

# DEVELOPMENT OF ENGINEERING QUALIFICATIONS IN NEW ZEALAND – A BRIEF HISTORY

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## 1.0 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.

### 1.1 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 established. 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 1800's.

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 5 years, and to have demonstrated competence therein.

### 1.2 The Intermediate Years 1890 – 1950

By **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 degrees in engineering could be used to exempt students from these preliminary examinations and thus fulfill the educational requirements needed to obtain full membership).

Special courses, including night classes, were implemented from the early 1900's at some technical colleges in New Zealand, to assist students in completing the correspondence courses provided by the British engineering institutions.

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Frequently this period of part-time study and correspondence courses would be completed as part of a “cadetship” with an engineering employer. Some of the people undertaking this study would already have another university degree (usually in science) who then 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, had the advantage of being able 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** (see following page), the NZIE became the engineering institution of choice in New Zealand for most engineering graduates and other engineers qualifying through passing these British engineering institution examinations and then wishing to join a professional engineering institution. However, a considerable proportion of these people also chose to join one of the British engineering institutions.

In the late 1940's, 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.

### **1.3 The Later Years 1950 Onwards**

**From 1950 onwards**, these 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 University School of Engineering's final year courses before sitting the Institution examinations.

Also, from 1950 onwards, 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 1980's.

In New Zealand, the examinations of the British engineering institutions were phased out in **about 1965** as by then, very few people were still using this route to professional engineering qualifications, rather than obtaining a four-year BE degree from a University.

### **1.4 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 New Zealand Institution of Engineers (NZIE) established in 1937 and which later became the Institution of Professional Engineers New Zealand (IPENZ) in 1982.

A period of several years of on 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.

### 1.5 Member and Fellow Grades

After obtaining about twenty 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 (later becoming IPENZ from 1982) adopted similar changes in the names of membership grades which were then called:

- “Corporate Member” – designated MNZIE (later MIPENZ), and
- “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.

### 2.0 THE TIME LINE TO IPENZ

From **1840 onwards** 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.

Local body engineers (municipalities and counties) from around New Zealand felt the need to discuss engineering works of common interest and their employment status, 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 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**.

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.

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

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

A timeline for the development of engineering qualifications in New Zealand is shown on Table 2.

From their inception in the late 1880's, 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 1950's, the two institutions 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.

#### 3.1 The Early Years 1887 - 1967

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.

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 said to be "a man of vision and forceful personality".

The School of Engineering moved from the central city site into new buildings at Ilam in 1960 as 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.

At **Auckland University College**, the Engineering School was originally within a School of Mines, and established in **1906**. The School of Mines was closed by 1912 but engineering continued on. In **1927**, Auckland was granted recognition 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 **1945** before a full engineering degree course was offered at Auckland, the first being in mechanical engineering with electrical and civil engineering following soon after.

From 1948 – 1967, the engineering school was located at Ardmore, near Papakura south of Auckland using buildings and other facilities adjacent to an airfield built during World War II. In 1968, the engineering school moved back to the central city into new buildings which had been purpose built in Symonds Street.

#### 3.2 The Later Years 1967 Onwards

From about **1967 onwards**, 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).

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 School within a School of Mines was established at Auckland University College. But students could only complete two years 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 of its first and second engineering professional examinations.
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).
1950's	The New Zealand Certificate in Engineering (NZCE) was introduced as a <b>middle group engineering qualification</b> (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-1960's	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 - 1960's	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.
1990's	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, leading to the establishment of <b>Technical Member</b> and <b>Associate Member</b> grades of IPENZ membership.
mid-1990's	Two polytechnics (Wellington Polytechnic and Christchurch Polytechnic and Institute of Technology), developed proposals to offer <b>three-year engineering degree qualifications</b> . Both degree programmes were approved and in operation and producing graduates by the late 1990's. Wellington Polytechnic was taken over by Massey University in about 1997. The degree at Wellington Polytechnic was originally named BTEch, but subsequently renamed BEngTech as a result of a national agreement to use the name 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 <b>the three-year BEngTech degree</b> 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 <b>National Engineering Education Plan (NEEP)</b> 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 <b>common two-year New Zealand Diploma in Engineering</b> across New Zealand at NZQF Level 6, taught in civil, mechanical 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.
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**Table 2** Timeline for the Development of Engineering Qualifications in New Zealand

In the late 1960's, 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), the latter 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.

