SURVEYING + SPATIAL

December 2017
Issue 92

The multiple and conflicting definitions of land

2017 New Zealand Spatial Excellence Awards

Cross leases – the legalities and complications

NZIS

www.surveyors.org.nz

Unparalleled Precision. Unrivaled Performance.

The Trimble SX10 – Scanning Total Station

The Trimble SX10 scanning total station sets a new standard for accuracy, capability and performance. Whether you're performing a typical job or your most challenging survey projects, the SX10 gives you the confidence to do it all and do it well.

For more information, visit: **trimble.com/SX10**

ALLTERRA™

AllTerra
New Zealand |
0800 ALLTERRA (0800 25583772) | info@allterra.co.nz |
www.allterra.co.nz

Trimble
Authorised Distribution Partner

SURVEYING + SPATIAL
DECEMBER 2017 ISSUE 92

COVER IMAGE
Definitions of Land (p7).
Images composited
by KPMDesign.

ARTICLES

REGULAR FEATURES

@nzsurveyors
https://www.facebook.com/nzsurveyors/
https://twitter.com/nzsurveyors
https://www.linkedin.com/company/nzsurveyors
https://www.youtube.com/channel/UChaMvgzMcaDaLOKVkEARqwQ

ISSUE 92 DECEMBER 2017

SURVEYING+SPATIAL
A publication of the New Zealand Institute of Surveyors – Te Rōpū Kairūri o Aotearoa
ISSN 2382-1604
www.surveyors.org.nz

EDITOR
Rachel Harris
surveyingspatial@gmail.com

Correspondence relating to literary items in *Surveying+Spatial* may be addressed to the editor. Papers, articles and letters to the editor, suitable for publication, are welcome. Papers published in *Surveying+Spatial* are not refereed. All correspondence relating to business aspects, including subscriptions, should be addressed to:

The Chief Executive
New Zealand Institute of Surveyors
PO Box 5304
Lambton Quay
Wellington 6145
New Zealand
Phone: 04 471 1774
Fax: 04 471 1907
Web address: *www.surveyors.org.nz*
Email: *nzis@surveyors.org.nz*

Distributed free to members of NZIS.

Published in March, June, September and December by NZIS.

DESIGN & PRINT MANAGEMENT
KPMDesign – *www.kpmdesign.co.nz*
info@kpm.co.nz

TO ADVERTISE
Email: *nzis@surveyors.org.nz*
or contact Jan Lawrence +64 4 471 1774

A year in review

Rachel Harris

This year has seen many major events on the world stage, from ongoing conflict in Syria, terrorist attacks, political tensions with North Korea to momentous climate events. In New Zealand, a change of government followed the September election and we recently marked the first anniversary of the 7.8 magnitude earthquake in Kaikōura.

There have been many remarkable events to reflect on in within the surveying and spatial industry as well, with the increasing rise of our talented industry professionals recognised at the New Zealand Spatial Excellence Awards. One of those significant achievements includes Wellington City Council's Living Labs entry, winning both the New Zealand Supreme Award and the Asia Pacific Spatial Excellence Award in Sydney.

This year has seen a first for New Zealand surveying, as Rebecca Strang was recently confirmed as the NZIS's first female president.

This edition features a diverse range of topics, from a young professional's secondment experience in Kaikōura's rebuild zone to this year's collection of honours dissertation abstracts, exciting global technology innovations and a legal perspective on the review of the rules for cadastral survey.

The definition of land is examined by the University of Otago's Mick Strack and Julian Thom who discuss the differences in interpreting the statutory meaning of land and why clearer definitions are important as the industry continues to develop 3D cadastre.

Land Development and Urban Design Stream Chair Phil Cogswell presents the design and development concepts of the multi-award-winning St Kilda development project in Cambridge, which has been designed with a strong focus on community and environment to achieve the desired principles of urban design.

This year's New Zealand Spatial Excellence Awards (NZSEA) showcased the best in innovation and excellence from across the industry at the recent awards dinner in Wellington. *Surveying+Spatial* presents the organisations and individuals that have been outstanding in their field at this year's NZSEA awards.

Matt Ryder tackles the thorny issue of cross leases this edition, discussing some of the complications that can arise from this title ownership, the requirements to upgrade, and conversions to fee simple or unit titles.

On a final note, with 2017 quickly drawing to a close, a sincere thank you to all our stream and regular feature contributors who have provided such a wide range of interesting and informative articles this year. Your support is always appreciated and valued by *Surveying+Spatial* and I look forward to receiving many more articles from across the industry in 2018.

A very happy Christmas to all our readers and best wishes for the new year ahead.

First female president appointed to NZIS

NZIS is marking a new professional milestone at the governance level with the recent appointment of the organisation's first female president.

Rebecca Strang, a registered professional surveyor based in Auckland, has been voted the first female president in 129 years by NZIS members.

Rebecca has been on the NZIS Council for two years as Vice President and was previously involved with the Young Professionals group at a national level, when it was first formed in 2006. She is currently the Digital Practice Leader at Aurecon NZ, helping define the way they deliver projects to clients in the most efficient and consistent way.

The role of NZIS president was a "huge honour", she said, and one of her aims would be to streamline the way the Council currently operated.

"I'll be looking to inject a bit more rigour into the way the Council runs and aiming to get all the stream leaders to be more transparent in what they're trying to achieve for the year," she said.

Rebecca said she would focus on improving communication across the membership, particularly within the branches, and involve more council members in coordinating specific issues.

The new president is joined by recently appointed NZIS Board members Michelle Bain and Dr Jordan Alexander. Board Chair Andrew Stirling said, "The three appointments increase the gender balance on the board and promote diversity within the surveying and spatial industry, which is one of our key goals."

NZIS welcomes three new Fellows

Three new fellows welcomed at the recent AGM in Wellington.

Warren John Haynes, Canterbury

Warren Haynes is a well-known member of the Canterbury Branch who has given many years of service to the Institute and the survey profession.

Born in Taumarunui and educated in Christchurch, he graduated in 1981 with a Bachelor of Surveying from the University of Otago. Warren joined the Christchurch fim of Eliot Sinclair and Partners, where under the supervision of Marton and Bruce Sinclair, he met the prerequisites necessary for registration by early 1984.

A year based in Singapore as a hydrographic surveyor for Geomex Surveys saw him on assignments throughout Asia, Australia and Oman. After a short return to Eliot Sinclair and contracting as a site engineer on an East Anglian construction site, an opportunity arose in Saudi Arabia to work on a large strategic petroleum storage project. Despite the Iraqi invasion of Kuwait and ensuing Gulf War, Warren maintained a role for three years in the quality assurance unit of the main contractor's Riyadh office, followed by a further year as chief surveyor on one of the project construction sites in the Asir region, near the Yemen border.

Warren returned to New Zealand, rejoining Eliot Sinclair as an associate. He became a principal and shareholder in 2008, and more recently a director in 2015. Warren currently maintains day-to-day management of the surveying division of Eliot Sinclair and has mentored many survey graduates and technicians.

Warren served on the Branch Executive Committee, as Branch Secretary and as Branch Chairman from 2001 to 2003, and the NZIS Public Relations Committee from 2002.

His efforts to maintain a strong Canterbury Branch leading up to and immediately following deregulation of the profession were evidenced in the many projects he was involved with in the Canterbury Branch and the Public Relations Committee. Some of his service contributions included: the development of a branch meeting guide, Cantamath sponsorship, introducing electronic communication to branch members, chairing the e-Survey Pilot User Group, organising student vacation employment in Canterbury, compiling and delivering school visit career presentation kits, establishing criteria for a local Professional Excellence Award, the 'Canterbury Peg', to recognise

and celebrate a member's professional work at branch level and establishing guidance rules for nominating and judging criteria for the NZIS Awards of Excellence at a national level.

Warren has served on numerous branch and NZIS sub-committees and working parties on such matters as the Christchurch City Council Development Contributions Policy, the review of survey practices in relation to the Canterbury rebuild, building location certificates for Christchurch City Council and most recently an NZIS Awards Committee, tasked with reviewing the currency and appropriateness of all existing NZIS awards.

Warren was on the organising committee and a key contributor to the success of the 2007 South East Asian Survey Congress and 2016 FIG Working Week in Christchurch.

In 1984, Warren received the Maurice Crompton-Smith Memorial Prize for the best set of projects submitted by a candidate for the Certificate of Competency, and, in 2004, the McRae Award for Service to NZIS.

Ross Douglas Thurlow

Ross Thurlow has made a strong contribution to NZIS operations as Engineering Examiner on the Examinations Panel. He has undertaken this role for the past 12 years including being the Convener of the Examination Panel for three years.

At a time when the role of surveyors in land development engineering is coming under increasing pressure from regulators and the engineering profession, Ross has played an important role in maintaining standards in the surveying profession. Ross's aim as an examiner has been to encourage surveyors to strive to become experts in land development so they can continue to lead that process. Ross considers that enhanced experience and continued involvement in engineering are key to ensure that surveyors undertake those engineering tasks in land development that they are best qualified to undertake.

Ross supports the current review of the pathway to professional status and is a strong advocate of the modern land surveyor being well founded in all the disciplines that surround land, its development measurement and tenure. Ross sees the role of the Examination Panel, utilising face-to-face interviews, supported by documented and representative records of projects and experience, together with mentored training as non-negotiable in this.

After completing a Bachelor of Surveying at the University of Otago in 1980, Ross carried on with his studies to complete a BE (Civil) at Auckland University. This was followed by a period of work in his home town of Dunedin for the Ministry of Works and Development. Ross was involved on roading projects, including the geotechnical investigations and road legalisations of the roading associated with the Clyde Dam. After registering as a surveyor in 1986, Ross worked for consulting engineers in London for three years including time on site investigations and infrastructure studies for the redevelopment of the London Docklands and Channel Tunnel projects.

He returned to Auckland in 1990 and registered as an engineer and worked for Takapuna City and then for Harrison Grierson on land development, engineering and roading projects.

Ross started Thurlow Consultants in 1994 and continues to lead the business on Auckland's North Shore. In 2015, along with Mark Myall, he founded Myall and Thurlow in Christchurch, with both businesses offering services in surveying, civil engineering, structural engineering, land development and hydraulic engineering within the Auckland and Canterbury regions.

Ross is a member of CSNZ and a regular attender at workshops and Auckland Branch meetings.

Stephen Ian Critchlow

Steve arrived from England in 1973, and graduated from the Otago Survey School in 1978.

His first holiday job was with Marton and Bruce Sinclair in Christchurch, early adopters of programmable calculators. Steve saw the potential to combine computers with surveying and, encouraged by Warren Hawkey and Bill Robertson, completed a BSc in Computer Science whilst working as a graduate surveyor in the Lands and Survey Dunedin office from 1978-81. During this time, he spent time at the Ministry of Works, and became a registered surveyor in 1980.

In 1981, he was appointed as research surveyor in the Lands and Survey Head Office, and fondly recalls investigating how computers might improve surveying productivity and cadastral records. In 1984, Steve joined Wellington's Tse Group, introducing PCs to Tse's surveying and valuation practices to improve productivity. He carried out redefinition and topographic surveys, and worked on control surveys for Taranaki gas pipeline easements.

Steve became self-employed in 1986 purchasing PC and surveying software which opened opportunities to manage large digital survey datasets. From 1987-89, Steve and Peter Berrill formed a partnership to establish a permanent network of survey reference marks and detailed

(continued p29)

Cadastral

The Cadastral Stream understands from LINZ that feedback received around the Rules Review has been extremely comprehensive.

The workshops were attended by 190 surveyors and these generated 244 items of feedback. In addition to these items, 30 written submissions were received by LINZ.

The Cadastral Stream Executive Committee prepared a submission on this matter which can be read on the NZIS website. The stream has been in discussions with LINZ around the Rules Review from the outset and will continue to advocate for our members in this space. Currently we are working with LINZ around the formation of a working group who will work with LINZ with the Rules Review process.

We are hoping to have a 'terms of reference', and ask members interested to apply for this group in the new year. As the process continues, we will also be calling for feedback from members to add to submissions when requested from LINZ. This is our opportunity to assist LINZ with the review and composition of the rules to ensure that the rules drafted represent the needs of both LINZ and the surveyors who will be working with them.

By the time this edition of *S+S* is published, NZIS will have hosted the GNSS\GPS Seminar for Cadastral Surveying which has been organised by the stream with the assistance of National Office. We hope that everyone who attended has gained further knowledge in this subject area and we wish to thank the presenters for their contribution to this.

If you wish to contact the Cadastral Stream, you can do so through National Office.

Matt Ryder, Cadastral Stream Chair

Engineering Surveying

Unitec in Auckland are now well under way with development of their Bachelor of Geospatial Science degree. There have been workshops with employers and industry experts to assess the content. Students will have the option of a spatial major or a survey major and they are aiming to have the first students enrolled for the degree in 2019. Together with the restructure of RPSurv, this new degree will work to provide a clear pathway for school leavers wanting to become certified engineering surveyors.

As always, new survey technology is becoming available to the New Zealand market. Along with the ever-evolving drone market, 3D scanners are becoming smaller and more user friendly (the Leica BLK), and Trimble's next generation machine control modernises their robust systems.

The Certification of Engineering Surveyors is still on the horizon, and a lot of work has been done. Professor John Hannah has been engaged to help, meeting with stream leads to hear the desires of the streams and form recommendations. Further discussions took place at the NZIS Stakeholder Workshop in November.

Michael Cutfield, Engineering Surveying Stream Chair

Hydrography

For LINZ, this year's civil hydrography programme is focused on undertaking hydrographic survey work within areas between Cape Campbell and Kaikōura in response to the November 2016 earthquake.

This survey is undertaken in partnership with the Ministry of Primary Industries, who are interested in the multibeam backscatter data to identify the distribution and extent of rocky reef habitats. As part of the Pacific Regional Navigation Initiative, hydrographic survey work will be undertaken in Tonga, with geodetic control and tide gauge installation to support the use of satellite derived bathymetry to help survey areas in the Ha'apai Group.

LINZ has also begun a comprehensive rewriting of their contract specifications for hydrographic surveys to align itself with its 'Digital First, Data Centric,' philosophy, and to reflect and standardise the data collected from emergent hydrographic surveying technologies.

The AHS is busy planning the HYDRO18 Conference and Trade Exhibition. It will be held at Doltone House in Sydney from October 30 to November 2, 2018, with 250-300 attendees expected. Keep an eye on the main page of the AHS website (*http://www.ahs.asn.au/*) for updates.

HYDRO18, with its theme of 'The Climate for Change – Hydrography in the 21st Century' will allow delegates and the hydrographic profession to consider how best to utilise the science of hydrography in the future to adapt to climate change, sustainable resource usage and renewable energy requirements. The conference will also highlight that hydrography is the key to facing the rising tide of climate change, knowing our oceans and understanding our future.

