

Preliminary update - Mw7.8 Kaikoura Earthquake (15 November 2015)

Upper Part of South Island

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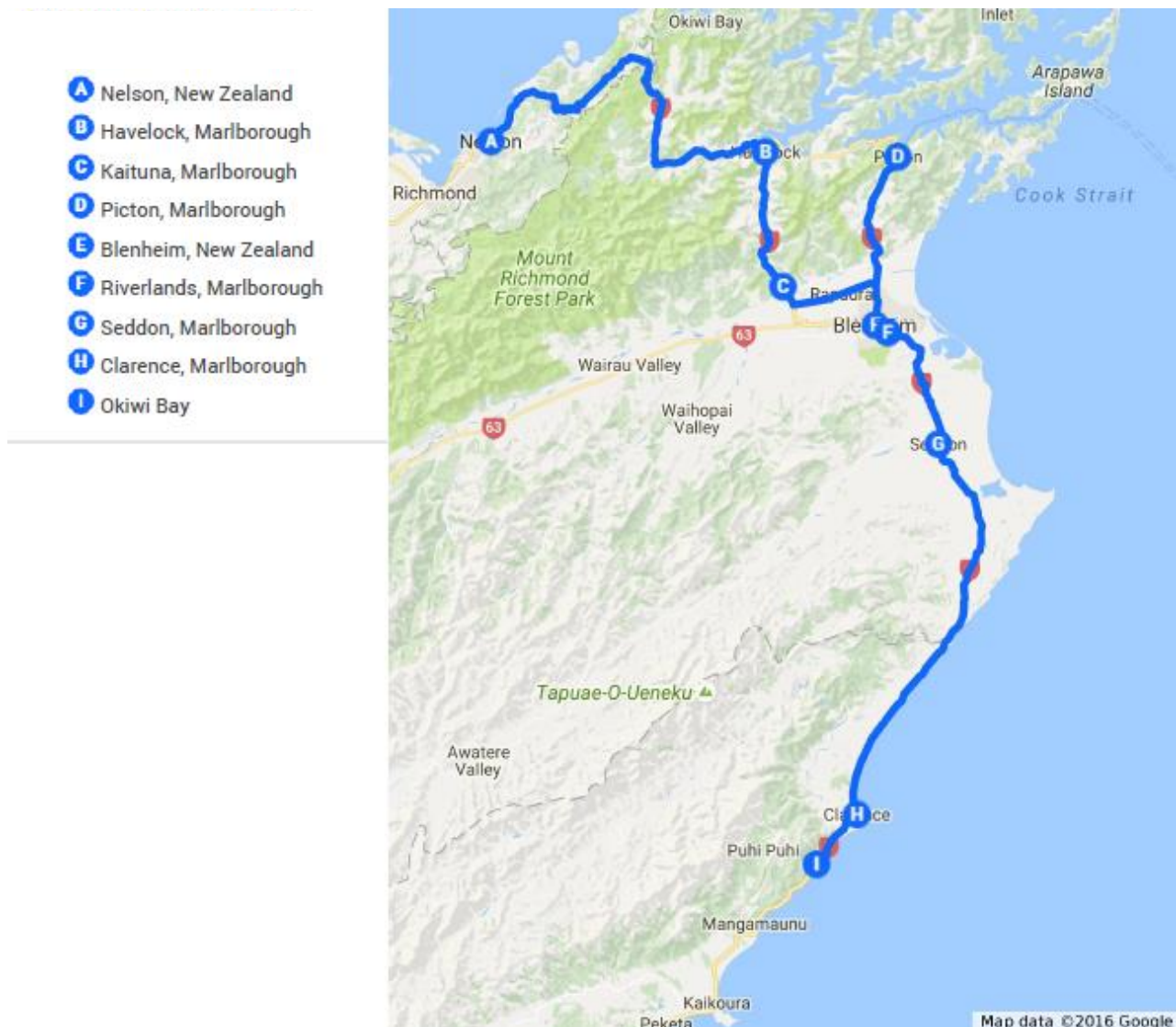
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By Dmytro Dizhur and Marta Giaretton

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Upper Part of South Island

This is a preliminary set of notes from observations made on 15 November 2016, route taken is shown below.



