CROSS
Confidential Reporting on Structural-Safety
For an introduction to CROSS see www.structural-safety.org. Email: structures@structural-safety.org

NEWSLETTER NO 49, January 2018

REPORTS IN THIS ISSUE:

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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INTRODUCTION – BUILDING A SAFER FUTURE

The Independent Review of Building Regulations and Fire Safety by Dame Judith Hackitt in December 2017 focuses on the future by learning from the past. She said that the whole system of regulation is not fit for purpose leaving room for those who want to take shortcuts to do so. Strong words which will resonate with CROSS readers because, for 12 years, we have gathered reports about safety concerns and events in construction demonstrating the dire condition of parts of our industry. Dame Judith collected evidence from 250 sources and we were amongst them with information obtained from responses to a recent survey of The Institution of Structural Engineers' Members and Fellows, from reports sent to CROSS, from SCOSS Biennial Reports over many years, and from the views of the SCOSS Committee and the CROSS Panel. We said that the quality of design submissions being made to Building Control Departments has declined, that there is a lack of coordination of design which stems from fragmentation of design responsibilities, and that the culture and capability of checking site work in progress has been hugely diminished. We said that there appears to be a particular lack of competence in assuring 'Fire Safety' and this partly stems from poor training whereby fire safety skills have hereto not been a major part of engineering training. Other factors are that responsibility for fire safety is frequently diluted by dispersion of tasks along the supply chain. We recommended that high-risk buildings should require a documented report justifying their overall fire safety as part of the Building Regulation submission and that the competency of those charged with managing fire safety throughout the life of a building needs to be addressed. We said that both designers and contractors, including major sub-contractors, should be better regulated to improve the quality of construction.

Such concerns and similar views from many others, all led to Dame Judith to state that she intends to create a better system for the future which will be easier to work with, deliver better solutions, and rebuild confidence. In the January 2017 Newsletter, when commenting on Report 612 Number of near misses and the regulatory regime, the CROSS panel commented: "There is certainly the possibility of another mega failure that will serve as a wake-up call. But that will be too late for those involved." This was written about structural collapse rather than fire but the underlying causes are generic and the Grenfell Tower fire is a tragic example. CROSS can help with the rebuilding process by getting more evidence from reporters and using this to emphasise the cultural changes that are needed to protect the public and to repair the reputation of parts of our industry.

The success of the CROSS system depends on receiving reports, and individuals and firms are encouraged to participate by sending concerns in confidence to Structural-Safety. In addition to structural reports we want weather damage reports for use in formulating future regulation and guidance. See What to Report.

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 for Communities and Local Government
- Department of the Environment
- DRD Roads Services in Northern Ireland
- Healthy and Safety Executive
- Highways England
- Institution of Civil Engineers
- Institution of Structural Engineers
- Local Authority Building Control
- Network Rail
- Scottish Building Standards Agency
- Temporary Works Forum
- UK Bridges Board

Scan the QR code on the right for access to Structural-Safety

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

706 General fire safety in residential blocks

A reporter discusses investigations of all types of building defects in residential blocks. In some cases, this involved reported concerns regarding fire safety, but in a number of cases, fire safety issues were discovered while looking at other issues, such as a lack of or poorly fitted fire collars at floor level, poor detailing of plasterboard and fire boarding missing around steel frames. The reporter's appointment typically includes specification and project management of remedial work with specialists appointed as necessary. The reporter feels, from their experience, that many fire safety issues are caused by:

- A drive to minimise design and construction costs
- Employing architects only at the planning stage and leaving the detailed cladding design to trade contractors with little coordination where different trades meet
- A lack of knowledge on site.

The reporter is aware of projects where fire engineers have had early input but have not been involved during construction. In such cases, the contractor appears to have proceeded either with ignorance of the potential fire safety issues, or has made their own judgement to what is required without seeking specialist advice. On numerous occasions during remedial works, the reporter has had to stand on site with the fire engineer, building inspector and contractor to resolve fire compartmentation details which were not previously considered. The reporter feels that fire engineers often lack previous site experience and struggle to suggest technically robust and practical solutions. General detailing is usually fine, but as always, 'the devil is in the detail'.