Emily Tidey, Hydrography Stream Representative

Land Development and Urban Design

After lengthy deliberations between political parties we have a change in Government and it will be interesting to see if it has any effect on the land development scene in the country. Early signs are that there has not been any significant reduction in members' workloads, particularly with large scale developments still occurring.

We have been representing the stream on the National Technical Committee, organising the content and speakers for the Nelson conference in May next year and in particular looking to attract high class speakers in the land development and urban design fields. Any suggestions or input into this process from stream members would be greatly appreciated and can be directed to me in the first instance.

On a local note, congratulations to Pete McLachlan from Cogswell Surveys Ltd who recently won the Property Professional of the Year Award at the Waikato Property Council awards, and to others who were nominated for these awards. It is pleasing to see our profession being represented in these forums which is a great promotion for our industry, particularly among kindred professional groups.

In conclusion, my replacement as Chair of the stream and Council representative is to be taken by Julia Glass who comes from Tauranga and is part of the Beyond Ltd team, a relatively new consultancy operating out of the Bay of Plenty. A vote of thanks to Julia for taking on this role and it is good to see young professionals participating in NZIS roles.

Phil Cogswell,
Land Development and Urban Design Stream Chair

Positioning and Measurement

Continuing with this year's stream theme, "Projections and Datums", the P&M stream was pleased to support the SNAP webinars, hosted by Nic Donnelly and Chris Pearson in October.

The SNAP (Survey Network Adjustment Package) software incorporates the deformation model, quasigeoid model and transformation parameters required to calculate coordinates in terms of New Zealand's official datums and projections.

These webinars will be available to view via 'Training on Demand' on the NZIS website, and a complementary 'The SNAP' story by Nic Donnelly and Chris Crook is published in this edition of *S+S*.

The stream looks forward to providing more resources on projections, datum and least squares analysis for our members.

Rachelle Winefield,
Positioning and Measurement Stream Chair

Spatial

The Spatial Professional Stream has implemented and completed its annual Stream Committee representative nomination process. Greg Byrom has stepped down from the SPS Committee, and as the SPS rep on the NZIS Council, and we would like to thank him for his contributions over the past few years.

The current committee comprises Kat Salm, Ben Dash, Elaine McAlister and Jasmin Callosa-Tarr. We do have a couple of additional committee spaces open, and would encourage any late nominations to be sent through to the NZIS National Office.

The SPS sent out a call for a NZIS spatial rep for the ASaTS working group in October. We are still looking for a suitable representative, so if you are interested, please contact Kat Salm for more information. This is a fantastic opportunity to ensure that the needs of the spatial industry are represented in the ASaTS development.

The NZ Spatial Excellence Awards were held on November 15 at a dinner at Te Papa Tongarewa in Wellington. It is great to see the variety of interesting and exciting work being undertaken across the industry.

There are a variety of spatial activities that are being supported by NZIS in various forms. These include the Geosocial Meet-ups in Christchurch (October speakers included Peyman Zawar-Reza from the University of Canterbury and Iain Campion from ECan), and the WIS events (October lunch included a presentation on 'Unconscious Bias' from Beth Gerling, from the NZDF Institute for Leader Development). Please let the SPS committee know if there are any additional spatial events on that may be of interest to the stream.

We are also looking to support a strong spatial representation at the NZIS conference in 2018 in Nelson. We encourage stream members to consider attending the conference, and also to support the attendance of emerging young professionals.

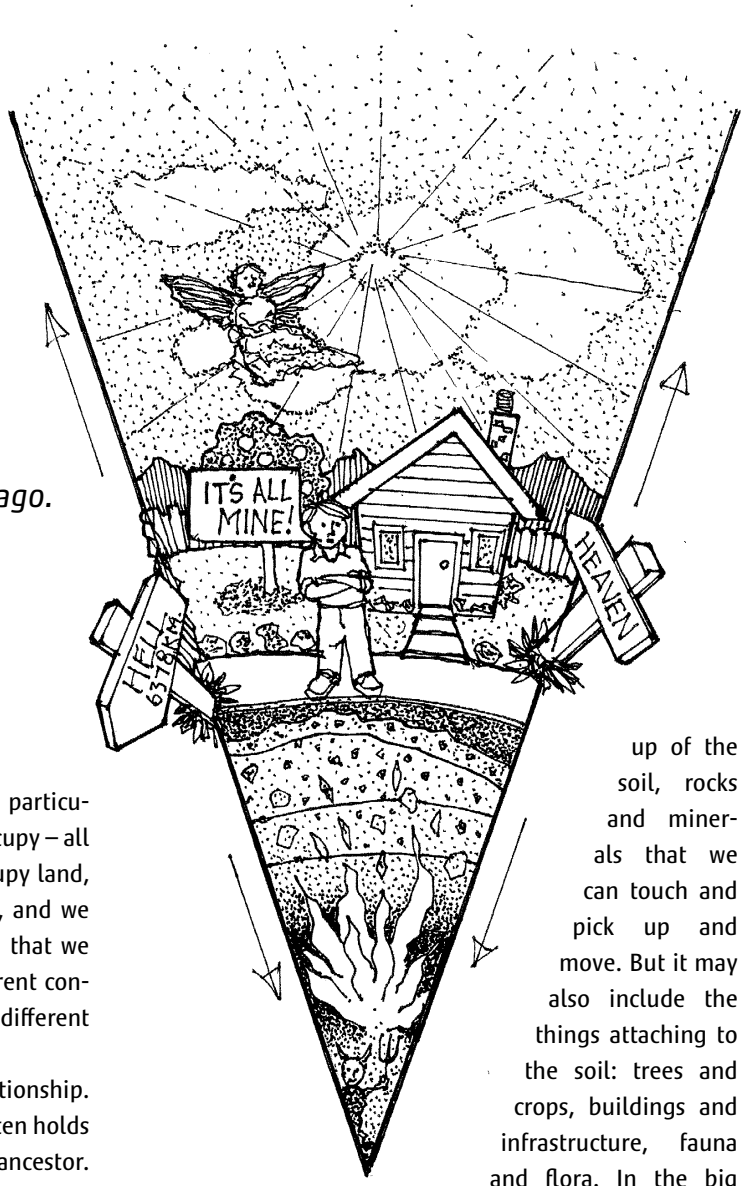
Kat Salm, Spatial Stream Representative

The Multiple and Conflicting Definitions of

LAND

Julian Thom (BSurv Hons candidate) and Mick Strack (PhD), University of Otago.
julian.raymond.thom@gmail.com and mick.strack@otago.ac.nz.

Illustrations: Wayne Thom



Introduction

Land is what we as land surveyors deal with, and particularly, we measure. Land is about the spaces we occupy – all our usual living activities occur on land. We occupy land, we use and develop land, we buy and sell land, and we have a relationship with land. So, it is expected that we know what land is. But land has numerous different contexts, and depending on those contexts, several different definitions.

Land is often about a personal or social relationship. Land is the basis for most creation stories, so it often holds spiritual references and embodies the original ancestor. This is particularly apparent for Maori who regard Papatuanuku as their actual maternal ancestor. There is therefore an individual, social and cultural relationship established that supports tikanga and more especially kaitiakitanga, manaakitanga and whanaungatanga. On this conception there are no boundaries or limits to the land, the whole earth is the body of Papatuanuku and we all live within her embrace. It most certainly cannot be broken up into layers and sections, nor subject to ownership claims for its commodity value.

All people, necessarily, have a relationship with the land, although it may be rather transient for many people. This relationship does not depend on ownership or property, but will usually depend on access and use. It may be about landscape, topography, recreation or security. The territorial boundaries and the meaning of land in reference to this relationship are very subjective and cannot be easily categorised or defined.

Land is the stuff that we walk on, build on, and that we cultivate for most of our food. In this sense it is made up of the soil, rocks and minerals that we can touch and pick up and move. But it may also include the things attaching to the soil: trees and crops, buildings and infrastructure, fauna and flora. In the big picture, it is the Earth, although some may make a distinction between dry land and wet (or submerged) land, and we could make a distinction between solid land at the surface of the Earth and the molten minerals that make up the core of the Earth. It is a tangible thing and it has an ill-defined spatial extent.

However, land is also the colloquial term for the *property* that we buy and sell and hold as a commodity. In this context it is a legal relationship between a person, group of people or entity and a collection of rights in a defined space, usually defined, measured and portrayed as a two-dimensional area with defined boundaries – as on a survey plan or map. But of course, it is not a plane surface in two dimensions. It must necessarily have depth/height to accommodate our occupation on the land and our possession. The extent of that vertical dimension is the major question at the core of Thom's dissertation (see abstract in this issue), and it is not an easy question to answer.

Property incorporates statutory interests and common law rights. So, what does the common law say?

Common law extent of land

There has been a long acceptance of the maxim that, in its Latin terms, appears to be of ancient provenance: *cuius est solum, eius est usque ad coelum et ad inferos* or, he who owns the earth, owns from the heavens down to the centre of the Earth. The maxim has an enticing poetry or theatricality to it that has attracted support without any attempt to address the impracticality or reality of the statement. An indepth literature search finds that the maxim is of relatively recent origin and may not be such an unquestioned part of the common law that was introduced to New Zealand in 1840. In practical terms it makes little sense.

The great 18th century jurist Blackstone supported the maxim and concluded that "the word 'land' includes not only the face of the earth, but everything under it, or over it". Since then it has largely been unquestioned. Only a small number of academics have investigated the validity of the maxim, and although there are several cases questioning the upper extent of 'land' (in the context of structures overhanging property – which is considered a trespass on someone's land, and the freedom of over-flying – which is not considered a trespass), there are very few that question the lower extent of land.

The maxim has been referred to in legal texts, policy documents, and (inappropriately) on survey plans of tunnel spaces, but there it is often treated uncritically as absolute doctrine and without regard for logic or practicalities. Furthermore, the maxim strongly supports the perception of the absoluteness of private property rights, but dismisses a broader consideration of the public nature of land. For comparison, while dry land is available for private property, most people acknowledge that wetlands should not be private property but part of the public commons. A similar formulation of the public-private divide should recognise that land space that is beyond any expectation of occupation or use – i.e. 'beyond reasonable control' – should be part of the public commons. (See Strack & Thom in *Surveying+Spatial* Issue 87).

So within the common law, does 'land' have vertical limits? We suggest that it certainly should.

But how does our legislation define land?

Statutory meaning of *land*

Various statutes in New Zealand define the meaning of land. While the statutes refer to 'land', they are often really referring to 'property', and while some refer to things, others refer to spaces. There are significant differences in these interpretations and no consistency. Under the LTA 1952, land includes things and interests —

> messuages, tenements, and hereditaments, corporeal and incorporeal, of every kind and description, and every estate or interest therein, together with all paths, passages, ways, waters, watercourses, liberties, easements, and privileges thereunto appertaining, plantations, gardens, mines, minerals, and quarries, and all trees and timber thereon or thereunder lying or being, unless specially excepted (LTA 1952, s 2).

Interestingly, 'waters' are included in this definition, but are excluded in the updated LTA 2017, which is due to come into force before January 10, 2019, which will simplify the definition of 'land' to include —

> (a) estates and interests in land:
>
> (b) buildings and other permanent structures on land:
>
> (c) land covered with water:
>
> (d) plants, trees, and timber on or under land (LTA 2017, s 5).

Under the LTA 1952 and LTA 2017, land includes legal interests in land, and also physical things attached to the earth's surface or under it. Similarly, the Property Law Act 2007 defines land as "all estates and interests, whether freehold or chattel, in real property" (PLA, s 2). In contrast, the Cadastral Survey Act 2002 and Resource Management Act 1991 reference spaces, although there is inconsistency in the spaces they reference. Under the Cadastral Survey Act land includes —

> (a) subsoil, airspace, and water and marine areas; and
>
> (b) interests in or over land (Cadastral Survey Act, s 4).

What is interesting about this definition is that it includes the subsoil which is a geological layer, also the space occupied by air, and the water area and marine area which are obviously areas and not spaces. It is reasonable to assume that the water area relates to fresh water areas such as rivers and lakes, and the marine area relates to salt water areas, or in other words, the foreshore and seabed.

Land in the RMA, "includes land covered by water and the *airspace* above land" (RMA, s 2). The Marine and Coastal Area (Takutai Moana) Act 2011 ("MACAA") references other spaces again. The marine and coastal area —

> (a) means the area that is bounded, —
>
> (i) on the landward side, by the line of mean high-water springs; and
>
> (ii) on the seaward side, by the outer limits of the territorial sea; and

> (b) includes the *beds of rivers* that are part of the coastal marine area (within the meaning of the Resource Management Act 1991); and
>
> (c) includes the *airspace* above, and the *water space* (but not the water) above, the areas described in paragraphs (a) and (b); and
>
> (d) includes the *subsoil*, *bedrock*, and other matter under the areas described in paragraphs (a) and (b) (MCAA, s 9).

Although limited to the marine and coastal area, this interpretation includes riverbeds and the seabed, and the airspace and water space above. But for what is below the surface, it defines the things: subsoil and bedrock.

None of these definitions reference a subsurface space deeper than the bedrock.

Other legislative definitions

The Rules for Cadastral Surveys (r2) define a 'parcel' as "an area or space that is a single contiguous portion of land separately identified in a CSD".

The Unit Titles Act 2007 defines a "*unit*, in relation to any land, means a part of the land consisting of a space of any shape situated below, on, or above the surface of the land, or partly in one such situation and partly in another or others, all the dimensions of which are limited, and that is designed for separate ownership" (s2). This Act explicitly provides for a unit parcel to be described in three dimensions – a stratum bounded by upper and lower limits recorded as reduced level measurements or by permanent structure boundaries.

The Public Works Act states "*land* includes any estate or interest in land", and the Crown Minerals Act states "*land* includes land covered by water; and also includes the foreshore and seabed to the outer limits of the territorial sea".

Many other statutes refer to land, assorted categories of land, and what can be done on land, but they appear to take it for granted that land needs no further interpretation.

The Civil Aviation Act 1990 has reduced or extinguished some interests in the airspace. It provides that:

> No action shall lie in respect of trespass, or in respect of nuisance, by reason only of the flight of aircraft over any property at a height above the ground which having regard to wind, weather, and all the circumstances of the case is reasonable, so long as the provisions of this Act and of any rules made under this Act are duly complied with (s 97(2)).

The protection provided by the Aviation Act is limited to a right of passage but extends to all flights provided they comply with statutory requirements. It restricts the vertical extent of the right to exclusive possession in the airspace to a reasonable height for the flight of aircraft. In other words, the exclusivity of possession has been removed from the private property rights affecting the airspace – other rights may still exist. This arrangement strikes a balance between the needs of the landowner to make reasonable use of the land, and those of the public for whom the air is part of the public commons and airspace is common property.

What do *subsoil* and *bedrock* mean?

While the Cadastral Survey Act, RMA and MACAA describe land as including the airspace, subsoil or bedrock, they do not provide definitions for these layers. Perhaps the complex nature of these geological layers, and the geographical variance in each geological layer, means a definitive definition is not possible. For example, some places do not have a topsoil layer, or indeed a subsoil layer, and the depth of the different layers can vary a considerable amount in different places of the country.

