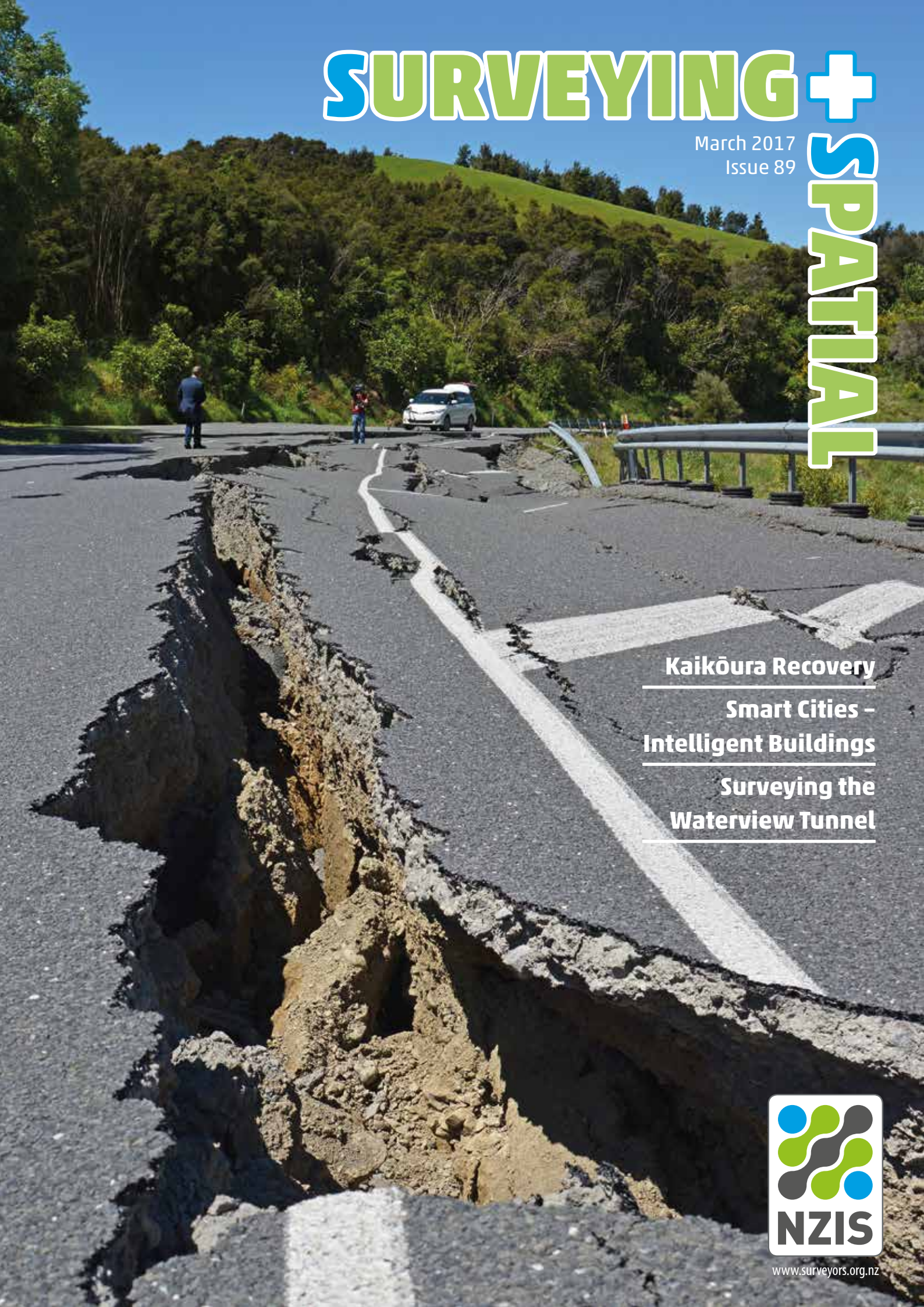


SURVEYING + SPATIAL

March 2017
Issue 89

Kaikōura Recovery

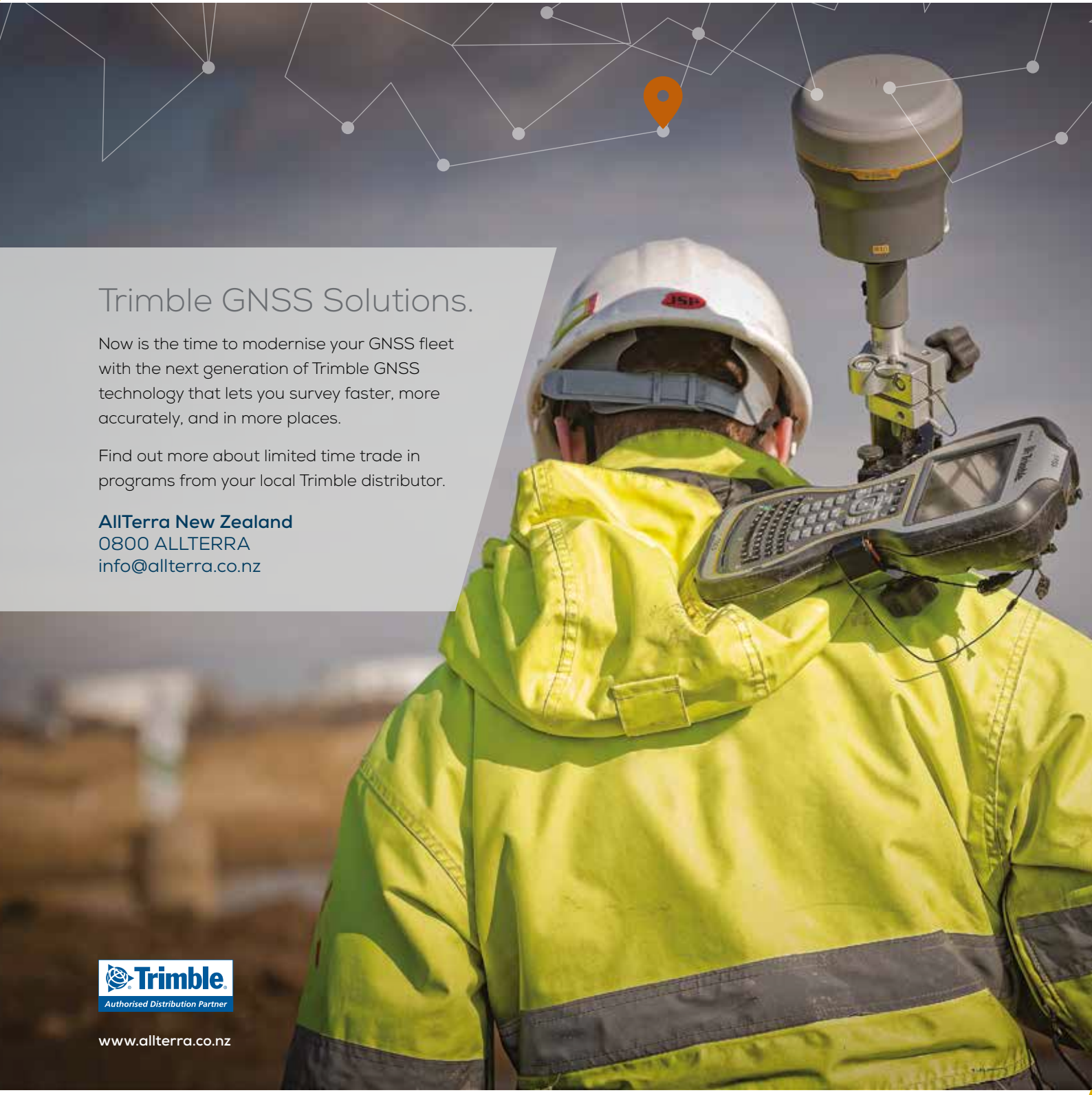
Smart Cities – Intelligent Buildings

Surveying the Waterview Tunnel

NZIS

www.surveyors.org.nz

Time to Upgrade to the Next Level of GNSS



Trimble GNSS Solutions.

Now is the time to modernise your GNSS fleet with the next generation of Trimble GNSS technology that lets you survey faster, more accurately, and in more places.

Find out more about limited time trade in programs from your local Trimble distributor.

AllTerra New Zealand
0800 ALLTERRA
info@allterra.co.nz

Trimble
Authorised Distribution Partner

www.allterra.co.nz

ALLTERRA™ formerly GeoSystems Future Thinking

SURVEYING + SPATIAL

MARCH 2017 ISSUE 89

COVER IMAGE

Kaikōura, New Zealand – November 15, 2016: Massive cracks that made the roads impassable at the top of the Hunderlee Hills on State Highway One, North Canterbury after the 7.8 Kaikōura earthquake. Photo by Nigel Spiers.

ARTICLES

REGULAR FEATURES

NZIS
New Zealand Institute of Surveyors
Te Rōpū Kairūri o Aotearoa

ISSUE 89 MARCH 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
Diane Moriarty
survey.editor@yahoo.co.nz

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

Disaster Recovery

Diane Moriarty

2017 is here and summer has finally arrived. 2016 left behind much tragedy and shocking news events such as the death of David Bowie, the Nice terror attacks, the Kaikōura earthquake and the US Presidential elections. But in the face of adversity life must go on.

The township of Kaikōura was cut off from the rest of New Zealand when it was hit by a devastating earthquake in November last year. For a town which relies on the tourist dollar as its lifeblood it was essential to get the roads open and the tourists rolling back in. Two articles in this edition show how NZIS members are putting their professional skills to good use and are actively involved in the earthquake recovery. Maurice Perwick of the Hydrography Stream was enlisted to undertake a hydrographic survey of the Kaikōura harbour. This was necessary due to the major uplift in the sea floor level which restricted wharf access for tourist boats (see pg 6). The Spatial Stream also provide an article (pg 38) relating to the works undertaken by Canterbury Maps that enabled responders to quickly ascertain the status of local roads, slip locations, whether bridges could be used and the state of houses. This spatial data was essential for the direct response and continued support during the recovery phase.

In addition to our Kaikōura reports, we have many other notable stories this month, two of which were sourced from the 2016 FIG Working Week. Tony Mulhall, Associate Director of the Royal Institution of Chartered Surveyors (RICS) writes of Smart Cities – Intelligent Buildings (pg 12) and how the digital information of buildings and cities must be integrated. He discusses the concept of City Information Modelling (CIM) to sit alongside Building Information Modelling (BIM) which is now becoming mainstream.

Greg Scott and CheeHai Teo of the Global Geospatial Information Management sector of the United Nations (UN) provide us with an account of how their team is putting together a mandate for the use of geospatial information for sustainable development (pg 16). Geospatial information can tell us where social, environmental and economic conditions occur, enabling us to make better use of our resources, identify patterns, predict outcomes and take preventative measures. The work that Greg and his team are undertaking is a key component of the UN 2030 Agenda for Sustainable Development.

Our technology page gives a quick run-down on the new technology created by Ballance Agri-Nutrients to enable the safe and sustainable application of fertiliser by top dressing pilots. This project won Ballance Agri-Nutrients the Innovation and Commercialisation Award at the New Zealand Spatial Excellence Awards last November. I hope to bring you the stories behind more of these award winners in the coming year.

Happy New Year everyone!

Surveying the aftermath

Mark G. Dyer

Kia ora

The 7.8 magnitude Kaikōura earthquake that struck in the early minutes of 14 November 2016 had a considerable effect on the land in the upper South Island. The fault ruptures caused ground movements exceeding 5cm from the middle of the South Island to the bottom of the North Island, with several metres of horizontal and vertical land movement occurring in some places.

The surveying and spatial community quickly brought its expertise and experience to the situation, with many practitioners getting involved in the initial response and later the recovery. The NZIS also played an invaluable role in coordinating these efforts. It is a reminder of the valuable role that our surveying and geospatial skills play in being prepared, and being resilient, in the face of natural disasters.

LINZ has been busy too. Our geodetic, hydrographic, topographic, data services and geospatial teams have facilitated the gathering and processing of Lidar data and imagery, and coordinating surveys to measure ground movements at geodetic control points. This information has helped the scientists to analyse the earthquake events. It also allows decision-makers, including myself, to understand the impact and consider responses, and local authorities and other infrastructure managers to get on with their jobs of restoring services.

The national survey control network was also impacted by the ground movement caused by the earthquake. Our geodetic office is working with private firms to re-survey the affected parts of the network which will allow a deformation model to be determined and applied to the geodetic network. This will also enable the spatial representation of the cadastral framework in Landonline to be updated.

There are challenges for surveyors carrying work in affected areas. Horizontal and vertical control for infrastructure projects will be more difficult to establish. The impact of ground movement in relation to property boundaries will also need to be considered on cadastral surveys. At this stage, the evidence indicates the movement is not like that associated with the large areas of liquefaction that occurred in Christchurch. Therefore the existing law and cadastral survey rules that apply outside of greater Christchurch should be adequate for re-establishing the location of property boundaries.

Users and managers of spatial data also need to consider what impact the earthquake has had on existing data in the systems they administer. Has its integrity been compromised? What is required to restore it? How can pre-earthquake data be correlated with post-earthquake data?

It is essential that we continue to work together to address these and other issues so we can achieve a rapid and robust recovery and ensure we develop our resilience for future events.

Ngā mihi

Cadastral

The Cadastral Stream has been busy over the last few months. We have been working with LINZ and NZIS National Office around the slow times being reported by Landonline users. We ask that if you are experiencing slowness with Landonline that you contact LINZ and log a call. The more calls they receive then the stronger case LINZ has for their providers. We are also working with LINZ on the ASATS project. A working group has been established and we are being kept in the loop on progress. We will provide regular updates to members when we can.

Another of our working groups is progressing with the review of Section 52 of the Cadastral Survey Act 2002. We hope that a report back to the Membership will be available later this year.

We have also begun preparing a seminar topic for this year – GNSS and Cadastral Surveys. This is in the planning stages. Please contact Vanessa Delegat at National Office for further information.

We hope to run the Cadastral Survey of the Year Award in 2017. Why not start to think about a challenging job you have worked on that may be suitable for entry. We all like to see how those difficult or 'out of the ordinary' situations have been dealt with.

If you would like to contact the Cadastral Steam, this can be done through the National Office: *nzis@surveyors.org.nz*

Matt Ryder, Cadastral Stream Chair

Engineering Surveying

This year, as the workload continues to grow, some of the large projects are coming to an end. We should see the end to a lot of work on Auckland's existing motorways. All of the western motorway from St Lukes to Lincoln Road should be open by the end of April with the completion of the St Luke's interchange, the Waterview Tunnel, the Causeway, and the Te Atatu and Lincoln Rd projects. The Southern Motorway corridor project will provide additional lanes around Takanini and the SH20a project will get travellers to the airport faster.