In about 1980, IPENZ commenced its professional accreditation programme for four-year engineering degrees.

Massey University in Palmerston North was accredited by IPENZ about two years later (1982), a year after Auckland and Canterbury Universities were first accredited by IPENZ.

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 have begun to offer four-year engineering degrees but only accredited by IPENZ since the early 2000's. 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.

### **3.3 Degree in Mining Engineering**

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.

**Many years later (date unknown but thought to be in the mid 1940's), 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.

This BE degree was discontinued in about 1964. At the same time, the Otago School of Mines 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 post graduate distinction. The Otago School of Mines celebrated its centenary in 1979.

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 1860's, but by **1898** only six remained due to the general decline in gold mining activity and by around the **1930's**, they mostly seemed to have been disestablished except for the School of Mines at Otago University.

It is noted that in **1906** when an Engineering School was first established at Auckland University College, it was originally located within a School of Mines. But that School of Mines had been discontinued by 1912.

The School of Mines at Otago University was closed down in the mid-1980's and some of the staff were transferred to the Faculty of Engineering at the University of Auckland.

This was presumably because it had been determined that in order to maintain uniformity of standards for accreditation of a mining engineering degree, this should be located within an existing Faculty of Engineering in New Zealand. But the mining engineering course did not survive the move from Dunedin to Auckland because of very little student interest in enrolling and it was soon discontinued.

So for New Zealand students wishing to now pursue a mining engineering degree qualification, the closest universities offering such a 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).

#### **4.0 INCLUSION OF TWO YEAR AND THREE-YEAR ENGINEERING QUALIFICATIONS**

Since about **1993**, there has been full recognition by IPENZ of the “wider engineering profession” within New Zealand. This has been a very significant 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 **1997** onwards.

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 (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 1950's and was discontinued from **2000** and last awarded in **2008**.

Both the above IPENZ membership grades, Technical Member and Associate Member, are now accorded professional standing in the engineering community. 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).



Since 2000, **IPENZ Practice Colleges** for the two groups have also been developed.

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

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

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

## 5.0 DEVELOPMENT OF THE TWO-YEAR LEVEL OF ENGINEERING QUALIFICATION

### 5.1 The Earlier Years Up To 1998

**The New Zealand Certificate in Engineering (NZCE)** was introduced in the 1950's and was a very popular qualification for people to obtain between about 1960 through to the late 1990's. 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.

NZCE courses were offered at various institutes of technology and polytechnics (ITP's) throughout New Zealand, and NZCE could also be studied by means of correspondence courses. The certificate for the NZCE was awarded by the AAVA (Authority for Advanced Vocational Awards<sup>2</sup>) rather than the individual provider institution.

After obtaining the NZCE qualification, a small proportion of students would then transfer to a University Engineering School and complete a Bachelor of Engineering degree after about two years (or a little more) of further full-time study.

During the period from about 1960 to 1998, NZCE-qualified people were highly regarded by employers in certain job categories. Engineering employers would often advertise for junior professional engineering staff as a “BE graduate or NZCE-qualified person”.

### 5.2 The Later Years From 1998 Onwards

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 institutions. **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 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.

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<sup>2</sup> Earlier, up to 1979, the NZCE was awarded by the Technicians Certification Authority, and after 1998, when the NZCE was being disestablished, it was awarded by the New Zealand Qualifications Authority (NZQA) until 2008 when it was no longer able to be awarded. NZQA still maintains the qualification records of NZCE students.

The courses in the early years of NZCE (Stages 1 and 2) were quite elementary and cross credits could be gained with passes in School Certificate and University Entrance examinations.

**From 2008, the NZCE could no longer be awarded** and in that year, the civil engineering two-year Diploma in Engineering (Civil) awarded 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 common 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 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 fifteen providers, mainly Institutes of Technology and Polytechnics (ITP's), now accredited by IPENZ to teach **the new "Unified" NZDE qualification**.

These providers are Northland Polytechnic in Whangarei, Manukau Institute of Technology (MIT) and 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 ten years from 2000 since the NZCE was no longer available to new entrants. AUT is now focused on providing three-year and four-year engineering qualifications.