It is worth considering what the different layers represent and the effects the choice of term will have on the statutory interpretation of land.

The *airspace* is the confined space between the surface of the earth and the outer limits of the atmosphere.

The *subsoil* could be interpreted as all the space beneath the soil. However, a more appropriate term for the space beneath the surface is 'subsurface'. Therefore, a more reasonable definition of subsoil is the layer of unconsolidated inorganic material usually beneath the topsoil (the upper, outermost organic layer in which plants have most of their roots and which the farmer turns over in ploughing) and overlying the bedrock.

The *bedrock* is the solid rock beneath the subsoil making up the crust of the earth.

It is obviously impractical to assert any rights in the space beyond the bedrock or the atmosphere. This position has been recently supported in *Star Energy v Bocardo* ([2010] UKSC 35) when Lord Hope stated "[t]here must obviously be some stopping point, as one reaches the point at which physical features such as pressure and temperature render the concept of the strata belonging to anybody so absurd as to be not worth arguing about".

Why it matters

It is reasonable to assume that law writers consciously choose the words they select, and when they choose different words, they mean different things. But that does not mean that they can be interpreted logically, what they mean and why they vary. But these things matter. Proper-

(continued p27)

Glenn Stone Insurance

Our story with the NZIS – So Far

Glenn Stone Insurance have partnered with the NZIS over the last 3 years and service over 50 land surveying and multi-disciplinary firms. We were the first diamond sponsor and this has enabled the NZIS to better support its members and the land surveying profession in general.

We work with the NZIS on insurance related topics or legislative changes that might impact the profession. Most recent examples include our advice on health and safety changes, construction contracts legislation and individual cadastral survey cover.

Some of our key achievements over the last few years:

- Lowering costs to land surveyors.
- Introducing an alternative insurance choice.
- Delivering covers not previously available in New Zealand.
- Scholarship introduced for School of Surveying.
- Continuous development of innovative solutions.

We recognise relationships are important

- Glenn Stone insurance is a New Zealand owned brokering firm, not a multi-national company.
- You will get to deal with the owners of the company directly.
- We provide personalised service.

Whether you are a present client of ours or not if you need help or simply want some advice contact us.

Start a conversation

Free call us on **0800 555 474** or email us at: **info@glennstone.co.nz**

Steadfast
STRENGTH WHEN YOU NEED IT

NZIS
Diamond Partner

GLENN STONE
INSURANCE

www.glennstone.co.nz

2017 NZSEA AWARDS

NZSEA
Recognising Spatial Excellence

Several of last year's New Zealand Spatial Excellence Award winners stunned the industry by going on to dominate the Asia Pacific Spatial Excellence Awards held in Sydney in April.

Wellington City Council's Living Labs entry won the New Zealand Supreme and the overall APSEA award for industry excellence and the People and Community Award. This year's winners are continuing with the high standard that allows us to hold our own on the world stage.

Mark Sainsbury hosted the awards dinner at Te Papa Tongarewa, and the following winners were announced for 2017.

Congratulations to all the organisations and individuals who submitted entries this year.

NZSEA website: *http://www.nzspatialawards.org.nz*

SUPREME EXCELLENCE AWARD

Representing the pinnacle of achievement in the spatial industry and showing the highest level of excellence or achievement

Entered under the **Innovation and Commercialisation** category recognising products or projects that implemented spatial solutions to an exceptionally high technical standard, and overcame significant technical challenges, delivering outstanding results for the client. In contrast with the Innovation Award, this category focuses on excellence in applying existing technology and methodologies.

Awarded to Trimble

Catalyst

This app for mobile devices brings high accuracy measurement into the mainstream.This innovation allows positioning measurements to be more cost effective and accessible to a much wider audience without compromising accuracy.

SPECIAL RECOGNITION FOR OUTSTANDING CONTRIBUTION TO THE INDUSTRY

Recognising the work done by a very special individual within the Spatial Industry in New Zealand: an individual who has had a key role in the formation of this relatively young industry and in shaping all three of our foundation partners.

Roger Smith

Mark Nichols, Trimble accepting the Supreme Award from Amy Wells, Wellington's Deputy Mayor

INDIVIDUA

New Zealand Esri User Group Undergraduate Student of the Year

Conferred on a student who has undertaken a research project in the course of their studies that contributes to the ongoing progression of the surveying and spatial profession.

Awarded to Craig John MacDonell, University of Otago

3D modelling of airport plant room using laser tech, 3D and virtual environment

Craig MacDonell has demonstrated outstanding leadership and communication skills as the driving force behind the successful completion of a topographic survey of Quarantine Island/Kamau Taurua in Dunedin. He successfully engaged with his student team as a leader and with a broad range of community audiences.

Anne Harper, SIBA President, presenting Euan Forsyth with his Postgraduate Student of the Year award

Spatial Industries Business Association Postgraduate Student of the Year

Conferred on a postgraduate student who has undertaken a research project that contributes to the ongoing progression of the surveying and spatial profession. Students eligible to enter this award include PhD and Masters Research students.

Awarded to Euan Forsyth, University of Auckland

Euan Forsyth's indexing method allows grading of walking environments that takes into account the different levels of physical activity amongst the population. Called the *Residential Scale Walkability Index (RSWI)*, the method can be consistently applied on a nationwide basis.

Guest speaker Keri Niven, Aurecon

AL AWARDS

Mark Allan, Trimble, presenting Kate Waterhouse with the Young Professional of the Year award

Eagle Technology Young Professional of the Year

Recognising a young professional who has made significant contributions in the field of Surveying and Spatial Science and acts as a role model for others in the industry.

Awarded to Kate Waterhouse, Western Bay of Plenty Council

An extraordinary spatial professional

Kate's enthusiasm and dedication in the geospatial arena have made her a high performer in the spatial industry. Her contribution, both professional and voluntary, has earned her recognition in various awards and honours including attending the ESRI User Conference in San Diego, USA in 2017.

Eagle Technology Professional of the Year

Recognising a practitioner who is working in any of the disciplines of the surveying and spatial sciences whose professional achievements are widely acknowledged as exemplifying the highest standards of excellence and ethical conduct.

Awarded to Trevor Hart

A significant advocate and contributor to the sector

As a significant but unassuming contributor to the spatial industry over 18 years, Trevor's expertise has allowed many GIS organisations to achieve best practice. His most recent contribution has been with the high-profile Wilding Conifers Information System project implemented by LINZ.

ORGANISATIO

National Map Technical Excellence Award

Recognising products or projects that implemented spatial solutions to an exceptionally high technical standard, overcoming significant technical challenges, and delivering outstanding results for the client. In contrast with the Innovation Award, this category focuses on excellence in applying existing technology and methodologies.

Awarded to Arup Jacobs Joint Venture, Auckland Light Rail Technical Advisors

Auckland Light Rail Utilities Clash Detection Interactive Model

This ground-breaking GIS-based technology is helping protect underground utilities and assets during a major, light rail construction project in a busy CBD. It minimises the risk of engineering construction clashes with a sophisticated detection process.

Land Information New Zealand People & Community Award

Recognising products or projects that make a difference to national, regional or local issues and affect communities via 'grass roots' initiatives, and/or educational programs, services or tools that permit the widespread adoption, use, understanding and access to spatially enabled products or services.

Awarded to New Zealand Cartographic Society

2016/2017 NZ Children's Map Competition

A map competition of global standards that has excited the imagination of kids and been highly successful not only with the young entrants, but also resulting in two Kiwi winners in the International Children's Map Competition. The three winning place-getters are displayed at the National Library beside the *Unfolding the Map* exhibition.

ONAL AWARDS

Wellington City Council Innovation & Commercialisation Award

Recognising products or projects that made a significant contribution to the industry through the introduction of a new idea, method, technology, process or application resulting in social, environmental and/or economic benefits.

Awarded to Trimble

Catalyst

This app for mobile devices brings high accuracy measurement into the mainstream.The innovation allows positioning measurements to be more cost effective and accessible to a much wider audience without compromising accuracy.

New Zealand Institute of Surveyors Environment & Sustainability Award

Recognising products and projects that help to resolve any issue in an environmental context.

Land Information New Zealand

Wilding Conifers Information System

Providing a critical mapping tool, this project allows communities to control one of New Zealand's biggest environmental threats – wilding conifers. The Wilding Conifer Information System allows accurate mapping of infestations and activities being undertaken to control them.

e-Spatial Award for Spatial Enablement

Recognising products or projects in which the application of spatial information, methodology and/or tools has greatly improved the outcomes of a project, process or product.

Awarded to Far North District Council

'Let's Plan Together' Community Engagement in the District Planning

Providing a new way of getting involved in Council planning, this interactive mapping tool called 'Storymaps' has allowed people in the Far North a new and interesting way to engage in the town planning process. The maps show localities with plain english explanations, timelines and web links. One of the most exciting results for the Council has been the participation of local Iwi and hapu in identifying their areas of significance.

Dave Mole, LINZ accepting the Environment & Sustainability award from NZIS President Rebecca Strang

Wellington City Council's Living Lab Programme

Jenny Rains, Julia Hamilton and Sean Audain – Wellington City Council

Over the past year, Wellington City Council's Living Lab programme has gone from strength to strength, winning accolades at both the New Zealand Spatial Excellence Awards, and at the Asia Pacific Spatial Excellence awards in Sydney. On the eve of the 2017 Spatial Excellence Awards we pause and reflect on what this recognition has meant to Wellington, how spatial enablement has delivered results for the city's social wellbeing, and where to next for this project.

What is the Living Lab?

Cities throughout the world are engaged in an urban revolution, as smart technologies to sense, provide insights, and optimise the urban environment gather pace.

In Wellington, the Living Lab is led by asking: Can these smart cities deliver a more empathetic and socially responsive future for our city? The Living Lab explores this challenge with communities and organisations charged with growing the city's social wellbeing.

At its core, the Living Lab uses the relationships built up between Wellington City Council and its partner agencies, focused on the different aspects of social wellbeing of the city. Through the leadership of the Council's Community Services Team these relationships and insights were brought into the Collaboration Agreement, signed in 2014 with NEC NZ Ltd, to drive innovation in how the social sector functions. These innovations have ranged from growing spatial capability in the sector, to deploying *Internet of Things* sensors and machine learning, to better understand the different environments and issues in the city.

Community Services has driven this project, which supports a model of gathering data, converting it to information, using information to shape relationships and using relationships to achieve tangible results in the city. The focus given to the spatial aspects of this process by winning the Spatial Excellence Awards has seen the Lab expand to include new partners and address new issues.

Data

City streets are complex environments, with many overlapping systems, relationships and interactions occurring each day. A key driver for this project was to better understand the social dimensions of our streets, who they served, how they served them and how different actions changed the way they these spaces were used. To gain these insights required much more data than was being collected. To acquire this data, a range of approaches has been implemented.

Council's local hosts were equipped with the Survey 123 app – taking paper reporting and replacing it with digital channels. This cut down the amount of time required for reporting, but also allowed geotagged, structured data to be collected in real time.

This collection means that information gained by ex-

perienced, knowledgeable staff in the field can be used immediately by management to better serve the city, but also over time, to make better strategic decisions. Sensors have also been used as part of the lab, both to understand basic street conditions like temperature and humidity, but also to feed machine learning systems which can measure activities such as begging and breaking glass.

The data generated by these machine learning systems has been used to help balance anecdotal reporting before Council with evidence, make the city more responsive to issues, and signal where different approaches need to be taken.

A key component of all the data collected is to make it spatially referenced. To be a successful city council, Wellington City Council needs to understand the place we work in, and spatial context is key to doing that. The emphasis on spatial by default has been key in enabling collaboration between agencies on common issues and the development of city platforms for understanding issues.

The latest focus for the Living Lab is the creation of a system to understand the movement of people. This technology uses a series of sensor technologies to understand the numbers and flows of people on foot. Trials have already proven successful at Wellington Railway Station and is now being expanded to cover more of the city.

The information gained from this system promises to be transformational to many aspects of the city, from street design to consent processes to traffic planning and retail relationships. As a city, a key determinant of our social wellbeing and wider success is the health of our streets, and a key measure of this health is the pedestrians using this infrastructure.

Information

The Living Lab unlocks the silos of data held in different agencies and integrates them through a Smart Board system. This system places the ability to convert data into information and action into the hands of operational managers and staff.

Over the past year, this ability to support our Community Services team to lead from where they stand has delivered better services to the city for liquor licensing, policy development and interagency work.

As the silos of information have been broken down, so too have the jurisdictional boundaries which can obscure a complete picture. This has allowed all of the organisations involved to see the same street, and their place in assisting each other to resolve an issue or situation. This common purpose and picture has been invaluable for focusing efforts and assisting social wellbeing in the city.

The Smart Board also allows the integration of third party data sources to provide further insight into trends such as weather, major event calendars and school holidays. This context enables better understanding of how certain behaviour patterns correlate with external factors such as, do school holidays bring an increase in graffiti? Once such correlations are understood, we can then respond with more informed and targeted interventions.

Over the past few months we have worked to develop a business intelligent function which enables a more in-depth analysis of the data and trends highlighted through the Smart Board. The platform enables other smart city projects to be connected together, providing shared benefits. This has already been seen with the use of the city Virtual Reality to scale between street and city intuitively and sees report patterns at these different scales over time. These enhancements have led to a much more engaging and useful user experience.

An award-winning partnership

Whilst the technical innovation deployed on this project has included a number of firsts for New Zealand local government, it is the transformation in relationships and the way organisations work that has been the hallmark of this project's progress over the past year. As well as the technical innovation, there has been a parallel stream of work adapting Council's processes and ways of working to gain the benefits of the Living Lab, and to push forward the principles of privacy by design, modulation and openness which allow the project to advance.

The Living Lab project is an award winner, late last year this project won the New Zealand Supreme Spatial Excellence Award, and Community and Engagement Spatial Excellence Award. In April this year, the project received further accolades receiving the JK Barrie Spatial Excellence Award, and the Community Engagement Award at the Asia Pacific Spatial Excellence Awards in Sydney.

Aside from the unique combination of technology that brings the solution together, we believe the success of the Safe City Living Lab comes down to the strength of Wellington City Council and NEC's community partnership approach – which is one of true open collaboration and co-design to achieve positive community outcomes.

The wave of modern technology that can be applied to make our cities safer and smarter holds great promise. With partnerships like those between Wellington City Council and NEC, there is a fantastic opportunity to practically apply and field-test these technologies so that other cities can benefit from these experiences. We see the Safe City Living Lab as a medium for ongoing innovation and are keen to extend an invitation for other cities to engage and share lessons.

GROW YOUR PEOPLE

We are proud to be the first and exclusive recruitment partner to the NZIS.

We offer recruitment and HR consultancy services to improve your business through its people – ultimately increasing your bottom line.

