What lies beneath Auckland, ask

Deep probes may provide first signs of seismic or volcanic activity

IF TELEVISION transmission is lost in the dying moments of the Rugby World Cup final, seismologists could be the first people outside Eden Park to know the result.

Seismometers within Eden Park and sensors on the stadium structure will register the degree of "surface excitation", as the scientists put it, when the final whistle blows.

Assuming the All Blacks are still in the game — and who would dare think otherwise? — a win by the home side should be enough to create a minor earthquake.

"We've seen [seismic readings at the ground] already," says Peter Malin, director of the University of Auckland's Institute of Earth Science and Engineering, which placed the seismometers 400m and 30m beneath the park, and one on the surface of the stadium's south stand.

The object, however, is not just to measure how excitable a rugby crowd can get. The instruments, which the institute began putting in place in 2008 in a project called Bicep (borehall instrumentation centre for Eden Park), are part of a bigger plan to build a picture of underground Auckland.

"There is a very serious purpose to that instrumentation," Malin says. "They are the first instruments at depth near the central city that have any chance of picking up precursory seismicity, which we call foreshocks, or magnetic movement, 15km below our feet."

GROUND ZERO: Scientists hope the seismometers beneath Eden Park (foreground) are the start of a wider Auckland network. Picture / APN

Seismometers and accelerometers fixed to the highest point of the stadium are intended to measure structural vibrations so its response in a quake can be predicted.

"Right now we're working on getting a transmission system so we can relay the data to the university," Malin says. Then comes the visualisation phase.

The institute, with IT company Nextspace, is developing a 3D system for displaying seismic effects, with a view both to understanding Auckland's risks, and creating technology that can be exported. To cast an eye beneath Auckland, the institute wants to bore two 1km holes in the CBD, then others further out — if it can come up with the money.

Auckland Mayor Len Brown has been shown the system's potential with a 3D

quake scientists

display of the Canterbury earthquakes.

"When you look at this in ordinary flat-screen projection you have a hard time seeing the relationship of one earthquake to the other," Malin says. "But on the 3D screen you could immediately see which ones were deeper, which ones were behind the other ones, giving a sense of depth."

The institute and Nextspace are working on overlaying details of civic infrastructure — sewer, gas and power lines, for instance — on geological maps to see which services would be disrupted by a quake.

"Our collaboration is still in its early days — we're in nappies, if you will — but it has international appeal. If we were to implement it in Auckland we would then be in a spot to export these types of technologies to equivalent city infrastructures."

> 'AUCKLAND IS A PRIME EXAMPLE OF A CITY THAT NEEDS TO BE STUDIED FROM UNDERGROUND.'
>
> **Peter Malin, University of Auckland**

The institute, which has mainly foreign staff, is already a big exporter. About 80 per cent of more than $7 million from contracts it filled last year was earned overseas.

"We take a very New Zealand Inc approach," says Malin, who was born in Finland. "We bought into the place; it's the best place in the world to live. The very clear purpose of all of this is wealth-creation for New Zealand."

Lifestyle aside, for seismologists, New Zealand has plenty going for it.

"If you're an earth scientist you work on active tectonic processes, and they're here in spades; between 1840 and 1940 there were 11 magnitude 7 earthquakes on land in New Zealand," Malin says.

What might they see by peering under Auckland: faults or simmering magma?

"Nobody knows because nobody has data. I would say our chances are even of getting both. The reason no one knows is that the city was built up before anyone had a chance to study its geology. We think Auckland is a prime example of a city that needs to be studied from underground."

Malin, who came to Auckland in 2007 from Duke University in North Carolina as the new institute's first head, made his name developing borehole seismometers. State-of-the-art instruments are about 10cm in diameter, a metre long, and can withstand the pressure 3km underground and temperatures of up to 150C.

Seismic data travels up the hole on wires and is recorded at the surface, for transmission to monitoring equipment. Placing sensors deep underground allows even tiny quakes to be detected.

And if the All Blacks win the Cup, what size quake might that cause? "That would be a magnitude 10," Malin says. ■

Anthony Doesburg is an Auckland technology journalist.