NZGS Symposium 2025

Geotechnical Horizons: Innovations & Challenges

SYMPOSIUM PROGRAMME

15 – 18 October 2025

Auckland, New Zealand

nzgs.org

Wednesday, 15 October 2025

Pre-Symposium Workshops & Welcome Function

Time / Location	Description
08:30 – 17:00 Limelight Room 1 Level 3	Earthworks: Theory to Practice **Dr Burt Look** NZ perspective presented by **Ayoub Riman**
08:30 – 17:00 Limelight Room 2 Level 3	Slope Stability in Practice: Exploring the NZGS Guidance Units **Richard Justice, Eleni Gkeli, Razel Ramilo, Alan Wightman, Tom Revell, Naomi Norris** Sponsored by Natural Hazards Commission - Toka Tū Ake
09:00 – 16:00 Weka Room T+T Auckland	Tier 2 Geotechnical Rapid Building Assessment Training **Rori Green and Jeremy Neven** Sponsored by Ministry of Business, Innovation and Employment
08:30 – 16:00 Parnell Cricket Club Remuera	In-situ Testing Practical Workshop **Robin Power and Dr David Lacey**
17:30 – 19:00 Wynyard Pavilion Wynard Quarter	**Welcome Function** Enjoy drinks, canapés, and great company as we kick off the Symposium with a relaxed networking reception.

For more details, please refer to the conference website.

Thursday, 16 October 2025
Symposium Day 1

07:30 Level 3 Foyer	Registration Desk Open			
08:30 – 09:00 Hunua Rooms Level 1	Mihi Whakatau Opening Ceremony **Emilia Stocks, 2025 Convenor & Philip Robins, NZGS Chair**			
09:00 – 09:45 Hunua Rooms Level 1	Earthquake- and Climate Change-Induced Cascading Hazards: Mechanism and Prediction **Keynote: Prof. Dr. Xuanmei Fan** Chaired by Emilia Stocks			
9:45 Hunua Rooms Level 1	New Zealand ShakeOut - Whakahaumaru Aotearoa			
09:50 – 10:10 Hunua Rooms Level 1	Auckland 2023 Storm Response: Successes, Challenges, and the Road to a Better Recovery **Ross Roberts** Chaired by Rajitha Subhasinghe (Sachi)			
10:15 – 10:45 Balcony Foyer Level 5	Morning Tea			
Presentation session 1	**1A: Earthquake Engineering, Liquefaction and SSI**	**1B: Slope Stability and Landslide - Risk Assessment**	**1C: Embankments, Dams and Stopbanks**	**1D: Resilience in Transport Infrastructure**
10:45 – 12:25	Limelight Room Level 3	Waitākere Room 1 Level 3	Waitākere Room 3 Level 3	Waitākere Room 2 Level 3
Chaired by	**Rolando Orense**	**Alan Wightman**	**Richard Justice**	**Jin Lee**
10:45	**Introduction**			
10:48	Design of shallow foundations on soft lacustrine silt in Rotorua, New Zealand **Jared Flynn**	Landslide hazard and loss-of-life risk assessment for Muriwai, New Zealand following Cyclone Gabrielle in February 2023 **Matt Howard**	Back-analysis of hydraulic conductivity of coal mine spoil to ensure lowwall stability during dewatering **Jiwoo Ahn**	A simplified approach to regional storm recovery: Lower cost, higher risk tolerance, and reduced level of service on Marlborough roads **Dan Chamberose**
11:00	Design of foundations in lower seismicity liquefaction prone areas - a case study **Max McLean**	KiwiRail slope risk analysis (KRL) guidance review **Tom Revell**	Spatial, geotechnical and hydrological characterisation of dams and stopbanks in New Zealand **Liam Wotherspoon**	Enhancing resilience of a critical State Highway route between Wellington and Hutt Valley through rockfall mitigation **Jayne Hodgkinson**

Thursday, 16 October 2025
Symposium Day 1 (continued)

11:12	Rocking foundations: geotechnical considerations **Luke Storie**	Evaluating the risk of under-slips – A reflection on the assessment approach in Auckland **Luke Xu**	Learnings of large-scale bulk earthworks in Tauranga soils **Berrick Fitzsimons**	Enhancing Resilience: The Tar Barrel Tunnel Bypass for KiwiRail's Main North Line **Razel Ramilo & Mark Dawson**
11:24	Proposed improvements to TS1170.5 seismic hazard estimates of PGA on soft-soil sites through rigorously considering the influence of soil nonlinearity **Chris de la Torre**	Risk assessment of high natural slopes in urban environments – the case of Napier Bluffs **Eleni Gkeli**	Numerical investigation on the period-dependent seismic amplification for embankment dams **Yuri Wang**	Ten years of emergency response in the Eastern Bay of Plenty – An engineering geological journey through the roading network **Pedro Martins**
11:36	Foundation design for a clarifier at the Te Maunga Wastewater Treatment Plant; lessons of good practice in design and construction **Carlos Santamaria**	January 2023 Auckland Anniversary Weekend rainfall event – Lessons learnt from assessment and remediation of coastal cliff properties **Matthew Wansbone & Omar Hasaniah**	Simplified assessment procedure for stopbank seismic vulnerability and resilience **Jarrod Forde & Saasha Marsters**	SH25A Taparahi bridge - Geotechnical challenges and solutions **Jia Hong**
11:48	Simplified CPT-based liquefaction ejecta severity model using Christchurch data **Kristian Azul**	Undertaking landslide risk assessment using AGS 2007 Guidelines – Interpretation and lessons learnt **Zhili Li & Luke Xu**	Empirical fragility curves for stopbanks (Levees) from the 2010-2011 Canterbury Earthquake sequence **Yaseen Mahmood**	Geotechnical Design Aspects for Highway Recovery following Cyclone Gabrielle **Paul Horrey**
12:00	Inertial and Kinematic Soil-structure Interaction Foundation Design of in Response to Seismic Events **Adam Beall**	Waikorora Bluffs Landslide - 48 Years of Monitoring and Management for the Maui Pipeline **Chris Foote**	Predicted and measured settlement of peat loaded by a reservoir **Titus Smith & Chris Gilbert**	Design and construction of a 55m tall cut slope at Auraki Stream, State Highway 4 **Christoph Kraus**
12:12	Liquefaction Hazard Assessment of Pumice Rich Sands - Case Study of Rangipo Substation **Sajjad Anwar**	Lessons from recent earthquakes for resilient design and management of slopes **Doug Mason**	Investigation of silty soil properties under cyclic strain-controlled conditions **Ismail Shah, Muhammad Mudassar Rehman & Nauman Khan**	Tawhai Tunnel Lining Reinstatement **Fraser Monteith**
12:25 – 13:25 Balcony Foyer Level 5	**Lunch and Poster Session 1** Poster presenters (odd #'s to stand with posters 12:50-13:20) Poster Session Sponsored by PDP			

Thursday, 16 October 2025
Symposium Day 1 (continued)

Presentation session 2	**2A: Lessons from Major Rainfall Events: Emergency Response and Recovery**	**2B: Earth Retaining Structures and Walls**	**2C: In-situ Testing and Ground Models**	**2D: Ground Improvement and Piles Design and Constriction**
13:25 – 15:05	Limelight Room Level 3	Waitākere Room 1 Level 3	Waitākere Room 2 Level 3	Waitākere Room 3 Level 3
Chaired by	**Romy Ridl**	**Ayoub Riman**	**Heather Lyons**	**Naomi Norris**
13.25	**Introduction**			
13.28	Mulitaka Landslide, Enga Province, Papua New Guinea - Geotechnical USAR response from New Zealand **John Seward**	Low carbon retaining wall design: An assessment of whole-of-life embodied carbon for 500 real retaining walls in New Zealand **Nick Humphries**	Stormwater Soakage Testing and Design in New Zealand: An Inconsistent Practice **Chris Gilbert & Morris Kleinjan**	Geotechnical Challenges and Outcomes in the Design and Construction of Te Kaha Arena **Sam Baker**
13:40	Geohazard response on North Island transmission pipelines following 2023 extreme storm events **Cam Watson & Chris Foote**	Rock bags rock **Lars Schmidt**	Paleo-gully formation and impacts for ground modelling in Tauranga **Jeremy Eade**	Geotechnical challenges and solutions in reconstructing a bridge post-natural hazard events **Rhiannon Robinson**
13:52	Landslide susceptibility assessment of the Auckland Region to enhance future resilience **Doug Mason**	Improving the pseudo-static design of retaining walls: The influence of Vs30 and normalised average wall displacements **CY Chin**	Geotechnical Challenges on a Residential Land Development site in Te Puke North **Jamie Lott**	Integrating sustainability into foundation design: A case study of a low-carbon piling solution **Alistair Briffett & Scott Sutherland**
14:04	Redclyffe substation – A cost-effective, risk-based approach to geotechnical design challenges for post disaster critical infrastructure **Sam Glue**	Technical challenges: The Kāeo Bridge upgrade success story **Dan Sandilands**	Estimation of soil modulus and friction angle for Temporary Gravel Platforms in New Zealand using the Plate Load Test **Nick Barounis**	Selection of the appropriate grillage construction methodology **Nick Wharmby**
14:16	Electrical resistivity tomography for screening landslide risk: A case study of Mangamuka Gorge **Lizzie Ingham**	Seismic earth pressures in 'c- Φ' materials: A comparative study of Mononobe-Okabe and alternative design approaches **Nick Clendon & Usama Fauzi**	Quantification of uncertainties associated with Vs30-based site classification **Liam Wotherspoon**	Ohinewai ground improvement – sleepyhead factory development **Nick Speight, Rayandra Putoa & Kieran Bursell**

Thursday, 16 October 2025
Symposium Day 1 (continued)

14:28	The impact of geology and soil mechanics on landslides in the Kaimai Ranges **Kim De Graaf**	Specialty Remedial Grouting, Taupo Control Gate, Waikato River **Anna Gooder & Nathan Townsend**	Evaluation of bearing capacity and settlement of gravelly soils using the Chinese dynamic penetration test **Gabriele Chiaro**	Anchor load test results in Wellington soil and rock – an update **Alan Wightman**
14:40	Mitigation of slope risks along the Paekakariki Escarpment for the NIMT **David Stewart**	Under the mountain - City Rail Link, Mt Eden tunnel portal temporary retaining structure design and construction challenges **Yolanda Thorp & Simon Farquhar**	Pile integrity testing – with 'The Lot' please **Dion Denes**	Performance-based and whole-of-life design of the Kaitoke Flume Bridge **Ioannis Antonopoulos**
14:52	Identifying and forecasting movement patterns of large, populated landslides: A case study of the Tāhunanui Landslide **Katie Jones**	Port Hills loess - The challenge of identifying the good from the bad in Canterbury **Peter Smale**	Quality control of large diameter bored piles using thermal Integrity profiling test **Mohammad Bagher Asadi**	Complexities for Large Diameter Pile Design in an Artesian Aquifer **Andrew Hills**
15:05 – 15:35 Balcony Foyer Level 5	**Afternoon Tea**			
15:40 – 16:25 Hunua Rooms Level 1	Engineering Uncertainty: The Struggle Between Facts and Beliefs in Geotechnics **Keynote: Dr Burt Look** Chaired by Martin Larisch			
16:25 – 17:25 Hunua Rooms Level 1	Engineering for a Sustainable and Resilient Future – online for public **Public Lecture: Prof. Jan Evans-Freeman** **Panelists: Prof. Jan Evans-Freeman, Jo Horrocks, Ross Roberts & Nick Wharmby** Chaired by Ann Williams Sponsored by Natural Hazards Commission - Toka Tū Ake			
18:30 Circle Foyer Level 3	**Pre-Dinner Drinks**			
19:00 – 23:00 Hunua Rooms Level 1	**Gala Dinner and Awards** Resilience Beyond the Blueprint: My Path to Creating Space for Communities **Dinner Speaker: Nu'uali'i Eteroa Lafaele**			

Friday, 17 October 2025

Symposium Day 2

07:00 Level 3 Foyer	Registration Desk Open		
07:20 – 08:50 Hunua Rooms Level 1	**YGP breakfast followed by four presentations by the Best Paper winners of the NZGS YGP mini-Symposia** Presentations will start at 7:40 Cyclone Gabrielle: A Collaborative Approach to Reconnecting Communities - **Rebecca Till** Engineering Geological Modelling of an Active Landslide to Support Engineering Design - **João Pedro de Souza Oliveira** Moving Geotechnical Engineering Forward Together - **Jerry Lei** Analysis of Rockfall Fragmentation in the Torlesse Terrane Greywacke - **Dion Dow** North Auckland Line (NAL) Ch ~86km Remediation Project - **Hamish Foy** Chaired by Christoph Kraus Sponsored by GDS		
09:00 – 09:10 Hunua Rooms Level 1	Day 2 Welcome **Emilia Stocks, 2025 Convenor**		
09:10 – 09:55 Hunua Rooms Level 1	Liquefaction-Induced Downdrag and Dragload from Full-Scale Blast Liquefaction Testing **Keynote: Prof. Kyle M. Rollins** Chaired by Ioannis Antonopoulos		
10:00 – 10:30 Balcony Foyer Level 5	**Morning Tea**		
10:35 – 11:00 Hunua Rooms Level 1	Update on current and future MBIE projects **Kiran Saligame, Tim Farrant** Chaired by Philip Robins		
11:00 – 12:30 Hunua Rooms Level 1	Geotechnical Design and Compliance: Making sense of the NZ Building Code, TS1170.5, and other guidance **Rick Wentz, Stuart Palmer, Ken Elwood, Kaley Crawford-Flett & Kiran Saligame** Chaired by Luke Storie		
12:30 – 13:30 Balcony Foyer Level 5	**Lunch and Poster Session 2** Poster presenters (even #'s to stand with posters 12:55-13:25) Poster Session Sponsored by PDP		
Presentation session 3	**3A: Volcanic Soils and Pumice**	**3B: Regulatory Practice, Risk, and Communication**	**3C: Machine Learning and Big Data Applications**
13:30 – 14:30	Limelight Room Level 3	Waitākere Room 1 Level 3	Waitākere Room 2&3 Level 3
Chaired by	**Mark Dawson**	**Roy Ching**	**Tom Revell**
13:30	**Introduction**		

Friday, 17 October 2025

Symposium Day 2 (continued)

13:33	Estimation of pumice contents of volcanic deposits from their index properties **Mohammad Baqer Asadi**	Natural Hazards Risk Management Action Plan (NHRMAP) - a risk reduction tool for Auckland **Rebekah McLelland & Florence Canal**	Integrating UAVs, automated construction monitoring, and real-time data analytics in embankment design and construction for the Mt Messenger Bypass **Dani Thompson & Razel Ramilo**
13:45	Cyclic behaviour and liquefaction potential of an italian volcanic soil through the energy-based approach **Ilaria Farina**	Mangahauini Gorge - Development of a conceptual ground model from non-invasive data for decision making purposes **Rob Haskell & Caleb Gaston**	Making Auckland's roads more resilient: Using machine learning to model landslide susceptibility and develop an adaptive resilience programme **Chris Armstrong & Stephen Parkes**
13:57	Determining the effectiveness of encased stone columns as a liquefaction mitigation in pumiceous sand by shake table testing **Balasubramanian Elankumaran**	Improving the Building Consent process: A case-study with Engineering New Zealand on geotechnical-related RFIs at Christchurch City Council **Marie-Claude Hébert**	A Comparison between Limiting Equilibrium and Finite Element Analyses in a Case Study Using Automation **Kelvin Lo**
14:09	Stormwater soakage rates in Taranaki Brown Ash **Matthew Sullivan-Brown**	Strategies for geotechnical risk management and claim prevention **Emilia Stocks**	New Zealand Geotechnical Database (NZGD): Features & beyond for a nationally significant database **Tony Kao, Hayden Grant-Ussher & Lucas Gordon**
14:21	Liquefaction assessment in pumiceous deposits - Guidelines to assist geotechnical engineers in selecting a suitable approach in design projects **Jordanka Chaneva**	Urban Development Impacts from Iron Pan Layers in Westport, New Zealand **Justin Lo**	
14:35 – 15:00 Balcony Foyer Level 5	Afternoon Tea		
15:00 – 16:00 Hunua Rooms Level 1	Mick Pender Memorial Session – A legacy of research, education and impact **Prof. Liam Wotherspoon, Prof. Rolando Orense, Arman Kamalzadeh, Dr Mark Stringer & Dr Luke Storie** Chaired by Eleni Gkeli		

Friday, 17 October 2025
Symposium Day 2 (continued)

16:00 – 16:25 Hunua Rooms Level 1	Graduate Geotechnical Engineers and Engineering Geologists – a lack of apparent cohesion? **Ken Read** Chaired by Christoph Kraus Time for question with Geo-education Working Group (Eleni Gkeli, Christoph Kraus, Liam Wotherspoon, Martin Brook)
16:25 – 16:35 Hunua Rooms Level 1	Update to the AGS 2007 Landslide Guidelines Review **Christoph Kraus & Ross Roberts**
16:35 – 16:45 Hunua Rooms Level 1	Enabling you to make sustainability a reality in your geotechnical work - an NZGS supported initiative **Robin Power**
16:45 – 17:00 Hunua Rooms Level 1	Closing Address **Emilia Stocks, 2025 Convenor**

Saturday, 18 October 2025
Field Trips

08:00 – 16:00	**MAGMATIC MYSTERIES: The Secrets of Rangitoto** Meet at 08.00 to pick up packed lunch from the Level 3 Foyer at the Aotea Centre Post Field Trip drinks from 16.00 at La Zeppa, 33 Drake Street
08:15 – 16:30	**SLIP 'N' SLIDE: The Chronicles of Ground Movement** Meet at 08.15 to pick up packed lunch from the Level 3 Foyer at the Aotea Centre Post Field Trip drinks from 16.00 at La Zeppa, 33 Drake Street

Poster Presentations

Poster sessions: presenters are asked to stand with posters in the second half of lunch to be available for questions and discussion. Odd numbered posters on Thursday (Session 1) and even numbered posters on Friday (Session 2).

#	Paper Title	Presenter
01	Review and certification of geosynthetic materials for Waka Kotahi roading projects	Paul Tan
02	Delayed onset of liquefaction in predicting lateral spreading using Newmark Sliding Block analysis	Rob Taylor
03	Single particle crushing test of pumice simulations using bonded element model in discrete element modelling	Denny Budiman
04	Providing New Zealand specific comment on the communication and management of geotechnical risk	Tom Palastanga
05	The power of conceptual models	Dan Sandilands
06	An epic tale of local expertise and collaboration in Tamatea/Central Hawke's Bay during the rapid rebuild following Cyclone Gabrielle	Joy Hoverd
07	Unsaturated soil mechanics in New Zealand: recent applications and advances	Katherine Yates
08	Changes in shear wave velocity of pumice sand before and after liquefaction	Keisuke Ishikawa
10	Geotechnical observations from the August 2022 Nelson rain event and consideration for debris barriers in an urban context	Clayton Freeman Markham Phillips
11	Management of Liquefaction Risk for Residential Land Development	Catherine Roh
12	2023 Auckland flood response: Rural road remediation and insights on integrated geotechnical and hydrological designs.	Nick Mellsop
13	Mitigating a complex landslide risk to the Puketeraki embankment on New Zealand's Main South Line north of Dunedin	Nima Taghipouran Janey Hansen
14	The importance of geotechnical coordination for modern developments	Matt Price
15	Determination of VS(30) and Site Class in accordance with TS 1170.5:2024 – A case study	Marco Holtrigter
16	Prediction of the one-dimensional heave of soil covering a wide range of soil expansivity and initial condition	Heba Elsaidy
17	Liquefaction characteristics of gravelly soils prepared by water sedimentation method	Linxuan Wang
18	Assessment of large-scale landslide susceptibility for the Auckland Region	Doug Mason Kuba Rozmus
19	Effect of carbon nanotubes on liquefaction resistance and shear strength of sand	S Shaswat
20	Transformative geoengineering solutions: Adapting to climate change and enhancing hazard resilience - A case study in Wellington, Eastbourne	Dani Thompson Adriana Garcia

Poster Presentations (continued)

Poster sessions: presenters are asked to stand with posters in the second half of lunch to be available for questions and discussion. Odd numbered posters on Thursday (Session 1) and even numbered posters on Friday (Session 2).

#	Paper Title	Presenter
21	Advanced barrier design: CMC-treated bentonite in GCLs for mitigating short-chain PFAS migration in landfills	Maryam Roshan Mooshaee Rolando Orense
22	Rapid response to weather damaged infrastructure in Manawatū	Will Conibear
23	An Open Landslides Database for New Zealand	Enakshi Chakravorty
24	Rooting for stability: Integrating a softer touch to hard engineering for slope remediation	Kuanjin Lee
25	Liquefaction performance assessment for solar farms.	Lee Buhagiar
26	Reconstruction of Heaphy Track bridges following ex-Cyclone Dovi	Sarah Jones
27	Monitoring and Assessment of a Large Road Landslide near Martinborough, South Wairarapa	David Stewart
28	Liquefaction damage in Toyama Prefecture during the 2014 Noto Peninsula earthquake.	Taichi Hyodo
29	Groundwork for Resource Consents: Geotechnical Reporting Essentials for Auckland Development	Nicole Li
30	Development of Earthquake Shaking-Based Vulnerability Models for Residential Buildings on Hillslopes	Vinod Sadashiva Chris Massey
31	Smartphone and Tablet based LiDAR for small scale geotechnical site assessments	Sam McVicar

Thank you to our NZGS Members who reviewed the technical papers, including:

Clive Anderson
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Emilia Stocks
Mark Stringer
Harry Wahab
Nick Wharmby
Hadley Wick
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NZGS 2025 APP

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Conference Committee

Emilia Stocks
Symposium Convenor
Principal Geotechnical Engineer, Tonkin & Taylor Ltd.

