

CROSS

Confidential Reporting on Structural Safety

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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 web site database.

CROSS Contact

Director:

Alastair Soane

Email:

structures@structural-safety.org

CROSS Website:

www.structural-safety.org

INTRODUCTION

CROSS has launched an additional category of reports to capture damage to buildings and related infrastructure from the effects of weather. There appear to be a greater number of storms and extreme weather events and the question is whether our buildings are being affected more severely now than was the case previously. Accordingly, the Department of Communities and Local Government has sponsored a programme to gather evidence which could help determine what changes might be required to future building regulations.

Reports are being requested from all local authorities in England and, with support from the relevant authorities, also in Scotland, Wales and Northern Ireland. Reports will be welcome too from anyone else who observes damage from weather effects. The aim is to build up a record of evidence, and events of interest include:

- extreme rainfall
- high winds
- flooding (including tidal and surge effects)
- freezing temperatures
- ground movement (earthquakes, sink holes, subsidence etc)
- high temperatures
- moisture
- snow/sleet/hail/ice

Reports will be submitted through the web site and the usual confidentiality will apply to reporters but locations will be recorded so that these can be linked to maps and to the severity of weather at the time. Categories of damage will be allocated so that the data can be analysed.

The programme has started and reports will be welcome. As with all CROSS material there will be lessons that can be learned by designers, contractors, regulators, building control officers and academics. Results will help to improve our knowledge and participation will help others.

The success of the CROSS programme depends on receiving reports, and individuals and firms are encouraged to participate by sending concerns in confidence to Structural-Safety.

577 BRIDGE WING WALL COLLAPSE

The masonry wing wall of a bridge fell as a single section and came to rest against an adjacent pile. Staff had been in the immediate area prior to the collapse but left following some observed movement in the previous 30 minutes. The wall collapsed because adjacent excavations had undermined the supporting ground.

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
- Communities and Local Government
- 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
- Network Rail
- Scottish Building Standards Agency
- Temporary Works Forum
- UK Bridges Board



Displaced wall resting on pile

Although the roles and responsibilities placed on individuals on site was clear, there was a lack of direction on who held ultimate responsibility for identifying the need for temporary works. This action relied on the recognition of the requirement by the site

team, the Temporary Works Coordinator and/or the designers. A requirement for temporary works was identified by the designers but this became diluted and was not picked up on site. A management issue was that some responsibilities, which might have been better if handled separately, were allocated to one individual. Ultimately it was decided that the event was a caused by a lapse due to lack of foresight.

It was recommended that:

- Designers review their risk registers and highlight temporary works issues.
- No one individual should be expected to prepare, review, and authorise either works control documents or design certificates. Reviews are to be independent.
- Formal documented handover meetings are undertaken between the design organisation and the project team.
- Prior to the commencement of major work or high risk activities a joint risk review is carried out by designers, contractors, and others as appropriate at a suitably high level across all disciplines and organisations.

Comments

When working on congested sites adjacent to existing infrastructure, the risk of the works affecting the stability of old structures, with low confidence on as-built condition, is high. Designers should be alert to this and draw attention to the risks, with a default position in favour of temporary works to remove or reduce uncertainty. Contractors should be aware and devise appropriate methods that recognise the uncertainties and associated risks. Communication between contractor and designer is essential, preferably at many levels to raise confidence that risks are sufficiently understood.

However, the sole responsibility for temporary works lies with the Contractor. A capable contractor will have appointed a Temporary Works Co-ordinator (TWC) who will assess the need for temporary works. [BS5975:2008+A1:2011 Code of Practice for Temporary Works](#) sets out the procedures. Reference should also be made to Regulations 19 and 22 of [CDM 2015](#), which imposes obligations on contractors in relation to stability of structures and excavation. On site it is the TWC who has ultimate authority and control, having regard to advice from the permanent works designers and the temporary works designers. The Contractor can only assess what is reasonably evident. It is for the permanent and temporary works designers to ensure that significant residual risks are communicated to the Contractor via the pre-construction information pack.

The suggestion that, prior to commencement of high-risk activities, there should be a joint review is a sensible move and to be welcomed. This should be chaired by an individual with appropriate technical, contractual and statutory knowledge of the situation and type of works involved. To supplement the paper work, it is prudent for those with experience to observe the works during execution just to be sure nothing has been overlooked. It is often much easier to see danger in real life than it is by looking at drawings.