The reporter often arranges for toolbox talks, to explain the basic objective of the remedial work, for the fire engineer to explain the specific fire issues and required remedial work, and for the manufacturer to explain how their products should be installed. The reporter states that even experienced tradesmen are surprised when the requirements of robust details are explained to them, and the reporter considers that often the tradesmen are ignorant to the importance of tasks they are undertaking. For example, tradesman and professionals are of the opinion that '2 layers of plasterboard gives 1 hour's fire protection', without any knowledge of the technical requirement to ensure that boards, laps, supports and fixings all must comply with the manufacturer's test conditions.

The reporter adds that there is often a lack of appreciation by owners/managing agents of the need to appoint a 'responsible person' or to arrange regular testing of key features such as Automatic Opening Vents (AOVs) for example. The reporter has been involved in investigations where, in buildings 10 years old, the fire mains were not connected, there was insufficient water pressure to ensure water could be delivered to the upper floors, or the outlets on upper floor landings were positioned such that a fire hose could not be attached.

The reporter summarises by stating that, in their experience, there is a lack of appreciation and coordination within the industry in relation to fire safety, which when combined with poor construction, is likely to result in fire safety issues with many modern residential blocks.

Comments

The reporter has clearly set out a range of fundamental problems and their statement echoes general feedback to Structural-Safety that there is considerable ignorance across industry of the complexity of fire protection demands in buildings. There is a lack of knowledge of the detailing required to assure compartmentalisation, poor inspection of the material installation processes, and thereafter, poor management of continuing functionality through the life of buildings. These factors must be emphasised continuously. Fire safety must be consistently stressed throughout design, construction, maintenance, use and, very importantly, when there are alterations. At all stages, the level of fire safety can be reduced by those not understanding the implications of what they are doing. More needs to be done to improve life safety in buildings. Experience and competence is one way of countering the risks but there needs to be more education at all levels to raise standards and understanding. Unique, and highly fire-engineered buildings, may have an increased risk of the important points not being understood in years to come. CROSS has received many reports listing concerns relating to designers not visiting site, contractors not following design intents, and essential information about buildings not being passed to those who may rely upon it to understand the building. It should not take a tragedy for these issues to be acted upon by industry.

707 FIRE SAFETY IN HIGH RISE RESIDENTIAL BLOCKS - SERVICE DUCTS

From their experience of working on high rise residential blocks some years ago, a reporter says that the risk of spread of smoke, hot gases and flames due to deficiencies in the design and as-built condition of service ducts is an important subject that needs detailed investigation. The reporter believes that there is a reasonable possibility that a number of high rise residential blocks will have such deficiencies. They consider that it would be remiss not to pass their concerns onto relevant authorities at this time.

Comments

This is similar to the above Report 706 General fire safety in residential blocks, and was received at the same time showing the level of concern about fire safety amongst readers. Service ducts must be constructed to maintain the integrity of fire compartments which they pass through. In some cases there is a need to penetrate the fire protection to install or renew cables, or to alter pipework or ducts. This may happen many times throughout the life of the building, and the contractors may not understand the need to fire stop the holes they have created. Occupants are more likely to be killed by smoke than by fire, so precautions against smoke generation and smoke dispersal are as important as protection against heat. The fire in MGM Grand Hotel, Las Vegas (1980) which killed 85, and the fire in Düsseldorf Airport (1996) which killed 17, are examples of smoke spreading via ducts and shafts. This is an important aspect of protecting life in buildings and demands the full attention of those involved.