- **RECRUITMENT SERVICES**
  We recruit for both permanent and contract roles, accessing the very best local and global candidates and returning Kiwis ready for a new challenge.

- **HR CONSULTANCY**
  Full HR analysis and review, offering recruitment strategies, expertise on how to build a successful team and best practice in all HR areas.

- **JOBS**
  Multiple opportunities NZ wide to progress your career. Contact us for a confidential chat and FREE salary check.

"After exhaustive attempts without success to recruit suitable staff for our land surveying consultancy, I met with Mark to discuss recruitment services. We have now employed 8 additional staff in the last 2 years, all of whom were carefully interviewed and screened by Mark and his team. Although recruitment costs are not cheap, the cost of not employing staff is even more expensive!"

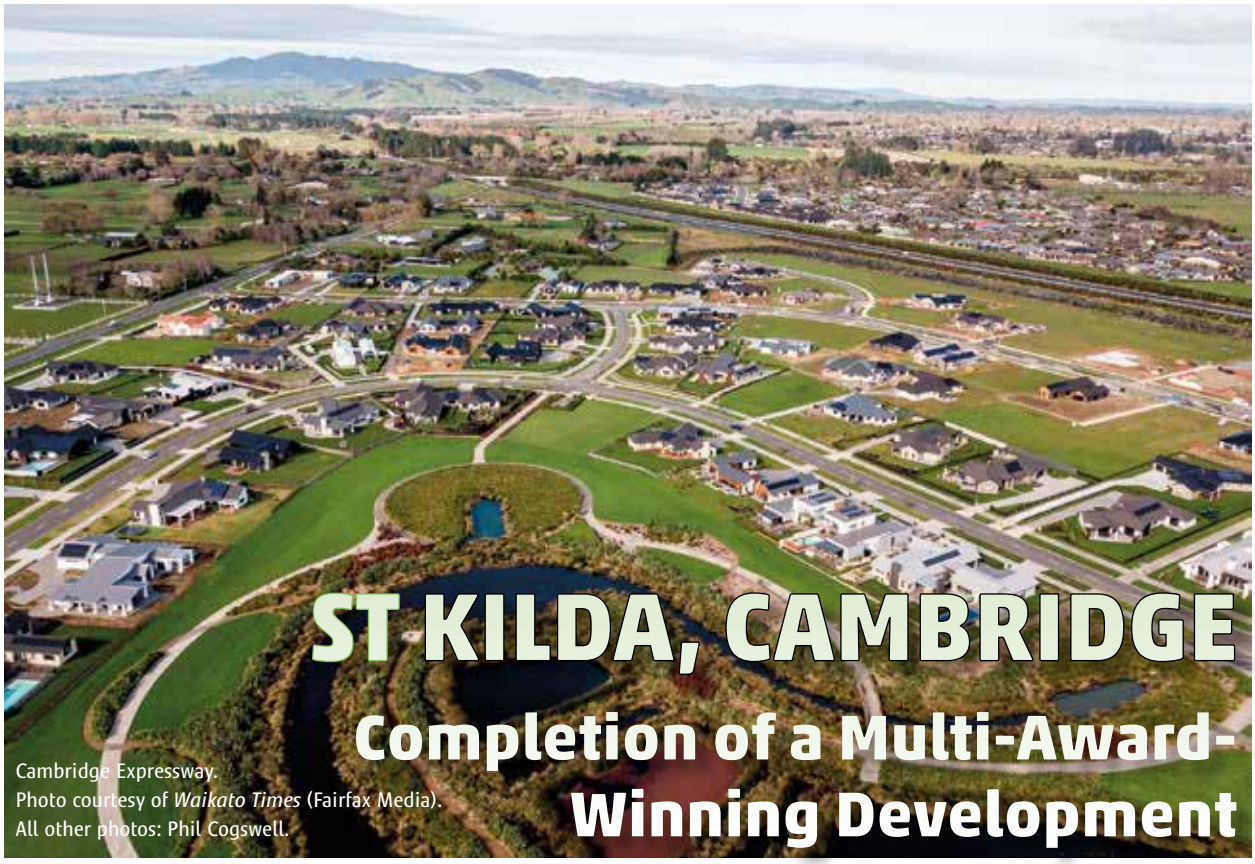
- Kevin Birch, Director of Birch Surveyors

EXCLUSIVE OFFER TO NZIS MEMBERS: FREE ONE HOUR CONSULTATION ON ANY HR AND RECRUITMENT NEEDS.

CONTACT:
Mark Fisher
09 391 8484 or 021 347 445
mark@eighty4recruitment.com
www.eighty4recruitment.com

100% NEW ZEALAND OWNED AND OPERATED

Eighty4
—RECRUITMENT.COM—



ST KILDA, CAMBRIDGE

Completion of a Multi-Award-Winning Development

Cambridge Expressway.
Photo courtesy of *Waikato Times* (Fairfax Media).
All other photos: Phil Cogswell.

Phil Cogswell, Land Development and Urban Design Stream Chair

Introduction

This development is the brainchild of the father and son partnership, Mike and Matt Smith, along with fellow Director Nichole Smith and their development company Grantchester Farm Ltd.

The parent property was operated as a small dairy operation and was dissected by the Waikato Expressway, leaving a portion within the Cambridge Town boundary and the larger balance of the property of approximately 80ha on the eastern side of the Expressway, left in the Rural Zone.

Following a lengthy consultation period with Council and surrounding landowners, a development concept was finally accepted for this 80ha tract of land and a plan change promulgated to include a new St Kilda Structure Plan Area in 2009.

The vision was to create an eco-friendly subdivision with strict building covenants in order to establish a high-quality development and in turn, an attractive, livable community.

Development concepts

The initial development concepts were for a rural residential-type development given the Expressway separation of the existing residential development on the western side of the Cambridge Bypass. However, this was not supported by Council and a new concept of larger residential sections of a 1600m^2 average size was developed, which was finally accepted. The final design would also incorporate a small commercial node and several local purpose reserves surrounding new wetlands and stream environs.

As the project evolved, a portion of the land in the north-eastern corner was purchased by BUPA and consent obtained for a small retirement village and care facility. Land use consent was also obtained for up to five duplex developments per stage to introduce a mix of higher density living.

Development requirements and constraints

1. Transpower infrastructure – A major development constraint was the major HV electricity feed and pylons that traversed the property to the Cambridge Sub Station, adjoining the northern boundary of the property. After extensive consultation and design work, these lines were relocated underground and a small portion of land on a neighbouring property bought to house the termi-

Wetlands with development in background

nation structure required to convert the lines from overhead to underground along road alignments. This process included approximately 2km of cable installed at a cost of approximately $6 million.

2. Earthworks – Earthworks design was also carried out by Beca, and a large earthmoving company (C & R Developments) was contracted to carry out these works. The project was one of the first to have machine control GPS on large excavators and this was a huge success given the intricate batter and wetland designs involved.
3. Stormwater disposal – Beca Ltd was also employed to provide design services for infrastructure and the brief was to create hydraulic neutrality involving a mixture of onsite disposal methods and waterways to minimise the impacts of concentrated stormwater. Mangaone Stream also traversed through the middle of the property and a proposal to divert this to an alignment along the Expressway boundary was included in the design process. Two large wetlands were designed to hold and treat concentrated stormwater with secondary flows to the stream. The largely flat contour of the site provided serious challenges to this design work.
4. Sewage disposal – With such a large spread of development on flat contour land, the logistics of gravity fed systems were difficult and the final design required four smaller pump stations feeding to a main pump station and then to a rising main that fed under the Expressway to connect to the existing Cambridge North infrastructure.
5. Water supply – An extension from a nearby water reservoir via a large diameter pipe was designed to provide the sites with the necessary water supply with firefighting capacity.
6. UFF and power – This was one of the first developments in the locality with solely fibre installation, and coordination of this along with large scale power installation was challenging, with a high level of coordination required of the project managers, contractor and service providers.

Construction staging

With the large scale of development of approximately 285 lots, a staged development was planned with a large portion of the development costs generated in the first stage with the infrastructure requirements and HV undergrounding required with Stage 1.

Development has occurred steadily over a five-year period and the surge in the property market over the past

Playground with café in background

few years saw the Stage 5 sections sold well before the end of construction in early 2017.

Marketing and sales

Through the St Kilda website and excellent marketing, the development attracted many people looking for larger sites in a high-quality environment, and it is considered the premium residential subdivision in the Cambridge locality. High-end building companies took the opportunity to purchase multiple sites, and design and build packages are popular. The high quality, broad range of house designs has provided a unique development that has become a vibrant small community.

Summary

St Kilda has been designed and constructed with a strong focus on community and environment to achieve the desired principles of urban design.

Positive contributions to the built environment include:

- Environmental engineering design – sustainable stormwater design incorporating wetlands and stream diversions, with an emphasis on site retention and recycling to achieve hydraulic neutrality with allowance for climate change.
- Energy conservation – solar energy systems have been made compulsory and design covenants include stormwater recycling, higher specification insulation and use of other eco-friendly building materials.
- Healthy lifestyle – 18km of shared cycleways/paths throughout the development will encourage a healthy, active lifestyle for residents and the community.
- Environmental – wetlands, in particular, provide a natural environment for birds and other small wildlife and the planting of native species has seen a large increase in the presence of native birds such as tui. Public resting places through these wetlands encourage the residents and general public to enjoy this amenity.
- Encouraging community – connectivity has been a large part of the urban design process, with paths connecting meeting places such as the local café and playground, encouraging neighbours in particular to commune.
- Public amenities – St Kilda has not been designed as an exclusive community and plentiful carparks adjoining reserves and wetland areas encourage non-resident use.

In conclusion, St Kilda has become a premier development on the outskirts of Cambridge, centrally located and within easy access to the Waikato Expressway. This has seen it become an attractive place to live, with many of the residents having relocated from places like Auckland to enjoy the lifestyle Cambridge and St Kilda offer.

For more information:
www.stkildacambridge.co.nz
https://www.youtube.com/watch?v=D_7wN7zxmlQ

Medical centre and childcare facility

RISING to the OPPORTUNITY

Erik Dahlberg

SURVEYORS FACE TIGHT SCHEDULES AND DIFFICULT CONDITIONS ON A HIGH-PROFILE PROJECT. A NEW SOLUTION HELPS THEM TAME THE CHALLENGE.

Surveyors use the Trimble SX10 in Changchun. They could scan eight buildings in one day.

Nine hundred buildings in two weeks. In biting cold. Grabbing data down to 5cm or better. It would be a daunting task anywhere, but especially so in the harsh winter of China's Jilin province.

In Changchun, Jilin's capital and largest city, local authorities are responsible for maintaining and improving city structures. Part of the effort includes a long-term project to improve insulation, provide maintenance and improve the exterior appearance on a large block of buildings in one section of the city.

The city's plan to repaint exterior surfaces called for detailed measurements of the building facades – accurate to 5cm (2in) or better. In order to achieve that level of accuracy, the city called in Heilongjiang Star Survey and Mapping Technology Co Ltd (Star Survey) to collect the required information.

Speed in the field

Field work began in December 2016, just as the harsh Jilin winter set in. The Heilongjiang surveyors were given barely two weeks to gather accurate data on all 900 buildings.

Faced with the tight schedule, Star Survey knew that standard surveying wasn't fast enough to capture the needed data in the allotted time. Instead, the company turned to laser scanning for data acquisition. In addition to conventional scanners, Star Survey put an important new technology to the test.

Star Survey assigned three survey crews to the project and equipped one of the crews with a Trimble® SX10 scanning total station. The SX10 combines the functionality of advanced robotic total stations with precise, high-speed laser scanning. Used in conjunction with Trimble Access™ software, the instrument uses built-in cameras to collect high-resolution images of the scene and enables the operator to 'see' through the telescope via a virtual display on a rugged tablet.

Over a 10-day period, the SX10 completed detailed scans on 80 buildings. By leveraging the instrument's long range, the two-person crew could typically capture an entire building façade from just one setup. When additional setups were needed, the crew used the SX10 surveying functions to tie setup points together. In addition to saving time in the field, their approach reduced the time for the office processing.

A second two-person team was equipped with Trimble TX8 and TX5 laser scanners. In 10 days, they collected data on an additional 400 buildings. Like the SX10 crew, they delivered each day's data to the office graphics team. A

Plan view of part of the project shows the multiple setups required. The SX10 could tie the setups together to reduce office processing.

The point cloud for part of the project illustrates the dense, complex information.

Technicians blended point clouds and images to produce 3D visualisations of Changchun buildings. The image includes locations of SX10 setup stations.

third crew made up of seven more people and three different scanners worked for 11 days to capture data on 420 buildings.

Integration drives office efficiency

In the office, Star Survey technicians processed and analysed the field measurements. Data from the SX10 was downloaded directly to Trimble Business Centre software (TBC). Because the SX10 captured complete data for each building, technicians did not need to stitch together multiple scans and could quickly complete checking and quality assurance.

"The quality and colour from SX10 data was excellent," said one of Heilongjiang's graphics specialists. Using TBC, the technicians combined the SX10 scanning data for individual buildings into larger point clouds that included multiple buildings.

Star Survey used Trimble RealWorks® software to download and process data from the TX5 and TX8 scanners. Technicians merged and cleaned multiple scanned datasets to produce large, coherent point clouds. They also used RealWorks to process the data from the other scanners used on the project. When the processing and quality control was complete, the point clouds were transferred from TBC and RealWorks into AutoCAD as requested by Changchun city officials. The transfer enabled the design and graphics team to complete their work efficiently and on time.

Working in rural areas where scanning is not required, the SX10 performs as a precise total station.

A successful outcome

Star City's performance kept the project on schedule. Fast data collection and efficient processing enabled technicians to meet the city's requirements and deliver accurate, comprehensive information. By merging point cloud data with on-scene photographs, planners could visualise the buildings in detail.

According to Star Survey, the SX10 performed well and demonstrated the instrument's exceptional flexibility. The solution provided "significant savings in time and personnel", said Yunfeng Wang, survey crew leader for Star Survey.

Examples of raw data (top) and finished elevation in Trimble Business Centre. Results could be exported to standard CAD software and formats.

"We were able to separate field and office teams and the instrument can be easily set up and scan a building in a short period of time. Data acquisition is very easy for office processing and drafting."

Based on its performance in such a demanding application, the SX10 has proven to be a valuable asset for Star Survey. In addition to scanning, the company will take advantage of the SX10 capabilities and use it on traditional work including cadastral surveys, topography and building locations.

Erik Dahlberg is a writer specialising in the geomatics, civil engineering and construction industries. Drawing on extensive training and industry experience, Dahlberg focuses on applications and innovation in equipment, software and techniques. (Images were provided by Heilongjiang Star Survey and Mapping Technology Co Ltd.)

Accurate

Nikon XF and XS
Mechanical Total Stations

are packed with features that make survey work easier and faster, including an 800m range Non-prism EDM, time-saving autofocus and dual full displays.

