Legislation: what civil engineers and their clients should be aware of

To protect the public, civil engineering professionals must comply with legislation by ensuring that competent persons with the necessary knowledge of the legislation, qualifications, skills and experience are appointed.

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INTRODUCTION

The Engineering Council of South Africa (ECSA) was established in 1969 with the purpose, among other things, of providing for the registration of professionals, candidates and specified categories in the engineering profession. ECSA is a statutory body which regulates the engineering profession through a register and a code of conduct. A person who demonstrates his or her competence, against standards determined by ECSA at an entry level to the engineering profession within one of the basic disciplines of engineering, is eligible to be registered. Registration as such confirms that a person is capable of working independently. ECSA thereafter relies on the integrity of the registered persons (self-regulation) not to take on work that they are not competent to perform, and to perform work within the "norms of the profession".

The Engineering Profession Act, No 46 of 2000, makes provision for ECSA to prohibit a person from performing any kind of work identified for any category of registered persons. The Council for the Built Environment (CBE) is responsible for identifying work based on ECSA's recommendations (Watermeyer & Smith 2016). The CBE in turn is required to consult with the Competition Commission before doing so. The Competition Act, No 89 of 1998, permits the Competition Commission to exempt all or part of the rules of a professional association (including a statutory body) from the restrictive horizontal provisions of this Act which have the effect of substantially preventing, or lessening, competition in a market.

On 29 January 2016 the Competition Commission rejected the CBE's application filed on behalf of ECSA for exemption from certain provisions of the Competition Act. The Commission did so on the basis that restrictions imposed by the identification of work rules would not only reduce the number of persons operating in the relevant market and increase the selling price, but also have some element of market allocation. The Commission pointed out that "*there are existing regulations or legislations in the sector that cater for public health, safety and financial risks associated with the work undertaken within the built environment, which, if used effectively, should suffice in protecting consumers of the built environment professional services from any wrongdoing or underperformance by persons offering engineering services*".

The key questions arising from the Commission's response in rejecting ECSA's work identification proposals are:

- What are the regulations and legislation that govern the civil engineering profession and what do they address?
- How does such regulation and legislation protect consumers?
- How can such regulations be used effectively?

REGULATIONS AND LEGISLATION GOVERNING THE CIVIL ENGINEERING PROFESSION

The pieces of legislation identified in Table 1 regulate aspects of the civil engineering profession and identify or "license" work or tasks for civil engineering professionals. These laws are rooted in Section 24 of the Bill of Rights embedded in the Constitution of the Republic of South Africa, which grants everyone the right to an environment that is not harmful to their health or well-being and to have the environment protected for the benefit of present and future generations. These pieces of legislation identify the high-risk aspects of civil engineering (Watermeyer & Smith 2014).

The three primary pieces of legislation governing the planning, design, construction and maintenance of structures (construction works having a structure including buildings) are the National Building Regulations and Building Standards Act, No 103 of 1977, the Housing Consumers Protection Measures Act, No 95 of 1998, and the Occupational Health and Safety Act, No 85 of 1993. The Occupational Health and Safety Act has the broadest coverage and applies to construction works which the Construction Regulations define as "*any work in connection with the construction, erection, alteration, renovation, repair, demolition or dismantling of or addition to a building or similar structure, or the construction, erection, maintenance, demolition or dismantling of any bridge, dam, canal, road, railway, runway, sewer or water reticulation system or the moving of earth, clearing of land, the making of excavation, piling or any similar civil engineering structure or type of work*".

