NEW ZEALAND GEOTECHNICAL SOCIETY INC

JUNE 2025 Issue 109

NZ GEOMECHANICS NEWS

Bulletin of the New Zealand Geotechnical Society Inc.

ISSN 0111-6851

RESIDUAL SOILS IN KERIKERI

- FOUNDATIONS ON SOFT SOILS
- CONCEPTUAL GROUND MODELS
- LIQUEFACTION LESSONS
- SOCIETY NEWS AND UPDATES

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We have successfully completed some 5000m of removable anchors and the level of enquiry continues to rise as the sustainable benefits of this technology are realised - once a construction project is completed, there is nothing left in the ground that will obstruct future developments on adjoining properties.

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We're proud to be the sole distributor in New Zealand for Samwoo Anchor Technology, BluGeo GRP60 Bar, OVM Prestressing Systems and Grout Grippa Grout Sock (Australasia).

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GEOTECHNICAL ENGINEER VACANCY

ABOUT EGL

EGL are based in Albany, Auckland. Since 1988 they have provided specialist geotechnical, earthquake and dam engineering consultancy services throughout New Zealand, Australia and the wider Asia-Pacific region.

The core activities of the internationally recognised EGL team are:

- **Geotechnical investigation, engineering design and construction support services for a variety of building types and retaining wall constructions.**
- **Dam and civil engineering for irrigation dams, water supply dams, flood control measures, mine waste and tailings disposal.**
- **Seismic hazard and earthquake engineering.**

EGL are looking for two talented Geotechnical Engineers to join their Water Resources Team in Auckland and focus on audit, design and construction support services for water storage and tailings dam projects.

AS A MINIMUM, THE IDEAL CANDIDATES FOR THIS POSITION WOULD HAVE:

- A Bachelor of Civil Engineering Degree from a Washington Accord University.
- Five years experience in geotechnical and civil engineering and some previous experience working on dam or water resource projects.
- Attained or is close to attaining Chartered Professional Engineer status.
- Full New Zealand Drivers Licence.
- Flexibility to travel and complete out-of-town site visits or fieldwork.

WHY YOU SHOULD CONSIDER JOINING EGL:

EGL has a focus on working on interesting and professionally rewarding projects. The company leadership strives to foster a supportive and collaborative working environment which allows staff to learn and grow professionally.

The key benefits of working at EGL are:

- A high ratio of senior to junior staff to enable close mentoring relationships.
- A competitive salary, that will be commensurate to the candidates experience, to be mutually agreed.
- A small, friendly team of very clever people.
- Opportunity to learn from some of New Zealand's leading geotechnical and dam design specialists.
- Free parking available around the office location.
- The company is led and managed by Geotechnical Engineers and has a focus on technical excellence.
- Opportunities to work on interesting projects throughout New Zealand and overseas.

HOW TO APPLY: Please direct all submissions of interest for this vacancy to the EGL Managing Director, Mr Tony Fairclough
E tony.fairclough@egl.co.nz PH +64 9 486 2546.
Applications for this vacancy close 17/01/2024

EGL
Geotechnical, Earthquake and Dam Engineers

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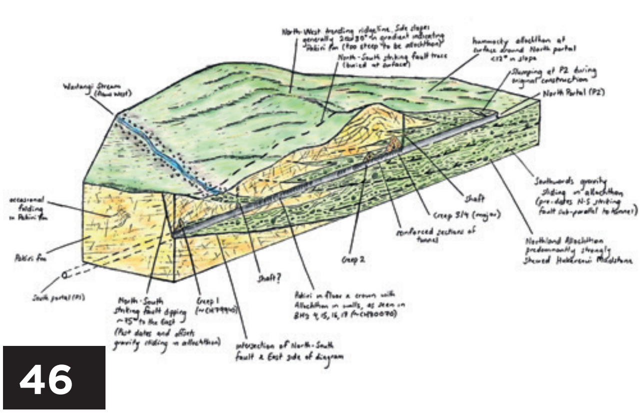

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COVER IMAGE: Haruru Falls with weathered basalt columnar jointing, Kerikeri. istock.com

From the Editors

A BREAK FROM the consecutive special "themed" editions, this edition covers a range of topical issues from new insights regarding shrink swell behaviour and testing to lessons learnt from liquefaction analysis of pumice and carbonate rich soils.

The featured article from Kerikeri presents detailed investigations into the shrink swell behaviour of samples from the region and implications to existing standards. The paper highlights limitations and biases of existing expansivity testing methods; both the AS2870 and recently suggested reliance on Atterberg limits. They highlight previously unknown initial moisture content bias of the Atterberg limits testing methodology, an approach that was itself suggested to overcome the same bias when using AS2870.

Away from the featured article, Sajjad reminds us of the limitations of the simplified procedure when interpreting results of liquefaction analysis particularly for pumice and carbonate rich soils. He presents suggested adjustment approaches for such soils based on recent research, laboratory testing, and projects. In "anticipating conditions – inspiration for conceptual models", Dan indeed provides inspirational conceptual models and a timely reminder of incorporating conceptual models in our daily work. It is also refreshing to see our YGPs well represented by the wonderful article from Manamea about foundation correction works on soft soils and why mixed foundation systems are usually not a good idea.

On a sad note, we include John Blakeley's obituary as posted on the Engineering New Zealand website. We managed to trace two articles from the archives celebrating his life and impact to the geomechanics society which are worth a read. As the "initiator" and first editor of the *NZ Geomechanics News*, we are grateful to your contributions, and it is great to see your brainchild flourishing.

And please don't forget the wonderful work done by the management committee, branch representatives, and ongoing NZGS projects. Any editorial summary cannot do justice to the ongoing work, and we recommend a detailed read of all the respective summaries.

Turn on the heat pump or fireplace and enjoy a copy of the magazine when it arrives. And then put on your thinking caps for suitable articles for the special contribution to the Australian Geomechanics Society (AGS); abstract deadline is 3 October 2025.

Camilla and Robert

Camilla Gibbons is a Principal and engineering geologist with Aurecon. She worked in the UK before moving to New Zealand in 2008 "for a year". The Canterbury earthquakes inspired what has now become her real interest in geohazards prepardness & resilience and she has since enjoyed working on projects combining this with her other interest of improving efficiencies and improving safety by the effective use of digital technology.
***NZ Geomechanics News* co-editor**

Robert Kamuhangire is a principal geotechnical engineer with KGA Geotechnical Group, based in the Christchurch office. He previously worked in the UK predominantly on large infrastructure projects, prior to arriving in New Zealand in 2012 to be part of the Christchurch Rebuild. In addition to forgetting his "perpetual warm/rain jacket" during his first summer in New Zealand (thanks to the consistent good summer weather), he has been blessed to work on a number of claim assessments, new residential and commercial buildings, subdivisions, retaining walls, deep and shallow foundations, and ground improvement schemes among other things.
***NZ Geomechanics News* co-editor**

From the Chair

Philip Robins is a Principal Geotechnical Engineer and Technical Director at Beca. Philip is an acknowledged specialist in geotechnical engineering, high-seismicity engineering and design development, and is recognised by his peers as a Fellow of Engineering New Zealand. Trained as a civil engineer with a broad range of experience, locally and internationally, Philip brings outstanding technical expertise in geotechnical engineering leadership that spans all sectors of civil infrastructure. Over the past 30 years, he has consistently shown his ability to lead geotechnical design and the development of geotechnical designs for numerous projects while developing key client relationships. Philip is a Nominated Member of the ISSMGE Technical Committee (TC104) - Physical Modelling in Geotechnics and (T220) - Field Monitoring in Geomechanics and was the ISSMGE Vice President – Australasia 2019 - 2021. Philip served on the NZGS Management Committee in 2009 and 2010 and was on the organizing committee for the NZGS Symposium in Dunedin, March 2021. Philip is now based in Palmerston North, where he moved with his family at the end of 2021.

Phil Robins
Chair, Management Committee

Kia ora koutou

I trust you have all had a good summer and made the most of our fine weather? Your NZGS Management Committee has been busy. Here are some of the exciting things we have been up to.

NZGS SYMPOSIUM 2025

Big news - the NZGS Symposium is ON from 15th to 18th October 2025 and registrations are open. As the NZICC will not be ready in time, we have had to pivot and find another suitable location. We landed on the Aotea Centre in the heart of Auckland. I will be in Auckland in October and looking to as meeting up with as many of you who can attend. Get you registrations in now and register for one of the four amazing pre-workshop courses.

CPENG RULES CHANGE CONSULTATION

We have met with Jodi Caughley (General Manager Strategy) of Engineering New Zealand who is leading the stakeholder engagement for the proposed CPEng Rules Changes and Richard Templer (EngNZ - Chief Executive) on a couple of occasions. We have put forward our objectives for PEngGeol and formally issued them to Richard in a letter. His response is attached.

NZGS SLOPE STABILITY GUIDELINES (SSG)

Big thanks to Richard Justice for leading the SSG Units development. This year Richard and his team will be issuing more units and provide some training sessions. Richard is also working with MBIE to get funding to plug the financial shortfall. I am determined to continue to support and encourage the SSG team to deliver an awesome group of guidelines.

SUB-COMMITTEES AND WORKING GROUPS

Over the last few months, a group of us has been meeting regularly to discuss various activities that our NZGS members are active with. Participants have included: Luke Storie, Ioannis Antonopoulos, Rick Wentz, Kaley Crawford-Flett, Merrick Taylor, Maxim Millen, Guy McDougall, Stuart Palmer, Liam Wotherspoon, and Andreas Giannakogiorgos. These activities have included:

- TS1170.5
- Joint Committee for Seismic Assessment and Retrofit of Existing Buildings (JC-SAR)
- C4 Geotechnical Considerations
- University of Canterbury: Seismic Retrofit Guidance, Multi Storey Concrete Buildings
- Low Damage Seismic Design
- Code of Practice for the design of ground-governed structures and design in non-elastic conditions
- Meeting between NZGS, NZSEE, and SESOC to happen at a technical level
- Updates to VM4 being considered by MBIE

ANNUAL GENERAL MEETING

At the AGM this year, we will put to our membership the changes due to the new Incorporated Societies Act 2022 (the 2022 Act) and the changes to our rules as part of the Incorporated Societies Regulations 2023 (the Regulations). The purpose, to maintain the NZGS's status as an incorporated society and to retain our charitable status with the Charities Commission

JOINT JTC1/JTC3 WORKSHOP

Great news, we are hosting the Joint JTC1/JTC3 Workshop on Landslide Risk Assessment, Communication and Geo-education in Queenstown, in April 2026. Ross and his team are knee deep in the planning for this workshop and rumour has it that Richard was tasting some locally brewed lagers for the event! :).

ISRM CONGRESS 2031

Speaking of symposia and workshops, I am delighted that Eleni, Romy and Christoph have offered to spearhead our bid for the Congress in 2031 in Christchurch. They will be travelling to put forward our bid at EuroRock 2025 in Trondheim, Norway. Good Luck Team. We are kindly supported by Tourism New Zealand and Christchurch City Council as we propose to host the Congress at Te Pae.

NATURAL HAZARDS COMMISSION (EQC)

On Tuesday 18 February 2025, I signed a Memorandum of Understanding between the Earthquake Commission and the New Zealand Geotechnical Society. In effect the NHC undertakes to provide annual funding beginning 1 July 2025 to be used on varying initiatives. NZGS acknowledges that NHC cannot fund any initiative which does not reasonably pass the criteria under the NHC act section 111 1.c. Thank you to Emilia for making this happen.

DIVERSITY, EQUITY, AND INCLUSION (DEI)

Rhiannon Robinson and I have been meeting with Tessa Beetham, Annie Scott and Charlotte Toma who have been working on initiatives to improve diversity and inclusion within the wider engineering industry. We have discussed the importance and impact of the technical societies having a DEI position statement/strategy. We hope to issue a joint DEI document with SESOC and NZSEE soon.

In closing, I hope that you are all as enthusiastic as I am about the NZGS Symposium 2025. See you there!

