

## Resilience to Nature's Challenges: Distributed Infrastructure

### Transportation Research: Summary as at April 2019

#### 1. Background

Resilience to Nature's Challenges Kia manawaroa - Ngā Ākina o Te Ao Tūroa (RNC) aims to partner researchers with stakeholders, including communities, to build shared understandings of natural hazards and risks, and to work together to develop practical risk reduction solutions. The RNC framework is intended to promote collaboration between infrastructure stakeholders and the New Zealand research community.

The resilience of lifeline networks like electricity, transportation and water is critical in enabling society to recover rapidly after a major disaster. The Distributed Infrastructure programme is developing tools to assess the performance of spatially-distributed infrastructure networks subject to extreme natural hazards. Working closely with relevant stakeholders, the programme is developing methodologies to quantify system-level performance of infrastructure networks when subject to natural hazards and cascading impacts, leading to improved resilience of communities through identification of multi-hazard related vulnerabilities in infrastructure critical for NZ society. More about this programme can be found here - [link](#).

#### 2. RNC-supported transportation research to date

**Research title:** Impacts of the Kaikōura EQ on transportation (2016-2017)

**Research partners:** NZ Transport Agency, KiwiRail, Canterbury CDEM

**Principal outcomes:** Summary of preliminary observations of performance of transport networks across affected regions and adaptations that were made to enable the provision of services.

**Status:** Complete.

**Outputs:** Journal paper - [link](#)

**Research title:** Data and decision making in the transport system following the Kaikōura EQ (2018-2019)

**Research partners:** Ministry of Transport

**Principal outcomes:** Summary of how the transport system responded and adapted to earthquake-related disruptions and examined the flow and use of information in post-disaster (response and recovery) decision making across all transport modes.

**Status:** Complete.

**Outputs:** Journal paper – [link](#) , Workshop report – [link](#) , Final report – [link](#)

**Research title:** Criticality of road networks in Auckland (2017-2019)

**Research partners:** Auckland Transport

**Principal outcomes:** Development of updated criticality framework for road networks and validation using trial area in Auckland. Framework introduces new criticality level to account for roads with minimal direct societal and economic benefit, and rationalisation of hierarchy between different criticality levels.

**Status:** Complete.

**Outputs:** Journal paper - [link](#)

**Research title:** Operational resilience assessment of a rural road network (2016-2020).

**Research partners:** NZ Transport Agency

**Principal outcomes:** Development of a regional transport model for the South Island in AIMSUN (complete). BAU model will then be modified to capture the effect of natural hazard events. The model is being validated using data from the 2016 Kaikoura earthquake and an Alpine Fault scenario will be applied in future.

**Status:** Underway

**Outputs:** ~~Outputs:~~ Conference paper - [link](#)

**Research title:** Assessing the evacuation of an urban transportation network (2016-2020).

**Research partners:** Auckland Transport, Auckland Council, NZ Police

**Principal outcomes:** Development of an urban transport model for Auckland in AIMSUN (complete). This forms a base traffic simulation model that emergency planners can use to test different contingency plans for the emergency evacuation of Auckland

**Status:** Underway

**Outputs:** Conference paper – [link](#)

**Research title:** Understanding evacuation and travel behaviour under emergency situations (2018-2021).

**Research partners:** Auckland Council

**Principal outcomes:** To improve the understanding of the behaviour of Auckland's population during the warning and evacuation phase leading up to a volcanic eruption, with a focus on transportation behaviour to improve evacuation models.

**Status:** Underway

**Research title:** Geospatial hazard exposure tools for infrastructure networks (2018-2020).

**Research partners:** Various

**Principal outcomes:** Development of methodology to automatically assign ground shaking, liquefaction and landslide hazard intensities to national infrastructure networks using ground motion simulation models.

**Status:** Underway

**Outputs:** Conference paper - [link](#)

**Research title:** Historic seismic performance of the New Zealand bridge stock (2017-2020).

**Research partners:** NZ Transport Agency

**Principal outcomes:** Collation of case histories of the performance of the bridges on the New Zealand State Highway network from the 1968 Inangahua earthquake through to the 2016 Kaikōura earthquake. Performance in past events is compared against estimated performance based on national scale high-level seismic screening of the bridge stock, and key learnings discussed.

**Status:** Underway

**Outputs:** Conference paper - [link](#)