

CROSS

Confidential Reporting on Structural Safety

Newsletter No 17, January 2010

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Please [click here](#) for link to CROSS website

INTRODUCTION

The new website is working well and reports are coming in through the new on-line system. More reports on all topics are welcome both to add to the database and to publish in Newsletters. Published concerns can generate others in similar veins and when there is a trend then steps can be taken to give practical advice which will reduce risk and improve safety.

There have been a number of CROSS reports about fixing failures which has resulted in the Construction Fixings Association promoting a new BS Code of Practice for the use of anchors in safety critical applications. The drafting is due to commence shortly. In addition, the fixings industry, in conjunction with SCOSS, is drafting a guide to ceiling fixings.

This is a success story: thanks to those who contributed towards this by submitting reports

The recent winter weather in parts of the UK has resulted in roof failures due to the dead weight of snow. Some of these have been highlighted in the press but more evidence is needed to learn how buildings are performing in unusual, but perhaps not exceptional conditions.

In this issue there is a good selection of reports on concerns from which lessons can be learned: the failure of blind bolts on an offshore platform resulted in the collapse of an important piece of equipment, hydrogen generated from a foamed concrete mix exploded, there is another case of a temporary works problem but this was spotted in time by an alert engineer, partial demolition of some brickwork arches led to a potentially dangerous situation, the importance of taking prompt action on stability is described, and there are two more ceiling failures – this time associated with dynamic loading.

If you have similar examples please send in a report.

BLIND BOLT FAILURE ON OFFSHORE PLATFORM (Report 170)

A reporter describes how there was a recent failure on an offshore platform of a 20 tonne winch base under load testing. No injuries, but significant business impact. Failure occurred in tension of a holding down arrangement of blind bolts which were of the locking pin/cam variety. There were three primary causes of the failure, two of which related to competence and checking of calculations. However the third cause was concluded to result from the presentation quality of the downloadable information on the manufacturer's website, which led to confusion by the designer between ultimate and allowable capacities. The failure also raised concerns over the application of blind bolts in tension where failure is rapid and catastrophic, with no ductile warning of overload.

CROSS comments: *Details on the cause of failure are not known but clarity of information on manufacturers' websites is a concern. The web is unregulated and it requires experience to write technical information unambiguously and to include all relevant material; at the very least this requires input from a competent structural engineer. However, it is for users to ensure they are satisfied with the data presented and for manufacturers to ensure they have correctly presented their material: their reputation will depend upon it. Issues around blind bolts have been raised previously: see CROSS reports 71, 86, and 113 which are in the data base on the website (found by searching for "blind bolts").*

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NEWS ITEMS

During the year there were press reports of children tragically killed by falling objects including the following:

Child killed by falling mantelpiece (Report 145)

An inquest jury ruled that a four year old child died from severe chest injuries after a 110lb stone lintel fell on him at his home. The verdict stated: "The mantelpiece became detached from the headstone as a result of a failure to apply a sufficient amount of approximately mixed mortar or additional fixings. The lack of national industry standards and regulation for the fitting of fire surrounds, including training, installation, quality inspection, secondary review and audit paper trails, were also a contributory factor."

Extract from the publication 'Natural Stone Specialist': *After the inquest the Deputy Coroner who presided wrote to the Department of Communities & Local Government expressing his concern about the lack of standards. The inquest heard that the fireplace fixing had been sub-contracted by the builder to another company. A spokesperson for the Department of Communities & Local Government said after receiving the Coroner's letter: "We will consider carefully the coroner's comments. While fixtures and fitting do not normally fall under building regulations, safety is our key concern and we will consider whether there is a need to provide guidance in future on this issue." The Health & Safety Executive, whose investigations into the child's death are on-going, have already contacted both Stone Federation Great Britain and the National Fireplace Association offering to work with them on developing standards for fixing stone fireplaces. The National Fireplace Association says they have also been in touch with British Standards Institution and want to try to develop a general British Standard for installing fireplaces, which they say is not adequately covered by BS1251. It is believed that there had been a similar case of a child being killed by a falling stone fire surround in 2003.*

One of the aims of CROSS is have such data available so that future failures of the same type can be avoided.

