LET'S GET YOU CHARTERED
PRACTICE FIELD DESCRIPTIONS

Engineering practice fields are loosely defined terms and are used as an indication of the nature of engineering work carried out by engineers in a certain field. The following diagram shows the natural cross over between some fields. Some fields may naturally cross over into other fields.

AEROSPACE ENGINEERING
Aerospace engineering is the design, development, and production of aircraft (aeronautical engineering), spacecraft (astronautical engineering) and related systems. Aerospace engineers may specialise in aerodynamics, avionics, structures, control systems or propulsion systems. It may involve planning maintenance programmes, designing repairs and modifications and exercising strict safety and quality controls to ensure airworthy operations.

BIOENGINEERING
Bioengineering draws heavily on the Chemical engineering discipline and involves the engineered development of raw materials to produce higher value products, using biologic al systems (biological catalysts). The description also encompasses the general application of engineering to biological systems to develop new products or solve problems in existing production processes. As examples, bioengineers are found in medical research, genetic science, fermentation industries and industries treating biological wastes.

BUILDING SERVICES
Building Services engineering is the application of mechanical or electrical engineering principles, and an understanding of building structure, to enhance all aspects of the built environment from air conditioning and mechanical ventilation, electrical light and power, fire services (e.g. sprinklers and alarms), water and waste services, data and communications, security and access control, vertical transportation, acoustics and energy management.

CHEMICAL ENGINEERING
Chemical engineering is concerned with the ways in which raw materials are changed into useful and commercial end products such as food, petrol, plastics, paints, paper, ceramics, minerals and metals. Often these processes are carried out at large scale plants. Research of raw materials and their properties, design and development of equipment and the evaluation of operating processes are all part of chemical engineering.
CIVIL ENGINEERING

Civil engineering is a broad field of engineering concerned with the, design, construction, operation and maintenance of structures (buildings, bridges, dams, ports) and infrastructure assets (road, rail, water, sewerage). The Civil engineering discipline underpins several engineering fields such as Structural, Mining, Geotechnical and Transportation engineering, in which civil engineers often specialise. General Civil engineers are likely to be competent to undertake work that relates to one or more of these areas.

ELECTRICAL ENGINEERING

Electrical engineering is the field of engineering which deals with the practical application of electricity. It deals with the aspects of planning, design, operation and maintenance of electricity generation and distribution, and use of electricity as a source of energy within major buildings, industrial processing complexes, facilities and transport systems. It includes the associated networks and the equipment involved such as switchboards, cabling, overhead lines/catenaries, earthing, control and instrumentation systems.

Areas of specialisation within the wider electrical engineering discipline, such as electronics and telecommunications are usually concerned with using electricity to transmit information rather than energy. For this reason, electronics and radiocommunications/telecommunications are captured under the field of Information engineering.

ENGINEERING ACADEMIC

The Academic practice field is defined for engineering academic staff members from tertiary education including engineering researchers.

In tertiary education, academic staff members may be involved in engineering activities in various roles, from building engineering prototypes, to contributing to knowledge in engineering. Engineering academic staff members may not be directly involved in the engineering design process but undertaking cutting edge engineering research to lead and enhance engineering activities. Examples of work samples of engineering academic staff members may be their authored quality assurance publications in engineering disciplines, and/or their authored quality assurance engineering reports at NZQA level 7, 8, 9 or 10 (graduate or postgraduate level). Academic staff members who are teaching an engineering programme without quality assurance publications in engineering disciplines or quality assurance engineering reports, may not qualify for academic practice field.

ENGINEERING MANAGEMENT

Engineering Management is a field of practice where engineers from any technical engineering background exercise engineering judgement in making decisions on the application and optimisation of physical, human and financial resources to achieve engineering outcomes in related processes or business activities. Engineering Managers may not be directly involved in the engineering design process.

General management – where engineering knowledge is of benefit or essential and covering many engineering disciplines.

- Qualifies as Management practice field.
- Example: Chief Executive or Director of an engineering or construction company.
Engineering management of a multi-disciplinary team where engineering knowledge is essential but specific discipline knowledge is not essential.

- Qualifies as Management practice field.
- Example: Engineering manager of a local authority or manufacturing company. A judgement may be necessary, but err towards including the management field – the candidate is appropriate for both management and discipline fields. *(Note: an example grey area is the general manager of a lines company where electrical engineering knowledge may be essential for the role).*

Management or leadership of a team, however large, where the candidate must have engineering knowledge to do the job competently. This management is part of the skills and knowledge of the discipline.

- Would not normally qualify as Management practice field.
- Example: Chief structural engineer of a large consultancy or compliance authority. A judgement may be necessary but err towards including the management field if management activities are beginning to dominate – the candidate may be appropriate for both management and discipline fields.

Part time management of a small practice or branch of a consulting practice managing budgets and staff and clients while carrying out frontline engineering or being the responsible person signing off compliance certificates.

- Would not normally qualify for the Management practice field, as a certain amount of management is part of the engineering function, and is ‘business as usual’ for an engineer in this situation. *(Note: Grey area accepted as to the boundary between ‘business as usual’ and the management becoming dominant. As an acid test, ask “could they give up their discipline practice field?”. If not, then Management should not apply. If so, then in theory they need to go through a full review to justify the change in practice field/area description. A balanced decision may lead to having the two practice fields).*

Full time engineering role where the applicant claims that they “do management”, as well as advising clients, planning other workloads, training staff etc.