Roads

- An amazing selection of geotechnical related observations (mainly from Seddon onward). The further one goes down SH1 the more impressive the observations.
- Road closed to public from Seddon onward, professional and roadwork personnel allowed further with permission.
- Going north to south Okiwi Bay is the furthest possible accessible point before you get to a massive land slip - machinery started to nibble through it but didn't get very far. Only a handful of people and no reception, so be well prepared.
- Need a 4WD to get through the stretch of road from Seddon to Okiwi Bay. Although, the roadwork teams started to filling some of the larger crevasses and levelling smaller slips.
- Horizontal shifts, uplift what seems to be whooping 4-5 meters in places.

- Manmade features such as railway-lines and roads provide best clues as to what happened, i.e. lateral or vertical movement.
- Landslides and rockfalls everywhere.
- Large number of GPS tagged photos collected.



Typical road conditions on approach to Clarence



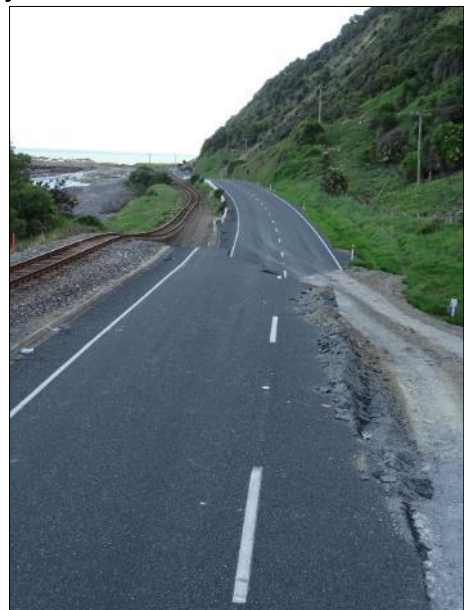
Typical road conditions on approach to Clarence



Meteres of vertical uplift, road completely destroyed – 4WD access across



Upto 3 meters of vertical drop in road level (looking north)



Upto 3 meters of vertical drop in (looking south)



Typical condition of nearby rural roads - 100s land slips



Typical condition of nearby rural roads - 100s land slips



Typical condition of nearby rural roads - 100s land slips



Significant soil deformation near SH1 – vertical and horizontal translation



Significant vertical and **horizontal** shifts in road alignment



End of the road – Okiwi Bay. Attempts are being made to start removing the mammoth slip

Railway Lines

Examples below that were not affected by landslides, ground movement only.



Rupture of railway lines at bolted joints – horizontal translation



Shear failure and spread of railway lines



Major lateral displacement of railway lines



Major lateral displacement of railway lines



Stretch and major dragging of lines



Major horizontal and vertical movement of land near bridge



Bridge movement over one meter away from abutment



Major vertical and horizontal movement – appears to be swampy land

Bridges

Road bridges overall seems to exhibited good performance. All drivable.



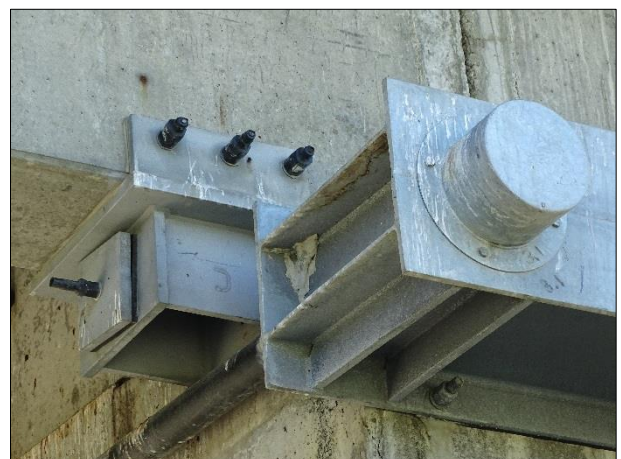
Overall bridge view – accessible to trucks



Evidence of pier inclination towards west



Minor concrete spalling at south abutment



Evidence of distress



Evidence of plate movement and losing of connections



Damage to south approach



No damage observed



No damage observed



Major railway bridge pier rotation



Close up of pier rotation

Wineries

- Interesting damage observed to some particular type of tank anchoring systems.
- Shear failures of some connections.
- Pull-out of some adhesive anchoring connection systems.
- Damage to the walking platforms atop of tanks due to tank movement.

