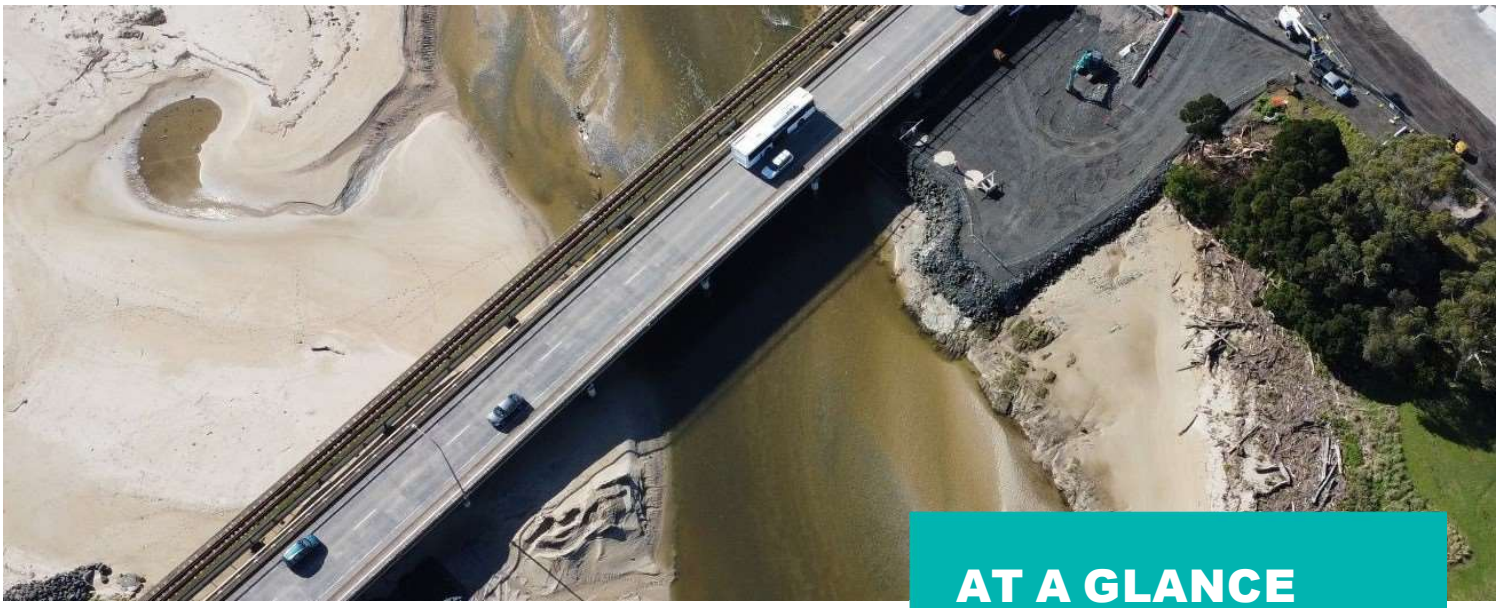


CASE STUDY: SMART Bridges Cam River, Tasmania

THE CHALLENGE

Load testing of bridges has traditionally been a complex and expensive process. Due to these issues, over the past decade many bridge condition assessments and bridge strengthening design has been based on somewhat subjective assessments without the benefit of load-response data.

Viotel recently provided real-time monitoring for a structural repair on a flood impacted road bridge. Numerical modelling had been used by the bridge engineers to inform the development of remedial solutions. However, to fully open the bridge to traffic, stakeholders required a more definitive test of the repairs. The Viotel Tilt nodes that were installed to monitor the movement of the bridge during remedial works were remotely configured to facilitate load testing of the bridge.

THE SOLUTION

Bridge Monitoring

Viotel triaxial Tilt nodes were mounted on the bridge beams and the upstream face of the flood impacted bridge pier. Each Viotel Tilt node only takes a few minutes to install.

A duplicate sets of Viotel Tilt nodes were also mounted on the adjacent bridge piers and the corresponding ends of the bridge beams.