713 THE ROLE OF DISTRICT SURVEYORS

Under the London Building Acts 1930, says a reporter, District Surveyors were appointed to supervise construction and enforce regulations, including, and especially, Means of Escape from buildings in the case of fire. There were the reporter thinks, 17 areas in London, each with its own District Surveyor. Everyone had to be professionally qualified, usually as a Structural Engineer, but some may have had other professional qualifications. However all, without exception, had to pass an internal exam run by the London County Council before appointment. The exam was competitive, no old papers were available, and the questions covered technical structural and materials knowledge, and knowledge of the byelaws and regulations. The effect of this system meant that extremely able individuals were enforcing the appropriate regulations, and because the mode of appointment made them independent of the Local Authority, they were not sensitive to outside influence. Indeed most contractors respected their ability and although sometimes found their attitude somewhat dictatorial, generally accepted their interpretation of the Regulations. It seems to the reporter that a similar system is now required, free from the influence of Council members and other outside forces. Their mode of appointment must ensure they are free from obligation to outside Authorities and they must have the status, qualifications and experience to gain the respect of all those in the building industry; and of course, would need salaries to match.

Comments

Prior to 1986, there was no national system of building control in England and Wales, but in inner London there was a system of local byelaws, controlled by the District Surveyors. The District Surveyors exam, colloquially referred to as 'the DS ticket' ensured very high standards, and only a Chartered Engineer with many years' experience could be awarded 'the ticket'. This meant that the District Surveyors were very well respected (and sometimes feared), and that work was generally very well controlled. One aspect was that the law stated all work had to 'be to the satisfaction of the District Surveyor'. The situation has changed but the London District Surveyors' Association *is very active and provides the Local Authority Building Control (LABC) service for all Greater and Central London Boroughs. Competence standards in relation to Building Control would undoubtedly help to raise quality; particularly now that the scope of the regulations is much wider and there is a competitive element. Ensuring competency levels for designers and constructors is just as important for raising standards in the construction process.*

694 DANGEROUS BALCONY CONSTRUCTION

A reporter has further concerns over site supervision and quality control during construction. During an investigation they discovered serious inadequacies related to total lack of co-ordination between sub-contract work packages coupled with lack of appropriate supervision. Invasive investigation and testing showed deliberately masked, very serious structural issues as follows. Concern had been expressed over the 'liveliness' of cantilever balconies but, despite the recent construction date, as-built records could not be located and Local Authority Building Regulation submission drawings were incomplete. Water penetration testing showed leakage through the balcony fixings and random removal of several primary connection bolts showed that there had been alignment problems. The secondary balcony steelwork was supplied and erected by a local fabricator, not the primary steelwork fabricator. Holes in the balcony steelwork did not match with holes in the main steelwork. The site remedy was deliberate machine tapering of Grade 8.8 bolts in primary cantilever connections subject to tension. Further investigation of a representative sample of numerous balconies indicated that the problem applied throughout. In many instances, the bolt tapering was excessive; so, to rectify further lack of fit, masking tape and building mastic had been utilised to hold bolts in position. In extreme cases of misalignment, bolt heads had been cut off, the threaded section discarded, and the heads tack welded over the bolt holes. Remedial works were carried out.

In the view of the reporter, the root causes of these issues are:

- Principal Contractor emphasising 'Value Engineering' and the Client unquestionably accepting that 'value = minimum cost'
- Fragmented design input with cost saving achieved by uncoordinated sub-contractor design and detailing with savings further augmented by limiting design team involvement/overall design control. Independent Chartered structural engineer involvement was limited.
- Unreasonable cost and programme constraints and penalties on hard pressed sub-contractors

Comments

CROSS has had reports about balcony failures over the years as referenced below. There are frequent cases in the public domain from many countries, some constructed from timber, some from reinforced concrete and some from structural steelwork. Balcony failures are usually sudden, without warning, and can result in multiple fatalities. Indeed, just before Christmas 2017 a timber balcony collapsed in Australia causing 2 deaths and injuries to 17 others. The integrity of cantilever balconies must be taken very seriously. Usually it is older balconies that fail so this reported case of balconies in a modern building that might have failed is quite shocking. The core reasons given by the reporter are similar to those given in the Edinburgh Schools Inquiry where a perfect storm of poor communication, poor construction and lack of supervision and inspection contributed to the failure of a masonry panel and repairs to many others. See the Report of the Independent Inquiry into the Construction of Edinburgh Schools February 2017 and the summarised SCOSS Alert on Inquiry into the construction of Edinburgh Schools. Another SCOSS Alert: Structural stability/integrity of steel frame buildings in their temporary and permanent condition *in February 2017 gave as an example the failure of the City Gates Church building where the steel frame collapsed catastrophically. The most likely failure scenario, according to the investigation, was due to poor quality issues during construction. This type of behaviour on site has been reported to CROSS too often. There are just too many concerns being expressed of inadequate site construction, too many concerns of faults being discovered, and too many concerns of wide spread complacency. The report is another which is indicative of a fundamental pattern of danger within the UK construction industry and action must be taken to remedy the situation.*