Wellington's Transmission Gully project continues this year, as does Auckland's inner city rail link, with the next stages going out to tender. There are some significant new local road projects in Tauranga, and Auckland has started on the Lincoln to Westgate upgrade and the brand new 18km road from Puhoi to Warkworth. There are also many new projects coming out for tender, with all this happening it's a great time to be an engineering surveyor!

Michael Cutfield, Engineering Surveying Stream Chair

Hydrography

Two exciting hydrographic events are already planned in New Zealand for this year and are outlined below. The NZ Region of the Australasian Hydrographic Society (NZR AHS) annual seminar to be held in Dunedin in July is currently calling for presentations, contact details are provided below.

NZIS HPS & SSSI Hydrography Commission Seminar – Wellington, 17 March 2017

Organiser: NZIS Hydrography Professional Stream and SSSI Hydrography Commission

Venue: Miramar Links Conference and Function Centre, Wellington

The day will include presentations and an open forum to discuss hydrography/institute/certification matters or other hydro related matters. It is planned that this will become an annual event in the hydrographic surveying calendar, ideally rotated between North and South Island venues.

For more details and to register: *http://www.surveyors.org.nz/Event?Action=View&Event_id=312*

NZR AHS Annual seminar and AGM – Dunedin, 6 July 2017

Organiser: New Zealand Region of the Australasian Hydrographic Society.

Venue: Te Kura Kairūri, National School of Surveying, University of Otago, Dunedin.

Theme: "Mapping our seas, oceans and waterways – more important than ever".

The seminars will include a series of presentations, as well as a bus trip along Otago Harbour to the Maritime Museum at Port Chalmers. Followed by the NZR's AGM and an informal dinner.

Call for presentations: 15min presentation abstracts to Emily Tidey: *emily.tidey@otago.ac.nz*

More info at: *http://www.hydrographicsociety.org.nz/events.htm*

Emily Tidey, Hydrography Stream Representative

Land Development and Urban Design

With an extremely busy 2016 behind us, the land development scene is still reaching new highs in most cities and regions throughout New Zealand, although Auckland is seeing some cooling in property prices. It is unlikely the pace of new developments will drop off in the near future.

Thanks to Dave Timms who put together an excellent article for the December edition of *Surveying+Spatial* on Cambridge Park, a local development that he has been involved with from the outset. Our Committee would like more of our members to showcase some of the developments they have been involved with as there are many outstanding new subdivisions which have successfully blended modern urban design principles with eco-sensitive environments to provide vibrant new communities. Contact Phil Cogswell *phil@cogswellsurveys.co.nz* if you have a project you would like to feature.

The Committee was also active in providing a submission on the Productivity Commission paper on "Better Urban Planning", which was a very detailed and large report. Thanks to Brett Gawn for co-ordinating the response and also Jan Lawrence from National Office for her help.

Moving forward in 2017 I would like to see some more feedback and involvement from the general membership and will be canvassing members for their ideas on the future direction of the Stream.

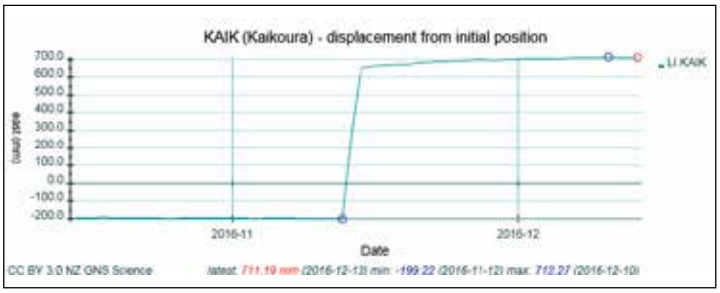
Phil Cogswell,
Land Development and Urban Design Stream Chair

Positioning and Measurement

Just after midnight (12.03am) 14 November 2016, Kaikōura was struck by the first of a series of ruptures in a complex earthquake sequence along the east coast of the South Island. The cumulative magnitude of the ruptures was 7.8.

CORS GPS sites operating in the area were readily able to track co-seismic (at the time of the earthquake) and post-seismic (since the earthquake) displacement. Within hours of the quake GPS data was used to estimate the initial areas impacted and the amount of displacement that occurred.

For example, the PositioNZ site KAIK (Kaikōura), shows 3D co-seismic displacements more than a metre and continued to move more than 10cm in January 2017. At the bottom of the page is a plot of the up displacement from KAIK by GNS Science.



Rachelle Winefield,
Positioning and Measurement Stream Chair

Spatial

Iain Campion and his Data and GIS team at Environment Canterbury have been working hard since the Kaikōura earthquake to provide GIS mapping (Canterbury Maps) to aid in the quake recovery. An account of the work undertaken by Iain and his team can be found in the Spatial Stream feature article on page 38.

LINZ has a project in the pipeline to determine whether topographic mapping will need to be updated in response to the earthquake. This project will begin in May and will likely result in contour layer updates which will be delivered via the LINZ Data Service (*data.linz.govt.nz*) and possibly other data layers.

The Christchurch Spatial Network Christmas event was held on 15th December and was very well attended. We would like to thank NZIS for their sponsorship of this event.

The Intramaps and QGIS User Forum will be taking place at the James Cook Hotel, Wellington, on 1-2 March. If your organisation is interested in open-source GIS this will be a worthwhile event to attend. It will be preceded by two days of QGIS and Python training. See *http://www.map-solutions.co.nz/blog/45-intramaps-user-forum* for details.

Greg Byrom, Spatial Stream Representative

KAIKŌURA
Getting Back to Sea

Kaikōura Boat Club channel post quake

Maurice Perwick, Director, Eliot Sinclair

Introduction

Monday, 14 November 2016, was a devastating day for the Kaikōura and Waiau districts when a massive Magnitude 7.8 earthquake struck the region causing tectonic uplift, which triggered huge slips to effectively isolate the Kaikōura township from the north, south and west.

The coastline lifted approximately 1.0 metre around Kaikōura, exposing kelp and paua alike to the drying effects of the sun. It also left the Marine Tourist industry high and dry and stranded hundreds of tourist rental cars and vans all-round the district.

The Royal New Zealand Navy (RNZN) was able to deploy its emergency response units and bring immediate relief to the town and its temporary visitors.

From a surveying perspective, the earthquake dislocated the whole region, both horizontally (1.35m SE) and vertically (0.3-0.94m) which, effectively, destroyed the existing coordinate and vertical survey infrastructure.

Project

We were tasked with re-establishing Chart Datum and surveying the South Bay Marina and North Harbour using topographical and hydrographic techniques.

GNS Science and LINZ were able to establish Continually Operating GNSS Reference Station (CORS) and determine new precise coordinates and NZVD16 heights on a number of sites in the Kaikōura region.

Methodologies

We had two priorities after negotiating the only open road (Inland Kaikōura-Waiau Road) in true convoy fashion, vehicle No '200' going in and '18' coming out a week later, and these were to set up our CORS on the old reservoir with a precise Marlborough 2000 Latitude Longitude E Height in terms of NZV16 Geoid and also to set up a tide pole and gauge in the Whale Watch Marina.

So, while Liam and Quentin, my two survey graduates, set up the GNSS Receiver up the hill, I was establishing my acoustic tide gauge on the wharf edge (photos below).

LINZ had supplied us with detailed tide prediction data which allowed us to determine the reduced level of the wharf and the probe height of our acoustic sensor which measured downwards (Nadir) to the water surface.

We were able to establish a tide pole on some bulwarks and synchronise the gauge to the pole.

We were also able to survey the position and height of

CORS GNSS receiver set up on the old reservoir

Establishing acoustic tide gauge on the wharf edge

the GNS occupied trig along the Kaikōura Peninsula which had a new post-quake precise position and back-calculate a position for our CORS.

By applying the offsets to Lyttelton Datum and the Chart Datum, we discovered that I had established the tide pole and gauge about 100mm in error. This became more obvious after a week of tide recording to match the predicted tides. Later we requested the LINZ Recorded Tide Data from their gauge in North Wharf and found that we had all the heighting within about 30mm.

Surveys

Of course, time was of the essence and we made sure our survey methods were consistent and in terms as we would adjust them when we had more data.

We had perfect weather, a light northerly, while we sounded South Bay and a southerly when we sounded North Wharf and Ingles Bay as each wind shift left the survey area in a wind shadow and calm conditions. We used our RHiB for the South Bay area and agreed to survey the Kaikōura Motorboat Club ramp and channel too.

By New Year's Day, the Club had excavated their channel and will make it available to the general public until the Marina excavations are complete.

Tectonic Uplift

With so much seabed now exposed above low tide, we were tasked to survey an area between the Marina and the Coastguard channels, both of which had limited navigable depths. We surveyed this area using our DJI Drone after marking prominent rocks with black crosses sprayed onto a white background. This proved very effective on the white limestone.

When we arrived in Kaikōura on Monday, 5 December 2016, we immediately sought out the local fixed wing and helicopter operations at the airport and obtained details and advice on what operations were continuing around the Kaikōura Peninsula and what restrictions were in place. We learnt that the restricted flying zone had, by this time, been revoked.

We were satisfied that we could operate legitimately under Civil Aviation Rule 101 and could operate in conjunction with the local flying operations. However we restricted ourselves to a maximum flying height of 80 metres (250 feet), but this meant that some of the other shoals photography didn't knit into our orthophoto solution.

Quarry Sites

The excavation of the marina and approach channel required the removal of limestone rock to reinstate the current depth from 1m to 2m below chart datum. This rock required disposal locally, and to this end we surveyed an existing quarry and a new site by the state highway using our drone and a Trimble SX-10, an integrated total station and scanner, to determine the volumes available.

CORS – COMS

Our CORS was able to take advantage of the surviving cellular telecommunications system and feed data back to our server in Christchurch and LINZ in Wellington. This data is received by our Trimble 'Pivot' system which makes it available to all our GNSS rover receivers. We have ten nodes, or CORS, available to us continuously anywhere in the country independent of the commercial companies.

We have UHF transmitters coupled to our NetR9 receiver in our CORS and this is used primarily for our hydrographic operations at sea and has an RTK range in excess

Ohau Point coastline and slip No. 6

of 25km from the base receiver. We can connect our radios to our TSC3 data recorders if cellular coverage is marginal for our GNSS control and topographic surveys.

In January 2017 we again used it for surveying the coastline north of Ohau Point at the Seal Colony, a distance of 22km from the base.

LINZ – Fast Static

We spent a day carrying out twin observations of a number of marks around the Kaikōura township as well as picking up the original Navy bench marks they used to establish chart datum in Kaikōura years before.

North Wharf & Ingles Bay

While I hired a local fishing boat for this deeper more open sea survey, Liam and Quentin carried out onshore surveys and checks on tide levels and the coastline.

Ingles Bay is often seen in postcards with fishing vessels on their moorings wallowing up and down. It is now full of shoaling rocks as it is much shallower with the recent uplift.

The locals tell me that aftershocks in the realm of magnitude 4.5-5.5 are still happening. Maybe I was becoming immune or just too tired at night and was fast asleep and not aware.

Post Processing & Plans

The benefits of a good cellular network are many-fold, but for us being able to remotely access the fast computers back in our Christchurch office, was exceptional. The transfer of data using 4G modems was reasonably fast but once there, it was immediately archived by the office system and then processed. We were able to use Trimble TBC and RealWorks, 12d, Trimble Hydro-NavEdit.

We had laptops, Trimble tablets and Trimble TSC3 Recorders to record the local field files and process as we needed to on site.

Seabed Flora

The Kaikōura coastline is very rich in flora and fauna which makes it a tourist and conservator's delight. However for the hydrographic surveyor it confuses the water column with false echoes and noise in the depth measurement. This makes editing of the survey depth data long and subjective.

Navigable Depth & Engineering Depth

Hydrographic processing software is a little unique as it can thin the density of data by depth bias, shallow or deep. Thus, for safe navigable depth we use a shoal bias to best represent the shallowest depth that a mariner is likely to encounter, but from an engineering perspective

we want the deeper depth as we want volumes of bedrock to be excavated.

We created two surfaces to represent these two situations and overlaid our orthophoto to confirm the shoal location.

This methodology gave a better appreciation of the engineering scope of works as it reduced the calculated volume to be excavated and allowed initial excavation to proceed.

Launching Pool

We understand the area of the foot of ramp was deepened to allow the large dolphin watch boats to launch and give them a six hour sailing window about high tide, i.e. mid to mid-tide instead of a three hour window. They could negotiate the shallower channel as their draft is not excessive, but need the deeper pool depth because of their lengths.

Excavation Method

A simple and straight forward method in shallow water is to create a bund, or embankment, and then excavate to the design depth and remove the bund as you withdraw.

The limestone seabed can be ripped with a single ripper tooth and excavated with a 35 Tonne digger. The material can be used to extend the bund and can be immediately driven on. The low tide bund maximised the reach of the digger and their efficient removal of seabed rock.

Whale Watch Marina

The future of the marina and concrete wharf infrastructure is not known at this time and may be removed if uneconomic to excavate.

The boat pens have shallowed by 1.0 metre, which, during a Spring Low Tide of 0.3 metres, means that they would touch the seabed instead of floating. They (the whale watch vessels) were moved to Wellington marina during the spring tides in mid-December, so there is an incentive to have their berth deepened.

We understand that a barge may be brought up from Christchurch to carry a digger into the marina. Barge vessels in this type of operation need spuds (piles) to constrain the barge's movement when the digger is mechanically breaking up the seabed with its pick and excavating with its bucket.

New Technology

The following technology was used throughout this project and was found to be invaluable in the work undertaken.

Airborne LiDAR is very effective on hard surfaces and has been used along the coast north and south of Kaikōura to provide the data for evaluating various roading options there.

The new LINZ orthophotography is a great resource for imagery.

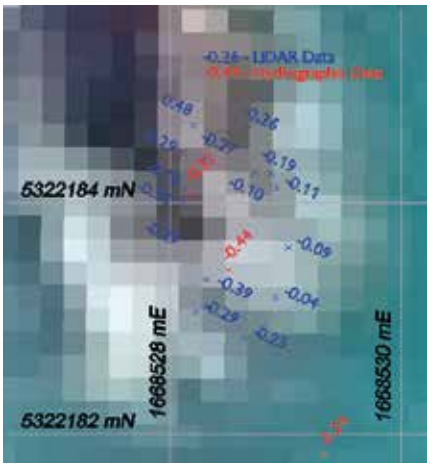
The New Zealand Vertical Datum 2016 (NZVD2016) which was introduced by LINZ in June last year proved

Note the amount of exposed seabed behind the digger

Liam in the boat pens, which have shallowed by 1.0m.

invaluable when re-establishing vertical datums and will become an accepted tool for surveyors, engineers and those involved with the third dimension.

We were able to prove the datasets from each of the technologies were consistent as we sounded over a shoal at high tide which had been exposed at low tide to the LiDAR aircraft. The results are impressive.



