A PILOT STUDY OF THE APPLICATION OF DEGREE APPRENTICESHIPS IN NEW ZEALAND: A FOCUS ON INFRASTRUCTURE ASSET MANAGEMENT

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Tertiary Education Commission
Te Amorangi Mātauranga Matua

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA
UNIVERSITY OF NEW ZEALAND

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A report for the Tertiary Education Commission

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LIMITATIONS

This report represents the views of a sample of employers that are engaged in infrastructure asset management. These views may not represent the broader view of this sector. As this is a pilot programme the findings from this work will form the basis for wider consultation from this particular engineering sector during phase 2 of this pilot programme.

1. Summary

Commissioned by the Tertiary Education Commission (TEC), through the Engineering-to-Employment (Engineering e2e) programme, Professor Jane Goodyer (Massey University) and her research team facilitated a group of engineering employers and Institutes of Technology and Polytechnics (ITPs) representatives to develop a Degree Apprenticeship Standard in Infrastructure Asset Management. The development of the standard, in an area of impending engineering employee shortage, was the first phase towards development of associated assessments, programmes and ultimate accreditation.

In association with the Institute of Public Works Engineering Australasia (IPWEA) and other local networks, 17 participants (with interests and responsibilities in asset management) were identified and invited to participate in the pilot study (March – June 2017). Participants included consultants, contractors, clients and tertiary education providers, from rural, regional and urban centres; predominantly from the lower North Island. The research team travelled to meet with participants individually to explain the project and seek their initial views about Degree Apprenticeships. This information formed the basis of the first draft of the standard which was discussed at the first of two face-to-face workshops in Wellington. The first workshop in May developed and refined a higher level standard (NZQA Level 9), and the second workshop (June) developed a Level 7 standard.

Key factors in the process included: employer belief in the concept of degree apprenticeships (workplace training that links theory and practice); empowering employers to lead the process; facilitating development by 'outsiders' who had dedicated time to organise the process, record discussions and distil key ideas into draft documents; listening to employer views and transforming them into required documents; allowing employers to start from their greatest concerns (succession planning and replacement of senior managers (L9) and then moving to developing the L7 standard; using a range of communication modes from face-to-face meetings (important for developing relationships and networks) and to email communications (efficiency) between meetings; involving personnel from a mix of urban, regional and rural locations dealing with a range of assets to enrich discussions and ensure the standard meets a range of industry needs; planning career pathways; training implications for employers and apprentices; and considering benefits for New Zealand.

2. Background/context of the study

TEC, in accordance with the New Zealand government's strategic plan, is striving to increase the number of engineers by investigating employer-led models of higher education. Professor Jane Goodyer, was approached by TEC two years ago to investigate employer-led opportunities and models. Her report included literature from the US, UK and Australia. Each of the jurisdictions was grappling with how best to grow engineering pipelines and develop strong pathways to accommodate people's varying backgrounds and capability.

The UK undertook a significant review of their apprenticeship scheme. They subsequently rationalised the apprenticeship system and based it on what the economy and country needed (e.g. social care, automotive, aerospace). The UK made a decision to support people at higher levels of learning – degree level. They trialled a 'Trailblazer' process which was employer-led and they were able to identify gaps in industry. Employers worked with tertiary organisations to deliver what they need.

Goodyer conducted a follow up study in Manchester, UK, in digital technology solutions, where collaboration occurred with employers and nine universities throughout the UK to develop apprenticeship standards and assessments. They have 60 apprentices in the course, supported by large (e.g. BBC) and smaller companies. Each university delivers the programme differently, depending on their employer mix. For example, some start with a block course and then day release (four days working and one day at university per week), with additional requirements for study in apprentices' own time. The Trailblazer project informed the direction of TEC to develop more work-ready engineers in NZ.

TEC, through their Engineering e2e programme, commissioned Professor Jane Goodyer to develop a Degree Apprenticeship Standard Pilot. The intention was to collaborate with engineering employers to develop an apprenticeship standard, associated assessments and course programmes which meet accreditation requirements. This document reports on the first phase of this development: employer led development of the draft standard.

3. Identification of one engineering occupation for study

The IPWEA (2015) report, Fostering our Future Project, identified a shortage of public works professionals. Engineering e2e subsequently developed a MOU with IPWEA "to identify roles and responsibilities of each party as they relate to collaboration to achieve the New Zealand government goal of increasing engineering graduates by 500+ per annum."

The report also identified a need for more pathways into tertiary engineering areas and employment. Another report/presentation supported this direction: de Silva-Currie and Morris (2015), The New Zealand Diploma in Infrastructure Asset Management Qualification – Is this qualification the best thing since sliced bread? These authors supported the call for more staff with relevant qualifications in the industry.

At the request of the research project team leader, the IPWEA consulted their members and agreed that Infrastructure asset management was an area of need in the industry which members were motivated to address. It was thus decided this area would be the focus of the Degree Apprenticeship pilot study.

4. Identification of employer representatives

4.1 Role of IPWEA and networking processes

Engineering e2e connected the Massey University research team with IPWEA .
Initial identification of employer representatives was through the Institute of Public Works Engineering Australasia (IPWEA). The Manager of fostering our future project IPWEA was instrumental in identifying and contacting initial leads on behalf of the research team. Thereafter, a process of networking resulted in additional representatives of Clients (councils), contractors and consultants, and the ITP sector where the Apprenticeship degree could be delivered. In all, 17 people were contacted and identified as suitable participants for the project. These people and their organisations are acknowledged below.

4.2 Participant representation

Of the 17 identified participants, five were consultants, eight were clients, two were contractors and two were ITP representatives. In terms of location, there was a mix of rural, regional and urban participants.

As the project progressed the need to identify further contractors was realized. (There was only one contractor initially). This was rectified by inviting a further participant after the first workshop had been conducted. Participants included:

• Consultants: Vaughn Crowther (Rationale), Priyani de Sliva-Currie (Calibre Consulting), Anna Bridgman (MWH Global), David Darwin (NZTA), Dr Jonathan Morris (Opus International Consultants Ltd), Robert Blakemore (Opus International Consultants) and Roger Oakley (MWH, Otago).

• Councils - regional, district and city: Anthony Wilson (Wellington City Council), Jamie Cox (Wairoa District Council), Geoff Swainson (Wellington City Council), Ramon Strong (Horizons Regional Council), Robert van Bentum (Palmerston North City Council), Deven Singh (Wellington City Council).

• Contractors: Lisa Stafford (Downer), Mike Manion (Higgins Ltd).

• Polytechnics: Nicky van den Bergh (UCOL), Malcolm Fair (Weltec).

A limitation of the sample was the representation of only two female participants. There were no Māori participants. This was noted as a weakness to be addressed in the second phase of the project. Furthermore, the sample comprised more of older male representatives. The age of the participants is probably due to the nature of the profession which attracts more experienced engineers.

