

NEWSLETTER No. 51, July 2018

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Reports sent to CROSS are de-identified, categorised, and sometimes edited for clarification, before being reviewed by the CROSS panel of experts. The panel makes comments that are intended to assist those who may be faced with similar issues. In the Newsletters, the reports are shown in black text and the comments are shown below these in green italics.

Reports and comments are also given on the website [database](#).

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IMPLICATIONS FOR STRUCTURAL-SAFETY FROM THE HACKITT REPORT

[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.

Whilst mechanisms exist to report safety issues around the structural integrity of a building there is no coherent approach to reporting issues during the construction or occupation of buildings. Similarly, there is no specific protection given to anyone (such as a resident) who wishes to raise a formal concern.

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 covering:

- Key roles and responsibilities;
- Digital records of all work;
- Tougher enforcement and sanctions;
- More effective leadership and competence for building safety and integrity;
- Clearer and more effective specification and testing of products.

Within these 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. A SCOSS Alert summarising the Hackitt Report will be published shortly.

Very importantly, and key to many of the changes, will be a continuation of the flow of reports to CROSS. The number that we get is significant, and their value is enormous. However, more are needed, especially now, so this is your opportunity to help make a difference to improve quality and safety. Concerns about any safety aspect of design, procurement, construction, inspection, regulation, maintenance and operation of buildings and structures should be reported. Reports are confidential, so your name and the details of any company, site, or product mentioned, will not be revealed. This is not whistle-blowing but the sharing of information for the benefit of the public and the construction community.

Send a confidential report of any safety issue that you have come across to [Submit Report \(https://www.structural-safety.org/confidential-reporting/submit-report/\)](https://www.structural-safety.org/confidential-reporting/submit-report/).

In this 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.

Alastair Soane, Director of Structural-Safety

What should be reported?

- concerns which may require industry or regulatory action
- lessons learned which will help others
- near misses and near hits
- trends in failure

Benefits

- unique source of information
- better quality of design and construction
- possible reductions in deaths and injuries
- lower costs to the industry
- improved reliability

Supporters

- Association for Consultancy and Engineering
- Bridge Owners Forum
- British Parking Association
- Chartered Association of Building Engineers
- Construction Industry Council
- Department of the Environment
- DRD Roads Services in Northern Ireland
- Health and Safety Executive
- Highways England
- Institution of Civil Engineers
- Institution of Structural Engineers
- Local Authority Building Control
- Ministry of Housing, Communities and Local Government
- Network Rail
- Scottish Building Standards Agency
- Temporary Works Forum
- UK Bridges Board

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HOW TO REPORT

Please visit the website www.structural-safety.org for more information

When reading this Newsletter online [click here](#) to go straight to the reporting page

If you want to submit a report by post send an email to the address below asking for instructions

Comments either on the scheme, or non-confidential reports, can be sent to structures@structural-safety.org

447 FATAL WALL COLLAPSE AT SCHOOL DUE TO 'WALL CLIMBING'

This report has been provided by HSE and once again highlights the potential dangers of freestanding masonry walls. It draws attention to a possible mechanism whereby a limited number of persons can impose actions on walls or partitions in excess of the values contained in the Eurocode. The findings arise out of a Fatal Accident Inquiry into the tragic death of a school pupil in an Edinburgh school sports hall changing room in 2014.

The changing room contained a disused shower area which was routinely used as an additional area for the pupils to change. The shower area had originally had a row of shower heads along the back wall forming a communal shower. This 'wet' area was separated from the rest of the shower area by a freestanding 'privacy' wall. The width of the area between the privacy wall and the back wall with the showerheads was approximately 900mm. The privacy wall was 3.6m long by 2.1m high, it was formed of a single layer of unreinforced clay bricks laid in stretcher bond and faced all round with a terrazzo finish to the full height of the wall. The finished wall was therefore 140mm thick. Such a slender unreinforced wall did not comply with any historical (or current) design code. When the changing room was originally designed in the early 1950s there were no relevant Building Regulations in force in Edinburgh.

On the morning of the incident, a group of 11-year-old pupils were using the area in front of and behind the privacy wall to get changed. At least one, and probably two pupils, who were standing in the gap between the privacy wall and the back wall, decided to support themselves off the floor by bracing their backs against one wall and both feet against the other wall. It is also possible that using this technique they were trying to climb up the gap between the parallel walls. The privacy wall then toppled outwards, striking and fatally injuring one of the 11-year-old pupils.

