

Number 1/2016

ISSN 2324-3635

OCCASIONAL & DISCUSSION PAPER SERIES

**Development Of Engineering
Qualifications In New Zealand:
A Brief History**

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OCCASIONAL AND DISCUSSION PAPER SERIES 1/2016

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This publication may be cited as:

Blakeley, J. P. (2016). Development of engineering qualifications in New Zealand: A brief history. *Unitec ePress Occasional and Discussion Paper Series* (1). Retrieved from <http://www.unitec.ac.nz/epress/>

This paper is the final and official version from a series of drafts that can be found at

<http://www.ipenz.org.nz/heritage/itemdetail.cfm?itemid=73>

<https://ipenz.nz/home/news-and-publications/news-article/canterbury-college-school-of-engineering-laboratory>

<http://www.ipenz.org.nz/heritage/documents/Blakeley,%20Engineering%20Qualifications%20in%20New%20Zealand%2028500%20KB%29.pdf?>

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ISSN 2324-3635

Development of Engineering Qualifications in New Zealand: A Brief History

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ABSTRACT

Post 1840, New Zealand's early engineers had mainly trained in Britain prior to emigrating. The need for educating and training young engineers was soon recognised. This was initially done by means of a young engineer working under the close supervision of an older, experienced engineer, usually in a cadetship arrangement. Correspondence courses from the British engineering institutions became available from 1897. Several technical colleges in New Zealand implemented night classes to assist students who were preparing for the associated examinations. The first School of Engineering was established at Canterbury University College in 1887. Teaching of engineering, initially within a School of Mines, commenced at Auckland University College in 1906. Engineering degrees did not become available from other universities in New Zealand until the late 1960s. The New Zealand Certificate in Engineering (NZCE) was introduced as a lower level of engineering qualification in the late 1950s and was replaced by a variety of two-year Diploma in Engineering qualifications from 2000, now consolidated together and known as the New Zealand Diploma in Engineering (NZDE) and taught at fifteen institutions throughout New Zealand from 2011. At an intermediate level, the three-year Bachelor of Engineering Technology degree qualification (BEngTech) was also introduced from 2000 and is now taught at seven institutes of technology and polytechnics, and the Auckland University of Technology.

HISTORY OF ENGINEERING QUALIFICATIONS

The system of engineering qualifications in New Zealand has closely followed the English system, and developed following the commencement of the original planned settlement of British people in New Zealand post 1840.

The Early Years 1840 – 1890

The three earliest British engineering institutions were established in civil engineering (1818), mechanical engineering (1847) and electrical engineering (1871). From 1840 onwards, the early European engineers in New Zealand had mainly learned their professional engineering skills in Britain, before leaving for New Zealand. The need to establish education and training for young professional engineers was soon recognised. Initially this was done by means of a young engineer working under the close supervision of an older, experienced engineer. Correspondence courses from the British engineering institutions became available in the late 1800s. To be admitted to one of these British engineering institutions as an Associate Member, applicants had to be at least 25 years of age, to have been engaged in engineering practice for at least five years, and to have demonstrated competence therein.

The Intermediate Years 1890 – 1950

Newnham (1971, p221) notes that in 1897 the Institution of Civil Engineers (ICE) had established its own examinations for use both in Britain and the British dominions (including New Zealand). Examinations from other British engineering institutions followed soon after, notably the Institution of Mechanical Engineers (IMechE) and the Institution of Electrical Engineers (IEE). Obtaining full membership (then called Associate Member) required passing these examinations (as educational requirements), followed by a period of several years' engineering experience and an interview. University



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degrees in engineering could be used to exempt students from these preliminary examinations and thus fulfill the educational requirements needed to obtain full membership of these institutions. Special courses, including night classes, were implemented from the early 1900s at some technical colleges in New Zealand, to assist students in completing the correspondence courses provided by the British engineering institutions.

From 1913 to 1939, Auckland University College (AUC) offered lectures for students studying for the British engineering institutions exams. In her book *Prospero's Island*, Judith Bassett (2003) notes that in 1913 the AUC Calendar was offering lectures for the qualifications of Associate Membership of the Institutions of Civil, Mechanical and Electrical Engineers, London (2003, p. 21). She also includes a syllabus of lectures from the AUC Calendar in 1939 which, under engineering, includes evening courses for cadets preparing for the Professional examinations of engineering institutions, including civil, structural, mechanical and electrical engineering (2003, p. 37).

Frequently, this period of part-time study and correspondence courses and possibly special courses including evening classes, would be completed as part of a 'cadetship' with an engineering employer. Some of the people

undertaking this study would have already had another university degree (usually in science) and would have wished to extend their knowledge and qualifications in engineering at a professional level. Being a member (or even a student member) of one of these British engineering institutions, and especially before the establishment of a New Zealand engineering institution, enabled individuals to keep up to date with the latest developments overseas, in a particular field of engineering, by receiving the very detailed technical journals and proceedings which were published by these institutions.

After the name change from the New Zealand Society of Civil Engineers to the New Zealand Institution of Engineers (NZIE) was made in 1937 (Cooke, 2014, p.49), the NZIE became the engineering institution of choice in New Zealand for most engineers wishing to join a professional engineering institution. However, a considerable proportion of these people also chose to join one of the British engineering institutions. The Engineers Registration Act 1924 imposed minimum engineering education and experience standards on engineers undertaking certain types of public works. In the late 1940s, NZIE introduced competence assessment, in the form of a professional interview for NZIE membership. It became the accepted route for a BE degree holder to progress to registration under the Engineers Registration Act 1924.

The Later Years: 1950 Onwards

From 1950, the examinations of the British engineering institutions became more difficult to pass by part-time study and correspondence courses. Some students would then opt to attend a final year course at a university school of engineering, before sitting the institution examinations or alternatively, enrol in courses being offered by the Auckland Technical Institute and some other technical institutes in New Zealand. The low university student fees and the bursaries then available made it much more affordable for many young people to be able to study for an engineering degree at a university in New Zealand. A considerable proportion of these bursaries were made available through Government departments who employed engineering graduates. This bursary system remained in place until most of those Government departments were corporatised in the late 1980s.

In New Zealand, the examinations of the British engineering institutions were phased out circa 1965. By then, very few people were still using this route to professional engineering qualifications and the professional interview for NZIE membership (rather than obtaining a four-year BE degree from a university). The last individual institution

1840	Engineers working in New Zealand would often be members of one of the three earliest British engineering institutions after these had become established in 1818 (Civil), 1847 (Mechanical) and 1871 (Electrical).
1912	The Institute of Local Government Engineers of New Zealand was established.
1914	The New Zealand Society of Civil Engineers was established.
1937	The New Zealand Institution of Engineers (NZIE) was established and became...
1982	...The Institution of Professional Engineers New Zealand (IPENZ).

Table 1. Timeline of the Development of IPENZ

examinations in New Zealand were held in 1968. However, courses and exams for the British CEI Part 1 and Part 2 examinations continued to be available. In New Zealand, courses for these exams were run by the Auckland Institute of Technology (AIT) and about two other technical institutes. AIT had stopped offering these courses by the late 1970s or early 1980s. CEI Part 1 was six common core courses. CEI Part 2 was six specialty subjects in the candidate's major discipline of civil, mechanical, electrical or other discipline. The CEI examinations were taken over by City and Guilds in 2001 and remained available for entry to the UK engineering institutions up to 2012.