Rajitha Sachinthaka (Sachi)
Promotions & Sponsorship Lead
Auckland University of Technology

Teresa Roetman
Promotions & Sponsorship Lead
NZGS Secretary, NZGS

Ayoub Riman
Technical Content & Programme Lead
Principal Geotechnical Engineer, ENGEO Ltd.

Roy Ching
Special Session Lead
Engineering Geologist, Stantec

Jin Lee
Field Trip Lead
Senior Development Engineer and Geotechnical Specialist, Auckland Council

Heather Lyons
Social Lead
Principal, ENGEO Ltd.

Special Dietary Requirements

If you indicated your dietary requirement during the online registration, this has been forwarded to the caterers. Depending on your requirement, the main food may be suitable for you or a separate table will have your food. Please make yourself known to the catering staff who will assist or please see the Registration Desk for assistance.

BUILDING PERFORMANCE

NZGD

Tony Kao

Ministry of Business, Innovation and Employment (MBIE)

Geotechnical Engineer

The New Zealand Geotechnical Database (NZGD) is a key resource for improving efficiency and decision-making in the building and construction sector. Widely adopted across central and local government, the NZGD provides free access to vital geotechnical information, including soil types, potential hazards, and ground suitability.

This tool supports better site assessments through various stages of construction development by offering insights into on-site ground conditions.

As the steward of the NZGD, MBIE is committed to enhancing its capabilities to further support the building and construction sector. To guide future investment and development, we invite you to share your insights via our SurveyMonkey questionnaire.

Learn more: [about NZGD]
Watch: [NZGD in action - video link].

Scan Questionnaire QR Code

Or
Click: [NZGD NZGS Symposium 2025] Questionnaire]

Keynote Abstract

Engineering Uncertainty: The Struggle Between Facts and Beliefs in Geotechnics

Dr Burt Look

Hunua Rooms Level 1, October 16, 2025, 3:40 PM - 4:25 PM

This paper has 2 parts; 1) Risk and uncertainty in practice and 2) Cognitive Dissonance in geotechnical practice. To advance geotechnical engineering practice, bridging the gap between empirical judgment and statistical analysis is essential.

Success in geotechnical projects is often attributed to engineers' judgment, yet it may stem from overly conservative designs with unnecessary costs. Historically, engineering judgment improved through failure observation. Judgment is refined in modern practice through forensic engineering studies which are more likely to be contractual rather than failures. But how many engineers are active in forensic engineering? Project lessons learnt are often not shared for legal reasons. Today, trials, observations, and statistical analyses substitute for direct failure observation, quantifying uncertainty to refine judgment.

Codes and standards reflect past experiences But even limit state codes are not a reliability analysis. A characteristic value addresses risk indirectly by choosing a cautious value + a partial factor. Any single point value is unlikely to be realised in the real world. A best estimate, even with upper and lower bounds, rarely captures all uncertainties. Statistics clarify this disconnect. One may not like statistics, but the meaning is clear. Statistical methods must be correctly interpreted as context, assumptions, and data quality matter. Engineers may misuse statistics by assuming homogeneity or a best fit trend line applies where variability is high.

A survey of practicing engineers asked to rank themselves show 74% and 94% consider themselves to be in the top 50% of engineers and drivers, respectively. This illustrates that we may be erroneously overconfident in our judgement. But can the opinions of "expert" engineers be more trustworthy? Case studies demonstrated that expert predictions often do not match actual failures with a tendency to also be overconfident in their knowledge and underestimating uncertainty.

Cognitive dissonance—conflicts between beliefs and knowledge—shapes many geotechnical practices. Despite evolving knowledge, outdated methods persist. Engineers often arrive at different conclusions despite identical data, suggesting that changing behaviours - not acquiring information - is the challenge. Heuristics, or mental shortcuts, aid quick decision-making but can lead to errors. This paper examines industry practices influenced by:

1. Disconnects between theory and construction practices
2. Tradition ("we've always done it this way")
3. Lag between practice and new insights

Oral Abstracts

Design of shallow foundations on soft lacustrine silt in Rotorua, New Zealand

Mr Jared Flynn[1], Professor Rolando Orense[1]
[1]University of Auckland, Auckland Central, New Zealand

1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Thick layers of soft lacustrine silts are often encountered below a shallow surface crust around the southern margins of Lake Rotorua and can present challenges for engineering projects in the region due to their soft and compressible nature. In recent years, a common approach to increase the bearing capacity and reduce settlement is to over-excavate the surface crust and replace it with a lightweight backfill, such as compacted pumice sand or layers of EPS geofoam, to create a compensated foundation. This paper aimed to evaluate the performance and applicability of the two geomaterials as a method for addressing settlement and bearing capacity-related issues related to the soft silts found around the margins of Lake Rotorua. In this paper, 2D & 3D numerical model tests were carried out on strip and rectangular foundations resting on both geomaterials to investigate the influence of the thickness and properties of the replaced zone on the load-settlement behaviours. The results indicated that an increase in the thickness of the pumice sand or EPS geofoam resulted in an increase in allowable bearing pressure and a reduction of settlement. However, the EPS had better overall performance based on settlement criteria and a greater load-compensating effect than the pumice sand.

Oral Abstracts

Design of foundations in lower seismicity liquefaction prone areas – a case study

Mr Max McLean[1], Mr Benjamin O'Loughlin[1]
[1]Engeo Ltd, Tauranga, New Zealand

1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

This paper primarily presents a case study of a Ministry of Education (MoE) building project on liquefiable dune sands in Tauranga. It presents our methodology for assessing liquefaction considerations including triggering response and step change behaviour, and how these aspects were considered in compliance with NZS1170, the MoE SGR and project challenges introduced by the release of the NSHM during design.

Liquefaction triggering just beyond SLS meant that careful consideration and guidance needed to be given to the level of foundation and structural resilience. Our analyses determined that punching failure and deformations could be addressed to avoid collapse, however significant repair and/or rebuild would be necessary at both SLS2 and ULS, ultimately requiring a resilient solution incorporating shallow ground improvement.

This paper discusses the soil structure interaction analyses undertaken to develop an optimised solution to increase the level of seismic resilience and safeguard the building from future building code updates.
It will also discuss how achieving minimum code requirements may result in low levels of seismic resilience, and why assessing triggering response and step change behaviour is critical to informing geotechnical considerations for foundations and ground improvements that deliver an appropriate level of seismic resilience aligned to project objectives.

This is a relatively common but less so talked about challenge for consultants working in lower seismicity areas, where liquefaction is not triggering at SLS.

Oral Abstracts

Rocking foundations: geotechnical considerations

Dr Luke Storie[1], Dr Maxim Millen[2]
[1]NZTA Waka Kotahi, Auckland, New Zealand, [2]Tonkin + Taylor, Auckland, New Zealand

1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The recent release of the draft Technical Specification TS 1170.5 (2024) includes guidance for the design of rocking foundations. Despite the potential benefits of rocking foundations in terms of reduced seismic loads transferred to the structure, the nonlinear nature of rocking foundations has made it difficult to implement in typical design practice. The simplified rocking procedure in TS 1170.5 (2024) provides a means to more easily take advantage of rocking foundations. It also creates opportunities for rocking foundations to be implemented outside of the limitations of the simplified procedure, with some additional design effort.
This paper explains the simplified rocking foundation design procedure outlined in TS 1170.5 (2024) and the limitations to adopting that procedure directly. The procedure is structurally focused, generally not requiring significant geotechnical input. However, this paper will explain the important geotechnical considerations that should be included in rocking foundation design through collaboration between the geotechnical and structural engineer. These geotechnical considerations include the ground profile most suited to adopting rocking foundations, implications for foundation design and building deformations, and opportunities to implement ground improvement techniques to implement rocking foundation design. Geotechnical engineers have a key role to play in promoting and implementing rocking foundation design for more efficient and seismically resilient structures.

Oral Abstracts

Proposed improvements to TS1170.5 seismic hazard estimates of PGA on soft-soil sites through rigorously considering the influence of soil nonlinearity

Dr Chris de la Torre[1], Prof. Misko Cubrinovski[1], Prof. Brendon Bradley[1], Dr. Sanjay Bora[2]
[1]Department of Civil and Natural Resources Engineering, University Of Canterbury, Christchurch, New Zealand, [2]GNS Science, Avalon, Lower Hutt, New Zealand

1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

This study examines the very high PGA resulting from the 2022 New Zealand National Seismic Hazard Model (NSHM2022) and carefully scrutinises the treatment of soil nonlinearity in the ground-motion models (GMMs) of NSHM2022. The NSHM2022 prediction is compared to globally-recorded strong motions, observations of soil nonlinearity in the Canterbury Earthquake Sequence, and results of nonlinear site-response analyses that handle soil nonlinearity more rigorously than the NSHM2022 GMMs. The PGA for VS30 = 225 m/s in Wellington, for the 2,500-year hazard, was calculated as 1.36 g by the NSHM2022. This value is in the realm of the global maximum instrumentally-observed ground motion for soft soil conditions. The default nonlinear site response models of the NSHM2022 GMMs were partially or fully constrained using equivalent linear site response analyses, which are only considered appropriate up to input PGAs of ~0.2-0.3 g. However, these models are used to predict ground motions with reference PGAs in exceedance of 1 g. Therefore, we propose adjustments to these nonlinear models, based on more rigorous, fully nonlinear site-response analyses for sites in New Zealand. The proposed nonlinear models suggest stronger deamplification of PGA at high ground motion intensities than the default models of GMMs, resulting in a decrease in PGA when these proposed models are run through the hazard calculation with the NSHM2022 earthquake source model. For example, the Wellington 2,500-year PGA reduced from 1.36 g to 1.0 g. This study forms the basis for a change proposal to modify the PGA values of the draft TS1170.5.

Oral Abstracts

Foundation design for a clarifier at the Te Maunga Wastewater Treatment Plant; lessons of good practice in design and construction

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1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The Te Maunga Wastewater Treatment Plant required the design and construction of a new clarifier as part of the Tauranga City Council plan to provide a resilient treatment process path. This required that some of the site geohazards, such as liquefaction and associated lateral spread, be well understood for the foundation design. Therefore, the ground investigations and assessments aimed to reduce the uncertainty around the depth and extent of liquefiable layers. Once the geotechnical assessments were completed, an optioneering process followed in conjunction with an early contractor involvement, to assess several foundation and ground improvement options. The outcome resulted in the selection of driven piles for the clarifier foundation. The pile type chosen consisted of an open-ended steel casing with a bottom driven concrete plug, and subsequent installation of reinforcement and concreting inside of the casing. As part of the design process, a site trial was undertaken to understand the construction risks and to gather information about pile capacity. During construction, the design assumptions were confirmed and an acceptance criterion was established by means of dynamic testing and a static load test.

Oral Abstracts

Simplified CPT-based liquefaction ejecta severity model using Christchurch data

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1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Christchurch, New Zealand, and its surrounding areas experienced significant liquefaction-induced damage during the 2010-2011 Canterbury Earthquake Sequence (CES) events. Ejecta is one of the liquefaction manifestations commonly observed and can cover significant parts of a site. This study focuses on developing a model that classifies sites based on whether liquefaction ejecta manifests or not, and the severity of the ejecta manifestation. Utilizing a database with 5000+ CPT data investigations in the region, the input parameters used in the model are simplified representations of fundamental geotechnical properties closely linked to liquefaction and the surface manifestations. Several models were developed using various combinations of these input parameters to segregate the sites into varying levels of ejecta severity, and their performances were compared. The final model presented can estimate the severity of ejecta at a site, specifically the lowest and highest levels (i.e. no ejecta and most ejecta classifications). Further analysis of various predictive capacity measures showed how much the model under- and over-predicted the observations. Combining severity levels into a single level was also studied to see its effects on the accuracy and performance of the model. Overall, given the relative simplicity of some of the inputs, the model shows promise as part of a large-scale liquefaction severity prediction system.

Oral Abstracts

Inertial and Kinematic Soil-structure Interaction Foundation Design of in Response to Seismic Events

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1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

In the field of earthquake engineering, structural response studies address the inertial loading of the superstructure that results in building lateral and rotational movements. The swaying of a building causes its pile foundations to move, where building structural forces are transferred to the top of the piles. As a result, the building lateral loads are resisted by the upper portion of the piles, and moments resisted by push-pull pile resistance. In addition to inertial loading, kinematic loading due to seismic shear waves travelling up through a soil column from bedrock, causes soil to move against piles therefore generating additional pile lateral loads and moments along the lengths of the piles. This paper discusses steps of seismic foundation design, including discussions on site seismic hazard, inertial and kinematic soil-structure interaction assessments for a project located in a seismic sensitive area. The project site geology is complex, comprising rock formation that had been subjected to tectonic deformation causing relatively intense folding, faulting and low-level metamorphism. The rock head dips steeply towards the northeast by around 20 m in height over a distance of 50 m in plan. Therefore 3-dimensional finite element numerical modelling has been adopted for inertial soil-structure interaction assessment. For kinematic soil-structure interaction assessment, free-field movements were assessed one-dimensionally and superimposed on to pile foundations for determination of pile structural forces; and was compared to dynamic kinematic assessment. Upon completion of both assessments, the pile structural actions from inertia and kinematic loading were combined for pile reinforcement design.

Oral Abstracts

Liquefaction Hazard Assessment of Pumice Rich Sands Case Study of Rangipo Substation

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1A: Earthquake Engineering, Liquefaction and SSI, Limelight Rooms Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The RPO Substation site is located within Taupo Volcanic Zone (TVZ) and based on the information obtained during the first phase of the site investigations comprising boreholes and CPT, is underlain by thick saturated deposit of pumice rich sands. The screening of the potential for the liquefaction is made using borehole SPT-N and CPT cone resistance data by adopting simplified methods recommended under local New Zealand standard practice. The goal of this evaluations was to determine whether the RPO site is free from liquefaction risk or whether soils will liquefy. For RPO site the ULS design PGA of 0.66g correspond to CSR of 0.44, SLS2 design PGA of 0.37g correspond to CSR of 0.24 and SLS1 design PGA of 0.09g correspond to CSR of 0.06. The results of the screening evaluation have shown the risk of liquefaction developing at RPO site, which will develop deformation incompliance to Transpower performance requirement for substation foundation. Based on latest development in the field of liquefaction, it is well understood now that the simplified methods are not applicable to pumice rich sands and risk of liquefaction shall, therefore, be assessed by undertaking laboratory cyclic triaxial tests under undrained conditions. Four (4) cyclic triaxial laboratory tests are undertaken on samples collected from depth range 9 to 11.5m below ground surface. The tested CRS values ranged from 0.42 to 0.80 to establish CSR vs N curve. The confining stresses are assessed as 40 to 80kPa, which corresponds to tested samples depth. Based on test results it was concluded that negligible to nil risk of liquefaction development at RPO site. The RPO Substation foundation design shall be assessed for static load case, where seismic liquefaction does not govern the foundation design.

Oral Abstracts

Landslide hazard and loss-of-life risk assessment for Muriwai, New Zealand following Cyclone Gabrielle in February 2023

Mr Matt Howard[1], Mr Ross Roberts[2]
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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Cyclone Gabrielle occurred on 14 February 2023 and caused widespread damage in the North Island, New Zealand. At Muriwai, west of Auckland, many houses were destroyed, and two firefighters were killed, by debris flows originating from a 150 m-long, up to 80 m high escarpment. In 1965 a similar event in Muriwai also caused the death of two people. The escarpment comprises extremely weak Awhitu Sand Formation sandstone that can form vertical outcrops, but weakens when saturated. Landsliding occurs in high magnitude, infrequent rainstorms, where increased porewater pressure causes failed blocks to disintegrate into downslope-traveling, destructive, rapid debris flows, often entraining large trees. A qualitative "fahrböschung" angle assessment partially informed emergency evacuation by identifying a broad zone of susceptible houses below the escarpment. For the longer term, a more precise loss of life Quantitative Risk Assessment was conducted to guide Auckland Council's property buy-out scheme. A key element was the RAMMS debris flow simulations, which were calibrated against some of the ~35 recorded large landslides and provided robust expected extent of future landslide extent. Observations of building damage in Muriwai suggest that >0.5 m of debris could cause fatalities of occupants, a key observation for the risk assessment.

Oral Abstracts

KiwiRail Slope Risk Analysis (KRL) Guidance Review

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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The recently developed KiwiRail Slope Risk Analysis (KRL) tool builds upon the well-used KiwiRail Slope Hazard Rating (KSHR) tool and adopts a similar approach to the New Zealand Transport Agency (Waka Kotahi) adapted New South Wales, Rail and Maritime Services Assessed Risk Level (ARL) method. The KRL tool aims to provide the framework for comparative prioritisation of slope hazards across the rail network for effective risk management.

This paper introduces the structure of the KRL, specifically the Likelihood, Consequence, and Risk assessment stages. The focus of this paper examines the indicative Annual Individual Fatality Risk (AIFR), and Annual Likelihood of Severe Event (ALSE) associated with each KRL risk level. The analysis reveals a generally good alignment between the KRL levels and the calculated AIFR and ALSE risk thresholds. This outcome provides confidence in the KRL approach in the effectiveness for the comparative prioritisation of slope hazards, considering both life-safety and operational risks, crucial for network safety and business continuity.

Oral Abstracts

Evaluating the risk of under-slips – A reflection on the assessment approach in Auckland

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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Landslide hazard is becoming one of the most critical natural hazards within the Auckland region and has now made it on to the top 10 list of insurable disasters in New Zealand. There is an increasing need for geotechnical professionals to become capable in evaluating the risk of landslides and having a stronger influence on where and how buildings are built.

As part of the Recovery Programme in Auckland, the Property Categorisation Scheme was set up to provide assistance for private properties that was damaged as part of the early 2023 weather events. Auckland Council teamed up with engineering design consultants within the geotechnical industry, to undertake landslide risk assessments for residential properties that have suffered from landslide hazards and opted into the Property Categoristion Scheme. The risk assessment was based on methods developed in the Australian Geomechanics Society (AGS) 2007 Guidelines.

While the AGS2007 Guidelines are a well-developed documentation, the guidelines itself and its associated commentary seems to emphasise more on landslides that occurs above the subject site (over-slips) than those that occurs below (under-slips). In comparison to over-slips, under-slips have a different behaviour and risk profile, where the impact on human life or structures can sometimes be much more subtle and subjected to engineering judgement.

This paper provides an overview on the interpretation and thought process that was undertaken during the evaluation of under-slip risks for the landslides that have occurred in Auckland, with emphasis on how the risk factors (outlined in AGS2007) are interpreted for under-slips.

Oral Abstracts

Risk Assessment of High Natural Slopes in Urban Environments – The Case of Napier Bluffs

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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Landslides in urban areas are prevalent in New Zealand and can cause significant disruption to communities affected. The Mataruahou Hill (Bluff Hill) in Napier City consists of 100-meter-high slopes along the coastal Breakwater Road and State Highway 50, which are prone to landslides and rockfalls, posing an ongoing hazard to road users, property, and the public. This paper presents the Detailed Risk Assessment (DRA) conducted for Napier City Council as part of their active risk mitigation strategy. The study included a desktop review of available landslide data, complemented by change analyses of digital terrain models of the past four years and the development of an informal inventory of historical landslides. Geomorphological and engineering geological mapping facilitated the identification of systematic failure mechanisms. Trigger analysis for notable historical failures, using available seismic and rainfall data alongside field observations, was employed to determine the probabilities of failure for the different mechanisms. Risk to road users was assessed using the New Zealand amendment of the NSW RMS Slope Risk Analysis (NZTA, 2023), while for qualitatively assessing the risk to property, the Landslide Risk Management Guidelines (AGS, 2007) were used. A review of existing and new mitigation measures for the highest-risk areas was completed. The DRA aims to support Napier City Council to make informed decisions regarding risk management and fund allocation for prioritised stabilization efforts.

Oral Abstracts

January 2023 Auckland Anniversary Weekend Rainfall Event – Lessons Learnt from Assessment and Remediation of Coastal Cliff Properties

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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The Auckland Anniversary Weekend rainfall event in January 2023 resulted in widespread slope instability, including along Auckland's coastal cliffs. Much of this affected existing residential development.

