resulted in overstressed members.

Project 2 – SHS sections used as supports

SHS sections were to be used in cable rack supports where the design was governed by deflections. The design report and drawings did not clarify the sub-grade to be used at the project start. Using cold formed sections rather than hot formed sections would have resulted in a very tricky situation with cost and programme impact if the design was not governed by deflection rather than stress.

The reporter says that if an engineer assumes hot formed steel and pushes their design close to unity but does not specify this on the drawings or in specifications clearly, the client may end up procuring cold rolled steel sections. These have less strength and inferior ductility properties so the affected structural elements could be overstressed. The lesson learned is to share this information and always state the sub-grade in the design report and in the drawings to provide clarity.

> **The lesson learned is to share this information and always state the sub-grade in the design report and in the drawings to provide clarity**

C Expert Panel Comments

The reporter's use of 'sub-grade' is possibly misleading as that term is normally used for the designation A, B, C etc which refer to products in the same strength grade but with varying values of toughness for selection when resistance to brittle fracture is a requirement. Refer to the Steel

Construction Institution (SCI) Technical Report: **Selection of steel sub-grade in accordance with the Eurocodes>**.

Sub-grade in steelwork usually refers to the toughness of the steel, and its ability to resist brittle fracture. A Charpy V-notch test is used to determine this. Thicker sections, and those subject to cold temperatures are more at risk, as are those with higher locked in weld stresses.

Hot v. cold rolled hollow sections

For SHS sections a further division is available as between hot rolled and cold rolled versions of the same serial sizes with hot rolled options generally having better buckling resistance. However, the main point is that designers must be precise when specifying products. One case is known of when a key connection failed because threaded bars of grade 4.6 were used instead of the grade 8.8 intended.

> **One case is known of when a key connection failed because threaded bars of grade 4.6 were used instead of the grade 8.8 intended**

CROSS report **761>** (Major UK steel manufacturer talks about steel substitution) from a UK steel manufacturer responding to a similar report **(740 Common use of S235 cold rolled steel instead of S355 hot rolled steel)>** also notes that the cold rolled product does not require the same "quality, traceability and testing" as the hot rolled, and may require different welding processes and weld design considerations. Thus, the implications of substitution may go beyond simply the change in strength.

Specifying steel grade and sub-grade

It is essential that the correct grade and sub-grade of steel is specified for the appropriate use. Modern architecture often calls for externally exposed steelwork, for instance to provide support to brise-soleil. In such cases the external exposure of the steel demands an appropriate sub-grade to be specified to account for external exposure. There is much published information on this matter e.g. **SCI 491 brittle fracture; selection of steel subgrade to BS EN 1993.1.10>**, by way of example.

An aspect to be considered is suppliers may offer inappropriate steel sub-grades because they have cheaper alternatives available.

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Professional indemnity insurance issues raise safety concerns

CROSS Safety Report Report ID: 1022

Several reporters have raised concerns in relation to significant cost increases and the introduction of new restrictions on professional indemnity insurance (PII) policies.

This is seen as a potential for the creation of concerning 'gaps' in the design process, as well as preventing companies taking on projects which could delay essential building safety work.

Key Learning Outcomes

For consulting engineers:

- Begin broker engagement regarding PII policy renewals at an early stage
- Work with your broker to ensure full and accurate business descriptions are given, with additional information including your firm's risk management procedures
- Make sure that you understand if there are limitations and exclusions to your PII cover and, if so, what those limitations and exclusions are before taking on work or when the scope of work is altered or extended

For clients:

- When asking for evidence of professional indemnity insurance from those firms you engage, ensure any exclusions to scope of work are disclosed

R Full Report

One reporter says that insurers excluding certain activities, particularly in relation to fire, from insurance cover, potentially creates gaps in the design process. Gaps are already a source of concern, where design responsibility is not clearly defined. For example, the interface of the primary frame and the cladding is often not considered adequately, the main frame being under one designer and the cladding under a subcontract package. The situation is exacerbated by the enormous increases in premium and some businesses not being able to get cover at all.

