

CROSS

Champlain Towers South forensic report findings

This month, Alastair Soane, Principal Consultant for CROSS, discusses the recently published report into this catastrophic collapse and considers the implications for building safety improvements.

Introduction

The most significant forensic report of recent times has been released by the US National Institute of Standards and Technology's (NIST) National Construction Safety Team. It is the technical findings on the cause of the partial collapse of the Champlain Towers South building on 24 June 2021, which took the lives of 98 people. The full technical findings can be viewed on NIST's website (www.nist.gov/news-events/news/2026/06/nist-releases-technical-findings-what-caused-2021-partial-collapse).

Forensic report findings

This was a 40-year-old 12-storey reinforced concrete structure with an adjoining ground level pool deck over a parking garage. The collapse began when two connections between

single-storey garage columns and the pool deck failed due to punching shear. This caused a redistribution of stresses in the pool deck over the next three weeks, resulting in the transfer of loads to adjacent slab-column connections.

The initial failures spread to other elements of the pool deck and parking structure, eventually unseating the far edge of the pool deck slab from a supporting wall. This caused the slab to sag further and eventually break away at its northern edge from the face of the middle part of the tower. When the pool deck slab broke away, it damaged two connections supporting that part of the tower. The failure then spread from the damaged columns to the middle part of the tower followed by the east part, in a catastrophic progressive collapse.

There were many punching shear failures throughout the structure during the process. Had the pool deck slab not been connected to the tower the failure would most probably have been limited to that slab alone.

The low margins against failure were primarily caused by two factors: first, severe and widespread deviations in the building's original structural design from the US codes and standards of the day, but also some limitations in those codes and standards. And second, deviations in the building's construction from the design drawings. Loads added to the structure over its lifetime – including pool deck modifications – further diminished the margins against failure, as did long-term degradation from reinforcement corrosion and ageing.

The team carried out an extraordinarily detailed forensic examination by analysing physical and photographic evidence and historical records; conducting extensive interviews with survivors and those familiar with the building; performing materials testing and geotechnical studies; constructing and testing building components like those within Champlain Towers South; and creating computer models of the collapse. Full-scale laboratory tests replicated conditions in the building and failure mechanisms matched the evidence found on site after the collapse and were validated by advanced finite element modelling (FEM) analysis and other analytical techniques. Some precursor events were identified and are listed in the video presentation.

What next?

The team will now focus on writing its final report, which will include all the

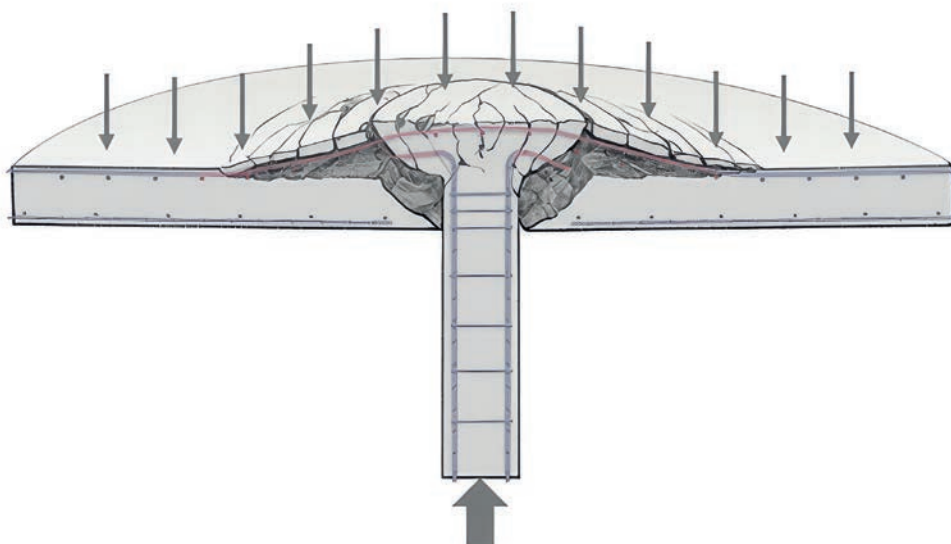


FIGURE 1: Representation of punching shear from NIST report [Used with permission. National Institute of Standards and Technology, rights reserved]

evidence analysis, test results and computational modelling to support the findings. The report will also include recommendations for changes to standards, codes and practices, as well as additional research that might be needed, and will serve as a road map as NIST works with others to improve building safety. During the process NIST will welcome any contributions from those who have comments or observations on the report.

