NHSScotland Assure
Quality in the healthcare environment

NHS National Services Scotland

Reinforced Autoclaved Aerated Concrete (RAAC)

Prepared for NHSScotland Health Boards

What is RAAC?

Reinforced Autoclaved Aerated Concrete (RAAC) is a composite material made from autoclaved aerated concrete and steel reinforcement. The concrete does not include course aggregate, but does include chemically induced bubbles, which make it lightweight and a good insulator. The autoclaving process is used to harden the concrete.

Is AAC as strong as ordinary concrete?

While Autoclaved Aerated Concrete (AAC) has a lower design strength than ordinary concrete; this need not be problematic in terms of structural integrity. Other common construction materials have similar strengths. Construction materials only need to be strong enough to resist the forces they are subjected to. Reinforced Autoclaved Aerated Concrete (RAAC) planks were designed, taking into account the strength of AAC.

How do RAAC planks work generally?

RAAC is generally used in the form of planks which are often supported at either end by steel beams. When load is added, the top surface is compressed, whilst the bottom surface is stretched, creating tension. Like ordinary concrete, AAC is good in compression, but poor in tension. For this reason, steel reinforcement is embedded in the bottom of RAAC planks.

Can RAAC fail spontaneously and without warning?

RAAC planks can become brittle and fail, often with no warning. This can happen if the bearing width is too narrow or if the reinforcing bars are absent over the support. If a RAAC plank that has been previously considered safe fails, there is usually an external cause. For example, the load on the plank has increased, or the capacity of the plank to bear load has decreased due to issues like water ingress. However, this type of failure can be addressed through management of potential causes.

Why has the Institution of Structural Engineers recommended that bearings be made wider or be investigated?

One way to mitigate the possibility of support failure in RAAC planks is to make the bearing wider. This increases the ability of the bearing to accommodate manufacturing and installation defects. When viewed from below, it is not generally clear what width of bearing has been provided over a support, nor whether reinforcement has been placed correctly. For this reason, intrusive investigation is often necessary to fully assess the associated risk.

Why is measuring deflection important?

Excess plank deflection is important because it often indicates that the working load has been exceeded and as a result the bond between AAC and the longitudinal reinforcing bars, which resist tension, has broken down. Thus, excess deflection can provide advance warning of underlying issues. In such cases it is important that transverse reinforcement is present in the plank ends, because it can provide an alternative way to bind the longitudinal, tension resisting, reinforcing bars to the AAC.

Why are cracks and or spalling important?

Cracks in concrete are ubiquitous, but are usually too small to be seen when viewed from the floor below. Cracks or spalls that are visible could indicate that a plank has been overloaded or damaged. It's important to find out why cracks have occurred, and whether they effect the integrity of the plank. The most important cracks are often found near plank supports as they may influence the bearings, especially if reinforcement is absent.

Why is water ingress important?

Since bubbles make RAAC porous, the embedded reinforcing bars are vulnerable to water penetration and will eventually corrode. This could happen if, for example, roof finishes failed. The original designers understood this risk and therefore protected the reinforcement with a latex cement coating, however in some cases this coating has been found to have aged and perished over time. The coating can also reduce the bond strength between the reinforcements and the concrete (ACC) making high deflections more likely. Additionally when RAAC planks become saturated with water, it can increase the weight, limiting the ability to support normal loads.

Does RAAC have a 30 year life span?

Popular articles about RAAC frequently repeat a claim that RAAC planks have a lifespan of 30 years. Given that many thousands of planks older than 30 years remain in existence, but have not failed, this claim seems hard to sustain. It's origin appears to be a letter written by the Building Research Establishment in response to an investigation in 1994. The context, as described in later documents, seems to be related to the anticipated life span of the latex cement coating applied to embedded reinforcing bars, and the associated potential for rusting of the bars and loss of bond.

Are ad hoc service penetrations problematic?

Sometimes penetrations are made in RAAC planks to accommodate service distribution, this often happens after the planks have been manufactured and installed. This is potentially problematic if the reinforcement is cut, especially near the end of planks where the transverse reinforcement is located. Without transverse reinforcement the tensile bars are without anchorage if the working load is exceeded.

Do I need to close my property if RAAC is found?

No, properties do not need to be closed simply because RAAC is present. Properties need only be closed if the condition of the RAAC has been assessed as being critical, by a competent engineer. The engineer should be experienced in the assessment of existing buildings and in particular RAAC structures. Ideally, the engineer will normally be chartered by either the Institution of Civil or Structural Engineers.

What should I do if RAAC is found during discovery?

Assuming that the discovered RAAC has not been judged to be critical, the next step is to put in place practical management processes to mitigate the potential causes of failure and to monitor their condition. The most important of these are ensuring that the RAAC remains dry and that existing loads are not increased. This will safeguard the planks while further investigations or enhancements, recommended by the engineer, are carried out. In the longer term complacency and corporate memory will become relevant factors. For this reason, long term plans should be made, while monitoring and management processes are in place.

The above information was prepared by consulting engineers WSP, and is reproduced by NHS National Services Scotland with their kind permission.

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