Nevertheless, participants who were interviewed and attended one or more workshops were fully engaged in the process and made insightful contributions to development of the Degree Apprenticeship standard.

5. Appointment of a chair

Pragmatics of location (Wellington-based), availability on the workshop dates, credibility in the industry, and support from various professional organisations identified Dr Jonathan Morris as the employer chair. Dr Morris also brought experience in designing and teaching the Level 6 Diploma on Infrastructure Asset Management with Connexis.

6. Description of the process

6.1 Sequence of project activities

The purpose of the investigation undertaken was to develop an apprenticeship standard, led and informed by employers and relevant stakeholders. The schematic diagram (Figure 1) of the process shown below portrays the sequence of key events in the project.
The timeline however is slightly different and this is shown in Figure 2.

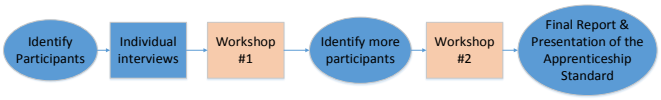


Figure 1: Development of the Apprenticeship Standard

A compressed timeframe created some difficulties in identifying potential participants who could be available for the pre-set workshop dates and providing preparatory lead-in time for participant interviews. Nevertheless, various project activities were carefully sequenced and coordinated to ensure employer interviews were completed in sufficient time to enable meaningful feedback during the workshops.

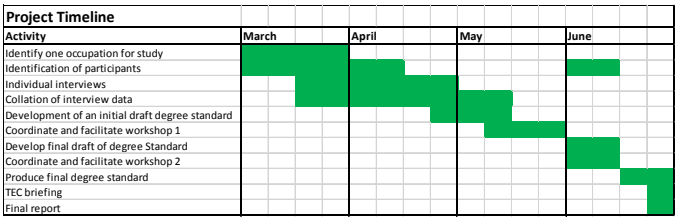


Figure 2: Project timeline

6.2 Individual interviews

Initially, a joint interview was conducted by the researchers to ensure consistency of interview procedure. Due to responsiveness to employer timetables and location preference for interviews, the researchers subsequently individually conducted the remainder of the employer interviews. The interviews were semi-structured with allowance made for deviations from the main thread of the conversation. Refer to Appendix A for copies of the information and consent forms and interview schedule.

6.3 Data recording and analysis

Interviews were recorded either on audio-tape for subsequent transcription, or in type-written notes. The typed notes were returned to interviewees for verification prior to being used for analysis. Thematic analysis was undertaken to identify convergence and divergence, as well as emergent factors and themes. This analysis was supplemented by analysis of pertinent UK Trailblazer documents to inform the first draft of the apprenticeship standard. Detailed notes were also taken at the workshops which were instrumental in the ongoing development and refinement of pilot documents.

6.4 Development of the Apprenticeship Standard

Apart from developing rapport with employers, the main purpose of the data gathering in the interviews was to inform the first iteration of the apprenticeship standard. The standard was modelled on commonly available apprenticeship degree standards offered in the UK. In keeping with the format of the UK standard, a list of Behaviours, Skills and Knowledge essential to the proposed degree in Infrastructure Asset Management was developed.

6.5 The role of the workshops

Two four-hour workshops provided opportunities for employers to generate and discuss categories, and their associated descriptors, of the draft apprenticeship standard. Attendance at workshops also enabled them to extend and deepen networks with colleagues in other companies and areas of the lower North Island.

In a sense, the first workshop was used to get different groups of people to work together on a common problem (developing a degree apprenticeship standard). This necessitated firstly a general discussion of the task as well as an acknowledgement of all the participants' perspectives. From that workshop, a list of behaviours, skills and knowledge as well as some detail on the level of these items that was needed for the job, were collected from the group. Their discussion revealed a strong preference for development of a career pathway.

Subsequently (in the weeks between the first and second workshop) a draft Level 9 standard for an asset infrastructure manager was circulated by email amongst the group for ratification. Accompanying the draft standard was a document distinguishing between the engineering roles of technician, technologist and professional engineer, and a mapping document identifying a list of outcomes from the existing Level 6 qualification, the draft level 9 standard and blank cells for development of Level 7 outcomes in the second workshop. The purpose of the role distinction document was to help employers 'convert' L6-9 standards into typical tasks undertaken by particular engineering roles. This document helped to bridge understandings (language and nomenclature) between the professional and tertiary academic worlds.

The second workshop was convened to further refine the L9 standard and to draft the L7 apprenticeship standard. Participants who were unable to attend were invited to submit feedback comments prior to the meeting. This discussion was more detailed; participants separated the levels of the different outcomes according to engineering role and successfully generated categories and descriptors for the L7 document. Finally, modifications suggested by the second workshop attendees were emailed to all participants for comment and verification before the final draft was prepared for submission. Refer to Appendix C for a copy of the Level 7 standard . Note the succinctness of the layout (consistent with the UK Trailblazer standards), with outcomes specified in relation to three major outcomes: behaviour, skills and knowledge (BSK).

7. Evaluation of the process

The process of developing a pilot degree apprenticeship has been evaluated by reflections of the research team and participants.

7.1 Participants' perceptions

Participants provided spontaneous reflective verbal feedback on the process at Workshop Two (16th June). Attendees expressed appreciation for the pilot in terms of: the concept of Degree Apprenticeships; the opportunity as employers to lead the process; the potential value of asset management qualifications to the engineering industry; the potential benefits across New Zealand, particularly to the rural and regional areas; and offered evaluative comments for future developments and delivery of the programme. Perceptions and voices of employers are recorded here:

7.1.1 Concept of Degree Apprenticeships

The concept of Degree Apprenticeships appealed to participants due to its blending of theoretical and practical learning, filling a recruitment gap of staff without the relevant qualifications, catering to the needs of rural NZ and school leavers.

[Degree Apprenticeships], "give people broad experiences through their training so they are better prepared and more flexible to employ. We need people to have the theoretical understanding from the outset, but also to have experience with practical materials to understand properties for design work."

"We need to have something that attracts the young people and encourages them to learn the fundamentals before rushing up the career ladder. If we went to the industry – we could rustle them up pretty quickly; 18 year olds paid and no loan."

[We need young people with]" work and finance smarts."

[This gives us the]" Ability to turn out people of immediate value and use to us."

"Relevance to the job – a qualification that is too specific is not as useful to the community as one that is broader."

7.1.2 Employer-led process

Participants appreciated their views being sought so that they could shape a qualification to meet their industry needs (from new to experienced employees). They also appreciated learning from other colleagues, different regions and organisations, and a diverse range of asset type. However, employers would have preferred more than 3 months for the development of the standard to allow time to reflect and discuss ideas for colleagues.

"I like the way you are flexible to broadening [the concept] and listening to us to realize that asset managers vary in what they do. [You have] opened the door to inquiry and understanding and growth in the areas we need as an organisation."

"Participation of personnel from different types of assets (water/roads) helps us work out generic descriptors. We have to think of specific examples and then the commonalities across the assets and organisations to write the descriptors."