Noho ora mai,
Philip Robins
Chair 2024-2025

LETTER TO THE CHAIR

Engineering New Zealand
hello@engineeringnz.org
www.engineeringnz.org

04 473 9444
L6, 40 Taranaki Street
Wellington 6011

PO Box 12 241
Wellington 6144

8 January 2025

Philip Robins
Chair
New Zealand Geotechnical Society Inc.

By email: chair@nzgs.org

Dear Philip

RE: THE NZGS VISION FOR PROFESSIONAL ENGINEERING GEOLOGIST

Thank you for your letter of 16 December 2024. Your letter is being considered as part of the submissions to the CPEng Rules discussion and this will be considered by the CPEng Board on 10 February.

However, we thought it would be useful to respond to your letter outside of this process as the issues raised are largely outside the CPEng Rules ambit. Thank you for your understanding of the limitations we face with respect to the CPEng Act, that we can change the Rules, but not the Act itself.

You asked us to work to ensure that the status of PEngGeol matches that of CPEng. You suggested two opportunities to enhance this, which we'd like to respond to:

Creation of a separate PEngGeol Register

Currently PEngGeols can only be found by searching 'Find an engineer' on the Engineering New Zealand website, whereas CPEng's now have a dedicated register with greater searchability. You have asked us to consider the creation of a similar register purely for PEngGeols, which would be hosted on the Engineering New Zealand website, as a membership register, but could be linked from the Registration Authority website.

We will do the work to estimate the time and resources required to create the Register.

On-going Re-Assessment of PEngGeols

As PEngGeols are Chartered Members of Engineering New Zealand, they are currently not subject to re-assessment every six years like CPEng. If we were to introduce re-assessment for PEngGeols, we would need to consult with all of them, to ensure that they wish to be reassessed. It is worth noting that the cost of reassessment would equate to an increase in annual membership of approximately $500.

Action requested

We would like to attend (in person or virtually) at your next management committee meeting to discuss the opportunities above, so we can work together on them.

Yours sincerely

R S Templer

NZGS Symposium 2025

Geotechnical Horizons: Innovations & Challenges

15 – 18 October 2025 • Auckland, New Zealand

NZGS SYMPOSIUM 2025

15th - 18th October 2025 • Auckland, New Zealand
New Zealand International Conference Centre, Auckland

Welcome to the 2nd NZGS Symposium
Geotechnical Horizons: Innovations and Challenges

In an era of unprecedented change and technological advancement, the field of geotechnical engineering is poised at the threshold of new discoveries and innovations. The 2025 NZGS symposium offers a unique opportunity to explore the latest developments, emerging trends, and pressing challenges shaping the future of geotechnical engineering both locally and globally.

Delve into a diverse range of topics spanning engineering geology, geotechnical engineering, seismology, geophysics, and cutting-edge technologies. From exploring the implications of climate change to harnessing the potential of digital innovation, our symposium offers a platform to explore the horizons of geotechnical engineering and envision its future trajectory.

WHY ATTEND?

- Gain insights from keynote speakers and industry leaders at the forefront of geotechnical innovation.
- Participate in interactive workshops, technical sessions, and poster presentations showcasing the latest research and advancements.
- Connect with peers, collaborators, and potential partners from across New Zealand and beyond.
- Stay informed about emerging trends, best practices, and regulatory updates shaping the field of geotechnical engineering.
- Elevate your professional development and expand your network within the geotechnical engineering community.

PROGRAMME – MAIN POINTS

Wednesday, 15 October 2025 – Pre-Symposium Workshops

- Full-day technical workshops on earthworks, slope stability, rapid building assessments, and in-situ testing.
- Evening Welcome Function at Wynyard Pavilion

Thursday, 16 October 2025 – Symposium Day 1

- Keynote by Prof. Dr. Xuanmei Fan, followed by storm response presentation in Auckland by Ross Roberts from Auckland Council.
- Morning and afternoon presentation sessions.
- Keynote by Dr Burt Look: Cognitive Dissonance in Geotechnical Engineering.
- Public Lecture by Prof. Jan Evans-Freeman + Panel Discussion.
- Gala Dinner and Awards.

Friday, 17 October 2025 – Symposium Day 2

- YGP (Young Geotechnical Professionals) breakfast
- Keynote by Prof. Kyle M. Rollins on liquefaction effects
- Morning panel discussion on geotechnical compliance and standards.
- Poster session and further technical presentations.
- Mick Pender Memorial Session celebrating his research and education

Saturday, 18 October – Field trips

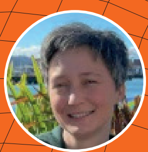
- MAGMATIC MYSTERIES: The Secrets of Rangitoto
- SLIP‘N’SLIDE: The Chronicles of Ground Movement

Note that workshops and field trips have limited spaces, so register earlier.

REGISTRATIONS ARE NOW OPEN!

Make the most of the early bird rates, available until 15 August 2025. Don’t miss out – register now and be part of the action! For inquiries and more information, please contact us at nzgs2025@confer.co.nz.

See you all there,
Emilia Stocks
NZGS 2025 Convenor



NZGS Management Committee Updates

IOANNIS ANTONOPOULOS
VICE CHAIR

Ioannis is a Chartered Geotechnical Engineer specializing in large infrastructure and development projects. He enjoys working with interdisciplinary teams on both design and construction, focusing on geotechnical earthquake engineering, water reservoirs, roading, ports, seawalls, foundations, cut-and-cover structures, tunnelling, slope stability, hydrogeology, and water resource management. As a volunteer for Engineering NZ, Ioannis serves as a Practice Area Assessor and frequently contributes to conferences as a presenter and reviewer. His expertise includes earthquake geotechnical engineering, soil-foundation-structure interaction (SFSI), numerical analysis and modelling, retaining structures, geotechnical design of soft soils, and geotechnical material characterization. Ioannis began his career in Greece, working on projects like the Athens Metro, the new Athens Conference Centre – Alexandra Trianti Hall, several highways, the Costa Navarino resorts, and commercial high-rises. Since 2012, he has been in New Zealand, contributing to major transport and water-related infrastructure projects, including Waka Kotahi NZ Transport Agency's highways, ports, dams, and levees.

WE HAD AN exciting first half of 2025, marked by significant achievements and developments across our initiatives. This report highlights the key milestones and progress made during this period. From recognizing excellence through awards to advancing technical standards and guidance, NZGS continues to support and elevate the geotechnical community. We look forward to building on this strong foundation in the months ahead.

AWARDS

1. NZGS SCHOLARSHIP

The NZGS Scholarship, formally known as the New Zealand Geotechnical Society Research Scholarship, is a prestigious award administered by the NZGS Management Committee to support postgraduate research in Engineering Geology and Geotechnical Engineering in New Zealand. It aims to foster academic excellence, promote innovation, and advance the Society's objectives by enabling members to undertake research that might not be possible due to financial constraints.

The scholarship is open to both student and non-student Members of NZGS and supports a wide range of postgraduate research activities, including:

- Master's or PhD studies by research
- Independent research projects, including those conducted by professionals in full-time employment
- Research that contributes to the profession, even if it does not lead to a formal degree

In 2025, the scholarship was awarded to **Ms. Katharine Vincent**, a PhD candidate at the University of Auckland, to support the continuation and completion of her doctoral research.

2. GEOMECHANICS LECTURE 2025

The Geomechanics Lecture is the premier technical award presented by NZGS. It is an annual honour that recognises individuals who have made outstanding contributions to geotechnical engineering, particularly in geomechanics—the study of how soils and rocks behave under various physical forces.

The lecture serves as a platform to:

- Celebrate the achievements of distinguished professionals
- Disseminate advanced knowledge and thought leadership
- Inspire both established and emerging engineers through cutting-edge research and practical innovations

In 2025, the honour was awarded to **Professor Rolando Orense** in recognition of his exceptional contributions to geotechnical engineering, both in New Zealand and internationally. His upcoming lecture is expected to explore advanced topics in geomechanics, offering both theoretical and practical relevance.

3. BRIGHT SPARK LECTURE AWARD

This international recognition, established by the ISSMGE, promotes and empowers young geotechnical engineers aged 35 or under by offering them opportunities to deliver keynote or invited lectures at major conferences. The link to the award is https://www.issmge.org/the-society/awards/bright-spark-lecture-award **Dr. Baqer Asadi** was selected as the NZGS nominee for 2025. His research introduces novel methodologies that challenge conventional approaches, offering new perspectives on soil behaviour, foundation systems, and risk mitigation. His upcoming lecture at the 21 ICSMGE 2026 is expected to inspire both practitioners and researchers.

CODE OF PRACTICE ON THE DESIGN OF GROUND-GOVERNED STRUCTURES AND DESIGN IN NONELASTIC CONDITIONS

We have reached a pivotal milestone in this initiative. A dedicated core committee of five members has been formed to lead the development of this important document. This Code of Practice will outline standards, procedures, and ethical considerations tailored to New Zealand's geological and seismic conditions. It will ensure consistency, and quality across the profession by aligning with current research and regulatory expectations.

MODULE 6 UPDATE

Work has commenced on updating Module 6 of the Earthquake Geotechnical Engineering series. This module, which focuses on the design of retaining walls, is being revised to reflect the latest seismic understanding and engineering demands. The updates aim to clarify fields of application, load combinations, and seismic considerations. By incorporating recent research and lessons from seismic events, the revised module will continue to serve as a vital resource for designing resilient retaining systems.

EMILIA STOCKS
TREASURER

Emilia is a chartered geotechnical engineer with over 15 years of experience spanning diverse geotechnical and civil projects in New Zealand, Hong Kong, and the UK. She holds the position of Principal Geotechnical Engineer at Tonkin and Taylor Ltd in Wellington, where she specializes in tackling complex geotechnical challenges. Emilia's expertise extends to overseeing technical issue investigations and their resolution, particularly in her role as a Risk Specialist.

treasurer@nzgs.org

WE'RE PLEASED TO share that NZGS remains financially stable, with consistent income from membership dues and sponsorships enabling us to support a wide range of activities and initiatives. This year, we successfully implemented our budget, which includes funding for industry research, 2025 NZGS symposium support, and educational programs. A key highlight is the development of Slope Stability Units, proudly sponsored by the NHC with acknowledgment by MBIE.

As we move forward, we're keeping a close eye on our finances to ensure we continue meeting our goals and providing the best support for our members.

JESSE BEETHAM
NATIONAL BRANCH COORDINATOR

Jesse Beetham is an Engineering Geologist (PEngGeol) with Tonkin & Taylor, based in the Tauranga office. He has been based in Tauranga for all of his career however, he has worked on projects all across the country. Jesse considers himself a true-blue Engineering Geologist with a strong background in the Earth Science field.

OVER THE PAST few months, NZGS branches across Motu have hosted a series of stellar activities, setting the stage for an eventful second half of 2025. Welcoming several new representatives and bidding farewell to some tenured ones, our diverse branches continue to evolve. The NZGS deeply appreciates all representatives who have volunteered their time and eagerly anticipates supporting those stepping into these roles.

However, a few of our national branches are finding it challenging to organize events or presentations. They would sincerely value any suggestions or ideas that could spur increased activity. If you have a potential idea for a branch activity or presentation, we encourage you to connect either with your local branch representatives or the NZGS Secretary.

As always, your thoughts and suggestions on the operations of our branches nationwide are invaluable. Please feel free to share your insights and don't hesitate to speak up!

RICHARD JUSTICE
PROJECT LEAD – SLOPE STABILITY GUIDANCE

I'm a Principal Engineering Geologist with ENGEO based in Christchurch. I graduated from the University of Canterbury in 1995. I was initially employed with Pells Sullivan Meynink, based on Sydney. After six years, I moved to URS, also in Sydney before moving to Wellington to be with Tonkin + Taylor. In 2008 I made the move to KiwiRail, to experience life on the client side for a while.

