OPUS

In-Touch

Opus Central Laboratories

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BENEATH THE SURFACE

OPUS WAS SUCCESSFUL IN THE MINISTRY OF BUSINESS, INNOVATION AND EMPLOYMENT'S RECENT SCIENCE INVESTMENT ROUND AND HAS BEEN AWARDED $2.54 MILLION OVER 4 YEARS TO RESEARCH THE "SEISMIC RESPONSE OF UNDERGROUND SERVICES".

The saying goes that while a duck seems to be moving serenely across the pond, its feet are actually paddling like mad. Our cities are the same – while we go about our daily lives, below us a vast infrastructure is keeping the cities running.

Similarly, after the shaking stopped in Christchurch it was easy to see the damage the earthquakes had wrought on the city above. What wasn't as evident was what effect they had underground and this is what this new research project led by Dr Rosslyn McLachlan focuses on.

Opus will be working closely with industry to research lessons from the damage caused to underground services such as water supply, wastewater, storm water and telecommunications in order to make those services more resilient to future seismic events.

A GIS database of damage data from Christchurch will be combined with state-of-the-art 3D geological information and those findings will be further analysed using a large shaking table with earthquake loading sequences in order to look at and optimise the behaviour of typical models of pipeline components. To ensure this process is robust, 3D numerical analysis will also be used to assess various scenarios.

The project will also draw on GNS Science's expertise around geology and earthquake load sequencing, as well as their RiskScape model, which provides a framework for calculating the impact risk from different types of natural hazards. The knowledge gained from the testing and analysis will then enhance the RiskScape model.

When combined with Opus' previous work, this physical and numerical analysis will help in developing methodologies to assess the remaining life of existing underground utilities. This will allow more informed planning and decision-making around the positioning of utilities within the Christchurch area, as well as provide the basis for enhanced asset management methodologies applicable throughout New Zealand.

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ENHANCING ROADSIDE HARMONY

OPUS' BEHAVIOURAL SCIENCES TEAM PROVIDES RESEARCH AND CONSULTING SERVICES FOCUSED ON HUMAN INTERACTIONS WITH INFRASTRUCTURE.

Balancing the needs of drivers and pedestrians in the central business district (CBD) is a challenge for any modern, successful city.

In Wellington recent traffic management changes may have made the CBD environment even more challenging, with a number of high-profile bus-pedestrian accidents.

To help prevent such accidents our Behavioural Services team was asked to provide an evidence base from which to evaluate potential safety interventions.

Using video footage to observe over 1,500 pedestrian crossings in Wellington, they identified more than 35,000 crossing-related behaviours and examined a range of explanatory factors in order to determine how they influence actual, potential or "near miss" incidents.

There were several key findings:

- Only four per cent of crossings were not conducted in a safe manner;
- Less than two per cent of people were using devices such as music players while they crossed and these people were just as safe as others;
- Barriers may only work to shift the type and location of an accident;
- Pedestrians are often 'lazy' in looking for traffic; only 46% of the sample engaged in full, active looking prior to crossing;
- Clever use of roadside infrastructure can influence safer behaviour in pedestrians.

As a result, changes in roadside infrastructure are being trialled over the next six months to see whether they enhance pedestrian looking, waiting and gap acceptance behaviour.

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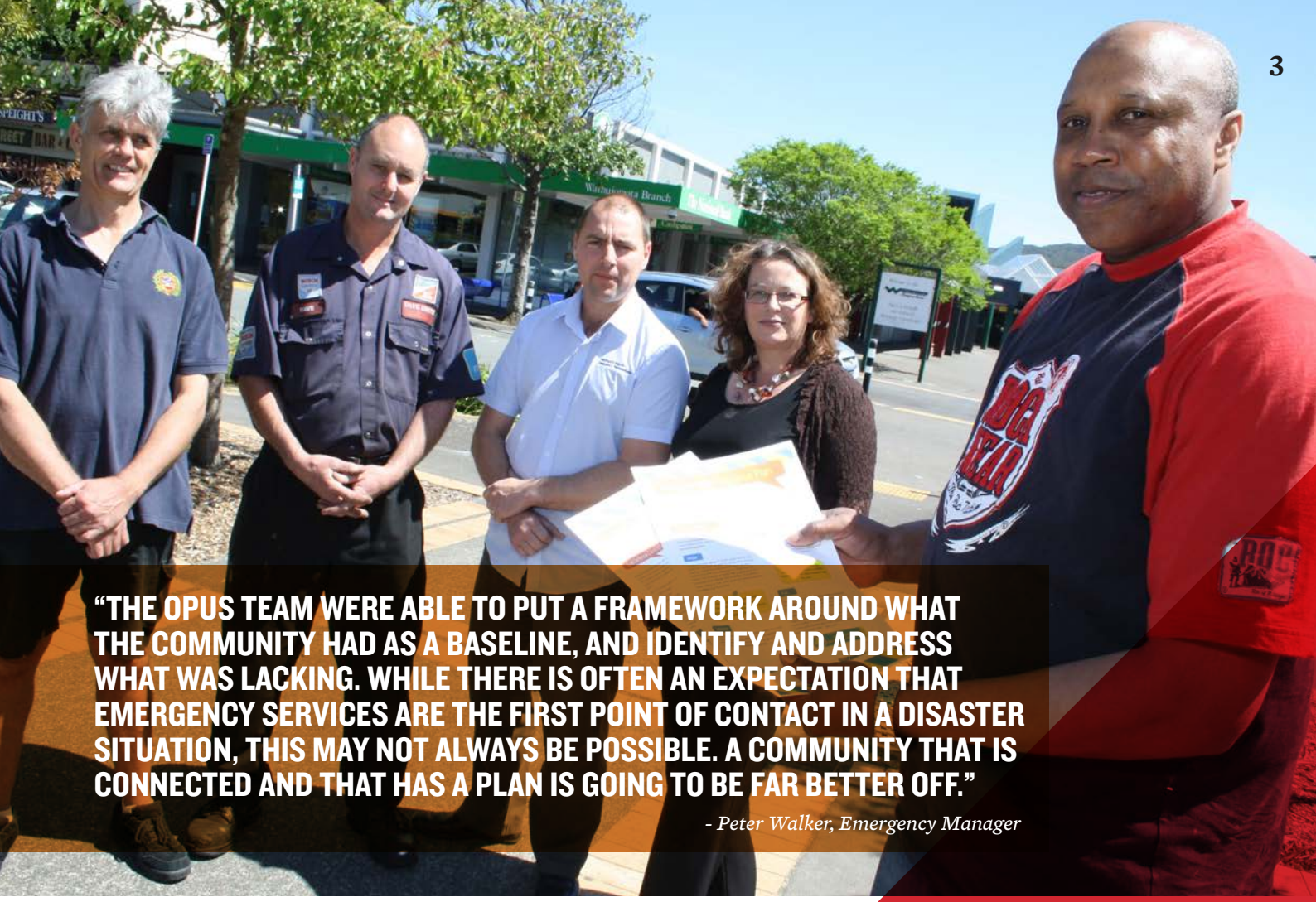