"We've had time to think about our expectations of what the person could do. It has helped to think about the end point [Level 9]. We could use people like this immediately. Training up and having an end point helped us to think about what the skill development would look like."

[This], "is like a stepping stone thing… it is also consistent with the systems approach of asset management to think of the pathway approach [Level 7-9].

"[This process has been] relevant, topical and generated a level of interest from a range of places. We need to lift our game and long term investment in [resilient] asset management."

"Great idea – I was not sure what to expect – two-way street in terms of benefits – it's been interesting listening to discussion and where we need to go in asset management and the challenges we have around recruitment. It's been a really interesting process".

"This is a great initiative and I will see what organisational commitment [named company] I can gather. This has great potential, so I will spread the word".

"We have worked 'out of our system', thought at the higher level and we can see a progression pathway."

"[It is great to have] industry contribution".

"I valued being invited to be part of an innovative approach to becoming qualified in an area that needs to be addressed. The chance to hear other viewpoints and the collaborative way it was done".

"Good facilitation and well thought through process."

7.1.3 Potential benefits to NZ from Degree Apprenticeships

Representing urban, regional and rural locations, as well as public and privately owned organisations, the participants perceived a range of benefits for the nation.

"Rural NZ needs degree apprenticeship programmes (experiential learning). This is an awesome model for rural NZ. We need technologists through to professional engineers. This [mapping document] is a great building block to get there. We need to articulate the whole profile. This is the first step looking at the bigger picture, possibly 10 year plan. To service educational needs in the workplace outside big cities is important."

"The logic is compelling –we need inter-generational participation in the workplace in asset management."

"There is a challenge in providing education in smaller centres – we would like to keep people in those centres, yet still grow their knowledge and skills."

"We need to support rural areas and smaller centres for good quality training and education. One of our goals is to support 55% NZ economy in the rural/regions (the heart of real productivity) and we need to be seen to support that. You need to keep assets running on a shoestring."

[This] "Will benefit our country and we are happy the conversation is received well. We understand it is a broad market place – different in metro, regional council, city care, medium size and rural councils and they have different ways in which asset managers can operate. [Being sufficiently general to accommodate these variations] enhances the strength of it."

"Integral part of asset management. Asset management – need to have systems to identify resilience risks and solutions. Resilience as a separate category – we need to know about and assess risk (skills and knowledge)."

"Identifying the need to teach/foster appropriate skills, not just assuming they will gain them in the workplace. Having people reach levels with those skills."

"Potential to add great value to stewardship of national assets"

"Relevant qualifications in an area of skill gap and potential employer support"

7.1.4 Implications for employers

Employers acknowledged that taking on degree apprentices would involve commitment, organisational systems and a range of support, including financial investment.

"A communication plan is needed between now and next year so we can align [needs of apprenticeship training] with projects we have planned, and fit it in with our recruitment plans."

"It is more about doing it properly. It is a drain of time away to mentor them and you cannot just do it with cheap labour. There is a cost to a company there. But there is a desire and need from industry for this – take that message to TEC."

"Will depend on the level of support the organisations are given to help people in this – you want the people be trained within workplaces to be trained by suitable people."

7.1.5 General principles for the programme

During workshop discussions, participants commented on a number of considerations for programme delivery and content. Implicit in the discussions were factors like time, travel, organisational needs, preparedness for a varied career and impact on the apprentice as well as the organisation from course requirements.

"Some face to face [block courses] are needed, but it just needs to be managed."

"I am wondering about broadness of this qualification to respond to community needs, like understanding consultation processes and relationship with community."

"Round out the competency for the personnel we need especially in regional councils."

"Educate the new generation about the asset and community outcome, and level of service – equip them with skills to understand that. At all levels they need to define the why – the purpose of the asset"

"Technologists come to us with varied backgrounds… if they are smart we grow them"

"Spread the word – there is currently nothing specifically in asset management in ITPs. They need foundational skills that can be applied across assets".

"One day a week out to attend classes still enables us to involve them in worthwhile projects".

"Apprentices could benefit from experiencing assets from multiple perspectives like contractors, consultants, labourers, consumers; as well as experiencing a range of asset types like the three waters, electrical systems etc."

7.1.6 Future considerations

Employer thoughts were pragmatic, in relation to communication and marketing plans to advertise the Degree Apprenticeships, as well as recruitment of apprentices and new employees.

"There is a need to take a communication plan to schools to attract the school leavers"

"Taonui Holdings Ltd is an employer in their own right who are aware of cultural dimensions. They would be important to involve in the next phase. They would be keen to train apprentices in their own area, especially to develop their own people."

"This is a great initiative and I will see what organisational commitment [named company] I can gather. This has great potential, so I will spread the word".

7.2 Research team perceptions

The research team identified six influential factors:

7.2.1 **Networks.** IPWEA, representatives provided valuable contacts of personnel with expertise, jurisdiction (in positions of company or organisational influence) and interest. Personal (social) networks supplemented regional and contractor representation.

7.2.2 **Value of face-to-face meetings**. Researcher efforts to travel to rural and provincial areas to meet with participants to explain the project and to conduct individual interviews were instrumental in establishing relationships and ensuring regional representation and participation in the project. Interactive workshops, at which employers could share perspectives and network, fostered co-construction of the draft standard and collaborative commitment to the concept of degree apprenticeships.

7.2.3 **Benefits of individual interviews to inform first workshop.** Listening to employer views (during individual interviews) and collating those into the first draft standard for discussion at the workshops demonstrated that this project was truly employer-led. This process established trust, and built participant confidence to contribute.

7.2.4 **Importance of listening to employers** (e.g. pathways). The initial draft standard equated to Level 9 of the NZQA Framework, beyond the level anticipated in the contract. However, it was critical to not interfere, given this was employer-led. As the project continued, participants were able to build from this L9 base to generate a L7 draft standard for degree apprenticeships and a possible career pathway.

7.2.5 **Start from their greatest concerns.** The initial focus and concerns of most participants were related to succession planning and secondly to recruitment. Central to succession planning was replacement of senior managers (like many of them), and thus it was important for them to generate role and task descriptions of these roles first. Once that task was completed they were able to focus on the central task of creating a draft standard for degree apprenticeships. This sequence is important in the change process literature – deal with immediate (emotional, identity-type) concerns first, and then participants are better able to focus on more distal matters.

7.2.6 **Organizational detail.** Involving employers requires advanced notification of dates and commitments, and accommodating various work commitments. Researchers were able to be more flexible with accommodating time and location preferences for the individual interviews. However, the workshop date was given to employers at the time they were invited to participate and was set to fulfil contractual requirements with TEC. Unfortunately prior commitments meant a few participants were unable to attend the second workshop. A central location was identified as best-fit for those travelling locally or from other areas.

