

About Surveying and Spatial

Spatial Science

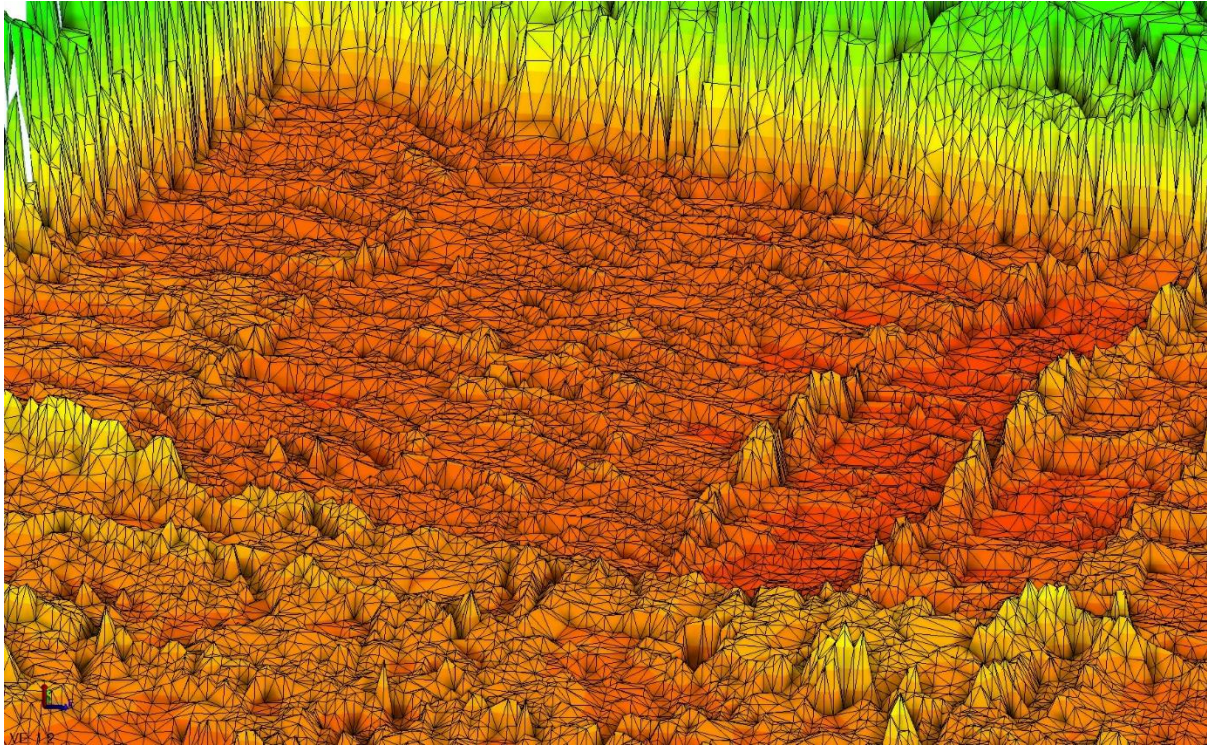


Image: 3D Excavation Image (Mackays to PekaPeka Alliance /Trimble Connected Community) featured in Surveying+Spatial magazine, March 2016.

Spatial Science is about measuring, recording, managing and communicating information about the Earth's surface - land, sea, rivers, lakes, roads and other built structure. The *Destination Spatial* and *Auckland University* websites describe spatial science as referring to place, space and location.

It is about measurement, management and analysis and presentation of spatial and location based information. It describes the Earth, its physical features on both land and water and our man-made environment.

Spatial Science is a collection of academic subjects or disciplines including surveying, GIS, satellite imagery, visualisation and maps and charts. Professionals

Geographic information science at Auckland University is described as broadly including geographic information systems, technology, spatial analysis, practice and related theory. It is a rapidly developing field, both in its own right and in its connections to disciplines in the social, physical, health, biological and earth sciences and to engineering.

Professionals in a wide range of fields use geographic information systems (GIS) to turn geographic data into maps, tables and other kinds of information needed to make informed decisions. In a rapidly changing world, detailed, up to date geographic data are indispensable for governance, for commerce, and for research intended to improve our understanding of social and environmental systems.

International Definition of Surveying

The Federation Internationale des Geometres (FIG) defines surveying as:

'A surveyor is a professional, skilled in measurement and resource management, who serves the public by the collection, provision and analysis of information on the extent and identity of land, water and other natural resources - including legal, economic and environmental aspects - and the provision of advice and services for their development, use and sustained management.'

Surveyors are experts in the science of measurement and gathering and applying spatial information to a wide range of uses. They specialise in a range of disciplines, such as land surveying, engineering surveying, geodesy, hydrographic surveying, mine surveying, geographic information systems or aerial mapping. Once spatial data has been gathered and processed it can be made available in many forms that are recognisable to the public, for example, topographical maps and plans, specialised maps on almost any theme, nautical charts and subdivision plans.

Surveyors are experts in applying spatial information through processes including land and resource planning, engineering design for land development, surveys for land title and geographic information systems.