The Chartered Professional Engineers Act 2002

The Chartered Professional Engineers Act 2002 restricts the use of the words 'Chartered Professional Engineer' to people so qualified under that Act which replaced the Engineers Registration Act 1924. The words 'registered engineer' should no longer be used as they indicate a qualification which no longer exists in New Zealand. It is important to note that because of its very common usage in the English language, the word 'engineer' cannot be legally restricted for use only by people with certain engineering qualifications. Any person can call themselves an engineer and probably this is one reason why the Institution selected the term 'Professional Engineers' when it changed its name from NZIE to IPENZ (The Institution of Professional Engineers New Zealand) in 1982. The only words for an engineer protected in law are 'Chartered Professional Engineer'.

Requirements of Practical Engineering Work Experience (On Job Learning and Development)

Completion of a four-year engineering degree at a university fulfilled the initial education requirements for graduate membership of the NZIE, which was established in 1937 and became IPENZ in 1982. A period of several years of on-the-job learning and development was then required after graduation, followed by a professional interview

(Competence Assessment) in order to achieve a competence-based membership grade of that institution.

Member and Fellow Grades

After obtaining about 20 years of high-level engineering experience and achieving a certain degree of eminence within the engineering profession, an Associate Member of one of these British engineering institutions could apply to be transferred to the grade of Member. In about 1967, these names were changed from 'Associate Member' to 'Member', and from 'Member' to 'Fellow'. At about the same time (1967), the New Zealand Institution of Engineers adopted similar changes in the names of membership grades which were then called:

- Corporate Member – designated MNZIE (later MIPENZ);
- Fellow – designated FNZIE (later FIPENZ).

The name of the 'Corporate Member' grade was changed to 'Member' in 1993 and then to 'Professional Member' in 2003, but still designated MIPENZ.

THE TIME LINE TO IPENZ

From 1840, engineers in New Zealand would often be members of one of the British engineering institutions and would retain that membership while working in New Zealand. Such membership helped to differentiate them from lesser qualified or non-qualified engineers. At that time, there was no regulation imposing minimum qualifications standards on people hired to do public engineering works. Local body engineers (municipalities and counties) from around New Zealand felt the need to discuss engineering works of common interest (La Roche, 2011, p.23), and formed the Institute of Local Government Engineers of New Zealand in 1912. New Zealand members of the Institution of Civil Engineers also felt the need for a New Zealand engineering organisation which could be more representative than only

Year	Engineering Qualifications in New Zealand - Description of Event
1879	School of Mines opened at Otago University. The three-year qualification was called AOSM (Associate of the Otago School of Mines) and awarded in metal mining, metallurgy or geology.
1887	School of Engineering was established at Canterbury University College with two part-time lecturers, Edward Dobson, the first Provincial Engineer in Canterbury; and Robert Julian Scott, who subsequently became Professor-In-Charge from 1894-1923.
1906	Engineering Department within a School of Mines was established at Auckland University College. But students could only complete one year of an engineering degree at Auckland before going to Canterbury to complete the degree. The School of Mines was closed in 1912, but engineering continued on.
1927	Auckland University College was granted recognition by the University of New Zealand of its first and second engineering professional examinations. However, students still had to go to Canterbury to complete their engineering degree.
1948/49	The School of Engineering at Auckland University College was relocated to Ardmore, near Papakura. At around the same time, a full engineering degree course was offered (so students no longer needed to transfer to Canterbury to complete their degree).
late 1950s	The New Zealand Certificate in Engineering (NZCE) was introduced as a middle-group engineering qualification (above trades and lower-level technician qualifications but below four-year engineering degrees), and awarded by the Technicians Certification Authority which later became the AAVA.
1960	The School of Engineering at Canterbury University was shifted from the central city site to new facilities at Ilam.
mid-1960s	Lincoln College in Canterbury first offered a four-year Agricultural Engineering degree (name subsequently changed to Natural Resources Engineering and eventually taken over by the Civil Engineering Department at the University of Canterbury).
late - 1960s	Massey University in Palmerston North first offered a number of four-year degrees in engineering and related technologies.
1968	The School of Engineering at the University of Auckland was relocated back from Ardmore to new facilities on the Symonds Street site in the central city.
1990s	Other providers in New Zealand began to offer four-year engineering degrees. Currently the University of Waikato, Auckland University of Technology, Victoria University of Wellington and Massey University at Albany all offer four-year engineering degrees in defined fields of engineering.
1993	IPENZ adopts the recommendations of the "Pathways" document, recognising the 'wider engineering profession' and leading to the establishment of Technical Member and Associate Member grades of IPENZ membership.
mid-1990s	Two polytechnics (Wellington Polytechnic and Christchurch Polytechnic and Institute of Technology), developed proposals to offer three-year engineering degree qualifications. Both degree programmes were approved and in operation and producing graduates by the year 2000. Wellington Polytechnic was taken over by Massey University in about 1997. The degree at Wellington Polytechnic was originally named BTech, but was subsequently renamed BEngTech as a result of a national agreement to use the letters BEngTech for three-year engineering degree qualifications.
1998/99	After an announcement by the Government in 1998, NZCE was progressively disestablished from 2000 and no longer able to be awarded from 2008. A wide variety of two-year Diplomas in Electrical and Mechanical Engineering were soon being offered around New Zealand and awarded by individual provider institutions, causing much confusion amongst engineering employers. In Civil Engineering, from 1998 a Consortium developed a common two-year Diploma in Engineering (Civil), taught at seven institutions throughout New Zealand, commencing with Year 1, first offered in 2000. Name changed to New Zealand Diploma in Engineering (Civil) from 2008.
2001	Teaching commenced of the three-year BEngTech degree at a number of other Institutes of Technology and Polytechnics around New Zealand, and the Auckland University of Technology. A three-year BEngTech degree is now the underpinning qualification for the Technical Member grade of IPENZ membership.
2009	The National Engineering Education Plan (NEEP) project actively supported development of three-year engineering degree qualifications at NZQF Level 7. A group of six Institutes of Technology and Polytechnics (the Metro Group) developed a common three-year BEngTech degree across their institutions, commencing with Year 1 in 2010. The degree is awarded by the individual institution.
2010	The NEEP project proposed that there should be a common two-year New Zealand Diploma in Engineering across New Zealand at NZQF Level 6, taught in civil, mechanical and electrical engineering. This new ("Unified") NZDE qualification was taught for the first time in 2011 (Year 1) and 2012 (Year 2). The qualification is awarded jointly by the NZ Board of Engineering Diplomas (NZBED) and the provider institution. The NZDE is now the underpinning qualification for the Associate Member grade of IPENZ membership.

Table 2. Timeline for the Development of Engineering Qualifications in New Zealand

local body engineers. So just two years later, the Institute of Local Government Engineers was wound up in favour of the New Zealand Society of Civil Engineers in 1914 (La Roche, 2011, p.24).

Mechanical and electrical engineers who were members of their respective British institutions also expressed a wish to join the new Society and the name was later changed to the New Zealand Institution of Engineers (NZIE) in 1937.