7.2.7 Summary comment:

While it needs to be acknowledged that the convenience and snowball sampling approaches used to invite participants has an inevitable positive bias (those who do not believe in the concept are likely to decline to participate), reflections of the employers and research team revealed a number of benefits of the concept of Degree Apprenticeships and the employer-led process. Overall the process appeared to work well and delivered the outcome of generating an infrastructure asset management standard.

8. Recommendations for future phases/projects include:

8.1.1 Apply the above six factors (7.2.1-7.2.6)

8.1.2 Programme: Give people broad experiences through their training so they are better prepared and more flexible to employ. Employers need people to have the theoretical understanding from the outset, but also to have experience with practical materials to understand properties for design work.

8.1.3 Representation: Invite participants from a range of locations; organisational types; roles associated with the occupation (e.g. consultants, contractors); mixed gender, age and cultural groups.

8.1.4 Flexibility: Build in sufficient time to allow employers to balance various commitments along with the requirements of the project, allow employers freedom to explore concepts and issues of immediate concern to them (e.g. L9) before focusing on the prime task of the project (development of L7 standard).

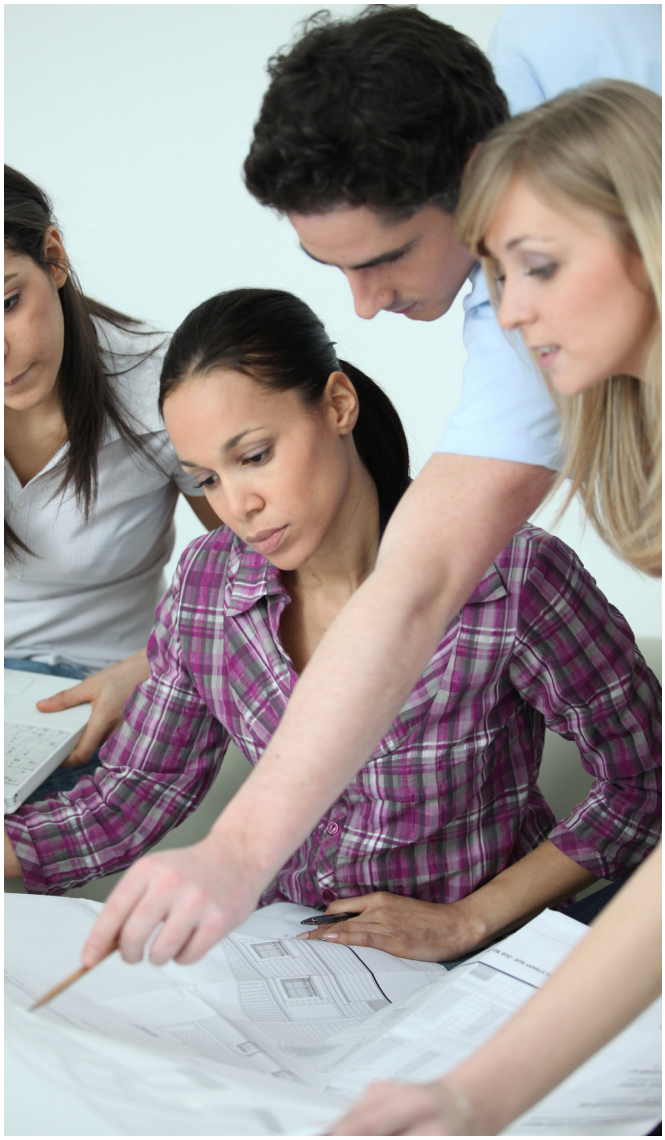
8.1.5 Recognition of Prior Learning: Create multiple pathways, from school leavers to those with employment experience who wish to reskill or upskill. Allow those with employment experience to be granted credit for relevant expertise and thereby encounter a shorter and adapted 'training programme'.

Urgent activities:

8.1.6 Develop a marketing plan to begin recruiting students for programme start

8.1.7 Confirm numbers of apprentices for first intake and where they will be located. This may have a bearing on which ITPs will be involved in developing a programme of study (since they need to ensure access for students in rural, regional and urban areas).

8.1.8 Any new programme will need to be quality assured by NZQA or CUAP. This requirement may have an impact on the launch date.



APPENDIX A

Information Letter and Consent Form

MASSEY UNIVERSITY
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UNIVERSITY OF NEW ZEALAND

Pilot Programme of Degree Apprenticeships – Phase 1 PARTICIPANT INFORMATION SHEET

Massey University has been commissioned by the Tertiary Education Commission to develop and pilot a programme of work-based degree apprenticeships in the engineering sector. A degree apprenticeship is where a person is employed whilst studying for a degree. One occupation within the engineering sector has been identified for the pilot study. A new approach to developing the apprenticeship is that the employers are in the driving seat, from specifying what they want out of the apprentice and how you'd like Tertiary Education Organisations, such as Institutes of Technology and Polytechnics (ITPs), to deliver. As such employers are critical to the project, to ensure that the resultant degree enables graduates to be work-ready. Representatives from Tertiary Education Organisations will also participate to help specify the apprenticeship standard.

You have been identified as a person with relevant expertise and potential interest in this project. We invite you to consider participating in the project. The following information is provided to assist you in your decision-making.

1. Why participate?

The purpose of this trial is to develop a degree apprenticeship in a specific occupation within engineering in which there is currently (or predicted to be) a shortage of qualified staff. If you choose to participate in this project you will influence the knowledge, skills and behaviours expected of these apprentices in the occupation. Furthermore you will learn the views of other employers, extend your professional networks, and influence the future direction of engineering qualifications.

2. What would I be expected to do?

If you choose to participate you would be expected to:

• provide your initial thinking in an initial individual interview by the Massey University research team;

• commit to two half-day workshops (26th May and 16th June) in which the group will draft an apprenticeship standard containing expected knowledge, skills and behaviours of graduates;

• review documents related to the draft apprenticeship standard, which may involve you discussing the standard with your colleagues to obtain a wider viewpoint; and

• reflect on the project processes (to inform future developments).

The introductory/initial interview session is intended for you to ask questions of the research team, and you may choose at that point to not participate. However, if you choose to participate you will be asked a few questions to inform Workshop One. Likely questions include:

- What issues have you encountered in trying to recruit suitable staff?
- What gaps have you noticed in their knowledge, skills or professionalbehaviours?
- What knowledge, skills and behaviours do you think are desirable in newly appointed engineers?
- What do you think would be important content and processes in a degree apprenticeship?
- In your employment position, what role would you like to have in training degree apprentices? What about their assessments?
- What factors might need to be considered in degree apprenticeships (e.g. scheduling of theoretical and practical components; consistency of assessors and assessment tasks, payments etc.)
- What other comments would you like to make?

Workshop One will begin with the purpose of the project, shared expectations of the design of an apprenticeship standard, discussion of a summary of the participant interview data, discussion of desirable knowledge, skills and behaviours of graduates, and creation of the first draft of the apprenticeship standard. Workshop Two will refine the apprenticeship standard.