Comparison between the LiDAR and hydro survey results

Conclusion

This project provided us with a unique opportunity to assist in the recovery of the town's marine tourism and roading network.

The best technologies available were used for the task of surveying in shallow water.

The support from the government departments, LINZ and GNS Science, was exceptional. They provided precise coordinates, heights and tides for re-establishing position and chart datum which enabled the engineers of Tonkin & Taylor Ltd to assess the damage and solutions to recovery. The new NZVD16 geoid model proves to be invaluable when re-establishing vertical datums and the open source data available from LINZ was essential in proving our survey measurements and calculations.

Our integration of equipment, methodologies and datasets proved very effective, as each complemented the other.

We wish to thank Tony Fairclough and Brian Davis of Tonkin & Taylor and Scott Becker of Opus for inviting us to do this work.

Personnel

Maurice Perwick
RPSurv MNZIS
Hydrographic Surveyor, Level 1 Accreditation,
Skipper Restricted Limits

Eliot Sinclair
Christchurch
Land Survey Experience – 40 years
Hydro Survey Experience – 30 years

Liam Jagvik
BSurv
Graduate Surveyor
Control/Topo/Sounding/Geodetic Processing/12d
Assistant Team Leader

Quentin Doig
BSurv
Graduate Surveyor
Control/Topo/Drone/Pix4d

Graeme Crouchley
BSurv
Graduate Surveyor
Tidal Analysis/Excel

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

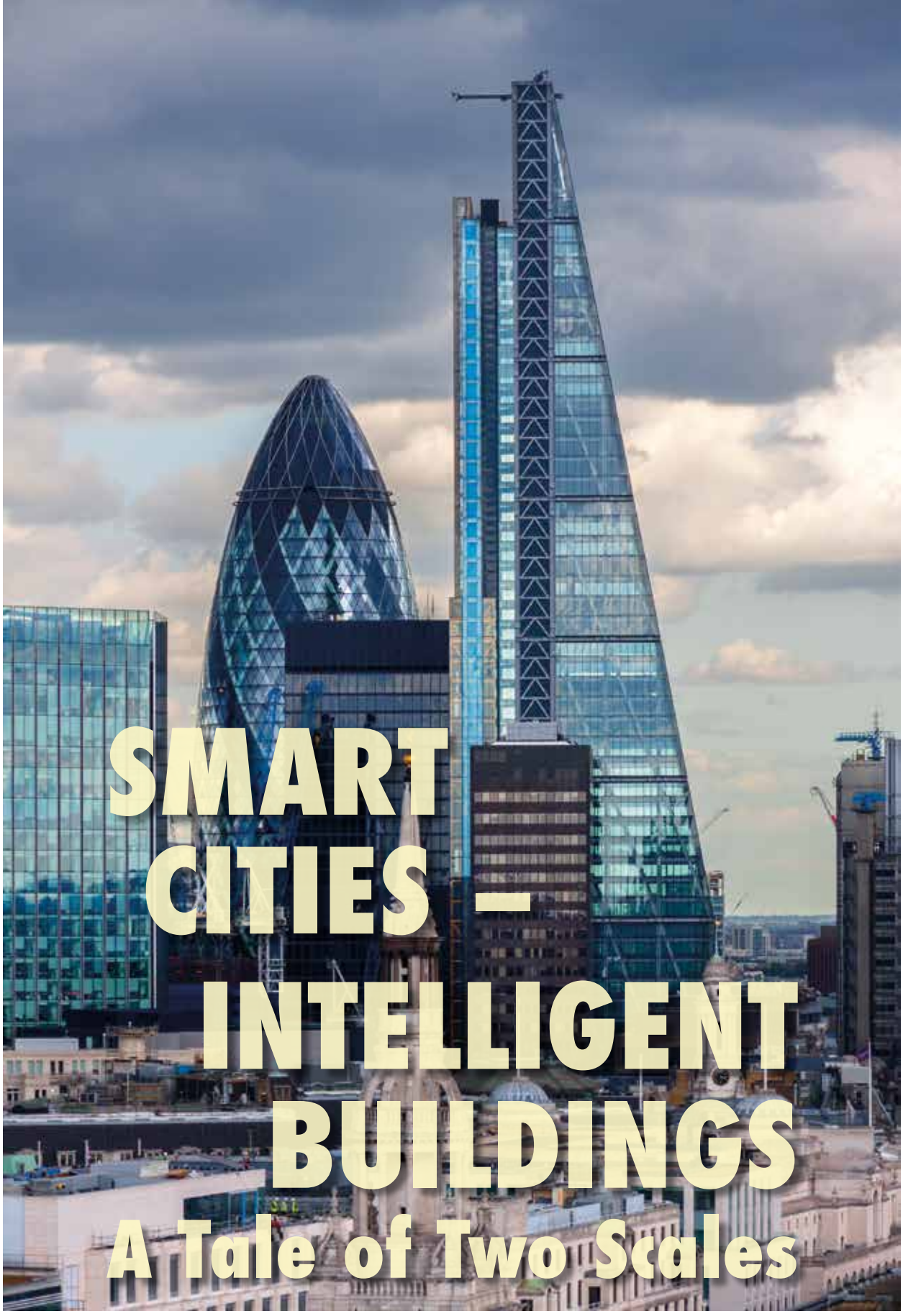
Free call us on **0800 555 474** or email us at: **info@glennstone.co.nz**

Steadfast
STRENGTH WHEN YOU NEED IT

NZIS
Diamond Partner

GLENN STONE
INSURANCE

www.glennstone.co.nz



SMART CITIES – INTELLIGENT BUILDINGS

A Tale of Two Scales

Tony Mulhall, Associate Director, Royal Institution of Chartered Surveyors (RICS)

Although it is difficult to imagine a city without buildings, when we talk about smart cities, unconsciously we may well be talking about the city as an abstract amalgam of all these disparate buildings without recognising that the individual structures are originated as discrete projects in themselves.

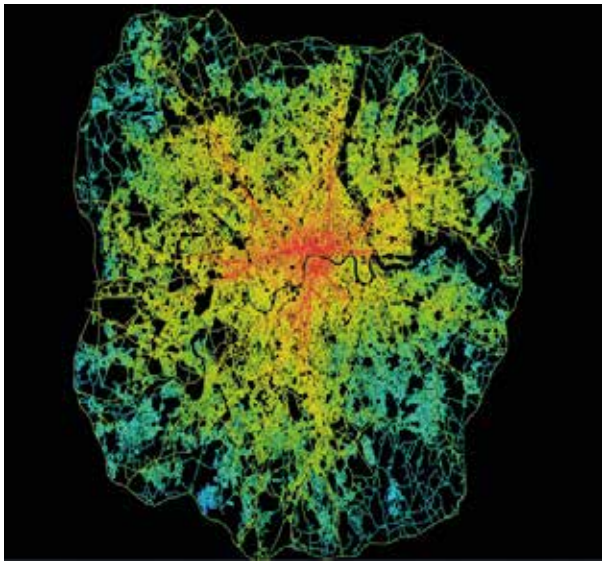


Fig 1 – London, Space Syntax, UCL

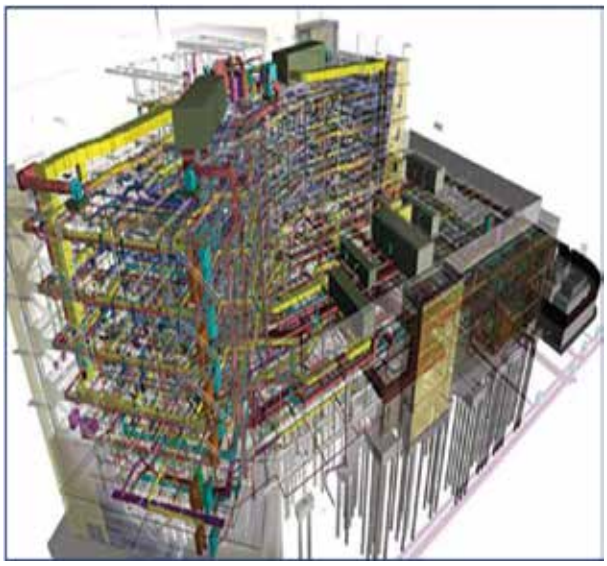


Fig 2 – BIM Model

At the urban scale, we may be making plans for smart cities without being fully conscious that at the scale of the building there is a distinct difference between how the building is procured and for what purpose, and how the city is run and whom it serves. In commercial and governance terms the building and the city originate as completely different enterprises. The building originates mainly through a private procurement process with all of the characteristics of private sector motivation, proprietary commercial interests and the confidentiality requirements that surround such an enterprise. In contrast the city has emerged by way of agglomeration to serve the needs of the citizens, governed by concepts of communality, democracy and openness.

Unsurprisingly then the digital manifestations of the city and the building are being generated separately at these two different scales, with distinct objectives, wrapped in quite different concepts of good governance. The concern is that the city and the building may not be talking to each other at these different scales and from these different origins. As a result, we may be missing out on a whole range of opportunities for the inter-operation of both. This article supports the argument for a new business model to integrate these two scales.

Different kinds of 'Smart'

Figures 1 and 2 provide typical representations of these two different scales. Fig.1 is a digital version of London, based on the space syntax method of analysis developed at University College London (UCL) delivered on a 2D GIS platform. Figure 2 is a Building Information Model of an individual building developed on a 3D platform.

How these two systems interact has taken on a new urgency in the UK. Since 2016 the UK Government has stipulated that all centrally procured projects should be planned to Building Information Management (BIM) Level 2 i.e. a managed 3D environment with data attached, but created in separate discipline-based models that may include construction sequencing and cost information. Essentially a building design based platform geared to the requirements of building procurement.

By contrast, in terms of city planning, 2D GIS has been the typical platform on which municipalities build the digital city although increasingly this is now being realised as a 3D GIS model.

Cultural difference

Despite the obvious interdependencies between buildings and cities the following clear cut distinctions emerge:

- City scale v Site scale
- City planning v Building design
- Public interest governance v Private interest governance
- Public sector objectives v Private sector objectives
- Public data v Private data.

At the higher level, the city tends to be urban policy driven for plan making, whereas the building is developer/investor led focusing on the creation of a secure property asset. Alignment of these interests will require the development of new business models combining the open sharing culture of city governance with the private proprietorial demands of commerce, with necessary safeguards for both.

The business end of smart

The UK Government regards the 'smart' agenda as essential to delivering competitive advantage in the global

economy. It sees the development of expertise in this area as highly transformative in terms of generating new services and new expertise for citizens as well as keeping the UK at the forefront of developments.

But it is not just about economic development. According to the British Standards Institute the smart city agenda is about effective integration of physical, digital and human systems in the built environment.

Economic drivers

At a basic level, the economic drivers for smart cities are about managing all of that 'dumb' 19th century networked infrastructure more efficiently through the application of sensors, actuators and a host of other digital aids to service maintenance and delivery. The benefits are reducing outages together with more efficient distribution.

In terms of smart buildings, there are clear economic benefits to be achieved. Some estimate savings on costs of up to 20% through the application of Level 2 BIM.

But according to the British Standards Institution (BSI) there are challenges to effective exploitation of data:

- **Additional costs** – ensuring that data being collected for internal use by an agency is done in an open, standards based format making it widely available will have additional costs.
- **Data security and privacy** – maintaining data security and privacy in a way that will give confidence to those providing data and individuals to which data relates.
- **Workable commercial arrangements** – Income from data needs to be distributed fairly to a number of different agencies reflecting costs of making data available and value that data would have to others
- **Data Capture** – Lack of a consistent approach to capturing data at every scale in a city specifically data modelling processes used by city planners and those used by architects.

Professional challenges:

- Different professionals are using different data modelling systems.
- Scale gap between micro, building-focused scale of architect and the macro city-focused scale of planner.
- Meso scale (street) where important social and economic life takes place, falls through gap. It is also where most of the city's networked infrastructure is located.
- Identification of useful data – What data is most useful; how could it be most easily collected and made available and what exactly could it be used for?
- Lack of appreciation of the potential of digital design: Architects and Planners use computers but simply to help do what they do already. The potential to design in a different way may be ignored.

Recent research commissioned by RICS on how far the Big data/Smart city agenda is progressing on the ground suggests that in the cities reviewed there is still a significant gap between the promise of this agenda and the clear business case for undertaking it. Moving the debate beyond government or local led government initiatives is proving difficult so demonstrating the end use case is therefore vital to success.

City Information Modelling

It is not difficult to see the connection between digital modelling at the building level and digital modelling at the city level. It has been observed that when BIM is more widely adopted the possibility of City Information Modelling (CIM) will emerge.

The capacity to move beyond policy making and begin managing the resources of the city to achieve 'more with less' is a goal worth pursuing through smart technologies – less waste in locations with abundance; better services for longer periods in places with extreme scarcity. So when we talk about the city and its infrastructure, clearly the need for interoperability at all scales becomes fundamental to effectively mediating between building and city.

CIM could address one of the key deficiencies in the construction and development process caused by the lack of precise, open-source data about the most basic daily challenges – the location of underground services for the purpose of connection or avoidance. Repeated failure to capture this information for shared use is one of the most contentious, disruptive and time-consuming aspects of urban development.

Whoever might be the CIM custodian would need to promote the benefits of sharing information to developers and contractors and then ensure that the resulting CIM model is shared on a commercial basis informing and enhancing future projects.

The long-term relationship between the building and the evolving city where BIM-enabled buildings become long-term multi-dimensional sensors in the city must be the goal. Clearly, there will be a requirement for planners and architects to use a common approach to enable this to happen. But there are also cultural differences between those operating at the city level and those operating at the level of the building which will also need to be overcome … not forgetting, of course, the business case.

Accurate INSTRUMENTS

www.accurate.kiwi | 0800 500 380

Promoting Best Practice & Industry Training for all facets of leveling and precision locating - above and below ground

New Product Release:
Stream C Ground Penetrating Radar Unit

From IDS Corporation, comes the new compact solution for accurate 3D Utility Mapping.

It will be the first of its kind in the GPR Survey world.

Global Launch Date: September 1st 2016.

We extend an exclusive invitation to all NZIS members only to register for demonstrations.

For more information on the new Stream C or to register your interest, please email:
elle@accurate.kiwi

United Nations Under-Secretary-General for Economic and Social Affairs, Mr. Wu Hongbo, opens the sixth session of the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) at UN Headquarters in New York on 3rd August 2016.

