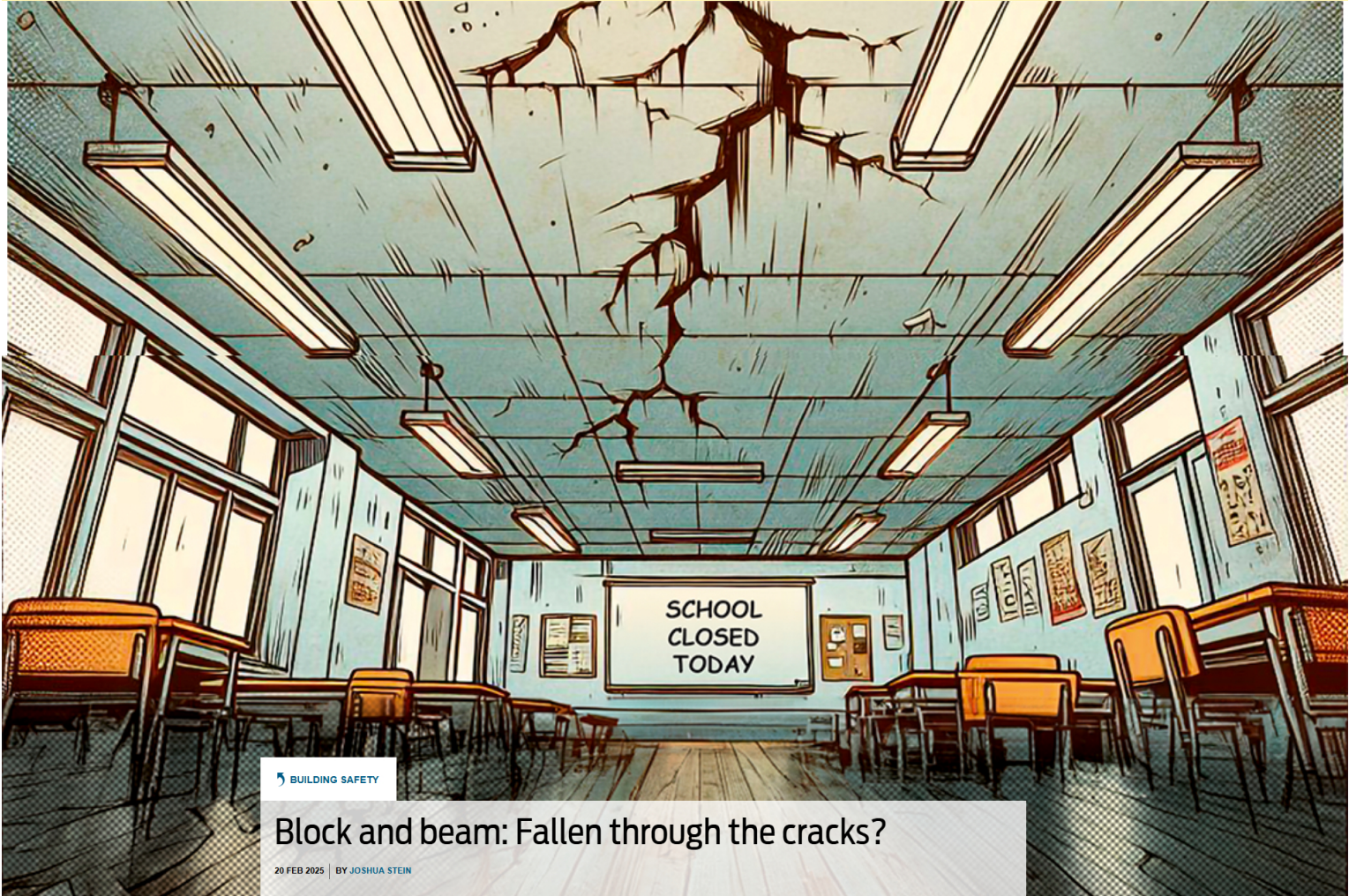




BUILDING SAFETY

Block and beam: Fallen through the cracks?

20 FEB 2025 | BY JOSHUA STEIN

Discovery of a latent building safety threat suggests gaps in the government's knowledge of its building stock

In December 2023, a section of concrete blockwork fell through a suspended ceiling at Fordley Primary School, landing on the floor of a classroom. Hours before the school closed for the Christmas holidays, staff found the debris on entering the building – thankfully no one was hurt.

The discovery revealed wider problems with the original construction in 1966 of the school, which is in Cramlington, North Tyneside. Specialist engineers found that the structure, known as hollow block and beam (see box, below), was “very brittle and highly susceptible to cracking”. The collapse triggered urgent surveys of schools across North Tyneside, revealing similar problems at three other schools in the borough.