With the pupils braced against one wall and pushing with their legs against a parallel wall, the amount of force with which they can push is not limited by friction as it would have been if they were standing on the floor. Ergonomic analysis confirmed that in this position it is possible for a small number of individuals to exert a force that exceeds the horizontal design loads given in the UK National Annex to BS EN 1991-1-1, Table NA.8. This braced position also allows individuals to climb up the gap, and consequently the force can easily be applied above the 1.2m max height given in BS EN 1991-1-1 paragraph 6.4(1).

It is felt that such 'wall climbing' is more likely to occur in facilities used for sports/recreation and in facilities used by young people (e.g. schools, colleges, student accommodation).

Practitioners undertaking surveys should carefully assess the stability of ANY freestanding walls; whether they are internal or external and irrespective of whether they show any signs of distress.

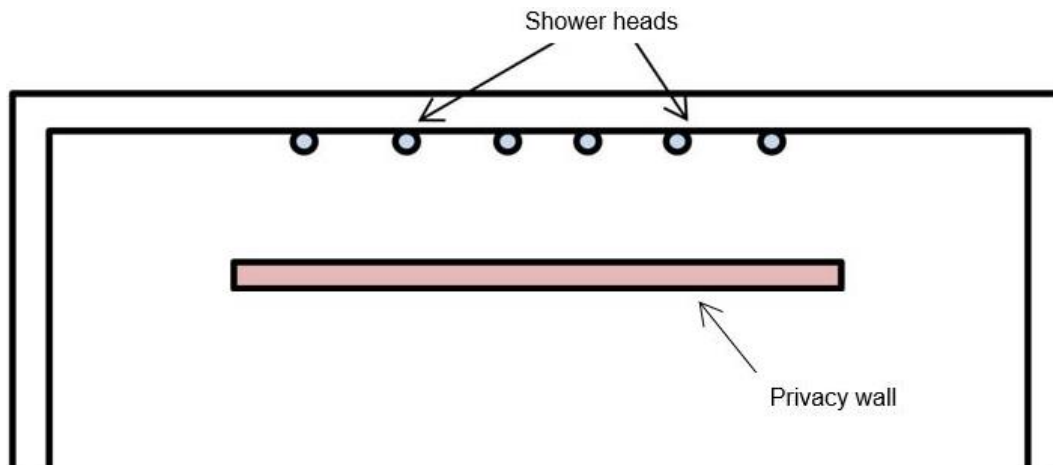


Figure 1: Part plan of changing room

Comments

There have been numerous cases of free standing wall collapses causing fatalities, particularly to young persons. The risk was highlighted in a [SCOSS Alert: Preventing the collapse of freestanding masonry walls – September 2014](#) and further examples are to be found on the CROSS database. Horizontal loading applied by people exerting pressure has been observed previously. In the 1970s, tests were carried out at Liverpool FC on barriers in the Kop end which was then for standing only. It was found that the highest loads were applied when, to resist pressure from the crowd behind, supporters put their feet on the rail and pushed back. Had they not done so, the pressure could have crushed their chests. This data was used when recommending barrier loading in the original [Guide to Safety at Sports Grounds](#).

It is important that the designer/assessor of walls such as those in the report consider what reasonably foreseeable loads could be applied beyond the code minimum values. Additional loading may arise due to the location, type of use or thoughtless or potentially malicious actions. When reviewing risks for any structure, what would be the potential consequences of failure?

669 LIGHT GAUGE STEEL FRAMING AND RESPONSIBILITIES ON SITE

As an increasingly popular method of supporting building envelopes, Light Gauge Steel Framing (LGSF) was utilised on the residential project in question. The LGSF acted as a secondary structure to the main concrete frame to carry finishes, façade and glazing at structural openings. The frame was installed satisfactorily by a sub-contractor and handed over following completion.

After the installation, additional balcony elements were fitted to the primary frame located at the first and second storey. Balcony brackets were required at a number of opening jambs, but no prior arrangements were made within the concrete frame to connect the balcony, nor was it coordinated with the LGSF sub-contractor or designer. In order to connect balcony brackets to the primary frame, the LGSF jambs were trimmed short at both head and base connections.