In 1982, the name of NZIE was changed to The Institution of Professional Engineers New Zealand (IPENZ), which is the national body representing the engineering profession in New Zealand. IPENZ sets and enforces competence and ethical standards for the engineering profession in line with international best practice.

DEVELOPMENT OF UNIVERSITY DEGREES IN ENGINEERING (FOUR-YEAR B.E.DEGREES)

A timeline for the development of engineering qualifications in New Zealand is shown in Table 2. on the previous page. From their inception in the late 1880s, engineering degrees were awarded by the University of New Zealand, the engineering schools being part of Canterbury University College and Auckland University College (until these institutions became autonomous universities in 1962). From 1963 onwards, the universities in New Zealand awarded their own engineering degrees. Until the late 1950s, the two main tertiary institutions then offering four-year engineering degree programmes in New Zealand had the word 'College' in their name, but at that time their names were changed to University of Auckland and the University of Canterbury.

The Early Years 1887 – 1967

Canterbury University College

The first School of Engineering in New Zealand was established at Canterbury University College in 1887 when 22 students were enrolled, with two part-time lecturers: Edward Dobson, the first Provincial Engineer in Canterbury; and Robert Julian Scott, who was Manager of the Addington Railway Workshops. Peter Cooke (2014, p.39) has noted that by 1893, a BSc (Engineering) degree was available at Canterbury in all three disciplines of engineering (civil, mechanical and electrical). Night classes were also being taught for artisan and third class marine engineer certificates and apprentices. Scott then became Professor-in-Charge of the School of Engineering from 1894-1923. He guided the Engineering School through its early years and was "a man of vision and forceful personality" (Newnham, 1971, p.223). From 1920, the

school became known as the National School of Engineering (Bassett 2003, p.23), a title used until the mid-1960s when it was dropped as it was obvious that it no longer applied and the school became a Faculty of Engineering.

The School of Engineering moved from the central city site into new buildings at Ilam in 1960 as part of the first stage of moving the whole of the University of Canterbury to the Ilam site. As a First Professional year student, the author clearly recalls this move in May 1960, but with laboratory classes remaining on the central city site until the end of that year.

Auckland University College

At Auckland University College (AUC), the Engineering School was originally within a School of Mines, and established in 1906 (La Roche, 2011, p.23). However, the School of Mines never really became established. It had offered a three-year Associateship course and a four-year Bachelor of Engineering (BE) course in mining, but few students enrolled and none had graduated by 1912 (Bassett, 2003, p. 20). The School of Mines was closed by 1912 but engineering continued on as the Department of Engineering, still officially within a 'School of Mines'. The AUC Calendar in 1913 listed under 'engineering' the following qualifications for which lectures were being offered by the Department:

- College Associateship in Engineering (a three-year course)
- Third Class Marine Engineers Certificate
- Certificate of Licensed Surveyor
- Associate Membership of the Institutions of Civil, Mechanical and Electrical Engineers, London
- The engineering subjects required for an Associateship of the Royal Institute of British Architects

However, this department was not yet recognised by the University of New Zealand as qualified to teach the four-year BE engineering degree course beyond the first year, so students wishing to obtain a BE degree had to go to Canterbury to complete their degree.

In 1923, the University College Council renamed the Department of Engineering to become the AUC School of Engineering. By this time, courses being offered were similar to the first and second professional years of a BE degree but these courses were still not being officially recognised.

In 1927, the University of New Zealand granted recognition to AUC of its engineering first and second professional examinations. But students could only complete

the Engineering Intermediate examination plus two professional years at Auckland, before going to Canterbury to complete their engineering degree. It was not until around 1945 that a full engineering degree course was offered at Auckland, the first being in mechanical engineering with civil and electrical engineering following soon after.

During the period up to 1925, a considerable number of people qualified with the three-year College Associateship qualification of AUC and went on to pursue engineering careers. In his book *The History of the University of Auckland*, Keith Sinclair (1983) notes that by 1925 there were 42 practising engineers with the Auckland Associateship and at that time, the School of Engineering had 114 students, of whom 79 had matriculated (Sinclair, 1983, p.119).

The AUC Associateship in Engineering was still being offered in 1939 as presented in a 'syllabus of lectures' being offered by the AUC School of Engineering in that year. This was probably because a number of students could not afford to go on to Canterbury for the final year BE third professional course and opted instead for the Auckland Associateship qualification, despite the fact that it was not officially recognised as an engineering qualification.

From 1948 to 1967, due to a pressing need to obtain satisfactory premises for teaching and laboratories, the engineering school was relocated to Ardmore near Papakura, south of Auckland, using buildings and other facilities adjacent to an airfield and airbase built during World War Two. In 1968, the engineering school moved back to the central city into new buildings which had been purpose-built in Symonds Street. (In 2014, the engineering school commenced moving its postgraduate student facilities and some major laboratory testing facilities to a new location on the former brewery site in Khyber Pass Road, Newmarket.)

The Later Years: 1967 Onwards

Lincoln College, Canterbury and Massey University in Palmerston North

From about 1967, other universities began to offer four-year Bachelor of Engineering degrees in defined fields of engineering. The first to do so was Lincoln College in Canterbury, first accredited by IPENZ in about 1980, which offered only Agricultural Engineering (name later changed to Natural Resources Engineering, and eventually taken over by the Civil Engineering Department at the University of Canterbury). Cooke (2014) noted that the 1980 review had described the agricultural engineering degree as being "inadequate" (Cooke, 2014, p.100).

In the late 1960s, Massey University in Palmerston North first offered a number of four-year degrees in

engineering and related technologies. Massey had commenced a BFoodTech degree in 1961, and in 1965 renamed it BTech (Food) (and also created a BTech (Biotech), being the first IPENZ-accredited engineering programme from Massey, in 1982). The first graduates emerged from that programme in 1967. By 1982, there was a wider set of four-year degree options at Massey in what are now called bioprocess engineering, industrial and manufacturing engineering, information engineering, computer systems engineering, software engineering and mechatronics. Circa 1980, IPENZ commenced its professional accreditation programme for four-year engineering degrees. Massey University was accredited by IPENZ about two years later (1982), a year after Auckland and Canterbury Universities were first accredited by IPENZ.

The Washington Accord (1989)

In 1989, New Zealand became one of the initial member countries of the Washington Accord, providing an international standard for the four-year Bachelor of Engineering degree and international benchmarking, allowing the holder of the qualification the recognition to work as a professional engineer more easily in other countries. Under this Washington Accord agreement, IPENZ became responsible for the accreditation of four-year engineering degrees in New Zealand.

Since then, other universities in New Zealand have begun to offer four-year engineering degrees but those degrees have only been accredited by IPENZ since the early 2000s. Currently, the University of Waikato, Auckland University of Technology, Victoria University of Wellington and Massey University at Albany all offer four-year degrees in defined fields of engineering. Massey University also delivered four-year degree programmes from its Wellington campus for a period from about 2000 to 2010, before discontinuing these programmes.

