

## Practice Field Guidelines - Structural Engineering

### Contents

Practice Field Guidelines - Structural Engineering .....	1
Purpose of guidelines .....	1
Practice area definition .....	1
Engineering problems.....	2
Engineering activities .....	2
Guidelines for Structural Engineering .....	4
Professional Engineering - Element 1 .....	4
Professional Engineering - Element 2 .....	6
Professional Engineering - Element 3 .....	7
Professional Engineering - Element 4 .....	9
Professional Engineering - Element 5 .....	10
Professional Engineering - Element 6 .....	11
Professional Engineering - Element 7 .....	12
Professional Engineering - Element 8 .....	14
Professional Engineering - Element 9 .....	16
Professional Engineering - Element 10.....	17
Professional Engineering - Element 11.....	18
Professional Engineering - Element 12.....	19

### Purpose of guidelines

The purpose of these guidelines is to provide **applicants** with suggestions on the type of evidence that is considered to demonstrate that they meet the competence standard. These suggestions are not exhaustive nor are they definitive – the assessment panel, which is the only entity with access to all of the applicant’s evidence, is required to make a judgement on the applicant’s competence.

All competence assessments are made in the applicant’s practice area (definition below). The applicant is asked to provide a brief description of his or her practice area – which is effectively the professional engineering activities they perform. This description will guide the assessment panel when it assesses the evidence submitted. Assessment panels are instructed to amend the applicant's practice area description if the panel find a mismatch. Hence applicants are asked to consider very carefully their practice area when describing what they do.

### Practice area definition

The **practice area** of an engineer is defined (in the CPEng Rules and IPENZ Regulations for competence registers) as:

**practice area** means an engineer’s area of practice, as determined by—

- (a) the area within which he or she has engineering knowledge and skills; and
- (b) the nature of his or her professional engineering activities.

## Engineering problems

**Complex engineering problems** means engineering problems which cannot be resolved without in-depth engineering knowledge and having some or all of the following characteristics:

- Involve wide-ranging or conflicting technical, engineering and other issues
- Have no obvious solution and require originality in analysis
- Involve infrequently encountered issues
- Are outside problems encompassed by standards and codes of practice for professional engineering
- Involve diverse groups of stakeholders with widely varying needs
- Have significant consequences in a range of contexts

**Broadly-defined engineering problems** means engineering problems having some or all of the following characteristics:

- Can be solved by application of well-proven analysis techniques
- Are parts of, or systems within complex engineering problems
- Involve a variety of factors which may impose conflicting constraints
- Belong to families of familiar problems which are solved in well-accepted ways
- May be partially outside those encompassed by standards or codes of practice
- Involve several groups of stakeholders with differing and occasionally conflicting needs
- Have consequences which are important locally, but may extend more widely

**Well-defined engineering problems** means engineering problems having some or all of the following characteristics:

- Can be solved in standardised ways
- Are discrete components of engineering systems
- Involve several issues, but with few of these exerting conflicting constraints
- Are frequently encountered and thus familiar to most practitioners in the practice area
- Are encompassed by standards and/or documented codes of practice
- Involve a limited range of stakeholders with differing needs
- Have consequences which are locally important and not far-reaching
- Can be resolved using limited theoretical knowledge but normally requires extensive practical knowledge

## Engineering activities

**Complex engineering activities** means engineering activities or projects that have some or all of the following characteristics:

- Involve the use of diverse resources (and for this purpose resources includes people, money, equipment, materials and technologies)
- Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues,
- Involve the use of new materials, techniques or processes, or the use of existing materials techniques or processes in innovative ways

**Broadly defined engineering activities** means engineering activities or projects that have some or all of the following characteristics:

## Guidelines for Professional Engineers – Structural engineering

- Involve a variety of resources (and for this purposes resources includes people, money, equipment, materials and technologies)
- Require resolution of occasional interactions between technical, engineering and other issues, of which few are conflicting
- Have consequences are most important locally, but may extend more widely
- Require a knowledge of normal operating procedures and processes

**Well-defined engineering activities** means engineering activities or projects that have some or all of the following characteristics:

- Involve a limited range of resources (and for this purpose resources includes people, money, equipment, materials and technologies)
- Require resolution of interactions between limited technical and engineering issues with little or no impact of wider issues
- Have consequences that are locally important and not far-reaching
- Require a knowledge of practical procedures and practices for widely-applied operations and processes