Investigation co-leads Judith Mitran-Reiser and Glenn Bell were founder members of CROSS-US, and, when the final report is published CROSS-UK will work with them to determine what similarities there are with UK practices and buildings of that era.

In the UK in the 1960s/70s/80s unknown numbers of buildings were constructed with flat slabs including; car parks, heavy industrial units, multi-storey residential blocks, shopping centres, and others. Designs were likely to have been carried out to codes which gave limited guidance on punching shear, and records of

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Reports related to such structures and views on how the issues might be progressed will be welcomed by CROSS.

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THE COLLAPSE BEGAN WHEN TWO CONNECTIONS BETWEEN SINGLE-STOREY GARAGE COLUMNS AND THE POOL DECK FAILED DUE TO PUNCHING SHEAR

construction probably no longer exist. Those parts exposed to the atmosphere may have been subject to decades of weathering.

There are three questions:

- 1) Could any of these structures be potentially vulnerable to punching shear failure?
- 2) Have there been any punching shear failures or observed precursors in the UK or elsewhere?
- 3) What action might be taken and by whom?



Alastair Soane

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Alastair is a founding member of CROSS where he is Principal Consultant and member of the CROSS Technical Board. He was responsible for setting up CROSS-UK and for introducing CROSS in Australasia and the USA.

Leading design software for long-span cellular and bespoke plated beams



105 Victoria Street and **1 Broadgate** are two major UK developments showcasing the application of bespoke Fabsec cellular beams to enhance structural efficiency, sustainability performance, and fire safety compliance in modern commercial buildings. Although neither scheme is residential, both are being delivered with the heightened safety, traceability, and documentation standards now common across the industry following the Building Safety Act, with contractors increasingly treating all significant projects as Higher Risk Buildings (HRBs).

At **105 Victoria Street**, Severfield fabricated the steelwork for a frame comprising long-span Fabsec cellular beams that support open, flexible floorplates. The project incorporates complex transfer structures and extended spans to satisfy architectural aspirations and sustainability objectives. Fabsec's contribution was central: the cellular beams, designed and optimised using the **FBEAM®** software, enabled engineers to minimise steel weight, provide efficient service integration, and robust fire limit state performance.



Image Courtesy of Severfield_Central Photography

1 Broadgate, fabricated by Hare, delivers two levels of retail space with new office accommodation above. The steel frame again makes extensive use of Fabsec cellular beams to create large, column-free floorplates suited to contemporary office layouts. Through the **FBEAM®** application, engineers were able to optimise both ambient and fire design, refine intumescent coating requirements, and achieve material cost, and embodied-carbon savings.

A key enabler on both schemes is the integration of Sherwin-Williams **FIRETEX®** intumescent coating technologies within the **FBEAM®** workflow. This provides certified passive fire protection while supporting compliance with the Building Safety Act 2022. Sherwin-Williams' focus on traceability, digital record keeping, and maintaining the "Golden Thread" ensures every coated element is documented from design through installation. **FBEAM®**'s interoperability with Tekla Structural Designer (TSD) and RAM Structures further strengthens digital assurance and record capture.

Collectively, Fabsec engineering, responsible fabrication, and Sherwin-Williams' compliant fire protection systems demonstrate how the steelwork sector is advancing sustainability, safety, and transparency in line with evolving regulatory expectations.



Image courtesy of Hare

The FBEAM/FIREBEAM software is third party verified and accredited by the SCI.

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