The Nikon XF allows for Survey Pro, Survey Basic and Layout Pro surveying software to run on-board.

The Nikon XS runs the standard Nikon survey software used on many generations of Nikon total stations.

Both total stations have:

- Nikon powered autofocus that delivers quick, precise focus even in low light conditions
- Superior Nikon optics
- 2 Hot-swappable long life Li-Ion batteries
- Choice of 1", 2", 3" and 5" instruments
- Choice of laser or optical plummet for the 2", 3" and 5" instruments (1"-- optical plummet only)

@AccurateInstNZ
accurateinstrumentsnz

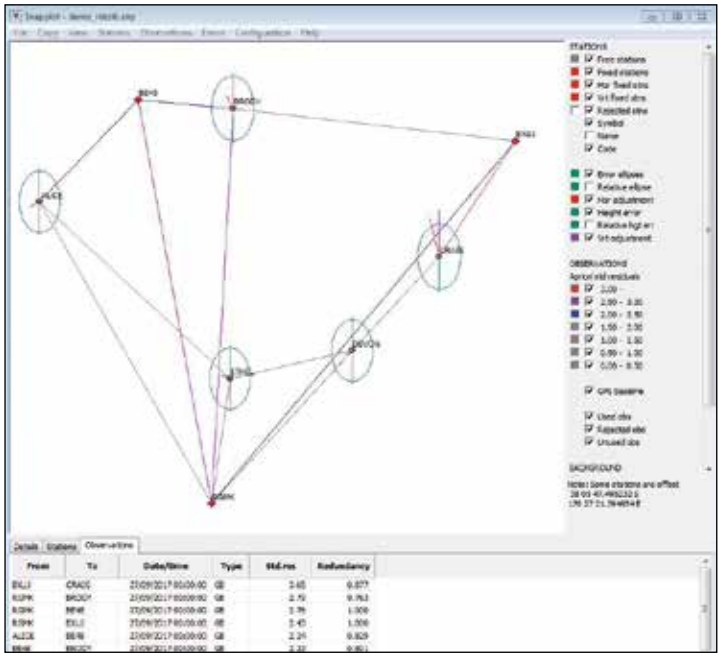
AUCKLAND & CHRISTCHURCH SHOWROOMS
FREEPHONE 0800 500 380
sales@accurate.kiwi

www.accurate.kiwi

SNAP

Least squares adjustment software for calculating accurate coordinates in New Zealand

Nic Donnelly, Manager Geodetic Infrastructure, Land Information New Zealand and Chris Crook, Technical Leader Spatial Information, Land Information New Zealand.



The results of a SNAP adjustment displayed in SNAPPLOT. Observations have been coloured by standardised residual to assist error detection.

THERE IS AN EVER-INCREASING DEMAND FOR ACCURATE SPATIAL DATA IN TERMS OF OFFICIAL GEODETIC DATUMS. IN NEW ZEALAND, THERE ARE TWO PARTICULAR FACTORS THAT MUST BE CONSIDERED FOR HIGH-PRECISION SURVEYS OVER EXTENDED AREAS.

Firstly, New Zealand's active tectonic setting presents a challenge, as physical locations among spatial entities (such as survey marks) change over time due to land deformation. Secondly, GNSS technology provides observations in terms of a global datum, not the official datum of New Zealand, or any other country.

Most surveys take place over small areas, in which case these factors can usually be neglected without compromising the quality of the coordinates. This is because any deformation or GNSS datum offset is assumed to be consistent over the extent of the survey. But where high accuracy is required, or the survey network covers an extended area, the deformation model and often a datum transformation must be applied to calculate accurate coordinates.

New Zealand's official geometric datum, New Zealand Geodetic Datum 2000 (NZGD2000), is aligned to the International Terrestrial Reference Frame 1996 (ITRF96) at the reference epoch, 1 January 2000. The datum includes a deformation model to enable survey observations made at different times to produce a consistent set of coordinates (latitude, longitude and ellipsoidal height). This deformation model includes a secular model of New Zealand's long-term tectonic motion, overlaid with a number of patches modelling various earthquakes. As observations are made further in time from the reference epoch, the impact of the deformation model (or of not applying the deformation model) becomes greater.

From NZGD2000 ellipsoidal heights, normal-orthometric heights can be derived in terms of New Zealand Vertical Datum 2016 (NZVD2016) using a quasigeoid model, New Zealand Quasigeoid 2016. Normal-orthometric heights are required for most heighting purposes as they relate to mean sea level and reliably indicate fluid flow, which ellipsoidal heights do not.

GNSS orbits, from which the datum of GNSS observations is primarily derived, are published in terms of the latest World Geodetic System 1984 (WGS84) datum realisation, for the broadcast orbits, or in terms of the latest ITRF datum realisation, for the precise orbits. Modern realisations of WGS84 are aligned to the ITRF, to the extent that the two datums can be treated as identical for surveying purposes. But modern ITRF realisations (such as ITRF2008 and ITRF2014) cannot always be treated as identical to ITRF96 (to which NZGD2000 aligns). This is particularly so where the GNSS data is processed to produce a set of point vectors, such as from Precise Point Positioning or SINEX files from the PositioNZ-PP online processing service.[1] The data needs to be transformed to ITRF96, which is done via a time-dependent 14-parameter transformation (three translations, three rotations, one

scale, plus the rate of change of each of these seven parameters with time).

The SNAP (Survey Network Adjustment Package) software incorporates the deformation model, quasigeoid model and transformation parameters required to calculate coordinates in terms of New Zealand's official datums and projections. Developed and maintained by Land Information New Zealand (LINZ), it uses least squares to calculate the best-fitting coordinates from survey observations, along with observation and coordinate uncertainties and various statistics to assist with data analysis. It is used by LINZ to calculate coordinates for geodetic marks, which are published in Landonline and the Geodetic Database. It is also widely used by surveyors, particularly for geodetic and engineering surveys. While SNAP is maintained by LINZ to enable the calculation of accurate geodetic coordinates for New Zealand, the flexibility of the software means it has been used around the world in diverse geodetic environments.

SNAP runs on Windows and can be downloaded for free from the LINZ website.[2] This same webpage contains links to guidelines for using SNAP for LINZ geodetic surveys and a SNAP tutorial (including sample files). SNAP is actively maintained and regularly updated on this webpage.

The SNAP Manager graphical user interface is used to operate the software and manage a series of text files that contain coordinates, data and SNAP commands. Adjustment results are provided as text reports and can be visualised using SNAPPLOT. There is extensive help within SNAP, which explains the commands, data formats and how to use the software.

There are a number of features to assist with geodetic and engineering surveying in New Zealand. SNAP can:

- Utilise New Zealand's coordinate systems and deformation/quasigeoid models, as well as commonly used global datums (WGS84 and ITRF) and selected overseas datums.
- Adjust 18 types of survey observation, including GNSS vectors, GNSS points, horizontal angles, slope distances, horizontal distances, zenith distances and height differences.
- Include GNSS and levelling data in a single SNAP adjustment, using the quasigeoid model, to calculate horizontal coordinates in terms of one datum and vertical coordinates in terms of another. For example, NZGD2000 horizontal coordinates and NZVD2016 heights.
- Rigorously transform coordinates between numerous New Zealand and global coordinate systems, using time-dependent transformations where appropriate.
- Visualise data and adjustment results using SNAPPLOT.
- Define custom CSV formats for input data.
- Define multiple accuracy specifications and test adjustment results against these.
- Calculate bearing swings and scale errors.
- Update coordinates from the LINZ Geodetic Database where geodetic codes are present in the SNAP files.

It also has a number of more advanced features to support large adjustments, custom workflows and complex analysis. SNAP can:

- Run directly from the command line, which is useful for calling it from other programs.
- Be customised using the SNAP scripting language to define new menu options and link to other programs (for example, connect to a user-created Python script that changes the format of a text file, or does a specific analysis task).
- Define station trajectories (for example, station velocities and steps), which is useful when managing observations collected over a long time period where the NZGD2000 deformation model does not adequately account for site-specific deformation.
- Apply commands to observations or stations using spatial and non-spatial classifications (for example, rejecting observations made before a particular date within an area defined by a well-known text (WKT) file).
- Use custom datums and projections, for example a site datum for an engineering survey, or a coordinate system for another country. Coordinates can then be transformed between these custom coordinate systems and the existing coordinate systems in SNAP.

SNAP has been a key tool for calculating accurate geodetic coordinates in New Zealand for nearly thirty years. Over that time, it has been adapted and enhanced to support an increasingly complex geodetic environment which is primarily driven by the widespread use of highly accurate GNSS technology. Land deformation and GNSS datum relationships mean that calculating rigorous and accurate NZGD2000 coordinates can be challenging. SNAP aims to reduce this challenge as far as possible by incorporating the models and parameters needed for New Zealand.

NOTES

1. *https://www.linz.govt.nz/positionzpp*
2. *https://www.linz.govt.nz/data/geodetic-services/download-geodetic-software/snap-concord-downloads*

Kairuri Community Trust Launched

An exciting development for the survey and spatial sector is the launch of a charitable trust providing a vehicle for bequeaths, donations and partnerships for the benefit of our New Zealand communities and the sector.

The Kairuri Community Trust was launched to members at the NZIS Annual General Meeting in November – it is independent of NZIS and will be overseen by three trustees. The trust deed was signed by all three Trustees, Jayne Perrin, David Fox and Bill Robertson in May.

Bill Robertson, the Trust Chair, is excited by the Trust's prospects.

"The Trust can give surveying and spatial careers and awareness a real lift and the focus is very pure. The concept of helping the communities we live in is huge and all the trustees are extremely excited about the potential effect this can have on young people and the sector," said Bill.

There are several future intentions that the Trust will fulfil. Among these aims are making grants that increase the diversity of skilled professionals in the sector and provide scholarships and support to people developing careers or wanting to further their education in surveying and spatial fields. It is especially aimed at people needing financial assistance to undertake tertiary education and to offer scholarships to help increase the diversity of people by gender, ethnicity and socioeconomic circumstances.

The Trust could also make grants to tertiary institutions and schools with the aim of assisting with resources, facilities or knowledge in courses and/or training in surveying and spatial.

Kairuri Community Trustees, Jayne Perrin, Bill Robertson and David Fox

The Trust will also look at ways to practically apply scientific knowledge and research for the benefit of the community in such ways as funding visiting scholars, lecturers and specialists so they can share their knowledge for the benefit of students and the community.

(continued from page 9)

ty rights are strongly defended by proprietors and any infringement of perceived rights, or limits imposed on the spatial extent of their property are likely to be challenged in court. This may be especially true in future conflicts between development of subsurface space and high-density surface development.

On the other hand, the public has an interest in all land; we are all affected by what people do on their land. There is a growing recognition that the assertion of freedoms in private property has led to poor management, and the ethic of sustainability suggests that all people have rights in the land in common. Logic suggests that private property has spatial limits.

Public freedoms in navigation have long been prioritised in the ocean, in waterways, and in airspace. Subsurface space should similarly be freely available for public navigation – road and rail tunnels. The time and cost of negotiating with and compensating surface owners for subsurface rights in space that is demonstrably beyond their effective control is an unreasonable burden on the public. Can legislation be drafted that comprehensively clarifies the downward and upward limits of property in land? Yes, certainly. Other countries have done it. Singapore is a model example of legislative intervention, and many civil codes have incorporated vertical (upper and lower) limits to land as property so that rights do not extend beyond the limits of reasonable control.

As we move towards the development of a 3D cadastre, we will need clearer definitions of stratum title and the vertical extent of land.

Review of the Rules for Cadastral Survey

Stephanie Harris, Glaistor Ennor Solicitors

As many of you will already be aware, Mark Dyer, the Surveyor-General, has announced a review of the Rules for Cadastral Survey ("Rules"). The original intention was to commence a review in 2015, however, the Canterbury earthquakes, and the establishment of specific rules and guidance in response has delayed the review until now.

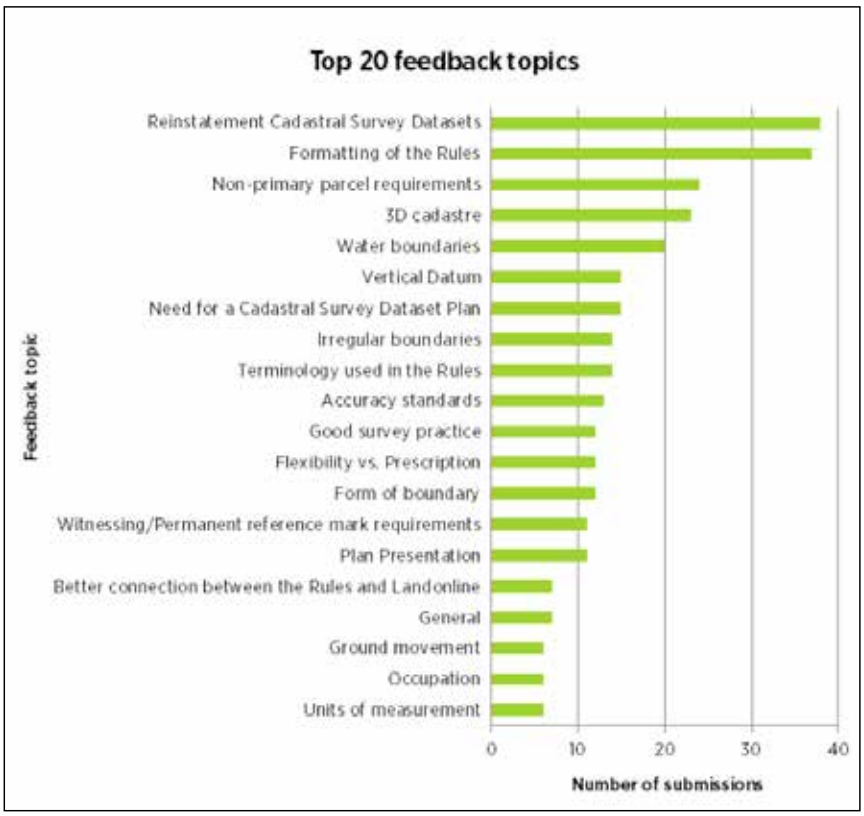
The review involves a three-stage process which is expected to take two years to complete. Stage one has been completed, including a consultation period from August 7 to October 4, 2017, and was intended to determine the issues that needed to be considered in the review process.

Initial analysis of that consultation process has provided the Top 20 Feedback Topics[1] below. The Surveyor-General has noted that the *Issues and Opportunities Paper* (dated 7 August 2017)[2] had already identified many of these same concerns.

Reviewing rules introduced in response to the Canterbury earthquakes

Part of the review will involve looking at the rules introduced in specific response to the earthquakes, which currently only apply to the Canterbury region, and considering whether some of those requirements should be extended to apply at a national level. Christchurch and more recently Kaikōura have both shown how ground movement can result in surface land movement and the need for cadastral practices to adapt and stay up to date.