UN-GGIM

Geospatial Information for Sustainable Development

Greg Scott, Principal Advisor & CheeHai Teo, Senior Advisor, Global Geospatial Information Management, United Nations Statistics Division, Department of Economic and Social Affairs

Introduction

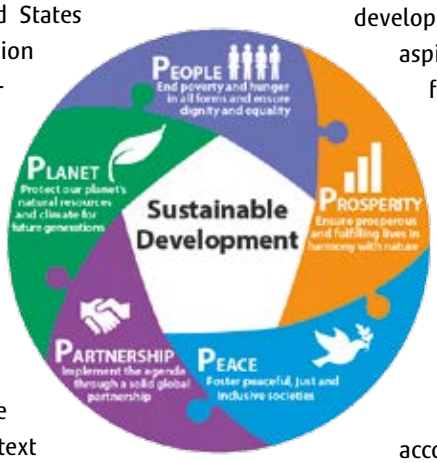
In July 2011 the United Nations Economic and Social Council (ECOSOC), the United Nations' central platform which supervises the subsidiary and expert bodies in the economic, social and environmental fields, established by resolution (2011/24) the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM) as the apex intergovernmental body for geospatial information. Meeting annually at UN Headquarters in New York, UN-GGIM seeks to play a leading role in setting the agenda for global geospatial information management and to promote its use to address key global challenges, and is the forum to liaise and coordinate among Member States, international organisations and stakeholders.

In making its decision in 2011, ECOSOC requested that the UN-GGIM submit to the Council in 2016 *'a comprehensive review of all aspects of its work and operations, in order to allow Member States to assess its effectiveness'*. Following its fifth session, convened in August 2015, UN-GGIM embarked on a consultative and comprehensive programme review of all aspects of its work, operations and activities with all Member States. This review culminated in the preparation and submission of a detailed report (E/2016/47) to ECOSOC in early 2016 in order for the member countries of ECOSOC to assess the effectiveness of UN-GGIM.

The review described how UN-GGIM, in its initial five years, had operated effectively and in line with the mandate given by the Council, producing key tangible outputs. The establishment of five regional technical committees, for Asia-Pacific, the Americas, Europe, Africa and the Arab States, attests to the global recognition of UN-GGIM's efforts in making joint decisions and setting directions for the production, dissemination and use of geospatial information within national, regional and global policy frameworks. A significant accomplishment by UN-GGIM has been the formulation and adoption of a UN General Assembly resolution 69/266, entitled *A Global Geodetic Reference Frame for Sustainable Development*. This landmark decision, adopted on 26 February 2015, calls for greater multilateral cooperation on geodesy, including the open sharing of relevant geospatial data, further capacity development particularly in developing countries and the creation of international standards and conventions. This resolution outlines the value of ground-based, aerial and space observations and measurements for informed policy and decision-making for sustainable development and the wellbeing of humanity.

Strengthened and Broadened Mandate

On 27 July 2016, having considered the report submitted by UN-GGIM and a subsequent draft resolution facilitated and submitted by the Permanent Mission of Mexico, (and co-sponsored by Argentina, Australia, Brazil, Burkina Faso, Chile, China, Germany, Jamaica, Japan, Sweden, the United Kingdom, and the United States of America), ECOSOC adopted resolution 2016/27 entitled *Strengthening institutional arrangements on geospatial information management*. The resolution acknowledges the considerable achievements and progress made by UN-GGIM over the past five years in the field of geospatial information management, and that UN-GGIM is well placed to continue to contribute to the work of the United Nations, especially in the context of assisting Member States to implement the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction, the Paris Agreement on Climate Change and the Small Island Development States (SIDS) Accelerated Modalities of Action (SAMOA) Pathway.



In his opening address at the sixth session of UN-GGIM the week following this significant ECOSOC decision, Mr WU Hongbo, United Nations Under-Secretary-General for Economic and Social Affairs stated *"this resolution acknowledges the considerable achievements and progress made over the past five years in the coordination and coherence of geospatial information management. It not only streamlines the work of the subsidiary bodies of the Council (ECOSOC) in the field of geospatial information management, but it also strengthens and broadens the mandate of this Committee as the relevant body to report to the Council on all matters relating to geography, geospatial information and related topics. In short, this resolution recognises the increasing role and relevance of the Committee."*

This resolution not just acknowledges the considerable achievements of the global geospatial information community but also recognises the significance and relevance of geospatial information for various global development policies and agendas. The resolution also stresses the need to strengthen the coordination and coherence of global geospatial information management, in capacity development, norm-setting, data collection, data dissemination and data sharing among others, through appropriate coordination mechanisms, including the broader United Nations system, building on the work of UN-GGIM.

2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development is a universal and transformative agenda that aims to shape people and planet in our lifetime. It calls for inclusive social progress, environmental sustainability and economic development, an Agenda that responds to the aspirations of all people seeking a world free of want and fear. The inclusive and integrated nature of the 2030 Agenda for Sustainable Development, with its 17 Sustainable Development Goals (SDGs) and 169 Targets, are ambitious and when realised across its full extent, the lives of all will be profoundly improved and our world will be transformed for the better.

This 2030 Agenda contains much more accountability than the Millennium Development Goals (MDGs), with considerable emphasis on measuring and monitoring with good policy, science, technology and especially data; and specifically demands the need for new data acquisition and integration approaches. While the SDGs and their targets were decided through negotiation by Member States, the General Assembly separately tasked the UN Statistical Commission, based on its 15 years of experience in measuring and monitoring the MDGs, to develop a global indicator framework.

The Agenda stipulates that the follow-up and review processes for the SDGs at all levels will be guided by a series of principles, one of which is that: *'They will be rigorous and based on evidence, informed by country-led evaluations and data which is high-quality, accessible, timely, reliable and disaggregated, including by geographic locations, relevant in national contexts'* (paragraph 74.g). The disaggregation of data including by geographic location is crucial to ensure that the key principle of the 2030 Agenda, to leave no one behind, is attainable. Paragraph 76 expands on this with regard to earth observations and geospatial information: *'We will support developing countries, particularly African countries, Least Developed Countries (LDCs), SIDS and Land Locked Development Countries (LLDCs), in strengthening the capacity of national statistical offices and data systems to ensure access to high quality, timely, reliable and disaggregated data. We will promote transparent and accountable scaling-up of appropriate public-private cooperation to exploit the contribution to be made by a wide range of data, including earth observation and geospatial information, while ensuring national ownership in supporting*

and tracking progress' (Resolution 70/1 paragraph 76).

Integrating Geospatial and Statistical Information

As indicated in Figure 1, the 17 SDGs of the 2030 Agenda comprise the integrated and indivisible global goals to be achieved by countries, and applicable for both developed and developing countries, balancing the three dimensions of sustainable development. The 169 aspirational targets provide the detailed and actionable objectives for governments to measure progress through to 2030. Each country will set its own national targets, guided by the global level of ambition, and will also decide how these targets should be incorporated into national planning processes, policies and strategies. In terms of a robust and annual follow-up and review mechanism for the implementation of the 2030 Agenda, it will be the global indicator framework (presently 230) where the data acquisition, integration and disaggregation will be needed.

'Data will be one of the fundamental elements of the accountability framework for the SDGs. Having high-quality data, and using it to create information that can track progress, monitor the use of resources, and evaluate the impacts of policy and programmes on different groups, is a key ingredient in creating more mutually accountable and participatory structures to monitor the new goals' (*A World That Counts*, page 20). Having data that informs on the "how" and the "what" is valuable, such as how many primary schools are needed or what commodities are being traded and in what volumes. It is profoundly better if we are able to also know the "where". Data on "where" is essential for informed policy-making, decisions and actions, data that allows us to know the 'how", the "what" and the "where" is required for the successful implementation of the 2030 Agenda.

In order to achieve the SDGs, the need to understand the interrelationships across the three pillars of sustainable development – economic, social and environmental – and the impact of the environment on socio-economic activities, and vice versa, will be critical. Within many national governments, there has been for some time a clear recognition of the need to link statistical information (primarily socio-economic information) and geospatial information (primarily environmental information) to improve sub-national data, its disaggregation, and the relevance of the evidence on which decisions are made. Put simply, linking people, business and the economy to a particular place or geographic location can result in a fuller understanding of social and economic issues than is possible through a socio-economic information lens on its own.

It is important that the SDGs can be consistently tracked over long periods of time at varying scales, and that comparability across nations can be achieved. The location element of data, including statistical data, will be a critical consideration. There is now emerging understanding that implementing the SDGs, and measuring and monitoring their progress, will require new and large amounts of data, more rigorous modelling and analysis, and much better data management. It will also take transformative change and collaborative approaches to link different data – demographic, social, environmental, statistical, earth observations, and geospatial data together with the one thing they have in common – to geographic location. Figure 1 suggests that, as a minimum, *'sustainable data for sustainable development'* will require consistent statistical, geospatial and earth observation data as the core information system inputs into the global indicator framework, and informed by good science, enabling technologies, and sound policy. These national information systems, combined with other sources of new data that reside outside of national statistical systems, including Big Data, will contribute the fundamental baseline data inputs, as well as any new required data collections, into the indicator framework.

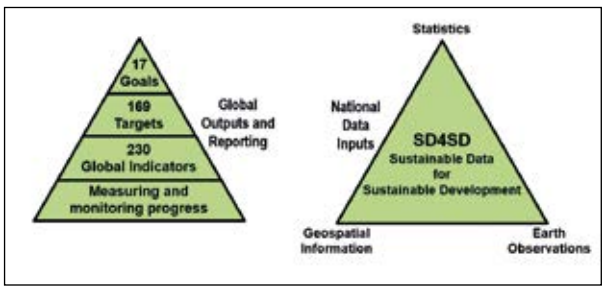


Figure 1: Global outputs and reporting progress through the indicators, targets and goals; and key areas of national data inputs towards the production of the global indicator framework.

The Path Forward

The adoption of the 2030 Agenda provides the global policy mandate to exploit the contribution to be made by geospatial information to support the SDGs. The global geospatial community now has a unique opportunity to integrate and connect geospatial information into the global development agenda in a more holistic and sustainable manner, specifically in contributing their data resources towards measuring and monitoring the 17 SDGs, and 169 associated targets, through the global indicator framework that anchors the 2030 Agenda for Sustainable Development. But is this enough for countries to implement change and achieve the mandate for the geospatial community to be mainstreamed into sustainable development? Our geospatial information community must recognise that our sciences, technologies, knowledge and practices go beyond state-of-the-art tools-of-trade instruments and devices, for improved precisions and accuracies. Our community needs to now urgently provide an increasing permutation of possibilities towards informed policy-making, decisions and actions. Geospatial information must be leveraged towards the successful implementation of the 2030 Agenda and thereby profoundly improving the lives of people, planet, peace and prosperity.

Maximising the value of fundamental geospatial information to capture elements of the 2030 Agenda, for informed policy-making, decisions and actions is going to be critical to the future development path of many national geospatial information agencies. This may be sooner than some may foresee but certainly in the coming 5-10 years. For many countries, especially developing countries, sustainable development will provide a tangible political 'trigger' to accelerate the development and adoption of legal, technical, geospatial and statistical standards; openness and exchange of data and metadata; interoperability of data and information systems; and integration of statistical and geospatial information, including its management and exchange. In other words, the 2030 Agenda will be a trigger to accelerate the development and/or expansion of national spatial data infrastructure (NSDI) strategies. It will also provide a strong consensus on the need to integrate the NSDI within national government's development plans. An NSDI strategy that is anchored to sustainable development, as an overarching theme, would provide an 'information' approach to national policy and implementation. It would also bring the analysis and evidence-base to the process, and thereby a consistent monitoring and reporting framework, that would benefit all – society, government, environment and economy.

The expectation is that by 2020 we are able to increase significantly the availability of high-quality, timely and reliable national data that is disaggregated by a number of characteristics, including geospatial information. However, in order to achieve this outcome, it will require collective global leadership, and it will require appropriate frameworks and methods to be realised. National geospatial information agencies will need to: collaborate more closely with national statistical and earth observation professional communities; be more unified with similar national to global objectives and aspirations; be delivering consistent and reliable data that is fit-for-purpose; and demonstrate the functionality and value of the geospatial data by integrating it into the wider sustainable development policy process.

Is Precision Paramount?

If you pride yourself on the accuracy of your work, talk to us about Z+F 3D laser scanning instruments.

With unparalleled data clarity, Z+F is the brand you need if you're serious about laser scanning.

Z+F Zoller+Fröhlich

FREE manufacturer training in Germany with every purchase*

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

*Terms and Conditions apply. 5010X and 5016 models only.

The daily survey tasks in action at the entrance to the tunnel.

Surveying the Waterview Tunnel Project

Michael Cutfield, NZIS Council Member, Engineering Surveying Stream Lead, Survey Manager for Fletcher Construction.

Due to open soon after this goes to print, the New Zealand Transport Agency's Waterview Tunnel project stands as New Zealand's largest infrastructure project in many aspects. The Surveying and Spatial elements on the project were wide ranging, and we needed to use just about every tool that comes under the "Surveying" banner.

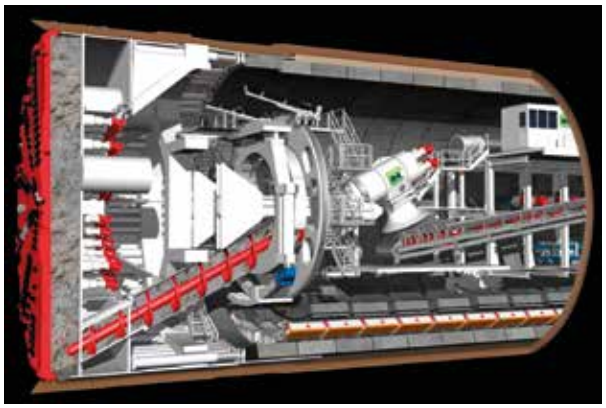
The Western Ring Route: The Waterview Tunnel project is the last piece of the puzzle.

Project Summary

The Waterview Connection links to State Highways 16 and 20 to complete the Western Ring Route, identified by the NZ Government as one of its Roads of National Significance to help underpin economic growth. The project's client, the NZ Transport Agency, decided that twin tunnels, 2.4km long, carrying three lanes of traffic each way, was the most efficient option for the connection. How the tunnels were to be created was the next decision, queue Alice, the Tunnel Boring Machine (TBM), designed in Germany and built in China. The decision was made by the Well-Connected Alliance, which included the Transport Agency and six major infrastructure companies: Fletcher Construction, McConnell Dowell, Obayashi Corporation, Beca, Parsons Brinckerhoff, and Tonkin + Taylor. All of which are well established in NZ, except for Japanese based Obayashi Corporation, who have literally built thousands of tunnels around the world.

To take three lanes of traffic, the diameter of Alice needed to be 14.6m, the largest ever in the Southern Hemisphere, and the 10th largest in the world. Alice was an Earth Pressure Balanced TBM, and would assemble the concrete lining of the tunnel as she moved at the snail's pace of 8cm per minute. The lining was assembled 2m at a time by bringing in 10 pre-cast concrete segments via a Mobile Segment Vehicle; and these were placed using a vacuum lifting system. The total volume of earth removed was 800,000m3. This was placed on a conveyor taking it to a spoil building where it was then taken a few kilometres south to fill in the old Wiri quarry.