3. What time would be involved?

The project is occurring between March and 30 June 2017. The total time commitment is 2 days, spread over four months. The initial interview is expected to take up to 30 minutes at a mutually convenient time (likely to occur on one of the following Fridays: 17th, 24th, 31st March 2017). The two half-day workshops are scheduled for Friday 26th May and Friday 16th June. Between workshops one and two you will be sent draft documents to suggest possible changes (expected to take no longer than one hour). In the last fortnight of June you will be asked for brief reflections on the project (to inform any future developments of degree apprenticeships. One of the employer representatives will Chair the group and this may have an additional half day spread across May and June.

4. What costs are involved?

The project will cover all transport costs and refreshments associated with attending the two workshops on Friday 26th May and Friday 16th June. However, no monetary compensation will be provided for your professional time in the project.

5. What about confidentiality?

Information you provide will be kept confidential by the Massey University research team. Written notes will be kept of the initial interviews, workshop discussions and final reflections, but your details will be kept confidential. The final report to the Tertiary Education Commission (TEC) will acknowledge your contribution but no information will be attributable to you. At the workshops the expectation will be free and frank discussion that is kept confidential to the group. However, we cannot guarantee that all information will be kept confidential by other group members. Any other publications arising from the research will not identify you. Data will be kept secure on Massey University's document system that is password protected.

6. What is likely to happen after the pilot?

A summary of the report will be sent to participants. The next phase is expected to develop how the apprenticeship will be delivered at an ITP with appropriate assessment methods to assure that the degree apprenticeship standard can be met. If the project is deemed to be successful, degree apprenticeship standards may be specified in other areas of engineering. The research team may present findings at conferences or in relevant academic publication sources.

7. Who can I ask if I have more questions?

You may ask questions of the Massey University research team visiting you at the introductory/initial interview meeting, the team leader (Professor Jane Goodyer), the Tertiary Education Commission or the Massey University ethics committee chair (contact details below).

8. What do I do next?

You do not have to participate in the research and if you choose to be included you have the right to withdraw at any time up until data collection is completed.

If you are happy to participate please sign the accompanying written consent form.

Yours sincerely,

Professor Jane Goodyer, Dr Jenny Poskitt and Dr James MacKay

J.Goodyer@massey.ac.nz

Phone (06) 356 9099

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 4000017371.

If you have any concerns about the conduct of this research, please contact
Dr Rochelle Stewart-Withers, Chair, Massey University Human Ethics Committee:
Southern B, telephone 06 356 9099 x 83657, email humanethicsouthb@massey.ac.nz

Tertiary Education Commission Contact:

Angela Christie, Programme Lead – Engineering e2e, 04 462 5166

APPENDIX B

Interview Questions

Pilot programme of degree apprenticeships – phase 1

Employer/TEO interview sheet

Name:

Organisation:

Date:

Interviewer(s):

Would you mind giving me some background information about your organisation please?
(What is its main focus or business; approximate number of employees, geographical area?…)

What issues have you encountered in trying to recruit suitable staff?

What gaps have you noticed in their knowledge, skills or professional behaviours?

What knowledge, skills and behaviours do you think are desirable in newly appointed engineers?

What do you think would be important content and processes in a degree apprenticeship?

In your employment position (either employer or ETO provider), what role would you like to have in training degree apprentices? What about involvement in their assessments? What training might be required of potential assessors?

What factors might need to be considered in degree apprenticeships (e.g. scheduling of theoretical and practical components; consistency of assessors and assessment tasks, payments etc.)?

What other comments would you like to make?

APPENDIX C

Standard for Degree Apprenticeship in Infrastructure Asset Management Technologist

PILOT DEGREE APPRENTICESHIP STANDARD:

INFRASTRUCTURE ASSET MANAGEMENT TECHNOLOGIST

Background

The Institute of Public Works Engineers Australasia NZ (IPWEA NZ) has a prime goal to uphold and improve the status of engineering and management of public infrastructure assets in NZ. In its document, Fostering our future – a strategic assessment on the future capacity and capability of the public works profession, IPWEA NZ expressed urgency in the need to attractive innovative, resilient and enthusiastic people to the profession.

Occupation(s)

The occupation covered by this standard is Public Works Infrastructure Management Technologist. Typical job titles can include: Engineering Technology Practitioner, Asset Management Analyst, Asset Management Engineer, Road Asset Manager, Contracts and Asset Manager, Maintenance Manager, Service Planning Engineer, Service Planning Analyst. They are associated with management of water, water treatment, waste water, transportation and associated infrastructure.

Occupational profile

An infrastructure asset management technologist is responsible for supporting implementation and maintenance of core infrastructure assets, relating to water, transportation and electrical distribution. They ensure that these assets are operating in accordance with NZ Law and associated Acts and maintain high levels of performance for their users. They create detailed analysis of sub-systems and make recommendations for improvement. They optimise technology use to anticipate and meet stakeholder's needs, problem-solve current problems and future-proof the resilience of assets.

Requirements: Behaviours, Skills and Knowledge

Behaviour	**Be able to**:
Professional	Operate in a punctual, timely, respectful and courteous manner with colleagues and clients. Be 'work ready'. Complete work ahead of deadlines in accordance with ethical and professional standards and code of practice. Be meticulous, thorough and reliable. Adaptable and responsive to existing and emerging community needs. Recognize limits of own knowledge/skills and exercise good judgment in consulting with or requesting appropriate expertise when required. Display interest, aptitude, initiative and willingness to learn.
Stakeholder Communication	Listen to and negotiate with colleagues and clients. Seek and gather information from pertinent sources. Explain concepts and tasks with the appropriate level of technical expertise according to the audience. Produce accurate and relevant documentation. Use appropriate format and formalities. Interact confidently and competently with individuals or small groups of stakeholders, with due cultural consideration.

Flexible thinking	Be open to new information. Ask thoughtful, information or clarification-seeking questions and seek out alternatives. Consider potential unexpected indicators. Understand limits in data, extract value from it and create alternative options. Adjust solutions to meet technical, financial, community and environmental service needs. Display curiosity and inquiring mind-set; initiative.
Working with people	Able to give and respond to orders. Manage small teams of technicians/ subcontractors. Identify, champion and develop others for whom responsible. Application of tactical strategies. Understand why and ensure things happen within project. Aware of professional expectations and recognises when to make recommendations. Work reliably and appropriately with team members and stakeholders.
Commitment & Accountability	Be resilient and show commitment to the apprenticeship and to the employing organisation. In rural areas, commitment and contribution to the wider community. Systematic implementation processes (accuracy, thoroughness, check, re-do or change if required). Meticulous, timely record-keeping and attention to detail.
Listening & negotiation	Use open-ended questions, skills in summarising and basic negotiation, related to technical matters with the project team.