In 2012, I helped set up the Wellington office of Geoscience NZ (now ENGEO), before moving to Christchurch in 2014 and have been there since, apart from a four-and-a-half-year stint working on the North Canterbury Transport and Infrastructure Recovery (NCTIR) project. My work passion is engineering geological models - making sure that we don't forget the geological part of our assessments.

DRAFT VERSIONS OF Unit 2 – Landslide Recognition and Identification and Unit 3 -Slope Stability Analysis were released onto the NZGS website in March and April. The comments period for both documents has now closed, and we expect to release final versions of these units in the near future (if not already released by the time of publication).

In parallel with finalising Units 2 and 3, work is currently underway on the development of:

Unit 4: Mitigation and Design Principles. This document should now be available on the NZGS website (or if not, should be soon!)
Unit 6: Debris Flow Assessment, Analysis and Mitigation. This document should now also be available on the NZGS website
Parts of Unit 7: Special Cases and Materials. Three of the proposed eight documents are currently in development, due to budget overruns on other units.

The remaining document, Unit 5, is earmarked for Rockfall; and is intended to be an update to the MBIE Design Considerations for Passive Protection Measures. We have had some discussions with MBIE and NHC this year as the first part of this process, and we will keep these communications active as we move into the second part of the year.

And finally, we have gone international! In late April, we were contacted by the Peruvian Geotechnical Society, who are keen to have the units translated into Spanish for their local geoprofessionals! After agreement from NHC, I am happy to say that translation is now underway. Muy emocionante!

LIAM WOTHERSPOON
TRAINING & SHORT COURSES

Liam is a Professor in the Department of Civil and Environmental Engineering at the University of Auckland. He has held an academic position in the department since 2009 and has been involved in the teaching of a wide variety of geotechnical engineering courses. His research also covers a range of geotechnical engineering areas and extends into structural and infrastructure engineering. He has worked with a number of professional organisations to translate the outputs of his research into practice and support the evolution of best practice.

LIAM HAS LED the organisation and management of the following short courses in 2025:

- GIS for Geotechnical Professionals
- Rock Mechanics & Rock Slope Engineering

Workshops have been organised for later in the year to sit alongside the 2025 NZGS Symposium, with these focussing on earthworks, slope stability, Rapid Building Assessment and in-situ testing. Liam has also been involved in the geo-education subcommittee that has been developing initiatives related to the development and expansion of the profession.

Liam has taken up a new role as a Technical Working Group Liaison. This role will connect NZGS with external working groups currently active and take advantage of future opportunities to provide technical geo-professional advice and input to government and non-government working groups.

AUSTRALIAN GEOMECHANICS
SPECIAL EDITION MARCH 2027

New Zealand Geomechanics Research and Practice Call for Papers

AUSTRALIAN GEOMECHANICS SOCIETY

NEW ZEALAND GEOTECHNICAL SOCIETY INC

Call for Submissions: Special Edition of *Australian Geomechanics*, journal of the Australian Geomechanics Society, featuring New Zealand contributions

The Australian Geomechanics Society invites submissions for a Special Edition of its Journal — *Australian Geomechanics* — that showcase the vibrant geotechnical engineering and engineering geology landscape of New Zealand. This exciting initiative underscores the strong partnership between our two nations and aims to highlight the shared challenges and recent advancements in Geotechnical Engineering and Engineering Geology.

THEMES

We encourage researchers, practitioners, and students to contribute papers on a diverse array of New Zealand-themed topics that would resonate with an Australian audience. Suggested themes may include:

- Innovative geotechnical methods and technologies
- Environmental geotechnics and sustainable practices
- Ground behaviour and site characterisation
- Landslide risk assessment and management
- Soil-structure interactions and foundation engineering
- Geohazards and natural disaster management
- Case studies of significant engineering projects

This is a unique opportunity to publish your work in a respected Australian journal, thereby broadening your reach and influence in the geotechnical community.

Please submit your abstracts for consideration by 3rd October 2025. We look forward to your contributions that celebrate the synergy between New Zealand and Australia in the field of geomechanics.

For further details, please contact editor@nzgs.org. Let's showcase the best of New Zealand's geotechnical expertise!

PAPER SUBMISSION

For further guidance on the preparation of papers, editorial policy and how to submit an abstract for consideration please refer to the *Australian Geomechanics* journal webpage:

https://australiangeomechanics.org/journals/

Abstracts of no more than 300-words should be submitted via Scholastica by 3rd October 2025 for consideration by the Guest Editors. We encourage submitting an abstract first to receive confirmation from the Guest Editors before completing and submitting a full paper.

Papers selected for publication will be based on their quality and relevance. Final paper to be submitted by 1st June 2026.

Papers for publication in this themed issue will be based on their quality and relevance to the topic. We encourage submissions from the geotechnical profession, other geoscience practitioners, the quarry industry, as well as academia.

All papers are peer reviewed.

MARTIN LARISCH
CHAIR OF NZGS CLIMATE CHANGE RESILIENCE & ADAPTATION GROUP

Martin Larisch is a Geotechnical Engineer with more than 25 years of international design and construction experience. He is based in Waikanae (Kapiti Coast), where he works as an Independent Consultant and Expert Witness on various geotechnical, piling, ground improvement and retaining wall projects across New Zealand and the Asia Pacific Region.

Since 2020, he is a member of the expert panel to revise the NZGS/SESOC Piling Specifications and he is also the current Chair of the NZGS Climate Change Resilience and Adaptation Group.

TC211 (GROUND IMPROVEMENT)

TC-211 Ground Improvement and TC-217 Land Reclamation Technical Committees of ISSMGE, National University of Singapore and Nanyang Technological University, the Geotechnical Society of Singapore is organising an **International Symposium on Land Reclamation, Ground Improvement and Coastal Protection**, which will be held on 26-28 November in Singapore.

In April 2025, Dr Suzanne van Eekelen presented the second part of the webinar **"Insights in Geosynthetic-Reinforced Pile-Supported Embankments Part 2"** which is available as a recording on the ISSMGE homepage.

TC212 (DEEP FOUNDATIONS)

The last meeting of TC212 was held on 15 September 2023 (online) and it was chaired by the Technical Committee Chair Prof. Alessandro Mandolini and there are no further updates.

NZGS CLIMATE CHANGE RESILIENCE & ADAPTATION GROUP

The draft of the C**limate Change and Resilience Advisory Note 1** will be released in due course.

LaGER 2026

Landslide Geo-Education & Risk

27 APRIL – 1 MAY 2026

An International Workshop of JTC1 & JTC3

QUEENSTOWN, NEW ZEALAND

LANDSLIDERISK.NZ

NAU MAI, HAERE MAI – WELCOME!

The New Zealand Geotechnical Society is delighted to invite you to the First International Joint Workshop of Joint Technical Committee 1 and Joint Technical Committee 3 on Landslide Risk Assessment, Communication and Geo-education. We will share the latest research and develop best practice guidelines in the stunning New Zealand city of Queenstown.

Our theme *"Landslide Geo-Education and Risk"* unifies the full lifecycle of landslide risk management. It encompasses the needs to educate the next generation of landslide risk managers, to robustly understand landslide risk, and to communicate that risk to the public and decision makers so that real change is implemented. Bringing together JTC1 and JTC3 on key aspects of landslide risk – assessment, education, communication, and outreach – will drive strategic improvements in managing landslide risk.

Key Dates

- **Sponsorships open now!**
- **Abstract submission:** May-June 2025
- **Abstract acceptance:** Aug 2025
- **Registrations open:** Aug 2025
- **Draft paper submissions close:** Oct 2025

Why attend?

This landmark international event unites JTC1 and JTC3 to advance landslide risk assessment, education, communication, and outreach – creating a unique opportunity for diverse impacts, and will be attended by leading experts from around the world.

The workshop is structured around specific projects through interactive sessions. Beyond disseminating knowledge, we will generate new ideas, develop ongoing projects, and create tangible outputs including guidelines and research direction.

LaGER2026 also delivers great training courses, keynote speeches, presentations, poster sessions, and field trips. The training courses will span landslide risk assessment, emergency response, science communication, and landslide geoeducation.

This international workshop conference is hosted by the New Zealand Geotechnical Society and is endorsed by the member societies of the Federation of International Geo-Engineering Societies:

New Zealand Geotechnical Society

FedIGS

IAEG ENGEOL

SIMSG ISSMGE

igs

Be a part of this world-first international event - sponsorship opportunities available now!

By sponsoring, your organisation will have the opportunity to profile your ideas and solutions on the global stage as well as connect with global experts, local practitioners, and key decision makers from around Australasia. Your name will be associated with real deliverables that will outlive the event and drive meaningful change in New Zealand and around the world. We look forward to your participation in making LaGER2026 a success, and to being permanently associated with the great outcomes of the workshop!

Some ways you might like to get involved – more on our website:

Gold and silver

Be a key supporter - align yourself with LaGER 2026 in all our outputs.

Platinum already sold – so get in quick!

Exhibition stands

Join the exhibition and use this excellent opportunity to exhibit your products and services to conference delegates.

Nametag Printing Kiosks

Display your logo on the main screen of self-service registration kiosks and printed name tags

Carbon zero

Demonstrate your environmental credentials by supporting our drive for this to be the most sustainable conference.

Smartphone App

An essential tool for engagement during the conference. Be in all delegates pockets!

Welcome Function

The Welcome Function will open the workshop Tuesday night at the Millennium Hotel.

Conference Dinner

Our main social function that acknowledges industry achievements at. stunning Walter Peak

Young professionals

Support the next generation and get your name in front of the brightest.

landsliderisk.nz/sponsorship-exhibition/

Our core workshops

As a workshop-focused conference, the meeting is structured around our four core workshops, in which specific projects and topics will be presented, discussed, and worked on in a fully interactive session:

LRM Guidelines

The 2007 AGS Landslide Risk Management guidelines are being updated by an international panel. The guidelines provide geotechnical practitioners, land managers, asset managers and regulators with a state of the art, internationally respected, clear and concise guidance to identify, assess and mitigate landslide hazards. While the focus is on use in Australia and New Zealand, they are expected to be useful globally.

Landslide Watch NZ

The programme aims to move away from expensive local reactive (post-event) in-situ monitoring to proactive (pre-event) space-based observation across New Zealand Aotearoa. This ambitious approach will enable landslides to be identified nationwide, link their movement patterns to climatic drivers, and characterise their behaviour before they cause damage.

Hōretireti Whenua – Sliding Lands

This programme will create national-scale landslide models that can forecast where rapid and dangerous landslides are likely to be triggered by earthquakes and rainfall events. The programme will have a significant focus on communication and outreach, investigating people's perception of landslide phenomena, hazards, and models, as well as their perceptions of vulnerability to landslides. Findings will be used to improve the communication and visualisation of model outputs around risk, as well as inform the development of the models themselves.

Landslide virtual field trip

LEARNZ is a programme of free virtual field trips, helping students access the inaccessible and visit inspiring places around Aotearoa, Antarctica and beyond.
This workshop, led by the LEARNZ team, will record a series of interviews with delegates as part of our field trips in interesting landslide locations. It aims to raise awareness with intermediate school children, and to introduce them to geoscience as a profession.

Progress Report for the update to the AGS (2007) Guidelines on Landslide Risk Management

THE AUSTRALIAN GEOMECHANICs Society and New Zealand Geotechnical Society are jointly working on an update to the AGS (2007) Guidelines on Landslide Risk Management. The updated guidelines will be complimentary to the NZGS Slope Stability Guidance Units.

Our project continues through 2025, and our four working groups comprised of experts from across Australia and New Zealand have achieved some important milestones.

Our working group researching international practice in landslide risk management (Working Group 1) has received 12 reports from eminent practitioners in different countries across the world. The reports describe best practice in landslide risk management in those regions and will provide important input to our updated guidelines to ensure they are learning from best practice globally.

Our working group on principles of landslide risk management (Working Group 2) has developed an outline for a document that will provide general guidance on landslide risk management to a broad range of stakeholders. This document is intended primarily for non-geotechnical practitioners and will convey information about landslides and guidance on how their impacts can be managed in plain English.

