IPENZ Transportation Assessment Guidelines

Evaluating Workplace Activities against the Professional Engineer Competence Standard and its Elements

General

These guidelines have been developed by a group of transportation practitioners, many of whom have experience in competence assessments. IPENZ plans to prepare guidelines for each of the currently used practice fields and publish them as a single document. At present, all existing guidelines are under review, and while the content is unlikely to change significantly, the format and 'packaging' will change. In the meantime, these guidelines are offered for use on a trial basis - feedback from users is most welcome. The goal in revising the guidelines is to offer consistent advice, reduce repetition, and focus on 'measurable' evidence for assessment.

IPENZ administer several quality marks for professional engineers – MIPENZ, CPEng and IntPE(NZ) – all of which are competence based. Assessments of competence are made by panels of peers who consider all elements of the competence standard holistically. The assumption underpinning assessments is that applicants will provide their best evidence to prove competence. The competence standard is defined in the CPEng Rules and the IntPE regulations, and these guidelines have been prepared to assist in gauging where the competence "bar" has been set, so that evidence of meeting the standard can be more clearly identified. Past experience has shown that a BE (Civil) Graduate with 4 to 5 years of appropriate engineering experience should be able to provide sufficient evidence to meet the competence requirements for these quality marks. The competence standard does not limit applications from those with a Washington Accord (or equivalent) qualification, but such engineers wishing to apply for professional level quality marks will need to show how they have acquired knowledge to the Washington Accord level (assessed through a knowledge assessment) and normally take longer to acquired the evidence required to meet the competence standard.

It is important to note, as indicated by the CAB, that applicants who are unable to demonstrate competence for any of the elements 1, 3 and 12 will not be successful in their application.

Regulations governing the Engineering Technologist Practitioners (ETPract), International Engineering Technologists (IntET) and Certified Engineering Technicians (CertETn) registers enable assessment panels make recommendations for registers for which the applicant had not applied. This would occur if the assessment panel considered that the evidence showed that the level of complexity of the engineering performed by the applicant (in respect to elements 3, 4, 5 and 6) more appropriately matched that of other quality marks. For example, the assessment panel might recommend that a CPEng applicant be approved for the ETPract register if it found the engineering problems/activities better met the definition of 'broadly defined' rather than 'complex' engineering.

Transportation covers a wide range of engineering, with most engineers coming from a civil background, but not exclusively. Different areas of Transportation to consider;

- Capital Projects
- Network Operations/Road Management and Maintenance/Programme Management/Asset Management
- Transportation Planning
- Traffic Engineering
- Road Safety
- Business Management/Leadership

Applicants will be from a variety of backgrounds, working for Contractors, Road Controlling Authorities, Consultants, Self Employer, etc and be engaged in a cross section of transportation fields, including investigation, design, maintenance assessment, construction, supervision, quality assurance, project management, group management, etc.

The guidelines are aimed at the CPEng level of competence – that is the 'minimum competence for a reasonable professional engineer'. Refer Chartered Professional Engineers of New Zealand Rules (No 2) 2002 and Amendments 2004 and 2005.

These guidelines are intended to assist applicants, such as Washington Accord qualified applicants and experienced non-BE qualified applicants (eg Sydney Accord or Dublin Accord qualified engineers or others with related qualifications recognised by IPENZ), who have not previously been assessed to prepare an appropriate portfolio of evidence for CPEng assessment. The guidelines are not intended to be exhaustive, rather they are intended to indicate examples of good evidence within each element that they can relate too and therefore expand on or adapt to their specific examples.

How to Use the Guideline Content

It is not intended that Applicants will be able to relate their qualifications, experience and skills to all of the *Examples of Good Evidence* listed in the guidelines, rather the intent is that Applicants can see several examples that relate to them and use this as a guide when preparing their portfolio of evidence.

