Guidelines – Assessment of Recognised Engineer Category A

Contents

Purpose of guidelines

The purposes of these guidelines are to:

1. outline the regulatory environment in which a Recognised Engineer practises;
2. The roles and responsibilities of a Recognised Engineer;
3. 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 the applicant's evidence, is required to make a judgement on the applicant's competence.

Roles of a Recognised Engineer

The requirements and the roles of a Recognised Engineer are defined in the Building Act. A Recognised Engineer must be a Chartered Professional Engineer (as specified in section 149 of the Act).

Role of Recognised Engineer (Building Act)

1. Audit the classification of dams (as either Low, medium or high potential impact)
2. Prepare/Audit dam safety assurance programmes – only Category A Recognised Engineers can do this for medium/high potential impact dams

3. Review compliance with dam safety assurance programme for the annual dam compliance certificate

Required Competencies of a Recognised Engineer

The Building (Dams safety) Regulations establish two types of Recognised Engineer – Category A and Category B Recognised Engineers - and specify the competencies requirements for each.

Category A Recognised Engineer Competencies

Category A Recognised Engineers can do all of the functions specified in the Act, namely

1. Dam classifications
2. Prepare and audit dam safety assurance programmes
3. Review dam safety assurance programmes

A Category A Recognised Engineer is an engineer who meets the requirements set out in section 149 of the Act and is assessed by the Competency Assessment Board as demonstrating that he or she is able to practise competently in the area of dam safety engineering to the reasonable standard of a professional engineer practising in that area. The extent to which the person has experience and knowledge in any or all of the following things must be taken into account when assessing whether that person meets this standard:

(a) geotechnical principles:
(b) design principles including structural geotechnical seismic hydrologic and hydraulic principles:
(c) dam construction techniques:
(d) operation and maintenance of dams:
(e) surveillance processes:
(f) response to dam safety issues:
(g) emergency planning:
(h) emergency response:
(i) resolution of potential dam safety deficiencies:
(j) dam safety critical plant systems.

Category B Recognised Engineer Competencies

Category B Recognised Engineer can issue dam classification certificates for low potential impact dams only. Category B Recognised Engineers do not have to be assessed but are Chartered Professional Engineers who can self-declare that they satisfy the requirements of a Category B Recognised Engineer.

1. Meets the requirements of section 149 of the Building Act; and
2. Has general civil engineering experience.

Practice area definition

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 a summary of the professional engineering activities they perform. This description will guide the assessment panel when it performs the assessment. Assessment

panels are instructed to amend the applicant's practice area description if it finds a mismatch between the practice area description and the evidence provided. Hence applicants are asked to carefully consider how they describe their practice area.

The **practice area** of an engineer is defined 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

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

Good evidence for Assessment of Recognised Engineer

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 appropriate 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

RECOGNISED ENGINEER CATEGORY A

The engineer (Recognised Engineer Category A) will have a good knowledge of some or all of different dam and appurtenant structure types, design principles (geotechnical, hydrology etc), how the different dam types work, the critical factors in their safety, a knowledge of dam failures, failure modes applicable to different structures, instrumentation, surveillance, operations, maintenance, emergency planning etc.

He/she will demonstrate his/her ability to apply engineering principles in hydrology, hydraulics, geotechnical, seismic, civil and structural engineering and risk management in relation to dams safety engineering and appreciate key issues and potential effects. Formal qualifications may include post graduate training in dams related engineering, or speciality training in dams engineering, dams safety and/or dams surveillance courses.

Professional Engineering - Element 1

ELEMENT DESCRIPTION

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

The required knowledge will have typically been obtained by working with a variety of dam related employers where work place training and mentoring have been available.

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 New Zealand

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

RECOGNISED ENGINEER

Demonstrates through activities a working knowledge of:

- NZSOLD Guidelines and other relevant best practice guidelines
- Local government Dam Safety Guidelines (e.g. Auckland Regional Council if practising in Auckland)
- Building Act provisions and regulations relating to dams
- Resource Management Act as applicable to dam safety
- New Zealand seismic hazard criteria
- Recognised risk management standards or guidelines

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

RECOGNISED ENGINEER

Examples of complex engineering problems that demonstrate the ability to apply established design and construction principles for dam engineering include:

- Development of and participation in dam safety assurance programmes
- Performance analyses
- Failure modes analysis
- Safety reviews
- Dams safety deficiency investigations
- Consequence assessments
- Integration with asset management operations and flood management (including flood retention dams)

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.

RECOGNISED ENGINEER

Demonstrate knowledge and ability to apply established design and construction principles for dam engineering of new and existing structures. Examples include:

- preparation of dam safety assurance programmes;
- development of emergency action plans;
- specification of surveillance requirements, alarm levels and response actions;
- evaluation and response to surveillance data and dam safety issues;
- preparation and management of contracts relating to dam engineering;
- monitoring dam construction;
- management, analysis and remediation of dam safety deficiencies.