Over the last 30-40 years, geotechnical engineers and practitioners have typically addressed stability and coastal sea cliff regression risk with building set-backs, deepened building foundations, and protection structures such as palisade walls. While these measures performed as they were intended by the designers, by protecting the primary buildings (and therefore life), recent slope instability has nevertheless had a profound impact on these properties including the loss of amenity area, a perceived loss of security/well-being for building occupants, and significant effect to property value. Consequently, many owners were left feeling that designs, whilst effective in protecting the main dwelling, had not met their expectations by protecting land and asset value. Additionally, the required stabilisation and remediation of affected properties are highly constrained by the existing development and proximity to unstable land.

Slope instability on cliff-top properties was observed to be most significantly affected by poor detailing and management of surface water, subsoil drainage and stormwater. Consequently, robust surface water and stormwater design has been identified as the most critical (and cost effective) mitigation measure for managing the long term stability of cliff-top properties.

This paper presents observations from several properties affected by sea cliff instability, the subsequent remedial works required to reinstate and stabilise the land, and provides "lessons learnt" and design considerations for future development of similar sites.

Oral Abstracts

Undertaking Landslide Risk Assessment using AGS 2007 Guidelines – Interpretation and Lessons Learnt

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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

In late January and early February 2023, Auckland experienced two significant rainfall events due to the Auckland Anniversary Weekend Flooding and Cyclone Gabrielle. Many parts of Auckland experienced at least an estimated 1-in-200-year event, or worse. In addition to significant flooding, this led to widespread slope instability across various regions of Auckland and caused landslide hazards that damaged properties, assets and infrastructure and involved three fatalities.
As part of the response to the event in Auckland, the New Zealand Government developed a Property Categorisation Scheme for residential properties that was implemented by Auckland Council. Auckland Council chose to use life risk and mitigation cost as the criteria for establishing which properties fit in to the various of the categories. The objective of the Council scheme was to assess the risk level and mitigate against life risks that are considered to be intolerable.
The assessment of the landslide risks was conducted with reference to the Australian Geomechanics Society Landslide Risk Management Guidelines (AGS 2007), with particular emphasis on risks to loss of life.

The approach for the risk assessment has been developed by both Auckland Council and the engaged design consultants. This paper provides an overview on the overall process of the Scheme, how the risk assessment was conducted, the difficulties encountered, as well as lessons learnt that could be valuable for the occurrence of similar hazards in the future.

Keywords: Landslide Risk Assessment, AGS 2007, Recovery

Oral Abstracts

Waikorora Bluffs Landslide - 48 Years of Monitoring and Management for the Maui Pipeline

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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The Maui Gas Pipeline was constructed between 1977 and 1979 to transfer natural gas from the newly discovered Maui Oil and Gas fields in South Taranaki to industry and population centres in the upper North Island. One of the many complex challenges along the alignment is a geologically complex and rugged wilderness area in North Taranaki known as Parininihi which includes Pukearuhe, Whitecliffs and Mt Messenger.

The more favourable coastal alignment through Parininihi was occupied by the Kapuni Gas pipeline, so an inland alignment requiring large scale earthworks to form an easement up to 30 m wide was required for the Maui pipeline. The constructors faced a major challenge on the inland alignment; a large imposing bluff approximately 50 m high. Alignments across the slope below the bluff proved unsuitable so the toe of the bluff was blasted for the pipeline platform. After construction, it became evident that the bluff was the headscarp of the Waikorora Bluffs Landslide, a large active landslide that the pipeline crosses for a length of approximately 250 m.

The history of investigations, land movement monitoring and mitigation works for the Waikorora Bluffs Landslide is summarised including some of the challenges associated with carrying out the work in such a unique environment on the longest monitored landslide project in the New Zealand Gas industry to date. More recent work at the site has involved collaborative working with Ngāti Tama the tangata whenua and kaitiaki of Parininihi.

Oral Abstracts

Lessons from recent earthquakes for resilient design and management of slopes

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1B: Slope Stability and Landslide - Risk Assessment, Waitākere Room 1 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

New Zealand has rugged terrain, and infrastructure, transportation routes, and residential developments are often formed on or in close proximity to steep natural slopes as well as engineered cut and fill slopes. The performance of these slopes in earthquakes is critical for the resilience of the built environment and communities. The 2016 Kaikōura earthquake resulted in severe damage and disruption of nationally important transport corridors from slope failures. This paper summarises observations and draws lessons from the Kaikōura earthquake and other recent events for the resilience of geotechnical slope assets to earthquakes.

The long outage of the corridor highlights the need to consider the importance of resilience, and the functionality needs of infrastructure in the design of earthworks and structures. Design approaches that limit damage and/or provide quick recovery of functionality are recommended for enhancing resilience. A fundamental part of this is the assessment of appropriate slope failure mechanisms, based on thorough geotechnical investigations and sound engineering geological models. Earthquake-induced landslides and rock falls from high hillslopes also pose major threats to infrastructure corridors, as experienced in Kaikōura and recent earthquakes such as the 2024 Hualien earthquake in Taiwan. These hazards need to be managed to protect life safety, infrastructure, and ensure operability and business continuity during emergencies.

Landslide susceptibility mapping and slope risk analysis can be used to identify critical vulnerabilities in the network, as well as provide the basis for proactive approaches to hazard monitoring including trigger action response plans (TARPs), early warning systems and emergency response plans.

Oral Abstracts

Back-analysis of hydraulic conductivity of coal mine spoil to ensure lowwall stability during dewatering

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

This paper presents a case study for the dewatering assessment at an open-cut coal mine in the Bowen Basin (QLD, Australia). These two pits had become inundated following the 2011 flood event, and had been used as water storage for the past 10 years.

Rapid dewatering or drawdown is a well-studied failure mechanism for earth dams. Similarly, the in-pit waste rock dumps (i.e., lowwalls) are at similar risk of instability, with the potential for deep-seated movements with sliding along a weak, inclined base. Such failures have historically occurred at this site, generating a significant tidal wave through the in-pit water that could have been fatal for any personnel in the pit.

Piezometers were installed in the lowwall of the flooded pit, and used to calibrate a transient seepage model in order to back-analyse the hydraulic conductivity of the spoil. The back-analysed conductivity were significant higher than large-scale laboratory testing of similar waste rock materials.

The assessed parameters were then applied in forward analyses to determine the maximum dewatering rate while maintaining lowwall stability. The flooded pit has now been safely and successfully dewatered.

Oral Abstracts

Development of a hazard classification for reservoir landslides

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

As part of dam safety assessments, ANCOLD, NZSOLD and ICOLD all require evaluation of reservoir rim stability to identify existing or potential future hazardous landslides. However, there is little clear guidance on the approach to assessing potential hazards associated with reservoir rim stability or application of the risk assessment outcomes into ongoing monitoring programs.

The Roxburgh reservoir extends for 30 km, mostly in a narrow, steep sided gorge with pre-existing landslides forming approximately 50% of the shoreline and is in a moderate seismic zone. The assessment approach described has been developed over the last 30 years through a process involving expert peer review panels. The initial 1996 assessment simply classified the landslides as either hazardous or non-hazardous. The most recent methodology update in 2021 considers the hazards of impulse waves (dam overtopping) and landslide dams (upstream flooding) separately with four hazard classes based on five key factors. The updated methodology incorporates learnings from the 2016 Kaikoura earthquakes on slope instability due to seismic shaking.

The hazard classification system has been used to better understand reservoir instability hazard and risk at Roxburgh, and feeds into emergency action plans and monitoring programmes. Higher hazard landslides have more instrumentation and are monitored more frequently.

Oral Abstracts

Learnings of Large-Scale Bulk Earthworks in Tauranga Soils

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The NZ Transport Agency Waka Kotahi Takitimu North Link project is a new 6.8 km long, four lane expressway located west of Tauranga, New Zealand, connecting Takitimu Drive (SH29) through to State Highway 2. Takitimu North Link involves approximately 3,000,000m³ of bulk earthworks using soils from cuts to construct fill embankments that traverse incised river valleys and terraces. Fill is predominantly site won Surficial Ash and Matua Subgroup comprising sensitive volcanic ashes and alluvium sourced from deep cuts. The project required site won material be utilised to construct the fills which include large embankments in river valleys located on thick deposits of weak Alluvium. This paper aims to summarise some learnings of large-scale bulk earthworks utilising Tauranga Group Soils including:

- Observations and management of ground and groundwater conditions in the sensitive Surficial Ashes and Matua Subgroup in a 20 m deep cut through a terrace to the west of the Wairoa River Valley.
- A comparison of design settlement estimates and monitored settlement results for fill embankments up to 15 m high located on thick alluvial deposits in the Wairoa River Valley.
- Efficient reuse and compaction of site won material and issues associated with traditional specifications for measures of compaction in sensitive volcanic soils.

Oral Abstracts

Numerical Investigation on the Period-Dependent Seismic Amplification for Embankment Dams

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Observations from strong ground motions recorded at dam sites during past earthquakes show that accelerations at the dam crest are generally higher than those recorded at the dam toe. The amplification effects vary and depend on the amplitude of ground acceleration at the toe, the finding also supported by previous numerical analyses. Typically, small input ground motions result in amplification of peak acceleration at the crest, while large ground motions lead to attenuation due to the non-linear behaviour of the embankment. However, there are limited studies on the amplification or attenuation of seismic responses at the crest for different structural periods. The current practice of embankment dam design requires consideration of ground motion amplification at the dam crest. Applying amplification factors for peak acceleration across different structural periods may lead to overestimation or underestimation, particularly in dams with large fundamental periods. This paper presents a numerical study using a finite element approach to investigate the amplification effects for embankment dams. A series of parametric analyses are conducted to assess the impact of various factors on crest response, including embankment height, structural periods, and ground motion parameters such as earthquake magnitude and spectral accelerations. Based on the results, a regression model for estimating amplification or attenuation factors over different periods will be provided. The outcomes of this study aim to improve the accuracy of seismic-induced displacement estimations in embankment dams, as well as road and railway embankments.

Oral Abstracts

Simplified Assessment Procedure for Stopbank Seismic Vulnerability and Resilience

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The currently available New Zealand stopbank guidance documents inadequately define seismic performance acceptability criteria and resilience. The most pertinent guidance relates to dams, which may share similarities in failure consequences and mechanisms, but they do not fully represent the unique challenges of designing a linear asset in often variable and/or liquefiable soils within a river corridor. We introduce a simplified seismic assessment procedure for stopbanks by adapting existing international guidance such as the United States Army Corps of Engineers (USACE) guidelines for seismic evaluation of levees to better reflect local conditions and design practices. Given the significant peak design ground accelerations characteristic of many areas in New Zealand, adopting a deformation-based assessment approach is more pragmatic than the traditional factor of safety method due to the inherent conservatism of pseudo-static limit equilibrium analysis. The procedure identifies Newmark methods to estimate horizontal displacements to evaluate potential internal structural damage triggered by seismic events and empirical methods to estimate the crest elevation loss and reduction in flood conveyance capacity. While it is difficult to fully ascertain post-seismic stopbank performance without more rigorous assessment, such as finite element modelling, the assessment aims to provide insight into the implications for post-seismic flood protection performance across a range of seismic events. The proposed procedure aims to facilitate risk-informed decision-making regarding stopbank seismic performance and limitations on achieving the desired resilience.

Oral Abstracts

Empirical Fragility Curves for Stopbanks (Levees) from the 2010-2011 Canterbury Earthquake Sequence

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Stopbanks (levees) are critical for flood protection, and any damage to these structures can pose significant risks to human life and property. During the 2010-2011 Canterbury earthquake sequence, the stopbank network along the Kaiapoi and Avon Rivers sustained various damages, which required substantial time and cost to repair. To assess the risk to flood protection structures, conducting a seismic fragility analysis for the stopbanks is essential. This study focuses on developing empirical fragility functions for the stopbanks in the Canterbury region, which were impacted by seismic shaking and liquefaction based deformations. The results are presented as fragility curves based on site-specific intensity measures, which can be used for risk assessment of stopbanks in the future.

Oral Abstracts

Predicted and Measured Settlement of Peat Loaded by a Reservoir

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Te Waihekeora Water Storage Reservoir, completed in 2024, stores 3.2M m³ of water within a 43Ha HDPE lined basin located 15km south of Dargaville. The site topography is dominated by dune formations of the Kariotahi Group, with recent organic deposits infilling valley sections. The adopted design solution involved installation of an HDPE liner over natural soils, which included organic deposits up to 12m deep, with only nominal surface preparation. To support the assessment of liner deformations due to reservoir loading, a range of tests were undertaken including in-situ and laboratory techniques. Upon completion of construction, high-resolution bathometric surveys have been undertaken at prescribed reservoir levels. The comparison of available settlement prediction techniques with measured deformations over an extended area provides a range of insights around their applicability and accuracy. Derived settlement coefficients are presented, which may be of interest to those working with similar ground conditions.

Oral Abstracts

Investigation of silty soil properties under cyclic strain-controlled conditions

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1C: Embankments, Dams and Stopbanks, Waitākere Room 3 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

This study evaluates the strain-dependent dynamic behavior and liquefaction potential of silty soil under undrained, strain-controlled cyclic triaxial loading. Reconstituted specimens were tested at an effective confining pressure of 50 kPa, with shear strain amplitudes ranging from 0.10% to 1.5% and a cyclic loading frequency of 1 Hz. Key dynamic parameters including shear modulus, damping ratio, excess pore water pressure ratio (r_u), and mean effective stress (p^′) were systematically analysed. Results revealed rapid degradation of shear modulus and damping ratio within the initial cycles, particularly at higher strain amplitudes. The ASHL method yielded lower and more realistic damping values than the ASTM method, especially under large strains. Pore pressure ratios increased sharply with strain, reaching r_u=0.85 within a few cycles at γ ≥ 0.66%, leading to a complete loss of effective stress and the onset of liquefaction. At γ = 0.1%, the specimen remained stable with no liquefaction observed. These findings confirm that strain-controlled cyclic testing provides a reliable framework for assessing stiffness degradation, pore pressure development, and liquefaction susceptibility in silty soils under seismic loading conditions. The results enhance the understanding of silty soil damping behavior under high-strain scenarios, which is essential for seismic response analysis.

Oral Abstracts

A simplified approach to regional storm recovery: Lower cost, higher risk tolerance, and reduced level of service on Marlborough roads

Ms Gina Yukich[1,2], **Mr Dan Chamberose**[1,3]
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1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The Marlborough Roads Recovery Team (MRRT) was established after a July 2021 storm event caused an estimated $80 million dollars of damage across the local Marlborough roading network. An additional, more damaging storm in August 2022 then necessitated a 'back to the drawing board' approach as repair estimates escalated to $400 million and timeframes extended out to 5+ years. In the current political and economic environment, MRRT has been challenged to move quicker, avoid 'over-engineering' our repairs compared to adjacent sections of road, while improving resilience where possible. Working closely with the client and wider team to understand risk tolerance and required level of service for the roads enabled the repair estimate to be halved and available funds to be stretched effectively across the network. Over 3 years of iteration, MRRT have developed a strong team and key processes and resources that allow an innovative, pragmatic, and cost-effective approach to recovery, and a model for future storm events. Valuable lessons have been learned around the development and application of such innovations as:

- Generic retaining wall designs and 'simple' repair solutions that can be applied and replicated with minimal site investigation,
- Standardised stormwater details,
- A 'geometric design-led approach' to reducing road widths and introducing new single lane sections,
- Secondment of a core, experienced team able to deliver in-house, simple designs at a much more rapid pace than would be possible if tendering to the market,

Oral Abstracts

Enhancing resilience of a critical State Highway route between Wellington and Hutt Valley through rockfall mitigation

Miss Jayne Hodgkinson[1], Mr Gareth Hickey[2]
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1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The Wellington Transport Alliance have recently completed rockfall mitigation on State Highway 2, at two sites south of Petone. This route is a critical high-volume connection between Wellington and the Hutt Valley, with traffic volumes averaging 35,000 vehicles per day in each direction.

Rockfall and rockslides from the steep, 90 m+ high slopes above the highway have caused significant traffic disruptions, including a large rockslide in 2006 which closed both northbound lanes.

An options assessment was completed which recommended rockfall attenuators would be the best solution to control small to medium volume rockfalls from the upper slopes, directing debris to the toe of the slope for easy clearance. An additional barrier was recommended for across the gully feature created by the 2006 wedge failure.

These options were preferred by the WTA as the construction period needed to be restricted to minimise traffic disruption. Safety in Design was also considered, to allow for most of the construction and ongoing maintenance activities to be completed from road level rather than rope access.

Rockfall modelling was completed using a design boulder of 0.5m size, to assess rockfall bounce height, velocity, and energy. To address the resilience and safety risks, three rockfall attenuators were installed to control the fall of rocks from the slopes above the highway. In addition, a shallow landslide barrier was installed across the gully, to capture future landslides originating from wedge failures. Construction of the systems was completed at night using Elevated Work Platforms and limited rope access techniques.

Oral Abstracts

Enhancing Resilience: The Tar Barrel Tunnel Bypass for KiwiRail's Main North Line

Ms Razel Ramilo[1], Mr Duncan Henderson[2], **Mark Dawson**[3]
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1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The Tar Barrel Tunnel Bypass is aimed to redirect the railway around Tunnel 21, located on the Main North Line (MNL) connecting Christchurch and Picton. This bypass is situated between Ward and Waima River, roughly 45 minutes south of Blenheim, and extends 167 metres through a fractured mudstone formation close to the London Hill Fault.

The condition of Tunnel 21 has declined over the years, especially after the seismic events from the Seddon and Kaikōura earthquakes. In an effort to improve the long-term resilience of the MNL whilst enhancing the line speed, reducing travel times, and improving operational performance, a decision was made to close Tunnel 21. Consequently, the railway will be re-aligned through a hill situated beneath State Highway 1 (SH1) as part of the bypass project.

This undertaking involved rail realignment stretching 1500 metres and road realignment covering 700 metres, necessitating the excavation of 400,000 cubic metres of mudstone to adjacent fill locations, and creating cut slopes of up to 35 metres high. Furthermore, a new 100-metre rail underpass structure with supporting retaining walls has been constructed to enable passage beneath SH1.

The bypass encountered various challenges, including seismic hazards, slope instability concerns, presence of compressible soils, and potential settlement issues surrounding the rail underpass and SH1 embankments. Additionally, ongoing road and rail operations presented logistical constraints.

This paper offers insights into this resilience enhancement project, focusing on the geotechnical challenges faced, the sustainable re-use of site won materials and the innovative design strategies developed to address them.

Oral Abstracts

Ten Years of Emergency Response in the Eastern Bay of Plenty – An Engineering Geological Journey Through the Roading Network

Mr Pedro Martins[1], Mr James Griffiths[1]
[1]Beca Ltd, Tauranga, New Zealand

1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

The Eastern Bay of Plenty is traversed by approximately 600km of state highways, crossing many different geological and geomorphological terrains. With such rich diversity of terrain comes a wide range of geohazards affecting the roading network. This paper explores ten years of emergency response in the Eastern Bay of Plenty, based on the experience gained with the Bay of Plenty East Network Outcomes Contract and Bay of Plenty Structures Management Contract.
Through an engineering geology lens, a number of cases of disruption to the roading network by geohazards are discussed, including an honest reflection on remedial measures implemented and how some solutions worked better than others. From rock avalanches in high greywacke hills, through river scour in the deep gorges, to rock falls in the coastal cliffs and internal erosion in pumice country, the engineering geology of the Eastern Bay of Plenty always has something new to throw at geotechnical practitioners. The purpose of this paper is to share experiences to learn collectively and promote advancement of our industry.

Oral Abstracts

SH25A Taparahi Bridge - Geotechnical Challenges and Solutions

Mr Hayden Bowen[1], **Mrs Jia Hong**[1]
[1]Tonkin + Taylor, Christchurch, New Zealand

1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

State Highway 25A (SH25A) between Kōpū and Hikuai, Coromandel Peninsula, suffered significant damage from a series of major storm events in January 2023, with the road collapsing and severing the link. Cumulative storm damage caused a slip to occur resulting in the total loss of a section of SH25A measuring over 100m.

A 124-metre multiple span bridge replacing the road was selected by NZTA as the safest to construct and most resilient option, with the shortest and most reliable timeframe for reconnecting Coromandel communities. Upon selection of the bridge repair option, contractors McConnell Dowell and Fulton Hogan in a joint venture, with support from Tonkin + Taylor and Beca, were selected to design and construct the bridge solution in June 2023. The bridge was constructed and SH25A open in less than 6 months from project award, and less than 12 months from date that the damage occurred. A typical bridge of the type delivered would normally take 18 to 24 months to design and construct.

This paper covers the geotechnical challenges of the project, which included large scale slope failures, variable geology and the fast-track design process, which was carried out in parallel with procurement and construction. The design and construction of the slope stabilisation works will be described, including a cement stabilised shear key, fill buttress, soil nails and horizontal drains. The bridge foundations are also discussed, describing the pile design, rock socket design, construction observations and pile integrity testing.