The glazing to the structural openings had already been installed and due to the removal of the LGSF jamb connections, it was now the plasterboard which both suspended the LGSF locally and restrained the glazing against wind and other loading applied. Fortunately, the LGSF sub-contractor was made aware of the occurrence, raised the issue with the supplier, and a remedial design was produced to bridge the brackets and reconnect the LGSF jambs back to the primary frame.

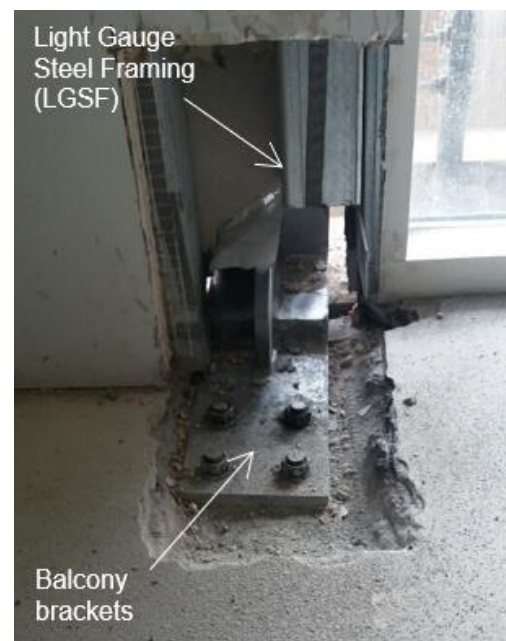


Figure 2: LGSF trimmed to allow for balcony brackets

If left unnoticed, this structural fault could easily have been covered and neglected, where under much lower loading than designed for, may have resulted in failure of the envelope and glazed openings. This could have led to the LGSF, glazing or other finishes failing and falling from their installed position.

It is important to remember that LGSF is a structural steel system and it is of vital importance that notching and material removal not confirmed within the design does not take place. Examples such as the above, where future elements of the site program require space not previously provided, must be coordinated during the LGSF design and ahead of installation to mitigate scenarios like this.

Comments

The LGSF sub-contractor is to be congratulated on their diligence in spotting the conflict which could have had serious consequences. It begs the question however as to what happened to the site supervision?

There are two main issues. The first is that there was a failure to recognise at the design stage that provision would be needed to accommodate the balconies. CDM 2015 promotes closer working between designers, facilitated through the Principal Designer, and the transfer of relevant information in order to overcome interface issues.

The second is the failure of the Principal Contractor to refer the issue back to the relevant designer once the problem became known and before allowing notches to be made. The report highlights the problems of multiple sub-contractor suppliers without one overall guiding hand. In any structure, the Principal Designer ought to ensure there is a viable load path which all parties understand and respect across all structural parts - whoever supplies them.

There is always a need to inform following trades (and indeed future occupiers through CDM) of the structural importance of secondary elements. This case illustrates once again some of the flaws highlighted in the [Independent Review of Building Regulations and Fire Safety: final report](#).

Balconies, particularly cantilever balconies, must always be treated with care. There are frequent failures and there have been many fatalities due to collapsing balconies. Entering "balcony" in the Quick Search facility on the [Structural-Safety website](#) will give examples.

SUBMIT SIMILAR REPORT

734 GLASS SMOKE SCREENS AND STRUCTURAL SAFETY

A reporter was asked to investigate the spontaneous failure of glass smoke control screens at a major retail store. The screens were made of fire rated toughened glass suspended from the roof structure by aluminium cleats - 3 bolts per glass pane.

It became evident, based on examination of the remaining glass panes, that there were no gaskets or bushes to separate the glass panes from their connections and there was no tolerance within the bolt holes. In addition, bolts were loose and washers were missing, indicating they were working in shear rather than acting as tension clamps.

It was also discovered that a smoke extract vent was locked open adjacent to the failed panes. This permitted a differential temperature to arise between the ceiling void and occupied space adjacent to the failure. In this case the external air temperature was as low as -6°C.

The trigger for failure was thus differential expansion and contraction between the aluminium cleats and glass screen. However, the defective connections were the underlying cause. They were inherently vulnerable to a trigger mechanism - an accident waiting to happen. Had the building been occupied at the time of failure, a serious accident could have resulted.

