LIQUEFACTION PROBABILITY ACROSS NEW ZEALAND TRANSPORT NETWORKS

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INTRODUCTION

Liquefaction during seismic events can result in significant damage to the built environment. When assessing distributed infrastructure networks, the number of in situ investigations required to identify liquefaction exposure can be high in cost and labour. In this case, **geospatial methods** combined with probabilistic evaluation can be used as an alternative approach.

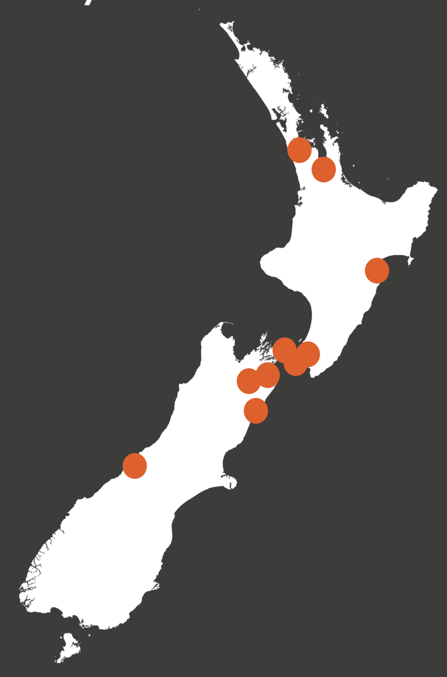
This research aims to estimate liquefaction probability across the New Zealand **State Highway and rail network** using a geospatial model.

GEOSPATIAL LIQUEFACTION MODEL

The Zhu et al. (2017) model relies on a set of variables which are related to factors most relevant to liquefaction: **soil density** (V_{S30}), **saturation** (water table depth, distance to water and precipitation) and **ground shaking** (PGV). To correlate these variables with liquefaction occurrence, case history data from different earthquakes in the United States, New Zealand and Asia were obtained. Despite limitations, the model provides useful results, especially considering its benefits regarding time and costs compared to traditional methods.

APPROACH

Since the geospatial model can be performed for geographic points only, the (linear) transport networks are converted into a point format (one point per 100m). Liquefaction probability is then estimated for **10 earthquake scenarios** across the country.



RESULTS

The assessment shows that (1) despite a similar track, results for rail are slightly higher compared to State Highways, and (2) **bridges** in general lead to higher liquefaction probabilities. Among the 10 earthquakes, the **Alpine Fault** scenario leads to the highest overall liquefaction probabilities (see hazard maps).

CONCLUSION

The geospatial model provides a useful tool to estimate the liquefaction probability across the State Highway and rail network.

Further research needs to consider more earthquake scenarios in order to achieve a more accurate evaluation of the networks' overall exposure to liquefaction. This could also include the assessment of **other seismic hazards** such as landslides or flooding. In addition, **network criticality** (e.g. traffic or freight volume) should be considered to better quantify the impact of seismic hazards to the wider community and society.

This will help to identify exposed infrastructure sections and to support decision making processes regarding infrastructure investment, emergency planning, as well as prioritisation of post-earthquake reconstruction projects.

REFERENCE

Zhu, J; Baise, L; & Thompson, E (2017). An updated geospatial liquefaction model for global application. Bulletin of the Seismological Society of America, Vol. 107, No. 3, pp. 1365-1385.

ALPINE FAULT

Epicentre in the south, rupture propagating north along the fault.