Degree in Mining Engineering – and Associate of the Otago School of Mines (AOSM)

The only long-standing School of Mines in New Zealand was opened at the University of Otago on 1 May 1879. Its three-year qualification was called Associate of the Otago School of Mines (AOSM) and was awarded in metal mining, metallurgy or geology. Some years later (date unknown but thought to be in the 1910s), a four-year BE (mining) degree was offered, above the three-year AOSM qualification, and this later became a BE in mineral engineering and the letters AOSM were retained as a post-graduate distinction.

Bassett (2003, p.26) noted that in 1925, Otago



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graduates with a BE (Mining) degree were practising as civil engineers.

Bassett (p.37) also presents a syllabus of teaching offered by the School of Engineering at Auckland University College in 1939 which includes offering lectures for the following course: "The Degree of Bachelor of Engineering (Mining and Metallurgical). (The final year must be taken at Dunedin)". In the latter part of this period, an outstanding BE graduate from the Otago School of Mines was Professor Alan Titchener who obtained his BE degree and AOSM there, before completing his doctorate at the Massachusetts Institute of Technology, followed by a long and distinguished career at the University of Auckland.

The BE degree in mineral engineering at Otago was discontinued circa 1964 (Parry, 1979, p9). Mineral processing was relocated to be within a faculty of science. Its qualification became a BSc or BSc (Hons) in mineral technology, and metallurgy was no longer taught. The BSc (Hons) was later converted to a BMinTech (Hons) degree and with the letters AOSM becoming a postgraduate distinction. The Otago School of Mines continued on with varying numbers of mining engineering students within a single department (Parry, 1979, p.9). The output of graduates with

a BE (Mining) degree qualification continued, and the Otago School of Mines celebrated its centenary in 1979.

Other Schools of Mines

It is noted that in 1906 when an engineering department was first established at Auckland University College, it was located within a School of Mines. That school never really became established and was discontinued by 1912, but engineering continued on. Many (more than 20) other small schools of mines were established in New Zealand to give basic technical instruction, some under the guidance of the Otago School of Mines. This followed the gold rushes from the early 1860s, but by 1898 only six remained due to the general decline in gold mining activity and, by around the 1930s, they mostly seemed to have been disestablished except for the School of Mines at Otago University.

Transfer of Mining Engineering to the University of Auckland

The School of Mines at Otago University was closed down in the mid-1980s and some of the staff (six academic staff and four technicians) were transferred to a new Department

of Mining Engineering within the Faculty of Engineering at the University of Auckland. The intention was to re-establish a four-year BE degree in mining engineering and in mineral processing engineering, with teaching scheduled to commence in 1986 (Bassett, 2003, p.139). This initiative occurred presumably because it had been determined that, in order to maintain uniformity of standards for accreditation of a mining engineering degree and a mineral processing engineering degree, these should be located within an existing faculty of engineering in New Zealand. But these initiatives did not long survive the move from Dunedin to Auckland because of very little student interest in enrolling and were soon discontinued. However, a small number of mining engineering graduates were produced. In 1994, the four remaining staff merged with civil engineering to become the Department of Civil and Resource Engineering (Bassett, 2003, p.139) and a mining engineering BE degree was no longer available.

So, for New Zealand students wishing to now pursue a mining BE degree qualification or a mineral processing BE degree qualification, the closest universities offering such an engineering degree are located in Australia. (Note also that the only four-year Land Surveying degree in New Zealand is located at the University of Otago.)

INCLUSION OF PEOPLE WITH A TWO YEAR AND THREE-YEAR ENGINEERING QUALIFICATION WITHIN THE WIDER ENGINEERING PROFESSION

The Technical Member and Associate Member Grades of IPENZ Membership

Since about 1993, following presentation and consultation over the unpublished IPENZ Pathways discussion document (The Pathway to the Future, – October 1993), there has been full recognition by IPENZ of the wider engineering profession within New Zealand. This has been a very significant IPENZ policy change which has now been implemented. This includes the Technical Member grade of IPENZ membership, for which the underpinning qualification is now a three-year BEngTech degree from a university, institute of technology or polytechnic, awarded in New Zealand from about the year 2000.

The wider engineering profession has now also been extended to include the Associate Member grade of IPENZ membership, for which the underpinning qualification is now a two-year Diploma in Engineering introduced from the year 2000 (now known as the NZDE), from an institute of technology or polytechnic; or its predecessor qualification, the New Zealand Certificate in Engineering (NZCE), which

was first established in the 1950s and was discontinued from 2000 and last awarded in 2008. Both IPENZ membership grades, Technical Member and Associate Member, are now accorded professional standing within the wider engineering profession. These membership grades have been developed to give professional recognition within IPENZ and through which members are bound by a code of ethics, professional development expectations and disciplinary processes.

The inclusion process began with the 1993 Pathways document which led to IPENZ creating the Technical Member grade. Then in about 1998, this grade was split between Technologist (three-year level of engineering qualification) and Associate Member (two-year level of engineering qualification). The Technologist grade was then renamed Technical Member in 2003 (at the same time as the Member grade was renamed Professional Member).

The IPENZ Engineering Edge document, originally published in about 2003, states that it is a guide to getting the right engineer for the job and that members of the wider engineering profession work at various levels of expertise and exercise different degrees of direct responsibility (The Institution of Professional Engineers New Zealand, 2012). This recognition of the 'wider engineering profession' within its membership grades enables IPENZ to be more representative in making submissions to organisations and government on various engineering matters of concern, rather than just being the views of a body representing engineers with a four-year engineering degree qualification. It also led to a significant increase in IPENZ membership numbers. Cooke (2014) notes that IPENZ could not afford to let its role fragment amongst other bodies (2014, p.110).

The Sydney and Dublin Accords

IPENZ has assumed responsibility as the authorised body in New Zealand for the engineering accreditation of both the three-year and two-year engineering qualifications.

The qualifications are benchmarked internationally for recognition in a number of other countries:

- Three-year engineering qualification – Sydney Accord (established 2001)
- Two-year engineering qualification – Dublin Accord (established 2003)

International Engineering meetings were then established to oversee all three of the Washington, Sydney and Dublin Accords, leading on to the establishment of the International Engineering Alliance in 2007.

Defining a Competence Standard for the Two-year and Three-year Engineering Qualifications

Cooke (2014) has noted that IPENZ played a leading role at the International Engineering meeting held in South Africa in 2001 in developing a proposal for differentiating between the two-year, three-year and four-year engineering qualifications by means of a competence standard (2014, p.126). It was determined that this definition should not be based on the length of time it took to obtain the qualification, or by definition of engineering role, but instead a distinction was developed, based on the complexity of engineering problems and the abilities of engineers with qualifications which took longer to obtain, to tackle more complex problems. Three graduate profiles were developed, based on three descriptors for the engineering problems, as follows:

- People with a four-year engineering qualification can work independently on solving complex engineering problems;
- People with a three-year engineering qualification can work independently on solving broadly-defined engineering problems;
- People with a two-year engineering qualification can work independently on solving well-defined engineering problems.

In the Engineering Edge document, IPENZ has defined three “occupational groups” (The Institution of Professional Engineers New Zealand, 2012, p.2) accordingly this is discussed further.