Last summer, the Department for Education (DfE) told *Construction News* the problem of deteriorating hollow block and beam blocks was limited to North Tyneside. However, a *CN* investigation reveals that the problem stretches across the country, with experts concerned that ignoring it could result in a harmful collapse.

This is not reinforced autoclaved aerated concrete (RAAC), the crumbling concrete widely used on schools and hospitals that came to prominence in 2023. But with the RAAC issue fresh in mind, the government is noticing the threat of other hazardous building techniques. In December, the DfE awarded PwC a £1.2m contract to research “significant structural risks” other than RAAC in post-war system-built blocks, and to recommend measures to mitigate them. The findings are not due until early 2026.

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in the meantime, *CN*'s investigation into hollow block and beam illustrates the scale of the challenge the government faces – and how little it knows about its own building stock.

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‘Highly susceptible to cracking’

Hollow block and beam is a building technique in which a composite concrete (or concrete/ceramic) slab is created by pouring in-situ concrete over hollow concrete or clay blocks, which are supported by precast reinforced concrete beams.

But how dangerous is it? *CN* has reviewed structural reports into the issue in North Tyneside, which it received via a series of Freedom of Information (FOI) requests.

Two of the reports mention occasions where concrete blocks dislodged from the ceiling and fell onto classroom floors. Pupils were also moved out of some of the other buildings due to concerns concrete blocks could fall.

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Inspections at Fordley Primary by a structural engineering specialist revealed the blocks were “especially weak” and “very brittle and highly susceptible to cracking”.

The inspectors also flagged “a significant health and safety risk” when they found six large sections of concrete block had fallen from the roof of another school in North Tyneside, Hazelwood Primary. They found similar issues at two more schools.

“We should know why they are failing and then reassess the risks – we have a moral and legal responsibility”

Chris Gorse, Loughborough University

University of Leeds professor of materials and structures Phil Purnell, who reviewed the reports seen by *CN*, says they reveal “a weak material coming to the end of its life, coupled with poor initial design[s]”.

The blocks, rather than the beams, seem to have failed in these instances, suggesting that “particularly shoddy blocks” were used during construction, he says.

Purnell says the main issue identified in the reports is that “a strong concrete topping fill, with no reinforcement, is poured over a weak concrete block”. He adds: “When the topping fails locally, loads are thrown onto the blocks which then fail in sequence.”

In the report into Fordley Primary School, engineers from Narro Associates say the blocks could have been damaged “very easily” during transportation or installation, due to the “inherent weakness of the blocks”.

Chris Gorse, professor of construction engineering at Loughborough University, says: “Most of the defects and failures that we are seeing with such systems do stem from poor maintenance or shoddy work. When installing new services, such as pipes and cables, it is not uncommon to see blocks damaged, or holes cut or broken out from the floors with little regard to the impact on the structural integrity. Sometimes these cuts damage the blocks, beams and... remove the structural support.”

Gorse warns that cracking on any concrete blocks leaves them at risk of failure, and that the problem is worse with hollow block and beam.

“As with any cementitious concrete structure, once a non-reinforced concrete structure is cracked, it’s cracked. It’s broken and no longer an integral unit,” he says.

“But because [hollow block and beam] have voids in them, once the cracks are there, [the blocks] do become fragile and brittle. And because the blocks have voids in the middle, if the flanges of any of the blocks break, the potential of a block failing increases.”

Purnell also points to “micro-damage” caused by fluctuating loads from weather, such as wind or temperature-related expansion, which will “eventually turn into visible damage and cracking”.

Other reports *CN* has seen raise questions around whether the structures have been subject to loads they were not prepared for, which could have caused them to crack and then fail.

Newcastle’s West Denton Sports Centre – one of four non-educational buildings found as having issues with hollow block and beam structures – is a case in point. In 2010, the building manager “found some suspended ceiling tiles and concrete blocks debris on the floor of a ground floor office”, an FOI response from Newcastle City Council says.

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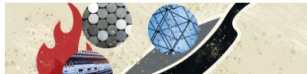
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An investigation into the site found the room above the office was being used as a free weight gym. “A lack of suitable protection to the floor in the gym [...] meant when free weights were being lowered or dropped, they had cracked the concrete screed and ultimately the block and beam flooring underneath in isolated areas,” it says.

‘A moral and legal responsibility’

When contacted about the issues in North Tyneside, the DfE has maintained that no other schools have had problems with hollow block and beam structures. But *CN* has uncovered issues at schools in East Ayrshire and Hampshire, while councils have identified similar issues in non-educational buildings in Middlesbrough, Worcestershire, Newcastle upon Tyne, South Norfolk and Lincoln (see box, below).

In East Ayrshire, the council dropped plans to refurbish Cumnock’s Netherthird Primary and Nursery School back in 2017, following a structural report that warned of “sagging floors” and “longitudinal cracking” on its first-floor hollow block and beam structure. FLN Consulting, a local engineering firm, warned at the time that there was “limited design life left in the floors” and that any permanent fix would be a “costly solution”. The engineering firm advised the school to install plywood planks to keep the structure safe.