In preparing remedial details, it has become apparent that standard glass smoke barriers are essentially designed for a specific fire rating, but there may be little consideration of structural factors. For example, they may not be designed for internal wind pressures and toughened glass is used irrespective of the height at which the barrier is installed. Toughened glass fails as a mixture of dice and heavy clumps of glass, which can cause serious injury, particularly as height increases.

Glass suppliers do not necessarily make the specifier (normally an architect) or client aware of the inherent risks that may be associated with their product - it is not even clear that they appreciate risks exist. It is the reporter's view that a risk assessment should always be carried out when designing overhead glass components.

Comments

Glass should never be directly supported by a material like steel as it does not yield and will cause concentrated stresses to form in the glass, causing it to fail. This is a well-known behaviour of glass so to hear of support details not following this principle is somewhat concerning. Normal practice would be to separate the glass from the supporting metalwork by nylon bushes, neoprene gaskets, poured resin or applied mastic with plastic spacer bars; appropriate to the situation.

As to the adoption of toughened glass at height, there is some merit in its use as its mode of failure is small pieces known as 'dice' once the tension and compression pre-stress becomes unbalanced within the glass pane causing it to shatter. The report's author is right to point out toughened glass can fail with clumps of 'dice' falling from height that can cause harm, however, this is not as dangerous as large shards of glass following the failure of annealed and heat strengthened glass.

The use of laminated glass is advisable for overhead glazing to reduce the risk of falling glass, however, the support detailing must be robust enough to restrain the glass in the first place following a failure of one of the plies within the laminated pane. For further guidance on this see the [CIRIA Guidance on glazing at height \(C632\)](#).

The report is not about 'structural glass' as such, but if there is any doubt, then it should be borne in mind that the design and installation of structural glass is a specialised business and appropriate competence and expertise is needed. The specifics of each location need to be considered including thermal and external loads and the consequences of failure understood and mitigated against. Guidance is given in the IStructE guidance on [Structural use of glass in buildings \(second edition\)](#).

SUBMIT SIMILAR REPORT

662 TOWER CRANE FOUNDATION DESIGN ERROR

The author was asked by a Principal Contractor to undertake an independent design check for two tower crane foundations for a project. Both cranes were to be founded off permanent pile caps that had been deepened to accommodate the mast fixing assemblies. These comprised of reinforced concrete caps each supported by four 600mm diameter symmetrically placed bored piles.

Naturally, it was the Contractor's intention to cast these caps ahead of the surrounding foundations so that the cranes could be erected early in the build programme. Consequently, the worst-case condition in terms of pile tension load was when the cranes were first installed. It quickly became apparent that the pile tension loads given on the structural engineer's pile load schedule fell well short of the potential tension created for both in-service and out-of-service load conditions. In the case of the latter, the tension generated using the approach recommended in CIRIA C654 was around 900kN (unfactored) compared to a value of around 300kN (unfactored) stated on the pile schedule.

Having alerted the client about this error, the author was then horrified to learn that the first crane had already been erected and had been working for a week! On reviewing the pile schedule issued by the engineer, it was apparent that the dead load for the piles had been combined with the crane load values. However, the dead load figure should have been ignored as this represented the full building's weight once completed.

This is the third occasion within the past 5 years that the reporter has experienced a similar tension shortfall on piled tower crane foundations. The reporter believes the root causes is that there is no overall design responsibility for the crane foundations.

Comments

This highlights the importance of a designer recognising that temporary load cases can be the determining factor for satisfactory structural safety. Did the Principal Designer only have responsibility for the permanent design with the temporary works design being carried out by another? Responsibility may have been divided without anyone having an overview of the processes. Or the designer(s) may have been inadequately experienced or trained.

Information across interfaces is a generic problem and hence the need for any designer to be absolutely clear as to what any given design information, such as pile loads, refers to. Did the incorrect pile loads affect the design of the pile cap too?

The problem was discovered during an independent check, which is good, although it may be that the check was not commissioned early enough in the process to identify the issue before construction started. A source of good advice on such matters is the [Temporary Works Forum](#). The Temporary Works Coordinator (TWC) could also have had a role here in directing the design and sequencing of the temporary works - see the [temporary works section on the HSE website](#).