Cross Referencing and Review

Applicants are urged to cross reference their portfolios of evidence. In doing so Applicants will find it much easier to check that they have adequately covered each of the elements and Assessors will be able to follow the portfolio of evidence succinctly. A recommended way to do this is to use an exposed RHS tab method to link each element from Work History through to Self Assessment through to Work Examples (eg for Element 1 use the number 1/1 to tab where competence for

example 1 of Element 1 can be found,1/2 for example 2, etc – in the work examples a highlighter can be used to isolate the specific aspects the applicant would like Assessors to comprehend – ditto for all other Elements).

Use a mentor or colleague with CPEng status to review an application before submitting to IPENZ. Note that some organisations have this as a formal process.

Applicants should ensure that they clearly identify their role, involvement and level of responsibility in projects, tasks, etc. Avoid the use of "we…." or "the team did……" and focus on what you personally did and learned on the project. Don't be concerned about describing problems; how you overcame these is important and is also a demonstration of your development and progression.

Continuous Improvement

This guideline will be subject to continuous improvement. Applicants and Assessors are encouraged to pass feedback to;

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Element	Examples of Good Evidence
1. Comprehend and apply knowledge of the accepted principles underpinning widely applied good practice in engineering. • 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 • Seeks advice, where necessary, to supplement own knowledge base and experience • Read literature, comprehend, evaluate and apply new knowledge	• This element is intended to show the candidate has an approved Washington Accord degree (or equivalent training) and has the level of knowledge and working experience and competence of the standard expected of a graduate with at least 4 years working experience after attainment of a Washington Accord degree. • BE (Civil), ME(Transportation) or any other relevant formal assessed qualifications are usually considered as equivalent to a Washington Accord degree, however, guidance and advice from IPENZ may be required • An applicant possessing other qualifications must be able to demonstrate they have 'bridged the gap' from an NZCE (Civil) or NZ Diploma or BEngTech (3 year degree). Early advice should be sought from IPENZ before submitting an application as a knowledge assessment may be required. • NZCE (Civil), NZ Diploma or BEngTech applicants with appropriate experience (and who can demonstrate this and other competencies) will be expected to show their ability to work from first principles and to comprehend and apply engineering knowledge. • The applicant undertakes relevant CPD for continued renewal and upgrading of their knowledge • The applicant actively participates with professional bodies and can demonstrate a diversity of engineering activities leading to learning and betterment of engineering skills by a combination of internal to organisation and external CPD • The applicant attends industry-based training courses and seminars–as provided by organisations such as IPENZ, Transit, LTNZ, Roading NZ, REAAA, NZIHT, etc (eg Road Safety Engineering Workshop, Project Evaluation, INGENIUM Conf, Roading Symposium, etc). • To gain knowledge the applicant participates in appropriate work place activities, such as scheme analysis, contract and project management , transportation/traffic planning, design, evaluation activities • Prepare and interpret design drawings and calculations For applicants not previously assessed, the above should be supported by work samples.

Element	Examples of Good Evidence
2. Comprehend and apply knowledge of the accepted principles underpinning good practice for professional engineering that is specific to New Zealand. ▪ 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	• Preparation of design solutions quoting principles underpinning good practice application (eg horizontal/vertical alignment and its match with the environment; implementing contract specification through the construction phase of a project; select, specify and construct maintenance measures such as reseals, side drainage, rehabilitation, etc). • Demonstrate awareness of transport studies, the principles used and solutions developed (eg corridor studies, traffic impact assessment, etc) • Awareness of relationships between economic development and the provision of transportation facilities – undertaking transportation assessment studies and investigations and demonstrating how these fit into national and regional local transport policies • Considers use of resources (eg aggregates and quarry sites); resource planning (materials, labour, plant); preparing, implementing and monitoring temporary traffic management plans; • Application of knowledge of RMA, LTMA, NZTS, regional land transport strategy and similar policy, also Acts, Regulations and Codes of Practice • Familiarity with and use of NZ Standards; COPTTM; LTNZ guidelines; AUSTROADS; Transit Guides, Standards and Specifications, Manuals/Guidelines; Service Authority requirements; local authority standards/guidelines • Involvement in consultation, negotiations with the NZ public and stakeholders • Understand and apply New Zealand (national or local) requirements related to environmental guidelines for noise, air quality, resource usage, design standards, pavement and surfacing standards, traffic engineering standards (eg traffic signals, MOTSAM I, II and III, Traffic Control Devices Rule and other Transport Rules), utilities and services, liaison with authorities (at all stages of a project); temporary traffic management for construction works • Be able to demostrate an ability to adapt guidelines (eg national to local) in project/operational situation/s • Health and Safety, awareness of statutory obligations and planning to overcome any issues from the client, consultant or contractor perspective • Quality management activities, from the client, consultant or contractor perspective • Seek and undertake continuous improvement activities to add value for clients and employers • Have 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 • Undertake consultation with diverse stakeholders such as Historic Places Trust, Iwi, etc. • Understand and apply Treaty of Waitangi requirements, • Be aware of good urban design principles [eg should cater for all road users (pedestrian and cyclist), green space, local roads should have “slow road” features (traffic calming, etc), collector roads balance needs] IPENZ Practice Notes Note – the above evidence could be approached from different perspectives, such as construction, aviation, maritime, road and rail, and other modes of transportation,

