

Built Environment

- Resilience to Nature's Challenges 2019-2024
- QuakeCoRE

Summary

- *“To improve the hazard response of the built environment and infrastructure that supports New Zealand.”*
- Budget - \$4.25 million over 5 years

Research Objectives

1. Understand natural hazard-induced demands on vertical and horizontal infrastructure.
2. Advance methods of natural hazard design and assessment.
3. Design analytical methods for quantifying performance of new and retrofit structures.
4. Quantification of infrastructure component and structural system fragility and vulnerability from case history observations and modelling.
5. Develop methods to quantify system-level performance of infrastructure networks and interdependencies.
6. Development of decision-making frameworks to inform resilience investments.
7. Examine the resilience of future alternate realisations of the built environment.

BE Streams

1 Horizontal Infrastructure

- Builds on RNC1

2 Vertical Infrastructure

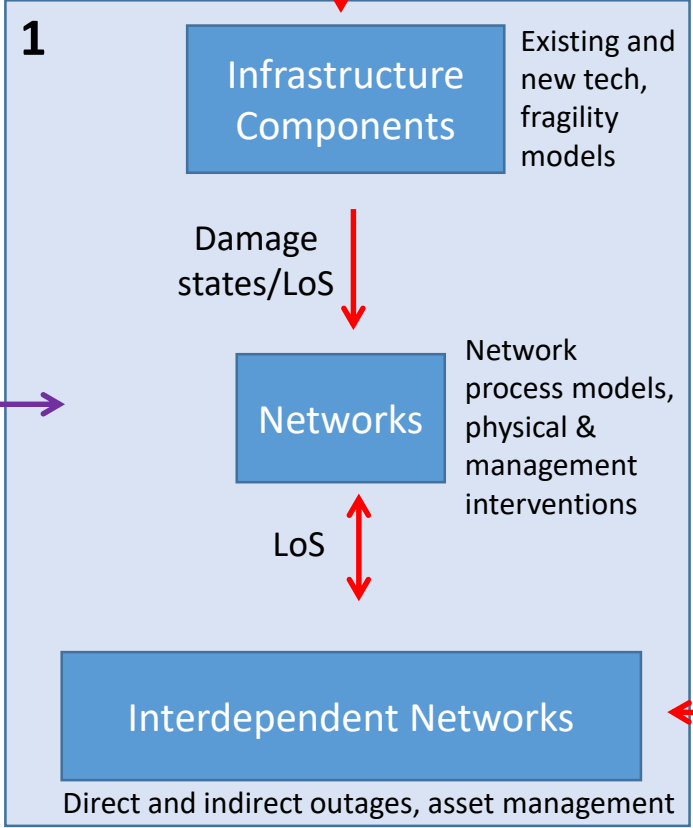
- Builds on NHRP and QC

3 Integrated Scenarios

- Case study scenario (EQ & Tsunami)