- Some tank buckling observed.
- A large number of tanks emptied.
- Collapse of stacking systems - particularly wooded barrels storage.
- Management are busy dealing with issues and not great time to approach from research perspective at this point in time.
- Selective examples below.



Typical tanks inspected



Free standing tanks – no evidence of significant movement



Typical tanks inspected



Tank buckling observed



Shear failure of tank connections



Shear failure of tank connections



Damage to the walking platforms atop of tanks and anchoring connections due to tank movement



Evidence of movement and losing of connections



Shear failure of connection rods



Shear failure of connection rods



No damage observed for large connections



Pull-out of some adhesive anchoring connection



Pull-out of some adhesive anchoring connection



Collapse of stacking systems - wooded barrels' storage



Collapse of stacking systems - wooded barrels' storage

Building damage

Nelson

- Buildings inspected in the town centre and not visible damage was observed (outside inspection only)

Havelock

- Buildings inspected in the town centre and not visible damage was observed (outside inspection only)
- Historic masonry buildings: **St Peter's Church** (1905) and **The Sacred Heart Church**, no visible damage was observed (external inspection only).
- Area flooded



St Peter's Church, stone masonry probably retrofitted



The Sacred Heart Church, clay brick masonry

Picton

- Damage to non-structural elements – masonry chimneys. Seems that most of the masonry chimneys have been previously removed (or lowered at roof line) in the past
- Gable collapse in one building which damaged the canopy. The area was already cleaned up on the 15/11 afternoon
- Historic masonry buildings: Chimney damage on the former **Picton Railway Station** (1902), **St Joseph's Church** (1917) seems retrofitted and no earthquake damage was observed (outside inspection only)



Picton Railway Station



Chimney damage and consequent ceiling damage





Chimney internal stack, torsional damage



Ceiling damage due to chimney



St Joseph's Church, clay brick masonry cavity-wall building (probably retrofitted)



Presence of existing damage (cracks and deteriorated bricks)



Historical monument – no observed damage to free-standing appendages



Collapse of front façade and canopy – all cleared and removed

Blenheim

- Damage to non-structural elements including masonry chimneys and ceilings
- Historic masonry buildings: **The Church of Nativity** (1861) and the former **Bank of Australasia** (1926) have been retrofitted and did not present damage; **Hotel d'Urville** (former Public Trust Office Building) minor damage observed; **War Memorial and Clock Tower** (1928) and **Court House**, not visible damage was observed (outside inspection only)



The Church of Nativity, retrofitted clay brick masonry building



The Church of Nativity, internal view



Bank of Australasia, retrofitted clay brick masonry building



Bank of Australasia, internal view



Hotel d'Urville, retrofitted concrete building



Hotel d'Urville, internal view



War Memorial and Clock Tower, stone and concrete



Court House, stone and concrete

Blenheim Surrounding Area

- **Rapaura Community Church**, not visible damage was observed (outside inspection only)
- **Junction Hotel**, damage to masonry chimney



Rapaura Community Church – no visible damage



Junction Hotel – movement of chimney

Seddon

- Damage to non-structural elements, ceilings
- In-plane damage to RC with in-fill masonry buildings



RC with masonry in-fill buildings



Major non-structural damage to local supermarket, shops and cafes

Wharanui

- Historic masonry buildings: St Oswald's Church, damage observed



St Oswald's Church, stone and concrete, collapse of parts of front parapet



Internal view with diagonal shear and shear sliding cracks

Clarence

- Damage to non-structural elements, chimneys

Non-Structural Elements – Chimneys



Inward collapse, Blenheim



Standing chimney in the same building of the previous photo, Blenheim



Horizontal crack at the roofline, Blenheim



Horizontal crack at the chimney base and torsion, Blenheim



Horizontal crack at the base, Blenheim



Extensive damage of the plaster, Blenheim



Dislodgement of the bricks, Blenheim



Inward collapse, Clarence



Outward collapse of the chimney stack, Clarence



Out-of-plane detachment of the chimney stack, Clarence



Example of removed chimney, Picton



Example of removed chimney, Picton