NEWS

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Lessons from forensics and their application to engineering design by Sean Brady

24 May 2016 - IStructE HQ London, United Kingdom
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530 INCENTIVISING SAFE BEHAVIOUR THROUGH STANDARD AGENDAS

A reporter was investigating a 'near miss' involving concrete construction in which pre-cast and in-situ concrete were used in combination (see report 529 Risks from off-site manufacture and hybrid construction in [Newsletter No 41](#)). This type of construction offers efficiencies and, as in this instance, can reduce the number of man-hours worked at height. It does however bring its own risks, and these need to be understood. The design had developed from all in-situ construction to a hybrid pre-cast/in-situ over a series of design meetings. It was the combination of pre-cast and in-situ construction that led to the near disaster in which multiple fatalities were a real possibility. During the investigation, the reporter was presented with a document developed from the 2007 CDM Regulations. This was a CDM Coordinator's standard agenda for a design review meeting. One heading was 'Significant Risks Identified during Design' which then elicited two questions: Q1: Since the last meeting have any significant hazards been identified that are likely to affect the works? (Yes/No). Q 2: If 'yes', please describe and confirm they have been added to the Risk register. Space was then given to describe the new significant hazards. There was however no Q3 which might have been. If 'no' how do you justify that no new significant hazard has been introduced? The absence of this question allowed for a 'passive negative'. Such an approach is complacent. There are also behavioural implications: without Q3 the CDM-C and the design team has a much simpler life of it than if their answer to Q1 is 'Yes'. Secondly, if a 'significant new hazard' had been introduced, surely this would be seen as a sign of failure, as design work should eliminate hazards? Third, the design team was innovating and it was working outside its area of experience; with no active prompt to seek out hazards, and the requirement to commit this to record, why would they go seek them out? Whilst the role of the CDM-C is now behind us, the duties to find hazards are not. Under CDM 2015, Principal Designers are asked to ensure that potential hazards are sought out diligently, and the industry is asked to apply a standard of 'active negative' as a part of the process to assure that this is done.

Comments

Report "529 Risks from off-site manufacture and hybrid construction" in [Newsletter No 41](#) contains comments from CROSS on the issues of divided responsibilities and emphasises the fact that procedures on their own are not enough to provide safety. They are only a part of the process which demands clear thinking about what might and could go wrong, and the allocation of duties and responsibilities.

The present report raises some observations on the standard agenda that is quoted.

- *The heading 'Significant Risks Identified during Design' should really have been 'Significant Residual Risks arising from the Design' i.e. those where it was not possible to eliminate or significantly reduce a risk, and on which others would welcome information.*
- *The suggested Q2 should more correctly have been 'What new Hazards have been identified which have given rise to significant residual risk'.*
- *Q3 as suggested may not be necessary. The emphasis should be on whether the Designer has implemented an appropriate risk management process. If the Designer has, then this would have identified any further Hazard.*

The above is now thought by some to be complicated by the fact that in CDM2015 HSE has removed 'Hazards' from the process, concentrating on risk alone. Innovation always requires care, although it is not to be discouraged needlessly as it can be a driver for safety.

566 SUDDEN HOLE IN PILING MAT



Hole shown to the right of the wall

This concerns a near miss on a site where a piling wall was being constructed. The reporter says that whilst digging a trench a 450mm diameter hole appeared in the pile mat about 0.5m from the guide wall. As the grab was being lowered into the 55m deep trench, bentonite from the wall panel gushed out from the hole. This was found to be 1.2m deep and went under the guide wall and into the panel trench. Steel plates were introduced into the front of the guide wall (piling platform side) and the opening filled with concrete. The reason for the hole

appearing is not known although one possibility is that the bentonite wash from the grab being continually withdrawn created a vacuum. This pulled in loose granular material from beneath the guide wall thus causing a cavity which extended into the piling platform. The integrity of the pile mat was then checked to ensure that work could safely continue. Had there been personnel in the vicinity of the hole when it appeared the consequences could have been serious.

Comments

Excavations always carry some risk partially because of unknown or unidentified conditions below the surface. The lesson to be learned from this is that there may be circumstances when holes may suddenly appear and personnel need to be aware and on the lookout for warning signs.

533 PV PANEL INSTALLATION

A reporter's firm used to carry out design work for installers of PV panels, many on domestic roofs. Unfortunately, because the market was buoyant, many 'engineers' entered the market and drove the prices for assessments down by undertaking far less rigorous analysis, and suggesting that far fewer fixings were adequate. Both the lower cost analysis and cheaper installation were just too attractive a proposition for the reporter's client base and they switched suppliers, despite efforts to advise them that the short term gain could leave the installations in a dangerous condition. Because of this the reporter's firm could not do the job properly within the current rates and left the market. The reporter agrees that the comments in Newsletter 40 on Reports [519 PV panels blown off roof](#) and [528 PV Panels on Domestic Roof](#) are entirely accurate and believes the issues stem from the use of design packages. These check that the rails will not be overstressed but, he says, may not properly account for the fixings and the roof structure itself. Even if the fixings are checked, most of the inspections that are carried out do not take account of the effect on the roof!

