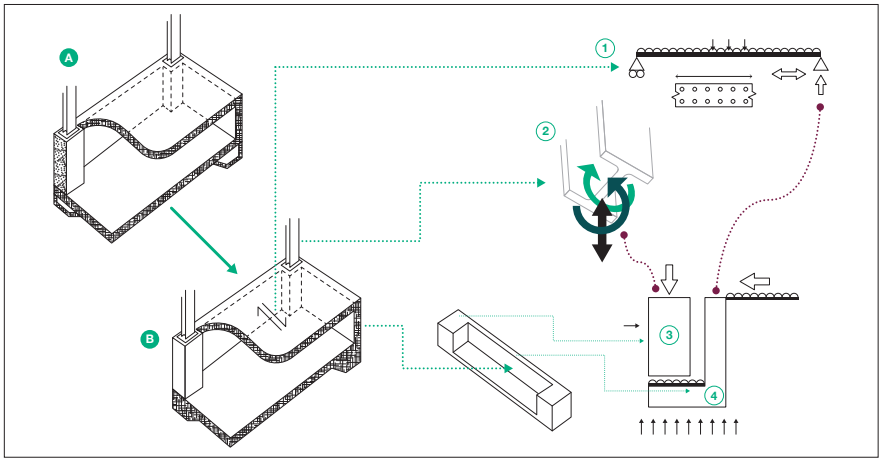
Calculation models – new guidance for the use of software for engineering calculations

A new IStructE guide provides a quality assurance and control framework to support the development, use and verification of software-based calculation models.



Since the Grenfell Tower fire, the UK construction sector has been through a period of serious reflection on the building safety environment. The question is no longer simply whether our processes work, but whether they are robust enough for the complexity and consequences of modern construction.

Structural engineering has long faced a quiet paradox. The tools we use have grown more powerful, more sophisticated, and also more opaque. Yet the frameworks guiding their use have not kept pace. Approaches to checking and validation have often developed organically: within organisations, within teams, sometimes at the level of individual engineers. These methods have provided valuable opportunities for learning and developing professional judgement, but they have also introduced variation. That variation makes consistency harder to achieve and oversight harder to apply.

Reviews of past failures, both in the UK and internationally, sometimes point to recurring themes: assumptions not fully tested, design changes not always subjected to the same level of verification, and checking processes applied with varying degrees of formality. Each case is shaped by its own circumstances, and comparisons must be made with care. But taken together, they suggest a broader need not only for checking that is rigorous, but for checking that is consistent, transparent and clearly understood.

Against this backdrop, attitudes toward verification are beginning to shift. Properly understood, checking is not merely a procedural step. It is a means of managing uncertainty in complex systems. It creates space to step back from a model, question its assumptions, test its outputs, and confirm it remains fit for purpose. The Institution's new guide – *Calculation models: Guidance for the use of software for engineering calculations* – is intended to support engineers in applying a consistent approach.

What does the guidance cover?

The guide provides a structured quality assurance and control framework for the development, use and verification of software-based calculation models. It does not seek to replace engineering judgement. Rather, it aims to support this judgement by offering clarity and definition in place of variation and ambiguity.

Roles and responsibilities

The guidance defines three key roles: the *designer*, responsible for creating and applying the model; the *checker*, who conducts independent verification; and the *technical manager*, who provides oversight. By making these responsibilities explicit, accountability is strengthened.

Model development and documentation

The guidance sets out expectations for how models should be developed and used, including the need to document assumptions, inputs, limitations and the basis of design. These important steps allow models to be understood, checked and revisited.

Levels of checking

Recognising that not all models carry the same risk or complexity, the guidance describes appropriate levels of verification – with more rigorous checking for more critical or complex work.

Independent checking

For critical elements, the guidance emphasises the importance of genuinely independent checking to provide a meaningful test of the model's validity.

Change management

Updates to a model must be controlled, recorded and re-verified where necessary. The guidance provides a framework for managing change without losing sight of the original design intent.

Checking certificate

A certificate template is introduced as a formal record confirming that the model has undergone appropriate verification, that defined procedures have been followed, and that responsible parties are identified.

Generative AI was used to support the drafting of this article.

Get the guidance

Calculation models: Guidance for the use of software for engineering calculations is available to buy at www.istructe.org/resources/guidance/calculation-models/.