

# Why it pays to be able to demonstrate your understanding of structural behaviour

**Tim Ibell** introduces the Institution's new Certificate in Structural Behaviour and explains the value of being able to demonstrate one's understanding.

There is nothing more fundamental to the skill set of a structural engineer than an understanding of structural behaviour. It is like an actor knowing their lines or a pilot understanding aeronautics. Understanding structural behaviour binds together structural engineers across the world, regardless of their chosen structural speciality.

About a decade ago, the Institution embarked on an ambitious education programme to enhance understanding of structural behaviour among its members, particularly Student and Graduate Members. The single most impactful initiative was the development and launch of the Structural Behaviour Course and its recent companion, the Certificate in Structural Behaviour.

The questions in the course help early-career engineers, and students in particular, to develop confidence in simple statically determinate structures. It's a flexible online test, with a bank of hundreds of questions, which can be taken repeatedly in one's own time and space.

As the course progresses, questions start to cover approximation of statically indeterminate structures, by linking deflected shapes to feasible bending moment diagrams via estimates of points of contraflexure. Such approximation is an essential skill of a structural engineer, not least to quickly assess the accuracy, or otherwise, of computer output.

Coupled with approximation is the skill of being able to sketch a bending

moment diagram without numbers, and to be able to determine the sense (compression or tension) in a truss, again without knowing specific numbers.

Some concepts in structural behaviour are difficult to grasp when first met. For example, changing the stiffness of structural elements within a statically indeterminate structure will lead to changes in bending moment distributions. Coupled with this, it is often stated that the lower-bound theorem allows structural engineers to sleep at night, so understanding its power is rather important. In a highly redundant building structure, we cannot possibly know what the bending moment distribution really is, because foundations move, for instance. These concepts must be understood before an engineer can hope to achieve a robust design.

Having easy access to an online resource that embraces the idea of 'having a go as often as you like' in a supportive atmosphere is exactly what's needed to embed understanding and increase confidence. Of course, when this skill has been developed, there is nothing quite like demonstrating this advance in your abilities to others, which is where the certificate offers a great opportunity.

From my own academic point of view, the course and certificate hold many advantages to embed core understanding. One option is to use the course as part of coursework, with the highest score achieved by the students,

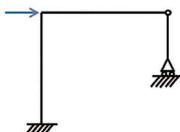
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**THE CERTIFICATE DEMONSTRATES TO EMPLOYERS A HIGH LEVEL OF UNDERSTANDING**

across as many attempts as desired, being the final coursework mark. This represents assessment-led learning, something which leads to profound understanding and confidence.

Following this, the certificate is a fantastic way for students to kickstart their career. The certificate demonstrates to employers a high level of understanding, and that the young engineer will be better at avoiding technical errors and able to 'sense check' errors in software output. Thus, the Institution's two resources on structural behaviour are a perfect combination for preparing students for the workplace.

Increasing numbers of employers are also supporting their graduates in developing their understanding of structural behaviour through both the course and the certificate. In doing so, they are improving their employees' chances of passing their Professional Review.

**Professor Tim Ibell FEng, FStructE** is a Past President of the Institution and Professor of Structural Engineering at the University of Bath.



↑ The course is based on a bank of hundreds of questions with multiple-choice answers

**FIND OUT MORE...**

→ Find out more about the Certificate in Structural Behaviour at [www.istructe.org/sbcertificate](http://www.istructe.org/sbcertificate).

**The employer's view**

**Ian Craig, Director, Evolve**  
**Nadia Perkins, Delivery Leader, Evolve**



At Evolve, people are the foundation of everything we do. Our key message is to inspire and develop great people who share our passion for engineering excellence. We believe that guiding our young engineers through the Structural Behaviour Course and encouraging them to gain the certificate is a positive step in bettering themselves, improving their skills, and pursuing a path towards becoming a chartered structural engineer.

We have a strong IStructE chartership programme within the company, into which all our graduates are enrolled. This gives them personal guidance in achieving the Initial Professional Development (IPD) core objectives. One of the most significant IPD objectives is 2.2, where the candidate must demonstrate the ability to solve structural engineering problems. While it can be difficult to gain good experience in a wide range of topics, achieving the certificate demonstrates that the candidate has already accomplished this and possesses essential understanding of structures.

To assist our graduate engineers, the Evolve team hosts internal lunchtime sessions to go through practice questions for the course and certificate, aided and assisted by chartered engineers and associates.

Our career development process gives Evolve's clients confidence that all the engineers working on their projects, even if not yet chartered, have strong engineering knowledge and capability. This can be formally demonstrated with the certificate, which is an internationally recognised mark of competence.

**The graduate's view**

**Hemant Gor, Graduate Member**



An engineer drawing a bending moment diagram for a structure is analogous to a doctor checking a patient's heartbeat. Diagrams like these provide insight into the load distribution of a structure, and effective utilisation of section and failure mechanisms. The exam for the Certificate in Structural Behaviour tested my ability to calculate load paths, perform approximate analysis, and understand how they will deflect, without the use of a computer.

This is important because, during the detail engineering stage of a project, these skills help to review the design and identify possible errors in 2D/3D computer modelling.

Practising for the certificate improved my skills in drawing bending moment and force diagrams, as well as approximate analysis. As a result, I was given the opportunity to work on new multibillion-dollar projects. I recommend the certificate to anyone who wants to put themselves forward for challenging new projects, improve their bid-winning skills or take the next steps towards chartered membership.

**The student's view**

**Tarun Mittal, Student Member**



During my early-career development, it was hard to demonstrate my skills formally, e.g. in the form of qualifications. However, this was possible through the Certificate in Structural Behaviour because it doesn't require industrial experience, just strong basics and a sound understanding of structural analysis. This is the only qualification that gives students the opportunity to achieve professional goals during their higher education.

Practising for the certificate, using the Structural Behaviour Course, helped me determine whether I would be able to handle designs responsibly in the professional world, as many lives depend on our designs. I've also taken my first step towards chartered status, as the certificate contributes to my Initial Professional Development objectives.

Finally, the certificate gave me confidence in my skills and an extra edge over other candidates, which helped me get a new job. I would recommend to every structural engineering student that they take advantage of the the course and attain the certificate to prove their skills to employers.

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