Comments

This emphasises the need for improved regulation and control in relation to PV panels and SCOSS is undertaking work to publish guidance. In the meantime it would be expected that any member of a professional institution would resist requests to undertake an incomplete design. There are many incidents of items falling off buildings or being blown off building and it's clear from this and other reports that there are uncertainties in the overall fixing capability both short and long term. Safety requires robust solutions rather than refined analysis based on spurious assumptions. The Scottish Government published [Low carbon equipment and building regulations: A guide to safe and sustainable construction – Photovoltaics](#) in 2012 which contains advice on installation.

176 LIFTING LARGE DOUBLE GLAZING UNIT

Inadequate instructions were provided by a double glazing pane supplier, who was also the designer, on how to lift and move their product, supplied on a flatbed truck, off the truck and onto the works.



Lifting mechanism

This was a large sheet measuring 3m x 2m with a weight of about 270kg and initial attempts were made to lift it with a 6 suction lifter 500mm x 750mm in size acting on a small central area of the panel. However, the complex operation had to be abandoned due to excessive bow and likely failure in the top of the sheet (as its central area deflected away from the lower sheet increasing the gap between the two sheets forming the unit). After half a day during which the truck partially blocked the road, a much larger 14 suction assembly (as shown in the photo) was obtained and used to lift the unit from a flat position, turn it through 90 degrees, and then lift it into position. A phone call to the supplier during the aborted lift

provided no information and in a later call they were advised to provide adequate guidance on the suction area needed to lift these large panels.

Comments

The designer has the responsibility to consider erection issues from a safety perspective. The construction process always requires items to be delivered to site then lifted into position. In all cases there should be clear instructions on what to lift and how to lift the item. This should include

information on weight, centre of gravity, and a check that the item is strong and stable enough under self weight (perhaps with wind) when supported at designated lifting points. The case also illustrates how lack of due consideration leads to additional cost and delay.

532 STORED GLAZING PANELS



Stacked glazing panels

A reporter has been undertaking facade inspections for insurers across many buildings in the UK and the same issue keeps appearing on every site; glazing is not individually tied back to storage frames or to a secure place when being stored. Some of the panels seen have been 3m by 5m. When a panel is moved from temporary storage to be installed, a suction force can be induced onto the panel behind, which could cause the panels to fall onto workers. This is not something that the managers on site take seriously as the storage of the panels appears to be done in a safe way. However, there are hidden dangers.

Comments

The provision of safe storage is the responsibility of the relevant sub-contractor and the Principal Contractor. A simple lack of care can lead to devastating consequences which have included death from toppling panels. Heavy glazing units, mirrors, and cement based sheets that have toppled have led to fatalities.

562 FALLING LATH AND PLASTER CEILING

A 100 year old lath and plaster ceiling in a shop unit collapsed in part, injuring the shop keeper. There were signs of distress (cracking) shortly before collapse. Upon inspection, says the reporter, it appeared that the 35-40mm thick plaster had become de-bonded from the laths. At the time some 'soft' demolition was being carried out on the floors above. This included removal of heavy computer cabinets and it is contended that vibrations contributed to the collapse.

Comments

Old plasterwork ceilings represent a hazard and collapses are not uncommon. The worst known case of this occurred at a London theatre (see [London Apollo Theatre ceiling collapse](#)) when 70 persons were injured. All structures degrade with time and ceilings are a cause of particular concern as a) they can be heavy and fall from height and b) various reports to CROSS suggest cascade type global collapses can occur from a minor initiating event. Guidance on the subject is being considered by SCOSS.

387 IMPORTANCE OF BEARINGS

Bearings are an important component of the superstructure. A reporter says that they are often underestimated in their long term characteristics and behaviour. This includes strength, space for inspection, types of connection and anchorages, and ease of replacement. It is vitally important to have regular inspections of bearings and seatings with maintenance as required and the facility to replace faulty components. The reporter wonders whether any systematic study on the overall issues of bearing assembly and associated requirements has been done.

Comments

The reporter is correct that bearings are important components of bridges and buildings and they may well be neglected. It is important that designers leave sufficient room around bearings for inspection and replacement and that maintenance regimes specify how often inspection should take place. Seized bearings can result in unknown loads being generated and affecting serviceability and ultimate performance. Failure of the bearings under the Thelwall viaduct on the M62 in 2004 resulted in reported replacement costs of £52 million. There have been other cases where it has been

necessary to partially dismantle a structure to maintain or replace bearings. Statements such as 'designed for life' or 'maintenance free' have to be treated with considerable caution.

A useful reference in this regard is [Safe access for maintenance and repair Guidance for designers, second edition 2009](#), published by CIRIA.

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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

DATES FOR PUBLICATION OF CROSS NEWSLETTERS

Issue No 43	July 2016
Issue No 44	October 2016
Issue No 45	January 2017
Issue No 46	April 2017