- Would not qualify for the Management practice field, as management is part of their normal engineering activity. This includes project management, unless it is dominant, in which case the practice field is still their engineering knowledge (discipline), and project management is written into the practice area description (ie they use their discipline skills to do project management).

**ENVIRONMENTAL ENGINEERING**

Environmental engineering draws on the Civil and Chemical engineering disciplines to provide healthy water, air and land to enhance human habitation. Environmental engineers devise, implement and manage solutions to protect and restore the environment, within an overall framework of sustainable development. The role of the environmental engineer embraces all of the air, water and soil environments, and the interactions between them.

**FIRE ENGINEERING**

Fire engineering draws on knowledge from the range of engineering disciplines to minimise the risk from fire to health and safety and damage to property through careful design and construction. It requires an
understanding of the behaviour of fires and smoke, the behaviour of people exposed to fires and the performance of burning materials and structures, as well as the impact of fire protection systems including detection, alarm and extinguishing systems.

GEOTECHNICAL ENGINEERING
Geotechnical engineering involves application of knowledge of earth materials in the design of structures, such as foundations, retaining walls, tunnels, dams and embankments. Geotechnical engineers assess the properties and performance of earth materials such as their stability and strength, and the impact of groundwater.

INDUSTRIAL ENGINEERING
Industrial engineering is the application of mechanical and electrical engineering principles to the design and operation of production equipment, production lines and production processes for the efficient production of industrial goods. Industrial engineers understand plant and procedural design, the management of materials and energy, and human factors associated with worker integration with systems. Industrial engineers increasingly draw on specialised knowledge of robotics, mechatronics, and artificial intelligence.

INFORMATION ENGINEERING
Information engineering is based on the Electrical engineering discipline but also draws heavily from Computer Science. Three areas of further specialisation can be identified:

1. **Software engineering** – the development and operation of software-intensive systems that capture, store and process data.
2. **Telecommunications engineering** – the development and operation of systems that encode, transmit and decode data via cable systems (including fibre optics) and wireless systems (radiocommunications).
3. **Electronics engineering** – the design, development and testing of electronic circuits and networks that use the electrical and electromagnetic properties of electronic components integrated circuits and microprocessors to sense, measure and control processes and systems.

MECHANICAL ENGINEERING
Mechanical engineering involves the design, manufacture and maintenance of mechanical systems. Mechanical engineers work across a range of industries and are involved with the design and manufacture of a range of machines or mechanical systems, typically applying principles of hydraulics (fluid control), pneumatics (air pressure control) or thermodynamics (heat energy transfer). Mechanical engineers may specialise in the Building Services or Industrial engineering field.

MECHATRONICS ENGINEERING
Integrates specialist knowledge in mechanics, electronics and computer systems to design and develop integrated automated systems, such as chassis-stabilising systems, anti-lock brakes, engine control units, disk drives, cameras, service and surgical robots and medical devices. Often these systems are largely mechanical in nature but could not function without their essential electronic and computer control system components.
MINING ENGINEERING
Mining engineering involves extracting and processing minerals from the earth. This may involve investigations, design, construction and operation of mining, extraction and processing facilities.

PETROLEUM ENGINEERING
Petroleum engineering is a field of engineering relating to oil and gas exploration and production. Petroleum engineers typically combine knowledge of geology and earth sciences with specialised Chemical engineering skills, but may also draw on Mechanical engineering expertise to design extraction and production methods and equipment. Petroleum engineering activities are divided into two broad categories:

1. **Upstream** – locating oil and gas beneath the earth’s surface and then developing methods to bring them out of the ground.
2. **Downstream** – the design and development of plant and infrastructure for the refinement and distribution of the mixture of oil, gas and water components that are extracted.

SOFTWARE ENGINEERING
Software engineers apply the process of analysing user needs and designing, constructing, and testing end user applications that will satisfy these needs through the use of software programming languages. A fundamental aspect is the application of engineering principals to software development. In contrast to simple programming, software engineering is used for longer and more complex software systems, which are used as critical systems for business and organisations.

STRUCTURAL ENGINEERING
Structural engineering is a specialised field within the broader Civil engineering discipline that is concerned with the design and construction of structures. Structures might include buildings, bridges, in-ground structures, footings, frameworks and space frames, including those for motor vehicles, space vehicles, ships, aeroplanes and cranes, composed of any structural material including composites and novel materials.

TRANSPORTATION ENGINEERING
Transportation engineering is a specialised field of practice in the civil engineering discipline relating to the movement of goods and people by road, water, rail and air.

A transportation engineer might specialise in one or more of: pavement design, asset maintenance/management, construction/project management, traffic operations and control, transportation planning and systems analysis, freight transportation and logistics, road safety, railways or public transport systems.

WATER ENGINEERING
Water engineers specialise in water based projects; many will have a civil engineering or environmental background. Water engineers generally deal with the provision of clean water from sources or treatment plants, return of waste water and treated sewage to the environment and the handling of stormwater including the prevention of flood damage. Asset management may be a major part in a water engineer’s job. This involves design, operation, maintenance and construction of infrastructure for water resources as
well as planning for the maintenance and replacement of three waters assets to maintain performance and minimise whole of life costs. These can include but are not limited to pipes, treatment devices, pump stations and reservoirs.