One example of this is irregular boundaries.[3] Currently the rules are consistent with the long-standing approach that irregular boundaries (in principle) follow the centreline of a river or stream and are fixed in position. However, there seems to have been no formal consideration to date on whether those boundaries are permanently fixed or capable of alteration in circumstances such as an earthquake that may have changed a water course. The issue has been partially addressed in the Canterbury context with the introduction of a new rule to enable the retention of existing centreline boundaries in water bodies. The review will consider whether the rule should be extended to the rest of the country as well, in the event of further earthquakes or other similar circumstances.



More generally, the review is also conscious that the rules for water boundaries are complex and the review is looking to clarify and address any confusion in the rules in this regard.

Glaister Ennor is currently involved in a proceeding in the High Court of New Zealand on the issue of a once-navigable and tidal water boundary that, at common law, remains under Crown ownership despite a change in its course. We expect the outcome of this proceeding to be of interest not only in the Surveyor-General's review, but to the wider surveying community in general.

Future-proofing the Rules Review

Technology is rapidly changing how we all work and cadastral survey is not exempt from this change. One statistic that highlights the change is the use of GNSS (Global Navigation Satellite System) which has more than doubled in the past eight years. In 2010, 20 per cent of all Cadastral Survey Dataset (CSD) lodged included GNSS-collected data, whereas 54 per cent of all CSD's now lodged are using GNSS data.[4]

Therefore, part of the review is considering the move toward automation and technological advances which are being, or could be, incorporated into future survey practices and enacting rules that can be easily adapted to take account of ongoing developments and advances. One other factor that is not being overlooked is how the rules will need to interact with Landonline and the incoming Advanced Survey and Title Service (ASaTS) which is under way and has a projected launch date of 2021.[5]

For example, while surveyors can already capture survey plans in 3D, both the current rules and Landonline only contemplate and support the use of 2D plans. However, ASaTS is aiming to have the ability for plans to be captured and represented in 3D. Accordingly, on this basis, the review is proposing that rule changes give consideration to enabling rules that would allow an easy transition to 3D plans that are likely to be incorporated as a part of ASaTS.

Next steps – Stage Two

With the first consultation process now complete, the Surveyor-General is considering the feedback that has been received, in order to present a response and proposals as a part of Stage Two of the review. It is expected that this will take until the new year when consultation on proposed changes to the rules will also commence. We will watch this process with a keen interest and will continue to report our legal perspective as it progresses.

NOTES

1 *https://www.linz.govt.nz/land/surveying/rules-standards-and-guidelines/information-review-rules-for-cadastral-survey-2010*

2 *https://www.linz.govt.nz/regulatory/tbc-0*

3 Identified in the Top 20 Feedback Topics Table (above) and in the Issues and Opportunities Paper (dated 7 August 2017) at item 3.1.1; *'Confusion about Water and Irregular Boundaries'*, page 10.

4 Issues and Opportunities Paper (dated 7 August 2017) at item 3.4.4; *'Collection, Storage and Production of Cadastral Data'*, page 14.

5 Issues and Opportunities Paper (dated 7 August 2017) at item 3.4.2; *'3D CSDs'*, pages 13-14.

(continued from p4)

profiles of the Hutt River channel for the regional council's flood capacity modelling and subsequent bridge and stop bank renewals, using electronic data recorders and automated plan generation software to execute this data-intensive job cost-effectively.

Steve, along with Sylvia Allen, created a New Zealand-wide map inventory of early childhood centres for the Ministry of Education to identify more equitable funding options. Steve also used early GIS software and a pen plotter to produce weekly revisions of geotechnical maps of the huge landslips in the Cromwell Gorge as the field geologists identified landslides that threatened the new Clyde Dam.

In 1989, Steve became the New Zealand reseller of MapInfo desktop mapping software, which worked on affordable IBM PCs, making GIS accessible to a wider user group. In 1991, he formed Critchlow Associates in Wellington with Simon Jellie to provide geographic information system services. Their first major contract was using GIS to map fisheries exclusion zones, defined in complex text by legal drafters, so the seafood industry could understand where they could fish legally.

The new company created address-ranged road centreline maps, using data sourced from Lands and Survey under a revenue-share deal that allowed large customer databases to be geocoded. These techniques enabled government and corporate agencies to know where their customers resided and along with census data, identify holes in services as well as finding new customers. Over the past 25 years, hundreds of organisations have used Critchlow's NationalMap database and spatial analysis to change the way services are provided and funded, including education, healthcare, school transport, and telecommunication networks.

In 2004, Critchlow became the Australasian reseller of the US Crisis Information Management System WebEOC, now the leading system for Australia's crisis management agencies as well as Fonterra, Maritime NZ and Air New Zealand.

Steve was NZIS Wellington Branch Secretary from 1984-86 and on the NZIS Council from 1989-94, acting as chair of the Ethics Committee from 1991-94. In 1988 he was presented with the Bogle Award.

Between 1999-2001, Steve chaired the New Zealand Chapter of the Australasian Urban and Regional Information Systems Association and became Founding Chairman of the Spatial Industries Business Association (SIBA) in 2009.

Smaller. Faster. Better.

iX Series
Robotic Total Station

Make all of your jobs faster and easier to complete. The iX series is 30 percent smaller and lighter, yet twice as fast — with a blazing fast rotation speed of up to 150° per second. Delivering exceptional prism-tracking and accuracy, this is the next generation of robotic total stations.

SOKKIA
WWW.SOKKIA.COM

Contact your local dealer for more information about Sokkia products

NSW
Position Partners
61 2 9714 0000
www.positionpartners.com.au

VIC
Lightwave Technology
61 3 9720 6222
www.lightwavetechnology.com.au

NZ
Position Partners Auckland
64 09 479 3064
www.positionpartners.co.nz

NZ
Position Partners Christchurch
64 03 366 2658
www.positionpartners.co.nz

CROSS LEASES

Matt Ryder, Licensed Cadastral Surveyor, Cheal Consultants Ltd

What is a cross lease?

Back in the early 1960s, lawyer Bryan Mahon devised a form of Property Title Ownership which allowed for an alternative to company structures for legal interests in units\flats or floors. The system developed was not considered to be a subdivision under the Municipal Corporations Act 1954. This was achieved by avoiding the minimum rate area subdivision requirements of this legislation and therefore these 'developments' were protected from demanding council requirements for subdivision by joint fee simple ownership of land plus a (usually) 999-year cross (flat) lease.

In practice, this means that in a simple two-flat cross lease, the owners of the two cross lease titles own one half of the whole land in fee simple and not any specific part of it – an undivided share as tenants in common. These two owners then lease out (as a group) the flats on parts of the land to each owner. Each lease allows the individual flat owners the exclusive use and enjoyment rights of that flat. Unless there are additional covenant areas recorded on the plan and the lease restricting use of the 'common areas', all parties are free to use the land held.

Many cross leases undertaken in the 1970s and early 1980s do not show or record these covenanted areas and hence there is no recorded restrictions on who is entitled to occupy specific parts of the land other than the flat itself.

Currently it is estimated that there are somewhere between 200,000 and 250,000 cross lease titles in New Zealand. Around half of these are in Auckland.

When the Resource Management Act 1991 came into effect, the Act included cross lease developments under the definition of 'subdivision' which then triggered an equivalent level of Council requirements and expense as a subdivision would. As such, new cross lease subdivisions are a rarity today and are even a prohibited activity in some district plans.

Today it would be very rare if not unheard of for a surveyor to recommend to a client to proceed with a new cross lease development over fee simple or unit title. However, usually when a cross lease title is being sold, a surveyor will often be engaged to update the title to reflect any changes.

What triggers the requirement to upgrade?

Cross lease titles are generally looked at when either the flat is being sold or if there is some issue between the parties owning the fee simple. Surveyors are generally called on to prepare the plan and gain the necessary Council consents to allow the solicitor to update the lease and title. The process generally goes along the lines of: vendor places property on the market, potential purchaser makes an offer subject to clauses, one of which being that the title is correct, the surveyor gets a call and is asked to update the title, generally with an unrealistic timeframe. If there is an issue that relates to ownership, the parties usually start by involving their solicitors, after which a surveyor may be engaged.

Cross lease upgrades

Licensed cadastral surveyors need to make a call on what needs to be shown on this plan. The Rules for Cadastral Survey 2010 set out how this information is shown within a cadastral survey dataset, but what defines the lease area or needs to be included, is left to the signing surveyor's interpretation of the law. There have been some robust debates following the Christchurch earthquakes as to what is required to be shown or if a 'flat' is rebuilt on its original footprint, does it need to be recorded on a new dataset? These debates have resulted in many differing opinions amongst both the surveying and law professions.

Cross leases have historically always been a lease of a building or part of a building. This still holds true under the current definition under Section 2 of the Resource Management Act. Most cross lease plans these days have a note on the plan face along the lines of "Boundaries of areas to be leased are the external face of exterior walls, structures and roofs unless shown otherwise". This statement clearly limits both the horizontal and vertical boundaries of the structure and thus any change to these would result in a defective title and the need for a CSD

encompassing the additions or alterations, the existing leases surrendered, and the new lease registered.

It is therefore imperative that a surveyor engaged to update a flats plan inspects all the available information available to them. Be that local authority building records, aerial imagery captured at different times, the current plan against what is actually built on site, talking with owners, the list goes on. It is not uncommon for various alterations and additions to have not been recorded in addition to the obvious for which instruction is received, some of which are very difficult to spot without some research, but still should be included in any upgrade.

It is also vital that all plans associated with the cross lease are searched. This will ensure that the common and exclusive use areas are consistent between the plans. It is not uncommon to find an area shown as an exclusive use area on one plan to be shown as common area on another. These differences are more common when the development of the flats has been undertaken at different times.

Many older plans only showed the flat as a 1mm thick line in two-dimensional form and surveys differed around if there was a need to show items like stairs, balconies or decks included within these. While these exclusions may appear to be defects in title, there is case law establishing that as long as these existed at the time of survey and when the lease was granted, it is unlikely these are defects in the title. Particularly when the survey plan was prepared in accordance with the standard practice at that time.

There is a ruling in the Auckland District Law Society Property Disputes Committee Rulings Manual from February 1997, which states:

> If the Flats Plan complied with survey practice current at the time of issue of the title, the lease and title did not become defective subsequently following a change in survey practice. As long as the Flats Plan identified the dwelling adequately, the grant of the lease incorporated the whole of the dwelling as it existed at the time that the plan was prepared, notwithstanding that the plan did not depict the dwelling with precision. The purchaser, therefore, did not have grounds for requisition in respect of the title.

In the case of *Williams v Cammock*[1] it was noted:

> "The depiction of the flat on the deposited plan is solely for identification purposes. The plan purports to depict the outer parameters of the leased area to enable identification, not all facets of its three-dimensional shape. What is leased is the actual flat as existed as at the date of the Cross Lease".

From these cases it reinforces that surveyors need to be clear what they are showing within their plans now to help the next surveyor, solicitor or owner understand the extent of the flat along with what is and is not included in it. The surveyor also needs to check the underlying plans as, in some cases, an update may not be necessary as what is differing from the as-built construction of the flat may not have been included due to the survey practice at the time the previous survey was undertaken.

So, what constitutes a structural alteration or addition?

Many cases are very simple to determine – has there been an addition to the existing flat which is not recorded on the 'Flats Plan'? If the answer is yes, we need to update the flats plan. One test that is helpful to consider is to ask if a building consent was required for the structural works. If so, then generally an update to the flats plan will be required.

There have been various cases in which the question of whether an alteration or addition is structural has been considered by the courts. In *French v Bickerton*[2], it was held that there was an arguable case that alterations involving the demolition of part of an exterior wall and the extension of a bathroom into the area of the balcony was a structural alteration.

In Roe v Stevenson,[3] Blanchard J noted that the removal of a staircase constitutes the making of a structural alteration. In *Smallfield v Brown,*[4] a window being substituted for french doors was held to be a structural alteration, and Fisher J noted that in cases of doubt, items would be more likely to be classified as a structural alteration if it had "some effect upon the neighbour".

In *Estate of Ferguson v Walsh,*[5] the owner of one flat had sought to separate his unit into two separate units, which would have the effect of increasing the number of units in the cross lease development. Potter J also suggested the following guidance on the issue as to when alterations and additions will be considered structural:

> Alterations to the exterior of the building which alter its shape or structure are structural.

It is the writer's opinion that based on the above if the flat is altered structurally in anyway which requires a building consent and or alters its three-dimensional space as recorded on the existing cross lease, then this should be recorded on a new CSD along with the lease and title being updated. This is also supported by the requirement of certification under s224(f) which certifies that the TA is satisfied that the building (flat) *"complies with or will comply with the provisions of the building code described*

in section 116A of the Building Act 2004"[6] This should trigger the need for the plan to be updated, even if there is a new building on the same footprint as one which had been removed from the cross lease. This is before even looking at how the flat was originally defined. It is rare to find a survey sheet showing survey ties to the flat, so it would be hard to certify that the replacement building is using the exact identical footprint, and potentially vertical space, as the one in the original lease.

Conversion to fee simple or unit title

The decision to convert an existing cross lease to a fee simple or unit title would depend on a number of factors. These may include the number of 'flats' involved, council development requirements and the need for ongoing interaction between the title holders.

For example, if there are two standalone dwellings on a cross lease, then, subject to the Council District Plan requirements, the likely best solution would be a fee simple subdivision where each dwelling would be contained within its own fee simple title with the only potential reason the parties may remain 'linked' would be through easements for servicing or access. If there were a number of cross lease titles involved and these 'flats' were conjoined, then it would likely be easier to convert these cross lease titles to unit titles as the owners of these are more likely going to need to stay connected for maintenance of the building as a whole, for example.

Should there be an easier way to convert to fee simple?

It has been reported in recent times by the media that cross leases are a "ticking time bomb", especially with some cross lease buildings nearing the end of their natural life.

Leases do not specifically address the rebuilding issues. This may be partly the cause of the debate around the rebuild of earthquake-damaged Canterbury's cross leased buildings as there have been very few cross lease buildings needing to be rebuilt in their entirety to date prior to this event. In some cases, the cost of converting these existing cross lease titles to fee simple or unit titles would be prohibitive, other times the consenting process required by councils due to the number of infringements in the district plan would prevent this happening.

In 1999, the Law Commission proposed a reform of cross lease titles along with unit title reform. The Unit Titles Act reform proceeded in 2010; however, the issues with cross lease were not fully addressed. The Unit Titles Act 2010 provides for a process whereby multiple cross leases with shared walls and infrastructure can be converted to unit titles without the need for a subdivision consent subject to the requirements of the Act. However, this Act does not allow for the situation where there have been amendments to the flat area, but these have not been recorded on the flats plan.