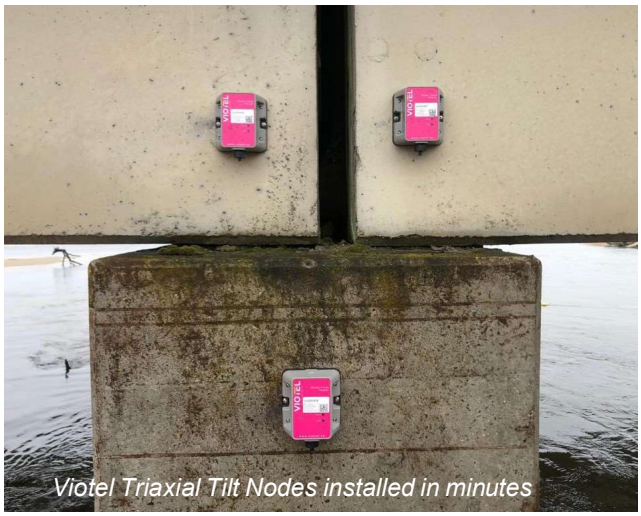
The Viotel Tilt nodes provide a feed of real-time monitoring data to the Viotel AWS Cloud database which is interpreted via a dedicated project dashboard. Trigger thresholds for bridge movements and alerts are set via the myViotel web based platform.

AT A GLANCE

Viotel's SMART Bridge solution provides on demand real-time Structural Health Monitoring (SHM) solutions for aging critical infrastructure.

SMART solutions can be applied to monitor the structural health of bridges, wharfs, mining assets, buildings and dams.

Viotel Triaxial Tilt Nodes mounted to the Cam River Bridge, Tasmania.



Viotel Triaxial Tilt Nodes installed in minutes

BRIDGE LOAD TESTING

Three load tests were undertaken on the bridge using the following configuration:

- **24t water truck** positioned over the pier. Duration: 10 minutes.
- **68t truck** positioned over the pier. Duration: 10 minutes.
- **Both trucks** over the pier. Duration: 10 minutes.

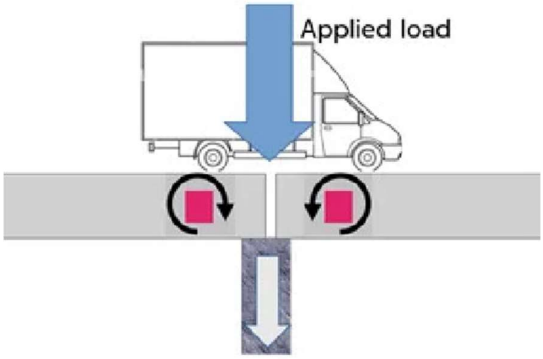
No vertical downward movement of pier was detected during Test 1 (24 tonne truck). Test 1 indicated deflection of the west bridge beam between piers (clockwise rotation) under the front axle loads. Test 1 was repeated twice at times T1 and T2.

If the pier under test yields under load (and the adjacent piers do not), a permanent downward movement of the pier would result in clockwise and counter-clockwise rotations of the beams (and tilt nodes). If the pier deforms laterally, this movement would be detected by the third tilt node that is mounted on the pier.

The reading and upload frequency of the Viotel Tilt node can be adjusted via the **myViotel** platform. For load testing, the Viotel nodes were initially set to 3 minute measurement, 30 minute upload. After the first test the tilt meters were set to 1 minute measurements with 5 minute uploading.

The noise level on the tilt nodes (0.001 degrees) allows detection of vertical movements of 18m rigid beams of just 0.3mm.