Table 1 Acts that "identify" work in the field of civil engineering

Act	Overview of requirements relating to specific aspects of civil engineering practice
National Building Regulations and Building Standards Act, No 103 of 1977	A registered person (person registered with ECSA) is required in terms of the Act to report on the condition of any building or the land on which a building was or is being or is to be erected or any earthwork if it is such that it is dangerous or is showing signs of becoming dangerous to life or property. The National Building Regulations issued in terms of the Act require a competent person (person who is qualified by virtue of his or her education, training, experience and contextual knowledge, i.e. a registered person) to: ■ prepare designs and/or rational assessments which demonstrate compliance with the provisions of the Regulations relating to structural design (foundations, floors, walls, roofs, glazing), excavations, drainage, non-waterborne means of sanitary disposal, stormwater disposal and fire installations where the deemed-to-satisfy rules provided in SANS 10400 are not applied; ■ judge an existing building to be capable of carrying additional loads arising from the erection or extension supported on such building; ■ submit rational assessments as to the adequacy of the existing systems and installations in combination with the contemplated extensions to comply with the relevant requirements of the Regulations for the whole building, including the extensions; ■ undertake an appropriate geotechnical site investigation; and ■ specify precautionary measures where the safety or stability of any property or service is likely to be impaired by such excavation.
Sectional Titles Act, No 95 of 1986	A professional engineer is required in terms of the Regulations issued in terms of the Act to prepare a report on the general physical condition of buildings, with specific reference to any defects in the buildings and the services and facilities relating thereto.
Occupational Health and Safety Act, No 85 of 1993	The Construction Regulations 2014 require a competent person (person who has, in respect of the work or task to be performed, the required knowledge, training and experience and, where applicable, qualifications specific to that work or task and is familiar with the Act and applicable Regulations) to: ■ perform a wide range of tasks and activities associated with safe working on construction sites; ■ perform the roles of construction manager (person responsible for the management of the physical construction processes and the coordination, administration and management of resources on a construction site); construction supervisor (person responsible for supervising construction activities on a site); and designer (person who prepares, checks or approves a design, arranges for a person under his or her control to prepare a design, designs temporary works, has overall responsibility for a design or prepares specifications). Professional engineers or professional engineering technologists are required to decide on the stability of soils in excavations where uncertainty exists. Professional engineers, professional engineering technologists and professional certificated engineers are required to certify the design of suspended platforms.
National Road Traffic Act, No 9 of 1996	A professional engineer or professional engineering technologist of the road authority concerned is required in terms of the National Road Traffic Regulations to approve every traffic signal installation at a signalised junction or pedestrian or pedal cyclist crossing.
Housing Consumers Protection Measures Act, No 95 of 1998	A competent person (person registered with ECSA or with the South African Council for Natural Scientific Professions (SACNSP)) is required by the National Home Builders' Registration Council (NHBRC) to approve plans and documents and to supervise the rectification of a home-builder's non-compliance or determine a home-builder's compliance with the NHBRC's Technical Requirements. Listed competent persons (competent persons whose credentials are accepted by the Council and are admitted to the Council's list) may in terms of the NHBRC's Technical Requirements: ■ demonstrate that a solution for a system, element or component satisfies the performance requirements in the terms of the structural system, prefabricated timber truss roofing system, steel frame homes, timber frame homes, water and drainage installations and stormwater disposal systems, roof glazing installations and fills, terraces and subsurface drains; and ■ provide certification services relating to site class designations and inherent hazard classes on dolomite land.
National Water Act of 1998, No 36 of 1998	Only an approved professional person (person registered with ECSA and approved by the Minister after consultation with ECSA) may in terms of the Act perform tasks associated with the safety of dams with a safety risk, including the design, repair, alteration and abandonment of a dam. A professional engineer is required in terms of the Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources to approve plans, specifications and design reports so as to prevent the pollution of a water resource for the construction of any surface dam which impounds waste, water containing waste or slurry, or the implementation of any pollution control measures at any residue deposit or stockpile, or any water control measures at any residue deposit or stockpile.

The Housing Consumers Protection Measures Act covers only homes. The National Building Regulations cover buildings, which are defined broadly to include structures for the accommodation of humans and animals; the manufacture, processing, storage, display or sale of any goods; the rendering of any service; and the cultivation or growing of any plant or crop. The Regulations include structures used in connection with buildings, such as a wall, swimming bath, swimming pool, reservoir, bridge, fuel pump or tank, as well as any facilities or systems incidental to a building.

The Construction Regulations issued in terms of the Occupational Health and Safety Act do not require construction work permits or the application of the Regulations relating to the duties of a client in the case of a single-storey dwelling for a client who intends to reside in such dwelling when completed.

