1 August 2012

Canterbury Earthquakes Royal Commission
PO Box 14053
Christchurch Mail Centre 8544

Email: canterbury@royalcommission.govt.nz

SUBMISSION RE: DISCUSSION PAPER ON TRAINING AND EDUCATION OF ENGINEERS AND ORGANISATION OF THE ENGINEERING PROFESSION

1. Introduction

In response to the questions posed by the Royal Commission, we have compiled a discussion paper and made suggestions for training opportunities which could be considered to improve the expertise of engineers practicing in the field of complex structures.

2. Civil Engineering Degree

The Civil Engineering degree offered by University of Canterbury and University of Auckland produces engineers of a very high standard, and this is recognised around the world. The Civil Engineering degree needs to be sufficiently broad and flexible so that fundamental engineering principles across all disciplines are all catered for. This enables students and teaching to be tailored to suit individual preferences and respond to market need for graduates in particular disciplines. Our Universities have also offered Masters of Engineering courses, including in Structural Engineering. We note that in the past 20-25 years, demand for structural engineering graduates has generally been low. In recent years, structural aspects of the Civil Engineering degree have faced greater competition from other fields within Civil Engineering. This may have led to a reduced uptake of the structural engineering disciplines and graduates taking the Master's course.

Many graduate engineers appear to have elected to focus across a variety of these fields to achieve a broad-based Civil Engineering degree. Whilst this has benefits for those practicing in generalist roles, (which is relevant in New Zealand because of the limited size of our economy and our geography), it does not consistently produce a pool of highly skilled and knowledgeable structural engineers.

This is primarily due to the market drivers as noted above, and we find ourselves in the position of not having the skill and experience base that we need in order to respond to the current market need. As a result, many Civil Engineering graduates do not have sufficient training in structural and seismic engineering to contribute in a meaningful way to complex seismic analysis and design projects. This leaves the onus on the employer to ensure that these knowledge gaps are filled.

There are several options to enhance the structural training provided by the Universities, and these institutions have been responsive to the changing demands. For example, Canterbury University has added additional structural topics to its Master's course options.

Canterbury are also putting considerable effort into leveraging off the recent increased demand for seismic engineering, with the impending establishment of an earthquake engineering 'Centre of Excellence'. It is our impression that an increased number of students are already choosing Structural Engineering disciplines offered in the BE course in response to the changing market demand.

The following options would help to enhance the level of training available in structural engineering. We have outlined them in order of preference:

- Create a post-graduate qualification specialising in structural engineering. We note that University of Canterbury has offered such training commencing this year, presumably as a result of lessons observed from the Canterbury earthquakes.

  This has the benefit that graduates can either continue straight on from under-graduate studies, or complete the current Civil degree, find their feet within the industry, and return for further study if they wish to pursue a career in structural engineering. We note that the opportunity to study part time or in block courses would encourage the uptake of study during career progression.

  To generate uptake of post-graduate training, this could become a prerequisite for the design of complex structures. This could be achieved by creating a new practice area under CPEng relating to the design of complex structures, and mandating post-graduate training as a requirement to practice in this field.

- Create a specialist structural engineering degree that runs in parallel with the current Civil Engineering degree. Such a degree would have explicit focus on structural engineering, and should be able to achieve the same result as a post-graduate programme. However, we don't think such a degree would be ideal or sustainable within New Zealand, as graduates may have difficulty finding employment in periods of construction downturn, where the design work related to complex structures can decrease dramatically.

3. Development of Graduate Engineers

The development and training of post-graduate engineers to the point where they become CPEng, is mainly the responsibility of the employer. The development and training of structural engineers in this phase is variable, with some companies having a limited variety of work and, sometimes a lack of experienced engineers to train them. The systems in place for graduate development are generally quite informal, and not prescriptive, and this is often necessarily the case, as specific training opportunities are not always available. This can result in a lack of consistency in the knowledge and skills of engineers practicing in the design of complex structures. Additionally, commercial pressures make it difficult for many consultants to expend resources on developing structural engineers.

Engineers applying for, and attaining, CPEng status from within such a development environment may not necessarily fully understand what constitutes competence in the design of complex structures.