APPLIED LOAD TESTS



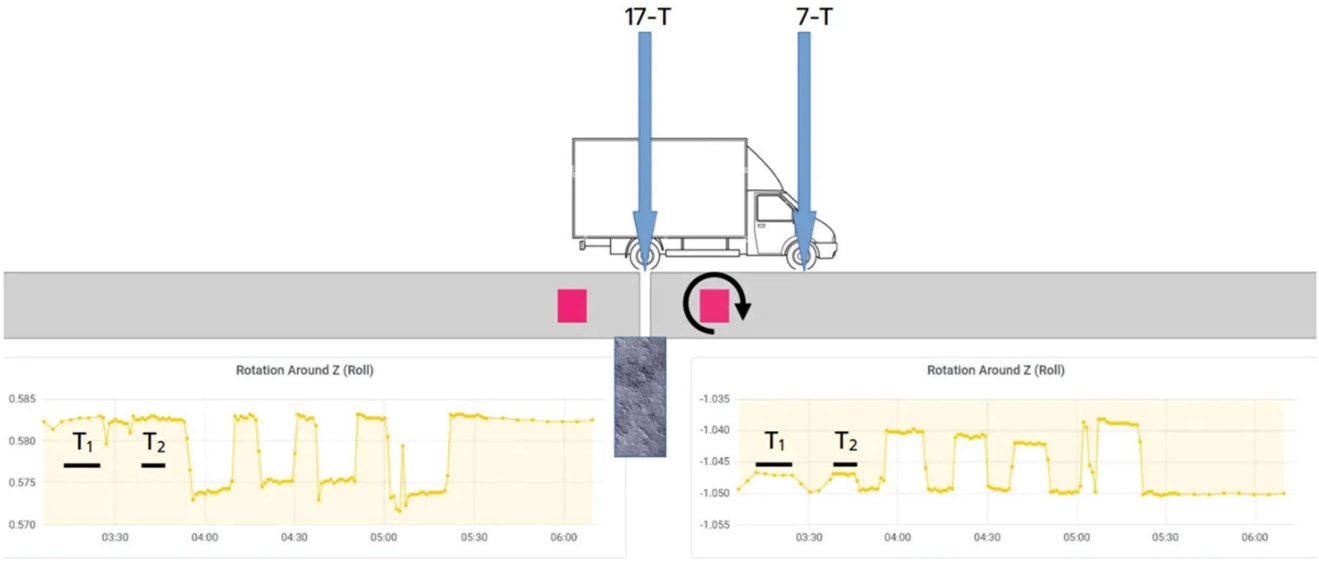
Applied load testing: 24t Water Truck

STATIC LOAD TEST 1

24 tonne truck

No vertical downward movement of pier was detected during Test 1 (24 tonne truck).

Test 1 indicated deflection of the west bridge beam between piers (clockwise rotation) under the front axle loads. Test 1 was repeated twice at times T1 and T2.

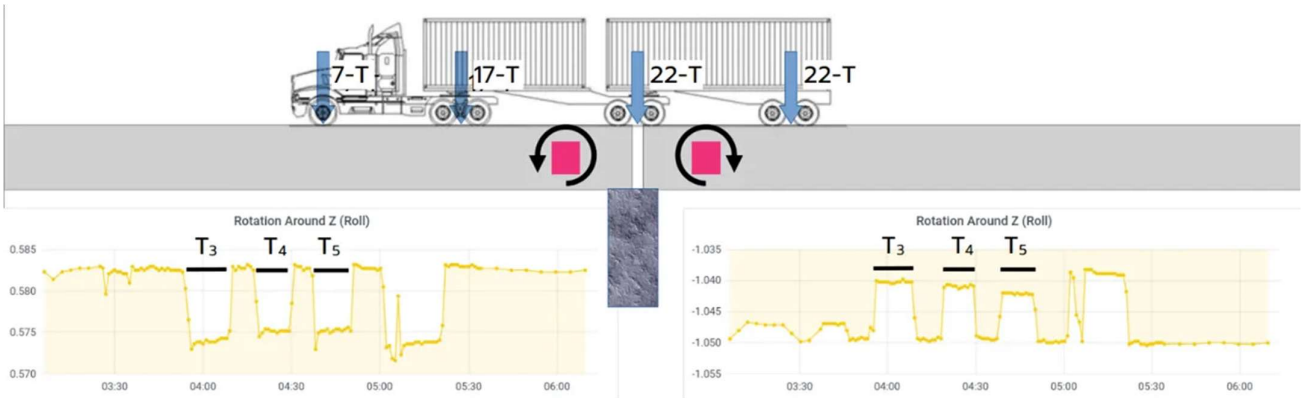


STATIC LOAD TEST 2

68 tonne truck

Test 2 (68 tonne truck) was repeated three times, at times T3 T4 & T5.

Test 2 indicated deflection of both the east and west bridge beams between the piers, with no permanent vertical movements seen after each load is removed. No lateral movement was recorded by the pier mounted tilt node during the load test.