Element	Examples of Good Evidence
3. Define, investigate and analyse complex engineering problems in accordance with good practice for professional engineering. ▪ 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	• Demonstrate an understanding of, and ability to undertake and plan, investigations into complex issues and situations, including identifying and breaking-down problems and scenarios related to transportation networks or parts thereof. • Define, investigate and analyse constraints for a given situation or project • Develop asset management plans • Undertake typical asset management activities and investigations, such as inspection of infrastructure features (eg bridges, road surface, identify problems, undertake inspections, develop an infrastructure inventory and programme required work programmes and activities • Undertake site investigation activities, multi directional and multi modal traffic count planning data gathering and analysis, quality assurance activities and similar activities • Prepare traffic management plans, including staging. Undertake auditing of installed plans and ongoing management supervision of the contractor • Undertake pavement design and geometric layout tasks using relevant Austroads, Transit or other RCA Guides • Identify strategic issues, for further analysis, where relevant and develop policies and/or strategies that address these strategic issues • Undertake project specific stakeholder consultation • Demonstrate an understanding of urban design principles (eg pedestrian and cyclist, green space, traffic calming, etc) related to transportation • Undertake transportation planning modelling activities, both with and without suitable data and information (select inputs, use standard techniques and analysis, validate results, prepare suitable reports highlighting assumptions, how validated and outcomes derived). Document use of specialist software, application of statistical tests, tests against known standards, and analysis results • Arrange/assess design surveys, collect data, validate data, undertake analysis and reporting • Undertake quantity and estimating activities • Apply engineering knowledge and interpretation and application in defining and analysing design requirements. Activities can be related to all forms of transportation and construction and management of these facilities

Element	Examples of Good Evidence
4. Design or develop solutions to complex engineering problems in accordance with good practice for professional engineering. ▪ 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	• Show evidence of first hand responsibility taken for 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. • Undertake design or construction activities relevant to the related project for a large project component or numerous smaller (can be similar) components • Consultation with stakeholders . Will include resolving mitigation measures. • Demonstrate an understanding of the affects and effects of traffic management planning (permanent and temporary) as related to traffic flow, composition and density • Develop generic or project specific traffic management plans for a major project (including staging) or a number of smaller projects for a network (eg reseals) or an intense network component (eg interchange) • Apply and use transportation modelling tools (eg Emme/2, SATURN, SIDRA, dTIMs, CIRCLY, TRIPS, etc), at a higher level than simple data input (manipulate and understand inputs, outputs and assumptions of models – make judgements on selection of software (and differences and correct selection where there is a choice) and results; prepare report and make recommendations s • Appreciate and understand uncertainty in modelling and design • Undertake validation, assessment and checking of all forms of engineering design and calculation • Undertake full site survey and set out • Quantities and estimates for projects • Prepare treatment selection and surfacing programmes; manage and supervise sealing and surfacing contracts on local roads and urban highways • Design and supervise or manage and construct basic road layout projects under supervision of senior engineering staff. Construction phase will typically be site representative or contractors representative and involve management of contractor sub-contractors progress claims, on site resolution, etc. (This eg is also relevant to Element 6) • Undertake design and contract management under the supervision and mentoring of more experienced staff (Typical work includes developing options and proposing solutions for all forms of transportation, such as shopping centre car park layout design, intersection design, car park building; construction site access; alternative design proposals; plan and site layout, construction activities. Applying standard solutions such as TLA Engineering Standards should be considered under Element 3))