EXPLODING FOAMED CONCRETE (Report 172)

In September 2009 the following Interim Advice Note was issued by the Highways Agency.

The Health and Safety Executive (HSE) has identified several incidents involving foamed concrete, including a serious accident at a sewage pumping station being decommissioned, when contractors were injured as a result of a gas explosion. In this incident, a dry well had been filled with a large volume of foamed concrete over the previous three days and a spark from an angle grinder being used to cut handrails is believed to have ignited an explosive gas mix that had accumulated. The foamed concrete mixture contained Incinerator Bottom Ash (IBA) which may in certain circumstances produce hydrogen gas. Aluminium metal particles present in the IBA react with the water and cement to generate hydrogen, the volume of hydrogen produced being proportional to the quantity of aluminium metal being present in the IBA. HSE investigations are on-going. Foamed concrete is sometimes used on Highways Agency contracts as trench reinstatement and for filling voids such as redundant structures and for other road construction applications. As a precaution, the use of foamed concrete containing IBA must not be used on any Highways Agency contracts from the date of this document until the HSE investigations are complete and if necessary further research by the Highways Agency has been undertaken. The use of foamed concrete without IBA is not affected. Once the HSE investigations are complete, the prohibition on the use of foamed concrete containing IBA will be reviewed. (<http://www.standardsforhighways.co.uk/ians/pdfs/ian127.pdf>).

TEMPORARY WORKS PROPPING (Report 146)

A self-employed structural engineer was working for a consulting firm on a design and build contract refurbishing a large office building which was anything from 50-80 years old. The structure consisted of hollow pot floors with concrete encased steel columns. During previous works a plant room had been added to the roof and no remedial work undertaken, so after a load assessment it was decided that a column needed strengthening over one storey. The work involved the installation of a stressed prop to provide temporary support to the structure.

It was noticed by the reporter on site that the props installed were in two sections - this was to facilitate installing them through two floors. The junction between the upper and lower sections consisted of a 152UC mounted horizontally. Four short sections of prop were balanced on top of it and four long props supported it from beneath. The 152UC would effectively act as a hinge in the middle of the props as there was no effective bracing. The Reporter's responsibility was for the permanent works and he had not designed the temporary works. Notwithstanding, he passed on his concerns, which, eventually resulted in changes being made. The Reporter was not sure what system might have prevented this happening. He was not on site to inspect the works so it was almost by accident that the issue was spotted.

CROSS comments: *The key learning point in this example is that the initial design resulted in the creation of 'pin' in the middle of an un-braced prop. Too often the design emphasis is on limiting stress, without sufficient regard to stability. Temporary works are a vital, and often safety-critical, part of many new build and refurbishment projects. Appropriate design is essential. In such cases there should also be a Temporary Works Co-ordinator appointed in accordance with BS5975:2008. Indeed contracts for such works are meant to ensure that temporary works are designed, checked and installed correctly.*

NEWS ITEMS (continued)

Council face prosecution over the death of a child (Report166)

A local authority is being taken to court over the death of a two-year-old crushed when a faulty wall collapsed during a storm. The child died from multiple injuries after a 6ft by 8ft (1.83m by 2.44m) panel of a boundary wall was blown over by gales in January 2007.

Although the Health and Safety Executive is not commenting officially until the summons is served, sources have said that the prosecution is in relation to the council's alleged failure to "maintain, repair and inspect" the defective wall. At the end of the inquest into the child's death the coroner said that latent defects in the wall meant the tragedy was "an accident waiting to happen".

CROSS comments: *These dreadful incidents add to the tally of small children who have died from the sudden and unexpected collapse of walls over the years. The security of mantelpiece fixings is apparently receiving attention and this is welcome. The problem of free standing wall failures, particularly when they are old, is difficult to assess but Local Authorities and engineers generally can help by drawing attention to obviously defective or badly maintained walls which may be dangerous.*

It would be expected that this action (or similar control measures) would flow from discharge of the designer's (both permanent and temporary works) CDM duties. There is a trend to exclude site visits by engineers although enough anecdotal evidence exists to suggest that an experienced eye cast over site works is of extreme value. Most severe failures are not due to overstressing but to instability. However as this report shows, nobody should be afraid to raise concerns and no one, on receipt of those concerns, should try to avoid the issues.