In the introduction, the IPENZ Engineering Edge document states: “There are three engineering occupational groups within the wider engineering profession” (The Institution of Professional Engineers New Zealand, 2012, p2). A key point to note is that a large majority of engineering problems to be solved are broadly-defined or well-defined and only a relatively small proportion are complex engineering problems. If a person is qualified to work independently on solving engineering problems (at whatever level of complexity) they are by definition an ‘engineer’ within the ‘wider engineering profession’ and therefore fully entitled to call themselves an engineer.

By definition, engineers are problem solvers at various levels of engineering complexity.

The Need for a Career Path for People With Two-year and Three-year Engineering Qualifications

Relevant to the paragraphs above, Cooke (2014) noted the IPENZ Pathways document of 1993 had suggested that

“professional engineers” would always supervise the work of “engineering associates” or “engineering technicians” (2014, p.120). He then quotes a statement from Dr Andrew Cleland, former Chief Executive of IPENZ as saying: “This is a nonsense [sic]. We need career paths for these people. They are alternatives, not assistants, to professional engineers; they simply undertake less complex work...” Cooke (2014, p. 120).

The IPENZ Engineering Edge document states: “The career model on page 36 shows how engineers may move between the three ‘occupational groups’ by deepening their technical knowledge and/or moving into team leadership or management roles.” (The Institution of Professional Engineers New Zealand, 2012, p. 3)

DEVELOPMENT OF THE TWO-YEAR LEVEL OF ENGINEERING QUALIFICATION

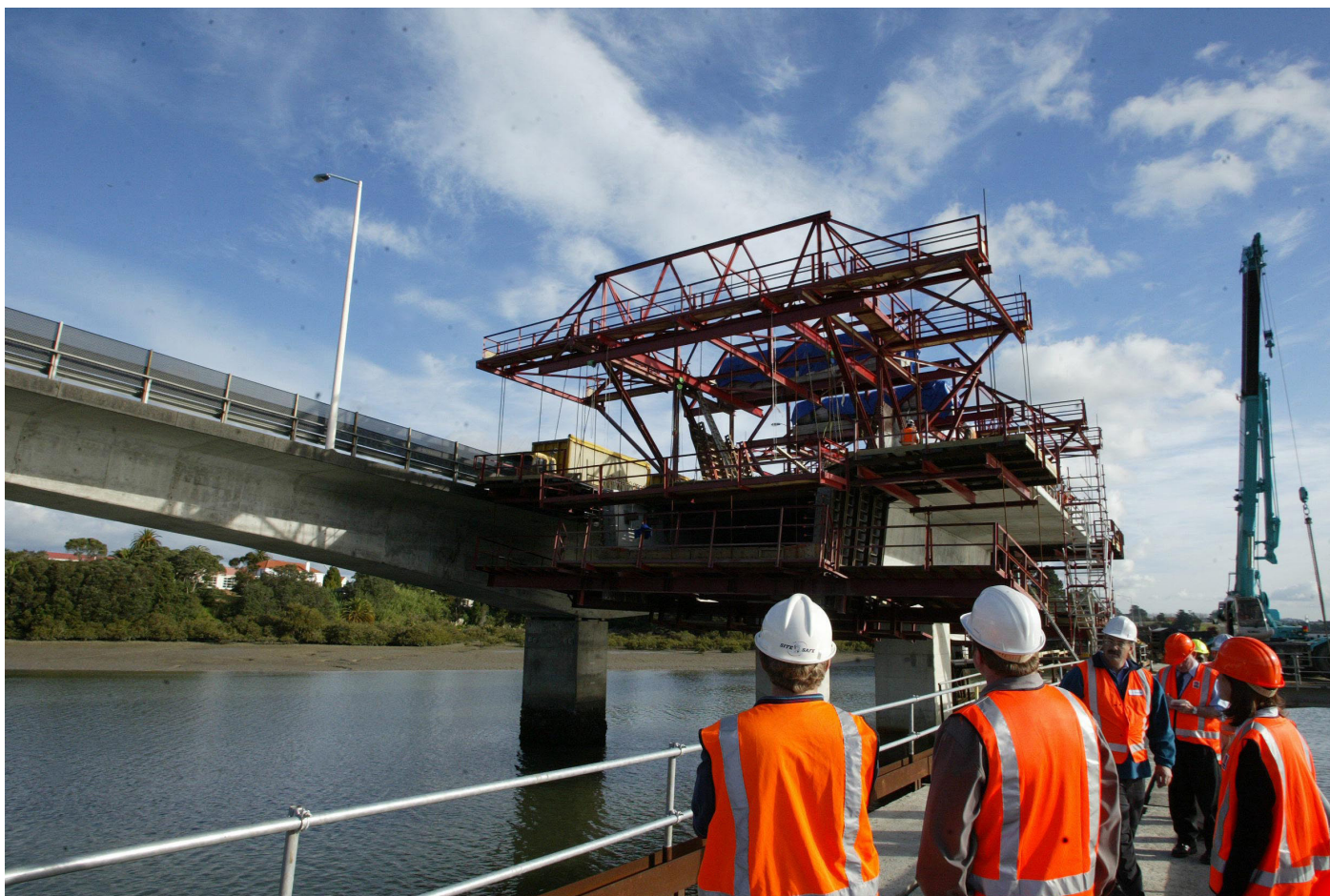
The Earlier Years: Up To 1998

The New Zealand Certificate in Engineering (NZCE)

The New Zealand Certificate in Engineering was introduced in the late 1950s. Its controlling authority was established in 1954 and the first NZCE courses were started in 1956 (Cooke, 2014, p.78). It was a very popular qualification for people to obtain between about 1960 through to the late 1990s. It was offered in civil, electrical and mechanical engineering, and also required a certain amount of practical engineering work experience to be achieved before the qualification could be awarded. It was often referred to as a middle group engineering qualification above trades and lower-level technician qualifications, but below the four-year Bachelor of Engineering degree (Cooke, 2014, p.78). Soon after 1956, New Zealand Certificates were also being offered in draughting, science and building construction, followed later by land surveying.

NZCE courses were offered at various institutes of technology and polytechnics (ITPs) throughout New Zealand, and NZCE could also be studied by means of correspondence courses. After initially being awarded by the Technicians Certification Authority until 1979, the certificate for the NZCE was awarded by the AAVA (Authority for Advanced Vocational Awards) rather than the individual provider institution. After 1998, when the AAVA was subsumed within the New Zealand Qualifications Authority (NZQA) and when the NZCE was being disestablished, the NZCE was awarded by the NZQA until 2008 when it was no longer able to be awarded. NZQA still maintains the qualification records of NZCE students.

After obtaining the NZCE qualification, a small



'Auckland Construction' with permission from Unitec

proportion of students would then transfer to a university engineering school and complete the Bachelor of Engineering degree after about two years (or a little more) of further full-time study. Some of these students then went on to have outstanding engineering careers.

During the period from about 1960 to 2000, NZCE-qualified people were highly regarded by employers in certain job categories. Engineering employers, especially in civil engineering, would often advertise for junior professional engineering staff as either a BE graduate or a NZCE-qualified person. A key point here is that the NZCE qualification was always regarded by employers in New Zealand as being an engineering qualification, albeit at a considerably lower technical level of complexity than a four-year engineering degree. The NZCE was a five-year part-time engineering qualification plus three years of full-time work experience, which could be obtained concurrently. It was that practical engineering work experience requirement which had helped to make the NZCE qualification so well-regarded by engineering employers. The courses in the early years of NZCE (Stages 1 and 2) were quite elementary, and cross credits could be gained with passes in relevant School Certificate and University Entrance examinations.