SUBMIT SIMILAR REPORT

704 WHO TAKES RESPONSIBILITY FOR PREVENTING A FAILURE?

After reading the [SCOSS Alert on Hazard identification for structural design](#), a reporter was prompted to write to CROSS about how various parties involved with structural safety sometimes see their responsibilities.

The reporter was consulted by a water company regarding a failed combined drainage system at the top of a cutting down to an old country road which has been reverted to a cycleway and footway. A circular slip had taken place causing displacement of the drainage line and caused instability to a row of large concrete fence posts which were precariously leaning towards the footway, at the top of the slip.

The highway authority disputed ownership of the bank, declaring that it was the landowner's responsibility, but unfortunately the landowner was not able to do anything due to financial constraints. The reporter managed to persuade the water company's lawyer that, knowing a hazard exists, they had a professional duty to avert the danger to the safety of the public, even if they are not directly responsible. If they thought it was not their direct responsibility, they could always make a claim later.

The water company eventually agreed to reinstate the slip in gabions and to repair the pipe. It took a long time to reach this stage and by the time the work had started, the concrete fence posts had already fallen down, but luckily no one was walking by.

The reporter is concerned about general awareness of the lack of responsibility and unprofessional attitudes taken by some public authorities based on cut-backs and hiding behind lack of funds.

Comments

A not unusual situation with disputed ownership of assets and the reporter is right to point out that responsibilities must be accepted by public authorities in the public good. The reporter did well to get the situation resolved and the event could have been more serious had people been in the vicinity at the time of collapse.

The reason for the slip occurring is not known, but had there been a HSE investigation, the initial focus would be on the landowner, since those that create a risk are best placed to control it. However, if there is a risk of serious personal injury and a lack of willingness from the highway authority to assist, then enforcement action could be taken against the highway authority to take steps to protect members of the public e.g. closing the footpath. SCOSS has previously recommended that there should be a duty to inspect incumbent on the owners of such assets.

SUBMIT SIMILAR REPORT

723 NO RESPONSIBILITY FOR DAMAGED FOOTBRIDGE

A small footbridge in a public car park has the centre of the web missing for the last metre on one beam, and at least half of flange missing for the middle 3m of the span. This was reported to the local authority council who declined responsibility and passed the problem to the County Authority as this is a bridge. In turn the County said that it was not their problem and suggested phoning the owner of an adjacent superstore who did not respond. Who is responsible if no owner can be identified?

Comments

This and report 704 are very similar. It is heartening to see that in both cases, someone not only raised the issue but had the determination to carry it through. It does though seem wrong that it is left to third party responsible engineers to act in such cases.

Ownership can be complicated; however Local Authorities have powers to take action if there is a potential imminent risk to the public. They can take such action as necessary to remove the risk and to charge the owner for the costs when ownership is determined. Powers are usually delegated to the Local Authority Building Control office.

It should be noted, however that the responsibility for maintaining a safe structure always rests with the owner.

SUBMIT SIMILAR REPORT

776 SPLIT RESPONSIBILITY FOR COLLAPSED BOUNDARY WALL ADJACENT TO RAILWAY

A train driver reported striking debris from a collapsed wall in an urban location. The material was part of a boundary wall that runs along the top of a retaining wall adjacent to the railway. The boundary wall was known to be in poor condition, including being disturbed by the removal of a large tree, according to the reporter. The ownership/responsibility for the retaining wall and the boundary wall was split, which led to a breakdown in communication for undertaking the required remedial works.

Comments

This apparently minor incident could have had serious consequences because it occurred alongside a railway line. The 2011 HSE report [Preventing catastrophic events in construction](#) defines Catastrophic Events as those that are beyond the ordinary or routine, and are characterised by being of low probability but high consequence.

Examples of occurrences which may be Catastrophic Events include structural collapse of permanent structure(s) with potential consequences for multiple deaths and serious injuries in a single incident and/or serious disruption of infrastructure (e.g. road, rail) and/or services (e.g. power, telecoms).