Skills	**Be able to:**
Communication	Select and use appropriate communication methods (written, verbal, graphic, software, social media) in timely manner at an appropriate level for their stakeholder. Identify appropriate stakeholders (who is affected, by what, how much – identify, measure and audit). Ability to produce operation and maintenance manuals.
Risk Management Literacy	Identify, quantify, analyse and predict trends in maintenance and deterioration of assets. Analyse likely failure, identify weak points and consequences to mitigate risk. Analyse, prioritize and evaluate risk (qualitative and quantitative) to installed and planned infrastructure asset components. Identify how these risks can be minimised or mitigated against. Establish appropriate levels of service. Balance trade-offs with providing essential services with limited resources. Use risk matrix framework and feedback loops to identify when tasks need to be done.
Systems Thinking	Understand a system, its elements and how they interact to provide a service. Think critically to identify, define and solve problems. Understand asset condition, use data analysis to model current state of an asset's condition profile and extrapolate what's required to achieve future state. Understand scope, the extent of the problem and the limits of your capability.
Engineering	Apply practical engineering solutions using established technologies. Apply life cycle costs, accounting and evaluation procedures. Supervise configuration procedures. Understand purpose, functionality, classification and configuration of an asset: as expected and perform at optimal level of service. Apply incident and problem recording and notification procedures.
Problem-solving and critical thinking	Ability to identify and define technical (or asset sub-system) problem(s). Propose and justify a range of solutions (cost, time, consequences and implications). Awareness of impact of potential solution on other parts of the system(s). Use cause and effect to ensure solving correct problem and be aware of change in system and consequence of failure.

Project Management	Follow a systematic methodology for initiating, planning, executing, controlling, and closing asset projects. Apply industry standard processes, methods, techniques and tools to execute small to medium-level projects.
Computer and data analysis/ utilisation	Use databases to enter, manipulate and analyse data in order to identify normal/ abnormal variability or trends. Use technology, where appropriate, for greater accuracy and efficiency (including the use of GPS and BIM).
Optimised decision-making skills	Support awareness of assets' working condition through feedback and identification of weak points. Generate a number of options using multi-criteria analysis to make recommendations or decisions related to areas of responsibility within projects, such as related to specific subsystems within a larger system. Show awareness of various constraints and competing demands, and factor into reasoned recommendations.
Business	Develop well-reasoned evidence based proposals for smaller-to medium level projects. Show awareness of the importance of affordability, availability, timeliness and fit-for-purpose considerations.
Service-oriented to stakeholder	Measure and analyse service level need. Make judgements on service priority level adjustments required and convert to technical requirements. Incorporate and action solutions, either for aspects within larger projects or small-scale projects, related to community problems.

Technical Knowledge	**Knows and understands:**
Engineering	Material properties in order to understand the assets and why they change (normal changes and detect causes of unusual changes). Understand function, design capacity and outcomes. Statistical concepts for setting up and interpreting databases, variability analysis, statistical modelling, interpretation of trends. Basic engineering (civil, mechanical, electrical, chemical and materials) concepts with specific knowledge in at least one field of engineering science. Concepts related to systems thinking, evaluation and improvement.
Environmental and social impact of technical solutions	The short and long term impact of the current project on the local environment and various categories of human activity. Modify small –scale plans, designs or projects to minimise detrimental, and optimise positive, consequences.

Asset Management Planning	Understand the purpose of the assets, configuration, capacity, asset parameters and functionality. Understand condition assessment (what is happening and why), modelling of current and forecasting future states, acceptable levels of service. Know lives of assets, use, maintenance, targets and limits. Determine causes (beyond symptoms) of deterioration and failure; when to do further investigation. Incorporate resilience and new global knowledge for disaster management. Contribute to, interpret and implement asset management plans. Where appropriate, ask thought-provoking questions or suggest changes, including modelling, forecasting and life cycle costing.
Business and Financial	Basic concepts and principles of financial management and economics. How budgeting, monitoring and projection of spending can contribute to evaluating options and making a business case for expenditure. Knowledge of contracts and contractual arrangements. Develop, tender and manage a small to medium–scale contract.
Cultural and social impact	Treaty of Waitangi principles and the implications for: consulting with local iwi, and asset management. Understand how, when and on what to consult or engage effectively with local iwi. Appropriately adjust plans and procedures to accommodate iwi wishes. Historical events in the area that impact on asset management. Basic concepts of human geography and interaction with the environment that relate to asset management (e.g. demographic patterns, migration, social structures and change, cultural identity, politics, natural and human resource availability, impact of geomorphology) and implications for asset management.
Legal impact framework	Familiarity with The Resource Management Act (RMA); NZ Law, Health and Safety; Local Government Act (2002), local by-laws and relevant standards. Understand implications of relevant laws for asset management, health and safety of human, physical and environmental resources. Develop and monitor safe asset practice. Incorporate legal understandings in plans, management and evaluation of local and smaller-medium scale projects.
Project management	How to deliver a 'regular' or small-medium-scale technology solution project accurately, efficiently, on-time and within budget
Resilience	Understand the future drivers and consequences of catastrophic failure. Knowledge about global trends and investments in design for asset system resilience.

Duration

The typical duration is likely to be three years but will depend on previous experience of the apprentice, and access to opportunities to demonstrate the full range of competence.

Entry requirements

As the qualification will be achieved at Level 7 of the New Zealand Qualifications Framework, the typical entry requirements for this Apprenticeship may be New Zealand Diploma in Engineering or NZ Diploma in Infrastructure Asset Management. If direct from school, apprentices will need to have achieved University Entrance, and preferably NCEA Level 3 mathematics and one or more science subjects. However, in conjunction with individual employers, accredited ITPs may consider applicants with relevant work experience under provision of Recognition for Prior Learning (RPL) requirements.

Qualifications

The following qualification will be gained: Degree Apprenticeship in Infrastructure Asset Management.

Link to professional registration

This Apprenticeship will include the knowledge, skills and behaviours required to achieve engineering technologist status with the Institute of Professional Engineers New Zealand (IPENZ).

Level

This apprenticeship Standard is at Level 7 NZQA Framework.

Review date

This apprenticeship standard will be reviewed three years after the date of approval.