Dam safety engineering competence is at a broad level - breadth is more important than depth in this case, and is most likely developed after involvement in a diverse range of dams – typically will take several years to develop.

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

RECOGNISED ENGINEER

Track record of responsible roles in dams engineering projects and currently practising in dams engineering. Examples may include responsible roles in:

- Dam deficiency remediation;
- Dam safety reviews;
- Development of dam surveillance programmes;
- Design or construction or remediation of dams and appurtenant structures;
- Design and evaluation of flood management procedures/operations;
- Dam safety related issues.

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.

RECOGNISED ENGINEER

Examples of relevant management of complex engineering activities include management of:

- dam surveillance programmes;
- dam safety deficiency investigations;
- flood or dam stability studies;
- dam safety risk assessments
- safety reviews;
- new dam/appurtenant structure design or construction; and
- existing dam/appurtenant structure remediation or upgrades.

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.

RECOGNISED ENGINEER

Examples of evidence include:

- Carries out dam safety review evaluations.
- Confirms and reviews classification of dams with respect to consequences if dam fails – PICs (potential impact classification).
- Prepares and reviews dam safety assurance programmes.
- Carries out dam safety deficiency investigations and assessments
- Lead role in risk assessments
- Develops risk management strategies for dams.
- Develops responses to dam safety issues.
- Participates in emergency planning and response relating to dams

Professional Engineering - Element 8

ELEMENT DESCRIPTION

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

PERFORMANCE INDICATORS

- Demonstrates understanding of IPENZ and/or CPEng codes of ethics
- 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)

GENERAL PRACTICE FIELD GUIDELINES

- Evidence of exercising judgement on own competence – outline actions taken when confronted with work outside own area of competence
- Evidence of managing conflicts of interest – description of actions taken to resolve
- Evidence of quality assurance procedures and risk management methodologies used in professional engineering practise

RECOGNISED ENGINEER

Applicants should describe a situation in which an ethical dilemma was experienced, and the actions taken in response to the situation (as required for CPEng assessment). Situations where an engineer might be presented with an ethical dilemma may include technical debate regarding:

- Annual certification;
- Compliance with dam safety assurance programme
- Classification of dams;
- conflicts of interest;
- Requests or pressure to work outside one's area of competence;
- Having no financial interest in the dam of concern

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

RECOGNISED ENGINEER

Examples of evidence include:

- Involvement in Resource Management Act consent processes for dams;
- Consequence assessments (effects of failure)
- Potential impact classification
- Sustainability issues related to impact on communities, environment and use of natural resources;
- Heritage issues related to historic dams
- End of life issues relevant to old dams
- Impacts on environment during construction or remedial work?
- Expert witness?

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 the English or other language (sign, Maori etc) language - 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

RECOGNISED ENGINEER

Examples of evidence includes:

- Technical papers or documents to NZSOLD or other recognised organisations in the dams safety field;
- Production of clearly understood reports and documentation relating to design, construction and safety evaluation of dams;
- Participation in teams for dam engineering work.
- Role as an expert witness - Environment Court, resource consent hearings etc
- Role as a peer reviewer
- Communications with non-technical people (lobby groups, community leaders, etc);

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

RECOGNISED ENGINEER

Undertakes CPD activities in dam engineering, e.g.

- Reads dam publications and journals. (such as 'Hydro review', 'Water Power and Dam Engineering', NZSOLD guidance and newsletters, ANCOLD guidelines and ICOLD bulletins)
- Department of Building and Housing dam related guidance – DBH website, *Codewords* etc;
- Attends and/or participates in dam conferences and workshops. (such as NZSOLD symposiums, ANCOLD annual meetings and similar international events)
- Attends and/or participates in dam related technical group meetings; and
- Maintains relationships with others practising in the dams safety engineering area (eg NZSOLD members etc)
- Attends and participates in employer provided dam related training
- Maintains currency with relevant standards and codes;

Active involvement is essential and applicants need to show that they have a high level of networking with other professional engineers working in dams engineering.

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)

RECOGNISED ENGINEER

Recognition by peers of both dams safety engineering expertise and ability to exercise sound professional judgement, demonstrated in the field of dams safety engineering.

- Effective assurance programmes, monitoring and surveillance regimes, emergency management regimes;
- decisions in response to ethical dilemmas, steps to mitigate/minimise risk
- Decisions could relate to analysis and investigation; design or development of solutions to problems; decisions in management of complex engineering activities; risk management; ethical conduct; impacts on society, environment etc