CROSS

Confidential Reporting on Structural Safety

Newsletter No 15, July 2009

Reports in this Issue

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INTRODUCTION

Several of the reports in this issue indicate a lack of competency amongst those designing or installing the works, and/or a lack of adequate supervision. None of these examples affected large structures; the failures were of relatively small works, but there were very serious consequences, and all had the potential for fatalities. It may be that there has been an increase in the numbers of site related problems that have occurred because of the demise of the resident Clerk of Works/ Resident Engineer. It is important for all concerned in the industry, and the general public, that CROSS receives details of failures so that a comprehensive picture may be established in order to support any proposed action.

Earlier in the summer there was a presentation on CROSS to a meeting of international regulators and building control bodies: CEBC/IRCC (Confederation of European Building Control/Inter-Jurisdictional Regulatory Collaboration Committee). There was agreement that defect reporting is an important mechanism for improving safety and saving money and several countries are interested in similar schemes. Meanwhile development is proceeding on the new CROSS web site which will be launched in the autumn. All subscribers will automatically be added to the system which will feature easier access to information, a data base of reports, and simple registration for new subscribers.

DEADLY RETAINING WALL

An engineer is concerned about the dangers from inadequately constructed brickwork and blockwork. He cites the case of a blockwork retaining wall, about 2.5 metres high. It was built around the mid 1990s and consisted of hollow 200 mm blockwork, which was partially filled with concrete, but had no reinforcement. This of course was not readily apparent. Backfill behind the wall was poorly placed and for this reason did not put sufficient load on the wall to cause it to collapse, though there was a certain amount of cracking. Shortly after a contractor started work adjacent to it the wall suddenly collapsed causing a fatality. The reporter cannot conceive that an engineer had anything to do with the original construction. To him it emphasises the need to get across to the general public, including in particular small relatively unskilled contractors, the importance of proper professional involvement in work of this nature.

The reporter's own very strongly held view is that except perhaps where specifically engineered, and where high quality workmanship can be ensured, no masonry wall should be built 100mm thick to any height greater than 450mm. He thinks the ODPM (now Ccommunities and Local Government) leaflet is along the right lines and free copies of this or a similar leaflet should be readily available in all DIY stores and garden centres. Whatever is produced, his view is that it should contain, in large red letters, the message that walls are potentially dangerous, and that for any wall higher than say 1m, or any wall retaining more than say 300mm of backfill, professional engineering advice should be obtained.

CROSS comments: *This tragic case follows earlier reports about fatalities and injuries from the collapse of free standing walls and boundary walls. It is difficult if not impossible for most people to see whether a wall is fundamentally defective and hence dangerous. Nor is it easy to comprehend*

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NEWS ITEM

At a music festival in Derbyshire three people were injured when strong winds lifted part of the roof off the stage. The event went on despite the incident which included neck, back and shoulder injuries and a suspected broken wrist. A number of people were also treated for shock. A witness was quoted as saying: "The supports from the marquee were ripped out from the ground and the wires broke".

CROSS comments:

This happened in mid May and soon after the collapse of a large lightweight fabric covered practice facility for the Dallas Cowboys at the beginning of the month when 12 were injured. (The same month in Malaysia the roof of a one year old 50,000 seat stadium collapsed.) In both cases high wind events were mentioned by observers.

Also in May the creator of an inflatable artwork which blew away killing two women was fined £10,000. He was convicted at Newcastle Crown Court of breaching the Health and Safety at Work Act by failing to ensure the safety of members of the public. Chester-le-Street Council, which carried out a safety check prior to the exhibit opening admitted breaching the Act and was fined £20,000. A useful summary of this incident may be found in the Safety and Health Practitioner July 2009 p41-42.

There are hazards for the designers, suppliers, erectors, and checkers of temporary structures, and lightweight structures, which may be exposed to high winds, and of course for users and members of the public. These hazards must be recognised so that construction is suitably robust. Advice on all aspects is given in the publication 'Temporary Demountable Structures: guidance on procurement, design and use', published in 2007 by the Institution of Structural Engineers.

that a low wall can become a deadly instrument. A long term campaign will be needed to inform and educate those who build such walls without engineering advice. The subject has been drawn to the attention of CLG with a view to issuing revised guidance. Even if the wall is engineered such walls do degrade either due to environmental actions or tree roots etc, such that a wall which is safe as constructed eventually becomes unsafe. This message needs to be put over, particularly for those carrying out modifications or work adjacent to such walls. (Report 134)

References giving guidance on good practice include:

- *Design of free standing walls, J O A Korff, Brick Development Association, February 1984 (BDA Design Guide 12; updated by information notes, August 1995)*
- *A reinforced brickwork freestanding boundary wall, G D Johnson, Brick Development Association, January 1988 (BDA Engineers File Note 7)*
- *BRE Good Building Guide - Building simple plan brick or blockwork freestanding walls GBG 14 (&19), May 1994*
- *BRE Good Building Guide - Surveying brick or blockwork freestanding walls GBG 13, April 1992*
- *BRE Good Building Guide - Building brickwork or blockwork retaining walls (up to 1,7m) GBG 27, 1996*
- *ODPM. Your Garden Walls, Better to be safe than sorry www.rbwm.gov.uk/public/050728_odpm_breg_garden_walls_274.pdf, 2004*

CRITICAL GABLE WALL FAILURE

There has been a report about the top triangle of a brickwork gable in a relatively modern building collapsing in high winds and very seriously injuring two passers by. The reporter believes that the cause was a lack of ties between the brickwork and the adjoining timber trusses.