Winchester’s Westgate School also needed work to its hollow block and beam structure “as part of a wider project during 2019”, according to an FOI response from Hampshire County Council, though the council said it did not commission a specific survey for that particular work.

Some argue the government should be more proactive about assessing the state of its building stock. Purnell believes that every public building should “have an ‘MOT’ every five years or so”, to better respond to structural issues.

“The reason these end up costing so much is that so little maintenance is actually done, because unless you have a savvy headteacher or caretaker, these things are never spotted,” he adds.

Gorse agrees. “We really do need to investigate the reasons for these collapses and determine why we are seeing such failures,” he tells *CN*. “We should know why they are failing and then reassess the risks – we have a moral and legal responsibility to do this.”

In 2021, the Public Accounts Committee said it would cost £11.4bn to fix the school estate. That number will have likely gone up in the past three years, Andy Walls, educational adviser at the National Association of Head Teachers (NAHT), tells *CN*.

“Even more schools will have fallen into disrepair [since 2021] because of the pause to the school buildings programme [under the previous Conservative government],” he says.

Walls also points to a yawning skills gap that is compounding the issue. “There simply aren’t enough specialist surveyors to go round and school leaders aren’t experts and can’t be expected to be experts at [spotting structural issues],” he says.

The recently-awarded PwC survey for DfE will rely on a desk review of existing research, plus fieldwork in a small sample of school buildings in order to model the risks.

‘I don’t know how we do this’

Gorse says there may be other problems with old structures that use hollow block and beam, making it difficult to work out why they failed in the first place. “My concern is, with all these historic materials, there’s very little performance data available,” he says. “Without actually going back and testing the product, crushing [the individual components], performing onsite tests and finding out whether there is a problem, we don’t know whether there’s a problem with the product, or whether this is a few individual cases where something’s been overloaded.”

Gorse also believes there should be a substantial overhaul of the way the UK deals with structures that are at risk of collapse – starting with data gathering. He suggests the industry could learn from the Grenfell Tower Inquiry and extend the new requirements on competence in the Building Safety Act beyond the construction site.

“We’re required to employ competent people to make judgements on the way buildings are maintained, repaired and operated,” Gorse says, adding that the Building Safety Act “places particular emphasis on ‘structural failure’ [and the] ‘duty to assess building safety risks’.

“At the moment, I don’t see how the ‘accountable persons’ are doing this when they do not have relevant knowledge of how such materials are behaving. If we can’t establish how materials are performing pre-modification, during building modification or after modification, then we’re stuck. I don’t know how we do this. I do think that we need more research, and we need a more systematic way of investigating these problems as they occur.

“We need to accept that we are heading towards a situation where many of our buildings are deteriorating rapidly.”

What is hollow block and beam?

Block and beam is a type of construction technique still used in the UK and Europe. It uses clay or concrete blocks that act as infill, supported by precast reinforced concrete beams. What is different about the structures *CN* researched is that the blocks are hollow (and sometimes known as pots) – a

technique that was used from the 1950s to the late 1970s. With hollow block and beam construction, in-situ concrete is poured over the top of the blocks and beams and into the spaces between the blocks to form a composite concrete beam. Block and beam, whether hollow or not, is often finished with a concrete screed on top, to distribute loads across a floor.

Chris Gorse, professor of construction engineering at Loughborough University, has spent a lot of time analysing RAAC samples and has recognised a similarity between the two systems. "One thing that I've seen with RAAC is people overloading roof structures when they're doing maintenance. Most of the damage caused to RAAC is through people overloading, prodding or breaking, rather than the RAAC collapsing because the system is faulty," he says. But while RAAC was mainly used in roofs, hollow block and beam structures were mostly used in floors.

Freedom of Information requests sent by *CN* to more than 400 local councils in the UK reveal that hollow block and beam has been found in the following buildings:

- Fordley Primary School, North Tyneside – built in 1966 (pictured left)
- Grasmere Academy, North Tyneside – built in the 1960s (pictured right)
- Churchill Community College, North Tyneside – built in the 1960s (pictured below)
- Hazlewood Primary School, North Tyneside – built in the 1960s
- Cardinal Newman Catholic School, Luton (pot and beam) – built in 1969, set to be demolished
- Netherthird Primary School, East Ayrshire – opened in 1959
- Westgate School, Winchester – various extensions built in 1960s and 1970s
- Viewley Shopping Centre, Middlesbrough – construction date unknown
- West Denton Sports Centre, Newcastle upon Tyne – built 1960s, now demolished
- Diss Leisure Centre, South Norfolk – construction date unknown
- City Hall, Lincoln – built in 1973

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