## Guidelines for Structural Engineering

### Professional Engineering - Element 1

#### ELEMENT DESCRIPTION

- 1 Comprehend, and apply knowledge of, accepted principles underpinning widely applied good practice for professional engineering**

#### PERFORMANCE INDICATORS

- Has a Washington Accord degree or recognised equivalent qualification or has demonstrated equivalent knowledge and is able to:
  - Identify, comprehend and apply appropriate engineering knowledge
  - Work from first principles to make reliable predictions of outcomes
  - Seek advice, where necessary, to supplement own knowledge and experience
  - Read literature, comprehend, evaluate and apply new knowledge

#### GENERAL PRACTICE FIELD GUIDELINES

- This element is intended to show the candidate currently has the level of knowledge of a Washington Accord degree – as evidenced by an accredited Washington Accord degree (or recognised equivalent qualification) supported by on-going CPD, although applicants can demonstrate they have acquired the same level of knowledge through other learning processes.
- Applicants are able to apply that knowledge through work experience. The competence required by the standard is that of a 4-year Washington Accord degree graduate with typically 4 to 5 years post-graduation work experience.
- Qualifications other than Washington Accord equivalent may require knowledge assessment
- Applicants will be expected to show their ability to work from first principles and to comprehend and apply engineering knowledge – and evidence of this skill will be critical for non-Washington Accord qualified applicants in meeting this element of the standard

#### PROFESSIONAL ENGINEER

A Washington Accord (New Zealand 4-year BE degree) or recognised Washington Accord-equivalent qualification, if gained recently, is good evidence. Otherwise CPD records and work samples will be better evidence to demonstrate how the required level of knowledge was acquired and applied.

Work experience shows career progression in structural design and with exposure to site construction activities.

Evidence includes clear, logical hand written calculations laid out in a manner that another engineer can readily follow (in preference to calculations produced using products such as MathCAD) as good evidence of the applicant's understanding and application of structural engineering models.

## Professional Engineering - Element 1

### ELEMENT DESCRIPTION

#### **1 Comprehend, and apply knowledge of, accepted principles underpinning widely applied good practice for professional engineering**

Evidence shows how engineers have worked within the limits of their knowledge and when they have sought advice from other engineers (“knowing what you don’t know”). For example, if their skills do not cover vibrations within structures.

Evidence that demonstrates a good knowledge of the behaviour of structures - in particular a good knowledge of statics that shows the applicant is able to:

- assess structural actions in typical beam and column structures, bridge structures, wall structures or in slabs, and when these are subjected to gravity and lateral loads with and without resorting to the use of a computer – this is an essential skill for structural checking and for analytical modelling;
- assess the structural strengths and deflections of members quickly without resorting to a computer,
- define load paths (both vertical and lateral) through the overall structure and through structural details (such as in the sample calculations)
- draw a free body diagram.
- Draw an engineering sketch with appropriate referencing
- Demonstrates knowledge of common structural materials
- Convey the design philosophy (ie the design features report)
- Define the basic failure hierarchy of a structure, ductility levels.
- Demonstrate understanding of relative stiffness and displacement compatibility.
- Understands basic constructability requirements e.g erection procedures/sequences, splices required for transport,

## Professional Engineering - Element 2

### ELEMENT DESCRIPTION

- 2 Comprehend, and apply knowledge of, accepted principles underpinning good practice for professional engineering that is specific to the jurisdiction in which he/she practices (For CPEng assessment this relates to the jurisdiction of NZ)**

### PERFORMANCE INDICATORS

- Demonstrates an awareness of legal requirements and regulatory issues within the jurisdictions in which he/she practices
- Demonstrates an awareness of and applies appropriately the special engineering requirements operating within the jurisdictions in which he/she practices

### GENERAL PRACTICE FIELD GUIDELINES

- Evidence that shows the applicant understands and works in compliance with the relevant regulatory framework - for example, compliance regimes covered by statute or local body by-law, mandatory standards or codes of practice.
- Demonstrate an understanding of situations and responsibilities when/where standards/guidelines/specifications need to be modified or amended to suit specific situations and document the resulting implications