DANGEROUS ARCHES (Report 153)

Several arches of an undercroft style structure in a conservation area were demolished, apparently without consent, leaving one standing which was used as a garage below and giving vehicular access to a multi-occupancy house above. The arches carried a road and, according to the reporter, the situation was very dangerous. He says that the Highways section of the Local Authority secured the retaining wall at the back of the arches to stabilise the elevated road but without any concern for the building next door. Local authority building control was then informed, but the house is divided into several flats with a number of different owners and this presented difficulties in communications. The LA advised that the driveway above the arch, which is used for parking, should not be used until analysis and safety remedial works were completed. The LA had difficulty in serving a dangerous structures notice as they were unsure who owned the arch. The situation demonstrated how unauthorised demolition of apparently redundant old masonry structures impinged on the safety of both a public highway and a multi-occupancy dwelling. Fortunately a collapse was averted.

CROSS comments: *The key learning point from this report is that stability cannot be considered in isolation. The demolition contractor should have taken account of the 'whole' and ascertained the role of adjacent structures, and the consequence should they be demolished or altered in some way. CROSS has received a number of reports about dangerous demolition which is an activity that can require as much engineering competence as does building work. Dangerous retaining walls and the like do not fall comfortably into the remit of Building Control and dangerous structures whose ownership is unclear can be problematic. However there are provisions under the Building Act section 78 for action to be taken by the Local Authority.*

CONCERNS ON STABILITY REQUIRE PROMPT ACTION (Report 171)

A reporter was concerned about overall building stability during an extension and conversion project. All old internal walls and floors had either been removed or were being removed and external walls were in a precarious condition. The Reporter had stressed the importance of temporary support/shoring of external walls on several occasions to his client, the building owner, who had advised that an internal bracing scaffold was to be installed. As yet this had not appeared and the client was pushing his builder to continue work on site without the scaffold. The Reporter had also made other recommendations which he suspected were being ignored, and he was concerned that the CDM co-coordinator's role was not being acknowledged.

The reporter contacted Local Authority Building Control and subsequently a building inspector paid very close attention to construction on site. HSE also then became more actively involved and identified that the client's CDM co-coordinator, to whom the reporter had also e-mailed his concerns, was not actually appointed to undertake the full CDM role, and work was stopped until a proper CDM co-ordinator had been appointed by the client. The reporter was pleased to state that his client was grateful for the help given to him in

responding to the demands made by the local authority and the HSE. The reporter was also much happier after the client undertook the work without cutting safety corners.

CROSS comments: *There are parallels here with the earlier report (Report 146), in that a concern has been noticed and successful action taken by someone who is not directly responsible. It is not uncommon for a construction professional to find themselves in a situation where a lay client or inexperienced contractor ignores advice and persists in unsafe practices. Sometimes an Approved Inspector may have a limited/no scope for site visits, similarly the CDM co-ordinator as in this case, but neither has any powers on site. Building Regulations are a matter of the final standards being achieved not necessarily how they are constructed on site. In the first instance there should be a formal communication be made to the CDM co-ordinator. The lead consultant can be copied as should the Principal Contractor. In the case of a domestic project with no CDM co-ordinator Local Authority building control would be the first point of contact for a safety issue.*

As in previous reports in this issue of the Newsletter, it is apparent that there are those who do not appreciate the fundamentals of stability especially in temporary works or building alterations. The need in all these cases is for a sound understanding of how structures behave and renovation of old buildings can often introduce significant risks if not approached in the appropriate manner. The Designer should be satisfied that there is a reasonable way in which the works could be executed. Whilst these actions are in the control of the Designer, and indeed are inferred obligations stemming from the CDM regulations, it is difficult if the client does not pay prompt attention. It is fortunate that, in this case, the reporter pressed the point.

SUSPENDED GRANITE CEILING COLLAPSE (Report 148)

This report is in relation to the selection of fixings for a suspended ceiling of granite which collapsed in the entrance area of a new office building due to failures of the fixings. The construction was of 40mm thick granite fixed to a robust sub frame, which in turn was fixed to a composite metal deck. The fixings selected were of an expanded anchor type. There was no appreciation amongst the designers or installers of the possibility of cyclical or dynamic loading from wind pressures. The European Technical Approval for the bolts stated that the bolt should only be used under static loading. The manufacturers were unable to supply test information to justify the use of these anchors.