Surveying spans everything from astronomy to the positioning of telephone cables in your local street or thousands of metres below the sea.

It is a practical science that enables projects to be planned and executed with the utmost confidence. Surveyors measure the shape and dimensions of land in cities, towns, the countryside, remote bush areas, at sea, from the air, and underground.

Members of the survey profession New Zealand are educated in many aspects of law dealing with land ownership, resource management and planning. Knowledge of such laws is essential to the proper execution of any development.

Surveyors are trained in all aspects but many choose to specialise in particular areas. Following are some of the specialist areas of surveying.

Geodesy

This is the science of measurement and representation of the Earth including its gravitational field. Geodesy provides the coordinate reference systems and datums that surveyors (and others) rely on for recording spatial information.

Global Positioning Systems (GPS) and other navigation systems rely heavily on geodesy to provide accurate positions.

Hydrographic Surveying

Hydrographic surveyors measure and map the shape and location of land features below bodies of water.

Hydrographic surveying requires training with different types of high-tech equipment and is used to measure erosion, guide dredging projects, explore for oil, or mark underwater hazards. The shipping industry, fishermen, recreational boaties, government researchers, oil and gas companies, utility networks and construction projects like harbours and bridges rely heavily on these types of surveys.

Land under water constantly changes due to currents and storms, so waterways and underwater assets are regularly surveyed to record changes.

The demand for surveyors who have training in hydrographic surveying is high. According to some estimates only 5 percent of the Earth's oceans have been mapped and New Zealand has a huge continental shelf area that requires charting.

Cadastral or Land Title Surveying

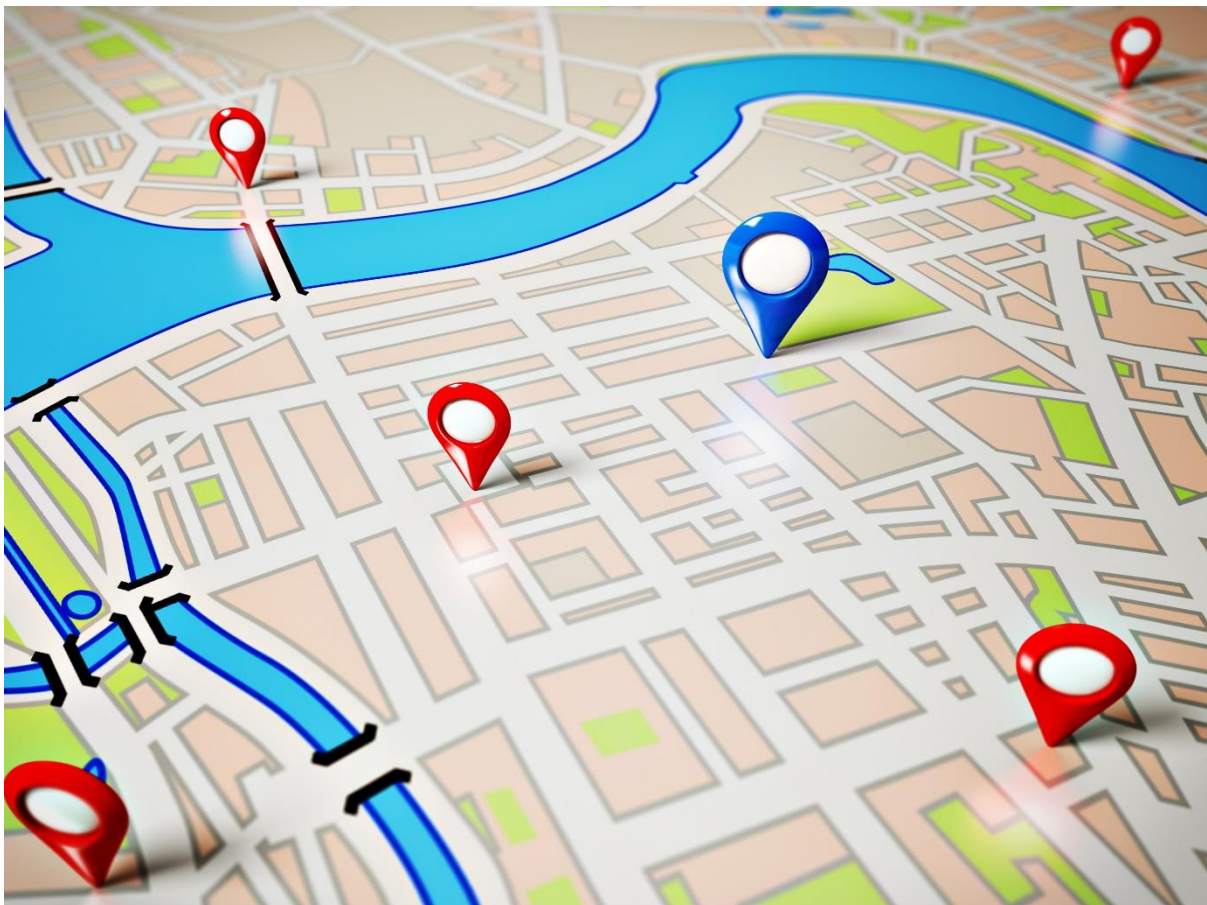
This is the largest discipline of surveying in New Zealand. The cadastre is the means of defining the dimensions and location of land parcels described in legal documentation.