### PROFESSIONAL ENGINEER

Evidence that the applicant is able to comprehend and apply knowledge of:

- Building Act and New Zealand Building Code
- Loading Standards, for example AS/NZS 1170, or the Transit NZ Bridge Manual
- Relevant structural materials standards, for example NZS 3101 for concrete structures, NZS 3603 for timber structures, and NZS 3404 for structural steel.
- Critical detailing for seismic actions and structural earthquake engineering as practised in New Zealand
- Technical specifications of materials, for example steel, cement, epoxies, etc
- Resource Management Act, occupational safety and health regulations and the Construction Contracts Act where relevant
- NZSEE 'Red Book'
- For reinforced concrete work (as appropriate) evidence of spiral anchoring, handling of steel (300 and 500 grade), diaphragms, connections, hollow core floor subassemblies

Evidence that candidates access recent material from the following sources:

- Department of Building and Housing advisory notices and publications (Codewords etc)
- SESOC, NZ Geotech Society, NZ Concrete Society, HERA, SCNZ, NZSEE and NZTDS publications and journals on matters of relevance
- NZCIC documentation guidelines
- BRANZ publications
- Relevant TA/BCA policy documents.

Evidence that shows the applicant understands the skill base and capability of the local NZ construction industry and its practices.

## Professional Engineering - Element 3

### ELEMENT DESCRIPTION

**3 Define, investigate and analyse *complex engineering problems* in accordance with good practice for professional engineering**

### PERFORMANCE INDICATORS

- Identifies and defines the scope of the problem
- Investigates and analyses relevant information using quantitative and qualitative techniques
- Tests analysis for correctness of results
- Conducts any necessary research and reaches substantiated conclusions

### GENERAL PRACTICE FIELD GUIDELINES

- Evidence demonstrates knowledge of technical fundamentals (including initial specification and brief in terms of client perceptions, use of engineering design standards and specifications) to scope a complex engineering problem
- Examples of methodologies used for analysis, prediction and choice outside those encompassed by standard codes (including preparing functional design requirements, addressing design concepts, and determining possible design constraints)
- Evidence of experiments conducted, prototypes built or simulations performed to test analyses
- Evidence of literature searches, use of network of peers to gather information on approaches to problem solving

### PROFESSIONAL ENGINEER

Evidence that shows the applicant is able to investigate and assess options, define and analyse complex structural problems with only limited assistance from more senior engineers includes:

- Work samples and/or reports, including (hand written) engineering calculations, and analysis models if appropriate

Defining and scoping the problem

- Defining constraints that the designer needs to work within – for example, building architecture, available materials, site constraints, operational requirements, budget
- Identification of missing or required information - site related problems – ground conditions, is the structure likely to be affected by settlement? Wind analysis – require wind tunnel tests? Development of briefs for external consultants in order to obtain missing information.
- Define loads
- Defining acceptance criteria for key parameters.

Investigate and analyse various solutions

- Research material properties, for example reinforced concrete – shrinkage, early age strength etc...
- Selection of appropriate analytical process, eg static vs. dynamic
- Define model including boundary conditions e.g soil structure interaction, staged

## Professional Engineering - Element 3

### ELEMENT DESCRIPTION

#### **3 Define, investigate and analyse *complex engineering problems* in accordance with good practice for professional engineering**

- construction considerations, diaphragm flexibility etc.
- Conduct analysis and can correctly interpret results e.g. chooses an appropriate building period, can correctly determine diaphragm design actions etc.
- Verify the authenticity and conducts sensitivity analysis of results

The calculations submitted for first time applicants could include basic checks, e.g. sum of reactions approximately equals what is expected, or the deflected shapes been checked to see that they 'look' right.

Note that for structural engineering there is likely to be several iterations between elements 3 and 4 – that is, scoping and analysis and developing of solutions

## Professional Engineering - Element 4

### ELEMENT DESCRIPTION

**4 Design or develop solutions to *complex engineering problems* in accordance with good practice for professional engineering.**

### PERFORMANCE INDICATORS

- Identifies needs, requirements, constraints and performance criteria
- Develops concepts and recommendations that were tested against engineering principles
- Consults with stakeholders
- Evaluates options and selects solution that best matched needs, requirements and criteria
- Plans and implements effective, efficient and practical systems or solutions
- Evaluates outcomes

### GENERAL PRACTICE FIELD GUIDELINES

- Evidence of personal responsibility taken in a project or significant task from the end of an investigation phase showing design solutions developed which resulted in all objectives being met. To indicate the level of complexity, describe involvement in detail. This can be over a range of similar projects/tasks, or one overall project/task with multiple components.