CROSS comments: *See report 149 below*

RENDERED CEILING FAILURE (Report 149)

A similar report relates to a failure of a false ceiling below a pre-cast concrete floor. The ceiling was constructed as part of a new office building, and was situated externally above steps forming part of the public highway. Early in the morning, the ceiling unexpectedly collapsed, and the event was captured on CCTV. The only warning was some falling debris moments earlier. No one was injured. The construction of the ceiling was as follows: aluminium channels wired together to form a grid, upon which expanded metal lath (EML) was fixed. This was then rendered. The grid was wired to hangars which were fixed into the precast units above by means of an expanding hammer-in bolt. The ceiling was not inspected as part of the Building Control process as the BCO was not aware of its design, and had thought that the render was directly onto the precast units. The failure seems to have a number of causes. Firstly the render was applied very thickly, up to 100mm in parts which greatly increased the weight. Secondly inappropriate fixings were used, which over time seem to have become loose due to vibration from the adjacent highway structure.

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
- British Parking Association
- Communities and Local Government
- Construction Industry Council
- Department of the Environment
- Health & Safety Executive
- Highways Agency
- Institution of Civil Engineers
- Institution of Structural Engineers
- Local Authority Building Control
- Scottish Building Standards Agency
- UK Bridges Board

REGISTRATION FOR CROSS NEWSLETTERS

To register for CROSS Newsletters go to the new website (www.cross-structural-safety.org) and on the right hand side of every page there is a 'Register' box. Enter your name and email address and click the 'Register' button. An email will be returned to your address confirming that you are on the list of subscribers.

FEEDBACK

With the 'Feedback' facility you can send comments on any aspect of CROSS or of the site or on anything to do with structural safety, and also read the input from others.

REPORTING

Use either the 'How to report' button on the top of the website www.cross-structural-safety.org or the similarly labelled button on the right hand side to send on-line or off-line reports. It is simple, confidential, and could be important. [Click here](#) to go directly to the reporting page

CROSS comments: *CROSS comments: The key learning point from these two reports is that there seems to have been no appreciation of the effects of vibration on the fixings. Dynamic action can cause fixings to work loose in substrates and/or nuts to loosen. Whenever there is cyclic action from traffic, wind effects, or machinery then fixings must be chosen that are suitable for both static and dynamic loads. SCOSS issued an Alert in 2009 on problems associated with the incorrect choice of secondary fixings and this can be found on: www.scoss.org.uk/publications/rtf/SCO8048A-Alert%20-Fixings-Final.pdf. There have been a number of CROSS reports about fixing failures which has resulted in the Construction Fixings Association promoting a new BS Code of Practice for the use of anchors in safety critical applications. The drafting is due to commence shortly. In addition, the fixings industry, in conjunction with SCOSS, is drafting a guide to ceiling fixings.*

There have been recent press reports of other ceiling collapses, including one from the Middle East about an incident which saw decorative panels fall from the ceiling of a large new mall. There were shoppers present at the time but fortunately nobody was injured. Another ceiling collapse, this time in the UK, resulted in the closure, for an extended period, of a Grade II listed art gallery. CROSS has been informed of a number of ceiling failures and they have in common that fact that the loads are uncertain, that the failure of one hanger increases loads on adjacent hangers and that rapid cascade type failure then occurs. It is also the case that the engineering of such ceilings often seems to be absent and no one takes responsibility. The large number of failures (some accompanied by injury) suggests that the design teams are not identifying ceiling design as an important issue. Fixing details get very little attention by the designer yet they pose significant safety hazards unless spotted by a 'passing site engineer/design engineer'. We would encourage further examples to illustrate this point. The Introduction provides useful contemporary information on fixings.

HOW TO REPORT

Please visit the web site www.cross-structural-safety.org for more information.

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

Post reports to:
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DATES FOR THE PUBLICATION OF CROSS NEWSLETTERS

Issue No 18	April 2010
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