Another reporter says that increasing premiums seem to be widespread. Quoting from the **Temporary Works Forum Yearbook 2021/22>**, *"consultants are seeing a worrying trend in the availability and affordability of professional indemnity (PI) insurance […] it may not be feasible to remain in business without significant increases in design fees. Will this drive consultants out of business?"* . This reporter suggests anecdotally that one firm has decided to forgo insurance, which is concerning.

Furthermore, the findings of a recent **pan-industry survey by the Construction Leadership Council>** pointed to widespread incidence of companies having to change the type of work they do because of restrictions on cover, with a quarter losing jobs because of tough conditions and limitations being placed on them by insurance firms. The survey results confirm that there is a widespread problem for many firms in being unable to obtain essential PI cover, which is having an impact on the ability of the industry to work, and undermining efforts to deliver remedial work to ensure building safety.

C Expert Panel Comments

One Expert Panel Member suggests the consideration of the use of 'project-based' insurance to ensure that all organisations engaging on the project are adequately covered.

It is also recognised that this is a very current issue for many in the construction sector, typical of a hard insurance market.

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IStructE strengthen CPD guidance on structural safety

News

John Veares, Chair of the Institution of Structural Engineers (IStructE) Professional Development Panel, introduces the changes that the IStructE have made to Continuing Professional Development (CPD) reporting on structural safety.

Background

There have unfortunately been many building and infrastructure failures in the past. Some of the most notable are Ronan Point and Oklahoma City (lack of robustness and progressive collapse), Tacoma Narrows Bridge (aerodynamic effects on long span bridge deck), Hyatt Regency (detail design change during construction), Florida footbridge (failure during construction) and Didcot Power Station (uncontrolled collapse during deconstruction). From just this small sample it can be seen that failures may occur at any stage during the life of the structure.

Although not necessarily a structural failure, the Grenfell Tower fire in June 2017 looks like having as significant effect on the UK construction industry. The subsequent review by Dame Judith Hackitt and the report Building a Safer Future identified significant shortcomings in the procurement, design, execution and management of construction projects; particularly Higher Risk Buildings (HRBs).

As a result of the Hackitt Review, those engineers involved in the design of HRBs will need to be included on specialist registers. This type of requirement is not out of the ordinary for many engineers around the world where registration systems already exist. Regular CPD is generally a vital part of maintaining registration and structural safety should be considered as a significant part of this.

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Even as I write this article there is breaking news of the tragic collapse of a multi-storey residential building in Miami. As this is an ongoing situation, speculation on the causes would not be fitting, but hopefully these will be fully reported following appropriate investigations. Again, painful lessons will need to be learned in order to drastically reduce the recurrence of such events.

IStructE and CPD

Around twenty years ago, IStructE made a decision to raise the priority of members' CPD. Whilst it was already mandatory to engage in CPD activities, the requirement to submit an annual return was on a voluntary basis. Starting in 2011, a random sample of members were requested to submit an annual return for audit, and from 2015, sanctions were added such that members that did not engage in the process were removed from membership.

From 2019, the Engineering Council (EC) decreed that all Professional Engineering Institutions would be required to introduce mandatory CPD audits with appropriate sanctions. The foresight of IStructE meant that such a system was already in place and its membership in step with the EC requirements. However, this did not mean that we could sit back and not develop the system. Having engaged the membership, it is important to now look to improve the quality of CPD returns submitted.

Structural safety CPD

The IStructE recognised the importance of safety related CPD for its members. Therefore, since 2019, the IStructE has suggested that members include aspects specific to structural safety in their CPD activities and returns. In 2021 there has been a campaign to further promote the importance of structural safety CPD. It is now suggested in the **guidance>** that *members should aim to gain at least six hours (of the recommended 30 hours) of structural safety related CPD each year*. It is hoped that this approach will have the same effect as mandatory CPD reporting and will put the membership in a good position to satisfy current requirements and any proposed new legislation.