### PROFESSIONAL ENGINEER

#### Design and develop solutions

- Demonstrate how the structural form evolved to meet the constraints (for example constructability considerations, resources, etc)
- How materials are suitable for the solution
- Design of subsystems and opportunity for standardisation
- Size of members, reinforcing bars, length of welds etc; connection design and detailing
- Constructability - Does the structure fit together? Do weld details make sense? Can they be made? For reinforced concrete – does the design indicate that the applicant has thought of how the reinforcing fits together, and the concrete placed and vibrated?
- Documentation and detailing of design solution - Can the applicant prepare and check drawings?
- Prepare observation/monitoring schedule for critical parts of construction process
- Recognise the need for expert assistance, respond positively to reviewers
- Documentation showing load paths (vertical and lateral) have been clearly identified for gravity, seismic and wind loadings

## Professional Engineering - Element 5

### ELEMENT DESCRIPTION

**5 Be responsible for making decisions on part or all of one or more *complex engineering activities***

### PERFORMANCE INDICATORS

- Takes accountability for his/her outputs and for those for whom he/she is responsible
- Accepts responsibility for his/her engineering activities

### GENERAL PRACTICE FIELD GUIDELINES

- Demonstrate effective self-management skills (including: undertaking professional development, setting own goals, practising effective time management, and recording professional development activities).
- Undertake and accept responsibility for higher levels of engineering activity, such as preparing and presenting submissions, estimates, project funding requests, annual planning activities and reports to client and senior management. Be responsible for and conduct public and stakeholder consultation and meetings

### PROFESSIONAL ENGINEER

The work history forms should record work where the applicant has taken responsibility for complex projects. The applicant can summarise in his/her 'Competence Self-review' where he/she has:

- Been responsible for making decisions and dealing directly with the consequences (as opposed to simply implementing decisions made by others) by documenting specific instances of such experience.
- The attributes that made the work complex – refer to definitions on CA03 (or CA13) form.

Evidence could include how the applicant:

- Handled significant changes to the requirements of a project, either due to a changing brief or unexpected site conditions;
- Handled a situation where there were unforeseen problems or when things 'went wrong', and the actions he/she took in resolving the problem(s);
- Was involved in preparing contracts, evaluating bids, and performing site inspection work;
- Was involved in reviewing contracts, preparing bids, and in managing the work required to get a project built

As CPEng is a quality mark of the applicant's ability and maturity to work as an independent professional structural engineer, evidence must show the applicant has been solely responsible for a wide range of the aspects of a particular project.

## Professional Engineering - Element 6

### ELEMENT DESCRIPTION

**6. Manage part or all of one or more *complex engineering activities* in accordance with good engineering management practice**

### PERFORMANCE INDICATORS

- Plans, schedules and organises projects to deliver specified outcomes
- Applies appropriate quality assurance techniques
- Manages resources, including personnel, finance and physical resources
- Manages conflicting demands and expectations

### GENERAL PRACTICE FIELD GUIDELINES

- Project Management responsibility for a group of smaller projects and engineering activities or a significant part of a larger project
- Undertake site management activities such as the Engineer/Client/ or Contractor's Project Manager.

### PROFESSIONAL ENGINEER

Evidence (with examples) of having been responsible for managing a complex structural project includes:

- planning, scheduling, organising (critical path planning, resource allocation, setting and monitoring budgets) and achieving results (this might be a construction site project or it may be organising a design team to complete a design);
- addressing issues such as plant accessing the site, safely building the design (including temporary work etc).
- handling conflict between 'demands and expectations' such as trying to deal with an unreasonable deadline (what compromises had to be made to get enough done in time to keep 'everyone happy' whilst still being able to complete the outstanding items before it is too late?)
- maintenance of a complete and thorough job file for each project – which combined with properly archived computer analyses, calculations, drawings, reports and contract documents, can be used to 'reconstruct' the course of a project at some (unexpected) time in the future;
- organising and co-ordinating other professionals – fire and building services engineers, geotechnical engineers, structural designers, architects and architectural designers;

For practitioners who are responsible for other engineering staff, evidence of their ability to identify poor practices and poor designs being carried out by persons under their control – and how these situations were handled (for example, training, mentoring, coaching etc.).