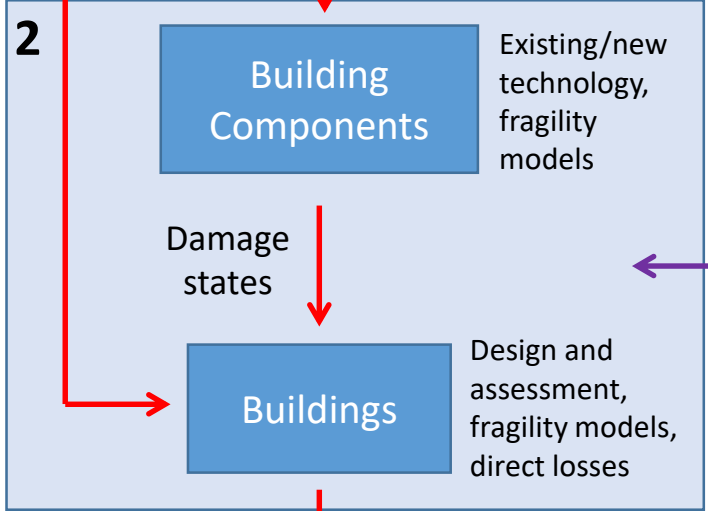
Weather/Coastal/Volcanism/EQ/Tsunami

Intensities

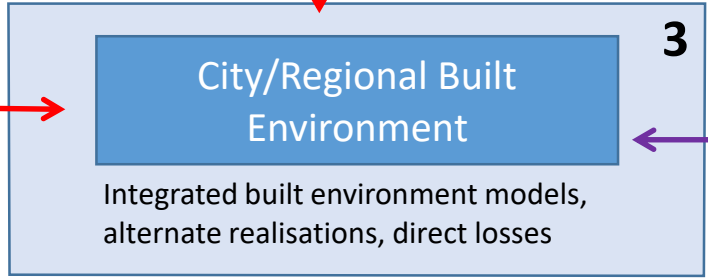


Rural, Urban, Māori, MRM, RPM

Intensities



Urban, Māori, MRM, RPM



Rural, Urban, MRM, RPM

LOS

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Volcanic/Rural co-funding

- Rural infrastructure systems modelling
 - Waikato & Taranaki
 - Road and electricity focus
 - Wider interdependencies
 - Inform rural interventions related to volcanic hazards
- Vulnerability of infrastructure components and small systems (ash and pyroclastic flows)
 - Physical modelling and case history based vulnerability models
 - Electricity distribution networks

High Impact Weather co-funding

- HIW fragility/vulnerability model development from NZ case histories
 - Use of nationwide case history data from HIW events
 - Storms, snow, flooding, etc
 - Expert elicitation & analytical modelling approaches
- Quantification of urban flooding resilience and assessment of mitigation strategies (with Urban)
 - Auckland focus – linked to HIW scenario storm
 - Stormwater modelling and resilience metrics
 - Built environment exposure
 - Assessment of stormwater devices and design

High Impact Weather co-funding

- Flood protection and detention system management strategies and impacts (with MRM, Rural)
 - Multiple potential case study areas
 - Framework to assess system
 - Exposure assessment for range of strategies
 - System management to minimise flood exposure
- Assessment of electricity system impacts and management strategies pre- and post- HIW events (with Rural)
 - Multiple focus regions
 - Operational vulnerability of wind generation
 - Management of transmission and distribution
 - Potential to integrate volcanic ash impacts

Coastal co-funding

- Flooding and storm surge impacts in the Hauraki District: mitigation and adaptation strategies (with HIW)
 - Adaptation strategies for coastal infrastructure networks and communities
 - Scale model testing of coastal defence designs
 - Staged engineering interventions & managed retreat

Multi-Hazard Risk Co-funding

- Multi-impact operability of infrastructure
 - Effect of impact from a previously occurring hazard on vulnerability to subsequent hazards
 - Range of infrastructure types and hazard combinations

BE- Horizontal

- Multi-Hazard Assessment of Operational Impacts on the Transportation Network
 - Builds on transport models developed in RNC1
 - Auckland/South Island
- Telecommunication-electricity system resilience
 - Focus on telecommunications post-event
 - Build on current industry led projects
 - Resilience interventions and post-event strategies
- Resilience through an Asset Management Long-term Planning Process
 - holistic investment logic decision approach to guide infrastructure investments
 - wellbeing perspective

BE- Horizontal

- Marae-based adaptations following infrastructure outages due to natural hazard events
 - Building on scoping study – geospatial analysis and surveys
 - Iwi wide assessment
- Tsunami infrastructure vulnerability & fragility of infrastructure components
 - Expand current suite for analysis
 - Loading characteristics to component performance
 - Assessment of mitigation measures

BE- Horizontal

- Geospatial seismic and co-seismic assessment tools for infrastructure networks
 - tools for application to infrastructure networks
 - developed for NZ conditions
- Infrastructure-building interdependencies and recovery
 - process-based modelling of networks and building exposure
 - current risk, future risk
 - mitigation/adaptation strategies and network recovery priorities

BE– Integrated Scenario

- Wellington – EQ and Tsunami
 - Geohazard and tsunami modelling
- Building stock seismic modelling
 - Loss modelling and decision making
- Infrastructure network analysis
 - Infrastructure-building interdependencies
 - Telco-electricity
 - Tsunami
- Resilience of current and future networks (ageing and investment)

Other Opportunities

- Infrastructure Interdependency Modelling
 - Application to other regions and hazards
- NZ Inventory of Stopbanks
 - Flood modelling and exposure
- South Island Transport Model
 - Assessment of other hazards and network modification
- Auckland Transport Model
 - Assessment of other hazards and network modification
- Buried Infrastructure Fragility model framework
 - Assess potable water networks in other regions
 - Apply to development using other data (pipes, cables)

Other Opportunities

- Geospatial hazard datasets
 - Seismic geohazards
 - Updated flood models
 - Sea level rise and storm surge
 - Volcanic hazard models
- Existing case history datasets
 - Infrastructure disruption for range of natural hazards