New Zealand government operates a digital titles register and digital cadastre called *Landonline*. The government guarantees the ownership of land based on accurate surveys recording the location of the parcel of land and the boundary dimensions.

When a new development or subdivision changes property boundaries, a land title survey is required and a new survey plan is prepared and electronically submitted to *Landonline*. The surveyor must first search survey plans in the area then locate old boundary or reference marks and prove their reliability before accurately defining the new or existing boundaries.

Only Licensed Cadastral Surveyors are authorised to certify land title surveys in New Zealand, although trained technicians often perform such work under direction.

Mapping



Maps are based on initial data provided by surveyors, which may involve field surveys, mapping calculations, aerial photography and laser scanning or remote-sensing surveys from satellites. In



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New Zealand, Land Information NZ is responsible for mapping and charting all of New Zealand and its territorial waters.

Maps are produced in digital form allowing them to be used in association with modern navigational aids such as GPS.

Resource Management

Surveyors have a broad involvement with land including matters relating to:

- title and legal interests in land,
- a deep understanding of landform and gradient limitations through topographic survey processes,
- and a sound knowledge of engineering and planning requirements for land subdivision and development.

As a result surveyors are well qualified to act as project managers and make decisions about how land should be used and what sustainable solutions are available.

The skills required include:

- good communication,
- an appreciation for the many different users of land,
- knowledge of earth's resources and how they interact
- knowledge of the law that governs all facets of land development.

Topographic Surveying

Topographic Surveys (or Topo surveys) are surveys of land to provide information about the physical and other features of land. These surveys are required as the base information from which to plan and design new roads, bridges, infrastructure, houses, buildings and subdivisions.

Almost any design or construction job starts with topographic information. Progress with construction often requires a surveyor to set out the works and the project often ends with an as-built survey of the completed works.

Urban Design

The process of designing the locations of new urban and suburban streets including services and drainage is undertaken by a surveyors. Because the survey plan must determine the legal ownership of land for issue of titles, surveyors are the professionals most commonly deciding the location, size, shape and orientation of the new allotments for house sites.

Buying and Selling Property

Before purchasing land it is wise to contact a Member of the New Zealand Institute of Surveyors. If you are unsure of the extent of the property boundaries, a licensed cadastral surveyor can accurately redefine all boundary points on the site.

Engineering and Design Surveys



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Surveyors undertake detailed engineering surveys and design for road construction, stormwater and sewer drainage, and water supply reticulation. They will also have contacts for other engineering professionals who may need to be involved in the project.

Development and Conservation

Surveyors are well qualified to advise you on all aspects of land development, including utilisation of difficult building sites. Surveyors can advise on the best locations and gradients of drive ways or pipeline routes to make feasible access with minimum cost or damage to the environment.

Civil Engineering

The involvement of a surveyor is essential for all engineering projects whether they be large or small. Employing a surveyor ensures construction is in the right place and that levels and gradients are correct. When construction is completed the surveyor makes reliable "As-Built" drawings for the client and/or the district council.

Structural Works

With the aid of modern optical and electronic instruments or GPS, surveyors set out major structural works such as highways and high-rise buildings. Before site works commence it is critical that the boundaries have been properly defined so that the setting out of the foundations, control of steel or reinforced concrete fabrication, building verticality, site drainage, location of services and access can proceed with confidence. For many of these tasks the design work and preparation of plans should be referred to a surveyor qualified with the necessary skills in this area of work.

Transportation

Many surveyors are very experienced in the design and management of contracts for roading and drainage requirements. Surveyors design the location, width and shape of the streets, reserves and pedestrian walkways within subdivisions. Others are expert in hydro graphic work, surveying the sea floor to control dredging of shipping channels or to carefully locate oil rigs or under-sea cables and pipelines.

Prospecting and Mining

Apart from their legal function in preparing maps and plans required for the issue of mining privileges, surveyors are able to provide a variety of other specialist and supervisory services to the mining industry. Within the petro-chemical industry surveyors provide expert service in surveying of pipeline reticulation for petroleum and natural gas products.

Farming, Forestry and Horticulture

In addition to their expertise in land measurement, boundary determination and title documentation, your rural based surveyor may well be qualified to counsel clients on land use matters relating to the agricultural, horticultural, forestry and fishing industries.

Project Management

As a professional experienced in all phases of urban subdivision development, your surveyor is the logical person to organise and co-ordinate all aspects of the project. Land development teams headed by surveyors may include input from some or all of the following experts: architect,



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landscape architect, civil engineer, geotechnical expert, geologist, solicitor, financial advisor, planner and valuer. Your surveyor has education and training in all aspects of land development projects.

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