Wainuiomata Community Leaders and Emergency Managers with the response plan

CREATING SELF-RELIANCE

A disaster and its aftermath are difficult to predict. A community could be cut off from emergency services immediately after a hazard event, which means the ability to be self-reliant is key to resilience.

To help with this, Opus partnered with the Wellington Region Emergency Management Office to work alongside key stakeholders in Wainuiomata, an urban community of Lower Hutt, to produce a community response plan that would allow the community to respond to an emergency without assistance from Civil Defence Emergency Management.

Previous work on community response plans in New Zealand has focused on small rural or coastal communities which have involved a large proportion of residents. Wainuiomata has a population of 18,000 and is geographically separated from the rest of the Hutt Valley, making it vulnerable to being isolated in a disaster event.

The project team worked with a small group of community leaders to create a plan that would empower the community to take ownership of their own resilience in an emergency event. A community resilience measurement tool was also developed based on Twigg's (2009) "Characteristics of a Disaster-Resilient Community" so that the community could evaluate change in resilience levels over time.

The resulting plan focused on identifying major hazards, identifying and distributing available resources, identifying available support services and defining how civil defence centres would operate in an emergency. The community engagement enabled the plan to become a living document – to be adjusted as and when needed.

A toolkit for implementing this process in other urban areas has been developed that includes key lessons for building a community-led response plan with representatives of a large population.

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MORE THAN MEETS THE EYE

Central Labs offers a wide variety of laboratory testing and assessment services through its well-equipped facilities. Alongside the more obvious services, there are a few you may not have heard of ... like these four.

FIRE ALARM SYSTEM TESTING

When they walk into a building, few people give much thought to the systems that provide a safe and functional environment such as fire detection and alarm. Opus has thoroughly tested the design of fire detection and alarms systems for over 30 years.

The New Zealand Building Code requires all commercial buildings to be fitted with a fire alarm system that meets an "acceptable solution", and currently the only "acceptable" solution is the New Zealand Standard NZS4512:2010. This Standard is based on the principles of detecting a fire as early as possible while also minimising false alarms, alerting occupants to evacuate while automatically ringing the fire brigade, and performing internal checks for possible faults and automatically calling for service if it finds any.

As the only company accredited by International Accreditation New Zealand (IANZ) to test these systems, we conduct compliance appraisals on any new models being developed by manufacturers. Each system appraisal takes about six weeks, indicating the detailed testing involved.

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THERMAL RESISTIVITY OF POWER CABLES

As part of their operation, high voltage buried cables develop a significant amount of heat and if that heat is not efficiently dissipated, the cables can fail. To make sure this doesn't happen, the backfills that are placed around the cables must be tested for thermal resistivity.

Over a number of years we have developed thermal resistivity testing equipment and calibration materials, and we carry out thermal resistivity testing for clients throughout New Zealand.

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RADAR INSPECTION OF CONCRETE

A radar unit specifically designed for determining the location of reinforcing and pre-stressing steel in concrete structures has recently been purchased. The equipment is a GSSI StructureScan Mini HR GPR which has a depth range of up to 400mm and a 3D capability to allow deeper layers of reinforcing to be detected. This unit significantly improves the ability to identify congested and/or deeply embedded steel and complements the capability of our existing electromagnetic covermeters. The equipment is particularly useful for supporting seismic investigation of buildings and HPMV assessments of bridges.

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REPEATED LOAD TRIAXIAL TESTING

Responding to growing demand to determine strength and the liquefaction potential of soils, the repeated load triaxial test (RLT) facility was recently upgraded to handle a 12 kN cyclic triaxial load with frequencies of up to 10Hz.

RLT is generally used for testing the suitability of basecourse material for pavements. This is done by applying repeated triaxial cyclic loads to a cylindrical test specimen. The resulting total resilient axial deformation response is measured and used to calculate the resilient modulus for various stress levels.

For the stress control and liquefaction potential testing, the pore pressure development and the volume change during cyclic stress are measured. This then determines at which point, if any, liquefaction occurs.

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