Oral Abstracts

Geotechnical Design Aspects for Highway Recovery following Cyclone Gabrielle

Stuart Finlan[3], **Mr Paul Horrey**[4,1], Mr Adam Akehurst[4,2], Sigfrid Dupre[3]
[1]Transport Rebuild East Coast (TREC) Alliance, Christchurch, New Zealand, [2]Transport Rebuild East Coast (TREC) Alliance, Auckland, New Zealand, [3]New Zealand Transport Agency Waka Kotahi, [4]Beca Ltd

1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

Cyclone Gabrielle caused extensive damage to the state highway and rail network in Te Matau-a-Māui (Hawke's Bay) and Tairāwhiti (Gisborne) in February 2023. The damage was distributed over hundreds of kilometers and typically comprised landslips above and below the road, deep-seated land movement, flooding and scour. The Cyclone also seriously affected the Northland and Coromandel regions, although this paper focuses on the East Coast. Following the initial emergency response, the Transport Rebuild East Coast (TREC) Alliance was set up by NZ Transport Agency Waka Kotahi (NZTA) and KiwiRail to work alongside local contractors and businesses to plan, organise and deliver much of the work to restore the regions' state highway and rail networks. The TREC alliance partners are Downer, Fulton Hogan and Higgins, with design partners Aurecon, Tonkin + Taylor, and WSP.

As with many of New Zealand's rural highways, much of the network traverses challenging topography and geology, and was originally constructed by simple cut and fill earthworks utilising local materials. Repair of so many sites required consistent but workable design standards which reinstate to an acceptable level of service whilst remaining in context with the risk profile of the undamaged balance of the network. A number of alternative design philosophies and departures from the prevailing design standard (the NZTA Bridge Manual) were found to provide benefits in terms of affordability and efficiency of design and delivery. There is also significant value in standardizing repair typologies and design elements for sites with similar characteristics to benefit from efficiencies of scale and repeatability. Fully detailed standard design however proved more difficult to implement.

This paper discusses some of the key geotechnical design standards and solutions developed collaboratively between TREC and NZTA for the recovery works. The authors hope that some of the learnings will assist responses to future extreme weather events impacting roading networks.

Oral Abstracts

Design and construction of a 55m tall cut slope at Auraki Stream, State Highway 4

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1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

On 19-20 June 2015 heavy rainfall caused extensive flooding and numerous landslides in the Taranaki, Whanganui, Rangitikei and Manawatu districts. Numerous roads were damaged or closed by landslides and flooding, including the State Highway 4 (SH4) corridor between Whanganui and Raetihi. One of the last sites affected by the 2015 storm to be remediated along SH4 was the Auraki Stream Road Retreat project, located about 55km north of Whanganui. During the 2015 storm, flooding of the Mangawhero River resulted in the erosion of the bank below the road, reducing SH4 down to one lane at this site.

A two-lane retreat option was chosen as the preferred remedial solution. The design of the remedial solution involved constructing a 55m tall cut slope and excavating about 120,000 m3 so that the road could be retreated by up to 15m onto a rock platform, thereby improving the future resilience of SH4 at this location. This presentation will focus on (i) the optioneering process and how the preferred solution was chosen given the constraints of the site; (ii) the geology encountered in the cut slope and the ground engineering solutions applied; and (iii) the co-design completed with iwi during the design, consenting and construction phases. As part of this presentation, we will provide learnings and recommendations which are applicable to future projects and cut slopes in the Tertiary sediments which underlie much of the lower and central North Island.

Oral Abstracts

Tawhai Tunnel Lining Reinstatement

Mr Fraser Monteith[1], Mr Dan Sandilands[1]
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1D: Resilience in Transport Infrastructure, Waitākere Room 2 Level 3, October 16, 2025, 10:45 AM - 12:25 PM

A partial loss of the structural lining of Tunnel 1 (Tawhai Tunnel) on the Stillwater–Ngakawau Line (SNL) near Reefton occurred on 15 June 2024, necessitating urgent remedial works to restore operational capacity. Originally opened in 1891, recovery of the tunnel posed significant challenges, including unknown construction details, uncertain ground conditions, and a constrained tunnel profile that limited remedial options. Given the tunnel's critical role in KiwiRail's South Island operations, emergency works were undertaken under a highly compressed timeframe. Strict regulatory oversight, including the Mining Operations and Quarrying Operations Regulations, further constrained access, investigations, and working methods, requiring an adaptive design and construction approach. This paper presents an overview of the project, detailing the investigative and engineering methodologies employed to assess and stabilise the tunnel. It examines key challenges such as geotechnical uncertainties, constraints on repair methodologies, and the need to adapt design decisions during construction. Tactics proven by this project such as the adaptive design techniques while the works advanced at pace, and the risk management processes used in a constrained environment, can be applied to future tunnel recovery works.

Oral Abstracts

Mulitaka Landslide, Enga Province, Papua New Guinea - Geotechnical USAR response from New Zealand

Dr Jan Kupec[1,2], **John Seward**[3,2]
[1]Aurecon New Zealand Ltd , Christchurch, New Zealand, [2]FENZ USAR Engineering Specialist, , New Zealand, [3]Auckland Council - Engineering Assets and Technical Advisory, Auckland, New Zealand

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

On 23 May 2024 a large landslide near the village of Yambali in the Highland Province Mulitaka of Papua New Guinea buried an unknown number of victims. Due to remoteness of the location rescue efforts were initially slow to respond and conflicting information about the number of victims was reported. The landslide buried multiple residential dwellings, but also blocked the sole access road to the Porgera Gold Mine and adjacent township of over 100,000 residents.

Recognising the complexity and access difficulties the PNG government has requested international assistance and the Australian and New Zealand governments responded by standing up two internationally certified Urban Search and Rescue (USAR) teams. The Fire and Emergency (FENZ) USAR team comprised of two geotechnical engineering specialists, the authors of this paper, operations, logistics, paramedic support and representatives with local knowledge from the Ministry of Foreign Affairs and Trade (MFAT).

This paper will describe in three parts the preparation for the deployment including harnessing NZ filed support with the government engaging GNS Science to support from New Zealand. We will describe the logistics and challenges getting to the site and then reflect on the deployment. The paper will focus on geotechnical engineering aspects of the landslide, detail how data was collected and processed in the filed and highlight the crucial back-office support that GNS provided to the field team. Lastly we will discuss building local capabilities in PNG as we collaborated with the government geotechnical specialists in country.

Oral Abstracts

Geohazard Response on North Island Transmission Pipelines Following 2023 Extreme Storm Events

Mr Cam Watson[1], **Mr Chris Foote**[2], Mr Neil Crampton[1], Mr Derek Coombe[3], Mr John Payne[3]
[1]Pattle Delamore Partners Ltd, Auckland, New Zealand, [2]Pattle Delamore Partners Ltd, Tauranga, New Zealand, [3]First Gas Ltd, New Plymouth, New Zealand

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

First Gas Ltd and Channel Terminal Services Ltd operate transmission pipeline networks across the North Island of New Zealand, and in the Northland and Auckland regions, respectively. The pipelines traverse a wide range of geological terranes including those susceptible to instability geohazards.

From late January to early February 2023, the Auckland Anniversary and ex-Tropical Cyclone Gabrielle storm events affected the mid and upper north island with extremely high rainfall. Ground conditions were wet due to preceding rainfall events. Further heavy rain events occurred in areas over the pipeline networks through to June 2023.

The rainfall events resulted in over 100 new or reactivated instability and erosion geohazards across the pipeline networks over the first six months of 2023. Initial response included multiple event related line flights and urgent site visits. Follow-up geohazard workshops included risk assessment and a coordinated response for sites requiring further action.

Observations and investigation highlights for two significant landslide geohazards and a flooding related erosion site are outlined. Mitigation and monitoring measures carried out to ensure the continuity of gas and petroleum products supply to the storm damaged regions are also provided.

Oral Abstracts

Landslide susceptibility assessment of the Auckland Region to enhance future resilience

Mr Doug Mason[1], Mr Pathmanathan Brabhaharan[1], Ms Melissa Goldsworthy[1], Mrs Rebekah McLelland[2], Mr Ross Roberts[2]
[1]WSP, Wellington, New Zealand, [2]Auckland Council, Auckland, New Zealand

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The Auckland Region encompasses significant areas of steep terrain that are underlain by materials that are prone to slope failure, and recent large storm events have caused significant and widespread impacts from landsliding. Auckland Council has a strategy to define and manage the risks from natural hazards proactively for more effective management of planning decisions and infrastructure resilience. A regional scale assessment of landslide susceptibility has been undertaken as part of this strategy. The assessment and mapping were done separately for: (1) shallow landslides and debris flows, and (2) large-scale, slow-moving or relict landslide features. This paper presents the results of the shallow landslide susceptibility assessment, and a companion paper presents the mapping of large-scale landslide susceptibility. Existing records of landslide were collated and additional landslide mapping was carried out to collate an inventory of past landslides including those from the more recent Auckland Anniversary and Cyclone Gabrielle storm event of 2023. This consisted of identification of variables that influence slope stability and statistical analysis of the landslide inventory and local site conditions to develop landslide susceptibility maps. The maps provide valuable hazard information to inform land use planning, urban growth strategies and plan change proposals, to ensure that development is discouraged where appropriate in areas of high susceptibility, and instead directed to areas which are more appropriate. The maps also provide information which can help understand and manage the resilience of infrastructure networks and for planning the emergency response and recovery after severe storm events.

Oral Abstracts

Redclyffe Substation – A Cost-Effective, Risk Based Approach to Geotechnical Design Challenges for Post Disaster Critical Infrastructure

Mr Sam Glue[1], Mr Jim Dabkowski[1], Miss Khin Kyi[2], Mr Scott Taylor[1], Miss Angela Robinson[1]
[1]Beca, Christchurch, New Zealand, [2]Beca, Yangon, Myanmar

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The Redclyffe substation in Napier is a key substation for the east coast of the North Island and is a critical lifeline for the region. On February 13 and 14, 2023, Cyclone Gabrielle lashed Hawke's Bay with record rainfall and the Tuataekuri River burst its banks and flooded the substation causing extensive damage to the infrastructure. Limited initial supply from adjacent sites was restored within 24hrs. Within three days the station was bypassed to allow greater supply to be provided from adjacent sites and following a concerted effort from service providers and staff, direct supply from Redclyffe was able to be reinstated six days after the event.

Following the event, Transpower engaged Beca to redevelop the site using a front end loaded (FEL) accelerated design process for the first time on a major redevelopment as they recognised the need to improve the post-disaster resilience for the region quickly. The site had significant geotechnical challenges including soft and liquefiable soils, high seismic risk (ULS PGA >1g), and flooding that would make redevelopment of this site a major challenge.

We worked with Transpower using a risk-based approach to understand the risks to the site development and the application of the performance standards. We reviewed the appropriateness and constraints of the performance standards and developed cost-effective mitigations. These mitigations included adjustments to performance standards, managing seismic displacements and creating controlled flexible connections between critical structures that could be easily repaired after a major event if required.

Oral Abstracts

Electrical Resistivity Tomography for Screening Landslide Risk: A Case Study of Mangamuka Gorge

Miss Lizzie Ingham[1], Mr Nick McConachie[1], Mr Tim Hunger[2]
[1]Cook Costello, Christchurch, New Zealand, [2]CLL, Auckland, New Zealand

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

In recent years the impact of heavy rainfall events has been widely felt around New Zealand. As a country of rugged topography and high rainfall, the risk that landslides pose to transport infrastructure is great and has been realised in several areas of the country, with devastating economic and social consequences for the affected regions. With the frequency and intensity of such rainfall events only likely to increase with climate change, a switch of perspective from reactive remediation to preventative design is required to ensure the resiliency of New Zealand's transport routes.

In this paper we discuss the potential of geophysical methods for efficiently screening landslide risk along lengths of high importance roading infrastructure. Using the case study of SH1 through Mangamuka Gorge, Northland, we detail the potential of Electrical Resistivity Tomography (ERT) investigations for efficiently and non-invasively screening lengths of road and assessing their risk of saturation-driven under slips. We present the results of ERT investigations across three under slip sites in the Mangamuka Gorge, displaying the effectiveness of the technique in mapping the depth, extent and failure plane of the slips. With its ability to identify saturation variations and produce detailed 2D profiles of the subsurface we detail how ERT could be an invaluable tool for landslide risk identification and early warning systems, enabling preventative design and reinforcement to be put in place before disaster strikes.

Oral Abstracts

The impact of geology and soil mechanics on landslides in the Kaimai Ranges

Dr Kim de Graaf[1]
[1]University Of Waikato, Hamilton, New Zealand

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

A period of heavy rainfall combined with a magnitude 5.1 earthquake on the Kerepehi fault in early 2023 resulted in a minor landslide on a rural property located in the Kaimai Ranges. Physical site investigations and geological assessment have identified a thick layer of tuff overlying andesite in the area. Site investigations suggest that there is at least one historical landslide on the site of much greater significance than the minor landslide that activated in 2023. The investigations identified highly weathered and geothermally altered materials for a significant depth. The effects of physical weathering have resulted in alteration and fracturing of the tuff resulting in a much weakened material. The fractured tuff appears to have weathered to a clayey gravel containing a high proportion of very sensitive halloysite. Deep groundwater levels appear to have little influence on the slope stability. Instead it is proposed that the landslide developed from an unlikely combination of factors including heavily fractured material likely with a preferential direction of fractures oriented downslope, development of sensitive halloysite within the fractured and weathered tuff, extended periods of heavy rain reducing the shear strength of the halloysite and a minor earthquake of 0.05g to 0.1g. The wider implications of co-seismic landslide risk in the Kaimai Range as climate change occurs must be considered further.

Oral Abstracts

Mitigation of slope risks along the Paekakariki Escarpment for the NIMT

Mr David Stewart[1]
[1]WSP, Wellington, New Zealand

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Between Pukerua Bay and Paekakariki on the Kapiti Coast the North Island Main Trunk railway line (NIMT) and Te Araroa (TA) walkway pass along a 4km very steep coastal slope prone to landslide hazards. This paper covers the management of slope risks by KiwiRail along this section of the NIMT from two landslide events, as well as proactive designs to address other higher risk slopes.

A slip event which occurred in colluvial deposits in October 2020 presented an elevated risk to the NIMT at chainage 33.44. The management of risk since that time is described, culminating in the stabilising of the slope with anchored mesh and reinstatement of the TA track through the site on a retained bench.

A debris flow event onto the line at NIMT 36.07 km in August 2021 resulted in derailment of a train. This paper outlines the subsequent risk mitigation process undertaken through to construction of a permanent debris flow barrier.

At both sites, catch fences with remote monitoring networks were employed to help manage immediate residual risks. Drones were used regularly to check site conditions.

Neither site had vehicles access with lengthy walks required and for the NIMT 33.44 site regular helicopter mobilisations. The challenges of working on such difficult sites will be discussed and how challenges were navigated.
Separately, KiwiRail have been undertaking a program of developing options and designs for improving resilience at other nearby high risk sites; some examples are provided which incorporate lessons learnt from the two completed work sites.

Oral Abstracts

Identifying and forecasting movement patterns of large, populated landslides: A case study of the Tāhunanui Landslide.

Dr Katie Jones[1], Dr Chris Massey[1], Marcus Lovell[2], Paul Wopereis[3]
[1]GNS Science I Te Pū Ao, [2]Tonkin & Taylor, [3]BECA

2A: Lessons from Major Rainfall Events: Emergency Response and Recovery, Limelight Rooms Level 3, October 16, 2025, 1:25 PM - 3:05 PM

In August 2022, an extreme rainfall event affected much of New Zealand. NIWA refer to this event as the "strongest August atmospheric river (AR) on record" and classified it as a 1-in-120-year rain event for Nelson. The rain event caused flooding across Nelson Tasman and Marlborough regions and triggered many hundreds of landslides, along with the reactivated of several large pre-existing landslides including the Tāhunanui landslide in Nelson City. Movement of >0.5 m was measured, and some areas of the landslide transitioned into more mobile earth/debris flows and approximately 30 homes were evacuated.

The active area of the Tāhunanui landslide (0.26 km2) contains about 120 dwellings as it has been lived on for over a century, despite well document history of movement - 1893, 1929, 1962 and more recently in 2011 and 2022. These types of landslides tend to move most during heavy rainfall, or ground shaking caused by earthquakes. Long periods of wet weather causing increased pore-water pressures and earthquake shaking are known to reactivate large landslides. As our climate changes, extreme variations in weather are more likely to occur, including longer periods of wet weather, droughts, and high intensity rain events, like the recent one. How will these slow-moving landslides respond to the changing climate? How will strong earthquake-shaking impact these landslides given these changing conditions? If we can identify the locations and future behaviour of these landslides, then the risk to people, buildings, and infrastructure could be reduced.

Oral Abstracts

Low carbon retaining wall design: An assessment of whole-of-life embodied carbon for 500 real retaining walls in New Zealand

Mr Nick Humphries[1]
[1]Tonkin + Taylor, Auckland, New Zealand

2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

There is continuing pressure to reduce carbon emissions from infrastructure projects as part of New Zealand's emissions reduction plan. Retaining walls can have significant embodied carbon due to the quantities of materials above and below ground level. This paper explores the whole-of-life embodied carbon of different types of retaining walls.

Previous research has typically compared the embodied carbon of retaining wall options for a hypothetical project or focused on sustainability of a specific wall type. This research paper sources data from over 500 detailed retaining wall designs from real projects around New Zealand. Data is considered for concrete pile, sheet pile, post and panel, gravity, MSE and timber pole walls. The design drawings for each wall show weights and volumes of materials per linear metre, which have been measured and factored by published data for embodied carbon of construction materials. The type of wall and the retained height have been used to make meaningful comparisons between the data.

The data shows a clear correlation between embodied carbon and wall height, where embodied carbon increases with the height of the wall. The embodied carbon is also dependent on the type of retaining wall, where a concrete pile wall has significantly higher embodied carbon than a timber pole wall for a similar retained height. This research demonstrates that significant impact on embodied carbon can be achieved early in the concept design stage by working with clients and constructors to reduce the required retained height or to adapt design constraints to enable a retaining wall type with less embodied carbon.

Oral Abstracts

Rock bags rock

Mr Luke Hectors[1], **Mr Lars Schmidt**[2]
[1]Holmes ANZ, Wellington, New Zealand, [2]Holmes ANZ, Wellington, New Zealand

2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

There are many different suitable slope remediation designs that can be constructed to stabilise a failed slope. Choosing the right design is difficult as it needs to be compliant, effective, practical, and cheap, making it simple for the client and contractors. This can involve the use of alternative methods (away from the usual selection of designs) to remediate a failed slope, particularly where conventional methods introduce a step change in cost due to site limitations.

For this project we agreed on the use of rock bags. They are robust, easy to install, free draining and competent in marine and waterway environments. The site provided challenges with serious access restrictions. Third-party land instabilities, influencing the site, formation well below the water table, environmental constraints and construction timeframes significantly limited the remediation options.

Rock bags were chosen as the remedial design as they are suitable for sites with significant amounts of groundwater and poor-strength ground. This presentation discusses the challenges faced during construction, as required design adjustments led to a hybrid solution where rock bags and conventional soil reinforcement were combined for the upper zone of the slope.

Oral Abstracts

Improving the pseudo-static design of retaining walls: The influence of Vs30 and normalised average wall displacements

Dr C Y Chin[1], Dr Claudia Kayser[1]
[1]Beca Ltd, Auckland, New Zealand

2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Traditional pseudo-static designs of retaining walls distinguish between flexible and stiff wall responses by applying solutions such as the Mononobe-Okabe and Stiff wall formulations. However, wall displacement thresholds in the application of these solutions lack rigorous definition. Additionally, factors to reduce free-field peak ground acceleration (PGAff) when applied as seismic coefficients to these solutions can sometimes appear to be arbitrary.

This paper presents the results of statistical multi-linear regression analyses carried out on observations from over 900 embedded retaining wall two-dimensional dynamic finite element analyses using OpenSees. The study identifies that, in addition to PGAff, retained wall height (H), and soil unit weight (γ), the consideration of the average shear wave velocity over 30m (Vs30) as a proxy for soil shear stiffness, and the normalised average wall displacement (NAD) are important predictors and have high statistical significance in the approximate assessment of the incremental seismic force acting on the wall. A unified predictive relationship incorporating these factors is proposed.

Oral Abstracts

Technical Challenges: The Kāeo Bridge Upgrade Success Story

Mr Dan Sandilands[1], **Mr Kushant Kishore**[2]
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2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The previous single-lane bridge over the Kāeo River, situated north of Kāeo township at the SH10/Whangaroa Road intersection, posed safety concerns for motorists, particularly during peak tourist seasons. It often became a bottleneck, leading to delays and confusion for those unfamiliar with one-lane traffic rules.

This paper discusses the key geotechnical design elements and construction insights of the Kāeo Bridge upgrade project. The project involved a two-lane replacement for the old bridge and a roundabout, improving traffic flow and enhancing safety while minimising vehicle queues in busy periods. The new bridge, measuring 110 metres, is over twice the length of its predecessor to mitigate flood risks.

The site's ground conditions includes soft estuarine mud, loose alluvial sands, and a variable bedrock depth of approximately 5 to 50 metres (greywacke and sandstone). The Whangaroa Road abutment was identified as vulnerable to lateral spreading, with limited options for ground improvement due to its proximity to SH10, which restricted temporary road realignment. To counter lateral spreading, a large cantilever soldier pile wall was designed to support the abutment and splayed wingwalls, using FEM and substructure equivalent static analysis. The paper also covers the monitoring and management of embankment settlements exceeding 1500mm, and the seismic design of the bridge structure through three-phase analysis (inertia, cyclic, lateral spreading) with non-linear lateral bridge pile springs.

