

CROSS Safety Report

Collapse of folded plate timber roof at a school

This month's report discusses a critical safety issue concerning folded timber roofs, in various settings, including over school halls.

Report

This report is about a critical safety issue concerning folded timber roofs, in various settings, including over school halls.

In 2011, the reporter told CROSS (known at that point in time as SCOSS) of a sudden failure of a proprietary timber roof system over a school hall that had been constructed in 1959. In response to the failure, SCOSS issued Report 273 – *Collapse of proprietary timber roof*. The reporter believes that local authorities shared that information to help identify similar roofs. However, the reporter, who is a Chartered structural engineer, has had another enquiry concerning a roof suspected to be of the same type of construction. In researching this enquiry, the reporter has come across a news report of a collapse of another school roof in England in 2019 which appears to be of the same type of construction as that which collapsed in 2011. The construction of the roof appears to be similar to that shown in **Figures 1** and **2**. The age of the roof is not known to the reporter.

Expert Panel comments

This roof collapse was reported as a sudden failure. Such types of failures should be guarded against as they often come with no warning. Very fortunately, the failure happened during a school holiday otherwise the outcome, as the reporter says, could have been catastrophic. The reporter is right that this incident should

have been shared widely. This would especially be the case if the roof is a proprietary system where generic weakness may exist.

The cause of the collapse was not clear, however any structure that relies upon glue and panel pins is unlikely to be robust if water damage occurs at critical connections. It may be that a lack of maintenance permitted water penetration which impacted critical connections and precipitated the collapse. Any roof with suspected water penetration or water shedding problems should be inspected and repaired as a priority, as water degradation can cause structural damage and failures. Water and moisture generally are contributing factors to much

deterioration and failure of buildings. Good detailing, construction, and maintenance of weatherproofing systems are essential.

Deterioration can contribute to the collapse of structures. An ice rink roof collapsed onto skaters in Bad Reichenhall, Bavaria, Germany, in 2006, killing fifteen people. Investigations found no single cause for the collapse, but rather a series of contributing defects and damage. The design capacity of the failed elements was found to be inadequate. This already inadequate capacity was then further reduced over time due to deterioration in the timber box girders. The structure was about 34 years old at collapse.

CROSS published Report 1227 –

Key learning outcomes

For owners and persons responsible for the safety of buildings including schools:

- | Inspect and assess existing buildings, particularly those that are of a significant age, to see if they contain unusual forms of construction, including roofs similar to the reported failure
- | If so, or if there is doubt, arrange for structural inspections and risk assessments to be undertaken by engineers who are suitably qualified and experienced persons – normally Chartered structural or Chartered civil engineers

For inspecting engineers:

- | Undertake a risk assessment of old and unusual structures where there is a life safety risk should they fail
- | Consider what combination of causes could lead to a structural failure
- | Understand where structural elements may be beyond their reasonable service life
- | Look out for signs of distress, including those in hidden components or locations
- | Be aware of the risks associated with moisture build-up, particularly where timber is a structurally significant component

FIGURE 1:
Sketch of roof system

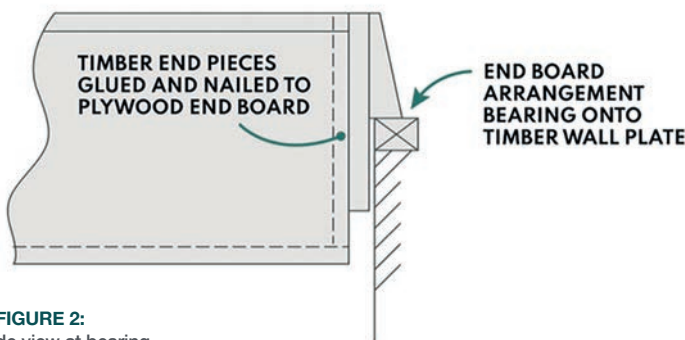
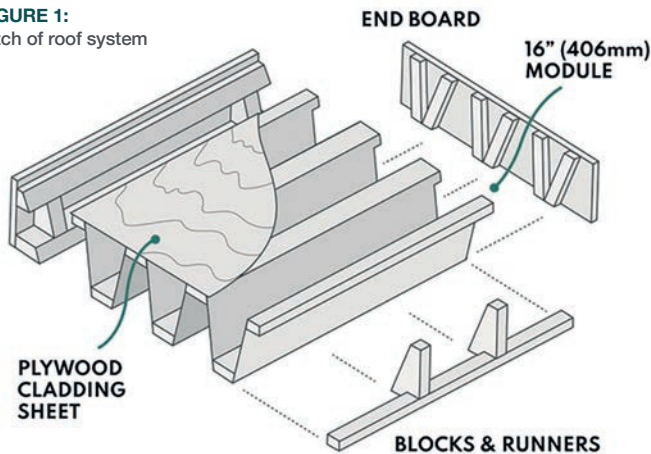


FIGURE 2:
Side view at bearing

Collapse of unusual hybrid concrete and steel strand truss on school roof in May 2023. This new failure in North West England, and the failure of the unusual hybrid truss, have remarkable similarities in that both are unusual forms of roofing structure, both were used in school roofs, and both roofs were of significant age.

For brevity, the findings of the unusual hybrid truss report, as well as CROSS Report 273 – *Collapse of proprietary timber roof* (concerning the collapse in 2011 mentioned by the reporter) are not repeated here. However, readers are advised to read both as the issues and concerns are wholly related to this latest report.

This report markedly reinforces the importance of robust and timely inspection and maintenance strategies as outlined in both earlier reports.

The reporter is concerned that previous efforts to identify similar plywood folded box timber roofs may not have been completely successful.

This failure in North West England appears to support that concern, and responsible bodies of buildings potentially containing such roof structures, are urged to take notice of this latest failure.

The reporter also makes the point that a robust system for local authority staff to share safety information concerning buildings is essential, but the reporter is not sure if any such reporting mechanisms that existed may have atrophied.

This concern emphasises the importance of the voluntary reporting system provided through CROSS and if any readers have experience of such roof systems then will they please submit a CROSS report.

In addition, CROSS understands that the Department for Education, seeks to make bodies responsible for education facilities in England aware of building issues of concern. Similar arrangements could be in place across other devolved administrations.

The full CROSS Safety Report, including links to guidance mentioned, is available on the CROSS website (report ID: 1160) at www.cross-safety.org/uk/safety-information/cross-safety-report/collapse-folded-plate-timber-roof-school-1160.

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.



SCAN ME