Guidelines for landslide hazard mapping (Working Group 3) are currently being drafted which will set out best practice for preparing landslide inventories, susceptibility, hazard and risk maps along with advice on how to use them for planning and landslide risk management. The existing guidance on landslide mapping will be enhanced with advice on the use of digital tools including databases and digital terrain models. This group includes some of the authors of the GNS Landslide Planning Guideline (2024) to help ensure alignment with this document.

Our working group on landslide risk assessment (Working Group 4) is preparing updated guidelines for practitioners setting out best practice for landslide risk assessment. In addition to rationalising the existing information, new guidance is being drafted on uncertainty in landslide risk assessments and the basics of probability along with a suite of worked examples.

Our working group chairs and steering committee will meet at the 1st International Conference on Engineering Geology to be held in Brisbane on 22 to 25 July 2025 by which time we expect to have the guidelines completed to about 40%. We would welcome any discussion or queries from conference attendees on the guidelines.

The aim is to complete the first draft of the guidelines by the end of 2025 and to commence engagement with our peer reviewers over that period. The drafts will then be distributed for comment more broadly and will be workshopped at the Landslide Geo-Education and Risk workshop conference in Queenstown, April 2026 (www.landsliderisk.nz) before finalisation in mid 2026.

Thanks goes to all those who have or will make a contribution to the project, which are too many to mention. Contributions, comments and feedback is welcome at any time through our queries page on the AGS website: https://australiangeomechanics.org/2024/03/05/ags-technical-committee-for-landslide-risk-management/.

15th Young Geotechnical Professionals Conference (15YGPC)

Adelaide, South Australia, 6-9 November 2024

Christoph Kraus, NZGS YGP Representative and Beca

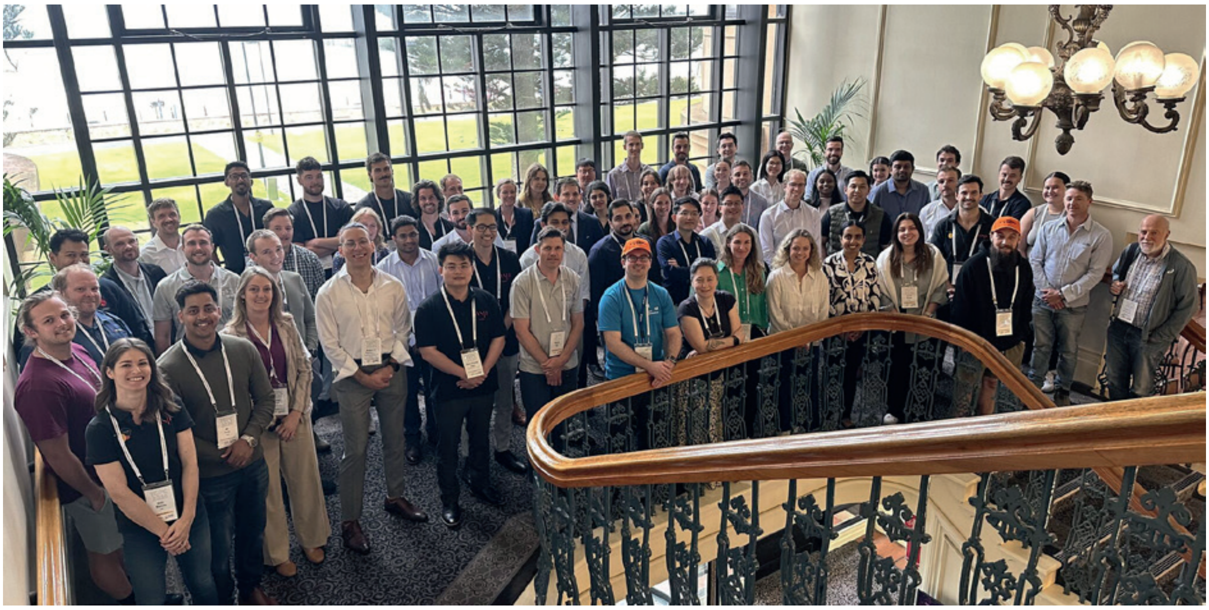


FIGURE 1. 15YGPC attendees at the Stamford Grand conference venue

Thanks to our sponsors: WSP, Beca, Hully, Keller (all gold sponsors), Conetec and IGS (both silver sponsors), and Broons Impact Rollers (bronze sponsor).

BETWEEN 6 AND 9 November last year, the Australian Geomechanics Society (AGS) and the New Zealand Geotechnical Society (NZGS) held the 15th Young Geotechnical Professionals Conference (15YGPC) at the Stamford Grand Hotel in Glenelg, Adelaide, South Australia.

The YGP conferences, which began in 1994 and are held every 2 years, are unique 3-day events facilitated by a joint initiative of the AGS and NZGS. They are intended to provide younger professionals within the Australian, New Zealand and Pacific geotechnical industry experience in the preparation of a technical paper and presenting at a conference. YGPC events also provide a great opportunity to network with peers and make new connections. It was the second time in the history of the YGPC events that Adelaide hosted the conference.

The conference was attended by 48 delegates from across Australia and New Zealand, 4 mentors, the organising committee, the AGS and NZGS chairs, as well as several industry sponsors. The mentors at the conference were Romy Ridl (KiwiRail), Emilia Stocks (Tonkin + Taylor and current NZGS Treasurer), Darren Paul (WSP and former AGS National Chair) and Mark Jaksa (University of Adelaide and former AGS National Chair). Mark held a dual role and was also on the organising committee together with Nikki Manche (WSP), who chaired the committee, Sean Goodall (Douglas Partners), Lauren Amato (Arup), Michael Crisp (Mott MacDonald), Jon Gibbs (AGS Secretary) and me.

The presentations were engaging, of very high quality, and covered a wide range of topics including landslides, slope remediation, risk management, liquefaction assessments, lava caves, foundation design, and more. A special mention goes to Rhiannon Robinson who tried to bring a pumice sample to the conference to support her presentation – unfortunately the sample didn't make it past the biosecurity checks at the border. Following each session, the four mentors kindly made themselves available to provide individual feedback for each presenter in that session. It was great to see all delegates take up that generous offer. The mentors also had a speaking slot each, where they presented some of their guidance and recommendations to the delegates.

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FIGURE 2. Left: Jesse Beetham, NZGS YGP Fellowship winner; Centre; Stephanie Salim, Don Douglas Youth Fellowship winner; Right: Rhiannon Robinson, People's Choice Award

After two days of amazing presentations, the mentors were tasked with deciding on the awards for the best New Zealand and Australian papers. After everyone had finished their presentations, and while the mentors were deliberating on who the winners would be, the delegates participated in an ISSMGE Heritage Time Capsule (HTC) session on what our industry will be like in 100 years' time. As part of the session, delegates were split into 8 groups, each answering a question which relates to the overarching question of what our industry will be like in 100 years. The session was very well received by the delegates, and we are looking to submit the outcomes of the session to the HTC project.

At the conference dinner that evening, the awards were presented to the following people:

- The NZGS Young Geotechnical Professionals Fellowship was awarded to Jesse Beetham (Tonkin + Taylor), for his work on *'The dangers of restricting access to residential housing following landslides'*.
- The Don Douglas Youth Fellowship was awarded to Stephanie Salim (PSM) for her work on *'Sustainable design and construction in Western Sydney: Repurposing tailings dams for industrial commercial development in Western Sydney.*
- The People's Choice Award was awarded to Rhiannon Robinson (Beca) for her work on *'Field and laboratory-based characterisation of pumiceous soils in the Bay of Plenty'*.

I once again want to congratulate all three winners!

The conference was rounded out by an amazing fieldtrip to Hallett Cove, led by Mark Drechsler (SMEC). Hallett Cove is home to some spectacular geology, including Permian aged (~280 Myr) glacial striations. Following a walking tour exploring the geology of Hallett Cove, the final stop of the fieldtrip was a visit to the Wirra Wirra vineyard for a wine tasting, as well as discussions on the history of the vineyard and the importance of geology and climate on viticulture. The vineyard even provided some pull-up banners with geological maps of the area!

FIGURE 3. Hallett Cove

NZ Geotechnical Society

2025 PHOTO COMPETITION

Call for Entries

The 2025 theme is

AMAZING SPACES:
Tight and Cramped, or Picturesque

ENTRIES CLOSE
30 September

FIRST PRIZE WINS $400
2ND PRIZE $200
3RD PRIZE $100

The winning photo and the top runners-up will be printed in the December 2025 issue of *NZ Geomechanics News*

SEND YOUR ENTRY TO

- Email to: editor@nzgs.org (send as jpgs)
- Entries close 30 September 2025
- Clearly mark your entry with your name and provide a caption for your photo

CONDITIONS OF ENTRY

1. Only amateur photographers may enter.
2. Photos must be taken by the entrant.
3. No computer generated pictures.
4. Any photographs received may be published in subsequent NZ Geotechnical Society publications and material.
5. Winning entries will be final and no correspondence will be entered into.
6. NZ Geotechnical Society members only may enter.

FIGURE 4. Permian aged (280 Myr) glacial striations at Hallett Cove

FIGURE 5. The 'Sugarloaf' at Hallett Cove

On a personal note, it was an absolute privilege to have the opportunity to help organise the conference together with an amazing organising committee. Finally, I would like to extend another big thank you to:

- our mentors Emilia Stocks, Romy Ridl, Darren Paul and Mark Jaksa for their time, support and advice,
- Jon Gibbs (AGS Secretary) for all his support, and Mark Jaksa for mentoring our organising committee,
- Mark Drechsler (SMEC) for leading the fieldtrip to Hallett Cove,
- all those who helped with paper reviews,
- our conference sponsors, without whom this event wouldn't have been possible: WSP, Beca, Hully, Keller (all gold sponsors), Conetec and IGS (both silver sponsors), and Broons Impact Rollers (bronze sponsor),
- the NZGS and AGS chairs Philip Robins and Tim Thompson, for your support and making the time to attend the conference and support our YGPs,
- James Robinson (AGS) for his support with the conference website and documents.

If you would like to have a read the conference papers, please keep an eye out for the proceedings which will soon be published on our website!

What's On at NZTA/Waka Kotahi

Stuart Finlan
Lead Technical Advisor Geotechnical, Office of the Chief Engineer,
Transport Services, Portfolio and Standards,
stuart.finlan@nzta.govt.nz

Comments and opinions expressed in this article are not necessarily those of NZTA/Waka Kotahi

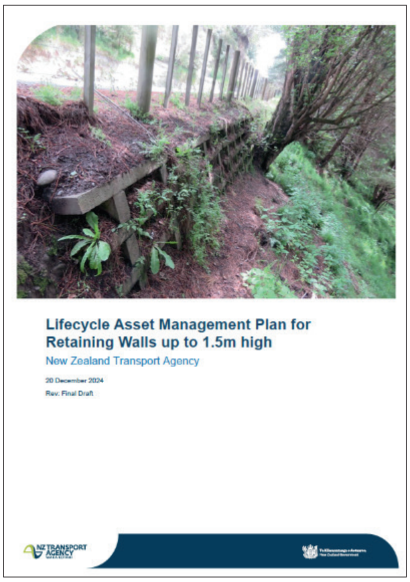
Stuart Finlan
Waka Kotahi

BRIDGE MANUAL AMENDMENTS

Many thanks to those members who took time to respond to the request around proposed amendments to geotechnically related clauses in the Bridge manual through the NZGS digital newsletter. Dante Legaspi is leading this work, and he personally thanks all those who have contributed.

LIFECYCLE ASSET MANAGEMENT PLANS

Early this year lifecycle asset management plans (LAMPs) were internally published for the key geotechnical asset groups: Low height retaining walls, geotechnical drainage, reinforced slope stabilisation structures and rockfall and slope debris structures. These form part of the NZTA initiative to develop a LAMP for all major assets.