## Professional Engineering - Element 7

### ELEMENT DESCRIPTION

#### 7 Identify, assess and manage engineering risk

### PERFORMANCE INDICATORS

- Identifies risks
- Develops risk management policies, procedures and protocols to manage safety and hazards
- Manages risks through 'elimination, minimisation and avoidance' techniques

### GENERAL PRACTICE FIELD GUIDELINES

- Evidence of training in risk management
- Knowledge of (not necessarily the use of) specialist software used for risk management
- Consider risks within alternative designs/timings/solutions/options
- Considers financial risk and/or potential liability to company.

### PROFESSIONAL ENGINEER

Demonstrate that engineers use good QA procedures and have take steps to identify and address risk in relation to:

- Health and safety
- On-site practice, errors or inappropriate use of design, correction processes
- Handling uncertain data – doing 'what if' analyses
- Adequacy of resources to do a good job
- Candidate's ability to recognise what he/she does not know
- Confusion over documentation, misuse of documentation
- Need to observe construction
- Document/drawing approvals process.
- Overview and integration of overall design process – for example are there processes to ensure that computer analyses accurately represent the structure as finally designed and documented
- Change control process.
- Financial risk versus liability
- setting project costs taking account of risks
- Identifying who share shares risks and how this is costed and incorporated into project documentation - cost estimation and contingency
- Engineering of new materials
- Retrofit constructions - Historic nature of buildings and constraints on design
- Safe practical construction
- Estimates, project components (such as geotech, structural), safety, work-sites, checklist engineering, toolbox engineering,
- risk management training
- qualitative and quantitative modelling; rank risk;

## Professional Engineering - Element 7

### ELEMENT DESCRIPTION

#### **7 Identify, assess and manage engineering risk**

- Safety audits – team member/leader
- Alternative design/timing/solution
- Stakeholder/consultation planning and risks to project from adverse consultation outcomes

It is essential that engineers appreciate the effect on their client and other affected parties of their failure to perform. This often necessitates the engineer 'speaking up', especially in the early stages of work, when others want things that may not be achievable with regard to programme, fees, cost and budget.

Candidates should show their understanding of risk by giving examples of situations where they have identified and managed a risky situation.

Also coming under Ethics, it is imperative that engineers do not think that failure to perform professionally is OK as long as it does not come back as a PI claim, and the resulting problems become someone else's to deal with.

<b>Professional Engineering - Element 8</b>	
<b>ELEMENT DESCRIPTION</b>	
<b>8</b>	<b>Conduct engineering activities to an ethical standard at least equivalent to the relevant code of ethical conduct</b>
<b>PERFORMANCE INDICATORS</b>	<ul style="list-style-type: none"><li>• Demonstrates understanding of IPENZ and/or CPEng codes of ethics</li><li>• Behaves in accordance with the relevant code of ethics even in difficult circumstances (includes demonstrating an awareness of limits of capability; acting with integrity and honesty and demonstrating self management)</li></ul>
<b>GENERAL PRACTICE FIELD GUIDELINES</b>	<ul style="list-style-type: none"><li>▪ Evidence of exercising judgement on own competence – outline actions taken when confronted with work outside own area of competence</li><li>▪ Evidence of managing conflicts of interest – description of actions taken to resolve</li><li>▪ Evidence of quality assurance procedures and risk management methodologies used in professional engineering practise</li></ul>
<b>PROFESSIONAL ENGINEER</b>	<p>The ‘Competence Self-review’ examples should show how the applicant has:</p> <ul style="list-style-type: none"><li>• Demonstrated a clear understanding of his/her competency limits and how he/she has worked within these limits;</li><li>• Had to stand up for professional standards (refer to the code of ethical conduct, and outcomes from Environment Court) in the presence of pressure to ‘take short cuts’;</li><li>• Shown an understanding of corporate behaviour – client/contractor/ consultant relationship and how he/she acted when exposed to compromise (to avoid being trapped by inappropriate ‘corporate behaviour’)</li><li>• Identified and taken action to resolve conflicts of interest; What resistance/conflict has the applicant experienced in such situations? How did he/she react when someone else tried to ‘deflect’ the candidate from potentially unethical behaviour?</li><li>• Had open and honest communication with stakeholders</li><li>• Applied his/her understanding of the code of ethics describing situations where he/she had faced and resolved an ethical dilemma satisfactorily.</li><li>• Engaged with the profession as a whole, and helped foster an environment where day-to-day practice encourages and maintains professional attitudes.</li><li>• Demonstrated behaviours expected of a competent structural engineer, such as honesty, openness to criticism, thoroughness, good site practices, being prepared to challenge and critically review, have an enquiring mind and an ability to question, debate and justify matters on a scientific basis.</li><li>• Accepted <i>constructive</i> criticism, <i>learnt</i> from own mistakes, and sought to improve practice. Useful work samples may include peer review correspondence.</li><li>• Recognised his or her obligations beyond the immediate client responsibilities – current and</li></ul>