The $40 million project, designed by Aurecon and built by Fulton Hogan for NZTA, opened February 2024 two months ahead of schedule, winning the Community Award at the 2024 Āpōpō Awards.

Oral Abstracts

Seismic Earth Pressures in 'c- Φ' Materials: A Comparative Study of Mononobe-Okabe and Alternative Design Approaches

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2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

This paper examines various approaches to calculating seismic earth pressures on retaining walls supporting 'c- Φ' materials when methods such as Mononobe-Okabe reach their mathematical limitations. The widely used Mononabe-Okabe (M-O) method, which incorporates the pseudo-static yield acceleration (kh) to account for seismic forces, is central to this analysis. However, the method has limitations when the slope angle and pseudo-acceleration are too steep or high. The recent SESOC (2024) guide on Timber Pole Retaining Walls, provides some simple approaches to managing these aspects by assuming the material will simple 'overtop' the wall and therefore minimise the loading. A similar approach can be seen in MBIE/ NZGS Module 6 (Appendix F) when kh values are limited. Are these recommendations realistic/ appropriate to be used in design? We have looked at a range of options, including Shukla (2015), Wood (2022), Trial Wedges and Limit Equilibrium approaches for the calculation of seismic earth pressures on retaining walls. This paper presents the findings including the results of real-world examples, and provides recommendations selecting suitable methods on the site-specific conditions and the desired outcomes.

Oral Abstracts

Specialty Remedial Grouting, Taupo Control Gate, Waikato River

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2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Specialised grouting methods were used to remediate a sheet pile retaining wall in zone of high turbulence, immediately downstream of the Taupo Control Gates on the Waikato River. Wagstaff Piling NZ, together with McConnell Dowell, developed the remedial work, involving a rapid gelling grout. Versions of this approach, which has been progressively developed over the last 12 years, has been successfully used on previous notable projects, although always with variations of the theme. The project required a rapid gelling grout to hold the grout in place, and prevent migration into the river, through highly permeable, voided and chaotic material behind the sheet pile wall. The grout mix design incorporated a Part A and Part B mix where sodium silicate was the key activator to a cementitious grout, with variable gel times controlled by the injection system to suit the down hole conditions encountered. The variable control allowed the grout to effectively fill voided material while confining it to targeted areas, all in close proximity to the turbulent river. Finally, a series of tube-a-manchette (TAMs) were installed for post grouting. The post grouting of the TAMs would be an important verification stage. This project was an innovative solution in extreme conditions and is an example of a customised approach to drilling and grouting, used to resolve a difficult problem. These techniques such as this are not textbook solutions, involving variable techniques, combinations and hybrids, although showing that with lateral thinking and drawing on experience, the most challenging conditions can be overcome.

Oral Abstracts

Under the Mountain - City Rail Link, Mt Eden Tunnel Portal Temporary Retaining Structure Design and Construction Challenges

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2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The City Rail Link (CRL) is the largest transport infrastructure project ever to be undertaken in New Zealand. It comprises a 3.45 km twin-tunnel underground rail link up to 42 m below the city centre. The Link Alliance are delivering the design and construction of two new stations, Te Waihorotiu and Karanga-a-Hape, redevelopment of the Maungawhau Station and boring twin tunnels between Maungawhau and Te Waihorotiu. This paper discusses the portal retaining wall at Maungawhau, where the tunnel boring machine started its journey to Aotea station. The portal wall is a complex reinforced concrete piled retaining structure up to 28 m high. In the order of 100 ground anchors provide stabilising tie back forces at four levels. 3D modelling was required to ensure no interaction between the bond lengths of the overlapping anchors, the tunnels, and the tightly constrained project boundaries. Three mined tunnels pass below the wall. The design was complicated by the presence of poorly cemented sandstone that was encountered at the mined tunnel face level, a 1.3 m diameter watermain that supplies a large area of Auckland inner city running just behind the wall, a street behind the wall that remained open for much of the construction period and a vibration sensitive television studio filming during construction across the road. This paper describes the design of the wall and monitoring results through the construction, excavation, tunnel mining and backfilling phases of the wall. Instrumentation includes inclinometers, surveyed surface prisms and ground anchor load cells.

Oral Abstracts

Port Hills Loess - The challenge of identifying the good from the bad in Canterbury

Mr Elliot Duke[1], Mr Bjorn Raasch[1], **Mr Peter Smale**[1]
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2B: Earth Retaining Structures and Walls, Waitākere Room 1 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The east coast of Canterbury, New Zealand, is characterised by extensive loess deposits, a wind-blown silt that can pose challenges in geotechnical engineering.

Loess soils can be hard, have a high bearing capacity, support vertical cuts, and be stable under high seismic loads. In areas loess is soft and dispersive, leading to instability and erosion issues, so how do we tell the good from the bad ?
How do we identify problematic loess soil, from stable loess slopes, and how do we maintain stability when working with loess soils in Canterbury.

Numerous published papers are related to loess slopes that have failed, and guidelines recommend the use of low soil properties when designing foundations and retaining walls in Port Hills loess soils (Typically Ø: 30, c: 0) yet in numerous sites in Canterbury, and Banks Peninsula laboratory testing has revealed high shear strength, and soil properties. (Ø: 32- 63, c: 6- 13+).

To address the risk loess soils pose, many engineers design retaining walls and foundation systems using conservative soil properties. While this may create resilience, there are financial and environmental impacts associated with over designing structures, so it is important to ensure the appropriate loess properties are used in design.

Site specific investigation, including laboratory testing, dispersivity tests, and mineralogy analysis can all assist in understanding the nature of the loess soils, and help identify challenging soils, and the extent of mitigation measures needed to ensure slopes and structures remain stable.

Oral Abstracts

Stormwater Soakage Testing and Design in New Zealand: An Inconsistent Practice

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Stormwater soakage systems are widely adopted across New Zealand in areas where reticulated systems are not available, where groundwater regimes are to be maintained following development, as well as lessening the effects of development on public stormwater infrastructure. Testing of soil conditions and design of these devices is outlined in Building Code E1. Nevertheless, many regional Councils have outlined their own guidance (typically based on guidance predating E1), where testing methodologies, and design practices differ significantly from those outlined in E1.

The interface between geotechnical professionals and civil engineers can lead to the risks associated with achieving their respective objectives, not being fully appreciated and considered. Inadequate appreciation of these risks can result in stormwater soakage systems being installed with insufficient capacity for the design storm events, or redesign of systems during construction threatening the feasibility of projects through increases in cost or other development restrictions. The appreciation of risk between disciplines is not outlined and captured well in current published guidance.

This paper outlines a review of the various stormwater soakage testing and design practices in New Zealand and explores risks that exist from geotechnical and civil perspectives. It is intended to provide some insight as to how geotechnical and civil engineers can better interact to achieve the desired design objectives.

Oral Abstracts

Paleo-gully formation and impacts for ground modelling in Tauranga

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The NZ Transport Agency Waka Kotahi Takitimu North Link Stage 1 project is a new 6.8 km long, four lane expressway located west of Tauranga, New Zealand, connecting SH29 Takitimu Drive Toll Road through to State Highway 2 near Loop Road. The project requires the construction of multiple bridges on deep piles in complex quaternary age geology. Two sites of interest form the subject of this paper. At Te Rangi tua nehe / Minden gully, three bridges were required to be constructed over an existing incised gully feature, with successive site investigations indicating increasing complexity in the arrangement of ignimbrite, tephra, and alluvium. At Takitimu Flyover Bridge on SH29 Takitimu Drive Toll Road, during construction, a previously unknown, deep, steeply incised paleo gully was encountered in piling proof boreholes. This resulted in redesign of the impacted piled foundations. This paper presents hypotheses of formation for the complex geology underlying Te Rangi tua nehe / Minden gully and Takitimu Flyover Bridge, and lessons on ground investigation and ground modelling in the Tauranga area.

Oral Abstracts

Geotechnical Challenges on a Residential Land Development site in Te Puke North

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The northern tip of the Te Puke township in the Bay of Plenty comprises an alluvial terrace mantled by a sequence of volcanic deposits which extend north as a series of ridges into an expansive flood plain of soft alluvial sediments. For a new residential land development at Te Puke, development in this geomorphology presented several interesting geotechnical challenges.

Through several phases of desk study, investigation and modelling, we identified evidence of extensive landform modifications, that resulted in the removal of the upper profile of ash in parts of the site, and the infilling of a former gully underlain by compressible organic soils.
Proposed landform modifications were identified to pose settlement and edge stability hazards. Additionally, the volcanic deposits identified were found to contain a thick sequence of crushable and highly weathered pumice lapilli; the Mangaone subgroup, known to be susceptible to collapse under loading, and notorious for its unsuitability for re-use in bulk earthworks. The underlying alluvial soils forming the ridge were determined to be vulnerable to liquefaction and the eastern slopes along the terrace margin posed a slope instability hazard.

This paper presents the work undertaken to characterise the site geology and hazards, and proposed mitigation measures developed to allow safe site development. During our work we developed a detailed 3D geological model using Leapfrog, and this paper discusses the benefits of this modelling in complex ground conditions and how this can be used to identify problematic soils, assess and communicate geohazards and risk, and inform earthworks design.

Oral Abstracts

Estimation of Soil Modulus and Friction Angle for Temporary Gravel Platforms in New Zealand using the Plate Load Test

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The plate load test can be used to estimate the vertical soil modulus Ev and the angle of friction for temporary working platforms and gravel rafts. This paper presents the results of plate load tests that have been undertaken on different sites across New Zealand. The paper details the procedures that need to be followed by practitioners (as per the DIN 18134 standard) and provides guidance for the proper execution and interpretation of the test results in the New Zealand context, the common pitfalls and how to avoid them. The paper is also related to the NZGS Specification NZGS_0510 Earthworks, dated 15/02/2024, Version 1.0 – Final, and provides some guidance on the correct interpretation of results.

The paper also presents the estimated friction angle using the Corke et al. (2021) method at the same sites and correlates them with the associated Ev values. The results are discussed, with emphasis on the main conclusion, which is that the Ev values do not align with the estimated friction angle values. The results indicate it is very probable to estimate acceptably high friction angles accompanied by unacceptably low Ev values. The paper discusses the significance of this finding and discusses the possible causes for this incompatibility. The paper also provides some awareness for this incompatibility to temporary works designers and gravel raft designers which could be related to the safe performance of temporary gravel platforms and the long-term performance of gravel rafts for shallow foundations.

Oral Abstracts

Quantification of uncertainties associated with Vs30-based site classification

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The introduction of TS1170.5 has changed the approach to seismic site classification in New Zealand, with the time-averaged shear wave velocity over the top 30 m of the subsurface profile (Vs30) at a site now being a key site classification metric. This allows for the use of multiple approaches to measure or estimate Vs30, and to account for the different levels of uncertainties across these approaches, uncertainty factors are introduced. These provide a representation of the uncertainty associated with Vs30, with these factors increasing as the approaches move away from direct measurements and towards depth interpolation and Vs-correlations. This paper explores the uncertainties associated with these approaches based on different datasets of measured Vs profiles from across New Zealand. This includes the influence of direct measurements methods (invasive and non-invasive), depth interpolation methods and CPT-based correlations for estimating Vs. These will be explored separately and then combined within the structure of the various TS1170.5 methods for the definition of Vs30.

Oral Abstracts

Evaluation of bearing capacity and settlement of gravelly soils using the Chinese dynamic penetration test

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

In gravelly soils, the evaluation of the bearing capacity and settlement required for foundation design is challenging. The standard penetration test (SPT) and the cone penetration test (CPT) are not generally useful because, due to the presence of large particles, the penetration resistance increases considerably and may reach refusal at shallow depths even when the soil is not particularly dense. This limitation makes it very difficult to obtain consistent and reliable correlations between SPT or CPT penetration resistance and basic gravelly soil properties. However, since 1970s, the penetration resistance derived from the dynamic cone penetration test (DPT) has been widely used in China in geotechnical practices for foundation design in gravelly soils. The Chinese DPT consists of a 74 mm diameter cone tip continuously driven by a 120 kg hammer with a free-fall of 100 cm. Recently, DPT has been introduced also in New Zealand. Field investigations conducted by the first author in Blenheim have indicated the DPT can be economically and effectively driven through alluvial gravelly profiles (irrespective of the gravel content and maximum gravel particle size) using a standard 63.5 kg SPT hammer with a free-fall of 76 cm. In this paper, the DPT-based procedure to evaluate the bearing capacity in gravelly soils is described in detail. Furthermore, three alluvial gravel sites in Blenheim are characterised in terms of DPT penetration resistance, bearing capacity and deformation modulus. Finally, for each site, settlement is estimated for the case of circular and square shallow foundations.

Oral Abstracts

Pile Integrity Testing – With 'The Lot' Please

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

A bridge upgrade project located north of Auckland involved the installation of permanently cased conventional drilled bored piles. The permanent casing was installed to the top of rock which extended approximately five meters above the tidal riverbed level. The proposed testing method to confirm pile integrity was Cross Hole Sonic Logging (CSL), however, to obtain confirmation of integrity within a few days, Thermal Integrity Testing (TIP) was also proposed. The actual integrity testing method adopted for the majority of the piles was TIP, CSL and Low Strain Pulse Echo Method (PIT). The results from TIP provided very unusual results, not normally observed and these results alone indicated potential flaws and defects within the pile. However, the collection of CSL and PIT data, in conjunction with quality construction records, confirmed that the were no issues of concern and the piles were built with satisfactory integrity. This paper reviews the limitations of testing for the three methods used and discusses TIP with regards to the effects of changing boundary/environmental conditions, which may affect the data to indicate that there are defects. Without the benefit of CSL and PIT, pile acceptance based on TIP alone may have presented a very different outcome.

Oral Abstracts

Quality Control of Large Diameter Bored Piles using Thermal Integrity Profiling Test

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2C: In-situ Testing and Ground Models, Waitākere Room 2 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Large diameter bored piles which are constructed using support fluid require careful planning and close supervision to ensure a high-quality pile. Even with the best construction controls in place, integrity testing is an important part of the pile design and construction process. In New Zealand, pile integrity has been traditionally assessed by either non-destructive methods such as Crosshole Sonic Logging (CSL) and Low Strain Pile Integrity Tests (PIT), or by way of coring into the pile. Thermal Integrity Profiling (TIP) is a relatively new technique capable of detecting imperfections in the pile shaft. With the use of a cloud-based platform, TIP is able to be used to provide an early indication on the integrity of the pile. This paper will discuss the theory and application of the TIP test as used by Brian Perry Civil Limited for the construction of large diameter drilled shafts for the Reeves Flyover Bridge, part of the Eastern Busway Alliance project. These piles range from 1.5m to 3.0m in diameter and up to 30m deep and were constructed using a 6m starter casing and polymer support fluid. This paper will also describe the process followed to determine an appropriate acceptance criteria for this project.

Oral Abstracts

Geotechnical Challenges and Outcomes in the Design and Construction of Te Kaha Arena

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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Te Kaha is a new permanently covered multi-use arena in Christchurch and is the final anchor project in the Christchurch Central Recovery Plan, following the Canterbury earthquake sequence of 2010-2011. The $683-million project will have a seating capacity of 30,000 for sports events and will hold up to 36,000 spectators for large music events. The Arena is located in the central city on a site with recent earthquake history and evidence of liquefaction. Extensive seismic hazard studies, geotechnical and hydrogeological investigations and geotechnical design have been completed to allow facilitate construction of the foundation system. The liquefiable site soils have been improved by installation of rammed aggregate piers and a combination of stiff rafts and intersecting grillage beams over the improved ground form the foundation system of the Arena. The adopted foundation system, soil-structure interaction analysis for static and seismic conditions, as well as some design and construction challenges and complexities are described.

Oral Abstracts

Geotechnical Challenges and Solutions in Reconstructing a Bridge Post-Natural Hazard Events

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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The Western Bay of Plenty District Council is undertaking a significant infrastructure project to construct a permanent bridge at the No.4 Road crossing at Te Raparaoa-a-hoe Stream. This initiative follows the destruction of the previous bridge during an extreme storm event in January 2023, which necessitated the installation of a temporary Bailey Bridge to maintain community access.
The new development involves constructing a permanent replacement bridge with pile foundations adjacent to the existing structure, within a highly constrained area. The southern bridge abutment presents particular challenges, due to the presence of very loose/soft alluvium, underlain by the Mamaku Plateau Formation Ignimbrite. The combination of soft soils, potential river-induced erosion, and tight geometric constraints introduced considerable design complexities.
This paper discusses the geological features, pile design, and slope stability challenges encountered during the bridge design phase. It details the geotechnical observational approach adopted to derive analysis outputs and describes the construction monitoring processes implemented to achieve the stability and integrity performance for the bridge during construction. The project provided valuable insights into managing geotechnical risks in constrained environments, offering potential applications for similar future infrastructure projects.

Oral Abstracts

Integrating Sustainability into Foundation Design: A Case Study of a Low-Carbon Piling Solution

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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

This paper examines the collaboration between the design team and Early Contractor Involvement (ECI) piling contractor in developing a foundation solution which not only proved cost-effective but also significantly reduced embodied carbon by 3,600 tCO_2e compared to the alternative foundation options. The ground conditions at the project site presented a number of challenges for pile design and construction. Bottom driven steel tubes (BDSTs) were identified early in the project as a potential optimal solution with the advantage of a low carbon-footprint, but with several challenges around constructability and environmental noise and vibration effects. A piling trial during the ECI phase was used to validate the solution and investigate risks. The trial provided site-specific information on constructability, pile capacity, and noise and vibration effects. The use of BDSTs achieved carbon and cost savings which would not have been achieved without the validation provided by the trial. Data obtained form the trial also enabled design optimisation which resulted in further carbon and cost savings. With proper management of vibration and noise during construction, these piles offered the most cost-effective solution for the client, delivered optimal structural performance for the designers, and minimized environmental impact.

Oral Abstracts

Selection of the appropriate grillage construction methodology

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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Over the past 10 – 15 years it has been recognised that grillage or lattice inground structures can provide a robust ground improvement solution particularly during seismic events where the likelihood of liquefaction or cyclic softening exists. During a seismic event the intersecting walls of a grillage provide stiff compression load paths through the ground minimising and limiting the loads experienced by the soil between the walls. In the event that the soil within the grillage experiences liquefaction, the walls serve to confine the soil and minimise any post event settlements. This unlike other methods of ground improvement using individual rigid inclusions rely on the stiffening effect of the elements and any improvement of the surrounding soils to reduce liquefaction potential but provide no confinement should it occur. Therefore, it is important to consider how the grillage is formed to ensure the load paths and confinement are provided. Grillages can be constructed using many different specialist construction methodologies, these can be summarized under the following categories:

1. Interlocking low strength concrete piles using conventional cased or fluid support methods or CFA
2. Overlapping deep soil mix columns formed with a mechanical tool or jet grouting
3. Trench construction dig and replace with low strength concrete or self-hardening slurry
4. Soil-mix trenching using CSM or Trenchmix

The paper will draw on experience and recent case studies to highlight some of the limitations and benefits of the different methods and provide some useful guidance on selection.

Oral Abstracts

Ohinewai Ground Improvement – Sleepyhead Factory Development

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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

This paper illustrates how hybrid geotechnical ground improvement solutions have been implemented to cost-effectively support a large-scale industrial project (The Sleepyhead development) on challenging ground conditions. The Sleepyhead development is located over a 37 ha block of land on the eastern side of State Highway 1 at Ohinewai, North Waikato.

The site is underlain by the Tauranga Group geological unit, which includes highly variable soil types. The upper soil types comprise Holocene Age fine to medium grain, loose SAND from the Taupo Pumice Alluvium, underlain by soft and highly compressible PEAT, clayey SILT and silty CLAY from the Rotokawau Formation. Pleistocene Age deposits are present beneath these layers, extending to depths of more than 30 m. The presence of loose sands, susceptible to liquefaction, together with highly compressible PEAT at risk of large magnitude total settlement, extending to depths of up to 15mbgl, presented significant engineering challenges for the development of the land. This necessitated robust ground improvement strategies for mitigation of multiple geotechnical risks.

This paper presents an overview of the ground improvement techniques employed, comprising a hybrid of earthworks, dynamic compaction and preloading. The adequacy and efficiency of the proposed ground improvements have been confirmed by multiple rounds of investigation, validation testing, trials and monitoring, which have enabled the designers to refine the ground model and soil behaviour prediction while enhancing safety and cost effectiveness.

Oral Abstracts

Anchor load tests in Wellington region soil and rock – an update

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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

Vertical and horizontal ground anchors are used frequently in the Wellington region. This study is an update of a similar work from 2017 and presents summaries of the results of tension tests of ground anchors across 92 sites in the Wellington region. The study includes ground anchors in soil and in rock, and both sacrificial and production anchor tests. Results of limit bond stress and stiffness are presented for several weathering grades of greywacke rock, and for several categories of soil. Suggestions for preliminary design values of limit bond stress and stiffness are provided for several soil and rock categories.