Previous CROSS reports on balconies are:
http://www.structural-safety.org/publications/view-report/?report=3105
http://www.structural-safety.org/publications/view-report/?report=4190
http://www.structural-safety.org/publications/view-report/?report=4365
http://www.structural-safety.org/publications/view-report/?report=8613
http://www.structural-safety.org/publications/view-report/?report=8649
http://www.structural-safety.org/publications/view-report/?report=9048

693 STABILITY OF EXISTING STRUCTURES IMPACTING CONSTRUCTION SITES

A reporter discusses the Client's and Principal Contractor's duties regarding the stability of existing structures on site, particularly those scheduled for demolition. There is no regularly accepted procedure for Principal Contractors to assess in detail the stability of structures when they take possession of a site says the reporter. If an existing structure is so unstable as to represent a risk, then should there not be a duty on the Client to point this out to the incoming Principal Contractor? Duties in regard to other types of existing hazard attract reference in the CDM Regulations. While structural surveys are a normal part of due diligence if a structure is to be preserved, such a survey seems unlikely if the structure is scheduled for demolition. Perhaps this is a general omission on the part of the industry says the reporter. The precautions taken by structural survey experts when approaching a structure, in particular historic structures, could be shared.

Comments

This type of risk is considered in the CIRIA Report Guidance on catastrophic events in construction (C699) *published in 2011 when the failure of a structure can have serious consequences on an adjacent structure. CROSS is aware of a fatality arising from the collapse of a partially demolished wall in such circumstances. The demolition contractor had left the site having carried out most of the demolition, but could not complete the task because there were concerns that the remaining construction was tied to another structure. It was agreed that the main contractor would complete the demolition. However, it transpired that this remnant section of the existing site was not tied in, and subsequently fell onto a member of the contractor's staff during the final demolition. It was clear that there was insufficient information made available between the parties which then led to the problem. Given the dangers associated with instability it would be thought that any contractor taking over a site ought to be informed over any existing structure's stability system and its status: not least so that inadvertent removal of any part of the system does not trigger disaster. On the other hand, a competent contractor would be expected to ask questions if they took over a site with a partially demolished structure in it and the paper work he was provided with was deficient. As ever on interfaces both parties have some responsibility, indeed in the submitted report it is probable that the contractor has more technical competency than the client.*

The provision of relevant information to help inform the development of a safe system of work is fundamental, the nature and extent of which would be dependent on the size and complexity of the project. The principal designer should assist the client in determining what information the principal contractor / contractor will require in order to develop the Construction Phase Plan. Unfortunately, as the reporter has highlighted, this doesn't always happen. BS6187:2011 Code of practice for full and partial demolition *specifically mentions gaining knowledge and history of the structure, including form, materials of construction, structural interactions and location. It states the chosen methods of work should be such that demolition activities can be carried out in such a way that the unplanned collapse of any part is avoided by maintaining the structural stability of the remaining parts at all times. Whilst BS 6187:2011 isn't mentioned explicitly in CDM 2015, there would be an expectation that Demolition Contractors would follow BS 6187 (or something similar) in producing the demolition plan as this represents good industry practice. Whatever the contractual position it is essential that full structural investigation is carried out by competent persons in such circumstances. The condition and nature of the structure must be ascertained and the deconstruction procedure risk assessed in order to foresee problems and eliminate, mitigate against, or control the remnant risks. If the client cannot provide such information from records in Pre-construction Information then it needs to be otherwise established. Perhaps the recommendation could be that the Client specifies compliance with BS 6187:2011, and this will create an item (including assessing stability) that the Principal Contractor / Demolition Contractor can cost for and deliver on. As can be seen from the comments this report generated considerable interest amongst the CROSS Panel.*