APPENDIX D

Infrastructure Asset Management (employer-led) qualification pathway

Requirements: Behaviours, Skills and Knowledge

Infrastructure Asset Management (employer-led) qualification pathway			
	Level 9 Master of Infrastructure Asset Management (outcomes)	**Level 7 Degree Apprenticeship in Infrastructure Asset Management (outcomes)**	**Level 6 Diploma (outcomes) (Unit)**
Behaviour	**Be able to:**		
Professional	Lead and conduct day-to-day operations in a punctual, timely, respectful and courteous manner towards colleagues and clients. Manage conflicts and deal with/solve issues. Complete work ahead of deadlines, in accordance with ethical and professional standards and code of practice.	Operate in a punctual, timely, respectful and courteous manner with colleagues and clients. Be 'work ready'. Complete work ahead of deadlines in accordance with ethical and professional standards and code of practice. Be meticulous, thorough and reliable. Adaptable and responsive to existing and emerging community needs. Recognize limits of own knowledge/skills and exercise good judgment in consulting with or requesting appropriate expertise when required. Display interest, aptitude, initiative and willingness to learn.	
Stakeholder communication	Be an effective storyteller. Have the ability to listen and engage effectively with small to large groups of stakeholders. Enable stakeholders to understand how an asset change will impact them. Deal appropriately with complex and politically sensitive issues. Produce high level reports and documents.	Listen to and negotiate with colleagues and clients. Seek and gather information from pertinent sources. Explain concepts and tasks with the appropriate level of technical expertise according to the audience. Produce accurate and relevant documentation. Use appropriate format and formalities. Interact confidently and competently with individuals or small groups of stakeholders, with due cultural consideration.	
Flexible thinking	Adjust an approach to a particular organisation and regional needs. Be open to new information and alert to unusual indicators or patterns.	Be open to new information. Ask thoughtful, information or clarification-seeking questions and seek out alternatives. Consider potential unexpected indicators. Understand limits in data, extract value from it and create alternative options. Adjust solutions to meet technical, financial, community and environmental service needs. Display curiosity and inquiring mind-set; initiative.	
Leadership	Lead teams and develop staff to meet changing technical and managerial needs. Demonstrate a strong improvement orientation, i.e. able to inspire others, discern innovative strategies/ direction/solutions, seek feedback, curious to learn and modifies behaviour and/or professional approach in response to new information	Able to give and respond to orders. Manage small teams of technicians/subcontractors. Identify, champion and develop others for whom responsible. Application of tactical strategies. Understand why and ensure things happen within project. Aware of professional expectations and recognises when to make recommendations.	Demonstrate knowledge of enabling processes to embed asset management practices in the organisation. (11429)
Working with people	Have a capacity to work independently and as a team. Be aware of how their role aligns with the rest of the project team	Work reliably and appropriately with team members and stakeholders.	Analyse advantages and disadvantages of working in groups (9691) Explain factors that affect group function. (9691) Outline strategies to manage conflict in a group. (9691) Plan and prepare team activities to achieve a complex objective (21336 &21335) Negotiate team processes to achieve a complex objective. (21336 &21335) Facilitate team processes to achieve a complex objective. (21336 &21335) Evaluate own performance. (21336 &21335)

Commitment & Accountability	Be resilient and show commitment to the apprenticeship and to the employing organisation. In rural areas, commitment and contribution to the wider community	Be resilient and show commitment to the apprenticeship and to the employing organisation. In rural areas, commitment and contribution to the wider community. Systematic implementation processes (accuracy, thoroughness, check, re-do or change if required). Meticulous, timely record-keeping and attention to detail.	
Listening & negotiation	Demonstrate value and gain commitment to a complex solution and being open to other points of view. Demonstrating stakeholder need, using open questions and skills in summarising and negotiation.	Use open-ended questions, skills in summarising and basic negotiation, related to technical matters with the project team.	
Skills	**Be able to:**		
Communication	Write and provide verbal communication proficiency to produce large project plans, write concise reports, synthesise and explain complex analyses in simple presentations within and outside the organisation; and in complex or politically sensitive situations.	Select and use appropriate communication methods (written, verbal, graphic, software, social media) in timely manner at an appropriate level for their stakeholder. Identify appropriate stakeholders (who is affected, by what, how much – identify, measure and audit). Ability to produce operation and maintenance manuals.	Plan the analytical report.(9685) Write the analytical report. (9685) Produce a demand management analysis report for an infrastructure asset group. (23592)
Risk Management Literacy	Analyse and evaluate risk (qualitative and quantitative) to installed and planned infrastructure asset systems. Identify how these risks can be minimised or mitigated against.	Identify, quantify, analyse and predict trends in maintenance and deterioration of assets. Analyse likely failure, identify weak points and consequences to mitigate risk. Analyse, prioritize and evaluate risk (qualitative and quantitative) to installed and planned infrastructure asset components. Identify how these risks can be minimised or mitigated against. Establish appropriate levels of service. Balance trade-offs with providing essential services with limited resources. Use risk matrix framework and feedback loops to identify when tasks need to be done.	Apply risk policies and procedures to infrastructure asset management, and process feedback for risk management improvement.(17308) Carry out risk analysis in an infrastructure asset management context.(17308) Determine intervention options in an infrastructure asset management context.(17308) Document risk management in an infrastructure asset management context.(17308)
Engineering	Develop and apply practical engineering solutions using established and emerging technologies, such as, in water and waste treatment, transportation, housing, operation of machines and provision of electrical power etc.	Apply practical engineering solutions using established technologies. Apply life cycle costs, accounting and evaluation procedures. Supervise configuration procedures. Understand purpose, functionality, classification and configuration of an asset: as expected and perform at optimal level of service. Apply incident and problem recording and notification procedures.	
System Thinking	Take a holistic view of the issues, environment, stakeholders, whole of life, to ensure the correct problem is being solved and the solution is sustainable.	Understand a system, its elements and how they interact to provide a service. Think critically to identify, define and solve problems. Understand asset condition, use data analysis to model current state of an asset's condition profile and extrapolate what's required to achieve future state. Understand scope, the extent of the problem and the limits of your capability.	
Problem-solving & critical thinking	Apply analytical and critical thinking skills to technological asset (system) solutions. Able to apply a systems thinking (awareness of interconnections, balancing varying needs of a system(s)) approach, has a questioning mind-set, and apply structured problem solving techniques to complex systems and situations	Ability to identify and define technical (or asset sub-system) problem(s). Propose and justify a range of solutions (cost, time, consequences and implications). Awareness of impact of potential solution on other parts of the system(s). Use cause and effect to ensure solving correct problem and be aware of change in system and consequence of failure.	Define the problem and/or opportunity and determine a range of options for infrastructure asset management. (17305)