There is no indication in the report that this wall collapse might have had catastrophic consequences, but the circumstances might have been slightly different. What might have been the result if there had been a derailment? CROSS reports frequently demonstrate that there is a very fine line between a near miss and a disaster; it is often a matter of luck and timing. It is the duty of all who own, or who manage assets adjacent to major communications links, such as railways, to be aware of their responsibilities.

Rail companies have significant influence over anything that could affect the operation of the railways, so, regardless of who the asset belonged to, they would ensure appropriate measures to keep the system safe. In the broader context, if a professional engineer sees something that looks dangerous they should, as an ethical duty at least, report it.

SUBMIT SIMILAR REPORT

727 QUESTIONABLE TENSION BRACING ARRANGEMENT

A reporter is concerned about the arrangement of diagonal tension bracing in one bay of a building. The connection is formed of 4 stainless steel bars connected by what looks to be a circular plate. The bars are out of alignment due to incorrect measurement or poor fabrication. To make the connection fit, the ends of the bars have been ground down and the plate skewed resulting in an eccentric loading arrangement. In the case of a brace under tension, the plate will rotate about its centroid due to the eccentricity of the tension force. The resulting rotation will force the opposing bars into compression increasing the likelihood of the bars buckling - all the more critical if the length of the bars is not as designed.

Comments

Another case of a third party picking up on a potential fault. The arrangement of the members is not unusual, but it seems to be a case of the installation not matching the design, and possibly the assumptions in design being breached. No connection is perfect in alignment, but a good robust design will cater for some deviations. If the members have needed to be altered on site to make them fit, that should have been the trigger to ensure the design was still valid. Any steel structure is only as good, or as safe, as the integrity of its connections. Hence the Principal Designer must be assured that the design intent overall has been correctly translated into reality.

However, has the reporter raised this with the building owner? There is no legal duty to do so but as a matter of good ethical practice an engineer who notices a potential safety issue would advise the owner, or tenant of their concern. If it is not known who this is, then the local authority could be informed. Where there might be an immediate and severe risk, then CROSS may be able to advise on a course of action.

SUBMIT SIMILAR REPORT

756 COLLAPSE OF DOMESTIC GLASS BALUSTRADE DUE TO INADEQUATE FIXINGS

A firm was asked to provide professional advice regarding the replacement of a glass balustrade which had collapsed. The balustrade was at second floor level, free standing in a prefabricated metal channel section which was inadequately fixed down to softwood decking boards. It is a single occupancy domestic property and all glass and debris fell within the grounds of the property. No one was injured. The reporter asks if the firm have an obligation to report the incident to the HSE or any other organisation?



Figure 3: Rusted screws used to fix the balustrade support rail

Comments

The cause of collapse was probably down to inadequacies at the time of construction. The question is whether there is a need to report such an event. RIDDOR (Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013) puts duties on employers, the self-employed and people in control of work premises (the Responsible Person) to report certain serious workplace accidents, occupational diseases and specified dangerous occurrences (near misses) to HSE. It is unclear from the report whether RIDDOR applies here and whether the reporter or their firm falls into one of the above categories. If unsure readers can contact [HSE Concerns and Advice team](#) who will be able to advise.

Whatever the legal requirements, CROSS wants reports on all collapses and near misses so that information can be built up on the types of problems that are occurring in buildings and structures.

SUBMIT SIMILAR REPORT

Response to CROSS Report 740 Common use of S235 cold rolled steel instead of S355 hot rolled steel

A major stockholder of structural hollow sections was surprised to read the CROSS report [740 Common use of S235 cold rolled steel instead of S355 hot rolled steel](#) in Newsletter No. 50 about the availability of hollow sections. They carry a large range of sizes and lengths in EN10210 S355J2H and EN10219 S355J2H. However, in their experience it is not uncommon for general steel stockholders to not be aware of product availability outside their own ranges, and to not be informed about the grades available. The stockholder says that they deliver all over the UK and Ireland and wanted to take the opportunity to set the record straight that the products are readily available.

The success of the CROSS system depends on receiving reports, and individuals and firms are encouraged to participate by sending reports on safety issues in confidence to [Structural-Safety](#). See [What to Report](#).

Company Presentations

We would welcome the opportunity to visit your office, share examples of CROSS reports and SCOSS Alerts, and tell you more about how the organisation works. Contact us at events@structural-safety.org to arrange a talk for your organisation.

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