The problem is not just limited to demolition but also includes alterations as part of refurbishment work recently highlighted in the 2017 CIRIA report Structural stability on site (C740)*.*

690 CONCERN ABOUT FOUNDATIONS TO TELECOMMS MASTS

Whilst recognising the attractiveness and value that is offered to the industry a reporter writes about a potential safety problem with the design and construction of "root" foundations for telecomms poles.

The reporter's concerns are:

- The telecommunications industry, apart from Planning requirements, is self-regulating.
- The industry is highly competitive, which may be an incentive for some to cut corners.
- The major companies distance themselves from the risk of failure by placing the onus for safety on the construction/contracting companies.
- Monopoles of up to 20m in height are being, and have been, erected in their thousands close to roads and railways on "root" foundations. If such a pole falls across a road or railway line then lives could be lost.
- Some are built at the back of footpaths so that on the side nearest the road there is often weak backfill to service.
- Trenches for power supply cables to the poles may be filled with gravel to facilitate drainage. Rainwater runs down the poles and pumping action due to wind forces may leave voids at the top of the root as material is displaced.

The "roots" are designed, according to the reporter on the basis of PD6547 (PD 6547:2004+A1:2009 Guidance on the use of BS EN 40-3-1 and BS EN 40-3-3) which is an advisory document for street lighting. The designers of "root" foundations have, says the reporter, adopted what suits them in PD6547 whilst ignoring other aspects. By imparting this knowledge to others the reporter hopes that the risk may be evaluated and any appropriate action if any might be taken before a tragedy occurs.

Comments

The requirements in PD 6547 – 2004 for planted foundations are a carry-over from an earlier version of EN40 (BS5649-2 – 1978, aka EN40-2). When EN40 was revised, the requirements were dropped in Europe but the UK did not want to lose them so they continued to be referenced in documentation.

CROSS's concerns are:

- *The robustness of a planted foundation depends on the workmanship achieved during installation. Given the cost of a monopole, there may not be sufficient site supervision in place to guarantee that a suitable standard is achieved.*
- *A PD contains guidance and is not a British Standard. This creates a problem for public clients who cannot then refer to a PD as a specification. They may "suggest" that application of the PD constitutes the default method of compliance with the Eurocodes or Euronorms. Private clients may do what they want, but often lack the technical know-how to say what's needed (and the value of a single monopole deters them from taking advice from an expensive consultant).*
- *The rules were originally introduced for lighting columns (the majority of which were in the 6m to 8m tall range). The same rules are now being applied to 20m tall monopoles with bigger head loads. There may therefore be an issue with extrapolation.*

The advice given by the reporter for caution and proper risk assessments on new installations should be heeded. Existing monopoles should be monitored periodically, particularly those whose failure might impact an adjacent building or facility. See Report 693 Stability of existing structures impacting construction sites*.*

635 INCOMPLETE CASTING OF COMPOSITE BRICK/CONCRETE PARAPETS

During a parapet raising scheme over a mainline railway, holes for new connecting dowels were drilled vertically through the coping stone of the existing high containment parapet. During this activity, a void up to 300mm deep was identified below existing coping bed level. The existing parapet wall was designed in accordance with BS6779 part 4 which comprises brick-clad external faces and an inner reinforced concrete core; construction was circa 2012. The original copings are also reinforced concrete and were detailed to be robustly connected to the inner core with high yield dowel bars. The core of concrete in the wall should therefore be flush to the underside of the coping. On identifying the void, the Contractor responsible for the parapet raising scheme undertook some further local intrusive investigations at the client's request and confirmed that the top lift of concrete was absent from within the core of the wall, through most of the length of the parapet. This meant that most of the original copings were not anchored to the wall as per the intention of the BS Code of Practice and original scheme designer (it should be noted that the original contractor and the contractor responsible for the parapet raising scheme are separate organisations). The support to the copings from the original wall construction is negligible and therefore posed a significant risk to safety from being struck by vehicles prior to corrective temporary and permanent remedial works.

