CROSS Safety Report

Reinforced aerated autoclaved concrete planks found on pitched roof of 1990s hospital building

This month's CROSS report serves as a reminder to all engineers about the problems associated with RAAC planks and to be vigilant during any site inspections of existing buildings.

Overview

A building constructed in the early 1990s has been found to contain reinforced aerated autoclaved concrete (RAAC) planks. This date is important since it is much later than the previously thought last significant use of RAAC in buildings in the UK and potentially affects the scope of buildings that could require screening for RAAC problems.

Key learning outcomes

For building owners, managers, surveyors, and other property professionals:

- →| If RAAC is suspected, a structural assessment should be made by a chartered engineer familiar with the investigation and assessment of reinforced concrete structures
- →| If RAAC is confirmed, a risk assessment of the building and its use is advised
- →| CROSS Theme Page *Structural safety of reinforced autoclaved aerated concrete (RAAC) planks* provides further RAAC information

For civil and structural engineers:

- →| *Reinforced Autoclaved Aerated Concrete (RAAC) panels: Investigation and assessment* provides the latest published guidance upon identification and remediation solutions for RAAC planks

Report

A reporter has confirmed that RAAC planks have been confirmed as existing on a building that was constructed in the early 1990s. The reporter considered the finding significant since the building is about 10 years newer than any other RAAC affected building known to the reporter.

The RAAC planks were found forming part of the roof structure at a UK hospital. It was on a pitched roof with a membrane, felt and concrete tile roof covering. The roof covered accommodation that included operating theatres on the top floor. Adjacent accommodation blocks built to a similar design, but in phases before and after the theatre block, had a similar concrete tile roof covering but no RAAC was present within the roof structure. The reporter is not clear why RAAC appears to have been used over the theatre area. The hospital was a 'nucleus' type layout. Drawings concerning the roof date from 1991.

Being validated is an unrelated report confirming structural issues with RAAC panels that were installed as late as 1998. The reporter does not know if this is an isolated case or otherwise.

Expert Panel comments

Autoclaved aerated concrete (AAC) is different from normal dense concrete. It has no coarse aggregate and is made in factories using fine aggregate, chemicals to create gas bubbles, and heat to cure the compound. It is relatively weak with a low capacity for developing a bond with embedded reinforcement. It has been used in two main forms of structural elements; lightweight masonry blocks and lightweight structural units (such as roof planks, walls, and floor units).

The unit weight and compressive strength of AAC vary greatly depending upon constituents and manufacturing process, but typically, AAC might

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> **THE BUILDING IS ABOUT 10 YEARS NEWER THAN ANY OTHER RAAC AFFECTED BUILDING**

weigh about 20% to 30% of normal structural concrete and may have only about 10% to 20% of the compressive strength of everyday structural concrete. It was used extensively because of its perceived advantages.

In the 1990s, there were instances of failure of RAAC roof planks installed during the mid-1960s and a proportion of such installations were subsequently demolished. In 2018, a report was received via the Local Government Association about the collapse of a plank in a school and the SCOSS Alert: *Failure of reinforced autoclaved aerated concrete (RAAC) planks* was issued in May 2019.

There is a risk of structural failure of RAAC planks. Failure can be gradual or sudden; if sudden, there is no warning. Structural failure can be caused by several mechanisms and it is now recognised that RAAC is considerably less robust than structural concrete and ages much less well. Because RAAC planks were most commonly used in roofs, sudden failure can be dangerous and could potentially result in death or injury. It should, however, be noted that, at present, reported failures of RAAC are few and far between.

RAAC elements were not thought to have been incorporated into buildings before the late 1950s or in significant quantity after 1980; however, this case of a building constructed in the early 1990s and confirmed as containing RAAC elements, albeit that no condition concerns were reported, potentially increases the scope of buildings that could require screening for RAAC concerns. Those persons responsible for buildings that could potentially be affected by RAAC concerns are advised to take this new information into account.

The finding of RAAC being incorporated into a later building should, however, not be totally unexpected. While it is not known how widely RAAC was used, RAAC has continued to be available as a construction option in the UK to the present day, even though some problems were identified in the UK in the 1990s. The problems found in the 1990s were in RAAC that had been designed pre-1980. Design standards, however, continued to allow the use of RAAC. The design of RAAC was covered in British Standard 8110 from 1985 to 2001, while the EU harmonised standard EN 12602 has existed from 2008 to date.

The planks originally promoting concern were designed pre-1980. Any planks designed, say, from the mid-1980s may have been designed and/or manufactured differently from earlier designed and manufactured units. Those manufactured after, say, 2010, when the European standard was available and those manufactured after 2013, which would have been legally required to have been CE marked to EN 12602, may also perform differently from earlier designed and manufactured units. CROSS is not aware of any evidence as to how later designed and manufactured units may perform.

The Institution of Structural Engineers has published updated guidance, *Reinforced Autoclaved Aerated Concrete (RAAC) panels: Investigation and assessment*, that provides identification and remediation solutions for RAAC planks. This guidance is recommended as essential reading when considering RAAC induced risk. The conclusions within the guidance state:

'Assessments of buildings with RAAC panels are recommended to include a balance of risks for the continued use of the building against the benefit of strengthening or replacement of the panels. The assessment should include a robust risk assessment and include consideration to the ongoing monitoring and future management of the RAAC panels. The failure of the panels which resulted in the SCOSS Alert was a sudden failure and could be an indication that it was due to a brittle shear failure at or close to the bearing. Based on this a cautious approach to the assessment of RAAC panels is recommended and assessments should only be undertaken by a Chartered Structural Engineer with experience in the investigation and assessment of reinforced concrete structures.'

In addition to the Alert, *Failure of reinforced autoclaved aerated concrete (RAAC) planks*, published in May 2019, CROSS has published a number of reports concerning RAAC. The CROSS Theme Page *Structural safety of reinforced autoclaved aerated concrete (RAAC) planks* provides a collation of all RAAC information published by CROSS.

Share your experience

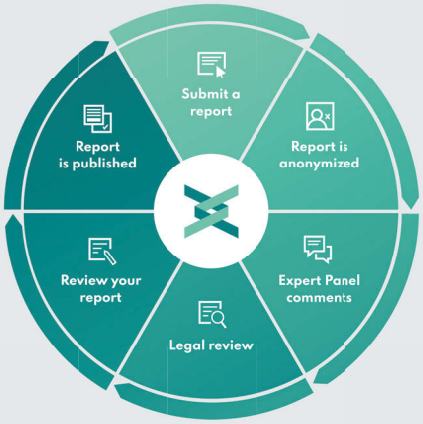
For all those with experience of RAAC planks, CROSS asks you to consider confidentially sharing your experience with CROSS for others to learn from.

The full report, including links to guidance mentioned, is available on the CROSS (report ID: 1125) at **www.cross-safety.org/uk/safety-information/cross-safety-report/reinforced-aerated-autoclaved-concrete-planks-found-1125**.

What is CROSS?

Collaborative Reporting for Safer Structures (CROSS) helps professionals to make structures safer by publishing safety information based on the reports it receives and information in the public domain.

CROSS operates internationally in the UK, US, and Australasia. All regions cover structural safety, while CROSS-UK also covers fire safety.



How reporting to CROSS works

The secure and confidential safety reporting system allows professionals to share their experiences to help others.

Professionals can submit reports on safety issues related to buildings and other structures in the built environment. Reports typically relate to concerns, near misses or incidents. Find out more, including how to submit a safety report, at **https://bit.ly/cross-safety**. Your report will make a difference.

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