Oral Abstracts

Performance-based and whole-of-life design of the Kaitoke Flume Bridge

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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The authors conducted and managed a performance-based design for a key structure in the Wellington city water network, the Kaitoke Flume Bridge. This design considered the entire project life from inception to completion. Located within Kaitoke Regional Park, the bridge conveys water to the Wellington regional bulk water network. It is also part of the park's walking and maintenance access track network. An initial risk assessment of the slope and foundation geotechnical conditions of the circa 1950 bridge led to the decision to replace it. The new structure is a network arch bridge designed to maintain and improve the functions of the older one. The design followed performance-based principles and a pragmatic approach. This included assessing the feasibility and suitability of slope reinforcement with permanent anchors, piled foundations, decoupled abutments, and a flexible steel pipe. The goal was to ensure performance under seismic conditions that do not exceed the stability limits of the natural slopes, which remain unreinforced or unprotected, or the tolerances of the bridge abutments and flexible pipe connections. Rigorous supervision and testing during construction, coupled with stringent project control, ensured the delivery of the new asset. This new bridge is expected to perform adequately under various adverse natural conditions. This paper outlines the logic and steps followed to complete the design and construction of the new bridge. It provides key examples comparing the design and actual construction elements.

Oral Abstracts

Complexities for Large Diameter Pile Design in an Artesian Aquifer

Mr Andrew Hills[1]
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2D: Ground Improvement and Piles Design and Constriction, Waitākere Room 3 Level 3, October 16, 2025, 1:25 PM - 3:05 PM

The design of a new road bridge across Te Awa Kairangi (the Hutt River) at Melling requires the installation of 3m diameter bored piles in the Waiwhetu Gravels, an artesian aquifer supplying 40-70% of Wellington's drinking water. A key consideration for this project is protecting the aquifer and ensuring construction of the bridge piles does not lead to long term global aquifer depressurisation or contamination of the water.

The bridge is part of the Te Wai Takamori o Te Awa Kairangi (formerly RiverLink) project under an Alliance structure, fostering a collaborative approach to pile design and pile construction methodologies. The Alliance has worked through the complexities of this project by calling on local experience, including case studies from other structures founded in the aquifer, as well as Brian Perry Civil's expertise in piling, specifically pile driveability and construction of fluid supported large diameter bored piles. The result of this collaborative process is a 'buildable' pile design where risks to the aquifer are mitigated efficiently without compromising performance of the bridge.

This paper discusses the key constructability components such as pile driveability assessments, support fluids and methods for rectifying leaks in the aquifer should these occur, along with the impact of these components on the aquifer and the pile design.

Oral Abstracts

Estimation of pumice contents of volcanic deposits from their index properties

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3A: Volcanic Soils and Pumice, Limelight Rooms Level 3, October 17, 2025, 1:30 PM - 2:30 PM

One factor which affects the engineering properties of natural pumiceous deposits is the amount of pumice sands present. Currently, other than visual inspection, there is no well-accepted method to quantify pumice content (PC). Methods based on the unique appearance, crushability and lightweight features of the pumice sand components have been proposed. In this paper, attempts were made to quantify the PC of natural pumiceous deposits obtained from various locations in the central part of North Island, New Zealand, through their index properties. Firstly, the index properties of the materials, such as specific gravity, maximum and minimum dry densities, maximum and minimum void ratios, and void ratio range, were determined in the laboratory. Next, the PC of each material was determined using the method previously developed by the authors, which was based on the crushability feature of the material and validated using scanning electron micrograph images. Finally, the index properties were correlated to the corresponding PC of the material. The results showed that the pumice content of the natural pumiceous sands is closely correlated to the sand's specific gravity and maximum/minimum dry densities. Hence, in place of the other more complicated methods proposed, the experimental correlations obtained can be used to reasonably estimate the pumice contents of natural pumiceous sands.

Oral Abstracts

Cyclic behaviour and liquefaction potential of an italian volcanic soil through the energy-based approach

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3A: Volcanic Soils and Pumice, Limelight Rooms Level 3, October 17, 2025, 1:30 PM - 2:30 PM

The energy-based liquefaction evaluation method has recently gained increasing interest, due to its relative independence from the typical factors that affect sandy soils. The normalized cumulative dissipated energy is an important indicator of liquefaction resistance in energy-based models, as it is independent of effective confining stress, stress amplitude, loading type, and test method. As such, this method can be applied more reliably to sands of different natures. Volcanic grains are angular and lightweight, and they may break under cyclic loading, either at the asperities or throughout the entire grain. Current liquefaction evaluation methods, developed for hard-grained sands, are not suitable for these particular soils. Considering that their cyclic behaviour in terms of pore water pressure and strain generation is different from that of hard-grained sands, the aim of this paper is to investigate how grain nature and various influencing factors affect the accumulated dissipated energy in volcanic soils. To evaluate the impact of test type, cyclic triaxial and cyclic simple shear tests were conducted on both undisturbed and reconstituted specimens of an Italian volcanic soil with varying amounts of fines. The role of low-plasticity fines was also examined. Test results showed that fines content, void ratio, and soil fabric influence the relationship between excess pore water pressure development and cumulative dissipated energy. By investigating the key factors that potentially affect the energy-based capacity, this paper provides new insights into the evaluation of the cyclic behaviour of volcanic silty sands.

Oral Abstracts

Determining the Effectiveness of Encased Stone Columns as a Liquefaction Mitigation in Pumiceous Sand By Shake Table Testing

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3A: Volcanic Soils and Pumice, Limelight Rooms Level 3, October 17, 2025, 1:30 PM - 2:30 PM

This study investigates the seismic performance of geosynthetic-encased stone columns (ESCs) in loose pumiceous sand through small shake table testing. The test bed consisted of pumiceous sand with 45–50% pumice content and a relative density of 40–45%, confined between dense sand layers. Two test conditions were considered—one with ESCs installed and one without—to evaluate the pore pressure ratio (ru) response under two different seismic loading levels. ESCs were installed in a triangular pattern, and sinusoidal shaking at 0.1g and 0.2g was applied for 25 seconds at 1 Hz via the shake table. Results showed that ESC-treated soil developed lower ru values at all depths under both excitation levels, indicating improved drainage. In contrast, untreated soil exhibited rapid pore pressure build-up, with ru reaching or exceeding 1.0 under 0.2g shaking. The observed response may be attributed to the contractive behaviour of the soil, finer particle size, and the water sloshing effect during higher amplitude shaking.

Oral Abstracts

Stormwater soakage rates in Taranaki Brown Ash

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3A: Volcanic Soils and Pumice, Limelight Rooms Level 3, October 17, 2025, 1:30 PM - 2:30 PM

Public stormwater infrastructure within Taranaki town centres is limited. Most historical and new developments dispose of stormwater run-off through on-site soakage systems.

Soakage design in Taranaki has historically primarily been based on assumed soakage rates and rules of thumb without site-specific permeability testing or design calculations. There are currently no Taranaki specific soakage testing and design guidelines and no requirement for soakage suitability assessment. Recent soakage tests on sites across the Taranaki region indicate that historical soakage rate assumptions using the E1VM1 design method are too high.

This paper presents a summary of the soakage test results from many sites across Taranaki. It provides a comparison of the design soakage rate calculation using three industry methods. Determination of a design soakage rate using each of the methods can be highly sensitive to small changes in the data.

The effect of the design soakage rate on soakage disposal system sizing is compared for a 'typical' residential development. The design soakage rate has a low impact on the sizing for deep soak hole systems; however, it has a high impact for shallow soakage trenches.

Designers should carefully consider the limitations and sensitivity of their selected soakage rate and design method. It is recommended for practitioners to adopt the Tauranga City Council soakage rate calculation and design method in lieu of Taranaki specific or national soakage guidelines.

Oral Abstracts

Liquefaction assessment in pumiceous deposits - Guidelines to assist geotechnical engineers in selecting a suitable approach in design projects

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3A: Volcanic Soils and Pumice, Limelight Rooms Level 3, October 17, 2025, 1:30 PM - 2:30 PM

It has been shown that conventional liquefaction assessment procedures used in everyday engineering practice are unsuitable for deposits containing pumiceous sands. The vulnerability of pumice particles to crushing during conventional penetration testing procedures (i.e. CPT, SPT), can lead to underestimation of the in-situ density of pumiceous soil layers, and give inaccurate soil behaviour factor evaluations. Furthermore, the conventional liquefaction triggering procedures are based on correlations developed on case studies of hard-grained soils, and pumiceous sands have been found to exhibit different undrained cyclic behaviour. In most cases pumiceous sands have been found to have higher liquefaction resistance, compared with hard-grained soils. Yet, to date, there are no NZ standards that prescribe a suitable alternative liquefaction triggering assessment procedure for pumiceous deposits. While these soils have received some attention in engineering guidelines (i.e MBIE Module 1), most often practicing geotechnical engineers ignore the presence of pumiceous soils and use conventional CPT-based correlations for assessing liquefaction hazards regardless. This paper provides a simplified, step-by-step procedure that will guide geotechnical engineers into a more conclusive direction when dealing with pumice. The procedure defines threshold ranges of physical and geotechnical properties (such as pumice content, fines content and CPT tip resistance) typical for pumice rich deposits. Ultimately, based on: (1) the mentioned geotechnical property thresholds, (2) the project location and (3) the importance level of the project structure, a liquefaction assessment approach (i.e. the most suitable simplified procedure (CPT or Vs-based) or cyclic triaxial testing) is recommended.

Oral Abstracts

Natural Hazards Risk Management Action Plan (NHRMAP) - a risk reduction tool for Auckland

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3B: Regulatory Practice, Risk, and Communication, Waitākere Room 1 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

Aotearoa New Zealand faces significant risks from various natural hazards, making effective risk management tools essential. This paper explores Auckland Council's Natural Hazard Risk Management Action Plan (NHRMAP), a comprehensive natural hazard risk reduction tool. The NHRMAP outlines Auckland's natural hazard risk and coordinates the actions Auckland Council is taking to mitigate risk. Given Auckland Council's integration of regional and city-level functions, natural hazard workstreams span multiple departments. The NHRMAP offers a multi-hazard, multi-disciplinary overview of all natural-hazard related projects within Auckland Council, facilitating the collation of projects and information to reduce duplication and identify gaps. This enhances collaboration and communication across departments and raises project awareness up to the elected member level. The NHRMAP consist of four key elements; 1. Part 1 – Natural Hazard-scape of Tāmaki Makaurau Auckland: provides up-to-date, accurate information on Auckland's natural hazard risk; 2. Part 2 – Recording Tool 'Action Plan': Records actions Auckland Council is taking to mitigate natural hazard risk; 3. Natural Hazards Scorecard (High-Level Gaps Analysis): Identifies gaps and opportunities; 4. Natural Hazard Community of Practice: Enhances awareness and communication of natural hazard information across Auckland Council. The recorded projects are diverse, involving various teams across council. The geotechnical team is involved in NHRMAP, contributing to various geotechnical projects focusing on enhancing resilience to geohazards with the natural hazard team coordinating the NHRMAP. Some projects initiated and promoted through the NHRMAP have been highly influential, such as the Auckland Region Landslide Susceptibility Study. The NHRMAP significantly enhances Auckland Council's understanding of natural hazard risks, developing and tracking key actions that work to reduce the risk over the next 10 years.

Oral Abstracts

Mangahauini Gorge - Development of a Conceptual Ground Model from Non-invasive Data for Decision Making Purposes.

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3B: Regulatory Practice, Risk, and Communication, Waitākere Room 1 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

Cyclone Gabrielle caused extensive damage to the state highway and rail network in Tairāwhiti (Gisborne) and Te Matau-a-Māui (Hawke's Bay) in February 2023. The Transport Rebuild East Coast (TREC) alliance was set up by NZ Transport Agency Waka Kotahi (NZTA) and KiwiRail to work alongside local contractors and businesses to restore the cyclone damaged network.

Mangahauini Gorge was impacted by a landslide during Cyclone Gabrielle. The displaced material dammed the river in the base of the gorge, leading to the loss of access through this part of State Highway 35, isolating communities on the East Cape.

A Preliminary Geotechnical Assessment (PGA) was undertaken to explore the viability of realignment options for the State Highway through a complex geological environment with a legacy of instability.
A conceptual ground model was developed from non-invasive, primary and secondary data sources, including LiDAR, geomorphological mapping, geological mapping, aerial photograph interpretation, conceptual modelling, UAV imagery, information from local stakeholders, and both published and unpublished geological information.

The conceptual ground model demonstrated that the level of geotechnical risk, associated with cuts on the eastern side of the gorge, was high. Completing the PGA ahead of ground investigations, and design, resulted in considerable savings for the client and refocused the project.

This work demonstrates the value of cost-effective, non-invasive data for quantifying geotechnical risk, and highlights the benefits of understanding geotechnical risk early in the life of a project. Recommendations for the early implementation of preliminary geotechnical assessment for public infrastructure projects are provided.

Oral Abstracts

Improving the Building Consent Process: A Case-study with Engineering New Zealand on Geotechnical-Related RFIs at Christchurch City Council

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3B: Regulatory Practice, Risk, and Communication, Waitākere Room 1 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

This case study examines the most common geotechnical-related Requests for Further Information (RFIs) encountered during the building consenting process at Christchurch City Council. The case study identifies recurring issues and offers insight into ways to improve the process for everyone involved.

Common RFIs include insufficient or unsuitable documentation to support the consent application, discrepancies between design drawings and geotechnical recommendations, lack of coordination between disciplines, ambiguous design details, and reliance on outdated geotechnical reports. These issues often delay project approvals, increase costs, and add time.

The case study has specific examples that highlight the importance of robust communications among project teams, thorough and up-to-date documentation, and clear design specifications. International studies have shown that poor documentation and co-ordination can increase project costs by between 10 to 20 per cent. Early involvement of geotechnical specialists and allocation of design responsibilities are essential for ensuring compliance with the New Zealand Building Code and reducing the number of RFIs.

By analysing these common RFI types and their root causes, the case study provides recommendations for improving the efficiency of the building consenting process. The findings offer valuable insight and guidance to those involved in the building process, such as geotechnical engineers, engineering geologists, structural engineers, architects, builders, project managers, and building consent authorities. This aims to enhance the overall quality, safety, and timeliness of building projects while striving for good practice in design and construction.

Oral Abstracts

Strategies for Geotechnical Risk Management and Claim Prevention

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3B: Regulatory Practice, Risk, and Communication, Waitākere Room 1 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

Geotechnical issues frequently serve as primary contributing factors to claims across the construction industry, impacting projects and businesses of all sizes. Common technical challenges such as differential settlement, groundwater issues, and errors/omissions in geotechnical design or construction execution often led to these claims. When such issues arise, the associated risk can be further exacerbated by resultant delays and contractual disputes. Key overlooked project stages include desktop assessments and monitoring data reviews, significantly increasing the likelihood of claims.

Common triggers for claims include design errors, miscommunication of design requirements, and instances where parties seek cost recovery. A proactive approach to risk management is essential and involves various elements tailored to specific projects. Effective risk mitigation measures encompass maintaining detailed and clear communication records, implementing robust quality assurance processes, exercising discretion over documentation, and adopting streamlined approaches for managing sensitive information. It is also crucial to maintain risk registers that outline roles and responsibilities clearly.

By implementing industry-standard geotechnical risk assessment procedures—such as detailed desktop assessments, well-scoped and executed site investigations, geotechnical hazard assessments, continuous monitoring, and timely risk evaluations—practitioners can adhere to expected professional standards. This paper will draw on case studies to highlight common sources of claims and present practical methods to mitigate these risks. Through early identification and management of potential geotechnical hazards and fostering ongoing stakeholder communication, engineers can minimize the risk of claims, enhance project efficiency, and uphold industry standards. Effective geotechnical risk management is vital for reducing disputes, preserving project timelines, and improving overall project success.

Oral Abstracts

Urban Development Impacts from Iron Pan Layers in Westport, New Zealand

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3B: Regulatory Practice, Risk, and Communication, Waitākere Room 1 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

Westport is a small town in the seismically active area of the West Coast of New Zealand with a high average rainfall and propensity to flooding. As a result, local and governing authorities are considering the future with a focus on future development in the southwestern and western areas of Westport. The area is home to layers of well cemented, iron pans up to 200 mm that have been observed in the Holocene and late Pleistocene deposits surrounding the Buller region, thus creating elevated perched groundwater levels. The iron pan layers have been a feature of its past, forming a moist to wet silty sands crust; it's present with uncontrolled filling and future with its effect on natural hazards.

Limited information is currently available on iron pans andtheir induced elevated perched groundwater. This paper focuses on recent investigation observations to spread awareness of the geotechnical considerations required when assessing areas underlain by iron pan layers for urban development.

Oral Abstracts

Integrating UAVs, Automated Construction Monitoring, and Real-Time Data Analytics in Embankment Design and Construction for the Mt Messenger Bypass

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3C: Machine Learning and Big Data Applications, Waitākere Room 2 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

Te Ara o Te Ata (also known as the Mt Messenger Bypass) is a new section of State Highway 3, located approximately 50 km north of New Plymouth. The 5.2 km section of the road is intended to improve the safety of the highway by bypassing the narrow, steep, and winding section of the road over Parininihi (Mt Messenger) located between Uruti and Ahititi.

A critical component of the project involves the construction of approximately 2.5 km of low-fill embankments up to 6m high across flat, low lying areas at both the northern and southern ends of the route. These embankments traverse deep, soft, and highly compressible soils of up to approximately 25 m in thickness necessitating ground improvement techniques.

This paper focusses on the surcharge and wick drain ground improvement techniques adopted for the embankment Fill 15. Unmanned Aerial Vehicles (UAVs), automated construction monitoring, and real-time data analytics were integrated into the design and construction process. The UAVs provided topographic mapping, whilst the automated monitoring systems tracked settlement and deformation in real-time. These technologies allowed for the dynamic adjustment of surcharge heights, optimisation of construction timelines, and more accurate predictions of settlement periods. This approach not only reduced overall project risk but also led to improved constructability and cost efficiency.

Oral Abstracts

Making Auckland's roads more resilient: Using machine learning to model landslide susceptibility and develop an adaptive resilience programme

Mr Chris Armstrong[1], **Mr Stephen Parkes**
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3C: Machine Learning and Big Data Applications, Waitākere Room 2 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

The Auckland Transport Science and Sustainability team has been following the MfE Dynamic Adaptative Policy Pathways process to develop signals, triggers and thresholds for the transport related assets across the Auckland region. The team has looked at coastal assets in detail and is now considering how to assess inland asset resilience. One of the critical items to assess in this regard is slope stability and landslide risk. Tetra Tech Coffey has been working with Auckland Transport to develop and predictive model to assess the locations on the Auckland road network that are most at risk from climate change driven extreme weather events.

This involved the use of A.I. to automate the acquisition of input data of triggers that increase landslide susceptibility, and development of an analytical model to assess the specific landslide risk at every 25m chainage along the 7800km of Auckland's road network.
With an emphasis o
n ease-of-use to the end user and practicality, the client has benefited from the work by being able to schedule comparatively lower cost preventative works, adaptive maintenance regimes and route resilience assessments.

Oral Abstracts

A Comparison between Limiting Equilibrium and Finite Element Analyses in a Case Study Using Automation

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3C: Machine Learning and Big Data Applications, Waitākere Room 2 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

WALLAP and PLAXIS are widely used in geotechnical engineering for trench excavation simulations, employing different methodologies: WALLAP uses limit equilibrium (LE) theory, while PLAXIS applies the finite element method (FEM) to calculate the Factor of Safety (FoS). The LE method assumes full passive (Kp) and active pressure (Ka) on either side of a wall, whereas FEM focuses on strain-stress relationships. In cases like a propped wall, failure criteria can be met along rotational slips, yet stress points behind the wall may not reach yield capacity, and full Kp may not be developed in FEM.

This study automates strength reduction simulations in WALLAP and controlled FEM analyses in PLAXIS using Python. Up to a hundred models were analysed to compare FoS results for a single propped wall under drained conditions with steady-state flow. The results highlight incompatibilities between the methods, largely due to PLAXIS's ability to model water drawdown—a feature missing in WALLAP. Notably, the drawdown's relationship to excavation depth is proportional and independent of soil permeability for uniformly permeable materials. This research provides insights and a data-driven chart to improve water drawdown estimations in WALLAP, yielding more consistent results compared to FEM analyses.

Keywords—Automation, Limiting Equilibrium, Finite Element, Trench Excavation.

Oral Abstracts

New Zealand Geotechnical Database (NZGD): Features & beyond for a nationally significant database

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3C: Machine Learning and Big Data Applications, Waitākere Room 2 Level 3, October 17, 2025, 1:30 PM - 2:30 PM

The New Zealand Geotechnical Database (NZGD) stands as a pivotal resource for the geotechnical field within New Zealand. Launched eleven years ago as the Canterbury Geotechnical Database, it has now expanded nationwide and contains around 200,000 records. The database has catered to over 12,200 unique users spanning science, engineering, government, insurance, and research sectors, with more than three million files downloaded by engineering consultants, researchers, and insurers.