Contractors, says the reporter, come under the remit of the CITB (Construction Industry Training Board), and some of their courses on general safety might help. He goes on to say that it is however an entirely different matter getting small contractors to give up the time and earnings necessary for such training, and it seems to him that this is an element that should be pushed strongly forward. He imagines that to have a realistic effect government money would have to be found to pay people to go on such courses, not merely to subsidise the direct costs. There might well be, he considers, a significant payback in a reduction in deaths and injuries, not to mention in prosecution costs after the event.

CROSS comments: *Gable walls must be properly tied to resist wind suction. The Approved Document for Part A of the Building Regulations (paragraphs 2C36 and 37 and diagram 16) shows the tying that is required by means of tension straps at not more than 2m centres at the top of a gable wall and at the level of the bottom of the roof trusses. Guidance is also given in BS 5628 Code of Practice for the use of masonry and in Eurocode EN 1996. However any lack of restraint straps or adequate fixings should be evident on an inspection of the roof space, even though access may be difficult, but there is no requirement for this type of inspection to be carried out by a Building Control Body. The number of inspections carried out by Building Control Bodies is currently (2009) under review. The frequency of inspections is linked to risk assessment but there should be greater emphasis on the risks associated with inadequate restraint for the benefit of all involved. Training and advice at many levels is given by CITB. As a leading member of the Sector Skills Council, ConstructionSkills understands the needs of employers and workers to ensure a safe, professional and fully qualified workforce. They provide advice, courses and funds for training to help improve construction businesses.*

What should be reported to CROSS?

- 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
- Communities and Local Government
- Construction Industry Council
- Department of the Environment
- Health & Safety Executive
- Institution of Civil Engineers
- Institution of Structural Engineers
- Local Authority Building Control
- Scottish Building Standards Agency

(http://www.cskills.org/).Notwithstanding, it is incumbent upon those constructing the building to ensure the work is adequately supervised.

Robustness in general will be dealt with in a forthcoming report from the Institution of Structural Engineers (due in 2010). (Report 135)

POST-TENSIONED PRE-CAST CONCRETE TANK FAILURE

A utility company suffered a sudden and catastrophic failure of a concrete tank at a sewage treatment works. The tank was constructed from pre-cast concrete panels which were pre-stressed with circumferential un-bonded cables in grease filled sheaths. They have a large number of similar tanks. A photograph taken after the collapse shows the concrete panels lying around the base in a star formation. All parties who have investigated this incident agree that the ultimate failure was caused by stress corrosion cracking, but it is not possible to say exactly what caused it. At some stage there was pressure water testing of the cable ducts which may have had an effect on subsequent performance. The design appears to rely on the grease and the sheathing to provide its corrosion protection, and it would not be expected that grease used for this purpose would emulsify in water. Tanks of this nature, which are built either above ground or partly buried, rely entirely on the tendons for their structural integrity. The utility company who own the facility therefore recommend erring on the side of caution and do not recommend the use of such tanks unless a system of protecting the cables from corrosion is in place and the possible influence of the grease is clarified.

CROSS comments: *Failures with unresolved causes are difficult to give advice on and this warning by the utility company should be taken seriously by owners, designers, and suppliers of such tanks. Of particular concern are failures which may be generic but not display signs of distress before collapse. CROSS would be very interested in hearing of similar concerns.* (Report 147)

OFFICE CEILING COLLAPSE

This reported event was in a commercial office building at a major airport. There was a 'lightweight' composite deck roof which was deemed insufficient for aircraft noise break-in. For this reason a double layer plasterboard plus mineral fibre overlay ceiling was recommended. This partially collapsed one morning – fortunately without any injuries. The reporter believes that the suspension system utilised undersized washers.

