

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

## Safety Initiative: Early warning system of ground and structural movement

**Story:** Bridge of Remembrance and Memorial Arch

**Theme:** Construction

---

A document describing the early warning system to alert team members of ground and structural movement at the Arch.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit [www.scirtlearninglegacy.org.nz](http://www.scirtlearninglegacy.org.nz)



This work is licensed under a [Creative Commons Attribution 3.0 New Zealand License](https://creativecommons.org/licenses/by/3.0/nz/).

The authors, and Stronger Christchurch Infrastructure Rebuild Team (SCIRT) have taken all reasonable care to ensure the accuracy of the information supplied in this legacy document. However, neither the authors nor SCIRT, warrant that the information contained in this legacy document will be complete or free of errors or inaccuracies. By using this legacy document you accept all liability arising from your use of it. Neither the authors nor SCIRT, will be liable for any loss or damage suffered by any person arising from the use of this legacy document, however caused.



## Early warning system to alert staff of ground and structural movement – Triumphal Arch



(1) Vibration Control Box



(2) Sensor Attached to Structure



(3) Alarm Beacon and Siren

### What is the initiative?

Vibration from Mobile Plant and EQ's causes movement in both the structure and ground. Site staff become desensitised to movement over time, becoming less aware of the potential hazards of ground shifts and structural movement. The units are designed to sound an alarm and have a flashing beacon, allowing staff to see and hear the warning signals and evacuate the area. As vibration is a known hazard on site, it is important that all practicable steps have been taken to decrease the risks by identifying, monitoring, evaluating, assessing this risk. If an increase of vibration occurs this flows on through the structure and ground causing movement and compromising the integrity of both. The system is programmed so that when measured vibration levels exceed 80, 100 and 120% of the project vibration criteria, the alarm will sound (along with the flashing beacon) and work onsite will be immediately stopped. With works stopped, the engineer will be called to site to assess the structure and the methodology will be reviewed with the aim of reducing vibration transmitted to the structure.

### How was it identified?

Vibrations monitoring and alert system made necessary because the ARCH is fragile and could crumble and fall on workers on site.

### Benefits and future plans

- Helps manage the Risk of being squashed by the structure
- Alert system to help warn in event of an emergency and minimise injuries
- Crew was trained on how system works and made aware of limits and benefit of system
- System shared with other contractors on site
- Can be replicated for Downer and other SCIRT delivery teams, where there is a risk of vibrations affecting workers and caused by Mobile Plant and equipment on site
- System had to be developed specifically for this project in collaboration with a Vibrations specialist

<b>For further information contact:</b>	<b>Fraser Sherson Graduate Engineer</b>	<b>Phone</b>	
<b>Authorized by:</b>	<b>David Maucor Zero Harm Advisor</b>	<b>Phone</b>	