There has also been no method developed which would allow the conversion of non-connected flats where the owners do not need an ongoing relationship, like in a unit title, to convert to fee simple. The Law Commission has drafted a bill which would allow legislation for a low-cost process to convert such titles to fee simple. This would prevent Councils impeding the process by requiring updated building, services or reserve/development contributions.[7]

Summary

Cross leases were a great mechanism at the time they were developed, which provided a means to an end allowing for infill housing and leasehold ownership of flats without the need to comply with the full subdivision requirements needed to obtain fee simple title.

With this loophole now closed by the Resource Management Act 1991, and some flats starting to get towards the end of their economic life, we are dealing with the unintended consequences of these titles and tenure ownership model. One of the biggest is that the public does not fully understand the tenure and the rights and restrictions associated with it.

The surveying profession needs to ensure that they understand this tenure type by undertaking updated surveys which ensure the needs of the cadastre are met along with being able to offer professional advice to clients should they be asked questions relating to cross lease. As a profession, surveyors should be looking to support and encourage any future efforts towards legislation which would allow a more streamlined conversion process of cross lease titles to fee simple or unit title, as this will help prevent the ticking time bomb exploding.

NOTES

1 HC Hamilton CP 48/99, 4 August 1999

2 French v Bickerton HC Auckland A1646/85, 14 April 1986.

3 Roe v Stevenson HC Auckland CP1356/92, 16 February 1993, at 5.

4 Smallfield & Anor v Brown (1992) 2 NZ ConvC 191, at 12.

5 Estate of Ferguson v Walsh (1999) 4 NZ ConvC 193, at 9.

6 Section 224(f) Resource Management Act 1991

7 Shared Ownership of Land New Zealand Law Commission Report 59 1999

Is it time to take a closer look at your Professional Indemnity Cover?

Land surveying is a business that demands precision and unbending professional standards. We take the same approach to insurance.

Our PI Cover has been specially created for New Zealand-based land surveyors and is underwritten by Lloyds of London. It comes with features that represent a significant advance on what's been offered up until now:

- Cadastral Survey Act cover
- Legal liability cover with limits starting at $1,000,000
- Lower excesses in almost all cases
- Premium advised before policy expiry date
- Professional claim support by Glenn Stone Insurance

Full Theft Business Asset Cover and cover for all your other insurance risks is also available.

Put us to the test. Contact Glenn Stone Insurance now and find out how you can have cover that's as professional as you are.

Freephone:
0800 555 474
info@glennstone.co.nz
www.glennstone.co.nz

GLENN STONE INSURANCE

NZIS Diamond Partner

Steadfast
STRENGTH WHEN YOU NEED IT

Glenn Stone Insurance Ltd
PO Box 15854, New Lynn, Waitakere 0640

A Kaikōura Secondment

Mariana Pagan, Beca

I have been in Kaikōura, my home town, since March working for the North Canterbury Transport Infrastructure Recovery (NCTIR) with the support of my home organisation Beca, as part of the construction survey delivery team.

The team is made up of six people from across New Zealand, and because of the varied work we're dealing with, we work closely with other surveyors involved with NCTIR – all with a range of expertise including the design survey team based in Christchurch.

The journey so far has been incredibly fulfilling. The opportunity to return to where I grew up, and to be a part of a team responding to a disaster situation, is something that doesn't come along too often.

This secondment has enabled me to learn many things

Set up at Waipapa Bay for the monitoring of Slip 9

Site 7 north of Ohau Point seawall construction, July 3, 2017

in an environment that is not so normal. Well, it's 'NCTIR normal'.

The work we are involved in is probably unlike any other project in New Zealand. Construction work involving bridges, earthworks, tunnels, seawall, road and rail. The pace and variety of work, just like the isolated location, is unique – just as much as the people and crews that we work alongside with.

It has been an adventure simply installing and maintaining survey control. The ever-changing nature of the sites and the construction work means that we have over 500 primary and secondary control marks across the project, from Ferniehurst, 40km south of Kaikōura to Flaxbourne, 90km north of Kaikōura, as well as through the Inland Road.

The primary network of control was our starting point when we arrived in March, which was installed and re-surveyed after the quake. As more areas opened for access, we established control in these areas.

I was almost certain that crews on site were questioning why I was walking to the furthest and highest rock on the beach to install a mark when the setout was in the opposite direction. I promised them I wasn't lost and explained that it was probably the only place I wouldn't be in their way.

Travelling to site is also not the usual 'load-the-gear-into-the-ute' situation either. With road closures, and the fact that there is no vehicle access, the commute to different sites could mean an escorted walk through a rail tunnel or loading our survey gear into the helicopter.

Like others on the project, we are working within challenging conditions: logistics of access, people, and plant movement, trains, weather, wildlife such as the local seals, and the changing of tides all within a very narrow working corridor positioned between the mountains and the sea.

Survey monitoring jobs in this environment is just one example of the unique aspects. Receiving measurements of movement 100mm+ in prisms can make monitoring exciting. The first time I received a difference of 494mm from the baseline reading definitely made me double and triple check the process!

There are currently eight different monitoring jobs within the project. Prisms have been placed to monitor movement at surface level as a safety precaution both for the people working on top of slips and those passing underneath.

One monitoring job, in particular, is Slip 9 at Waipapa Bay. After a recent rain event, three of the prisms were wiped out as a new slip on the slope came down. The first time I travelled there, I was almost in tears at the dramatic change in the landscape that I was once so familiar with. The photos do not do the reality justice.

The progress that has been made at Slip 7 north of Ohau Point is remarkable. The first bit of work we were involved

Site 7 north of Ohau Point seawall construction, October 12, 2017

Site 7 north of Ohau Point seawall construction, October 12, 2017

with on this site was the setout of rail and drainage. This was then followed by the setout of the foundation of the new seawall and placement of the seawall blocks. At first, this setout was very limited due to access, but soon opened up as a container wall was installed to protect us from the slip above.

The Kaikōura Marina saw the mooring of the first Whale Watch boat on October 12. Leica machine control was installed which enabled the excavator to dig out, to the desired depth, the fill that was placed when work began. We have been involved in the setout of the resting, mooring and jetty piles as well as the new promenade retaining wall.

While writing this, I asked the other surveyors what they thought about working on the project. We maintain high levels of job satisfaction which is something quite special.

We are involved in many different jobs under NCTIR, travelling to more sites than most, witnessing incredible changes, and witnessing the development of the project. Knowing that we are involved in something so significant for the community of Kaikōura, and for New Zealand, is something we will never forget.

INTERGEO

A Personal Account of the World's Largest Survey Technology Show

Bruce Robinson, Global Survey

Bruce Robinson

Attending any conference is a big commitment and if it includes international travel, I need to be confident that there will be tangible benefits.

INTERGEO is a conference that always delivers on expectation. Held annually in Germany, this show lives up to its claims of being the world's leading international trade fair for geodesy, geo-information and land management.

Split into two parts there is a conference and trade show, I usually visit the trade show as my interest is in seeing new products in the ever-changing geo-technology world and also maintaining our current supplier relationships.

The trade show is simply huge, boasting more than 18,000 visitors and 570 exhibitors from 35 different countries. To give you some idea of the size, it takes me a full three days to walk around the whole venue as there are over 30,000 square metres of indoor exhibitions.

With an event of this size it's important to plan ahead; I like to make a shortlist of exhibitors I want to see. The first day I try to see as much of the show as possible (with an open mind) walking in a structured way so as not to miss any stands and stopping where my interest takes me. I talk to exhibitors about their products, some are ready for market and others are in their infancy. The next two days is then spent back at the stands of particular interest trying to learn as much as possible.

What I find interesting is to see the innovations from previous years that are now fully developed into products and conversely, I'm sometimes surprised by the products that have not made it.

All the large manufacturers have enormous booths [some are bigger than entire conferences in NZ!] with continually rolling interactive presentations on their latest products plus live demonstrations.

Drone Zone

This year one of the exciting additions to the trade show was a new outside Drone Zone with demonstrations. Thankfully they had some basic air traffic control rules in place!

Drones and their sensors were a hot topic with lots of small and large manufacturers competing for attention, lots of varieties were on display including small and large fixed-wing, rotary and combination UAVs. Sensors included the hyperspectral, Lidar, and GPR. Interestingly, the market seems to have settled on two leaders for their flight processing workflows, with the vast majority choosing either Pix4D or Bentley Context Capture.

All the drone manufacturers I spoke with raised the need for robust workflow and a high confidence in the processing software, but each had their own variation of flight planning and safety software considerations to take into account.

Focus on software

The new software developments on display could be generally divided into two categories: augmented reality and integration of the point cloud data from terrestrial scanners, UAVs and mobile mapping. There were numerous technology stands showing how data could be integrated into VR and AR workflows and while in recent years we have seen the growth in drone tech at the show, I believe we are now on the wave of massive VR and AR implementation from both the traditional players and new start-ups.

The integration of point cloud data focuses on improved data classification and workflows for data extraction. This includes 'understanding' the accuracy of the captured data not just the data, as well as improved software developments for auto extraction of details. While auto extraction seems to be improving, it is a slow progression.

There were a large number of mobile mapping solutions on display, trolley based, backpack based and vehicle mounted. Integrating mobile mapping with fixed platform scanners was a focus of discussion, with many referring to the recently launched Leica BLK360 imaging scanner as an innovative solution to support mobile capture due to its

compact size and ability to be easily transported.

This year one of my goals was to find some new monitoring solutions for rail, bridge and tunnel type work. We are now at the negotiation stage with suppliers and hopefully will be able to introduce these new products to the New Zealand market very soon.

Star of the show

Without a doubt the star of the show was the new Leica GS18 T [the T stands for Tilt pole]. The GS18 T is, in my opinion, easily the most impactful innovation for surveyors in years.

The Leica outdoor demonstration/test area was crowded with people dumbfounded at the repeatability and functionality of the GS18 T. Those who tested the equipment, including myself, tried to prove it was unreliable but I could not fault the unit. Indoors Leica had a unit displayed at a 30-degree angle on a rotating stand. The buzz and discussion around this stand was palpable.

The effect the GS18 T will have on surveyors is huge, it will dramatically speed up both setout and capture times. With this new technology, there is no need to level the bubble, just guide the tip of the pole to the location and press capture.

The GS18 T also starts to introduce augmented reality into the survey field crew workflow as the unit measures the direction the antenna is heading, and any data displayed in the 3D viewer on the controller is laid out in front of the user. This makes viewing the design in the field easier than ever before.

Shortly after the show, we received our demo units at Global Survey. Having now taken the GS18 T through its paces, I can tell you it is just as impressive; within five minutes of using it our team could see the enormous impact it will have on the industry.

With so many new developments in technology hardware and integrated software for surveyors, it's clear we live in exciting times!

For anybody interested in survey/spatial technology, INTERGEO is definitely one of the best international conferences to attend.

My next not-to-be-missed conference is HxGN LIVE in June 2018 in Las Vegas where the Hexagon group of companies [including Leica Geosystems] showcase a huge variety of new innovations in The Zone technology area.

Bruce Robinson is a Director at Global Survey, agents for Leica Geosystems in New Zealand. He is a surveyor by trade with a particular interest in GNSS technology and its application. Contact him at bruce@globalsurvey.co.nz.

NZIS welcomes ASaTS Lead Consultant

Outgoing NZIS President Mark Allan is pleased to welcome Nick Stillwell as the NZIS Lead Consulting Surveyor for the Advanced Survey and Titles System (ASaTS) that is being developed to replace Landonline.

Landonline is one of the New Zealand government's larger digital systems and is considered to be part of the national infrastructure with over 13,000 professional users across the country. The system maintains survey and title information, defines property location and records property rights for all land in New Zealand.

"NZIS has welcomed the opportunity to work with Land Information New Zealand (LINZ) to create this position to represent the views of NZIS members as stakeholders in the redevelopment of Landonline and to provide strong leadership in this space", says Mark Allan. "Nick will be responsible for communicating and providing feedback from the sector to the ASaTS team to ensure that we take the opportunity to deliver a solution that will be able to respond to the changing demands of the sector in the future."

Nick has a Bachelor of Surveying with First Class Honours from Otago University and is a licensed cadastral surveyor. He has most recently been Work Group Manager at Opus International Consultants. He brings extensive experience and history in the surveying sector to the role and is skilled in land development, cadastral surveying and spatial data management for infrastructure projects.

Nick is looking forward to the opportunity to capture the views and ideas of the NZIS membership and advocate for them within the ASaTS project team to ensure that we continue to have a world leading digital land administration system that works for surveyors.

Information on ASaTS: *http://www.linz.govt.nz/about-linz/what-were-doing/connecting-property-information/advanced-survey-and-title-services-asats-programme*

2017 SURV590 Honours Dissertation Abstracts

An honours degree differs from a standard BSurv, both in the significant research entailed, culminating in a substantial dissertation, and also in the fact that several courses in final year are taken at a more advanced level. Honours students thus have a considerably higher workload, which necessitates a high standard of personal discipline and time management.

Irrespective of their specific dissertation topics, honours graduates have all demonstrated comparatively advanced research skills, and many dissertations are also directly relevant to the advancement of knowledge within the surveying profession. It is expected that the higher academic standards, critical thinking and writing skills will become increasingly noticeable throughout a surveying career. These students deserve special recognition for their achievement.

Mick Strack, Senior Lecturer, University of Otago School of Surveying

THE FOLLOWING ABSTRACTS ARE THE WORK OF OUR 2017 STUDENTS

Nicki Shaw

3D Point Cloud Structural Element, Deformation Modelling for the Percy Burn Viaduct, Fiordland

The aim of this research was to develop an effective modelling process for structural elements in order to measure deformation over time, with particular reference to the Percy Burn Viaduct, Fiordland.

It involved obtaining 3D point cloud data, trialling relevant modelling software, creating accurate models and quantifying deformation. A statistical analysis and software-accuracy experiment was then performed of the final process. The research concluded that mesh models created in CloudCompare were the most effective of maintaining the true shape of structural elements, and accurately detecting deformation to a millimetre level. Overall, it is hoped the process will assist with the restoration of structural elements of the viaduct and more broadly will help professionals model other large degrading structures.

Luke Johnson

The Kinematic Performance of Low-cost, Multi-Constellation, Single-Frequency RTK Receivers, for integration with RPAS

Recent advances in technology make Remotely Piloted Aerial Systems (RPAS) increasingly accessible for Photogrammetric applications.

Essential to resolving a photogrammetric solution, is the linearisation of the collinearity equations, causing any solution to rely on initial positions determined by the on-board GNSS unit. The advent of GNSSs, and new global constellations, increase the availability of satellites around the world.

This research looks into testing for improved positions on RPAS, analysing a low-cost, multi-constellational, single-frequency GNSS receiver; leveraging the improved geometry and increased redundancy these constellations provide.

Dynamic testing of the unit, using two separate controls, has found these receivers can provide reliable positions with acceptable differences from a known trajectory.

Michael Lister

Life's a Bach – The Past, Present and Future of Baches and Cribs on New Zealand Public Land

Baches and cribs, often located on public or private land not owned by the occupier, are a staple part of New Zealand outdoor recreational tradition. Current perceptions concerning baches and cribs were ascertained by interviewing right holders and land administrators. International land rights models were also studied and contrasted.