The Later Years: From 1998 Onwards

Diplomas in Engineering

After an announcement by the Government in 1998, the NZCE qualification was progressively disestablished from 2000, as it no longer fitted within the New Zealand Government's qualifications framework. It was replaced starting in 2000 by two-year full-time Diplomas in Engineering, but these diplomas did not include an engineering work experience requirement as the NZCE had done, and also there was no common standard across New Zealand, as had been the case with NZCE.

As a result, from 2000 a wide variety of diplomas in electrical and mechanical engineering were soon being offered around New Zealand and awarded by individual tertiary institutions. This caused much confusion amongst engineering employers.

In civil engineering from 1998, a consortium led by Unitec Institute of Technology developed a common Diploma in Engineering (Civil), which was taught in seven institutions throughout New Zealand.

The New Zealand Diploma in Engineering (NZDE)

From 2008, the NZCE could no longer be awarded and in that year, the civil engineering two-year Diploma in Engineering (Civil) administered by the consortium had a name change to New Zealand Diploma in Engineering (Civil) approved by the New Zealand Qualifications Authority (NZQA).

Then in 2009/2010, the National Engineering Education Plan (NEEP) project proposed that there should be a 'unified' New Zealand Diploma in Engineering (NZDE) qualification across New Zealand in civil, electrical and mechanical engineering at NZQF Level 6, to replace a variety of two-year Diplomas in Engineering. This proposal

Typical Qualification	Current Competence	Professional Standing (in IPENZ)
BE degree (4 years study)	Chartered Professional Engineer CPEng	Professional Member MIPENZ
BEngTech degree (3 years study)	Engineering Technology Practitioner ETPract	Technical Member TIPENZ
NZDE or DipEng (2 years study)	Certified Engineering Technician CertETn	Associate Member AIPENZ

Table 3. Competence and Professional Standing Quality Marks

Source: The Institution of Professional Engineers New Zealand. (2012)

was approved by NZQA and the new NZDE qualification was taught for the first time in 2011 in Year 1 and 2012 in Year 2. There are at present 15 providers, mainly ITPs, now accredited by IPENZ to teach the new 'unified' NZDE qualification.

These providers are Northland Polytechnic in Whangarei; Manukau Institute of Technology (MIT) and

Qualification	Engineering Work Experience Required*	Review	Competence Quality Mark
BE degree (4 years study)	4-7 years	Competence assessment and interview	CPEng
BEngTech degree (3 years study)	4-7 years	Competence assessment	ETPract
NZDE or DipEng (2 years study)	4-7 years	Competence assessment	CertETn
NZDE/NZDEP	2-4 years	Competence assessment	CertETn

Table 4. Pathways to Current Competence Quality Marks

Source: The Institution of Professional Engineers New Zealand (2012)

*Frequently now expressed as 'On Job Learning and Development'

Unitec Institute of Technology in Auckland; The Queens Academic Group in Auckland Central; Waikato Institute of Technology (Wintec) and the New Zealand Institute of Highway Technology (NZIHT) in Hamilton; Bay of Plenty Polytechnic in Tauranga; Western Institute of Technology Taranaki (WITT) in New Plymouth; Universal College of Learning (UCOL) in Palmerston North; Wellington Institute of Technology (Weltec) and The Open Polytechnic of New Zealand in Wellington; Nelson Marlborough Institute of Technology in Nelson; Christchurch Polytechnic and Institute of Technology (CPIT) in Christchurch; Otago Polytechnic in Dunedin; and Southern Institute of Technology in Invercargill.

The new NZDE qualification is jointly awarded by the New Zealand Board of Engineering Diplomas (NZBED) and the provider institution.

In 2011, the Auckland University of Technology (AUT) commenced phasing out teaching of two-year Diplomas in Engineering (electrical and mechanical) which it had been offering for the previous 10 years from 2000, (when the NZCE became no longer available to new entrants). AUT is now focused on providing three-year and four-year engineering degree qualifications. A two-year Diploma in Engineering or NZDE qualification is now the underpinning qualification for the Associate Member grade of IPENZ membership (AIPENZ).

New Zealand has had provisional member status of the Dublin Accord since 2006 and in 2013, moved from being a provisional member of the Dublin Accord to having full signatory status.

DEVELOPMENT OF THE THREE-YEAR LEVEL OF ENGINEERING QUALIFICATION

The Earlier Years 1997 – 2008

The BEngTech Engineering Degree

In the mid-1990s the first polytechnics in New Zealand to develop proposals to offer a three-year engineering degree qualification were the old Wellington Polytechnic (taken over by Massey University in about 1997) and CPIT. Both of these degree programmes were approved and under way by 1997.

The Wellington Polytechnic three-year engineering degree programme was initially called a BTech degree but a national agreement was then brokered to use the BEngTech letters for three-year engineering qualifications and reserve the letters BTech for use with some four-year engineering degree qualifications then being offered by Massey University. A key point here is that the BEngTech degree was conceived and developed as a three-year engineering degree qualification. The letters BEngTech were adopted for the degree in order to sufficiently differentiate the name and

letters for a three-year engineering degree from a four-year engineering degree qualification, so as to be acceptable to providers of four-year engineering degree qualifications in New Zealand. In Wellington, Massey University renamed their three-year engineering degree qualification as a BEngTech degree programme soon after 1997 and continued to teach it for several years before discontinuing.

As the NZCE qualification commenced phasing out in 2000, a number of other ITPs and AUT began to offer a three-year BEngTech degree at NZQF Level 7 in civil, electrical and mechanical engineering from about 2001. The BEngTech degree is now the underpinning qualification for the Technical Member grade of IPENZ membership (TIPENZ).

Following the signing by New Zealand of the Sydney Accord in 2001, the first BEngTech degree accreditation by IPENZ was at the Christchurch Polytechnic and Institute of Technology (CPIT) in 2001 (in electrotechnology). This provisional accreditation was followed soon after by other ITPs, and the Auckland University of Technology.

(IPENZ became a founding signatory of the Sydney Accord in 2001 but had begun accrediting three-year degree programmes before that date.)

The BEngTech degree is intended to be an 'intermediate' level of engineering qualification between two-year Diplomas in Engineering (at NZQF Level 6) and four-year Bachelor of Engineering qualifications (at NZQF Level 8). But as a degree, the BEngTech qualification does have considerably more "status" than a two-year engineering diploma.

The Later Years: 2009 Onwards

In 2009/2010 the NEEP project encouraged the ongoing development of the three-year BEngTech engineering qualification (at NZQF Level 7) throughout New Zealand. Also, a group of six ITPs (the "Metro Group") took the initiative to establish a common BEngTech degree programme across their six institutions, and this concept was supported by the NEEP project. This common BEngTech degree is awarded by the individual provider institution.

The Metro Group consists of Unitec and Manukau Institutes of Technology in Auckland; Waikato Institute of Technology (Wintec) in Hamilton; Wellington Institute of Technology (Weltec) in Wellington; Christchurch Polytechnic and Institute of Technology (CPIT) in Christchurch; and Otago Polytechnic in Dunedin.