Project Management	Follow a systematic methodology for initiating, planning, executing, controlling, and closing asset system solutions projects. Applies industry standard processes, methods, techniques and tools to execute larger or complex projects. Is able to manage a project (specify time, degree of interdepen dency with other projects and degree of strategic impact) including identifying and resolving deviations and the management of problems and escalation processes.	Follow a systematic methodology for initiating, planning, executing, controlling, and closing asset projects. Apply industry standard processes, methods, techniques and tools to execute small to medium-level projects.	
Computer and data analysis	Use databases to manipulate and analyse system-level data in order to identify normal or abnormal variability. Select and use appropriate software for data collection and storage. Understand and use drawings and 3D modelling of systems such as transport networks, drainage systems etc. Use or modify technology, where appropriate, for greater accuracy and efficiency (including the use of GPS and BIM). The ability to visualise, process and extract value from complex data to detect trends or emerging system issues to communicate or inform decision-making.	Use databases to enter, manipulate and analyse data in order to identify normal/abnormal variability or trends. Use technology, where appropriate, for greater accuracy and efficiency (including the use of GPS and BIM).	Demonstrate knowledge of infrastructure asset management information systems. (23590) Demonstrate knowledge of the collection and management of infrastructure asset management data. (23590)
Optimised Decision-making	Make optimum decisions for infrastructure acquisition, renewal, operations and maintenance. Use multiple sources of data to make system or project-level decisions. Balance communities' competing demands, with financial constraints and future utilisation into the optimal management of current assets.	Be aware of assets' working condition through feedback and identify weak points. Generate a number of options using multi-criteria analysis to make recommendations or decisions related to areas of responsibility within projects, such as related to specific subsystems within a larger system. Show awareness of various constraints and competing demands, and factor into reasoned recommendations.	Explain optimised decision-making process in relation to infrastructure asset management. (17305) Determine and report the optimal decision in relation to an infrastructure asset management problem and/or opportunity. (17305)
Business	Develop well-reasoned investment proposals and work within set budgets, develop budgets and integrate these within strategic plans by being commercially aware.	Develop well-reasoned evidence based proposals for smaller-to medium level projects. Show awareness of the importance of affordability, availability, timeliness and fit-for-purpose considerations.	
Service oriented	Monitor, identify and anticipate system-wide service level needs; prioritise appropriate actions to minimise detrimental, and optimise positive, consequences for the community. Respond promptly and in measured way to address unexpected occurrences in larger projects or at system-level.	Measure and analyse service level need. Make judgements on service priority level adjustments required and convert to technical requirements. Incorporate and action solutions, either for aspects within larger projects or small-scale projects, related to community problems.	Explain process for developing levels of service for infrastructure assets. (23589) Develop and measure levels of service for an infrastructure asset group. (23589)

Knowledge	Knows and understands:		
Engineering	The fundamental operations and interconnections of a variety of key asset systems. To be able to test a complex solution, confirm its applicability	Material properties in order to understand the assets and why they change (normal changes and detect causes of unusual changes). Understand function, design capacity and outcomes. Statistical concepts for setting up and interpreting databases, variability analysis, statistical modelling, interpretation of trends. Basic engineering (civil, mechanical, electrical, chemical and materials) concepts with specific knowledge in at least one field of engineering science. Concepts related to systems thinking, evaluation and improvement.	
Environmental and social impact of technical solutions	The short and long term impact of various categories of human activity (waste treatment, global warming, construction, etc.) on the wider environment and the broader community. Modifies larger – scale plans, designs or projects to minimise detrimental, and optimise positive, consequences.	The short and long term impact of the current project on the local environment and various categories of human activity. Modify small –scale plans, designs or projects to minimise detrimental, and optimise positive, consequences.	
Asset Management Planning	How to construct an asset management plan and to adjust relative to maintenance requirements, demand projections, local/regional needs, criticality and consequential risks, resilience, disaster preparation and external factors, such as deterioration.	Understand the purpose of the assets, configuration, capacity, asset parameters and functionality. Understand condition assessment (what is happening and why), modelling of current and forecasting future states, acceptable levels of service. Know lives of assets, use, maintenance, targets and limits. Determine causes (beyond symptoms) of deterioration and failure; when to do further investigation. Incorporate resilience and new global knowledge for disaster management. Contribute to, interpret and implement asset management plans. Where appropriate, ask thought-provoking questions or suggest changes, including modelling, forecasting and life cycle costing.	Explain demand management practices for infrastructure assets. (23592) Conduct infrastructure asset management planning (11429)
Business & Financial	Intermediate concepts and principles of financial and business management. The value of technology investments and how to formulate a business case for a new technology solution, including estimation of both costs and benefits and NPV. How budgeting, forecasting and projection of spending mitigate risk and influence a business case for expenditure. How contract management and procurement practices can support the ability to evaluate different sourcing options. Develop, tender and manage a medium to large – scale contract.	Basic concepts and principles of financial management and economics. How budgeting, monitoring and projection of spending can contribute to evaluating options and making a business case for expenditure. Knowledge of contracts and contractual arrangements. Develop, tender and manage a small to medium–scale contract.	Demonstrate knowledge of valuation and depreciation of infrastructure assets. (23591) Demonstrate knowledge of components of life-cycle financial models for infrastructure assets. (23591) Explain the procurement and delivery methods in terms of relative advantages and disadvantages with contracts for infrastructure assets. (29486) Demonstrate knowledge of contracts for infrastructure assets. (26155) Form a contract for infrastructure assets. (26155) Manage the contract for infrastructure assets(26155) Manage tendering for an infrastructure asset. (26156)

Cultural and social Impact	Treaty of Waitangi principles and obligations for consulting locally and nationally with iwi for optimal benefit. Understands how, when and on what to consult and engage effectively with local or other groups of iwi. Ensures iwi consultation/agreements are incorporated appropriately into consents, asset planning, design and implementation. Advanced and contemporary concepts of human geography and interaction with the environment (e.g. demographic patterns, migration, social structures and change, cultural identity, politics, natural and human resource availability, impact of geomorphology) and implications for asset management.	Treaty of Waitangi principles and the implications for: consulting with local iwi, and asset management. Understand how, when and on what to consult or engage effectively with local iwi. Appropriately adjust plans and procedures to accommodate iwi wishes. Historical events in the area that impact on asset management. Basic concepts of human geography and interaction with the environment that relate to asset management (e.g. demographic patterns, migration, social structures and change, cultural identity, politics, natural and human resource availability, impact of geomorphology) and implications for asset management.	Describe features of the rule of law in New Zealand society. (14949) Describe New Zealand's court system. (14949) Explain the relevant standards used in New Zealand for infrastructure asset management.(29486) Explain the relevant New Zealand laws used in infrastructure asset management.(29486) Demonstrate knowledge of contract standards for infrastructure asset management. (29486)
Legal impact framework	In-depth understanding of The Resource Management Act (RMA); NZ law, Health and Safety; Local Government Act (2002), local by-laws and relevant standards. Understand implications of the relevant laws for asset management regarding the safety of physical and human resources in everyday life, emergencies and natural disasters. Oversee the development, monitoring and review of safe asset practice. Incorporate legal understandings in plans, management and evaluation of medium-larger scale projects.	Familiarity with The Resource Management Act (RMA); NZ Law, Health and Safety; Local Government Act (2002), local by-laws and relevant standards. Understand implications of relevant laws for asset management, health and safety of human, physical and environmental resources. Develop and monitor safe asset practice. Incorporate legal understandings in plans, management and evaluation of local and smaller-medium scale projects.	
Project management	How to deliver a complex or larger-scale technology solution project accurately, efficiently, on-time and within budget.	How to deliver a 'regular' or small-medium-scale technology solution project accurately, efficiently, on-time and within budget	Implement the actions identified in the infrastructure asset management planning process (11429)
Resilience		Understand the future drivers and consequences of catastrophic failure. Knowledge about global trends and investments in design for asset system resilience.	