Not currently available externally, they cover lifecycle management and financial forecasting and will greatly assist asset managers in their roles.

STANDARDISES DESIGNS FOR RONS PROJECTS

The "*Standardised Designs: NZTA Standardised design solutions for use on State Highway Roads of National Significance",* detailed in the last *NZ Geomechanics News*, has been updated to Version 3 which can be downloaded from the HIP (Highways Information Portal) at https://www.nzta.govt.nz/resources/standardised-designs/

MAINTENANCE OPERATIONS AND EMERGENCY WORKS

Those working in this space (maintenance as opposed to new -capital- projects) will know what a constraint the Bridge Manual can be when designing which generally results in solutions out of context with the corridor it sits within and depletes our limited funding rapidly with less remedials being treated.

As a consequence, a supplement to the Bridge manual is in preparation that will cover the investigation and design requirements for network earthworks repairs, drainage and retaining structures (except those forming part of, or adjacent to, bridges), undertaken as part of physical works by Maintenance & Operations and during declared Emergency Works.

Being applicable to only

Maintenance and Operations works, that maintain the existing network, and during declared Emergency Works, the overarching principle is to return the network to service as soon as reasonably practical to match the existing level of service/ performance of the corridor unless there is an intention to increase resilience, static stability and/or seismic stability that requires full compliance with the Bridge manual.

GEOTECHNICAL ASSET MANAGEMENT FRAMEWORK

Also internally published is the Geotechnical Asset Management Framework (GAMF) for geotechnical assets across NZTA infrastructure, which is intended to fit within the national NZTA asset management policy at a discipline level. In relation to the International Infrastructure Maintenance Manual (IIMM), asset management maturity is classified into five distinct stages: Aware, Basic, Core, Intermediate, and Advanced. Presently, the GAMF is positioned at the basic level of maturity against the international standard but provides the foundation for the evolving NZTA asset management practices.

SOIL NAILS

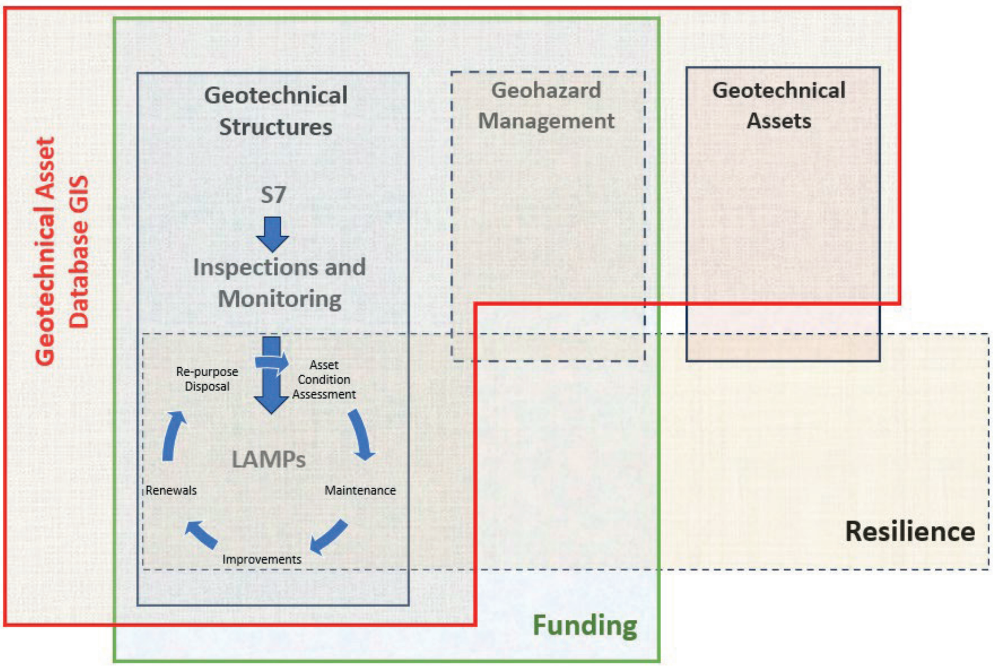
Use of soil nails has seen a recent increase though not without some concerns at NZTA. The use of 'soil nails' to support structural facings (including formed and pre-formed concrete facings) is not in keeping with the use of soil nails to create a mass reinforced soil block being in essence a quasi-ground anchor in this scenario.

Similarly use of soil nails in soils below the groundwater table has increased with concerns around potential soil softening within the soil nail block below long-term groundwater levels reducing capacity during the design working life, and testing of soil nails continues to be a frequent topic at the Departures Committee.

Consequently a Technical Advice Note (TAN) is being prepared to respond to these issues and provide more clarity around requirements.

AU REVOIR

As my tenure as NZTA Lead Technical Advisor Geotechnical draws to a close, it has been a privilege to have been the first NZTA principal geotechnical engineer through to my current role. My aim has been to raise the profile of geo-professionals in horizontal infrastructure and that of geotechnical 'structures' being an important part and playing as important a role as 'hard structures'. Challenges remain for those that follow, not least in terms of climate change, depleting quality materials, seismic considerations and how to meet all that based on what New Zealand Inc can afford. If you want to stay in touch for a coffee, a chat, or maybe as a past lead advisor, give me a call.



KiwiRail Update

June 2025

Tom Revell, Principal, Geotechnical Engineering

STANDARDS UPDATE

KiwiRail has recently updated its Retaining Wall Standard "C-ST-RW-4104 Retaining Walls". This is a significant update, superseding the previous version, and reflects KiwiRail's commitment to best practice in infrastructure management. The revised standard is intended to better capture the whole-of-life considerations for managing retaining walls on the network. This means that the standard now places a greater emphasis on not just the initial design and construction of these structures, but also their long-term maintenance, inspection, and eventual replacement. By taking a whole-of-life approach, KiwiRail aims to ensure the safety, reliability, and cost-effectiveness of its retaining wall assets over their entire lifespan. Furthermore, the updated standard aligns design requirements with current industry good practice. This ensures that KiwiRail's practices are in line with the latest engineering techniques and safety standards, promoting consistency and quality in retaining wall design and construction across the network. This document can be provided on request, by contacting a member of the team at geotech@kiwirail.co.nz.

INTERISLANDER FERRIES ANNOUNCEMENT

KiwiRail's Civil Engineering team welcomes the Government's recent decision to procure brand-new rail-enabled Interislander ferries. This decision is seen as great news for the public, international visitors, and the freight market, as it will ensure the lowest operating cost for rail freight and increased capacity for road transport operators. KiwiRail also welcomes the announcement that planning for the port infrastructure in Picton and Wellington is underway and that the ferries will enter service in 2029. The procurement of new ferries represents a significant investment in New Zealand's transport infrastructure.

RAIL NETWORK INVESTMENT PROGRAMME (RNIP) FUNDING

KiwiRail has secured funding from the Government for the next few years through the Rail Network Investment Programme (RNIP). This funding will enable KiwiRail to progress a number of critical projects across the rail network. The first three-year RNIP cycle came to a close in June 2024, with the second RNIP cycle (RNIP 2.0) now developed and currently underway. RNIP 2.0 is funded through the National Land Transport Land Programme (NLTP), which funds the majority of government-led road and rail projects. This funding will provide a secure pipeline for critical projects in the coming RNIP cycle, allowing KiwiRail to plan and execute essential upgrades and maintenance with confidence. These projects are crucial for maintaining the safety and efficiency of the rail network, as well as for supporting economic growth and connectivity throughout the country.

Residual soils in the Kerikeri Volcanic Group, Northland

Index properties, mineralogy and shrink-swell characteristics

Keavy Mitchell, Martin Brook, Nick Richards

Keavy Mitchell

Martin Brook

Nick Richards

ABSTRACT

So-called "expansive" soils undergo significant volume change in response to changes in soil moisture, creating challenges for ground engineering. Consequentially, the testing and characterization of soil "expansivity" is important for accurate design of shallow residential foundations. In New Zealand, the engineering industry generally utilized AS2870-2011 (Residential slabs and footings) for soil expansivity determination, until MBIE's November 2019 NZ Building Code amendments to Clause B1, further increased characteristic surface movement (ys) values and drought return-periods (from 300 year to 500 years). This amendment potentially increased building costs in many parts of the country, renewing discussions about the suitability of soil "expansivity" testing methods. This discourse led some North Island councils to alter the requirement of soil expansivity determination from AS2870 methods, to a semi-qualitative Atterberg limits method. However, recent research suggests both tests are flawed. Given the complexity of differing parent rocks and climates across Australia and New Zealand, it is perhaps unrealistic to expect a blanket testing approach to be applicable to all. We used residual soils from the Kerikeri Volcanic Group, Northland, as an exemplar of how physical and chemical properties of a soil can vary even locally on the same geology, affecting a soil's response to testing methods. Particle-size distribution, Atterberg limits, shrink-swell testing, XRD and SEM analyses were conducted to help form the basis of this argument. From the results, neither AS2870 shrink-swell or Atterberg limits testing, should be solely relied upon for soil expansivity determination. This research substantiates shortcomings of these testing approaches, and should provide stimulation for further research into this important aspect of ground engineering.

1. INTRODUCTION

Expansive soils pose significant challenges in soil engineering, both in New Zealand (Brown et al., 2008; Giannakogiorgos et al., 2020) and worldwide (Jones & Jefferson, 2012; Hobbs et al., 2019). Recognized as a global engineering concern since the early 1990s, expansive soils (soils prone to shrinking and swelling) impact many countries, yet standardized approaches for testing and predicting their behavior remain inconsistent, globally (Fityus et al., 2005; Rogers et al., 2020). The expansivity phenomenon affects clay-rich soils, with the intensity of such, dependent on the type of clay mineral that dominates in any given soil mass, the texture and structure (Wesley, 2010; 2020). In suburban areas, where development extends onto greenfield sites, the behavior of such soils can pose structural damage risk if soils are exposed to large moisture changes (i.e. rainfall; pipe leaks; tree root absorption; Brown et al., 2008).

In recent years, debate has emerged on the most suitable methods for testing expansive soils, with conjecture intensifying between New Zealand and Australian academics and industry professionals, due to conflicting perspectives on the efficacy of current Australasian methods (Fityus & Burton, 2020; Karunarathne et al., 2020; McDougall & Rogers, 2020; Rogers et al., 2020). A further critique has been that foundation damage caused by so-called “expansive” soils in New Zealand, is generally due to soil shrinkage during long, hot summers, rather than swell-strain, as seen more prevalently in Australia (Rogers et al., 2020; Wesley, 2020). However, from its inception, the classification of soil expansivity has been theoretical, qualitative and widely debated (Sridharan & Prakash, 2000). A particular criticism is that many site soils are either under- or over-classified, potentially leading to under or over-conservative foundation designs. The corollary is that foundation solutions are either at risk of soil movement-induced damage, or in contrast, unnecessary financial consequences for home builders if foundation designs are overly robust (Rogers et al., 2020). While the BRANZ research study (Brown et al., 2003; Brown et al., 2008) is the only recent major publicly funded study of expansive soils in NZ, it was based on a limited dataset focused on Auckland soils. A further point raised by Wesley (2020, p.82) was that during his professional career, houses on volcanic soils in Auckland appeared exempt from shrinkage issues, unlike houses constructed on weathered Waitemata Group clays. Early work by Wesley (1973) and others (e.g. Maeda et al., 1977) suggests that this lack of reactivity may be explained by the chemical and physical properties of some volcanic parent rocks, and pedogenic processes in the prevailing local climate. Thus, further examining possible volume change issues on volcanic soils is important, as is extending shrink-swell research to areas outside of Auckland. The aim here is to probe some of these shrink-swell characterization issues in a case study from the Kerikeri Volcanic Group (KVG) residual soils at Kerikeri, Northland. These residual soils are anecdotally recognized by local engineering professionals for their unusually high liquid limit values, yet there are few, if any, documented cases of shrink-swell related damage to residential dwellings, founded on these soils.