The NZGD collects crowd-sourced data from extensive geotechnical investigations, geological surveys, and monitoring systems across New Zealand. NZGD provides detailed insights into soil behavior, ground stability, and seismic hazards, assisting engineers, geologists, building control authorities, and policymakers.

In 2023, MBIE appointed Beca as the new supplier to develop NZGD 2.0, which has been operational since November 2024. This updated platform retains the original database's core focus on collaborative data sharing while integrating modern design and an improved implementation framework.

Building on its success, there are significant opportunities to further understand and leverage the data beyond download actions. Continued effort is needed to enhance the capabilities available to users locally and nationally.

This presentation will explore the features of the new platform, outline the roadmap, and initiate discussions on expanding the success of NZGD. Attendees will receive valuable insights into recent advancements and contribute to how we foster knowledge sharing and innovative approaches to addressing geotechnical challenges in New Zealand's unique environmental context.

Join us to contribute to how the NZGD can evolve and support the geotechnical community, driving efficiency and innovation.

Poster Abstracts

Review and certification of geosynthetic materials for Waka Kotahi roading projects

Dr Alexei Murashev[1], **Mr Paul Tan**[1], Mr Stuart Finlan[2], Dr Dante Legaspi[3]
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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Geosynthetics have been successfully used in the construction of New Zealand roads and railways for decades. They fulfil all the classic functions of reinforcement, drainage, filtration, separation, soil retention and erosion control. With the increasing emphasis on sustainability for road and railway projects in New Zealand, geosynthetics are not only viable, but also competitive materials in terms of carbon footprint - the amount of carbon dioxide resulting from production, delivery, and use the product through its life cycle compared to conventional construction materials. A summary of geosynthetics applications for roading and railway projects is given. Given that multiple geosynthetic products and systems are currently available in New Zealand and internationally, designers should develop a good understanding of geosynthetic product types, their quality and reliability as well as product-specific design methodologies. Use of poor quality geosynthetic products or deficient design methodologies can lead to partial or total failure of geosynthetic reinforced soil slopes, walls, fill embankments and pavements. Several failures of geosynthetic-reinforced soil systems are discussed. A detailed NZTA review and certification framework for geosynthetic reinforcement and geosynthetic-reinforced soil systems has been developed and successfully used in recent years. The certification frameworks ensures that the reviews are carried out in a well-structured manner and only quality geosynthetic products are used on NZ roading projects. Details of NZTA review and certification framework as well as recent examples of review and certification for various geosynthetic materials are discussed.

Poster Abstracts

Single Particle Crushing Test of Pumice Simulations Using Bonded Element Model in Discrete Element Modelling

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Pumice sand is a type of volcanically derived sand that is porous and lightweight, easily crushable, and compressible. In this study, single particle crushing tests on Japanese and New Zealand pumice particles between 1 mm and 8 mm are simulated in Discrete Element Modelling (DEM) using PFC3D V6.0. A 4 mm Japanese pumice sand particle and 1, 2, 4, and 8 mm New Zealand pumice sand particles are simulated as spherical bonded agglomerates comprising 0.2 - 0.4 mm individual balls. The linear parallel bonded element model was used to bond the agglomerates, while the linear contact model was used for the interactions between balls. The agglomerates were generated based on the particles' apparent porosity from the apparent specific gravity of New Zealand pumice measured using vacuum extraction. The agglomerates were compressed between two rigid frictionless plates at a constant velocity of 0.1 mm/s until the agglomerates underwent catastrophic crushing or failure. The simulations were calibrated by setting the DEM strength parameters to a value that produced a similar peak force to the laboratory results, while the contact and bond stiffness parameters were controlled to match the force - displacement response and the strain at which the peak force occurred. As the particle sizes increase, the strength parameters are adjusted using the Weibull statistics (m) to represent the inverse relationship between particle size and its strength. The DEM parameters and m at which satisfactory force - displacement predictions are produced are proposed as representative parameters for DEM simulations of pumice sand.

Poster Abstracts

The power of conceptual models

Mr Dan Sandilands[1]
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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

This paper emphasises the critical role of a well-formulated conceptual model in geotechnical projects. Drawing parallels to scientific methodology, it defines a conceptual model as a preliminary explanation that guides site assessments and informs risk management. The author argues that current geotechnical projects often lack a robust conceptual model, leading to misinterpretation of ground conditions - a significant source of liability claims against geotechnical engineers. By comparing project methodologies, the study highlights the pitfalls of relying solely on physical investigation data and advocates for an iterative process where a conceptual model is established early and challenged throughout the project lifecycle.

The paper outlines practical steps for developing a sound conceptual model based on thorough desktop studies, geological understanding, and effective communication among multidisciplinary teams. Examples of conceptual model development and their benefits will be demonstrated for several New Zealand projects, showcasing improvements in ground condition interpretations and risk management outcomes. The narrative is enriched by the metaphor of "The Blind Men and an Elephant," illustrating the importance of collaboration and comprehensive analysis in geotechnical work. The findings urge practitioners to integrate conceptual model-driven approaches in geotechnical assessments to enhance project outcomes and mitigate risks associated with unforeseen geological conditions.

Poster Abstracts

Unsaturated soil mechanics in New Zealand: recent applications and advances

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Unsaturated soil mechanics principles are relevant to a wide range of geotechnical problems associated with soils above the groundwater table. For these materials, the presence of both air and water between soil particles result in matric suction that affects a soil's shear strength and permeability. This is particularly important for understanding expansive soil behaviour, assessment of soil slope stability, design of embankments, and understanding the behaviour of earthen building materials (e.g. rammed earth) where the soil exists predominantly in an unsaturated state.

While internationally the application of unsaturated soil mechanics is advancing rapidly, historically in New Zealand it has been limited. However, local capability in this area is growing due to interest in the effect of climate change on New Zealand's unsaturated soils. Climate change means that unsaturated soils are becoming wetter (through increased rainfall) or drier (through intense drought periods) leading to a change in their properties. This can lead to further slope failure, volume change in expansive soils and damage to earth buildings.

This paper highlights the importance of this field for geoprofessionals by outlining a New Zealand context for unsaturated soil mechanics in both practical and academic applications. It also presents to the New Zealand geotechnical community a summary of recent New Zealand specific advancements in unsaturated soil mechanics related to slope stability problems and rammed earth structures.

Poster Abstracts

Management of Liquefaction Risk for Residential Land Development

Ms Catherine Roh[1]
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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Management of natural hazard risks, such as liquefaction, is a critical component for New Zealand's residential land development sector. The "February 2011 Christchurch Earthquake" in the second most populated city in New Zealand was one such event.

The earthquake, paired with significant liquefaction, saw over 400,000tonnes of silt brought up affecting thousands of homes and costing over NZD $40 billion in damages, making it New Zealand's costliest natural disaster at the time.

Hence, in 2021, just over ten years following the Canterbury earthquake, the regulations influencing how residential structures are designed changed.

The change signals a significant move in how liquefaction risk is managed for residential land development in New Zealand. The change presents challenges around ensuring the effectiveness of the procedure outlined in the MBIE liquefaction guidance to capture the liquefaction risk and design for it. Ongoing adaptation and refinement of the procedure, liquefaction hazard map, and standard liquefaction resilient foundation guidance will be essential in addressing these challenges. Auckland Council responded by publishing liquefaction hazard maps and implementing the change at the Building Consent stage. Four years since its implementation, this paper discusses the process set up as per the MBIE Liquefaction Document (MBIE.MfE.2017) including hazard maps and standard liquefaction resistant foundation designs.

Poster Abstracts

Mitigating a Complex Landslide Risk to the Puketeraki Embankment on New Zealand's Main South Line North of Dunedin

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

The Main South Line (MSL) traverses the Puketeraki Landslide Complex north of Dunedin. The Complex is made up of deep-seated movements and shallower earthflows, having displaced by up to 2.5 m since 1992. Historic movements of the landslide had resulted in the abandonment of a historic rail embankment and a railway tunnel, followed by the construction of the new rail embankment and cutting (referred to as the Yellow Cutting) in 1936. Based on the monitoring data and considering the effects of climate change, horizontal displacement of the landslide complex affecting the rail embankment and the Yellow Cutting over the next 50 years is predicted to be in the order of 7 m.
Geotechnical investigations and mapping indicate the embankment is underlain by earthflow materials followed by Otakou and Onekakara Group Sediments. Recent inclinometer readings suggest that displacements occur at approximately 21 m depth, corresponding to the transition from completely weathered to slightly weathered Burnside Mudstone.

Measures to arrest the ongoing movement of the landslide is impractical due to its scale. A practical approach allowing for widening of the existing rail corridor and the Yellow Cutting to accommodate the predicted movements and improved site drainage through a new culvert has been adopted. The widening utilises the materials excavated from the historic embankment, creating a sustainable solution to minimise imported fill volumes.

This paper presents a summary of the site history and previous assessments and describes the proposed solution and design philosophy to improve the resilience of this section of the MSL.

Poster Abstracts

Determination of VS(30) and Site Class in accordance with TS 1170.5:2024 – A case study

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

The draft version of the Technical Specification TS 1170.5:2024 provides a site classification system based on the time averaged shear wave velocity over the upper 30m, VS(30). The TS specifies seven site classes (I to VII) depending on VS(30). Three methods for evaluating shear wave velocity (VS) are provided. The methods distinguish between direct field measurements of VS and those inferred from correlations (such as from CPT). The TS specifies percentage uncertainties depending on the method used, which results in a range of VS(30) values to apply in the determination of the site class. By applying the applicable uncertainties, it is possible for multiple site classes to be assigned.

In this case study, CPT, DMT, downhole seismic, cross-hole seismic and MASW were undertaken in close proximity to provide five independent techniques to evaluate VS. The methods for evaluating VS in TS 1170.5 were applied and VS(30) determined for each of the five testing types.

The results showed a range of VS(30) that are generally within a single site class (Class V) but fell over multiple classes (up to four) when the uncertainty percentages outlined in the TS were applied, depending on which of the three methods were used. Established correlations from CPT and DMT to VS performed reasonably well in comparison to measured VS. It is suggested that uncertainty percentages could be relaxed where correlations are shown to be reliable or site specific correlations can be developed.

Poster Abstracts

Liquefaction Characteristics of Gravelly Soils Prepared by Water Sedimentation Method

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Field observations and evaluations from 32 case histories of liquefaction in gravelly soils worldwide, including three in New Zealand, have indicated that gravelly soils in alluvial deposits are particularly prone to liquefaction. However, replicating these conditions in the laboratory tests remains a challenge, particularly in achieving uniform specimen preparation for reliable liquefaction assessment. This study addresses these challenges by using a newly developed water-sedimentation (WS) method for gravelly soil specimens that can effectively replicate the macro stress-strain behavior of naturally deposited alluvial sand, enabling a realistic assessment of liquefaction potential. Notably, this WS method enhanced density uniformity (even at very loose densities Dr =20%) and minimizes the inherent segregation between small sand and large gravel particles. A series of stress-controlled undrained cyclic triaxial tests were conducted on WS gravelly soil specimens reconstituted at relative densities between 20% and 60% and isotropically consolidated at 100 kPa confining stress. These specimens were then subjected to cyclic stress ratios (CSR) ranging from 0.10 to 0.45. Comparisons with specimens prepared by the wet tamping (WT) method showed that soil fabric significantly influence the liquefaction resistance, particularly at CSR values above 0.134, where the WS specimens have a reduced liquefaction resistance. In addition, density and gravel content also play a critical role. The liquefaction resistance increases with both density and gravel content. This study indicated that an accurate evaluation of the liquefaction resistance of gravely soils, the combined effects of fabric, density state and gravel content need to be considerate individually but all together

Poster Abstracts

Effect of Carbon Nanotubes on Liquefaction Resistance and Shear Strength of Sand

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Innovative materials have been used recently as additives to improve soil behaviour. This paper investigates the effect of multi-walled carbon nanotubes as an additive to improve the liquefaction resistance and shear strength of sand. Carbon nanotubes (CNT) are cylindrical nanoparticles with unique physical properties, such as extremely high yield strength and modulus of elasticity. A series of undrained cyclic and monotonic triaxial tests were conducted on sand specimens with varying CNT contents (0.1, 0.25, and 0.5%) at a constant skeletal sand relative density of 25%. Cyclic loadings at different cyclic stress ratios were applied to understand the development of excess pore water pressure and axial strain with the number of loading cycles. The results showed that the liquefaction resistance of the soil mixture increased with CNT content at 0.25% and 0.5%, whereas a reduction in resistance was observed at 0.1% CNT content. The strength reduction at 0.1% CNT is due to the formation of a thin layer of CNT coating around the sand particles where the bonding was not strong enough to prevent the sliding between the sand grains. Additionally, undrained monotonic compression tests at different effective confining pressures (50, 100 and 150 kPa) were conducted to investigate the shear strength of the mixture. The test result suggests the development of apparent cohesion between the sand particles, which is responsible for the increase in the shear strength of the mixture. Post-test microstructural analysis using scanning electron microscopy confirmed the formation of bonds and reinforcement mechanism within the sand-CNT mixtures.

Poster Abstracts

Advanced barrier design: CMC-treated bentonite in GCLs for mitigating short-chain PFAS migration in landfills

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Growing environmental concerns over per- and polyfluoroalkyl substances (PFAS), particularly short-chain compounds like perfluorobutanoic acid (PFBA) and perfluorobutane sulfonate (PFBS), have underscored the need for more efficient landfill liner barrier systems. This research evaluates the hydraulic performance of geosynthetic clay liners (GCLs) modified with carboxymethyl cellulose (CMC), a biopolymer used to enhance bentonite's containment properties. Various CMC dosages were blended with bentonite to assess their effect on reducing hydraulic conductivity. Both untreated and optimally modified bentonite samples were then tested against synthetic leachates containing PFBA and PFBS using a flexible wall permeameter. The findings revealed that bentonite modified with 8% CMC exhibited the lowest hydraulic conductivity under both distilled water and PFAS leachate conditions. These results highlight the potential of CMC-treated bentonite as a reliable barrier material for controlling PFAS migration in landfills, supporting improved waste containment and groundwater protection.

Poster Abstracts

An Open Landslides Database for New Zealand

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

In New Zealand there are multiple agencies that record landslide information in landslide inventories for hazard and risk management applications. Many organisations manage and store landslide data in isolated databases, which can limit shared utility for hazard assessments and planning. This paper outlines the context for the establishment for the New Zealand Open Landslides Database (NZOLD), its potential role in a national federated database system, and the challenges faced in ensuring data accuracy, fostering consistent engagement, and achieving interoperability between landslide databases.

Poster Abstracts

Liquefaction performance assessment for solar farms

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Renewable energy and solar farms are a key part of building a resilient power network in NZ. While solar farm construction is an established industry, NZ's young geology comes with a set of unique geohazards, including liquefaction. Liquefaction assessments typically focus on free field settlement as a performance parameter. However, solar farms have a unique foundation layout that requires a different approach. Solar farm foundations generally comprise single driven pile foundations, typically in the order of 3m deep. The primary design loads for solar farm foundations are lateral and uplift loads.

This paper will explore the use of alternative tools such as liquefaction severity number (LSN), to help predict liquefaction-induced deformation for PV solar arrays. A case study compares results from a detailed liquefaction performance assessment for a solar farm development in Foxton with the results of traditional free field settlement and LSN results. The detailed assessment of liquefiable layers in the upper 3m and the effects on the performance of a single pile subject to lateral loads has shown that LSN correlates well and can be used with confidence to predict expected liquefaction performance for the solar array.

Solar farm developments also typically involve tens of thousands of driven pile foundations. This paper will also present the results of a ground improvement trial to assess potential liquefaction mitigation due to vibro-densification as a result of pile installation. These approaches aim to enhance the resilience and longevity of solar farms in New Zealand's challenging geological conditions.

Poster Abstracts

Monitoring and Assessment of a Large Road Landslide near Martinborough, South Wairarapa

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

A series of significant movements occurred from 2020 to 2022 following heavy rain events at a landslide on Hinekura Road in South Wairarapa. The site is located in soft rock country susceptible to landsliding and the landslide itself was 100m wide and 500m long. While initial movement events were able to be managed by the local Council, a much larger (~80m) displacement occurred in June 2022. This resulted in prolonged road closure and a process to determine reinstatement options for the road.

This paper discusses the behaviour of the landslide, utilising repeat drone surveys over the 3 year period as well as data from a remote slope monitoring network. It also covers the risk assessment and risk mitigation options for the road. Options for reinstating road access, including multiple realignments options, were presented to the council and community, using engineering geological maps based on updated UAV survey models.

The paper will also discuss how the monitoring, particularly the comparison of repeat UAV surveys, was able to provide the council with sufficient confidence to proceed with reinstatement of the road through the slip on the roughly the original alignment.

This case history shows the value of UAV and monitoring technologies to enhance understanding of landslide models and behaviour and to inform risk assessments to assist clients to better manage risks. Such technologies will be increasingly valuable in helping manage increased risks from Climate Change in the future, in particular when expensive robust options are unaffordable.

Poster Abstracts

Groundwork for Resource Consents: Geotechnical Reporting Essentials for Auckland Development

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Geotechnical reporting and assessment play a critical role in obtaining resource consents for land development projects nationwide. Auckland has a diverse geological and geomorphological setting including volcanic, residual and reclaimed soils, coastal cliffs and steep slopes, etc. Therefore, sound understanding of the site-specific ground conditions and potential geohazards are essential for safe and sustainable construction practice and sustainability to the global environment. This paper provides an overview of the geotechnical reporting requirements for resource consent applications under the Auckland Unitary Plan and Resource Management Act particularly in areas subject to natural hazards or requiring earthworks.

Geotechnical investigations typically involve site-specific subsurface testing, groundwater monitoring, and slope stability assessments to identify potential geohazards such as liquefaction, landslides, or consolidation settlement which impact the site, development or adverse effects on the wider environment. Geotechnical reporting submitted in support of resource consent applications must address site suitability for development, proposed mitigation measures for identified risks, and ensure compliance with both local and national regulatory frameworks. The collaborative efforts between geotechnical professionals, engineers, planners and Territorial Authority fosters successful resource consent approvals.

The paper also shares key challenges faced during regulatory geotechnical reviews as a local territorial authority, such as balancing conflicting specialist agendas, inconsistencies in reporting details and substandard reporting within increasingly complex urban environments. This paper provides a guide for professionals involved in the resource consent process on the necessary components of geotechnical reporting and why, emphasising the importance of thorough geotechnical reporting in safeguarding Auckland communities and development.

Poster Abstracts

Smartphone and Tablet based LiDAR for small scale geotechnical site assessments

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Lunch and Poster Session 1, Balcony Foyer Level 5, October 16, 2025, 12:25 PM - 1:25 PM

Light detection and ranging (LiDAR) is a form of remote sensing that is used to derive digital surface or elevation models which are commonly reviewed in topographic, geomorphological and geotechnical assessments. Selected models of smartphones and tablets now include integrated LiDAR sensors that enable point cloud data capture at centimetre scale resolution. This paper explores the use of mobile LiDAR platforms, such as the smartphone and tablet, in small scale geotechnical site assessments.

Large swathes of publicly available LiDAR data are available for various regions around New Zealand on platforms such as the LINZ data service and OpenTopography. Sometimes these datasets lack the resolution required to capture the fine scale features relevant to small sites. Mobile LiDAR can supplement these data sets by acquiring higher resolution point cloud data, especially in areas with limited access or that are obscured by vegetation such as a tree canopy.

Case studies in this paper demonstrate the practical use of mobile LiDAR for deriving topographic surfaces, extracting cross section profiles and performing measurements of key site features. The ability to render 3D textured models enables virtual site visits and facilitates the assessment of hidden or inaccessible features. Limitations of the technology include georeferencing accuracy due to GPS drift, point cloud warping from non-linear capture paths and reduced performance in vegetated or on bright reflective surfaces. Some guidelines are suggested to help geoprofessionals capture reliable and accurate mobile LiDAR data.

Overall, with careful planning, mobile LiDAR has proven to be a useful tool for small scale site characterisation, preliminary design input and visual communication for small scale geotechnical investigations.

Poster Abstracts

Delayed onset of liquefaction in predicting lateral spreading using Newmark Sliding Block analysis

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

The magnitude of liquefaction-induced lateral displacement during an earthquake is often challenging to predict. One method that is commonly used is the Newmark Sliding Block (Newmark, 1965) approach. This method involves pseudo-static analyses using limit equilibrium slope stability models to derive yield accelerations. Displacement of the slope is then determined by using acceleration time history records and integrating periods of movement when the seismic ground accelerations exceed the yield acceleration.

More conveniently, recent studies have analysed multiple earthquake time history records using Newmark's method and the results presented as regression models of displacement for various yield to design seismic acceleration ratios. These regression models assume soil strengths remain constant throughout the earthquake, therefore liquefied soil strengths are typically adopted. However, prior to liquefaction triggering, the ground will exhibit much higher yield accelerations compared with later in the earthquake following the onset of liquefaction. As a result, adopting consistent liquefied soil properties (and corresponding yield acceleration), such as those used in the NSB regression models, may overpredict displacements.