## Professional Engineering - Element 8

### ELEMENT DESCRIPTION

**8 Conduct engineering activities to an ethical standard at least equivalent to the relevant code of ethical conduct**

future building owners, users etc.  
Shown an awareness of the limitations of graduate engineers, and must actively support, educate and encourage graduate engineers (and engineers in general) to 'learn their trade.'  
What happens on a project they work on 'when the budget is blown?' Do they complete the project to the best of their ability?

## Professional Engineering - Element 9

### ELEMENT DESCRIPTION

- 9 Recognise the reasonably foreseeable social, cultural and environmental effects of professional engineering activities generally**

### PERFORMANCE INDICATORS

- Considers and, where needed, takes into account health and safety compliance issues and impact(s) on those affected by engineering activities
- Considers and takes into account possible social, cultural and environmental impacts and consults where appropriate
- Considers Treaty of Waitangi implications and consults accordingly
- Recognises impact and long-term effects of engineering activities on the environment
- Recognises foreseeable effects and where practicable seeks to reduce adverse effects

### GENERAL PRACTICE FIELD GUIDELINES

- Evidence of addressing needs of key stakeholders (Iwi, historic places, archaeology, etc - consultation, and possibility for alternative design to reflect needs and aspiration of those affected)
- Evidence of life-cycle considerations in engineering designs – wastage, buildability, materials used, energy consumption and maintenance requirements during operational life, end-of-life issues (disposal and demolition)
- Identify the need for sustainable solutions to engineering and construction activities
- Evidence of actions taken to address health and safety and environmental implications of projects during and after construction/implementation

### PROFESSIONAL ENGINEER

Evidence demonstrating competence in this element may include:

- Reports illustrating how the applicant had personal input to decisions on design options or manufacturing processes were made based on minimising the impact on the environment – wastage, water contamination, run-off, energy savings, etc
- Work samples - where applicants have recognised and considered the wider social cultural and environmental aspects of an engineering project for which they were responsible.
- A design brief prepared for client approval, where the applicant considered the broader impact of
- Preliminary design options, or correspondence;
- Structural engineering reports which include discussions/concerns of affected parties, and recommendations with options and the 'pros and cons' of each option.
- Discussion and examples on Sustainability in Design & Construction and Lifetime costs

## Professional Engineering - Element 10

### ELEMENT DESCRIPTION

**10 Communicate clearly with other engineers and others that he or she is likely to deal with in the course of his or her professional engineering activities**

### PERFORMANCE INDICATORS

- Uses oral and written communication to meet the needs and expectations of his/her audience
- Communicates using a range of media suitable to the audience and context
- Treats people with respect
- Develops empathy and uses active listening skills when communicating with others
- Operates effectively as a team member

### GENERAL PRACTICE FIELD GUIDELINES

- Effective communication in English and other language (sign, Maori etc as appropriate) - orally and in writing
- Preparing, interpreting and presenting information, issuing clear and accurate instructions, interpreting instructions, and selecting appropriate methods of communication – for variety of audiences (one-to-one and one-to-many communications; technical and non-technical personnel etc)
- Evidence of acceptance by peers by attendance and active participation in meetings, work place activities, training courses etc where candidate presents points-of-view and debates the topic or issue
- Evidence of leadership - of self and others

### PROFESSIONAL ENGINEER

Evidence includes:

