

Verification and demonstration of structural engineering abilities

INTRODUCTION

ECSA (Engineering Council of South Africa) registration is a generic process, based on education, training and experience at an entry level to a profession. Registration as such confirms that a person is capable of working independently. ECSA thereafter relies on the integrity of a registered person (self-regulation) to not take on work which he is not competent to perform, and to perform work within the “norms of the profession”. The shortcoming with this approach is that no matter how ethical a registered person may be, he is not capable of self-assessing what he does not know. Alternatively, a registered person may solve the wrong problem.

Reliance on competence demonstrated at the point of entry to a profession on a generic basis does not sit well with the principles of quality management as espoused by ISO 9000:2005, *Quality management systems – Fundamentals and vocabulary*. ISO defines competence as “**demonstrated ability** to

apply knowledge and skills”. In quality management systems competence is linked to specific requirements in a specific context.

The mitigation of risk on projects is uppermost in the mind of “intelligent” developers and clients. It is also in the mind of regulators such as the National Home Builders Registration Council (NHBRC) and the National Regulator for Compulsory Specifications who deal with the NHBRC structural warranty scheme and National Building Regulations, respectively. The starting point in mitigating risks relating to structural failure or substandard performance is to be able to identify structural engineering competencies amongst persons registered with ECSA.

Verification of knowledge and appreciation of a field of engineering can be assessed through multiple-choice questions. Such tests can confirm a person’s ability to apply knowledge. The confirmation of a person’s ability to apply skills requires a more in-depth assessment.

Choose the correct deflected shape under the load

Select one:

a

b

c

d

Selected answer

X Just to the right of the internal pin, the beam must be in sagging

Correct answer is b

Figure 1: Question and answer sample

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VERIFICATION OF KNOWLEDGE AND APPRECIATION OF STRUCTURAL BEHAVIOUR

The Institution of Structural Engineers (IStructE) has recently launched a structural behaviour course (www.istructe.org/resources-centre/structural-behaviour). This course currently offers 200 sample questions which assess elements of structural behaviour, and provides detailed feedback on answers, as indicated in Figure 1. Twenty randomly generated questions are assembled into an on-line quiz.

The course provides an invaluable resource for students seeking to test their knowledge of key engineering fundamentals, and enhances their CVs and career prospects in the process. Students are able to return and try out sample questions at their convenience, ensuring a thorough understanding of structural behaviour.

The course is free for IStructE Student Members, and for members of its Academic Community. For other members of the Institution it costs just £5 for a year’s access to the course.

The IStructE launched an invigilated exam to complement the Structural Behaviour Course in September 2016. The exam was run initially on a pilot basis at a limited number of examination centres, but will be launched worldwide in 2017. Those involved in the practice of structural engineering will be able to have their knowledge and appreciation of structural behaviour verified. This can provide clients, employers and regulators with a means of identifying those persons who have knowledge and appreciation of structural behaviour. This is particularly important in the current digital age where reliance is increasingly placed on outputs of software programmes.

THE JSD LIST OF STRUCTURAL ENGINEERING PROFESSIONALS

The JSD List of Structural Engineering Professionals provides a means of identifying persons who have structural engineering capabilities. This publically accessible listing (www.jsd.co.za/structural_engineering_professionals.php) enables clients, employers, regulators and procurers to identify structural engineering professionals who have demonstrated their structural engineering skills to their peers. This enables them to mitigate their risks in their fields of interest.

The listing is confined to only those persons who are registered with ECSA as professional engineers or professional engineering technologists, and who have

demonstrated their structural engineering abilities. The list is complementary to legislative requirements and enables those professionals who have structural engineering competencies to have their capabilities verified and recognised.

Persons admitted to the JSD list of structural engineering professionals are required at the time that they apply for admission to the list to satisfy the following three criteria:

1. be registered in terms of the Engineering Profession Act 2000 (Act No 46 of 2000) as either a Professional Engineer or a Professional Engineering Technologist;
2. be actively engaged in structural engineering, i.e. the science and art of designing and constructing, with economy and elegance, buildings, bridges and frameworks and other similar structures so that they can safely resist the actions to which they may be subjected; and
3. have demonstrated to their peers the five outcomes indicated in Table 1. Sufficient evidence of demonstrating the five outcomes can be achieved by one of the following:

1. The demonstration of the five outcomes through a submission of a portfolio of work and an interview conducted by the JSD Assessment Committee
2. The passing of the IStructE Membership or Associate Member examination
3. Corporate membership of the Institution of Structural Engineers (IStructE), i.e. Fellow (FIStructE), Member (MIStructE), Associate (AIStructE) or Associate Member (AMIStructE); or
4. Membership of a professional body which assesses structural engineering competence as a prerequisite to membership and is recognised by the JSD Assessment Committee for admission purposes.

Persons admitted to the JSD list of structural engineers are required to:

1. Maintain their ECSA registration and immediately notify the list administrator of any change.
2. Confirm annually that they have undertaken continuing professional development within the practice area.
3. Provide services in accordance with the Standard for Structural Engineering Services (www.jsd.co.za/technical_articles_guides.php). □

Table 1: Structural engineering competencies

Outcome	Assessment criteria
1 Communicate the environment within which structural engineering is practised.	<ul style="list-style-type: none"> Professional bodies associated with structural engineering are described. Codes of conduct regulating structural engineering are described. Legislation governing structures is described. Procurement arrangements for structural engineering works are identified. Quality assurance systems are identified.
2 Produce viable structural solutions, within the scope of a design brief, taking account of structural stability, durability, aesthetics and cost.	<ul style="list-style-type: none"> A brief is appraised in accordance with structural engineering principles and concepts. Approximate structural engineering solutions are identified. Two different structural designs are developed from a brief and are communicated. The implications of changes to design briefs are identified and communicated.
3 Determine and document the form and size of principal structural elements from a proposed structure.	<ul style="list-style-type: none"> Structural engineering problems are solved using a variety of suitable methods of analysis. Structures are appraised for overall stability, resistance to progressive collapse, fire and performance of a structure as a whole. Compliance with all relevant criteria for the design of primary structural materials (concrete, steel, masonry and timber) is demonstrated by calculation with all assumptions stated. General arrangement plans, sections and elevations are prepared for estimating purposes. Connection details associated with a given structure are sketched.
4 Specify and coordinate the use of primary structural materials.	<ul style="list-style-type: none"> Properties and behaviour of primary construction materials (concrete, masonry, timber and steel) are defined. Testing procedures are defined. Storage and handling procedures are described. Construction standards are described.
5 Communicate construction techniques and sequencing for structural engineering works.	<ul style="list-style-type: none"> Basic construction techniques and equipment are identified. Construction programmes and construction sequencing are described. Site activities and safe working methods pertaining to structures are communicated.