This research uses time history finite element dynamic analysis to predict the point within an earthquake scenario at which liquefaction is triggering for a case study in the Bay of Plenty, NZ. The change in soil properties from peak to liquefied shear strengths and ultimately the reduction in seismic yield acceleration is then adopted within the NSB method to integrate lateral displacement from time history records. Displacements are compared to those determined from conventional NSB regression models that consider a consistent yield acceleration.

Poster Abstracts

Providing New Zealand specific comment on the communication and management of geotechnical risk

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

Recent hazard events in New Zealand have enforced the importance of being able to clearly communicate and manage risk.

Effective management of risk cannot be carried out unless it is communicated openly and honestly, and the affected parties are given accurate information about the risk in order to make informed decisions.

Hazards are not constrained by planning boundaries, and impact on all types of land use including residential, agricultural, recreational, commercial and infrastructure, and therefore the impacted parties can range from land, business or home owners, to crown entities or local government.

Being able to communicate effectively with the impacted parties, whose level of understanding of geo-hazards may range from very limited, to experienced is of upmost importance.

Given the inherent variability associated with the ground, and usually limited subsurface information, it is often difficult to accurately define the risk, particularly when providing a response immediately following a hazard event.

Using established guidelines of assessing risk, such as AGS 2007 for landslide risk management, help ensure consistency of the hazard assessments across the industry.

The guidelines can be further refined for certain specific settings (such as geological / geomorphological / climatic) within New Zealand. An example of this would be updating the AGS 2007 guidelines by incorporating findings from the numerous recent landslide assessments carried out in New Zealand following hazard events, and providing outcomes that can be easily understood by all parties.

Poster Abstracts

An Epic Tale of Local Expertise and Collaboration in Tamatea/Central Hawke's Bay during the Rapid Rebuild following Cyclone Gabrielle

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

On February 15th, following Cyclone Gabrielle, the Waipawa River abruptly returned to its historical course, causing extensive damage across rural farmland and challenging the resilience of local communities. Critical infrastructure, including roads, bridges, power networks, homes, and farm facilities, suffered significant impacts. In response, local authorities, technical experts, and contractors collaborated effectively to devise and implement a solution over three months of intensive construction.

Site observations indicated that the stopbank did not experience overtopping; instead, the failure mechanism was likely due to either foundation or structural integrity issues. After executing emergency measures to redirect the river, efforts commenced to repair and restore the breached stopbank.

A Geotechnical Design Philosophy was formulated based on a high-level understanding of the anticipated ground model, site hydrology, and available borrow materials, with physical works initiated concurrently. During the early phases, Geotechnical and Geophysical investigations were conducted in parallel, allowing for adjustments to the Geotechnical Design as the Ground Model evolved. Geophysical assessments included Electrical Resistivity Tomography (ERT) surveys to evaluate soil/rock and groundwater interactions, along with Multi-Channel Analysis of Surface Waves (MASW) surveys to ascertain shear wave velocities of subsurface materials. Key geotechnical risks addressed in the stopbank Modelling and Design included elevated groundwater pressures and the presence of soft, erodible silts in the foundation. The final stopbank design featured a 1V:7H upstream face and a 1V:3H downstream face, with a homogeneous embankment primarily composed of sandy gravel, devoid of a clay core or filters, keyed in 1.5 meters below ground.

Poster Abstracts

Changes in Shear Wave Velocity of Pumice Sand Before and After Liquefaction

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

This research aims to investigate the liquefaction behavior and post-liquefaction sediment structure of pumice sand, focusing on its dynamic properties. In particular, the study examines the effects of compressibility and shear wave velocity on cyclic loading histories, in comparison to silica sand types. Cyclic triaxial tests were conducted on pumice sand, river sand, and Toyoura sand at the Geomechanics Laboratories of the University of Auckland and Tokyo Denki University. Samples were prepared at 50% relative density, saturated using CO and de-aired water, and consolidated under 100 kPa isotropic stress. Shear wave velocity was measured using bender elements both before and after cyclic loading under undrained conditions to assess liquefaction behavior. After liquefaction, samples were reconsolidated, and shear wave velocity was measured again. Additional tests were conducted at higher relative densities to analyze post-liquefaction behavior. Results indicate that shear wave velocity behaves differently in pumice sand and river sand after liquefaction. In pumice sand, at 50% relative density, liquefaction-induced strain history results in a more homogeneous structure, increasing shear wave velocity post-reconsolidation. However, at 80% relative density, the structure becomes less homogeneous, and velocity decreases. At 70%, an intermediate behavior is observed. Conversely, river sand shows a consistent decrease in shear wave velocity after liquefaction, regardless of its initial density, revealing differences in post-liquefaction structural changes between pumice and river sands. The angular surface of pumice sand likely leads to heterogeneous pores when loose, but more homogeneous pores when dense. However, significant strain history may cause dense skeletal structural instability.

Poster Abstracts

Geotechnical observations from the August 2022 Nelson rain event and consideration for debris barriers in an urban context

Mr Clayton Freeman[1], **Mr Markham Phillips**[1], Mr CHRISTOPHER SANDOVAL[1]
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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

During the August 2022 Nelson rain event, a common hazard was inundation from falling debris sourced from areas upslope of dwellings often beyond property boundaries. This has been an issue for EQC (now the Natural Hazards Commission) when outlining viable options for remediation. Debris barriers are a typical remediation concept proposed during reporting.

In the August 2022 Nelson rain event handrails were found to be partially effective at temporarily retaining small-scale falling debris (slip debris and rock fall).

New retaining wall developments greater than 1m high regularly include balustrades or handrails to minimise the risk of falling from heights. A similar mandate could be implemented for barriers to protect people and property from small-scale falling debris where the hazard cannot be addressed nearer to its source.

We see an opportunity to reduce this risk in urban residential settings at minimal additional cost for example by improving the standard handrail design to better protect against falling debris. Where retaining walls are not required this could be in the form of a cost-effective stand-alone debris barrier.

This paper documents observations from the August 2022 Nelson rain event, reviews current standards of practice and provides considerations when designing debris barriers in an urban environment.

Poster Abstracts

2023 Auckland Flood Response: Rural Road Remediation and Insights on Integrated Geotechnical and Hydrological Designs.

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

The January 2023 Auckland floods exposed significant inadequacies in the north Auckland rural road drainage network. Damage to the roads typically expressed at locations of poorly constructed embankment, with landslides commonly triggered by uncontrolled surface water discharge.

Working with Downer and Auckland Transport, ENGEO were presented with several opportunities to lead the remedial designs. This project presented an opportunity for integrated geotechnical and hydrological remedial design, with a focus on resilience.

Several project examples are presented in this paper, with a focus on key stormwater elements which geotechnical designers need to consider. On Matakana Valley Road a new 7 m high wall block/geogrid wall was designed to widen a road and upgrade an undersized culvert. Restrictions due to the steep, rocky terrain were accommodated through collaboration on a custom wing-wall design and channelising a steep stream to prevent overtopping the head-wall.

On Pine Valley Road, a failing embankment and undersized and damaged culvert were replaced with geogrid reinforced mass block walls and a large box culvert. Ecological concerns and conflicts between geotechnical and stormwater design elements presented common, but important challenges to be overcome through design.

Diversion of the streams in each of the above case presented construction staging and safety in design complexities requiring close geotechnical and stormwater design collaboration as well as significant stakeholder engagement and early contractor involvement. This paper presents our design led thinking and problem solving through all stages of initial response, concept to detailed design, peer review, and construction.

Poster Abstracts

The importance of geotechnical coordination for modern developments

Mr Matt Price[1], Mr Michael Sheridan[2,3], Mr Mike Trigger[1], Danielle G. Insley[2]
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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

Geotechnical reports are often issued with recommendations related to earthworks and building foundations to manage a variety of geotechnical risks. Issues can arise when the recommendations are either not understood or ignored by other parties. Councils are becoming increasingly aware of these issues and are more frequently seeking confirmation that structural or civil design complies with geotechnical recommendations.

Engineers working in silos can result in insufficient scope and conflicting information in documents between disciplines. This is common on private sector projects where geotechnical works are completed first with basic development plans. If geotechnical reports lack recommendations for further works or plan reviews, project teams must interpret the recommendations and collaborate with geo-professionals when uncertainties arise.

This report presents a number of common coordination challenges observed by geotechnical consultants and Tauranga City Council along with recommendations for better collaboration procedures and technical coordination of geotechnical constraints. Implementing these practices can enhance interdisciplinary alignment, reduce processing delays, and improve project outcomes.

Poster Abstracts

Prediction of the one-dimensional heave of soil covering a wide range of soil expansivity and initial condition

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

Heaving of expansive soils due to wetting is a well-recognized geotechnical problem. Over decades, many one-dimensional empirical formulas with different degrees of complexity had been developed to predict the heave. However, the formulas' empirical fitting coefficients are often site-specific and their applicability to different soils remains doubtful. In this study, an empirical formula with input parameters including the soil's intrinsic expansivity and initial condition is proposed. The formula aims to be universal in which the same set of model fitting coefficients are applicable to a wide range of expansive soils at different initial conditions. Five different expansive residual soils retrieved from Auckland, New Zealand were studied. The model fitting coefficients are calibrated from the test results of two soils having the lowest and the highest expansivity. The proposed formula is validated using the results of the remaining three tested soils, and relevant data collected from different countries around the world. The prediction is generally satisfactory given the fact that a unified set of model fitting coefficients are adopted for all samples in the dataset. Furthermore, using the same dataset the prediction performance of the proposed formula is compared with another seven existing formulas. The proposed formula noticeably outstrips the others.

Poster Abstracts

Assessment of large-scale landslide susceptibility for the Auckland Region

Mr Doug Mason[1], **Mr Kuba Rozmus**[1], Mr Harley Porter[1], Mr Pathmanathan Brabhaharan[1], Mr Aaron George[1], Mrs Rebekah McLelland[2], Mr Ross Roberts[2]
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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

The Auckland Region encompasses significant areas of steep terrain that are underlain by materials that are prone to slope failure. Auckland Council has a strategy to define and manage the risks from natural hazards proactively for more effective management of land use and infrastructure resilience. A regional assessment of landslide susceptibility has been undertaken as part of this strategy, for: (1) shallow landslides, and (2) large-scale, slow-moving or relict landslide features. This paper presents an overview of the large-scale landslide susceptibility assessment, and a companion paper focuses on shallow landslides. Consideration and mapping of these landslide types was carried out separately because they differ considerably in their frequency of occurrence, the type and extent of impacts, and the susceptibility of the geological formations within the region. Large-scale landslides are observed as geomorphic features that span over most of the height of the hillslopes. Their occurrence is related to geological structures and groundwater conditions within the bedrock formations and landscape-scale processes such as tectonic uplift and fluvial incision on timescales of hundreds to thousands of years. The primary objective of the study was to map areas susceptible to landslides associated with large scale landslide features across the region. To highlight these areas, an inventory of landslide features was compiled, and factors that influence slope stability were collated in GIS and combined to develop landslide susceptibility maps. Statistical analysis and engineering geological assessment of the landslide inventory and geomorphology were used to inform the relative importance of specific variables to landslide susceptibility.

Poster Abstracts

Transformative Geoengineering Solutions: Adapting to Climate Change and Enhancing Hazard Resilience - A Case Study in Wellington, Eastbourne

Miss Dani Thompson[1], **Miss Adriana Garcia**[1]
[1]Tonkin And Taylor | Te Ara Tupua Alliance, Wellington, New Zealand

Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

Tupua Horo Nuku is the Eastbourne branch of the Te Ara Tupua Alliance project. The alliance is working to deliver a shared pathway around Wellington Harbour, starting at Point Howard and winding down to the south end of Days Bay. The project will construct a total of 4.4 km of shared path supported by seawalls and rock revetments. Currently, all road users are forced to use traffic lanes on Marine Drive - a narrow, winding road exposed to the elements, with little to no shoulder space and speed limits varying from 50 to 70 km/hr. The new shared path is intended to improve safety for road users not in vehicles and connect to the broader network of cycle lanes and shared pathways in Petone and Lower Hutt, in Wellington.

Adaptation to the impact of the Sea Level Rise is increasing the physical and environmental challenges for seawall design and construction. This paper discusses a geotechnical-led design solution illustrated through a case study. It offers an equilibrium of various inter-disciplinary constraints including the seismic loading and liquefaction impact of the deep beach sand layers, erosion of beach deposits in storm events, adaptability and resilience to sea level rise (including future crest raising of seawall), tight spatial constraints in an urban setting, constructability limitations, and resource consent restrictions in a highly valued marine habitat.

Poster Abstracts

Rapid response to weather damaged infrastructure in Manawatū

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

In the aftermath of severe storms, road infrastructure often suffers extensive damage, causing loss of service of the asset affecting both communities and businesses alike. Thus, a yet robust design solution is required to restore the asset to its existing level of service. This paper presents the assessment, investigation, design, and construction, of an anchored steel H-pile retaining wall. The wall was used to remediate a significant road downslope failure below an access road near Palmerston North in Manawatū, following storm damage during late 2022. This paper predominantly focuses on the comparative performance of two types of anchor systems: traditional grouted anchors and mechanical (plate) anchors. These anchors were evaluated during on-site testing to assess their performance within the varying ground conditions across the site. The study explores installation challenges including those associated with temporary works, ground-structure interaction, and the load-bearing performance of each anchor type. Findings show there are advantages and limitations of both systems, particularly in the context of highly variable ground conditions and level of service restrictions during construction. The results contribute to an informed decision-making process for selecting anchor systems in anchored retaining walls in flood-affected areas.

Poster Abstracts

Rooting for stability: Integrating a softer touch to hard engineering for slope remediation

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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

Landslides are a significant geotechnical hazard in New Zealand, particularly in areas with steep topography and unfavourable subsurface conditions. With the increased frequency and intensity of severe weather events, as observed in early 2023 with the Auckland Anniversary Flooding and Cyclone Gabrielle, landslides will likely become a greater danger across the country.

Traditional hard engineering solutions, such as retaining walls, are often environmentally disruptive and have complications in safety in design towards the end of their design life. Irrespective of these limitations, they remain one of the most prevalent means of slope remediation. However, there has been a growing call for soft engineering solutions (e.g., selective planting for slope stability, recontouring for stormwater control, etc.), and a focus on environmental sustainability (Broquet et al. 2024). Unfortunately, these practices have yet to gain significant traction in New Zealand with a vast majority of remedial design and works remaining exclusively reliant on hard engineering structures.

Vegetation is well known to enhance slope stabilisation by anchoring topsoil with it's root systems, suppressing groundwater levels and attenuating the flow of water during severe rain events. While plants are typically used for surface erosion control, a hybrid approach with hard engineering solutions could provide a more sustainable, safer alternative, leveraging the best of both worlds. A hybrid approach can be attractive as it promotes biodiversity and ecosystem restoration in affected areas and delivers significant value in large, public spaces while covering the shortcomings of soft or hard engineering solutions individually.

Here, we evaluate different engineering solutions and explore some critical concerns with both soft and hard engineering effectiveness. In addition, we examine the potential for using native New Zealand vegetation communities to enhance slope stability through a hybrid solution for shallow seated slope failures, and outline how this can better align with national, regional and district policies.

Poster Abstracts

Reconstruction of Heaphy Track bridges following ex-Cyclone Dovi

Ms Sarah Jones[1]
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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

The Heaphy Track is one of New Zealand's 10 Great Walks, located between the townships of Karamea and Collingwood. The track receives in the order of 10,000 overnight visitors per year (2020/2021) and the tourism associated with it is a significant source of income for the local communities. Significant rainfall and flooding during ex-Cyclone Dovi in February 2022 resulted in severe damage to the Heaphy Track. Along with damage to the track itself, several bridges were damaged in the section between the Lewis and Heaphy Huts. The Heaphy Bridge, originally constructed in 2012, was washed away completely. The track was closed for 18 months following the storm event, with noticeable economic impacts on the communities at either end of the track.

It was quickly identified that reconstruction of the Heaphy Bridge in its existing location would not be feasible due to modelled future flood levels. In order to provide a resilient solution that would account for the potential impacts of climate change on flood levels, construction of two new bridges over the Lewis and Heaphy rivers was proposed. Stantec worked with the Department of Conservation (DOC) to provide geotechnical advice regarding the proposed abutment locations for the new bridges. This paper highlights the difficulties encountered in working in a remote area of New Zealand's second largest national park, while balancing the practicality of undertaking works in the area and the importance of constructing a resilient solution that would support the local communities.

Poster Abstracts

Liquefaction damage in Toyama Prefecture during the 2014 Noto Peninsula earthquake.

Dr Taichi Hyodo[1], Professor Gen Furuya[1], Mr Keigo Fujishima[1]
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Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

The 2014 Noto Peninsula earthquake, which occurred in Japan on 1 January 2014, caused liquefaction damage over a wide area, including Ishikawa, Toyama and Niigata prefectures. Many media and reports reported liquefaction in the northern part of the Noto Peninsula and parts of Ishikawa Prefecture, the epicentre of the earthquake. However, less was reported about liquefaction damage in Toyama Prefecture. In Toyama Prefecture, liquefaction damage was confirmed in areas with intensity levels of 4-5+. In this paper, we would like to share information on liquefaction damage in Toyama Prefecture.

Poster Abstracts

Development of Earthquake Shaking-Based Vulnerability Models for Residential Buildings on Hillslopes

Dr Vinod Sadashiva, **Chris Massey**

Lunch and Poster Session 2, Balcony Foyer Level 5, October 17, 2025, 12:30 PM - 1:30 PM

Christchurch experienced a series of major earthquakes between September 2010 and December 2011, as extensively documented in the literature. The 2010/11 Canterbury Earthquake Sequence (CES) not only triggered liquefaction in the city and damaged properties in the flat-lying suburbs but also significantly impacted properties on the hillslopes of the Port Hills area. The availability of comprehensive data on hazard, property damage, and resulting insurance loss claims from the CES events provided a unique opportunity to develop new vulnerability models, particularly for the Natural Hazards Commission (NHC) residential portfolio.
This paper focuses on a recent study which investigated the influence of topographic amplification on earthquake-induced damage to low-rise residential buildings (primarily one- and two-storey structures) situated on Port Hills hillslopes. The primary outcome of this research is a set of newly developed vulnerability models, which are presented and discussed in the following sections.

Engineering New Zealand: Rainbow Special Interest Group

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The Rainbow Special Interest Group (ENZ:RSIG) advocates for improved representation of rainbow communities in Engineering and Architecture.

We provide a place for organisations and individuals passionate about diversity to connect, share, and grow together. We're here to be loud and proud, supporting our members to thrive!

Our Pursuit

- Advocate for rainbow inclusion across the Engineering & Architecture industry
- Provide a forum for better policy and workplace advocacy
- Share resources, knowledge and better practices
- Host activities and events for fun and awareness
- Offer a safe space for members to voice challenges and receive support

Our Members

We welcome all in the Engineering and Architecture industry with a passion for Rainbow inclusion and advocacy.

Students, Allies, and Rainbow folk are all invited to join our national advocacy network and connect with like-minded people.

Get in touch:

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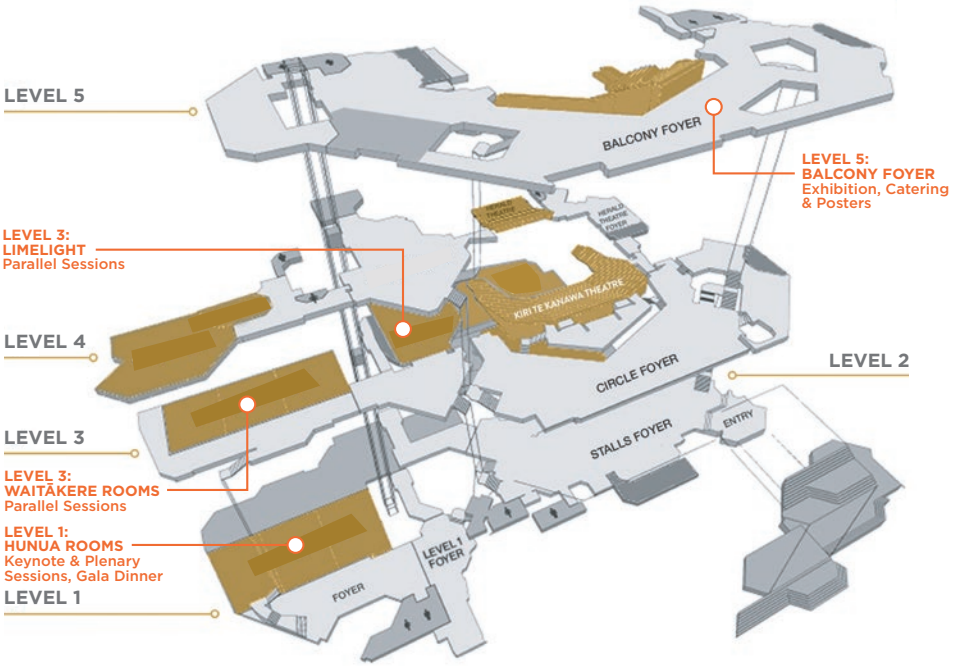

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