There are at present three other BEngTech degrees being offered in New Zealand. These are from Auckland University of Technology (AUT) in mechanical and electrical engineering; The Open Polytechnic of New Zealand (TOPNZ)

– based on a degree from the University of Southern Queensland (USQ); and a BEngTech (Highways) degree being offered by the NZ Institute of Highway Technology (NZIHT) in Hamilton – awarded through the Western Institute of Technology, Taranaki (WITT).

Note that NZIHT has recently discontinued its three-year BEngTech degree. They are no longer taking enrolments and are teaching it out until 2016.

QUALIFICATION STRUCTURE OF THE ENGINEERING PROFESSION IN NEW ZEALAND

Competence Standard and Professional Recognition

In New Zealand, in distinguishing between competence standards for people with four-year, three-year and two-year engineering qualifications, the main distinction is in the nature of the engineering problems tackled and the engineering activities undertaken, as follows:

- Can work independently on solving complex engineering problems (four-year BE degree);
- Can work independently on solving broadly defined engineering problems (three-year BEngTech degree);
- Can work independently on solving well defined engineering problems (two-year NZDE qualification).

All three levels have the same ethical obligations. This can be interpreted as meaning that all three competence standards now come within the wider engineering profession in terms of ethical obligation, but they qualify for different grades of membership within IPENZ.

From 1989, IPENZ became responsible for the accreditation of four-year engineering qualifications in New Zealand under the Washington Accord.

IPENZ has extended its professional accreditation programme to:

- Three-year engineering qualifications from 2001 coinciding with the signing of the Sydney Accord; and
- Two-year engineering qualifications from 2012, as IPENZ moved from being a provisional member of the Dublin Accord to becoming a full member in 2013.

(Note IPENZ began accrediting three-year degree programmes before 2001 but the Sydney Accord provided an international benchmark and enhanced international recognition for that accreditation activity.)

Category	Qualification Being Studied For In 2012	EFTS	Percentage
1	Doctorate	890	7.7%
2	Masters Degrees	550	4.7%
3	Honours Degrees – including Postgraduate Certificates/Diplomas	4,890	42.2%
4	Four-Year Degrees	1,910	16.4%
5	Three-Year Degrees	970	8.4%
6	Two-Year Diplomas	2,280	19.7%
7	Graduate Certificates and Diplomas	110	0.9%
Total		11,600	100.0%

Table 5. Qualifications being studied for within New Zealand in “Engineering and Related Technologies” in 2012 from two-year Diploma up to Doctorate level

Source: Education Counts (2014)

Field of Study	1 Doctorate	2 Masters	3 Bachelors Hons And Postgrad Diploma	4 4 Year Bachelors	5 3 Year BEngTech	6 2 Year Diploma	7 Graduate Certificates and Diplomas	8 Total	9 %
Process and Resources Engineering	160	70	560	150	-	70	10	1020	8.8
Manufacturing Engineering and Technology	-	10	120	50	-	110	-	290	
Automotive Engineering and Technology	-	-	-	90	-	-	-	90	
Mechanical/Industrial Engineering and Technology	240	90	980	-	250	270	10	1840	19.1
Civil Engineering	150	140	810	-	250	400	30	1780	15.4
Geomatic Engineering (incl Land Surveying)	20	20	50	480	-	60	-	630	5.5
Electrical and Electronic Engineering and Technology	160	130	1120	400	470	580	40	2900	25.0
Aerospace Engineering and Technology	10	-	10	280	-	410	-	710	6.1
Maritime Engineering and Technology	-	-	-	30	-	240	-	270	2.3
Other Engineering and Related Technologies	150	90	1240	430	-	140	20	2070	17.8
Total	890	550	4890	1910	970	2280	110	11600	100.0

Table 6. Qualifications being studied for in “Engineering and Related Technologies” in New Zealand in 2012 in various stated fields of study

Source: Education Counts (2014)

Note: Three-year BEngTech degrees are not differentiated from four-year Bachelors degrees in the Ministry of Education data. The known number of EFTS on BEngTech degrees has been split off the four-year Bachelors degrees in compiling this table.

Competence and Professional Standing Quality Marks

The present situation in New Zealand with regard to engineering competence and professional standing quality marks is summarised in Table 3.

Pathways to Current Competence

The usual pathways to current competence are shown in Table 4. The pathway to Chartered Professional Engineer (CPEng) status is to obtain a four-year Bachelor of Engineering degree then four to seven years of engineering work experience followed by a competence assessment (professional review and interview).

The pathway to Engineering Technology Practitioner (ETPract) status is to obtain a three-year BEngTech degree, then four to seven years of engineering work experience, followed by a competence assessment. The pathway to Certified Engineering Technician (CertETn) status is to obtain a two-year Diploma in Engineering or NZDE qualification, then four to seven years of engineering work experience, followed by a competence assessment.

An alternative pathway after obtaining the NZDE qualification is to obtain a New Zealand Diploma in Engineering Practice (NZDEP) which can be achieved after a further two to four years part-time study and work experience, followed by a competence assessment. The NZDEP is awarded by some of the Industry Training Organisations (ITOs).

PRESENT DAY DIVERSITY OF ENGINEERING EDUCATIONAL QUALIFICATIONS IN NEW ZEALAND

From the two-year Diploma up to Doctorate level

There is now a wide diversity of engineering qualifications within New Zealand, both in terms of level of engineering qualification and the major discipline (field of study).

Total EFTS in New Zealand in Engineering and Related Technologies (in 2012)

Table 5 lists the available information (Education Counts, 2014) of the number of students (in EFTS) studying engineering and related technologies in New Zealand in 2012, from two-year Diploma level up to Doctorate level (after separating out lower level Certificate qualifications). EFTS is the abbreviation for equivalent full-time students. Note: This information was the latest available when this exercise was undertaken (and which first became available in July 2013).

Table 5 shows a total of 11,600 EFTS in 2012 for

students engaged in “engineering and related technologies” studies from two-year Diplomas up to Doctorate level. This is double the number of EFTS given in published information (Collins, 2012), which stated that the source was from the Ministry of Education for the year 2011. (However, the figure of 5,570 EFTS given by Collins was stated to be for Bachelors level engineering qualifications only).

Based on the information given in Table 5, in 2012 out of a total of 11,600 EFTS in ‘engineering and related technologies’ studies from two-year Diploma up to Doctorate level, there were a total of 6,800 EFTS in Categories 3 and 4 (being four-year Bachelors degrees and Honours degrees in engineering and including postgraduate certificates/diplomas). Hence in 2012, 58.6% of the total EFTS were in Categories 3 and 4.

Table 6 gives a breakdown of this information on EFTS into the various stated fields of study within engineering, as presently being studied in New Zealand (2012).