Suggested sources of structural safety CPD

- **Collaborative Reporting for Safer Structures (CROSS)>** – CROSS is one of the most accessible sources of free and relevant information regarding structural safety. This could be via CROSS Newsletters, searches regarding specific issues or actual involvement in the confidential reporting of safety issues to CROSS. Whilst originally established to report safety issues in the UK (CROSS-UK), CROSS now also operates in Australasia (CROSS-AUS) and the United States (CROSS-US).
- **Temporary Works Forum (TWf)>** – many failures occur during construction due to inadequate

consideration of temporary loadings. TWf has a great deal of useful information available to assist in the proper provision of temporary works.

- **The Structural Engineer>** – The IStructE magazine has and continues to publish articles such as the Temporary Works Toolkit, project papers and technical guidance. An excellent example of the latter is two papers, published in the June 2021 edition, on the subjects of analysis and justification of existing structures where modifications are proposed. Journal articles are available on the IStructE website and free to members.
- **Technical meetings, seminars and courses** – numerous opportunities from various sources with most now available as online events or webinars.
- **Employer driven learning** – provision of lunchtime seminars either internal led or supplier presentations.
- **Study of relevant text books** – of particular note is the recently published **Designing a Safer Built Environment: A complete guide to the management of design risk>** – John Carpenter and the upcoming Structural safety: Theory and Practice – Allan Mann.
- **TV documentaries** – although generally designed for entertainment rather than education some, such as the series **Massive Engineering Mistakes>**, can provide useful reminders of vital lessons to be learned.
- **Project based research** – use of the above, and other, sources for the design of real projects to ensure that all aspects of structural safety are considered.
- **Mentoring** – it is vitally important that previous lessons learned by more senior engineers are passed on to those more junior to ensure that the same mistakes are not repeated.

CROSS is one of the most accessible sources of free and relevant information regarding structural safety

As with all CPD activities, the real worth can only be realised through reflection on the benefits gained and using these to make changes to the way you and colleagues carry out your work.

By now, all engineers should be well aware of the benefits of meaningful CPD. However, post-Grenfell, it is obvious that maintaining up to date knowledge in specific areas is likely to become mandatory; particularly in England / UK. The introduction of structural safety specific CPD to IStructE members is seen as a first step in preparation for any new legislation. Hopefully, other engineering institutions will be taking a similar approach with their members.

In addition to the benefits gained by engineers, there is also the benefit to employers in having a better prepared workforce and the benefit to the public in the awareness that structural safety is of high priority.

Potentially unsafe software design for steel beams

CROSS Safety Report Report ID: 1003

A steel beam design package makes simplified assumptions that may carry risks if not used by competent engineers.

Key Learning Outcomes

For architects and designers:

- Steel beams used in conjunction with masonry (and elsewhere) must be designed by competent civil and structural design engineers
- Software packages offering automatic design for non-engineers must be treated with caution

For civil and structural design engineers:

- Software should be used as only a part of the complete design process which requires knowledge and experience
- It is good practice to carry out sense checks and validate all design outputs from proprietary design and analysis software

R Full Report

A website, that has come to the attention of a reporter, offers steel beam design for a very small fee with a quick turnaround. However, it appears that the system relies on the user to assess whether a simple beam will be suitable for the task, and to then provide all the information required for a basic design.

The onus is on the user and the website says calculations and warranty are void if incorrect information is provided. The reporter is concerned that a domestic client, or even some builders, are expected to make the correct assumptions. These include the dimensions of brickwork that must remaining after an opening is made to retain overall stability. Beam lengths can be up to 4m.

While the beam calculations may be satisfactory as a stand-alone entity, it is plainly terrifying, says the reporter, that the website and associated designers state they are not considering overall stability. The whole concept aims to overly simplify what can be very complex domestic structures and put the onus on the builder or client.