I have been asked many times why Alice isn't re-used for, say, the City Rail Link, or the next Harbour Crossing? The simple answer is that Alice was custom made, the cutter head size and formation is precisely built to deal with the ground conditions found at Waterview only, and the remaining mechanical and structural components undergo significant stresses which limit its ability to be re-used.



The insides of Alice the TBM.

Survey – in the Tunnel

The Survey Manager for the tunnelling works was Maconnell Dowel Surveyor, Colin Taylor. His experience with tunnel construction in Australia and his passion for surveying enabled Alice to break through each portal within 20mm, well within the construction tolerance of 50mm. This accuracy is only achieved by meticulous attention to detail, and by being aware of all possible sources of survey error and accounting for it.

Although it may seem like the only way to guide Alice is via a hanging line traverse, it is actually a braced traverse or a series of closed networks. Thanks to robotic total station technology, and the investment in a few prisms and specialised brackets that attach securely to the tunnel wall, many rounds of observations are easily executed, allowing for plenty of redundancy. Care is also taken to avoid any observations that graze the tunnel walls, because this can introduce refraction errors.

From the primary control network, the location and orientation of the tunnel guidance total station is determined. This system is provided by VMT (VMT GMBH *http://vmt-gmbh.de/en/*) whereby a Leica 1200 series total station is modified to include a visible laser. Together with a prism, the laser receiver can then not only determine the position of Alice, but also her heading. The data received from the total station is autonomously sent to a computer on-board the TBM, where it is processed and displayed to allow the operators to make any number of adjustments to correct the course.

A diagram showing how the VMT guidance system is setup at the rear of a TBM, very similar to the setup for Alice.

Once the main tunnelling was completed, work could then commence on each cross passage located every 150m, which serve primarily as emergency escape routes. The tunnels were excavated conventionally with small excavators, and were intensive on surveyor time to minimise the amount of over and under excavation.

Monitoring

Possibly the most onerous and least enjoyable task of the surveyors on site was the many various monitoring requirements of the project. With deadlines of sometimes every ten minutes, the systems required to meet these deadlines needed to be robust. Not to mention a high level of time management by all. The main tunnel and the cross passages were monitored internally for convergence, with monitoring prisms installed around the tunnel diameter. This was reported daily. In addition, the surface was monitored for settlement daily in Alice's immediate location. However, at the North end of the Tunnel, where the geology was the weakest, and the tunnel was the shallowest, *and* it passed beneath the country's busiest local road – the monitoring system needed to be supercharged. As the Surface Works Survey Manager, I was presented with the task of feeding near real time 3D movement data from the surface to the TBM engineers. We decided to invest in Trimble 4D which provides this capability and worked with our S8 Total Station. Prisms were then mounted to the settlement rods in the park adjacent to the road. The project also invested in numerous "cat's eye" prisms (small 10mm prisms mounted inside a

cat's eye type housing) which were installed on the road, allowing for zero traffic disruption. The real-time monitoring of these prisms had to be performed at approximately a 100m stretch around the Alice's location, and two total stations were used in a leap-frog formation to ensure all the required measurements were made continuously. Because these total stations were running 24/7, security huts were also needed, with basic facilities. But the most difficult problem to solve around the real time monitoring was the IT system. The many different permutations of power and data connections had to be weighed up, and for this part of the project, the total station proved to be the best option. This was powered by a 12V deep cycle battery, communicating to a nearby laptop via radio powered by another 12V battery, which handled the database and processing, and was connected to the internet via a 3G mobile stick.

The real-time monitoring system was also used at launch and breakthrough time to make sure that the permanent structure was not moving under Alice's might. The real-time solution also came in handy to monitor the movement of the deck and the suspension arch when tensioning the strands that hold up the pedestrian suspension bridge Te Whitinga at Hendon Park.

3D Scanning

A 3D Scanner was acquired early for the purpose of monitoring the main trench excavations. It was established that scanning was the best method for monitoring the trench walls, because the moment any wall was exposed, it required monitoring. Scanning did not require survey targets, which in these locations were getting destroyed, if not getting completely covered in dirt and construction materials. There was also the added benefit that the entire structure was being captured.

From there, the scanner was put to use checking various high precision structures in the tunnel, and also for existing condition surveys of the road when the project's scope was occasionally increased. The scanner was the ideal tool for these road pick-ups because it cut the field time in half, and reduced the amount of traffic management required, in comparison to conventional surveying.

Survey – on the Surface

At the height of the project, there were 23 full time surveyors on the job; 11 for the tunnel works and 12 for the surface works. The surface works team was split between the North and South sides of the tunnel, with each end being a significant project in itself. Each end had some common civil and structure works, such as large retaining walls, the headwall and portal structures for the tunnel, vent stacks, and pavement and drainage construction.

The North

The North had the Great North Road Interchange (GNRI), which are four long ramps to connect the existing Northwestern Motorway (SH16) to the end of the tunnel (SH20). The GNRI was the most visible part of the project to the public, with many commenting that the columns with their cross-heads on top were like mushrooms that seemed to sprout up overnight. The bridges are made up of 51 columns, the highest being 19.9m, and 280 precast concrete beams, each 1.5m deep and up to 35m long. The total length of bridge structure is 1.7km.

One of our survey control pillars on top of one of the GNRI cross-heads. (No trucks in the way up here!)

A lot of 3D modelling was done on these ramps in the early stages, a combined effort of the surveyors and the CAD team, who sat primarily inside the Design team. The initial 3D model was then used for all subsequent setout, and was crucial to the correct positioning of each column, crosshead and beam.

The South

Hendon Foot Bridge, which is now named Te Whitinga, is the project's signature footbridge. The architects created an amazing design, however these types of designs are always a challenge for engineers and surveyors. This bridge, like the ramps in the North, was fully constructed in the virtual world beforehand, which again greatly aided in the setout. Another issue was the fact that the 100m long suspension arch was fabricated off-site to the correct dimesions, whereas on site we were using the Mt Eden 2000 co-ordinate system. This meant that we had to take account of the 1cm difference due to the scale factor in the co-ordinate system, in order to set the anchors for the arch to within tolerance.

The Maintenance Building meant that we had to step away from the familiar – working with horizontal civil and structural work – and move our thinking to vertical construction. This was another challenge, but the right people on the job made this all run smoothly.

The final stages of the project required 3km of motorway widening and an intersection upgrade to allow for the forecasted increase in traffic volume, and to ensure that the traffic speed inside the tunnel never drops below 30km/h.

Machine Guidance

It was decided early on that the project would benefit from the purchase of Machine Guidance equipment for a couple of the excavators on site. The investment immediately started paying for itself. As we surveyors are well aware, it saved survey resource from not only laying out a countless number of stakes, but it also saved us from laying them out again, and again, because of the stakes that would inevitably get destroyed in close-quarter construction.

The survey team is the only team capable of managing the machine guidance for many reasons: we understand how the GNSS positioning operates; we work with 3D CAD models and understand what is required to produce an accurate model. And we understand map projections and sources of error.

Wiri and Unmanned Aerial Surveys

All the 800,000m^3 of spoil from the tunnel needed to go somewhere, and the old Wiri quarry down the road had finished its life, so this was perfect fit (to the extent that the hole in the ground was almost exactly 800,000m^3).

The spoil that came from the tunnel was very wet due to the lubrication applied to enable Alice to remove the material (much like how shaving foam works). So before the spoil was placed and compacted, the majority of the moisture needed to be removed by placing the spoil into "windrows" for drying. All this meant that volumes needed to be monitored between the dump site, the windrows and the final compacted areas.

The survey team was asked to survey the site regularly to monitor volumes. Drones were the obvious choice as they were starting to become main-stream. The conventional method of having a survey team with GNSS rovers measuring individual points was not only inefficient, but prohibitively unsafe, because within the wet material there was the possibility of sink holes.

We were able to try out many Drone multi-rotor systems. Fixed wing systems were not tried due to the lack of space for take-off and landing, and also the relatively small square site of approximately 500m x 500m. Though this site was also within 4km of the Auckland International Airport, the airport's proximity did not create any problems because we were using the Airshare webpage and communicating with the control tower.

In the end, we are able to fly the site in less than two hours, and the volumes are computed by the following day. Using the same number of surveyors the conventional way would take a week, with a lower quality result. The

The Wiri site, with the dumping zone along the bottom of the image, the windrows in the middle, and compacted spoil to the left.

Then Prime Minister John Key with our former Alliance Project Manager John Burden (and a survey target in the background)

orthophoto produced also provided unexpected value around planning and visualising progress.

The End

The Waterview Tunnel project was a surveyor's dream. It had everything from complex, millimetre accurate set out and monitoring, to large topo and asbuilt surveys. Some of the jobs were more exciting than others. The monitoring was a chore, but was possibly the most important as it carried some of the highest risk to the project. The set out of the large structures are the most enjoyable for all surveyors as it is like a giant puzzle that needed to fit together, but most of all, leaves a legacy which will last many generations to come (not to mention the social interaction with all members of the team to achieve the task).

From my point of view, the ability to test the market for the latest survey technology was a highlight. To be now flying drones, considering that when I started my career the chain and steel band had recently died as a technology – how quick was that? What next? It's impossible to predict, but all we can do is be ready for the next change and find that sweet spot between scepticism and an open mind.

Alice's cutter-head with a perspective on size. 14.6m, the largest used in the Southern Hemisphere.

MAKE smart savings HAPPEN

Your partner, Staples.

At Staples,™ our aim is to provide you with everything your business could ever need, easily and cost effectively. Our partnership with NZIS means that you can access competitive pricing and dedicated account management to help your business succeed. With an unparalleled distribution network, Staples™ is the right partner for your business.

Our range includes:

- Safety Solutions
- Facility Solutions
- Office Products
- Furniture Solutions
- Print Solutions
- Promotional Products
- Technology Solutions
- Kitchen Supplies

For more information visit staplesadvantage.co.nz or call 0800 800 547.

Staples New Zealand Limited.

LEGAL COLUMN

Complex subdivision in the modern era can lead to problems

Stephanie Harris, Glaister Ennor Solicitors

Subdivision today is remarkably more complex than it was ten years ago. Subdivisions are now more sophisticated and such can be incredibly difficult at the same time – it is not uncommon to see complex projects taking place such as resubdivision of lots, subdivision into superlots and more difficult pieces of land being subdivided. The reasons for more complex, sophisticated and difficult subdivisions include the high demand of land in the Auckland area, clever marketing approach and difficult land being turned to better use, but with complicated outcomes.

Complexity leads to complications. Complications can lead to traps and pitfalls. There are numerous examples of subdivision not matching with future sale needs or past processes. For example, failing to identify conditions of initial resource consent can lead to problems in subsequent stages of resubdivision. Also, failing to remove easements or land covenants can cause problems related to vesting of road in the future.

For example, we come across the following kind of situation relatively frequently. Extensive rights of way and other services easements are left on the title after subdivision without being removed or realigned. A lot on a plan of subdivision is to become road and vested upon deposit of the plan, which must be transferred to Council free from all existing interests (at the applicant's cost). However, the easements benefit adjacent land where 100+ dominant owners are situated. It is virtually impossible to obtain the consent of all the dominant owners and their mortgagees. The developer must seek Council's consent to transfer the road by way of dedication rather than by vesting. As the land is to be transferred subject to the existing interests (which, depending on the nature of the interests, may not be attractive from the Council's perspective), this is likely to impact on Council's discretion to grant consent.

Where stages of subdivisions are involved, boundaries between say, stage 1 and stage 2 could mismatch, resulting in the ownership of land between the stages not matching. This requires readjustment of boundaries involving consent of a number of parties, which will come at a high cost to the developer.

Another real-life example involving boundary adjustments during a subdivision that was also subject to a partial sale. The original owner of a much sought after piece of land in west Auckland *(Vendor)* planned to subdivide the land into two lots, Lot 1 and Lot 2. Prior to subdivision consent being granted, the Vendor sold Lot 2 subject to title being issued. The Purchaser of Lot 2 intended to then resubdivide the land into multiple household units.

After a somewhat lengthy process, the Vendor finally obtained subdivision consent but it was subject to extensive work requirements for overland flow drainage. The Vendor did not inform the Purchaser of this requirement. In the meantime, the Purchaser obtained resource consent for a sophisticated resubdivision of Lot 2 into multiple household units, involving roading and engineered overland flow in respect of Lot 2.

The Vendor adjusted the boundary between Lots 1 and 2 after subdivision but before Section 223 without informing the Purchaser. The boundary adjustment resulted in a slightly smaller Lot 2, with the land being subject to several easements in favour of the territorial authority with consent notices.

The Purchaser objected to the smaller size of Lot 2 as it obliterated three of the lots in the Purchaser's resubdivision, and the Vendor's overland flow drains also affected various lots with the Purchaser's engineered overland flow through the road network.

To resolve the issues, the Purchaser was left with the extensive costs of readjusting the boundary and reengineering the overland flow. It seems the lack of communication between the Vendor and the Purchaser, and their respective surveyors and engineers was a major contributing factor to the complications.

In summary, subdivision and sale of subdivided land requires significantly more collaboration between surveyors and lawyers over the methodology and outcomes. Awareness of the end to end process and where the client's subdivision or resubdivision fits in the process will assist in the decision making.

Stephanie Harris is the joint managing partner of Glaister Ennor Solicitors. She has extensive experience in property and commercial law. She acts for SMEs, larger corporates, investors and developers on many large and complex property transactions and developments, ownership structures, leases, security interests and general structuring and finance.

Contact Details:
DDI: *(09) 356 8232*
Fax: *(09) 356 8244*
Email: *stephanie.harris@glaister.co.nz*

Changes are afoot

Earlier conference for NZIS, new website, new format for awards and a new leader's guide

National Office, NZIS

Following the *Stakeholder Workshop* conducted in November 2016 with Branch and Stream representatives, changes are afoot for both the annual conference and the technical recognition awards. Planning is underway for this year's conference in June. Traditionally the annual conference has been held in conjunction with the NZIS Annual General Meeting in October, however from feedback and discussions more flexibility in timing and length is the preference. This year's conference is planned for three days 22-24 June and will be hosted by the Napier Branch.

There have been indicators that the way we recognise the professional and technical excellence amongst members is overdue for a review. The number of entries for the Awards of Excellence have been steadily declining in the last few years and this, along with the introduction of the Cadastral Survey of the Year award and strong growth of the NZ Spatial Excellence Awards, are good indicators that the model we have been using is in strong need of an overhaul. Action is underway with a working group set up. They will review and recommend how we recognise and award the excellent work undertaken by members in the future. Feedback will be sought as the group progress their review. Any NZIS members who have strong ideas and thoughts on this matter can send them to *nzis@surveyors.org.nz*.