2. EXPANSIVE SOIL CHARACTERIZATION AND STANDARDS IN NEW ZEALAND

Since 1990 the New Zealand Standard for Timber-framed buildings NZS3604 and its predecessor code have required identification and assessment of expansive soil (Teal & Rogers, 2021). In NZ 3604:2011 expansive soils are defined as those with:

- Linear Shrinkage, LS > 15% (as tested by NZS4402.2.6:1986)
- Liquid Limit, LL > 50% (as tested by NZS4402.2.2:1986)

In 1999 NZS3604 was updated to require designers to classify the site in accordance with AS2870 ‘Residential slabs and footings’ where the definition of ‘good ground’ for expansive soil was not met. The most recent version of the AS2870-2011 expansivity classification is shown in Table 1, with ‘reactivity’ (i.e. expansivity) assessed and placed into one of six classes, and from the work of Grayson (2000) and Teal and Rogers (2021), its uncertain that AS2870-2011 is appropriate for NZ conditions.

Table 1: Summary of classification of site (i.e. soil) reactivity (AS2870:2011)

Class*	Relative Reactivity	Characteristic surface movement, y_s (mm)
A	Sand and rock sites with no ground movement from moisture change	-
S	Slight	$0 < y_s \le 20$
M	Moderate	$20 < y_s \le 40$
H1	High	$40 < y_s \le 60$
H2	Very High	$60 < y_s \le 75$
E	Extreme	$y_s \le 75$

*a ‘Class P’ classification also provides for sites where ground movement would be significantly affected by factors other than reactive soil movements due to normal moisture conditions
(e.g. soft ground, collapsible soil, landslide instability etc).

In 2019 amendments to the New Zealand Building Code Clause B1 Structure–Verification Method VM1 General brought the site classification provisions of AS2870 directly into the building code (but using the older 1996 version of site classes in AS2870-1996; Teal & Rogers, 2021). This amendment included provisions for standard footing designs for various expansive soil site classes. In particular, the design Serviceability Limit State (SLS) drought return period was increased from 300 years to 500 years, and therefore the characteristic surface movement (ys) values, were increased. The reasoning for the increase to the new return period was not explained by MBIE and the policy shift reignited discussions among professionals and academics about the suitability of current testing methodologies for New Zealand's soil types (Rogers et al., 2020; McDougall & Rogers, 2020; Fityus & Burton, 2020; Teal & Rogers, 2021; Wesley, 2020).

In particular, Rogers et al. (2020), criticized the AS2870 shrink-swell test for its 'initial moisture content bias', making a robust argument based on thousands of shrink-swell tests conducted on Auckland soils. Rogers et al. (2020) unequivocally identified strong correlations between a soil's initial moisture content, and the severity of the resulting shrink-swell index (I_{ss}). Thus, in the context of Auckland soils, the higher the initial moisture content of the soil, the larger the resulting moisture reactivity potential, a fundamental flaw in the shrink-swell test. Furthermore, data showed that I_{ss} severity was almost always due to the shrinkage strain not to swelling strain, presented in most shrink-swell tests. The impact of Rogers et al. (2020), in part, led some North Island councils to stop accepting the long-used AS2870:2011 shrink-swell tests for soil expansivity classification, preferring semi-qualitative determination through the codified Atterberg limits tests (e.g. NZS3604:2011). However, this shift introduced new challenges. Atterberg limit testing often results in much higher limit values for residual soils, particularly those formed from volcanic parent rock (Maeda et al., 1977), while specific clay mineralogy, soil texture and structure can minimize the effect of shrinkage movement in-situ. Soils rich in clay minerals such as halloysite and allophanes, in conjunction with other properties like sesquioxide content, react much more strongly to mechanical reworking and oven-drying due to physiochemical make-up (Wesley, 2010). It is arguable that this switch to a reliance on Atterberg limits testing had particularly stronger implications for Northland home builders, often on Kerikeri Volcanic Group soils, among other residual soils, resulting in unnecessary financial consequences.

3. STUDY AREA AND GEOLOGY

The study area is situated in Kerikeri (35°13′28″S, 173°57′5″E), Northland (Figure 1). Kerikeri, the largest town in Northland with a population of 8,060 (Statistics New Zealand, 2022), is located at the upstream end of the Kerikeri inlet on the eastern side of the Northland Peninsula. This narrow peninsula, ~300 km long, lies between 34°S and 36°S and has a subtropical climate. Compared to other parts of New Zealand, chemical weathering is prevalent (Carr et al., 1980), driven by subtropical climate in the region, including high annual rainfall. This influences slope instability (Garrill et al., 2021) and damage to structures via seasonal soil expansivity. Three study sites in the Kerikeri area were selected based on similar underlying geology, being within the Kaikohe-Bay of Islands Volcanic Field of the KVG (Smith et al., 1993). The choice of these sites was guided by the availability of suitable soils for investigation and landowners granting access.

4. METHODS

Soil samples were collected independently through hand-operated intrusive groundworks from Inlet Road, Kotare Heights, and Greenway Drive (Figure 2). Some site photos showing the characteristic soils and weathering of the Kerikeri Volcanic Group lava flows are shown in Figure 3. Atterberg limit data also included additional samples from 18 other local KVG sites, to help identify trends. Laboratory tests included particle-size distribution (using both wet and dry sieving, and a Malvern Mastersizer 3000 laser diffraction apparatus), water content, liquid and plastic limits, linear shrinkage, and shrink-swell testing were also carried out on the 3 subject sites. Geochemical analyses were also conducted on samples from these sites, including Scanning Electron Microscopy with Energy Dispersive Spectroscopy (SEM-EDS) and X-ray Diffraction (XRD).

The three study sites (Figure 2) were chosen based on accessibility, with soil samples retrieved using 50 mm diameter boreholes to a depth of 0.9 m. Samples were sealed in airtight bags on-site to preserve the natural moisture content of the soil. For the shrink-swell test samples, SEM, and XRD tests, samples were recovered with a 100 mm diameter core tool using 63 mm thin-wall steel tubes, to retrieve undisturbed soil samples.

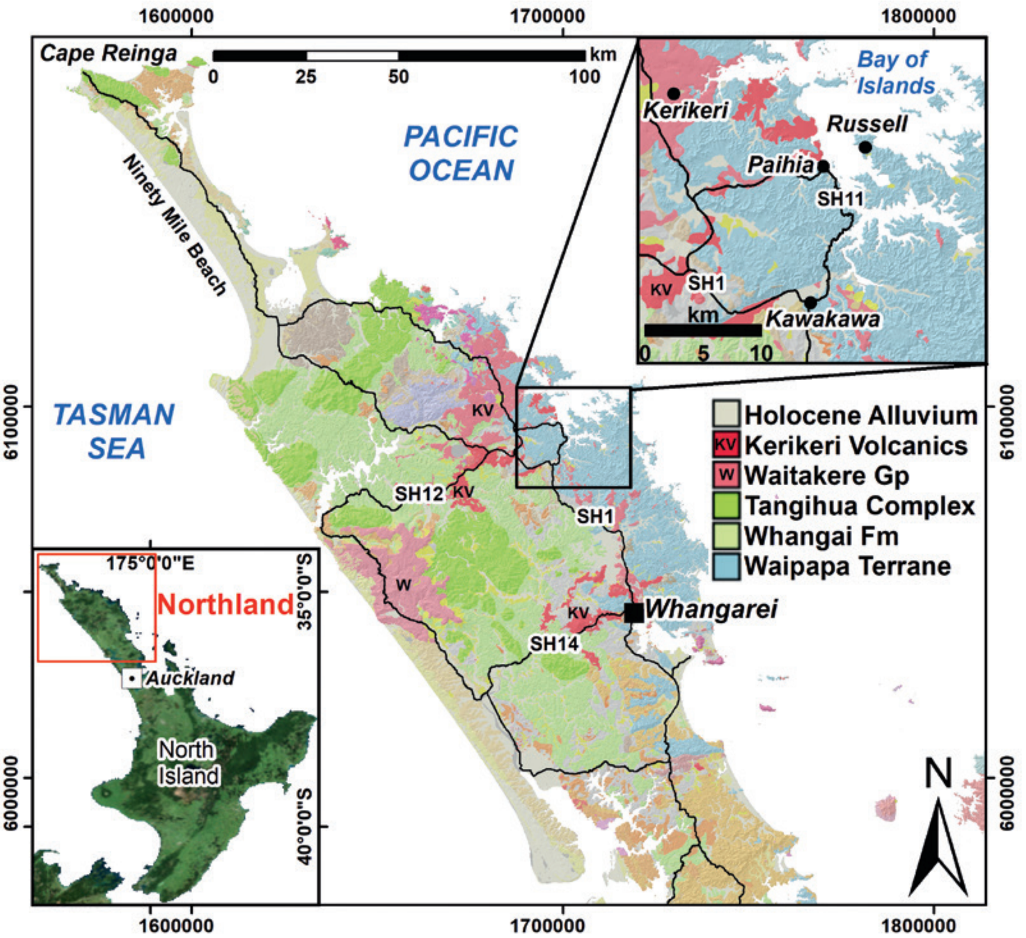


FIGURE 1: General geology of the Northland and distribution of the Kerikeri Volcanics Group (KV), with inset showing the local geology of the Kerikeri/Bay of Islands area

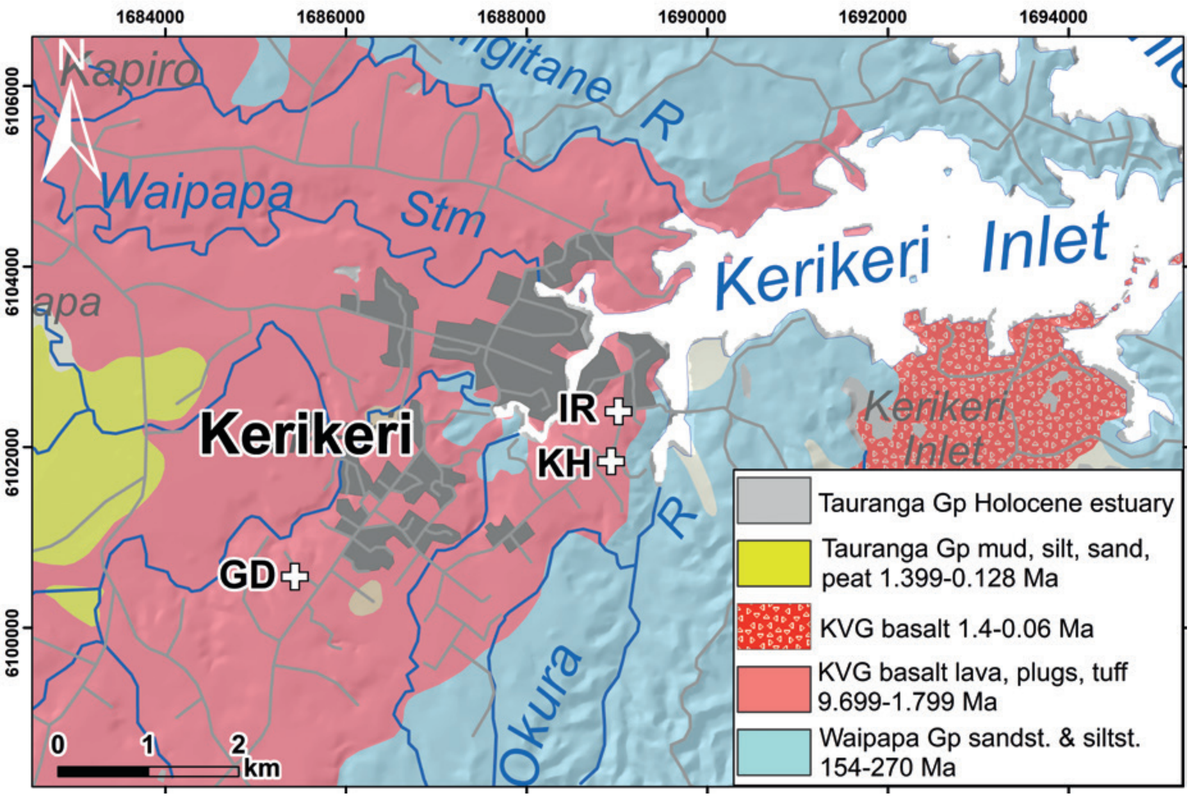


FIGURE 2: Study areas in Kerikeri and local geology, with approximate site locations denoted (GD, Greenway Drive; IR, Inlet Road; KH, Kotare Heights)