There is a reason, as engineers, we sit chartership assessments (says the reporter), and it takes many years to achieve this. It is simply not safe to have an un-trained person putting numbers into a website and trusting the output. Again, this is an example of why the industry should be pushing for the legal requirement to have chartered (appropriately qualified and experienced) engineers involved when making structural alterations to dwellings.

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C Expert Panel Comments

These trends are indeed worrying particularly because the website may be used by people who have no knowledge or experience about the risks that may be involved. Many inexperienced designers grasp the concept of bending well enough, but a skill is determining what loads go on to a beam and whether these are UDLs, triangular or point loads, and other issues such as eccentricity. It is important to have sufficient brickwork at the ends of an opening to comply with Part A of the Building Regulations and provide overall stability.

Furthermore, a length of 4m immediately suggests a standard I beam that will need lateral restraint. Interfaces breed danger and if a designer is competent enough to

evaluate loads, loading conditions and lateral restraints (and deflection limits), they should need no assistance in working out a beam size. If they do need that assistance, then more fundamental help is required than offered by this website.

> **Interfaces breed danger and if a designer is competent enough to evaluate loads, loading conditions and lateral restraints (and deflection limits), they should need no assistance in working out a beam size**

This report is typical of many over the years that point out deficiencies in supposedly automatic design packages aimed at those who have no, or limited, engineering knowledge. There are no regulations to prevent these systems being sold and the people who are likely to use them will not read CROSS reports. It is therefore up to those who may be a position of influence, such as architects, surveyors, project managers, and local authority checkers to be alert.

The reporter is quite correct to say that it is not safe for engineering design judgement to be made by non-engineers.

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Fire safety concern over green walls

CROSS Safety Report Report ID: 976

This report discusses how building close down procedures that include isolating automated water systems might result in the drying out of green walls, thus presenting a significant fire hazard in external walls.

Key Learning Outcomes

For building owners, managers and occupants:

- Be aware of the need to maintain water supplies to vegetation that does not have access to groundwater through the roots

For fire risk assessors:

- Risk assessors should be aware of this issue and when assessing buildings with this feature, advise Responsible Persons accordingly
- The **Fire Safety Act 2021>** clarifies that the external walls and any attachments should be considered as part of the fire risk assessment

R Full Report

Green roofs and living walls are increasing in popularity. More information can be found on the **Royal Horticultural Society website>**.

Green walls are often irrigated by an automatic timed water feed switch system. Building close down procedures that include isolating electrical/water supplies or branches might close down such a system, resulting in the drying out of the green wall and thus presenting a significant fire hazard in the external wall. If the vegetation is allowed to dry out, it may become a fuel for fire.

Guidance regarding **fire safety measures>** has been published by HM Government and by the **NFPA>**.

Considering external walls in fire risk assessments

External walls are not routinely covered in fire risk assessments and are not considered a separate compartment in structural fire safety terms due to the likelihood of fire spread through window openings and the weak fire performance of standard (non-fire resistant) glazing units.

C Expert Panel Comments

There is greater pressure through planning for green walls, for reasons of biodiversity, urban heat island effect and wellbeing. Planning will often require the maintenance of the planting, for visual reasons, but when approving for building regulations irrigation is a critical factor.

Any system which is important to safety needs to have appropriate measures in place to allow for maintenance, or for breakdown. It is probably not currently on people's radar that irrigation may fall under the same category as sprinklers or fire alarms, so fire strategies and fire risk assessments need to reflect its importance.

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Lightweight concrete roofs

News

CROSS-UK has worked with the industry and government to raise awareness of and to help address safety issues associated with reinforced autoclaved aerated concrete (RAAC) planks.

What is RAAC?

