NEW ZEALAND GEOTECHNICAL SOCIETY INC
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2025 GEOMECHANICS LECTURE

SOIL LIQUEFACTION MITIGATION USING SUSTAINABLE ADDITIVES AND RECYCLED MATERIALS

The NZ Geomechanics Lecture is the premier award of the New Zealand Geotechnical Society. It is presented by a person prominent in Geomechanics who can, in the presentation, contribute a statement of significance and value relevant to New Zealand.

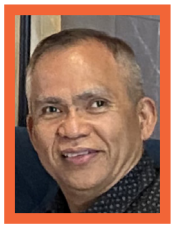
In 2025, this award is presented to Professor Rolando P. Orense as a recognition of his long-standing contribution to the geotechnical profession in New Zealand.

The NZGS Committee would like to specifically mention the exceptional academic work Rolly has carried out through the years and the mentorship to younger generations.

ABSTRACT

Soil liquefaction remains one of the primary causes of severe damage during earthquakes. Although significant advances have been made in understanding its mechanisms and developing mitigation strategies, liquefaction continues to pose a major threat, particularly in densely populated areas where traditional remediation techniques are often impractical. Many conventional methods generate excessive noise and vibrations, which complicates their application near existing infrastructure. Others involve the high-pressure injection of toxic chemicals or consume substantial energy, resulting in a large carbon footprint. As urbanisation and technological development accelerate, there is an increasing need for innovative liquefaction mitigation approaches that are non-disruptive, environmentally responsible, and aligned with low-carbon objectives. Interdisciplinary research and the adoption of sustainable materials offer promising pathways to address these challenges.

To this end, the presentation investigates the use of alternative and recycled materials as soil amendments to enhance liquefaction resistance. Leveraging advancements in materials science and multidisciplinary engineering, new additives have been identified that can improve soil performance and complement existing mitigation strategies. Laboratory experimental studies are presented on the use of tyre chips, coal ash, biochar, and various nanoparticles (laponite, carbon nanotubes, polymerised waste glass powder) as sustainable additives to enhance the liquefaction resistance of sands. The findings underscore the potential of these materials to support a low-carbon approach to geotechnical hazard mitigation, highlighting future research directions in sustainable liquefaction mitigation.



PRESENTER

ROLANDO P ORENSE

Rolly is a Professor of Geotechnical Engineering in the Department of Civil & Environmental Engineering at the University of Auckland. He holds a BSCE (cum laude) and MSCE from the University of the Philippines, and a Doctor of Engineering degree from the University of Tokyo. His research and professional work focus on geotechnical earthquake engineering, with particular expertise in liquefaction-related hazards and site/soil characterisation. His contributions bridge both academic research and applied practice, advancing the understanding of seismic geohazards worldwide. He currently leads the "Soil Liquefaction" research strand within Disciplinary Theme 1 (DT1: Integrated Seismic Geohazards) of QuakeCoRE – New Zealand's Centre for Earthquake Resilience, a multidisciplinary network driving innovation in seismic risk reduction.

SCHEDULE

- **Tuesday 17 February – Dunedin**
- **Wednesday 18 February – Christchurch**
- **Thursday 19 February – Nelson**
- **Wednesday 4 March – Tauranga**
- **Thursday 5 March – Wellington**
- **Tuesday 17 March – Hamilton**
- **Wednesday 18 March – Auckland**

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