Resilience to Natures Challenge (Built Environment Theme)

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Opportunity

The resilience of vertical infrastructure (residential, commercial and industrial buildings) and horizontal infrastructure networks (electric power, transportation, telecommunications, three waters, and liquefied/gas fuels) play a significant role in everyday society. Following a shock natural hazard event, they play a critical role in the ability of society to rapidly recover. This research, funded by Resilience to Nature Challenges (http://resiliencechallenge.nz/), will result in the development of improved approaches for the design and assessment of the built environment, new tools to quantify the performance of the built environment and better quantification of the interaction between different components of the built environment. These developments will inform actions that can reduce the direct and indirect impacts during future natural hazard events. High resolution modelling across a range of regions and natural hazard will provide an evidence base to inform the breadth of resilience strategies that can be operationalised through asset management and loss estimation methodologies.

If you would like to access more information on horizontal infrastructure and vertical infrastructure projects, please click on the following links:

Horizontal Infrastructure

Vertical Infrastructure

Thrust Areas

The RNC research key thrust areas are:

1. Developing toolboxes upon the outcomes of the RNC1 project to accurately model and assess the seismic performance of spatially (horizontally) distributed infrastructure components.
2. Developing improved design, assessment, and repairability approaches to manage and mitigate the financial risk posed by earthquakes.
3. Developing advanced modelling methods to investigate the seismic performance of built environment (Wellington region) in response to major subduction zone rupture.

Thrust Areas	Tasks
Horizontal Infrastructure	1. Models for infrastructure component performance across a range of natural hazards.
	2. Expanded geographic coverage and capabilities of infrastructure network models.
	3. High resolution regional and urban interdependency models.
	4. Decision making and rating tools for infrastructure.
Vertical Infrastructure	1. Execution of a broad benchmarking study to clearly define the seismic performance, in terms of expected annual monetary losses due to direct repair costs, of various code-compliant building typologies in different parts of New Zealand.
	2. Development of tools and guidelines to quantify the reparability of buildings. In particular, steps will be made to establish improved criteria for repair versus replacement of steel structures in post-earthquake scenarios.
	3. Development of new guidance for the assessment and rehabilitation of earthquake-damaged reinforced concrete structures.
	4. Development of tools to account for soil-foundation-structure interaction effects on building performance.
	5. Identification, for marae, of effective resilience interventions and decision making processes against natural hazards.
Integrated Scenario	1. Physical damage to vertical infrastructure: shaking damage to commercial buildings via detailed analysis and the smart seismic cities concept, co-seismic landslide damage to residential housing, geotechnical mass movements and shaking-induced damage to waterfront structures, damage to port and structures due to tsunami inundation.
	2. Physical damage to horizontal infrastructure: damage to lifeline structures from shaking, co-seismic geohazards and tsunami, quantification of interdependencies across affected area.
	3. City-wide integration of effects: building-infrastructure interdependencies, direct cost estimation, assessment of alternate built environment realisations.