The new NZIS website is in final testing phase as we go to print. The refresh includes, amongst other things, a new look and feel, refreshed layout and text, and improved directories for features such as news items, events, members and Registered Professional Surveyors.

The website makes it easier for the public to find out more about what spatial professionals do and simplifies the process of finding consulting surveyors, members and registered professional surveyors. Members can also control what contact details they want discoverable to other members and the public.

A comprehensive NZIS *Leader's Guide* is in the final stages of review and should be available in March. It is designed to help NZIS branch, stream, special interest group or division leaders with their executive functions. The supporting material in the guide covers all the key functions expected to be encountered, and is designed to be easily updated and added to in the future.

SPREADSMART™

Creating safer skies and better sustainability for aerial topdressing

Andrew Old, GIS Analyst, Ballance Agri-Nutrients

An award winning development in aerial topdressing is making it safer for pilots to navigate one of the world's most dangerous professions while improving on-farm sustainability.

SpreadSmart™, by Ballance Agri-Nutrients, provides topdressing pilots with an innovative map system for applying fertiliser across New Zealand's diverse farmlands. The system was recognised at the New Zealand Spatial Excellence Awards (NZSEA) in November last year, winning the Innovation and Commercialisation category.

How it Works

Previously, fertiliser application via aerial topdressing required pilots to manually open and close a hopper door to spread fertiliser while navigating a variable and complex landscape, whilst travelling at 250 km/hr. To address this, the following hardware is installed on the aircraft: a TracMap GPS, a hopper gate controller, and a hydraulically operated hopper gate.

Fertiliser product algorithms were created and loaded into the controller, and variable rate capability is coded into the guidance system.

A prescription map process has been created using ArcGIS that models slope based research for nutrient productivity and nutrient transfer on hill country farms using a farm boundary map. The prescription map generates different slope categories from an elevation model for the property. The slope classes are 0 – 12 degrees, 13 – 25 degrees, and over 25 degrees, and are aggregated to a grid of 45m x 45m squares. This is the minimum response unit for the aircraft. A fertiliser rate can be associated with each slope class. Exclusion zones are defined and a 30 metre buffer is incorporated for environmental compliance purposes to ensure areas such as waterways, dwellings, native bush, and stock camps are excluded. A surface area calculation to estimate the true farm area is included to allow for a better estimation for the ordering of fertiliser.

The resulting prescription map created is then transferred to the GPS device, which in turn informs the hopper controller as to what fertiliser rates should be applied.

The above GIS process is automated through ArcGIS Model Builder.

Benefits of SpreadSmart™

Most importantly this automated technology has led to an increase in safety for topdressing pilots. However the system was also developed as part of Ballance's Clearview Innovations Primary Growth Partnership programme with the Ministry for Primary Industries, and was designed to improve nitrogen and phosphate management systems.

Improving fertiliser management was achieved by the creation of a prescription map that the aircraft was able to follow. When a prescription map is created it can be compared to the proof of placement that is returned from the aircraft. It also has the potential of becoming an auditable document. This can be passed back to the farmer as a record of the job completion.

The automated hopper gate had a response speed of 0.2 seconds for a rate change, this is dramatically faster and more accurate than the manual, human-operated system which was measured at 0.8 seconds for a rate change, thereby removing human error.

The process focussed on excluding areas that were deemed unproductive or environmentally sensitive. Examples of these are streams, wetlands, bush areas, retired land, dwellings, and raceways/tracks.

Ballance Science Strategy Manager, Warwick Catto, says SpreadSmart™ will provide the opportunity to explore different spreading techniques – allowing for the development of fertiliser products that can target certain land features or production limitations.

"This system keeps fertiliser out of waterways, gullies, forestry blocks, tracks and other no-go zones and allows for different fertiliser products to be specifically targeted to different areas of the farm, improving overall production," says Mr Catto. "It also combines variable rate application, so different parts of the farm get exactly the volumes of fertiliser they need. With fertiliser one of the largest on-farm costs, precision applications also mean budgets go further, improving farm margins."

SpreadSmart™ Success

SpreadSmart™ was launched at Mystery Creek Fieldays in June 2015 and has grown in popularity and interest. Fol-

(continued bottom p30)

Geodesic Precision

Garry J. Tee, Department of Mathematics, University of Auckland, tee@math.auckland.ac.nz

The Shanghai Supercomputer Centre is the world's most powerful computer (so far as is known, publicly). Its speed and capacity are so large that it could handle four times its current workload. I presume that many people are considering projects which could apply that surplus computer capacity in a useful manner. Many previous computers, when they began operating, could handle much more than the initial workload, this has stimulated some people to make effective use of that surplus computer capacity.

In 1958 I realised that electronic computers were going to become extremely important, and so I went to England to get into computers. Quite literally – on cold winter days, three of us at a time would huddle inside the central processor of a DEUCE computer, basking in the radiation of thousands of glowing thermionic valves. From 1958 to 1964 I was a consultant mathematician with English Electric Co; where I gained experience in numerical analysis and in computing.

Many universities were founded in the United Kingdom in "the white heat of the technological revolution". Early in 1964 I got shanghaied into the Department of Mathematics at the new University of Lancaster, to be opened six months later.

Much planning and organisation was essential to get the University started in its temporary site at St Leonardgate, and then at Bailrigg. I was closely involved in the selection of the ICL 1909 computer, and of the IBM 1620 computer as a stopgap until the ICL 1909 could be delivered. I have vivid memories of the IBM 1620 being moved to its site on the top floor, by methods which you will find illustrated in an Egyptian tomb of the Old Kingdom, depicting a colossal statue being hauled into place by many men sweating with ropes.

When the ICL 1909 was installed at Bailrigg in 1966, its computing capacity was much greater than the University people could then use, as has often happened when a new computer has been installed. Accordingly, the University offered to hire its computing facilities to businesses, at periods when the computer was not required for internal usage.

One application (in 1967) by a pigeon-racing firm in Oldham was referred to me for action. The firm organised races for homing pigeons, including sending the pigeons by train in baskets to a specified railway siding, where the railway staff were instructed to release the pigeons at a specified time. Each pigeon fancier recorded the time at

(continued from p29)

lowing a review of the SpreadSmart™ service, Ballance has decided to make the use of the SpreadSmart™ technology a standard for all jobs where the aircraft is fitted with the equipment.

Ballance beat finalists Marlborough District Council and fertiliser co-operative Ravensdown to win the Innovation and Commercialisation category of the NZSEA, and is now eligible for the Asia Pacific Spatial Excellence Awards, to be held in Sydney in April next year.

which his pigeon returned to its loft. The firm also provided its customers with the distance from the train to the home loft. Such firms had traditionally used Ordnance Survey maps with a plane approximation to the Earth's surface – but some rival firm had recently offered the incentive of spherical trigonometry, using mechanical calculators to compute the path-length over a spherical Earth. The Oldham firm decided to outbid their rivals, by offering to compute the path-length over a flattened ellipsoid, correct to one part in 100 million! I explained to the representatives of the firm that such accuracy was meaningless for a pigeon, flying over the Earth which is not exactly a flattened ellipsoid – but the representatives insisted that their customers would want it. Accordingly, I consulted Guy Bomford's treatise *Geodesy* (Clarendon Press, Oxford, 1952), and selected one of the several oblate spheroids which have been used to approximate the Earth's surface. I wrote a far-from-trivial procedure in ALGOL 60 to read a pair of (spheroidal) latitudes and longitudes and produce the geodesic distance in metres, and I used that in a programme which read those pairs of coordinates and printed out the geodesic distance converted to miles and feet.

After the firm had used my programme on several occasions, one of our data-punching staff noticed that the data sheets provided by the firm included numerous longitudes ending in 0.2 or 0.8 seconds of arc. I asked the representatives of the firm about that oddity, and they told me that British Rail supplied them with the coordinates of the end of each railway siding, to one second of arc in longitude and latitude. Most of the sidings used by that firm were orientated East or West; and somebody in the firm realised that, at English latitudes, when a luggage wagon was oriented east-west, the central door was 0.2 seconds of arc of longitude from the buffer, at the end of the railway siding. Accordingly, for such sidings, the longitudes supplied by British Rail were "corrected" by the firm, by adding or subtracting 0.2 seconds of arc!

After I returned to the University of Auckland in 1968, I heard that the University of Lancaster had, in the 1967-1968 academic year, earned 140 pounds from that Oldham firm by using my programme.

Garry John Tee studied at Auckland University College, and graduated as MSc (NZ). In 1957 his first job was as a Computer, with a geophysical prospecting team searching for oil in the Northwest Australian desert. He analysed geophysical data by cranking a Brunsviga calculating machine and flipping a slide rule. In 1958 he realised that electronic digital computers were going to become extremely important, and so he went to England where he became a mathematical consultant in industry. He became a foundation member of the Department of Mathematics at the University of Lancaster in 1964, and he returned to the Department of Mathematics at the University of Auckland in 1968. In 1980 he also became a foundation member of the Department of Computer Science. In 2003 he became the first Honorary Doctor of the Auckland University of Technology. He works on numerical analysis and on the history of Science.


24 Lancaster Guardian Special Supplement

COMPUTER FACILITIES

The Department of Mathematics is responsible for the management and operation of the University computor. This is an ITC 1909 machine, the initial installation consisting of a 16K (24-bit, 6 microseconds), with facilities for paper tape and cards, four magnetic tape decks and a fast line printer. This is housed in a specially designed building at Bailrigg, and is adequately staffed with operators and programmers.

ICL1909 computer. Image provided by Professor Andrey Lazarev, from a supplement to the newspaper *Lancaster Guardian* in 1967.

START TO FINISH Survey Grade RPAS

From $9K - $26.5K+GST

Aerial mapping with cm accuracy has never been so easy!

PHANTOM 4 ESSENTIAL

M100 HIGH PERFORMANCE

B.Y.O RPAS AeroPoints

With our RPAS survey bundles, you get:

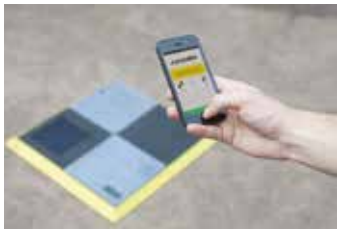
- Your choice of DJI Phantom 4 or Matrice 100
- AeroPoint revolutionary control points
- Propeller web-based processing & analysis tools

Already own a Remotely Piloted Aircraft?

Simply purchase a pack of AeroPoints to add accuracy, efficiency and simplicity to your aerial mapping tasks.

1. Set out AeroPoints

2. Fly RPAS



3. Collect AeroPoints

4. Analyse Data

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

Protecting Outstanding Natural Landscapes

Mick Strack & Mitchell Holyoake (BSurv(Hons)), National School of Surveying
Mick.strack@otago.ac.nz, mbholyoake@gmail.com

Outstanding Natural Features and Landscapes (ONFLs) are clearly identified in our environmental legislation and policy as requiring protection. The Resource Management Act 1991 (RMA) identifies the protection of ONFLs as a matter of national importance, and the New Zealand Coastal Policy Statement 2010 (NZCPS) includes policies to avoid adverse effects of activities on ONFLs, and specifically to protect them from inappropriate subdivision, use and development. Therefore, surveyors and land development planners have a specific responsibility to ensure the implementation of the legislation and policy. However, there is uncertainty about how to make this work. While policy guidance is provided for coastal landscapes (in the NZCPS), other landscapes are not similarly provided for. Furthermore, some court decisions are either unclear about their application, or are inconsistent. It is worth reviewing how local authorities, surveyors and planners may enhance their understanding of landscapes and their protection.

Protection of Landscape in the RMA

The RMA provides specific recognition for the protection of landscapes that are both outstanding and natural. While the protection of ONFLs is not the primary purpose of the Act, it is a strongly stated principle that contributes to the sustainable management of natural and physical resources.

> s6. In achieving the purpose of this Act, all persons exercising functions and powers under it, in relation to managing the use, development, and protection of natural and physical resources, shall recognise and provide for the following matters of national importance:
>
> > (b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development (s6 RMA 1991).

It is, therefore, a vitally important consideration for all land development, resource consent applications and land use changes. However, there are numerous uncertainties about addressing landscape protection, not least of which is determining the meanings of 'outstanding', 'natural', 'landscape', and 'inappropriate'.

What is Outstanding?

Some definitions of outstanding suggest that an outstanding feature or landscape is conspicuous, or to stand out from the surroundings. However, other decisions from the Environment Court have held that a feature or landscape can be outstanding if the surrounding landscape is outstanding. The Environment Court affirmed this in *Upper Clutha Tracks Trust v Queenstown Lakes District Council* 2010:

> an averagely natural landscape may be an outstanding natural landscape simply because its experiential or associative relationship character is so remarkable it lifts the landscape into the category.

The judgment of "outstandingness … depends on the specific characteristics of the 'natural landscape' being considered." It remains problematic that the definition of 'outstanding' is inconsistently applied.

What is Natural?

The Courts have acknowledged that almost all of our landscapes are, to some degree, influenced by human activity, but have been inconsistent in assessing a critical point of naturalness, between pristine and a developed landscape.

The Environment Court has provided some useful criteria to assess naturalness. In 2008 the Court described a natural feature or landscape as:

- relatively unmodified and legible physical landform and relief;
- the landscape being uncluttered by structures and/or "obvious" human influence;
- the presence of water (lakes, rivers, sea);
- the presence of vegetation (especially native vegetation) and other ecological patterns.

What is a Landscape?

The New Zealand Institute of Landscape Architects (NZILA) defines a landscape to be:

the cumulative expression of natural and culture features, patterns and processes in a geographic area, including perceptions and associations.

In other words, the term landscape is understood at two levels. The first is as a vista; a physical view, and the second is the human perception.

When identifying a landscape type, an assessment of both physical elements and the human associational component is required. The first is primarily used for the purpose of mapping. The second method is a psychophysical approach used to understand how the community and individuals appreciate and value an area. Both of these approaches are included in a landscape assessment. One of the many important qualities of natural landscapes is that they enhance the quality of life, especially those living in urban environments. Natural landscapes support many recreational activities and provide a means for people to re-connect with nature and refresh their minds and bodies. This multifaceted understanding of 'landscape' is often not well understood and applied. In many cases a landscape is only assessed for its physical qualities and human perception is disregarded.

Outstanding Natural Landscapes (ONLs) are normally identified by regional councils in their regional plans. Land developers, surveyors and planners therefore need to consider how land development will affect these ONLs. Subdivision and new boundary alignments do not in theory have a direct impact on the landscape; it is the subsequent landuse that has the impact. But given that a change of landuse is the inevitable outcome of any subdivision it is disingenuous to deny the effects of subdivision.