The more traditional categories within engineering made up 68.3% of the total as follows:

	EFTS %
Electrical and Electronic Engineering and Technology	25.0%
Mechanical/Industrial and Automotive Engineering and Technology	19.1%
Civil Engineering	15.4%
Process and Resources Engineering	<u>8.8%</u>
	68.3%

The remainder of 31.7% is made up as follows:

Geomatic Engineering*	5.5%
Aerospace Engineering and Technology	6.1%
Maritime Engineering and Technology	2.3%
Other Engineering and Related Technologies**	<u>17.8%</u>
	31.7%

*Geomatics Engineering is a new term incorporating the original field of Land Surveying, along with many other fields of spatial data management, including global positioning systems (Geomatics engineering, 2015). The Ministry of Education data includes 480 EFTS studying for a four-year Bachelors degree in land surveying, which in New Zealand would not be regarded as an engineering qualification.

**A qualification in some of these ‘related technologies’ would not be regarded as an engineering qualification in New Zealand.

ADJUSTMENT FOR NON-ENGINEERING QUALIFICATIONS

In addition to the 5.5% of students (630 EFTS) studying Land Surveying (geomatic engineering) in New Zealand in 2012, it is estimated that a further 5.0% of students (580 EFTS) are studying for a qualification not regarded as an engineering qualification in New Zealand, but rather a “Related Technologies” qualification. (The author did not have access to detailed information, so this is a broad estimate only).

This would reduce the total number of EFTS studying on engineering programmes between two-year Diploma and Doctorate levels in 2012 from 11,600 EFTS to 10,390 EFTS.

For the 2012 year, this would alter the figures given in Section 8.0 for various “fields of study” within engineering to the following:

	EFTS %
Electrical and Electronic Engineering and Technology	27.9%
Mechanical/Industrial and Automotive Engineering and Technology	21.4%
Civil Engineering	17.1%
Process and Resources Engineering	9.0%
Remainder	24.6%
Total	100.0%

INCREASING VARIETY IN MAJOR ENGINEERING DISCIPLINES OF IPENZ-ACCREDITED QUALIFICATIONS

Since 1970, there has been a steadily growing variety in the major disciplines being offered for IPENZ-Accredited engineering qualifications, especially at the level of four-year BE and BE (Hons) degree qualifications.

Whereas the two-year NZDE qualification is still only awarded in the three major engineering disciplines of civil, electrical and mechanical engineering in 2014, by a total of 15 tertiary institutions; the BEngTech three-year engineering degree qualification is now being awarded in eight specified engineering disciplines by a total of nine tertiary institutions; and the four-year BE and BE (Hons) degree in 31 specified engineering disciplines by a total of six tertiary institutions.

The specified major engineering disciplines are listed in Tables 7, 8 and 9 respectively for the two-year, three-year and four-year engineering qualifications being offered in 2014 (Professional standards, n.d.).

Major Engineering Discipline	Number of Tertiary Institutions Offering this Major Discipline
Civil Engineering	11
Mechanical Engineering	9
Electrical Engineering	8

Table 7. Two-year NZDE Qualification

(Fifteen Tertiary Institution Providers)

Source: <https://www.ipenz.nz/home/news-and-publications/news-article/ipenz-accredited-two-year-diplomas-in-engineering>

Note: Specified major engineering disciplines being offered in 2014 for the IPENZ-Accredited NZDE qualification and the number of tertiary institutions offering each major engineering discipline.

Major Engineering Discipline	Number of Tertiary Institutions Offering this Major Discipline
Civil Engineering	6
Mechanical Engineering	5
Electrical Engineering	5
Electrical and Electronic Engineering	1
Electronic Engineering	1
Network and Communications Engineering	1
Computer and Mobile Systems Engineering	1
Highways Engineering	1 (now discontinued but being taught out until 2016)

Table 8. Three-year BEngTech Degree Qualification

(Nine Tertiary Institution Providers)

Source: <https://www.ipenz.nz/home/news-and-publications/news-article/ipenz-accredited-three-year-engineering-technology-degrees>

Note: Specified major engineering disciplines being offered in 2014 for the IPENZ-Accredited BEngTech degree qualification and the number of tertiary institutions offering each major engineering discipline.

Major Engineering Discipline	Number of Tertiary Institutions Offering this Major Discipline
Civil Engineering	2
Mechanical Engineering	4
Mechatronics	3
Electrical and Electronic Engineering	3
Electrical, Electronic and Communications Engineering	1
Electronic and Communications Engineering	1
Electronic Engineering	1
Biotronics	1
Electronic and Computer Systems Engineering	2
Computer Engineering	1
Computer Systems Engineering	1
Computer and Electronic Engineering	1
Software Engineering	5
Telecommunications and Network Engineering	1
Network Engineering	1
Forest Engineering	1
Natural Resources Engineering	1
Environmental Technology and Sustainable Energy	1
Engineering Science	1
Biomedical Engineering	1
Product Design Engineering	1
Product Development Engineering	1
Engineering and Industrial Management	1
Industrial Automation Engineering	1
Multimedia Systems Engineering	1
Chemical and Materials Engineering	1
Chemical and Process Engineering	1
Chemical and Biological Engineering	1
Materials and Process Engineering	1
Biotechnology	1
Chemical Engineering and Nanotechnology	1

Table 9. Four-year BE and BE (Hons) Degree Qualification

(Six Tertiary Institution Providers)

Source: <https://www.ipenz.nz/home/news-and-publications/news-article/ipenz-accredited-four-year-degrees>

Note: Some of these specified major engineering disciplines are similar to but slightly different from other specified major engineering disciplines.

It is noted that civil engineering has broadly managed to remain the major engineering discipline for a number of very important engineering sub-disciplines, including:

- Structural engineering
- Water engineering (including water supply, catchment control, flood protection and coastal protection)
- Water-waste engineering (solids and liquids)
- Geotechnical engineering
- Transportation engineering and Roading (including highway and traffic engineering)
- Environmental engineering
- Harbour and Ports engineering
- Earthquake engineering
- Fire engineering

Whereas in more recent years, the other early major engineering disciplines (electrical, mechanical and chemical) have each split off into a number of separate major engineering disciplines.

CONCLUSION

The history of the development of engineering qualifications in New Zealand from first British settlement in 1840 up to the present time has been described, which includes:

- Four-year engineering degrees awarded from the early 1890s up to the present;
- Courses and examinations prepared by the British engineering institutions from 1897 up to the mid 1960s;
- Two-year engineering qualifications, commencing with the New Zealand Certificate in Engineering (NZCE) from the late 1950s until about 2000, through the Diploma in Engineering qualification, to the present New Zealand Diploma in Engineering qualification from 2010;
- Three-year Bachelor of Engineering Technology (BEngTech) degree qualifications from about 2001 up to the present.

The total of equivalent full-time students (EFTS) studying engineering in New Zealand from two-year diplomas up to doctoral level, had risen to 10,400 EFTS by 2012, of which 59% were for students who are enrolled in four-year BE or BE (Hons) degree qualifications.

The number of major engineering disciplines being offered on the various engineering qualifications in

New Zealand has risen greatly in recent years. There are still only three major engineering disciplines to choose from on the NZDE qualification (civil, electrical and mechanical), but there are seven major engineering disciplines currently being offered for the BEngTech engineering degree qualification and a total of 31 major engineering disciplines now being offered on accredited four-year BE or BE(Hons) engineering degree qualifications in New Zealand.

ACKNOWLEDGMENTS

The author and ePress would like to acknowledge and thank Jonathan Leaver and Brett Williams for their guidance.

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