It was found that neither right holders nor administrators feel that new constructions should be allowed and, in some cases, administrators felt existing baches and cribs should be removed. The study concludes that there are ways to achieve a position where administrators have better control and occupiers have more certain rights.

Julian Thom

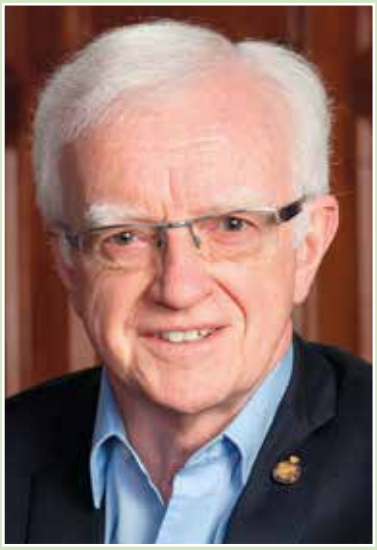
Blurred Lines: An Investigation into Property Interests in Subsurface Rail and Road Tunnel Spaces

This examines property interests in subsurface rail and road tunnel spaces. The research aim is to evaluate whether New Zealand's property rights system clearly defines the vertical extent of ownership.

The research found that the law surrounding the vertical limit of ownership is confusing and founded on an ancient and misleading maxim. Recorded interests for a selection of case studies were also investigated by examining the title register and cadastre, and collecting data from interviews. Analysis of this data shows that the cadastral system does not effectively record and communicate the vertical extent of subsurface interests, and recommendations are made.

ABSTRACT FOR BRIAN COUTTS' PHD THESIS

(PhD to be conferred 16 December 2017)



Land Surveying: has technology fundamentally changed the profession?

Land surveying has grown from a technical occupation into a profession. The definition of what constitutes a profession, as distinct from a trade, is explored. Surveying meets the criteria to be considered a profession.

It is maintained that the history of surveying can be seen as having two distinct paradigms. The question is raised as to whether it is entering a third paradigm based on technological developments of the past half century, but answered in the negative.

The introduction of the term 'geomatics' is considered and is found to have failed to meet the advances expected of it at the time of its adoption. It is maintained that the descriptor 'land' has outlived its usefulness. It is proposed that the adoption of the term geospatial surveyor, by stealth rather than statute, is likely to achieve what geomatics did not. It is noted that this is already happening in the United Kingdom and a similar trend is occurring in Australia.

RECENTLY PUBLISHED JOURNAL ARTICLES

A short list of some relevant recent journal articles from staff at School of Surveying, that should be of interest to the profession:

Coutts, B.J. 2017. Geospatial Surveyors – what's in a name. Surveying the world of tomorrow. XXXVIII FIG Working Week. Helsinki, Finland. 29 May to 2 June, 2017.

Odolinski, R. and Denys, P. 2015. On the multi-GNSS RTK positioning performance in New Zealand. Proceedings of the International Global Navigation Satellite Systems Society (IGNSS) Symposium 2015, Gold Coast, Australia, 14th-16th July.

Strack, M. 2017. Draw conclusions on the wall. Defence of the monumented cadastre. Australian Property Law Journal (2017) 26 APLJ 1:1-23.

Strack, M. 2017. Land and Rivers can own themselves. International Journal of Law in the Built Environment. Vol. 9(1):4-17.DOI:10.1108/IJLBE-10-2016-0016.

Strack, M. 2014. 'They'll be drownded in the tide': Reconsidering Coastal Boundaries in the Face of Sea-level Rise. Geographic Research Forum. Vol.34:23-39. *http://raphael.geography.ad.bgu.ac.il/ojs/index.php/GRF/article/view/423/414*

BACK TO BASICS

Robert Odolinski and Christina Hulbe, National School of Surveying.

Most folks who read this column remember the Surveying final year camp, SURV 399, the big adjustment that showed you what you could really do (quite a lot) and provided some inspiration for your fourth year of study. If not, you missed out!

This month, Dr Robert Odolinski discusses how the camp is changing—digging into the underlying fundamentals and preparing graduates for the complex problems they are sure to encounter. Overall, he is making the case that by deepening their understanding of statistical analysis, students improve their results *and* make the work more efficient.

The SURV 399 field work is conducted in Dunedin with a combination of short and (very) long lines. The students combine GNSS, total station (TS), simultaneous reciprocal vertical angles (SRVA), and digital levelling (DL) observations, and perform a constrained least squares adjustment to determine a set of coordinates in three dimensions along with their respective uncertainties. These coordinate uncertainties are subsequently compared to Land Information New Zealand (LINZ) accuracy standards so that students can evaluate whether the coordinates fulfill a certain coordinate order. It is a two-step procedure;

1. The minimally constrained adjustment: to detect observation blunders and identify a realistic weight matrix;
2. Constrained adjustment: to improve the adjustment through the larger degrees of freedom and to tie the network into a set of well-defined marks.

The SNAP software developed at LINZ is used for all of the analyses.

This year we have focused a lot of attention on Chi-square distributions and the 'Chi-square test'. SNAP does this but to develop a deeper understanding, students should compute the test statistics manually and examine the terms in the context of a real-world problem.

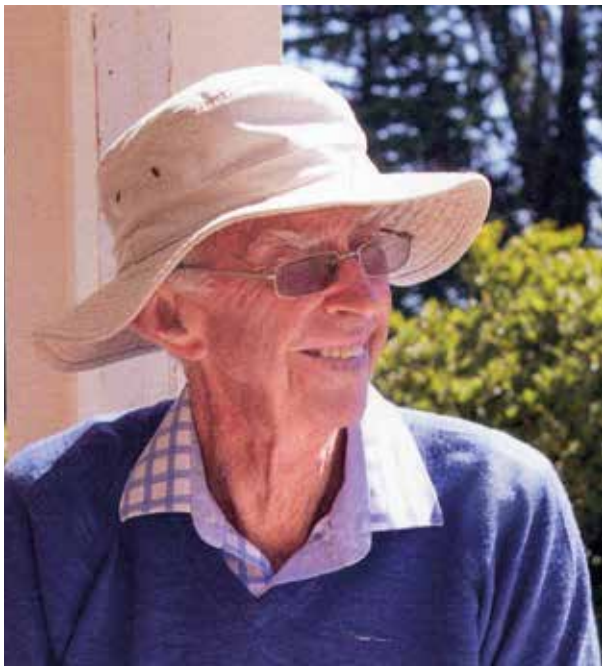
The Chi-square test is sometimes called the 'overall model test', as it tests the overall validity of the models used, that is, the significance of the standard error of unit weight (SEUW). The SEUW is the quotient of the sum of the weighted least-squares residuals and the degrees of freedom in the problem. Ideally, the ratio should be close to one but it's not immediately obvious why that's important. Wrestling with the numbers shows that it means the uncertainty of the final adjusted coordinates has been minimised.

In the case of the minimally constrained adjustment, a Chi-square test provides an early indication that the data contains outliers or blunders (which would implicitly show up in the residuals). Because the SEUW is based on the weight matrix, it also indicates whether the nominal errors, in terms of instrument specifications (in this case for GNSS, TS, SRVA, and DL), are correctly defined.

This is important because re-scaling the weight-matrix with the SEUW might mask outliers in the observations. Testing the significance of the SEUW checks for this possibility and if the Chi-square test fails, then further investigation is required.

Once all potential observation blunders or outliers have been removed, the Chi-square test is applied again to evaluate the overall model performance. The residuals should now be 'error-free' because the weight matrix and the degrees of freedom are the only contributors to the SEUW. If the Chi-square test fails at this point, a statistical justification must be identified before scaling the nominal errors associated with each instrument. But simply knowing that this is the next step is not enough. The practical justifications for scaling must be well understood and explained. Is the observation a long line? Was the observation affected by atmospheric refraction? Measurement errors arise from real processes and both the errors and the underlying causes should be understood. If the justifications are unsatisfactory, then re-observation is required. With practice, the statistical understanding becomes part of the surveyor's (or surveying student's) common-sense toolkit and leads her to make the right decision about potentially time-consuming actions such as re-observation of certain parts of the network.

(continued page 48)



Robert Gifford Middleton 1933–2017

Contributed by Bruce Alexander, August 2017

Officially Robert Gifford Middleton was born on March 6, 1933, at 14 Gloucester Street, Christchurch, and passed away on February 1, 2017, in his 84th year.

From all who knew him, from day one he was known as Pip, the name of the central character in Charles Dickens' *Great Expectations*. His maternal grandfather enjoyed Dickens, and an uncle on his mother's side was known as Pip.

Pip was the only child of his father, James Seymour Middleton's second marriage to Nina Gifford Moore, from a well-known Palmerston North legal family.

His education began in Christchurch when he attended St Margaret's kindergarten in 1938-39, before going to Cathedral Grammar School from 1940 to 1945. During 1944 the family moved to a large two-storey house at 48 Fendalton Road. He completed his schooling at Christ's College between 1946 and 1950.

On leaving school there was no shortage of jobs for young men. Employers were ringing the headmaster to enquire if there were any likely lads looking for work. When it came to the choice of a vocation, Pip's father, a bank manager and accountant, urged Pip to take up the same professions. However, with his love of the outdoors, Pip chose land surveying along with two other lifelong friends, Bruce Alexander and Dick Brittan.

And so, Pip became an articled survey cadet in January 1951 to Harold Jack Mayhew Hudson at the princely salary of £2-2-6 ($4.25) per week. Training to become a registered surveyor in those days was not easy. One had to work hard during the day and study at night, carrying out assignments from the Technical Correspondence School in Wellington. There were no computers or hand calculators readily available then.

Pip records: *"When I started in 1951 I was presented with a seven-figure log book and told that all calculations were done with that. This was actually very good grounding as we had to do all the work in the exams with the log book. But it was not very efficient when it came to field and office work."*

In his unpublished history of the firm, Pip noted that Jack Hudson purchased a new car in 1952. *"It was an Austin A40 Somerset and we were the smartest survey firm in Christchurch. There were brackets on the front bumper to put the legs etc in and luckily no one had a collision. One of the first country jobs we did with the new car was at Lowry Peaks Culverden. On the first day we drove through paddocks of long grass and the new car completely filled with grass seed much to Jack's horror. He also suffered very badly from hay fever. From then on I think I was delegated most of the country work."*

In 1946, Jack Hudson acquired the business of F.W. Freeman OBE, who had commenced practice in 1906. When Jack suddenly died in 1958, at the age of 57, Pip was left in the difficult position of trying to carry on the business while not having a practising certificate. He had hoped to qualify in six months, and so agreed to purchase the practice when he became registered. In order to do so, it was arranged that Eliot Sinclair, Michael Davis, Claude Williams and Brian Lovell-Smith would sign his survey plans in order to keep the practice going until such time as he could legally purchase it.

When Pip finally acquired the practice at the end of 1958, he found it difficult to carry out field work and run an office at the same time, so he called on Bruce Alexander to join him and together they formed the partnership of Middleton & Alexander.

In 1966, they were joined by Jack Williams and the firm then became known as Middleton, Alexander & Williams. When Bruce left the firm in order to further his career in town planning in 1978, the name was changed to Middleton, Williams & Co.

Throughout his career, Pip could read the land and had a prodigious knowledge of Cantabrian properties and Canterbury genealogy. The firm undertook subdivisions both large and small, having opened a branch office in Rangiora in the 1960s.

Pip's professional success was not achieved alone. He married Barbara Blakely in 1959, a country girl, who broadened his outlook. They brought up their four children, Andrew, Julia, Patrick and Alastair in a large 1912 colonial homestead in Yaldhurst Road which became the family home for 32 years.

Pip did not figure largely in public life, although he was on the Avonhead School committee when his children attended there. He also served as Secretary to the Canterbury Branch of the Surveyors Institute.

Deeply committed to his family and friends, he possessed an encyclopaedic knowledge of his family – both sides. He had cousins, second cousins and third cousins everywhere.

Among his sporting interests were skiing, tennis and golf. In his later years, golf was a particular sport that he excelled at. His mother was a one-time runner-up to New Zealand women's golf champion. Although he did not enjoy playing cricket or rugby at school, it did not stop him from watching his children play and he would be glued to TV for the big matches.

Pip was a friendly person with an ability to connect with people. He was kind and thoughtful, modest and self-effacing. He was not given to any pomposity or cant, and just beneath the surface, there was always a puckish sense of humour.

In his professional and business life, he was a man of integrity and independence. He was firm in his decisions, often with the intensity that sometimes verged on stubbornness. Pip was well regarded by his peers and continued in full-time practice after Jack Williams retired in 1997. Pip finally retired in 2001, aged 68 years.

He will be sadly missed by all who knew him.

(University Happenings continued from page 46)

For the constrained adjustments, where more marks than necessary are fixed, the Chi-square test is again a very useful tool. In this situation, coordinate errors of the fixed marks will propagate into the residuals. This requires the surveyor to investigate potential coordinate errors using strategies such as fixing one mark at the time and analysing the SEUW. Fixing all available marks along a suspected line or loop of observations can be used to detect large observation errors that do not fit the fixed coordinate. Again, proper decisions can be made about the necessity of re-observing any particular line or loop of observations.

The end product of SURV 399 is a Professional Project Report written so that an expert will appreciate the completeness of work and a general reader will understand what has been done and have confidence in the result. Practical applications are the best way to learn and master most material, whether it's how to set up a tripod or how to use statistical theory to improve a result. And while the learning begins here in the School of Surveying, it carries on into work as a graduate.

What we hope, as we reflect upon and refine our course content, that graduates are also bringing something new along with them, whether it is knowledge of new technologies or a comprehensive perspective on the full lifecycle of a project, from concept and planning, to field work, to final report.

Milford Road

Wireless Monitoring

Any Site.Any Scale

Scalable • Reliable • Robust

Senceive
Wireless condition monitoring

Monitor any structure or landscape, without prisms and entirely wire free!

Senceive is an innovative deformation monitoring solution that delivers unparalleled accuracy and reliability, with the ability to fit to almost any structure or landscape and be scaled to any size of project. Without the expense of maintaining prisms, Senceive offers a more versatile and cost effective way to monitor.

Ideal for:

- Roads
- Rail
- Bridges
- Tunnels
- Façades

Get in touch today:

09 479 3064 Auckland
03 366 2658 Christchurch
info@positionpartners.co.nz
www.positionpartners.co.nz

Position Partners

Shaping New Dimensions

Forget the bubble with the worlds fastest GNSS RTK Rover.

LEICA GS18 T

- First true tilt compensation solution
- Immune to magnetic disturbance
- Calibration free

GLOBAL SURVEY | SURVEY & CONSTRUCTION TECHNOLOGY

0800 453 422

GLOBALSURVEY.CO.NZ/FORGETTHEBUBBLE

Leica Geosystems