CROSS Safety Report

Incorrect steel section properties in structural analysis software

This month's report highlights the importance of varied quality assurance when using structural design and analysis software after a reporter found a steel section with erroneous data in the software's database.

Reporter's submission

A reporter who works for an engineering design consultancy uses a structural design and analysis software for secondary structures. It was observed that the software's database contained erroneous data, which led to the production of invalid designs.

During a routine quality assurance (QA) check of one of the software models, the reporter noticed that one of the selectable sections from the software's database had incorrect section properties. Namely, the section they found to be incorrect was the 200 × 150 × 10 rectangular hollow section (RHS). This member had the properties of a 250 × 150 × 10 RHS member. Upon further inspection, it was noticed that the 200 × 150 × 8 RHS was also incorrect and had the properties of a 250 × 150 × 8 RHS member.

The section in question is available on multiple dropdowns, says the reporter, and they feel that the database needs updating to remove spurious sections and that there should not be multiple entries for the same section type.

Since these section properties were derived from larger structural elements, they overstated the actual structural properties, resulting in inflated estimates of structural capacity. When the sections were showing as 'passing', this was not actually true, as the software was using the properties of a larger section.

This has raised concerns about the validity of checks done on these elements in other models previously and has resulted in the need for a rigorous internal review, with some models being subject to reanalysis, says the reporter.

This highlights the importance of performing QA by different means and methods and not relying on one software, programme or individual for full verification of structures, especially for elements critical to safety. For example, this error was picked up by checking manually calculated stresses in a spreadsheet against the software outputs. The reporter notes that without this comparison it would have been impossible to spot such a discrepancy.

The reporter says that the matter has been raised with the software corporation and is currently in discussion.

The full CROSS Safety Report, including links to guidance mentioned, is available on the CROSS website (report ID: 1504) at **www.cross-safety.org/uk/safety-information/cross-safety-report/incorrect-steel-section-properties-structural-1504**.

> **"THIS REPORT EMPHASISES A CRITICAL VULNERABILITY IN RELYING SOLELY ON STRUCTURAL DESIGN SOFTWARE WITHOUT ROBUST CROSS VERIFICATION**

Key learning outcomes

For civil and structural design engineers:

- It is good practice to check and validate all outputs from proprietary design software
- If you are concerned with any of the outputs, consider raising this with the software's technical support team and seek clarification
- The IStructE guide, *Computational engineering*, says that: 'Computers will, usually, give you an answer – but it is for you to ensure that you asked the right question and received the right answer'
- CROSS's Digital Engineering Theme Page (www.cross-safety.org/uk/digital-engineering) collates content around the topic to enable professionals to understand common errors, learn how to mitigate them, and to share their own experiences and insights

Expert Panel comments

CROSS has recently received an increasing number of reports related to structural analysis and design software which indicates the growing gap between the use and understanding of some software programmes. CROSS has published its Digital Engineering Theme Page (www.cross-safety.org/uk/digital-engineering) to collate content around the topic. The page enables professionals to understand common errors and how to mitigate them, and to share their own experiences and insights for others to learn from.

CROSS has also long promoted the good practice of ensuring design outputs from software models are always checked and validated. The reporter and their firm must be commended for firstly recognising the safety issue in the software and secondly for raising the issue with the software developer and also sharing the issue with CROSS to raise further awareness.

However, whenever we design there are error risks. If designing this by hand, someone might also look up the wrong section size. Due to this, all design calculations need to be checked. Software is a tool and the designer is always responsible. It is encouraging to hear that the engineering firm in the report has been carrying out QA checks on their analysis and design tools. This should happen more regularly but sadly some engineers assume that all commercial tools, and homemade spreadsheets, are perfect. Unfortunately, all software contains bugs, regardless of who created it.

This report emphasises a critical vulnerability in relying solely on structural design software without robust cross verification. Such errors, especially when embedded in dropdown selections and replicated across multiple models, can potentially pose serious risks to structural integrity and safety.

The reporter's findings highlight the importance of diversified QA practices. Manual checks, such as comparing software outputs with independently calculated values in a spreadsheet, are essential in identifying discrepancies. This reinforces the need for multi-layered validation processes and the avoidance of overdependence on a single tool or dataset. Even trusted digital tools require scrutiny, and human oversight remains indispensable in safeguarding design accuracy. The back cover of IStructE's *Computational engineering* (www.istructe.org/resources/guidance/computational-engineering) says that: 'Computers will, usually, give you an answer – but it is for you to ensure that you asked the right question and received the right answer.'

One positive aspect of this report is that the software provider was informed of the bug, which allows them to fix it. One would hope that the provider also then determined how the error crept in, and lessons were learned to prevent, or at least mitigate, such errors in future.

Similar recent CROSS Reports on this topic include:

- →| **CROSS Safety Report: Potentially unsafe software design for steel beams:** www.cross-safety.org/uk/safety-information/cross-safety-report/potentially-unsafe-software-design-steel-beams-1003
- →| **CROSS Safety Report: Potentially unsafe buckling resistance checks using software:** www.cross-safety.org/uk/safety-information/cross-safety-report/potentially-unsafe-buckling-resistance-checks-using-1075
- →| **CROSS Safety Report: Proprietary steel connection design software concern:** www.cross-safety.org/uk/safety-information/cross-safety-report/automated-steelwork-connection-design-concern-1362

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.

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COLLABORATIVE REPORTING FOR SAFER STRUCTURES

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.