RESPONSIBILITIES FOR COMPLYING WITH LEGISLATION RELATING TO THE PLANNING, DESIGN, CONSTRUCTION AND MAINTENANCE OF STRUCTURES

The persons responsible for ensuring compliance with the legislation governing the planning, design and maintenance of structures are as indicated in Table 2. In essence:

- The owner (person in whose name the land on which a building was or

Table 2 General duties imposed upon those responsible for complying with legislation

Person responsible for compliance	Key duties imposed by the Act on the person responsible for complying with the provisions of the Act
National Building Regulations and Building Standards Act, No 103 of 1977	
The owner (person in whose name the land on which a building was or is erected is registered in the deeds office)	■ Obtain approval for the erection of any building. ■ Notify the local authority when building work is to be commenced. ■ Proceed with building work within the stipulated time limits or apply for extension of such time limits. ■ Appoint where required registered professionals for the design and supervision of various aspects of the building or to provide professional services as prescribed in the Act and the Regulations. ■ Obtain certificates of occupancy for completed buildings prior to occupation. ■ Notify the local authority if a building or earthworks has become dangerous. ■ Maintain the structural safety performance of the building and ensure the resistance of rainwater penetration and moisture into the interior of the building.
Housing Consumers Protection Measures Act No 95 of 1998	
Home builder (person who carries on the business of a home builder, or an owner builder who has not applied for exemption from the Act)	■ Register with the NHBRC. ■ Enrol a new home with the NHBRC and enter into a written agreement with the housing consumer. ■ Build homes which are in accordance with the NHBRC's *Home Building Manual*, fit for habitation, constructed in a workmanlike manner and in accordance with the agreement entered into with the housing consumer. ■ Provide the standard warranty which protects the consumer during the three-month non-compliance period, the one-year roof leak period and the five-year structural defect period. ■ In the event of a complaint, follow the complaints procedure set out in the Regulations. ■ Rectify at own cost non-compliance with, or deviation from, the contract with a housing consumer, major structural defects and roof leakages reported within the warranty period. ■ Comply with the NHBRC's *Code of Conduct for Home Builders*.
Occupational Health and Safety Act No 85 of 1993	
The client (any person for whom construction work is being performed)	■ Apply, if required, for a permit for the intended construction work and appoint an agent to act as a representative. ■ Ensure that the principal contractor keeps pertinent information in the occupational health and safety file for inspection. ■ Prepare a baseline risk assessment for an intended construction works project and site-specific health and safety plans for intended construction work. ■ Provide the designers with a health and safety specification and include such information in tender documents. ■ Ensure that the principal contractor has the necessary competencies and resources to carry out the work safely and is registered with the compensation fund or a licensed compensations insurer. ■ Approve the principal contract's health and safety plan and take reasonable steps to ensure that each contractor's health and safety plan is maintained and implemented. ■ Ensure that periodic health and safety audits and documentation verification are conducted. ■ Stop any contractor from executing a construction activity which poses a threat to the health and safety of persons. ■ Ensure that a contractor submits a report to the provincial director where a fatality or permanently disabling injury occurs.
The principal contractor and contractor (person who employs or provides work to any person) who performs construction works	**General** ■ Provide and demonstrate to the principal contractor/client, based on the client's health and safety specification, a suitable site-specific health and safety plan. ■ Open and keep on site a health and safety file which satisfies the Act and related Regulations. ■ Appoint the necessary competent persons and engineering professionals to perform prescribed tasks and activities. **Principal contractor** ■ Ensure that other contractors that are appointed for a part of the work (subcontractors) have the competencies, resources and information necessary to perform the construction work safely. ■ Take reasonable steps to ensure that each contractor's health and safety plan is maintained and implemented. ■ Ensure that periodic health and safety audits and documentation verification are conducted. ■ Stop any contractor from executing a construction activity which poses a threat to the health and safety of persons. ■ Appoint a construction manager and, where appropriate, assistant construction managers and health and safety officers. **Contractor** ■ Cooperate with the principal contractor in complying with the provisions of the Act, promptly providing health and safety information which might impact on persons carrying out construction works. ■ Do not allow or permit any employee or person to enter any site unless that person has undergone appropriate health and safety induction training.
Owner of a structure	■ Ensure that inspections of structures are carried out at least annually by competent persons to render the structure safe for continued use. ■ Ensure that the structure is maintained in such a manner that it remains safe for continued usage.