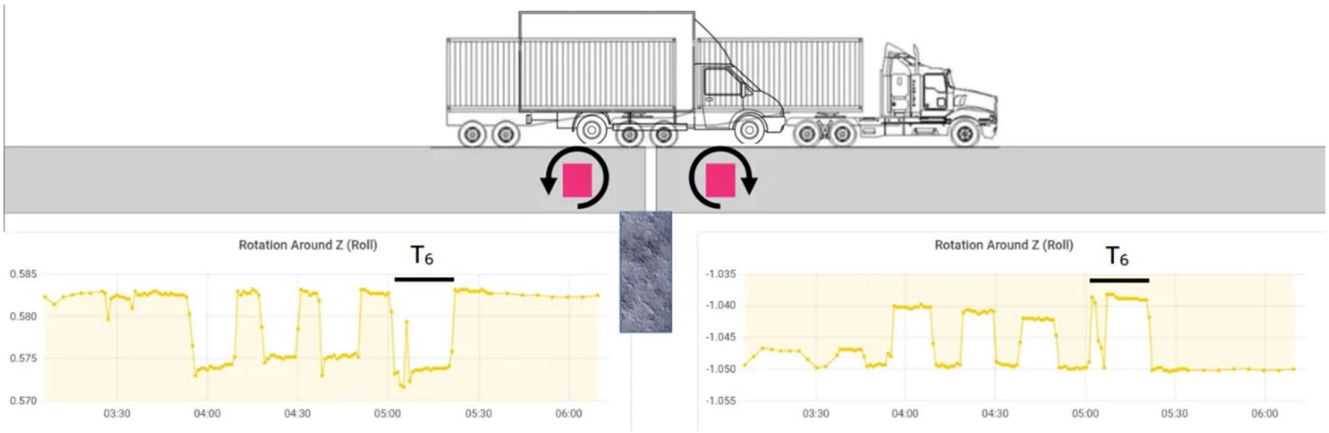


STATIC LOAD TEST 3

24 tonne & 68 tonne trucks

Test 3 (interrupted near beginning) with both trucks (24 tonne & 68 tonne) at time T6.

Test 3 indicated deflection of both the east and west bridge beams between the piers, with no permanent vertical movements seen after each load is removed. No lateral movement was recorded by the pier mounted tilt node during the load test.



RESULTS

The bridge load testing, conducted quickly and efficiently using the Viotel tilt nodes, provided confidence that the remedial works were successful, and the bridge could be fully reopened to traffic.

An ongoing monitoring regime using Viotel tiltmeters, dashboard and alerting system was implemented.

APPLICATION TO HEAVY VEHICLE TRANSPORT ROUTES

Bridge load capacity assessments, necessary to facilitate heavy vehicle transport route planning, have left many asset owners/ managers facing bridge strengthening costs in the $10's of millions.

When making these assessments, it is necessary for engineers to consider the most recent standards and consider the potential deterioration that may have occurred in the structure. In many cases there may be limited documentation of the original design of the bridge. Thus, engineers will need to interpret the information they can source from bridge inspections and understandably err of the side of caution.

Realtime monitoring can provide a path for asset owners to calibrate the results of load capacity assessments and make informed risk based decisions on bridge strengthening requirements. The potential savings on being able to reduce or defer bridge strengthening requirements are significant compared to the costs of a monitoring program.

Viotel Wireless Triaxial Tiltmeter

APPLICATION TO HEAVY VEHICLE TRANSPORT ROUTES

cont.

Bridge monitoring can also assist in identifying issues such as loose expansion joints or poorly seated bearings. Our systems are easily configurable to record action response rates and help provide auditable records.

The **Viotel** units are safe, self-contained IoT sensor packs which are discrete, simple to install and calibrate, powered with mains/battery &/or solar power and with analysis power via on-board microprocessors. The **myViotel** app, accessing internet-based data, transforms a sensor from a disconnected unintelligent asset to a networked live data device.

Integrated data path from source to decision

Viotel monitoring enables asset owners to adjust load capacity assessment results and make informed decisions on bridge strengthening needs based on risk.

ABOUT VIOTEL

Our mission is to empower businesses with better data for better decisions. At **Viotel** we believe knowledge is power and understand the critical role data plays in managing risks, identifying opportunities and protecting business assets. Using 'plug and play' Smart Box technology, coupled with the power of Amazon Web Services, **Viotel** has created a data ecosystem. We believe in ***making smart technology smarter.***

By continually investing in new technology and collecting and analysing data in real time, our cutting- edge solutions empower businesses to identify cost savings, increase productivity, streamline maintenance, increase OHS, monitor assets from any location and respond faster to emergencies.

Viotel currently have operations support in Australia and New Zealand.

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Viotel SMART Structural Health Monitoring Systems are applied to monitor the structural health of bridges, towers, wharfs, buildings, and dams.