There is uncertainty as to how this principle is to be applied and what protection the RMA provides for ONFLs. As may be expected, the Courts have been drawn into the interpretation debates. In 1999, the Environment Court attempted to guide landscape assessment and produced what became known as the Pigeon Bay criteria. In a later case, *Wakatipu Environmental Society v Queenstown Lakes District Council* [2000] held that "a precise definition of 'landscape' cannot be given" and instead a list of criteria defining landscape is most appropriate. The Court held that the *Pigeon Bay* criteria were a more appropriate way of defining 'landscape', but it provided a modified version of how landscapes may be assessed:

a. the natural science factors – the geological, topographical, ecological and dynamic components of the landscape;
b. its aesthetic values including memorability and naturalness;
c. its expressiveness (legibility): how obviously the landscape demonstrates the formative processes leading to it;
d. transient values: occasional presence of wildlife; or its values at certain times of the day or of the year;
e. whether the values are shared and recognised;
f. its value to tanagta whenua;
g. its historical associations.

More recently, the Environment Court case *Maniototo Environmental Society Incorporated v Central Otago District Council and Otago Regional Council* in 2009 rejected the amended Pigeon Bay criteria. The Court criticised the criteria for being out of date, holding it did not correspond with contemporary landscape practice. In *Upper Clutha Tracks Trust v Queenstown Lakes District Council* [2010], the definition of landscape was reconceptualised into three sets of factors:

(1) a reasonably comprehensive (but proportionate to the issues) description of the characteristics of the space such as:

- the geological, topographical, ecological and dynamic components of the wider space (the natural science factors);
- the number, location, size and quality of buildings and structures;
- the history of the area;
- the past, present and likely future (permitted or consented) activities in the relevant parts of the environment; and

(2) description of the values of the candidate landscape including:

- an initial assessment of the naturalness of the space (to the extent this is more than the sum of the elements described under (1) above);
- its legibility – how obviously the landscape demonstrates the formative processes described under (1);
- its transient values;
- people and communities' shared and recognised values including the memories and associations it raises;
- its memorability;
- its values to tangata whenua;
- any other aesthetic values; and
- any further values expressed in a relevant plan under the RMA; and

(3) a reasonably representative selection of perceptions – direct or indirect, remembered or even imagined – of the space, usually the sub-sets of:

(a) the more expansive views of the proposed landscape; and

(b) the views, experiences and associations of persons who may be affected by the landscape.

What is inappropriate?

Up until *King Salmon* in 2014, there had been little guidance from the courts in defining the scope of inappropriateness. Historically, courts simply addressed what is inappropriate on a case-by-case basis, generally deciding that if the effects were positive then development was appropriate and if effects are negative, then development is inappropriate. However this did not provide a clear guide for decision-making. In *King Salmon* "some uses or developments may enhance the natural character of an area". An applicant, therefore, has the ability to emphasise positive effects associated with a proposed development and the severity of adverse effects could be overlooked. Such a balancing act does not provide adequate protection. National guidance has the ability to require decision-makers to follow a procedural method whereby positive effects would not suppress adverse ones.

National Policy Statement

As described in the *King Salmon* [2014] case, National Policy Statements (NPS) are at the top end of the cascade of documents used to provide guidance for the RMA. Also as decided in that case, a NPS can provide clarification about the choices that may seem open in the interpretation of the RMA. Specifically, and as demonstrated in the NZCPS, a clear statement about the need to "**avoid** adverse effects of activities on outstanding natural features and outstanding natural landscapes in the coastal environment" (Policy 15 (a)) had the same effect as a rule – or an environmental bottom line – rather than just another of the multiple considerations that may be balanced out in decision-making.

So, while the NZCPS addresses protection of outstanding natural landscapes in the coastal environment, those landscapes should similarly be protected in non-coastal environments. A specific landscape NPS could be an appropriate means of achieving consistent direction and environmental outcomes throughout the country. Benefits of having a NPS on ONFLs include having a clear direction on what effects are tolerable. Similar to the NZCPS, a NPS on ONFLs could mandate the avoidance of adverse effects. A NPS would provide regional councils with guidance for how they are to identify, recognise and provide for ONFLs in their Regional Policy Satements. Ultimately, a NPS would specify the minimum expectations for how ONFLs are to be protected. This would provide local government with guidance for what issues policy statements and plans need to address, and standards for how ONFLs are to be protected. Local government plans will have to give effect to the national policies but they would also have sufficient scope to tailor responses and policies in their region to be most effective for the local context.

Implementation

It is a clear responsibility of surveyors to implement law and policy in a well-informed and proactive manner. The importance of landscapes should be at the forefront of decisions with all land development; land use and subdivision consent applications. Surveyors may enhance their reputations by advocating for ONLs. They may be more effective at gaining resource consents if they have appropriately engaged with a full understanding of landscapes. And they will design and develop more appropriate subdivisions if they have brought this essential element of resource management into their professional practice.

Conclusion

Natural landscapes contribute largely to New Zealanders' sense of place, improve their quality of life, support the economy through tourism, and provide a haven for biodiversity. Despite these benefits of natural landscapes, there remains concern about how legislation and policy documents provide protection. Some bottom-line rules on protection of ONLs would provide guidance for local authorities, surveyors, planners and land developers, and will assist with the promotion of the sustainable management of our natural and physical resources.

Seven traits of a healthy workplace culture

Mark Fisher, eighty4 Recruitment

Talk to any massage therapist and they'll tell you just how toxic a bad workplace can be for an employee. Headaches, hunched shoulders, depression and malaise are all common symptoms of someone working in an organisation with bad culture. I'm no doctor but I'm pretty sure that Sundayitis is truly a real disease and a direct result of a toxic work environment. It doesn't matter how big your pay packet is or how many weeks holiday they throw at you, nothing is worth the stress of being battered down by a unhealthy workplace.

But sometimes it's not until you're in a job that you realise the company, no matter how awesome your job description is, is terrible to work for. How do you avoid the trap of signing up to a company with a miserable workplace culture? In my experience, there are seven things you can look for.

(If you're a manager in a company, see how your business weighs up against these seven things. There may be places you can improve your culture to become an even better place to work.)

1. TURNOVER IS LOW. See if you can talk to some of the staff. Do you come across plenty of long-termers or does it seem like most are new recruits? How about the management team – have they been there forever and moved up the ranks, or are they new hires too? Low turnover is a good sign of a healthy workplace culture. People don't look for greener pastures if they're being fed well where they are.
2. STAFF HANG OUT AFTER HOURS. Social clubs, after-work BBQs, regular exercise groups, work teams entering sporting events and in-house competitions are all good signs that employees get on well and enjoy the company of each other. This in turn leads to employees acting as a team, working towards the same goal, rather than working as less productive silos.
3. THERE IS A CLEAR VISION OR MISSION. Some companies proudly hang their mission, vision or core values in the reception area, where anyone visiting can see them. Ask employees, check their website – is their mission clearly communicated? A happy employee is one who knows what the end goal is and how their cog fits into that process. It also helps them make decisions that are in line with what the business is ultimately gunning for.
4. EMPLOYEES ARE KEPT IN THE LOOP. The fastest way to make your team disgruntled is to keep them in the dark, and hold your cards close to your chest or close doors for every meeting. Stop doing this. Sure, you don't need to spill every company move or secret to all in sundry, but the more you communicate with people and keep them in the loop, the more they feel part of the team and the harder they'll work for that team.
5. AWESOME PEOPLE WORK THERE. Why would the cream of the crop work at one business over another? Because of the culture. Businesses with a healthy workplace culture have a good reputation – a reputation of innovation, fun and success – so people *want* to work there. Think Facebook. Think Google. Think Zappos. (If you don't know about the workplace culture of these places, Google them and get inspired).
6. THE BUSINESS IS INNOVATIVE. A healthy workplace is one where people aren't afraid of making a mistake. Rather than sitting with their head down and mouth shut, they know they can offer their opinion and be heard. They know they can try new things (and possibly fail) without being flogged. They know that their company will support their efforts to do things a new and better way. That's why companies with a great culture are always ahead of the pack when it comes to innovation.
7. MANAGERS ARE LEADERS TOO. The top tier at workplaces with an awesome culture don't just sit locked away in closed offices instead they inspire and motivate their staff. They mentor and they lead by example. As a result, their employees enjoy working for them and learning from them and enjoy turning up to work each day.

So when it comes to joining a new company, access their workplace culture. If it seems negative and toxic, steer clear – you'll never achieve what you want to there. If they tick the seven boxes outlined above, put your hand up to be part of a company that has drive and enthusiasm. Your health will thank you for it.

Mark Fisher is a straight-shooting career coach and founder of Eighty4 Recruitment, which specialises in recruitment and HR consulting for the engineering, construction, transport and planning sectors. www.eighty4recruitment.com

Eighty4 Recruitment are assisting an NZIS Young Professional to attend this year's FIG Working Week in Helsinki , Finland in May. Visit the YP Facebook page: @NZISYoung-Professionals for more information.

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!"

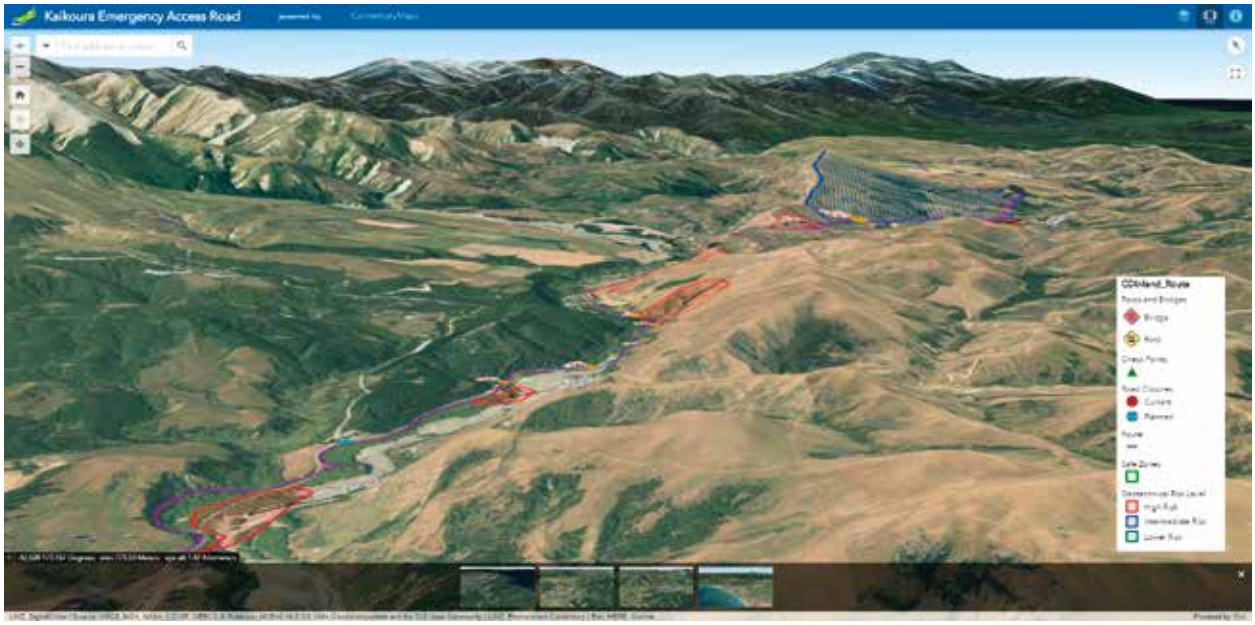
- Kevin Birch, Director of Birch Surveyors

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—



Example of 3D application used in emergency response – Kaikōura Inland Route Hazard Assessments

CANTERBURY MAPS

The importance of a regional mapping service during the Kaikōura earthquake

Iain Campion, Environment Canterbury Team Leader Data & GIS

A 7.8 MAGNITUDE EARTHQUAKE STRUCK NORTHEAST OF CULVERDEN, IN CANTERBURY, ON 14 NOVEMBER 2016. THE INITIAL EARTHQUAKE, AND ITS SUBSEQUENT AFTERSHOCKS, CAUSED SIGNIFICANT DAMAGE TO LAND, COASTAL AREAS, BUILDINGS, AND INFRASTRUCTURE.

The initial effort by various agencies was focused on saving and preserving lives, and starting to understand the magnitude of the situation. Vital to this was understanding what had happened to the environment; there were rumours of several destroyed houses, a lifted seabed, slips cutting off the highway north and south of Kaikōura and broken sewerage pipes leaking.

Very quickly, Civil Defence identified geospatial support would be of high importance to help provide the insights and overview of the efforts happening on the ground. Canterbury Maps' partner councils realised they needed to work together to provide the required geospatial support for the direct response and continued support during the recovery phase.

What is Canterbury Maps?

It is a joint data-sharing initiative by Canterbury's regional and local territorial authorities.

As the name suggests, Canterbury Maps is a repository of maps, applications and data from the local government councils in the Canterbury region.

Interactive map resources include, but are not limited to; Canterbury's air and water quality, recreation and parks, planning zones, resource consents, transport links, local attractions and council services.

It has been co-ordinated by staff at Environment Canterbury Regional Council working with: Kaikōura District Council, Hurunui District Council, Waimakariri District Council, Christchurch City Council, Selwyn District Council, Ashburton District Council, Waimate District Council, Mackenzie District Council, Timaru District Council and Waitaki District Council.

Involvement of Canterbury Maps platform

The Canterbury Maps cloud platform enabled the government, not-for-profit, and private organisations involved in the earthquake response to easily access and disseminate information, manage field data collection and work in a collaborative manner from locations all over the country.

In the early stages of the response, the most affected councils, Hurunui and Kaikōura, worked directly with the Canterbury Maps team and associated partners to get the platform configured and up and running.

Access to the platform was then granted to those who needed it; from contractors working directly with the councils involved, to staff from other councils across New Zealand and central agencies, including the New Zealand Fire Service, the Ministry for Civil Defence Emergency Management to technology partner's Eagle Technology.

By having one platform, the regional council was able to achieve an overview of the many activities occurring, and streamline processes so more than one council could re-use those same data-rich applications. The data was rapidly entered with lots of new datasets collected which all helped develop spatial and situational awareness for all three councils. It was vital to the response effort.

In its simplest form, the data provided points of reference on roads, pipes, contours, titles and addresses. Ultimately though, this data meant responders could quickly ascertain the status of local roads, where slips were, whether bridges could be used and the state of houses. The spatial view was vital to this as it helped provide the 'picture' of the emerging situation.

Aerial imagery also helps councils by providing data for future information. Canterbury Maps hosts historic aerial imagery that can be used to compare the current to the then. This was particularly important after the Canterbury earthquakes when identifying past historical land uses.

The new 'map': the future of data

In the response and recovery phases of natural disasters there is a large drive, and hunger, for spatial data.