Table 3 Description of the structural performance of a building in qualitative terms

Focus area	Objective	Performance description
Structural safety	The risk of collapse or other kind of severe damage resulting from structural failure, which may affect the life and safety of the building occupants, or people in its vicinity, shall not exceed a level acceptable to the user/regulator.	The whole building and its parts shall, with an appropriate degree of reliability, maintain strength and stability under all actions likely to occur during the building's design working life.
Structural serviceability	The following characteristics of a building, under all expected actions for normal use and conditions, shall be kept within levels acceptable to the user/regulator: ■ functioning and appearance of the building and its components ■ functioning of the occupants and equipment in the building ■ comfort of the occupants ■ asset value of the building.	The whole building and its parts shall, with an appropriate degree of reliability, perform within established parameters under all expected actions for normal use in terms of local damage, including cracking, deformation and vibration.
Structural durability	The structural safety and serviceability performance of the building shall be acceptable to the user/regulator over the specified design working life.	The whole building and its parts shall, with an appropriate degree of reliability, fulfil its intended safety and serviceability performance in the environment in which it is located over the specified design working life when subject to its intended use, taking into account the external and internal environmental agents (including those associated with microclimates that can arise in buildings), maintenance schedule and specified component design life and changes in form or properties.

is erected is registered in the deeds office) is responsible for ensuring compliance with the requirements of the National Building Regulations and the Building Standards Act.

- The home builder is responsible for compliance with the NHBRC Technical Requirements established in terms of the Housing Consumers Protection Measures Act.
- The client (any person for whom construction work is being performed) and the contractor are responsible for ensuring compliance with the provisions of the Occupational Health and Safety Act, other than requirements relating to the maintenance and annual inspection of structures in use, which are the responsibility of the owner.

Owners, home builders, clients and contractors need to appoint professionally registered civil engineers in order to satisfy the requirements of the aforementioned Acts, particularly in the high-risk areas of civil engineering practice, namely:

- **Structural engineering** – 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.
- **Geotechnical engineering** – the science and art of identifying the risks posed by geotechnical site conditions to humans, property and the environment, and the analysing, designing and construction of foundations, slopes, embankments and structures that are made of or supported by soil or rock.

RISK ASSOCIATED WITH THE FAILURE OR SUBSTANDARD PERFORMANCE OF STRUCTURES

Structural performance can be broken down into three objectives as described in Table 3 (Watermeyer & Pham 2011 and ISO 19208). It is impacted on by mechanical agents (gravitation, forces imposed or restrained deformations, kinetic energy and vibrations and noises), electromagnetic agents (radiation, electricity and magnetism), thermal agents, chemical agents (water and solvents, oxidising agents, reducing agents, acids and salts) and biological agents (vegetable, microbiological and animals). Retention of performance over the required service life of a structure is always subject to regular maintenance.

Condition assessments are a key part of determining the remaining useful life of structures. This is recognised by the regulator in the Construction Regulations which requires the owner of a structure to ensure that inspections are carried out at least annually to confirm their continued safe usage.

Figure 1 illustrates this important requirement of the regulator. Regular maintenance ensures that the minimum accepted level of performance is maintained over the expected useful life of the building. Renewal (demolition and rebuilding) is required where the level of performance has fallen below that which is required. Rehabilitation (bringing the structure back to an acceptable level of performance, often with improvements) can safely prolong the life of the structure.

There have in recent years been a number of structural failures in South Africa resulting in the collapse of a structure with loss of life and severe economic implications. Although many structures may not collapse, they may perform differently from what was intended. For example, the deflections may be noticeable to the naked eye, or walls and floors may have visible and disturbing cracks. The root cause of failure may lie in the design, construction or lack of maintenance of structures, i.e.in one or more of the areas regulating structures.

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The consequences of a fatality or severe injury due to a structural collapse have implications far broader than the tragedy itself. The police will typically declare the collapse site a crime scene, which will be handed over to an investigator from the Department of Labour. The Department will investigate the incident in terms of the Occupational Health and Safety Act, irrespective of whether or not the structure is old or new. Insurers or interested parties will appoint professional engineers to write "expert reports". The site will only be released once the Department has decided that it can yield no further information. If so determined by the Chief Inspector, a Commission of Enquiry will be set up. A prosecution may follow, depending on the outcome of the enquiry.