CROSS comments: *This is another collapse of a heavy acoustic ceiling similar to those already reported and which contributed to the SCOSS alert on secondary fixings. See:*
www.scoss.org.uk/publications/rtf/SCO8048A-Alert%20-Fixings-Final.pdf

This pattern of such failures needs further publicity as it is likely that the importance of the selection and installation of fixings is overlooked and the loads from acoustic ceilings, and other heavy ceilings, are underestimated. The fact that these fixings are safety critical is not understood by those managing the design and construction process. The Alert mentioned above

sets out the key actions for safe choice, design, installation and use of fixings. See also CROSS comments on reports 100,101,102 and 103 in Newsletter No 10. (Report 124)

SCHOOL CEILING COLLAPSE

Ceiling and heaters after collapse

Concrete beams above

A new suspended ceiling incorporating radiant panel heaters had been installed at an existing school a few years ago. The flat-roof above consisted of a timber boarded deck supported on pre-cast concrete beams at approximately 1m centres. It was constructed 30-40 years ago. The original ceiling was of plasterboard fixed to timber battens spanning perpendicular to the concrete beams at approximately 0.6m centres. These battens were secured to the underside of the concrete beams with oval wire nails nailed into timber fillets cast into the soffit of the beams. The new ceiling and heaters were all supported by a system of hangers all fixed through the original ceiling and into the battens which carried the original ceiling. The plasterboard forming the original ceiling had been left in place. The combined weight of the new ceiling, heating panels and original ceiling was too much for the nails (acting in tension) fixing the timber battens to the soffit of the RC beams. Five years after installation the new ceiling suddenly collapsed, pulling the original ceiling and battens with it. The collapse affected virtually the full extent of one classroom. Fortunately it happened during the school holidays and no one was injured. The new ceiling had been specified by an Architect without reference to a Structural Engineer. No details of how the new ceiling should be supported were supplied and all responsibility for the fixings of the new ceiling and heating system was passed to the Contractor. It is not known whether the Contractor was aware of the form of the existing roof construction or whether he thought that he was fixing into the underside of traditional roof joists.

CROSS comments: *Schools have the subject of several previous reports including an earlier ceiling collapse and here again it appears that the importance of a fixing system has not been appreciated. If this had been constructed under present legislation the architect would have failed to comply with duties under CDM in that the hazards associated with detailing such a structure without structural engineering input, or adequate supervision, were not adequately dealt with.* (Report 130)

UNDERPASS CEILING COLLAPSE

This was an underpass for cars and pedestrians to access the central courtyard of a residential complex. The soffit of the structure was finished with an internal suspended ceiling construction anchored to the concrete soffit. The ceiling was boarded and rendered. Six months after handover and whilst the residential building was inhabited there was a total collapse of the ceiling structure. It is believed that the failure was caused by wind suction. Fortunately it happened late at night and there were no injuries. The ceiling was replaced by a structural frame of cold rolled steel.

CROSS comments: *It is fortunate that most collapses reported to CROSS have occurred at night or other times where no one has been underneath. Indeed this represents one of the strengths of the scheme in that trends can be detected before the headline cases of deaths and injuries from structural failures. However the information is only of value when action is taken and it may be timely to give more publicity to the SCOSS alert on secondary fixings http://www.scoss.org.uk/publications/rtf/SCO8048A-Alert%20-Fixings-Final.pdf* (Report 140)

NEXT NEWSLETTERS

Issue No 16	**October 2009**
Issue No 17	**January 2010**

HOW TO REPORT

Please visit the web site www.scoss.org.uk/cross for more information.

When reading this Newsletter online click here to go straight to the reporting page.

Post reports to:

PO Box 174

Wirral

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Comment on the scheme, or non-confidential reports, can be sent to dir.cross@btinternet.com

CROSS REPORT FORM

Please complete the shaded boxes and the description below
For more information see www.scoss.org.uk/cross

Name:		1. Your personal details are required only to enable us to contact you for further details about any part of your report
Address:		2. You will receive an acknowledgement
Telephone:		3. This original report will be returned to you
Date of report:	**Approximate date concern was noticed:**	**NO RECORD OF YOUR NAME, ADDRESS, OR TELEPHONE NUMBER WILL BE KEPT**

Affiliation	IStructE	ICE	RICS	other			
please tick the small grey boxes ✓	**grade**	none	graduate	technician	associate	member	fellow
Location England		Wales		Scotland		N. Ireland		elsewhere	

Your job title:		**Age of structure (approximate)**	

Organisation –check		**Project stage** – check		**Structure type** – check		**Material** – check	
approved inspector		appointment		domestic building		brickwork	
builder/contractor		design process		building structure		pre-cast concrete	
client/developer		construction		bridge		pre-stressed concrete	
consulting firm		temporary works		highway		reinforced concrete	
government		In use		tunnel		steelwork	
LA building inspector		during maintenance		marine		stonework	
project manager		de-commissioning		water related		timber	
research/academic		demolition		other		other	
supplier		vacant				**where 'other' boxes are checked please describe in text**	
utility company		other					
other							

Description of the reason for concern – use additional sheets if necessary

Post your report to: CROSS, PO Box 174, Wirral CH29 9AJ Complete confidentiality will be maintained and the technical content, without identification, will be given to SCOSS for analysis. An EMAIL REPORT form is available on the web site www.scoss.org.uk/cross for use when security of electronic transmission is not of concern.