Every activity, or condition of assets on the ground, can be related back to a number of spatial datasets and is better represented as a 'map'. For example, when rivers are flooding, dams are forming, when properties are damaged, when water pipes are leaking and when roads are damaged, this information would usually be displayed on static printed maps, but technology has moved on from paper maps. The Canterbury Maps platform offers live 2D or 3D maps that let the user move/pan around the region zooming in and out at different scale levels, it shows live data streaming onto the page and typically an aerial picture of the location. For example, some of the first earthquake response aerial photos helped build up a picture of the various slips which went on to the website for anyone to look at if they zoomed into that scale.

During, and after, the event there are a large number of new datasets acquired. Typically these are used and acquired for purposes directly related to the local or regional council activities.

Technology has evolved rapidly which increases the capability of the platform to host more information. Typical technology used now ranges from multispectral imagery, 4 band aerial imagery, LiDAR, use of drones and a simple use of taking video and pictures shot on an iPhone from helicopters. All these sources are used to develop situational awareness maps, 3D scenes, site maps and building inspection applications to gather and distribute critical information to stakeholders.

In the regional council case, this work is critical for coastal hazards analysis, dam landslide assessment, river engineering assessment and flood assessment. The geospatial products needed for these activities are, and can be re-used, for other activities that the spatial industry is involved in. Therefore, it is important that local government acquire data in an open and re-useable license so that the region doesn't have to pay the cost of the data over again. This is the case on the Canterbury Maps service with more than 400 datasets available to be downloaded and re-used by spatial professionals free of charge.

The importance of a regional mapping service

Regional mapping services, like Canterbury Maps, are important to collate the various regions' data to a common dataset and disseminate the data through public download services.

Datasets acquired for local authorities have many other uses, not just the primary function intended for the council. Councils gaining an understanding of what datasets are important to their stakeholders can then take this into consideration when curating datasets within the region.

This leads to businesses being more efficient and hence eliminating wasteful cost and time out of the region's economy. These datasets are then re-used by various industries and companies in their own business activities to solve real world problems. For example, Aurecon's geospatial services team use the historical aerial photography web service to show site usage through time, which is particularly useful for its land development team and geotechnical engineers, as well as its clients when assessing the suitability of a site for future development.

Datasets regularly used are aerial photography, permitted activities data (such as consent records), wells data, planning data, infrastructure data and elevation data.

Lessons and challenges

During disasters like the Kaikōura event, challenges with spatial data are uncovered or highlighted again. When there is a hive of activity in an area collecting data on various reference objects, issues can arise of sharing a common understanding of that reference object.

Problems highlighted in the Christchurch earthquake were still evident in this event. Assessing and capturing dwellings can be challenging to record when New Zealand still is behind other countries in terms of reference data relating to property. What does the word property mean to you? It means many things to many people and has many datasets associated to it. The most common dataset that hangs off all these is the common street address. But, our street address datasets are not in a form to link 100 per cent to the right dwelling(s), parcel(s) and title(s) in all cases.

For example, data was captured against a school which has one address but multiple dwellings in various states. This caused the issue of determining which dwelling needs to be demolished and which dwellings are safe? Practical measures take over in the latter case with pieces of paper taped to the windows.

Example of collected building assessment data and the challenges relating this to existing property information

You would be surprised how much time was spent during the event geo-coding and correcting data flowing into and out of the councils because the common data element was only a non-validated street address. In rural areas, such as Kaikōura and Hurunui, this problem is different again, with a common understanding from a person that property is of the farm area, not the simple intersection of the street address with the first parcel.

Although these issues still exist after the Christchurch earthquake, there is light at the end of the tunnel as Land Information New Zealand is actively working on solutions to link all these datasets together through initiatives like the integrated property framework.

The biggest learning overall, which underpins everything we're trying to achieve, is that natural disasters don't discriminate between regions, meaning collaboration is more important than ever for quick reliable data gathering to inform response and recovery decisions both for councils, contractors, businesses and the community.

Spatial Open Data

Nathan Heazlewood (right) has been working with Auckland Transport supporting initiatives such as encouraging more people to commute using cycles rather driving. It is hoped that by releasing data as open data other organisations can come up with innovative solutions that will assist with initiatives like this.

Nathan Heazlewood, GIS Programme/Project Manager, Eagle Technology

Professionals in the Spatial Industry are well aware of the benefits of GIS data. Studies such as the ACIL-Tasman 2009 Report: "Spatial information in the New Zealand economy" as well as other more recent international studies have highlighted this. However one of the key undertakings that underpin this, and something that needs to continue to be enhanced, is the sharing of GIS data.

One aspect of GIS that differentiates it from many other branches of technology is that there is a 'common denominator' which can be used to bring many disparate datasets together and provides many meaningful relationships between datasets that might otherwise appear to be incompatible. Geography is a common fabric onto which many different types of data can be overlaid and many new insights can be determined, even from seemingly unrelated sources. It is hard to think of many other variables that provide this type of common variable that can be used to relate and compare many different types of data. I can think of only two that demonstrate this property: the date/time when events happen and US dollars, which can both be used to associate and compare all sorts of different data.

In part due to the common fabric of geography that the spatial industry shares it has been a tradition as old as the industry itself for different organisations to attempt to share data with other organisations. It is generally efficient to try to use data created by someone else as the first course of action when setting up any GIS project.

In the early days of the industry organisations often attempted make money from sharing their data (and some still do). I recall early in my career at Department of Survey and Land Information when the complete NZ Topo Dataset was charged to clients for seven figures, so hardly anyone purchased the entire thing. People used to purchase tiny tiles and specific layers because of the costs.

Case Study: Auckland Transport

Roger Jones, Chief Technology Officer at Auckland Transport is a keen proponent of Open Data. I asked him for some comments on this topic and he said:

> "Auckland Transport has been working for several years to make data openly available, enabling third parties to develop new and innovative applications for use by citizens and the travelling public. We have already provided a number of developer API's (application programme interfaces) and the extension into providing a GIS Interface we believe will provide further opportunity for developers to provide enhanced information and customer facing solutions. Auckland Transport will be working to continually expand on the data that is available."

Recently I have been working with the GIS Team at Auckland Transport on their new GIS Open Data Portal (released December 2016). The Technology Strategy for Auckland Transport indicates a strong support for the release of Open Data. Auckland Transport recognises the benefits of providing its data as Open Data in terms of its own direct strategic goals, business partners, customers, technology innovators and ultimately for the wider benefit to Auckland ratepayers and transport users. A key objective mentioned in Auckland Transport's Technology Strategy is: *"enabling collaborative use, reuse, discovery and management of information"* whether it be internally, with partners or with the wider community through channels such as Open Data.

The strategy document highlights the importance of digital technology for a modern transport system:

> "A modern transport system requires the technological "glue" to collect, process and utilise data to provide operational effectiveness, efficiency, safety and resilience across all transportation modes and services. Future modes such as semi or fully autonomous vehicles ("driverless cars"), freight drones and mobility as a service (such as carpooling or car/bike sharing), will be reliant on digital technology."

Auckland Transport has committed to "make it easy for customers to do business with us" and providing Open Data contributes to this.

There are a number of challenges that need to be addressed when considering releasing Open Data:

- Business Owners often want to charge for releasing data. In central and local government this attitude is slowly being changed. While in some cases there may be valid reasons for organisations wanting to charge for data, many public sector organisations are realising that the public benefits of making data available outweigh the internal costs of publishing that data. It would be useful if the industry could provide more case studies and information to continue this trend.
- Understanding the provenance and accuracy of data that has been sourced from somewhere else is critical for knowing whether that data is fit for the purpose that another organisation has in mind for it. Auckland Transport have recognised this and have attempted to assist Open Data users by including metadata.
- Business Owners are often worried that if their data is not 100% accurate then they may face criticism. Increasingly people are recognising that the likelihood of criticism is low, and there are benefits in utilising crowd-sourced feedback to help improve the quality of the data. I think that criticism is mounting of Business Owners that cling to this excuse when the public would rather have caveated slightly inaccurate data rather than no data at all.

There are multiple Open Data channels that can be used and this can be confusing. Some organisations chose to have their own open data websites, while others effectively outsource this other sites such as Esri ArcGIS Online, Koordinates or LINZ. Each of these approaches have different pros and cons, for example using LINZ Land Data Service means that data is being catalogued with many other datasets with an NZ focus, whereas Esri ArcGIS Online means that those datasets are more visible to an international audience. Auckland Transport also has an API Platform that is intended for all types of IT developers to be able to find data and APIs (including but not specific to GIS). In my view, the best approach is to store the data in one place but then set up 'links' from many of the other catalogues to ensure that their audiences can also find the data. The work that Department of Internal Affairs (DIA) is doing with their new version of data.gov.nz and the Comprehensive Knowledge Archive Network (CKAN) API for 'harvesting' links between data repositories is important and more application of this concept is important.

- Many data owners and even a lot of spatial professionals don't fully understand the implications of data licensing and things like the differences between Creative Commons version 3 and version 4. Also, many people don't understand what 'derived data' is and the implications of, for example, mixing commercial data with your own data (this could theoretically land you in court!) I think that this is one area that the industry could do with more information about which would lead to better adoption of Open Data principles.

Auckland Transport has been working through many of the issues raised above and is making good progress. There are twenty datasets that are currently available through the Esri ArcGIS Online platform. This solution was chosen partly because of ease of publishing from Auckland Transport's internal systems, but also because there is already an index of 56,000 open data datasets from 3,600 organisations worldwide and therefore there is already a sizable international community utilising this facility and searching for Open Data through it. However, Auckland Transport is keen to ensure that users can also find this data through other channels and therefore work is planned to link this Portal to the Auckland Transport API page at *https://api.at.govt.nz/* and also to the new version of *data.govt.nz*.

Auckland Transport GIS Open Data Portal can be found here: *http://data.atgis.opendata.arcgis.com/*

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

CELEBRATING SUCCESS

Christina Hulbe, Dean, National School of Surveying

Happy New Year to you all. 2016 was certainly busy and 2017 is off to a great start as well. An excellent new cohort of students have completed their first surveying field camp and we are looking forward to seeing what they do next.

Starting the first professional year with a camp is important. It maintains the high standard for active learning that Jim Baszika establishes in SURV101 while steering students toward the high expectations yet to come. I'm sure that most folks reading this column remember the long days, late nights, and challenging work of a surveying field camp. What *we* remember is that you stayed the course, overcame the challenges, and developed important new skills. Jim takes these goals very seriously as he leads the large team required to pull it all together.

While we welcome a new class to the School, it's also a good time to reflect on student and staff successes of the year just passed. Four students pursued honours dissertation research in 2016. Working with Mick Strack, Mitchell Holyoake examined how outstanding natural features and landscapes have in practice been recognised and provided for. Without definition in the RMA, "outstanding", "natural", and "inappropriate" are all left to the discretion of courts and councils, with predictable results.

Michaela Thomson cast her net out across the Pacific and to the heavens, aiming to understand the astronomical significance of standing stone alignments at Taputapuātea and Hauviri maraes on Ra'iātea, in the Society Islands. Working with David Goodwin, her research combined traditional land surveying with star mapping software and geospatial visualisations in the Otago Museum planetarium.

In "Monitoring on a Budget", Ahmad Musa collaborated with Robert Odolinski to investigate the capabilities of low-cost, multi-constellation, single-frequency GNSS receivers for tracking the motion of engineering structures. Following this theme, Callum Johns worked with Robert to examine the true limits of low-cost GNSS, characterising errors associated with both the receiver and the location of the antenna phase centre.

Callum's academic capability was also recognised in end of year prize giving. He was awarded the 2016 *Premier Undergraduate Prize* in the Division of Sciences, given to the most outstanding undergraduate or honours student in the Division. The citation noted his honours dissertation, peerless academic performance, and dedication to extracurricular tutoring and support of his classmates.

All three of the School's 2016 New Zealand Spatial Excellence Awards finalists won in their categories. BSurv graduate Jeanette Ma won the *Wellington City Council Undergraduate Student of the Year* award for her work on 3D modelling of the Dunedin Airport plant room. MAppSc GIS graduate Mike McConachie was recognised as *Postgraduate Student of the Year* for his project using drone-based imagery to classify sand dune vegetation at Mason Bay, Stewart Island. And staff member Antoni Moore won the *NZIS Education and Professional Development Award* for his teaching and research in geographic visualisation. In addition to the acknowledgement by the NZSEA, Tony's excellent performance in research, teaching, and service were recognised in his promotion to Associate Professor.

Continuing on with staff success, Mick Strack was recognised for his Innovation in Māori or Pacific Islands Course Content in the end-of-year Otago Sciences Divisional Awards. The honour recognises initiatives in the teaching of Māori or Pacific content in a sustained way in the teaching of sciences. Mick has engaged surveying students on these topics throughout his career and it's great to see him recognised in this way.

Colin O'Byrne has defended his PhD thesis on the "Influence of Governance on the Built form: The Redevelopment of Wellington, New Zealand's Waterfront Precinct." It's an interesting examination of issues that matter to us all and I'd encourage you all to have a read (it's a slim 284 pages if you don't count the appendixes). You'll find the thesis at the Victoria University open access research archive.

I will also add a welcome to Hamish McKenzie at Bay of Plenty Polytech. After years of focused effort establishing the distance taught Diploma in Surveying, Debbie Hallam has moved on to other challenges and Hamish now leads that programme. We're looking forward to new opportunities for collaboration in the year ahead.

ULTIMATE SPEED

- UltraSonic Motors
- 30% Smaller
- TSshield™ Service
- UltraTrak Technology
- Guaranteed Reliability

iX Series Robotic Total Station

Experience performance like you've never seen before. This is the fastest, lightest and most powerful robotic instrument on the market. And it's backed by a best-in-the-industry three-year instrument, five-year motor guarantee.

SOKKIA

www.sokkia.com

Contact your local dealer for more information about Sokkia products

Position Partners Auckland
09 479 3064
info@positionpartners.co.nz
www.positionpartners.co.nz

Position Partners Christchurch
03 366 2658
info@positionpartners.co.nz
www.positionpartners.co.nz

Position Partners

Shaping New Dimensions

"The Leica Captivate solution enables Envivo to make better on site decisions improving the efficiency of our field crews and the quality of our field work. We can now visually check on site the completeness of our job, ensuring that we have captured all the data we need and thus avoiding costly returns to the site. The Captivate hardware along with Global Surveys support solutions also provide Envivo with the technological framework to allow us to cope with the industries changing needs and venture confidently into the exciting world of 3D and BIM."

MARK FINLAYSON
Survey Director, Envivo Planning, Surveying & Engineering

LEICA CAPTIVATE RANGE

Experience the future of 3D surveying
Free LIVE Demo

GLOBAL SURVEY
SURVEY & CONSTRUCTION TECHNOLOGY

0800 453 422
WWW.GLOBALSURVEY.CO.NZ
Contact us now for our great promotions

Leica Geosystems