Element	Examples of Good Evidence
5. Be responsible for making decisions on part or all of one or more complex engineering activities. ▪ Takes accountability for his/her outputs and for those for whom he/she is responsible ▪ Accepts responsibility for his/her engineering 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 • Drafting of evidence for a senior colleague to present at hearings or preparation and presentation of evidence for a lower level project at hearings • Undertake responsible levels of project management, from the perspective of the client, engineer or contractor • Determining and agreeing project scope with clients • Checking of plans, designs, schemes • Existing network and project safety audit participation as a team member • Presentation to public/stakeholders • Take responsibility for the preparation of project estimating from both client and contractor perspective; be aware of model uncertainty in analysis and also cost estimating • High awareness of transportation systems – trip generation, human factors, sustainability, etc • Include in work examples- economic analysis of project options to arrive at preferred option; assess horizontal and vertical alignment in respect of speed environment, seal design, pavement design, etc • Undertake site supervision of work elements or packages or minor projects and subcontractors • Undertake site management roles such as the Engineer's or Contractor's Representative Consideration of the wider inputs of a multi-disciplinary team and decision making and relationships with other disciplines such as planners, urban designers etc can be considered under this element.

Element	Examples of Good Evidence
6. Manage part or all of one or more *complex engineering activities* in accordance with good engineering management practice. ▪ 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	• Manage projects or a series of tasks or resources (Rule 7 defines resources as including people, money, equipment, materials and technologies) • Undertake Elements 3-5 by taking responsibility for inputs and outputs • Managing transportation studies involving multiple stakeholders • Manage commissioning and post construction monitoring of a new facility • Take responsibility for full estimating and tender submission activities, project management and budgets (preparation and monitoring reporting) • Programming, allocation of resources, responsibility for personnel • Co-ordination/programming and management of staff and other resources to complete tasks and projects. Communication of programme to team members and others • Project Management responsibility for a group of smaller projects and engineering activities or a significant part of a larger project • Undertake and manage quality assurance activities • Undertake site management activities such as the Engineer/Client/ or Contractor's Project Manager (work at higher level than Element 5) • Manage multi-disciplinary teams • Present findings to groups, stakeholders, etc Physical works contracts (supervision/management) need high complexity (such as involved client contractor/stakeholder/urban & high traffic volume motorway work) to be considered under this element. It is unlikely that routine highway maintenance contract activities are more suited to element 5.

Element	Examples of Good Evidence
7. Identify, assess and manage engineering risk. ▪ Identifies risks ▪ Develops risk management policies, procedures and protocols to manage safety and hazards ▪ Manages risks through 'elimination, minimisation and avoidance' Techniques	• Document risk at various project phases: at concept/scheme could be estimate related, resource consent, demand analysis; at design stage extent of geotechnical coverage, cost escalation; at construction stage, sub surface variation, weather. • Identify risk and opportunities – estimates, project components (such as geotech, structural), road safety proofing, work-sites, checklist engineering, toolbox engineering, etc, • Show evidence of training in risk management • Undertake qualitative and quantitative modelling; rank risk; • Undertake Road Safety Audits • Undertake Treatment at Crash Locations Studies • Undertake audits on contractor systems, including safety and quality • Consider risks within alternative designs/timings/solutions/options • Cost estimation and contingency and project management • Balancing of options • Stakeholder/consultation planning (identifying risks to project from adverse consultation outcomes) • Knowledge and application of the risk management standard (AS/NZS 4360 Risk Management), Transit estimating procedures and contract management manuals • Preparation and implementation of Risk Management Plan • Knowledge of (not necessarily the use of) specialist software used for risk management