Autoclaved aerated concrete (AAC) is different from normal dense concrete. It has no coarse aggregate, and is made in factories using fine aggregate, chemicals to create gas bubbles, and heat to cure the compound. It is relatively weak with a low capacity for developing bond with embedded reinforcement. It was used in two main forms of structural elements; lightweight masonry blocks and structural units, including roof planks.

When reinforced (RAAC) to form structural units, the protection of the reinforcement against corrosion is provided by a bituminous or a cement latex coating. This is applied to the reinforcement prior to casting the planks. The reinforcement mesh is then introduced into the formwork and the liquid AAC mix added.

RAAC roof collapse

In late 2018, the Local Government Association (LGA) and the Department for Education (DfE) **contacted all school building owners>** to draw attention to a recent failure involving a flat roof constructed using RAAC planks. There was little warning of the sudden collapse.

Figure 1: RAAC roof collapse at a school in 2018

Raising awareness of the safety issue

Following the RAAC roof collapse at a school in 2018, CROSS-UK worked with the LGA and the DfE to publish a safety alert on **reinforced autoclaved aerated concrete (RAAC) planks>** in May 2019.

The purpose of the alert was to help raise awareness of the safety issue among owners of schools and similar buildings which might have been constructed using RAAC planks, and professionals working on RAAC projects. It also provided guidance on how RAAC planks could be identified, inspected and managed.

The alert was widely disseminated to building owners and built environment professionals.

> **The consequences of an RAAC roof collapse are unthinkable. CROSS-UK's support and expert advice has been invaluable in our attempts to raise awareness and provide advice to councils and other duty holders on this critical issue.**
>
> Lord Porter, Local Government Association's building safety spokesperson

Helping professionals to share experiences

Following publication of the alert, a number of professionals working on RAAC projects used CROSS's secure and confidential safety reporting system to share their experiences with RAAC to help others.

Report 874> was from a reporter who had surveyed a number of buildings with RAAC roof planks, while **report 908>** was from a structural engineer who had investigated a RAAC roof collapse in a separate school to the 2018 collapse.

CROSS-UK were contacted by numerous professionals who were interested in learning more about RAAC, including how others were managing issues with RAAC planks. There was a strong desire from professionals to learn from each other and share best practice.

As a result, a RAAC Study Group was established under the leadership of the Institution of Structural Engineers (IStructE). The Study Group provided professionals with the opportunity to collaborate with each other, to share best practice, and to investigate ways of ensuring continued safety to occupants of the affected buildings. If you would like to know more about the RAAC Study Group, you can contact **technical@istructe.org>**.

> **CROSS has allowed those people with experience of RAAC to share their knowledge and expertise**
>
> Martin Liddell, Chair of IStructE RAAC Study Group and Director at MLM Group

Working with government

It is believed that RAAC planks are present in many buildings constructed between the 1960-80s. These include some schools and hospitals. CROSS-UK have been working with government departments on the topic. We have engaged with the Department for Education (DfE), the Department of Health and Social Care (DHSC) and the Ministry of Housing, Communities and Local Government (MHCLG).

We provided expert and independent advice on the need for further research into RAAC planks. We also worked with the DfE to publish guidance for how schools can identify and take action if RAAC is found in roofs: **reinforced autoclaved aerated concrete in roofing in schools>**.

We continue to work with government departments on managing the issue, including updating on any industry developments of which we are aware.

TDfE has worked closely with CROSS to develop our understanding of the potential issues of RAAC for schools and the wider education estate. We expect that productive relationship to continue, and welcome the expansion of the CROSS remit to cover fire safety.

Crawford Wright, Head of Design at Department for Education

Unsafe excavation practices

CROSS Safety Report Report ID: 1026

A builder undermined the existing footing of a masonry wall without being aware of the risks.