A two-year Diploma in Engineering or NZDE qualification is now the underpinning qualification for the Associate Member membership grade of IPENZ (AIPENZ).

## **6.0 DEVELOPMENT OF THE THREE-YEAR LEVEL OF ENGINEERING QUALIFICATION**

### **6.1 The Earlier Years 1997 – 2008**

In the mid-1990's 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 BEngTech for three-year engineering qualifications and reserve BTech for use with some four-year engineering qualifications. In Wellington, Massey University renamed their three-year degree as a

BEngTech degree programme and then shortly after, closed down the BEngTech (effectively transferring it to Weltec) in about 2001.

As the NZCE qualification commenced phasing out in 2000, a number of other ITP's and AUT began to offer a **three-year BEngTech degree** at NZQA Level 7 in civil, electrical and mechanical engineering from about 2001. The BEngTech degree is now the underpinning qualification for the Technical Member membership grade of IPENZ (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 electotechnology). This provisional accreditation was followed soon after by other Institutes of Technology and Polytechnics, and the Auckland University of Technology.

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.

## 6.2 The Later Years 2009 Onwards

In 2009/2010 the National Engineering Education Plan (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 ITP's (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 the NZ Institute of Highway Technology (NZIHT) in Hamilton – awarded through the Western Institute of Technology, Taranaki (WITT).

## 7.0 QUALIFICATION STRUCTURE OF THE ENGINEERING PROFESSION IN NEW ZEALAND

### 7.1 Competence Standard and Professional Recognition

In New Zealand, in distinguishing between competence standards for people with 4-year, 3-year and 2-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 in solving complex engineering problems (4-year BE degree)
- Can work independently in solving broadly defined engineering problems (3-year BEngTech degree)
- Can work independently in solving well defined engineering problems (2-year NZDE qualification)

**BUT** all three levels have the same ethical obligations.

This can be interpreted as meaning that **all three competence standards now come within the profession of engineering in terms of ethical obligation**, but they qualify for different grades of membership within the engineering institution (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.

## 7.2 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.

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

## 7.3 Pathways to Current Competence

The usual pathways to current competence are shown in Table 4 on the following page.

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. The NZDEP is awarded by some of the Industry Training Organisations (ITO's).

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 (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

\*Frequently now expressed as “On Job Learning and Development”.

## 8.0 PRESENT DAY DIVERSITY OF ENGINEERING EDUCATIONAL QUALIFICATIONS IN NEW ZEALAND

Table 5 lists the available information (Source: Ministry of Education) 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.

This information is for the 2012 year, the latest year for which this information is currently available (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 2-year Diplomas up to Doctorate level. This is double the number of EFTS which was given in published information (New Zealand Herald, 19 November 2012), which stated that the source was from the Ministry of Education for the year 2011. (However, the figure of 5,570 EFTS given in the New Zealand Herald was stated to be for Bachelors level engineering qualifications only).

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%
<b>Total</b>		<b>11,600</b>	<b>100.0%</b>

**Table 5** Qualifications being studied for within New Zealand in “Engineering and Related Technologies” in 2012 (Source: Ministry of Education) from two-year Diploma up to Doctorate level.

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.

**TOTAL EFTS IN NEW ZEALAND FOR ENGINEERING AND RELATED TECHNOLOGIES (IN 2012)**

<b>Field of Study</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
	Doctorate	Masters	Bachelors Hons And Postgrad Diploma	4 Year Bachelors	3 Year BEngTech	2 Year Diploma	Graduate Certificates and Diplomas	Total	%
Process and Resources Engineering	160	70	560	150	-	70	10	1020	8.8
Manufacturing Engineering and Technology	-	10	120	50	-	110	-	290	19.1
Automotive Engineering and Technology	-	-	-	90	-	-	-	90	
Mechanical/Industrial Engineering and Technology	240	90	980	-	250	270	10	1840	
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
<b>Total</b>	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 (Source: Ministry of Education) in various stated fields of study.

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.

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

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

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%
Remainder	<u>31.7%</u>
	100.0%

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%

\*Geomatic 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 (Source: Wikipedia). 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.

## 9.0 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:

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	<u>24.6%</u>
<b>Total</b>	<b>100.0%</b>



## 10.0 INFORMATION SOURCES

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