Element	Examples of Good Evidence
8. Conduct engineering activities to an ethical standard at least equivalent to the relevant code of ethical conduct. ▪ 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)	• Understand and apply IPENZ Code of Ethics • Understand the respective roles of the Engineer to the Contract and the Contractor's Manager • Be aware of personal capabilities and know when to seek input from more competent advisors • Personal day-to-day behaviour – stand up for professional standards (refer to the code of conduct) • Understand and apply the concepts of good environmental management and sustainability. • Understand the role of an engineer in a court • Understand the role of an expert (witness, engineer etc) • Understand relationships with other professionals and management • Understand corporate behaviour – client/contractor/ consultant relationship • Identify and resolve conflicts of interest • Understand compromise – not being trapped by corporate behaviour • Open and honest communication with stakeholders • Prepare and present evidence and reports to Employer/Client/Court/Council or others – identifying the extent of experience and expertise • Understand typical ethical issues in contract bidding/admin, managing contractors etc? • Contracts – public interface is dealt with honestly, in a timely manner, ensuring closure • Dealing with stakeholders/customers (often the client) – listen to issue, take details accurately, investigate, develop an answer, close communication loop
9. Recognise the reasonably foreseeable social, cultural and environmental effects of professional engineering activities generally. ▪ 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	• Identify the need for sustainable solutions to engineering and construction activities (could include issues related to multi-modal transport, travel demand management, consider future possible needs for transport (eg ageing populations etc), use of resources • Understand and apply NZTS objectives within a multi-criteria assessment framework • Consider alternatives and options (trade-offs between competing interests etc) • Undertaking adequate project evaluation and use of correct and justifiable inputs to benefit cost analysis • Identify community severance and other social impacts of roading, traffic and transport schemes • Understanding of needs of key stakeholders (Iwi, historic places, archaeology, etc - consultation, and possibility for alternative design to reflect needs and aspiration of those affected) • Consider health and safety and environmental implications of projects during and after construction

Element	Examples of Good Evidence
10. Communicate clearly to other engineers and others that he or she is likely to deal with in the course of his or her professional engineering activities ▪ 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.	• Research, preparation, and content layout of formal reports and evidence and supporting documentation. May accompany a senior colleague to get hearing or Environment Court exposure • Preparation of reports for specific audiences; addressing specific topic/needs – eg technical presentations, conference presentations, reports for clients, public; stakeholders; politicians; Court • Ability to stand up and speak about a subject – supported by presentation material or similar and show evidence of this skill • Active participation in IPENZ activities • Show evidence of acceptance by your peers by attendance and active participation in meetings, work place activities, training courses etc where you present points-of-view and debate the topic or issue • Oral presentations to internal and external groups; public meetings and hearings • Team membership and leadership activities and communication to others • Interaction with other engineers – wider disciplines and offices to hear other points of view
11. Maintain the currency of his or her professional engineering knowledge and skills. ▪ 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 assessment)	• Continued Professional Development (CPD) records • Attendance and/or presentation to conferences and workshops • Membership of IPENZ Transportation Group or similar (REAAA, IHT, etc) • Knowing about and understanding changes within the profession and industry • Sharing achievements with others – development of best practice, demonstration of understanding of new policy, documents, current affairs etc • Undertake advanced or supplemental training (can include engineering, management or similar activity) • Undertake relevant reading and/or research as a supplementary reference or source of knowledge to support your engineering and management activities and role (can be to establish a first principles approach)

Element	Examples of Good Evidence
12. Exercise sound professional engineering judgement. ▪ 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.	• Undertake decision making - where there is a choice of options (eg using economic, social and environmental criteria), including justification, learning from mistakes and the benefit of hindsight • Respect others points of view and decisions and peers reviewing your work • Undertake peer review and recognise responsibilities • Responding (in professional manner) to and resolving issues arising from a peer review/audit/consultation, constructive criticism • Undertake complex and multi-criteria analysis as a part of exercising engineering judgement • Feedback and learning from one's peers (eg good positive peer review of work) • Appreciates social/economic/technical balance in transport solutions • Evidence of learning from project experience ("school of hard knocks") • Organisation/management/leadership awareness and activity