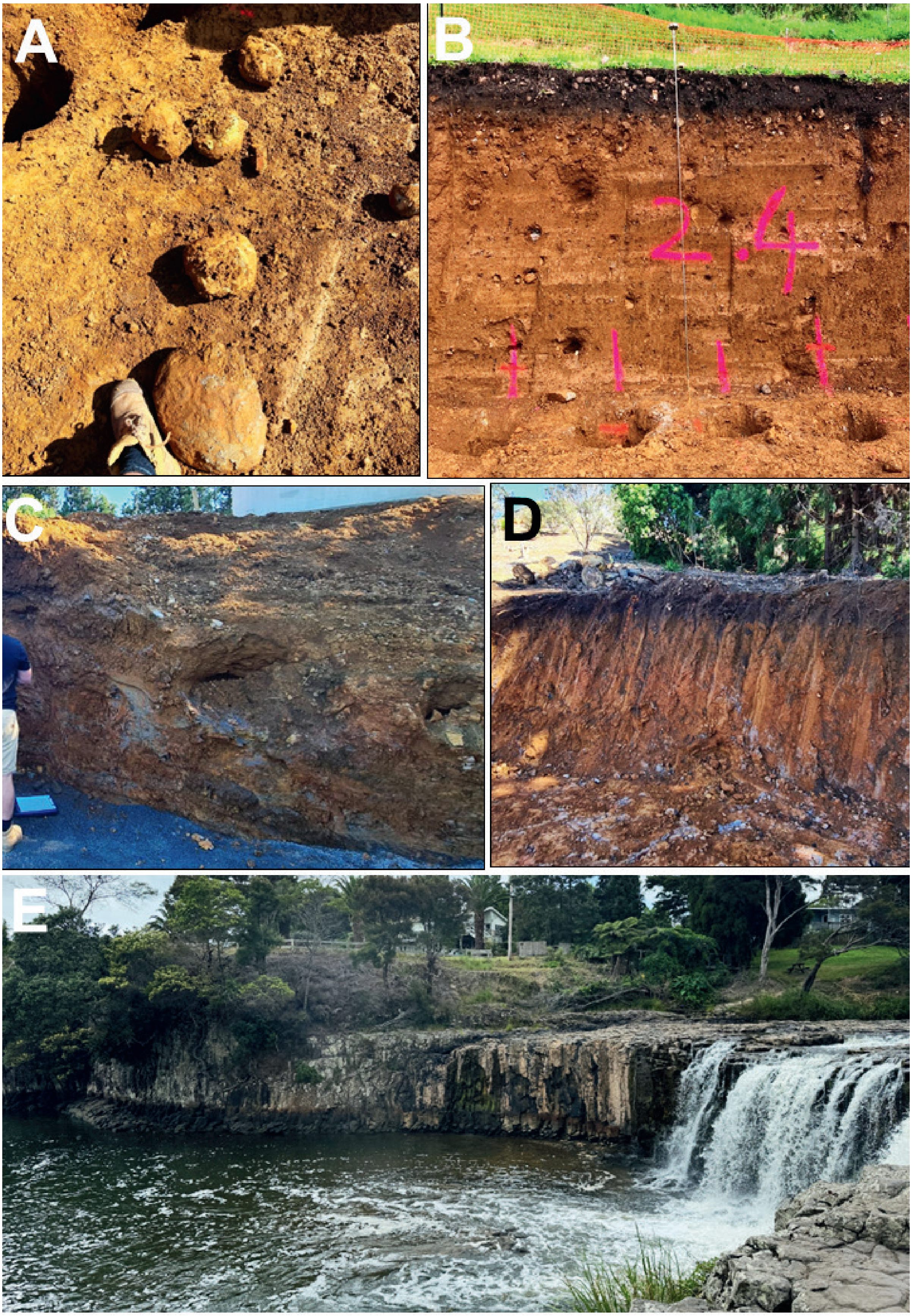


FIGURE 3: (A) Basalt 'bombs' extracted from bored piles holes near Alderton Park, Kerikeri; (B) deep retaining wall cut exposing Kerikeri Volcanics residual soils; (C) stormwater tank cut exposing Kerikeri Volcanic Group residual soils at varying degrees of weathering, holes from extracted basalt boulders; (D) timber retaining wall cut exposing Kerikeri Volcanic Group residual soils, near Kapiro Road; (E) Haruru Falls with weathered basalt columnar jointing

Particle-size distribution was obtained using a Malvern Mastersizer 3000. Water content tests were performed to calculate the natural moisture content of each of the KVG soils, at each subject site, with liquid limit, plastic limit, linear shrinkage, AS2870 shrink-swell tests and plasticity indexes also undertaken. Geochemical testing included SEM analysis to examine clay microstructure and XRD analysis to identify clay minerals. Sample preparation included air-drying, ethylene glycolation, and furnace drying to 550°C. XRD results were obtained over a 2-theta range of 5–70°, with a beam knife applied to reduce background interference. Shrink-swell attributes were determined on selected samples using the Shrink Swell Index of Fityus et al. (2005):

$$I_{ss} = \frac{\epsilon_{shrink}+\frac{1}{2}\epsilon_{swell}}{1.8} \quad (1)$$

For comparison, a method based on the assessment of a 'modified plasticity index' (I'p) used by the Building Research Establishment (BRE) was also used on a selection of six wet-sieved samples. The BRE (1993) method involves adjustment of the Plasticity Index (Ip) based on particle size, the fraction passing the 425µm sieve:

$$I'_p = I_p \frac{\%<450\mu m}{100\%} \quad (2)$$

5. RESULTS

5.1 SOIL INDEX TESTS

Particle-size distribution (PSD) indicated the samples comprised predominantly silt, followed by sand, with clay fractions generally being the least abundant (Figure 4A), aside from Inlet Road, where clay content varied from 4.7% to 53.26% (Table 2).

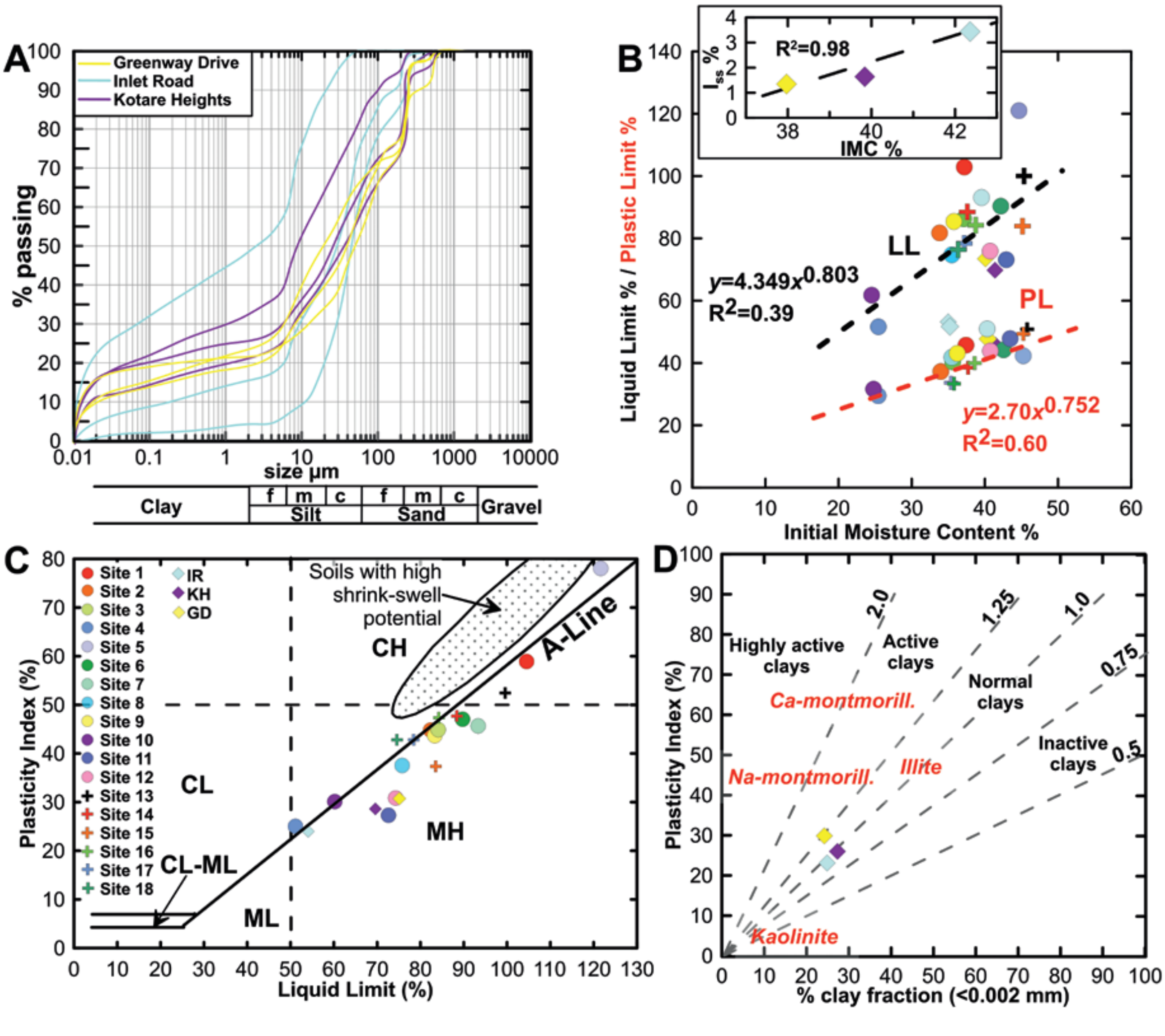


FIGURE 4: Selected soil properties. (A) particle size distribution for; (B) relationships between initial moisture content and liquid limit and plastic limit for the 3 main sites, and additional 18 samples across the Kerikeri area (symbol legend in C). Inset shows relationship between initial moisture % and shrink-swell index (Iss); (C) Casagrande plot of the three main sites and the 18 additional sites, including Wesley's (2020) high shrink-swell potential envelope; (D) activity plot, following Skempton (1953)

Table 2: Soil sample descriptions and laser particle-size distribution (PSD), from 0.6-0.9 m sampling depths

Sample Site	ID	Clay %	Silt %	Sand %	Soil Description
Inlet Rd	IBH1	4.7	60.52	34.76	Sandy SILT with trace clay
Inlet Rd	IBH2	17.54	58.44	24.02	Sandy SILT with some clay
Inlet Rd	IBH3	53.26	46.73	0.01	Silty CLAY with trace sand
Kotare Heights	KBH1	27.7	37.73	34.58	Clayey, sandy SILT
Kotare Heights	KBH2	35.73	47.77	16.48	Clayey SILT with some sand
Kotare Heights	KBH3	22.93	35.84	41.21	Clayey, silty SAND
Greenway Dr	GBH1	22.67	31.43	45.89	Clayey, silty SAND
Greenway Dr	GBH2	21.55	38.77	39.68	Clayey, silty SAND
Greenway Dr	GBH3	26.08	40.35	33.59	Clayey, sandy SILT

Table 3: Results of dry sieve particle size distribution (psd) tests, alongside <425 west sieve psd and BRE (1993) modified plasticity values (I'p)

Sample	Silt	Fine Sand	Medium Sand	Coarse Sand	Fine Gravel	Medium Gravel	West sieve	Mod. I_p
	<63 µm	212- >63 µm	600-212 µm	2.0-600 µm	6.0-2.0 mm	20-6.0 mm	<425 µm %	I'_p
Inlet BH1	9.6	18.8	14.9	24.8	23.1	8.5	72.5	16.0
Inlet BH2	5.1	7.1	9.6	24.5	34.4	19.4	72.2	15.9
Kotare BH1	2.7	11.5	17.3	28.8	28.8	10.7	66.4	17.3
Kotare BH2	3.4	11.1	15.8	27.0	27.5	15.0	66.7	17.1
Greenway BH1	1.2	5.1	13.8	27.1	32.9	19.7	75.5	22.6
Greenway BH2	13.9	13.1	9.9	21.1	24.9	16.9	85.9	25.8

Wet sieving through a 425 µm sieve removed, on average, 26.96% of coarse material (Table 3), while dry sieving revealed that significant cementation occurs upon drying the soil (Table 3). Indeed, in a dried state, the soils exhibit characteristics similar to medium to coarse sandy gravels, or fine to medium gravelly sands. This cementing behavior reflects the underlying mineralogical composition, namely sesquioxide presence (Wesley, 2010).