Key Learning Outcomes

For contractors and builders:

- Be aware of the risks of excavations, the collapse of even quite shallow excavations can cause death
- HSE offers extensive advice on excavations, see: **Structural stability during excavations>**
- It is good practice to carry out a risk assessment and method statement (RAMS) for all construction activities. This can ensure the sequencing of work activities such as trench excavation are considered and planned.
- In June 2019, the Temporary Works forum (TWf) published guidance on **The safe management of temporary works - The basics for small and medium-sized enterprises (SMEs)>**

For civil and structural design engineers:

- Ensure that the requirements of CDM Regulations 2015 for site specific hazards (such as the risk of undermining existing structures) have been clearly communicated to the principal contractor during the project planning stage
- Consider how the design risks, such as the risk of undermining existing structures, can be effectively communicated to contractors on site

R Full Report

A reporter was called to inspect a foundation excavation and found the situation as shown in Figure 1. The builder said *'I haven't undermined the foundation at all.'* The outer face of the excavation was neatly in line with the outer face of the 225mm wall to the neighbour's house; whose footing can be seen to the right.

When told that this was highly dangerous, their response was *'I've been doing it like this all my life'.* The reporter told them that if he continued in this manner then it would probably bring his life to an early conclusion.

The builder did not understand that:

- the load was now concentrated on a footing that was only two thirds of its original width
- the bearing capacity of the outer edge was almost zero, due to the lack of lateral resistance
- there is a natural tendency for any trench to fail under the weight of the soil alone never mind with a foundation load applied to its edge

There was no appreciation of the risk to their own life never mind the risk to the householders' lives.

Figure 1: Unsafe excavation undermines masonry wall

Emergency propping was immediately installed, and the new foundation constructed a day later, and nothing untoward occurred on this occasion. The reporter can recall many cases where the outcome wasn't as happy; the number of lives lost or forever changed by such practice would be a sobering statistic worth knowing.

The problem was ignorance. Not of soil mechanics as much as a lack of awareness of the limitations of knowledge. This is why the licencing of builders is important; not to set a bar which prevents conscientious people entering the business, but to give something which can be taken away for failure to train, supervise, and educate themselves and their employees.

Emergency propping was immediately installed, and the new foundation constructed a day later, and nothing untoward occurred on this occasion

C Expert Panel Comments

Undermining any foundation to the degree shown is an absolute failure without the sanction of an engineer with a method statement and risk assessment. Normally a method statement would give an indication of a type of hit and miss sequence with a limit on width exposed of between 1 and 1.2m depending upon the wall construction and ground condition.

Awareness is key to improving safety

Training for excavations gives different risk profiles for depths of excavation and therefore solutions for propping, though the circumstances in which the work is being undertaken does need to be taken into account for the risk assessment and mitigation measures. As the report says awareness is key and despite having done it this way all of their career is no guarantee that today will not be a bad day for the builder.

As a generalised statement, the key issue with construction – anything from work in the ground to erecting a steel frame, is to appreciate that at any intermediate stage prior to completion, possibilities of instability exist and possibilities of design conditions (for strength) are likely to be more adverse than in the final assembled state. Thus design as a whole must consider how a project will be built so that the issues of strength and stability at all intermediate stages can be verified. Frequently this will require dialogue and consultation between those charged with designing and those charged with executing.

Training for small building firms

As is the case with so many reports of this type there will probably not have been any engagement with an engineer, so it is essential to provide more training for small builders, modelled on what is carried out by larger companies. Licensing, which is often talked about, may be associated with training but would require extensive consultation and legislation. Of more immediate use would be publicity about risk at the level where it would be seen by small builders. For example, notices and leaflets in builders' merchants.

HSE offers extensive advice on excavations, see: **Structural stability during excavations>**, which begins with the statement:

'The law says you must prevent danger to workers in or near excavations. To maintain the required precautions, a competent person must inspect excavation supports or battering at the start of the working shift and at other specified times. No work should take place until the excavation is safe.'

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We help professionals to make structures safer. We do this by publishing safety information based on the reports we receive and information in the public domain.

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