MITIGATING STRUCTURAL RISKS

The starting point in mitigating risks relating to structural failure or substandard performance is to be able to identify structural engineering

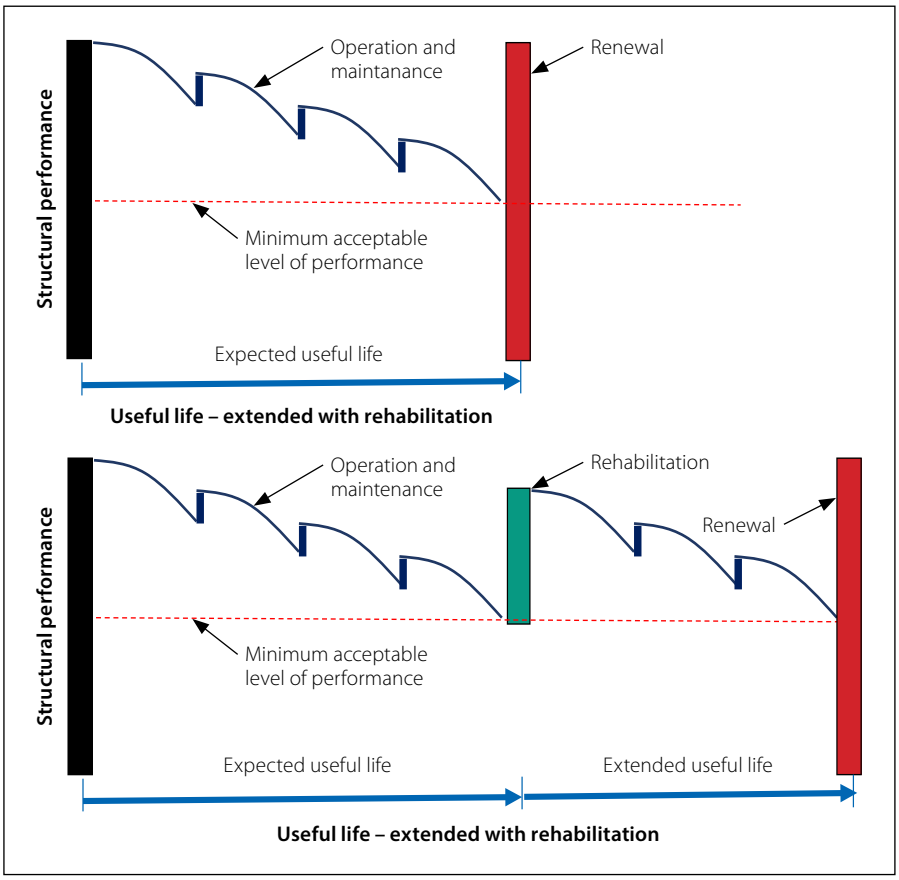

Figure 1 Expected useful life with and without rehabilitation

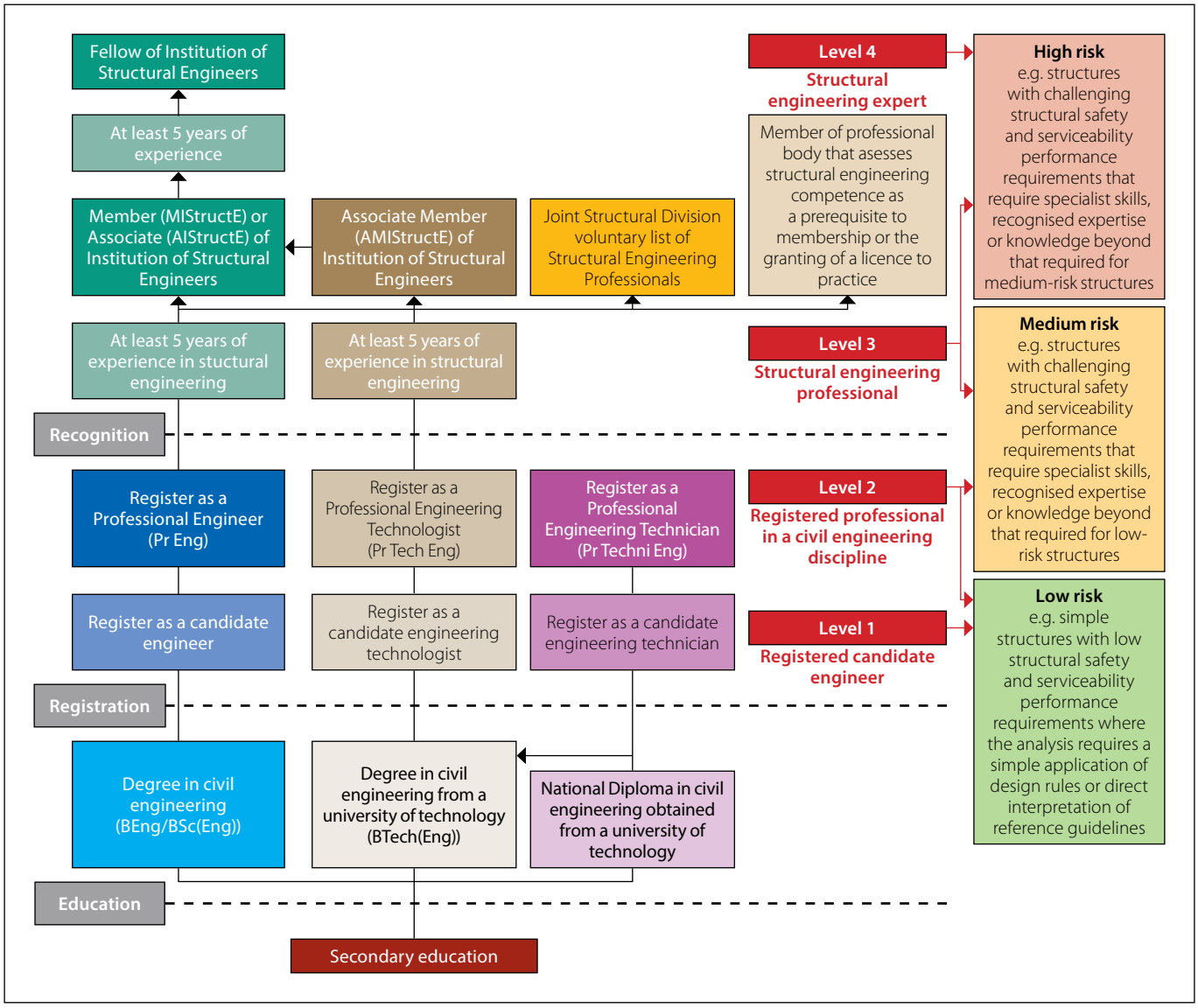

Figure 2 Levels of competence required for structural engineering linked to levels of risk

competencies among persons registered with ECSA. In 2014 the Joint Structural Division (JSD) published a *Guide to Good Practice for Structural Engineering* (see www.jsd.co.za) to address the issues surrounding the practice of structural engineering. According to this guide, structural engineering practitioners, depending on their tertiary education, training and experience, category of registration and recognition by the profession, function at one of four distinct levels, as indicated in Figure 2. The level of practitioner assuming responsibility for the design of a structure is linked to the category of risk as indicated in this figure.

The JSD List of Structural Engineering Professionals, which is linked to the provision of services in accordance with the JSD's *Standard for Structural Engineering Services* (see **www.jsd.co.za**), provides a means of identifying persons who have structural engineering capabilities who may assume responsibility for medium-risk and medium- to high-risk structures. Only those persons who are professionally registered with ECSA as professional engineers and professional engineering technologists, and who have verifiable structural engineering abilities are admitted to this publicly available listing. The list is complementary to legislative requirements and enables those professionals who have structural engineering competencies to have their capabilities verified and recognised, particularly those who have not had the opportunity to obtain internationally recognised qualifications (Watermeyer, Smith & Visser 2016).

CONCLUSIONS

The current legislation relating to the work undertaken by the civil engineering profession can adequately protect the public, provided that those responsible for complying with legislation appoint competent persons to do so, and that the appointed person has the necessary qualifications, skills and experience to do so. □

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