Comments

This too is a situation envisaged by the CIRIA Report Guidance on catastrophic events in construction (C699) about failure of one structure impacting on another nearby. In this case had the coping be dislodged, perhaps by a vehicle strike, and fallen on an operational railway line the consequences could have been catastrophic. In 2015 an HGV tried to reverse back over the Froxfield railway bridge and pushed over the brick parapet onto the track below. Although a passenger train struck and ran over part of the fallen masonry parapet, the train did not derail. However in 2001 a vehicle veered off the M62 onto the East Coast main line and caused the Selby rail crash. A London express train and a freight train collided, killing six passengers, four railway staff and injuring more than 80 others. As in Report 693 Stability of existing structures impacting construction sites and in numerous previous CROSS reports, many instances are still emerging of construction not being in accordance with design intent. It is of little comfort to public safety (after a failure) if the party with responsibility can be identified. There are too many instances of poor and dangerous construction which put innocent parties at risk. These all suggest more supervision and inspection are required. The Report of the Independent Inquiry into the Construction of Edinburgh Schools February 2017 and the summarised SCOSS Alert on Inquiry into the construction of Edinburgh Schools state that public sector clients should engage individuals or organisations with the necessary professional expertise to undertake on their behalf an appropriate level of ongoing inspection. It is critical that there is effective communication of essential design information in an accessible form to tradesmen such as bricklayers working on site. Client organisations could revisit the robustness of their technical assurance regimes to provide additional independent assurance that the requirements of specifications for workmanship and materials, drawings, inspection and test plans and other design documents, are being complied with.

703 INADEQUATE STRUCTURAL DESIGN FOR DOMESTIC PROPERTIES

A reporter has recently been asked to re-design several projects for domestic extensions/alterations, where the original design and drawings were produced by another organisation for structural beams, columns, and masonry piers/walls. According to the reporter, two problems were found. In one case the full lateral restraint for a structural member had been assumed where no restraint was present, so the member could have failed in buckling. On another occasion, the design had specified double beams of different sizes to support the two leaves of a cavity wall, but did not specify which leaf each beam was designed to support. The reporter believes that the designer is not competent to be carrying out such work and is concerned that Building Control did not spot any of the errors, especially as the original designer's specification of structural elements stated 'beam and columns sizes to be confirmed with BCO prior to installation'.

Comments

A designer has the responsibility to design his own work, not Building Control. It is simply not acceptable to make the statement that the BCO should confirm it. Building Control bodies are under extreme pressure on fees, and are not on site all the time, so it is not a surprise that they miss things on occasion. A competent contractor would have queried any design that was not clear in its intent. The report is another reminder that the issues of stability and support are poorly dealt with in domestic construction. There must be better competency in domestic design and in construction

works. Failures are not usually on a catastrophic scale but can be costly, time consuming, have safety implications, and bring reputational risk. Health and Safety legislation places duties on individuals as well as companies to ensure that they don't put people at risk of harm. In the most serious of cases, and where a death results, this can amount to gross negligence manslaughter. There have been cases where, following collapse, designers have been prosecuted as individuals. Penalties can include prison sentences.

Weather Damage Reporting

CROSS need reports of damage caused to buildings and building related infrastructure by weather events. These can be sudden actions such as high winds or lightning strikes, or longer term actions such as flooding, snow/sleet/hail/ice or high/low temperatures. The aim is to gather information that can be used to assess the capability of our buildings to withstand the weather patterns that may be becoming more common. Visit our What To Report page for more information or submit a report on weather damage.

Severe weather events have caused extensive damage and disruption to infrastructure and buildings with serious consequences for many. Creating a record of damage to buildings and structures has the support of DCLG to help formulate long term strategies for the Building Regulations. The CROSS system will be used for collecting and processing information on weather damage.

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