To improve this, we consider that a more structured development path would be beneficial for engineers who intend to practice in the field of complex structural design and analysis. Some mechanisms through which this may occur could include:

- Some form of employer accreditation for employers recognised as producing CPEng applications capable of complex structural design. This may be related to, or an extension, of the existing "Professional Development Partner" scheme created by IPENZ.

- Requirement for formalised post-graduate training prior to CPEng application in complex structures practice area, or possibly an alternative experienced based route which is subject to robust scrutiny.

- A more structured programme of key competency development and review by IPENZ or other accredited organisation in a staged manner prior to CPEng application.

4. CPEng Registration

CPEng is currently used as the measure of whether an engineer is competent to practice in the area of complex structural design. Because of the high public safety implications associated with complex structural engineering activities, consideration should be given to reviewing the effectiveness of the current CPEng registration process in ensuring competence of engineers operating in this field.

There are a number of aspects of the current CPEng process that we consider could be improved upon, namely:

4.1 Practice Areas

Transparency of practice fields and practice areas needs to be addressed. It is not clear for engineers to understand a colleague's practice area without seeking a declaration from them regarding their accredited practice area. For others in the building industry, such as owners, contractors, and regulatory authorities it must be difficult to easily understand whether the CPEng engineer is competent to undertake complex structural design. As a minimum, we consider that a CPEng engineer's practice areas should be publically available on the CPEng register.

Engineers can gain CPEng (structural) based on design of simple low-rise structures, and are deemed then 'qualified' to practice in the area of complex structures. The CPEng Code of Ethical Conduct requires that engineers do not practice outside their area of competence. This requires an individual to apply a self-regulating test to determine when the knowledge step from design of simple structures to more complex structures is too great; such a process will not produce consistent outcomes. Our observation is that self-regulation is not effective across-the-board. Because of the high public safety implications of practicing in the area of complex building design without sufficient competence, it may be that self-regulation is an insufficient safeguard.

4.2 Possible Improvements

To overcome this, we consider that a two tier approach should be adopted for CPEng registration in the structural engineering field. This would distinguish between competence in the design of simple structures (Class I) and competence in the design of complex structures (Class II). We note that the two classifications are only labelled as such for clarity.

We have effectively implemented a simplified version of a two-tier system within Opus as a temporary measure. This has been done by creating a shortlist of CPEng Engineers who are the only people who can release structural engineering evaluation reports.

Such a system would require the development of a defined practice area scope for Class I and Class II structural engineers as part of the CPEng registration process. For seismic related work[1], this could be aligned with analysis and design limitations within 1170.5, such as Class I design limited to buildings that:

- are less than 10m in height;
- are not classified as irregular; and
- have a fundamental translational period of less than 0.7s.

Competency of engineers working within the specific practice area of complex structural design (Class II) could be recognised in the following ways:

- Passing examination, similar to those discussed above;
- Proven performance through a structured development programme;
- Undertaking specialist post-graduate training, such as the post-graduate qualification in structural engineering proposed above;
- Through a more rigorous and thorough assessment of continued competence assessment.

Such a system would avoid onerous requirements on engineers who practice in the simple structures area.

By comparison, the US licencing system has a similar two tier approach defined by the Civil/Structural Engineering (CE) Practice Act and Structural Engineering (SE) Title Act; both assessed through examination. The SE licencing entitles engineers to use the title Structural Engineer, while the CE's can design anything except schools, hospitals, and emergency facilities.

[1] This document is building's focussed, although similar definitions could be established for other complex areas, such as dams and tunnels.

4.3 Performance/Competence Review

The Canterbury earthquakes have highlighted instances where it is questionable if competence standards of engineering design and assessment have been met. There should be a review of competence standards, assessment procedures, and recommendations for improved training of graduates and CPEng.

We support the engineering profession being self-regulated and would encourage IPENZ to more actively promote the skills and capability of the profession. We consider that our reputation will be enhanced by demonstrating our standards are rigorous, actively reviewed and constantly improved.

Yours sincerely

David Prentice
Chief Executive