- Project reports that demonstrate clear thought process and conveyance of appropriate unambiguous information – either of a technical nature or as a communication to non-technical persons;
- Own application is an example of applicant's communications ability, and will be part of the evidence assessors consider;
- Examples of various forms that have been used to communicate information – has the applicant found these to be effective, and has he/she suggested improvements to improve communications?
- Leadership roles at meetings – leading technical discussion, presenting documents to influence decision makers (management, regulators, clients or other stakeholders);
- Correspondence – especially where the content of the correspondence had (potentially) significant consequences, such as contract related matters, issues involving regulators and related requirements, etc.
- Reference relevant evidence submitted for other elements (such as in competence self-review form – such as management of complex engineering activities, where applicant may have had to negotiate resources, timeframes and costs).
- Design feature reports that document structural concepts, load paths and loading assumptions.

## Professional Engineering - Element 11

### ELEMENT DESCRIPTION

#### 11 Maintain the currency of his or her professional engineering knowledge and skills

### PERFORMANCE INDICATORS

- Demonstrates a commitment to extending and developing knowledge and skills
- Participates in education, training, mentoring or other programmes contributing to his/her professional development
- Adapts and updates knowledge base in the course of professional practice
- Demonstrates collaborative involvement with professional engineers (NZ engineers for CPEng assessments)

### GENERAL PRACTICE FIELD GUIDELINES

- Maintains Continued Professional Development (CPD) records
- Identifies future needs and plans competence development accordingly
- Actively participates with professional bodies
- Participates in diverse engineering activities leading to learning and betterment of engineering skills by a combination of training internal to organisation and external CPD, and self directed learning
- Maintains a network of professional engineers – peer reviews, collaborative activities
- Evidence of reflecting and learning from mistakes with the benefit of hindsight

### PROFESSIONAL ENGINEER

'Good evidence' is evidence that shows the applicant has taken made a commitment to gaining new knowledge and apply it in his/her practice area, and includes:

- IPENZ CPD records
- Documentation of applicant actively taking responsibility for his/her own professional development, with appropriate balance between technical and "softer" learning ;
- Evidence of efforts made to actively seek out information on engineering failures, 'near misses,' contractual issues and the like – learning from own and others' mistakes, and avoid repeating them.
- networking with other professional engineers – especially important for sole traders and those in small practices or where few professional engineers are employed by company;
- mentoring, coaching or taking a leadership role in sharing new knowledge with peers;
- learning from peer reviews of own work – cite specific examples to illustrate learning.

## Professional Engineering - Element 12

### ELEMENT DESCRIPTION

#### 12 Exercise sound professional engineering judgement

### PERFORMANCE INDICATORS

- Demonstrates the ability to identify alternative options
- Demonstrates the ability to choose between options and justify decisions
- Peers recognise his/her ability to exercise sound professional engineering judgement

### GENERAL PRACTICE FIELD GUIDELINES

- Undertake complex and multi-criteria analysis as a part of exercising engineering judgement
- Takes a holistic approach in the development and implementation of engineering solutions, respecting other professional and individual inputs and demonstrating a balanced process to achieve desired outcomes.
- Undertakes decision making - uses technical, economic, social, environmental etc criteria when where there is a choice of options (e.g., what factors were taken into account in making the decision? What impact did those factors have? What were the benefits/compromises in making the decision?)
- Feedback and learning from one's peers (e.g. positive peer review of work)

### PROFESSIONAL ENGINEER

Candidates can demonstrate how they have evaluated options and exercised engineering judgement in:

- Competence self-review form – cite examples and highlight instances where personal input to decision making process. Reference other elements where evidence may also demonstrate engineering judgement – such as ethical behaviour, analysis and investigation of complex engineering problems, taking responsibility for decisions in complex engineering activities etc.
- Work history summary – reference calculations and/or reports (with further expansion as required – or include as work samples);
- A design brief prepared for client approval;
- Preliminary design options, and related correspondence;
- Structural engineering reports which include discussions/concerns of affected parties, and recommendations with options and the 'pros and cons' of each option.
- Discussion and examples on Sustainability in Design & Construction and Lifetime costs
- Demonstrates that technical judgements are in accordance with the intent of the relevant standard or code where not specifically covered within said documents.