Atterberg limits (Figure 4; Table 4) for the three main study sites and the additional 18 sites show marked variability, with plastic limits ranging from 28–51%, liquid limits from 51 to 121%, and linear shrinkage values from 12 to 25%. Notably, none of the 21 soil samples that were tested fully accord with the NZS 3604:2011 expansive soils threshold (Table 4). All liquid limit values presented exceed 50% while 17 of the 21 linear shrinkage values presented exceed 15%. Overall, the Atterberg limits suggest significant variation in plasticity and moisture sensitivity. On the Casagrande chart (Figure 4C), ~77% of the samples are within the region characteristic of halloysite-dominant soils (after Wesley, 2010), and do not coincide with Wesley's (2020, p. 79) zone of high shrink-swell potential. On the Skempton (1953) activity plot (Figure 4D), soils from the three main sample sites are categorized as 'normal' activity clays. Atterberg limits data also indicates a potential correlation between initial moisture content and both liquid and plastic limits, with the plastic limit displaying a stronger relationship (Figure 4B).

Using the core samples retrieved from the three main study sites, a shrink-swell test was undertaken at

Table 4: Natural water content (NWC) and Atterberg limits from 21 sites within the KVG, including the three subject sites

Site ID	NWC	Plastic Limit %	Liquid Limit %	Plasticity Index %	Linear Shrinkage %
Inlet Road	35.16	51	73	22	13
Kotare Heights	41.2	44	70	26	15
Greenway Drive	40.1	45	75	30	19
Site 1	37.1	45	103	58	23
Site 2	33.5	37	81	44	18
Site 3	37.4	40	84	44	21
Site 4	25.1	28	51	23	12
Site 5	44.6	42	121	79	25
Site 6	42.1	43	90	47	20
Site 7	39.5	48	93	45	22
Site 8	35.1	40	77	37	18
Site 9	35.7	41	83	42	22
Site 10	23.8	31	61	30	13
Site 11	42.7	46	73	27	16
Site 12	40.2	43	74	31	18
Site 13	45.4	49	100	51	23
Site 14	37.1	39	86	47	21
Site 15	45	49	83	34	18
Site 16	37.7	38	84	46	22
Site 17	36.7	38	79	41	23
Site 18	34.9	33	74	41	19

each site to determine a shrink-swell index (I_{ss}) value. The initial moisture content (IMC) of the soils, along with the I_{ss} values are presented in Figure 4B inset), and although this is only 3 data points, a very strong, positive relationship (R^2=0.98) implies an initial moisture content bias is present within the shrink-swell testing. The I_{ss} values of Kotare Heights (1.7%) and Greenway Drive (1.6%), indicate that the soils at these sites could be classified as Class S, 'Slightly expansive', under New Zealand Building Code B1 Structure. In contrast, Inlet Road exhibited I_{ss} = 3.6%, corresponding to Class M, 'Moderately expansive' (NZBC, 2019), and it exhibited a significantly higher initial moisture content than Kotare Heights and Greenway Drive. Notwithstanding the small dataset, this substantiates the argument of Rogers et al. (2020) that an initial moisture content bias exists within the AS2870 shrink-swell test approach. Using the BRE (1993) approach, the six samples recorded modified plasticity index (I'_p) values of 15.9-25.8 (Table 3), with all being classed as "low" volume change potential (I'_p = <20), aside from the two Greenway Drive samples, which are classed as "moderate" volume change potential (I'_p = 20-40; Table 3).

5.1 MINERALOGY

SEM-EDS imaging (Figure 5) revealed a range of clays present including kaolinite, halloysite, and smectite, as well as volcanic glass and opal-CT bladed lithospheres (example Energy Dispersive Spectrometer [EDS] chemistry is in Table 5).

Kaolinite was the most prevalent clay mineral identified within all of the SEM images, typically exhibiting a platy, pseudo-hexagonal morphology. Small spherules of kaolinite were also present. XRD was used to confirm the clay minerals present at each of the three study sites (Figure 6). Runs were conducted on the same bulk sample at each site, prepared through three different methods. Red lines are air-dried soils, dark blue lines are soils prepared using the ethylene glycol clay preparation method (e.g. Mosser-Ruck et al., 2005), and green lines are soils heated to 550°C for 1 hour (Figure 6). The XRD analyses indicated consistency across all three sites, with runs including characteristic sharp peak intensities at 2-theta readings indicative of kaolinite, halloysite, quartz, gibbsite and hematite. Kaolinite and halloysite are chemically similar and are difficult to distinguish through XRD, but in all three air-dried XRD runs, a 10Å (~8.8 two-theta) deflection is apparent, which may represent the hydrated halloysite analogue (Ece & Schroeder, 2007). Interestingly, in all runs (Figure 6), the ~12 two-theta peak (characteristic of kaolinite and halloysite clays) increased in intensity after heating up to 550 C (green lines). This contradicts other research findings where dihydroxylation usually occurs, signified by peak disappearance or flattening. Thus, this may represent kaolinite and/or halloysite transforming into meta-kaolinite and meta-halloysite (e.g. El Ouahabi, et al., 2017). Mixed layered clay (i.e., illite, smectite, chlorite) are characterized in diffractograms by expanding to a higher spacing upon ethylene glycolation and collapsing when exposed to >500°C temperatures in the furnace (El Ouahabi et al., 2017). Importantly, the absence, or very low concentration, of reactive smectite clays in these soil samples is characterized by the lack of change in the XRD peaks seen across the different preparation methods at ~5-6 two-theta (Figure 6).

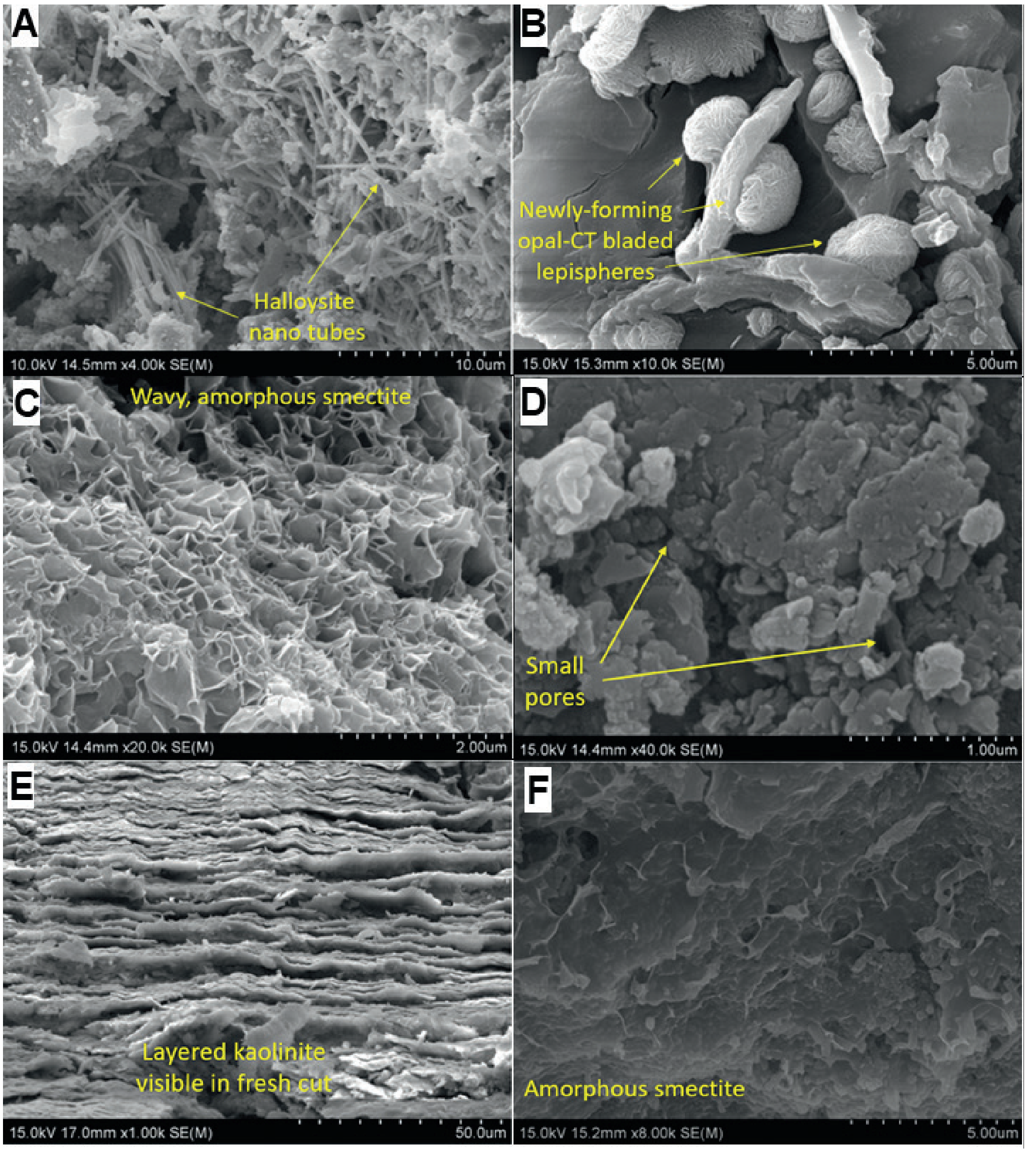


FIGURE 5: SEM images of the Inlet Road soil samples showing (A) halloysite nanotubes and (B) newly forming opal-CT bladed lithospheres and (C) wavy, amorphous smectite; from Kotare Heights soils showing (D) platy kaolinite with small pore spaces and (E) layered kaolinite in fresh cut, displaying characteristic inter-layer spaces; (E) Greenway Drive sample of smectite showing wavy, amorphous character

Table 5: SEM-Energy Dispersive Spectrometer (EDS) results of two tests target spots on selected Inlet Road, Kotare Heights and Greenway Drive SEM images

		Weight %		Atomic %	
	Element	**Area 1**	**Area 2**	**Area 1**	**Area 2**
Inlet Road	C	10.70	5.63	21.44	15.11
	O	32.67	17.48	49.14	35.20
	Al	9.04	7.02	8.06	8.38
	Si	1.66	1.43	1.42	1.65
	Mn	18.53	18.78	8.12	11.02
	Fe	27.41	49.66	11.81	28.65
Kotare Heights	C	4.25	5.45	8.16	9.06
	O	43.05	50.77	61.98	63.40
	Al	8.83	14.96	7.53	11.07
	Si	8.43	17.16	6.19	12.21
	Ti	7.52	1.48	3.62	0.62
	Fe	27.39	10.18	11.30	3.64
	Mg	0.53	-	0.50	-
Greenway Drive	C	2.83	-	5.54	-
	O	30.59	36.50	45.01	59.45
	Al	22.45	12.61	19.59	12.18
	Si	26.65	10.04	22.37	9.31
	Cl	0.59	-	0.39	-
	Fe	16.87	40.85	7.11	19.06

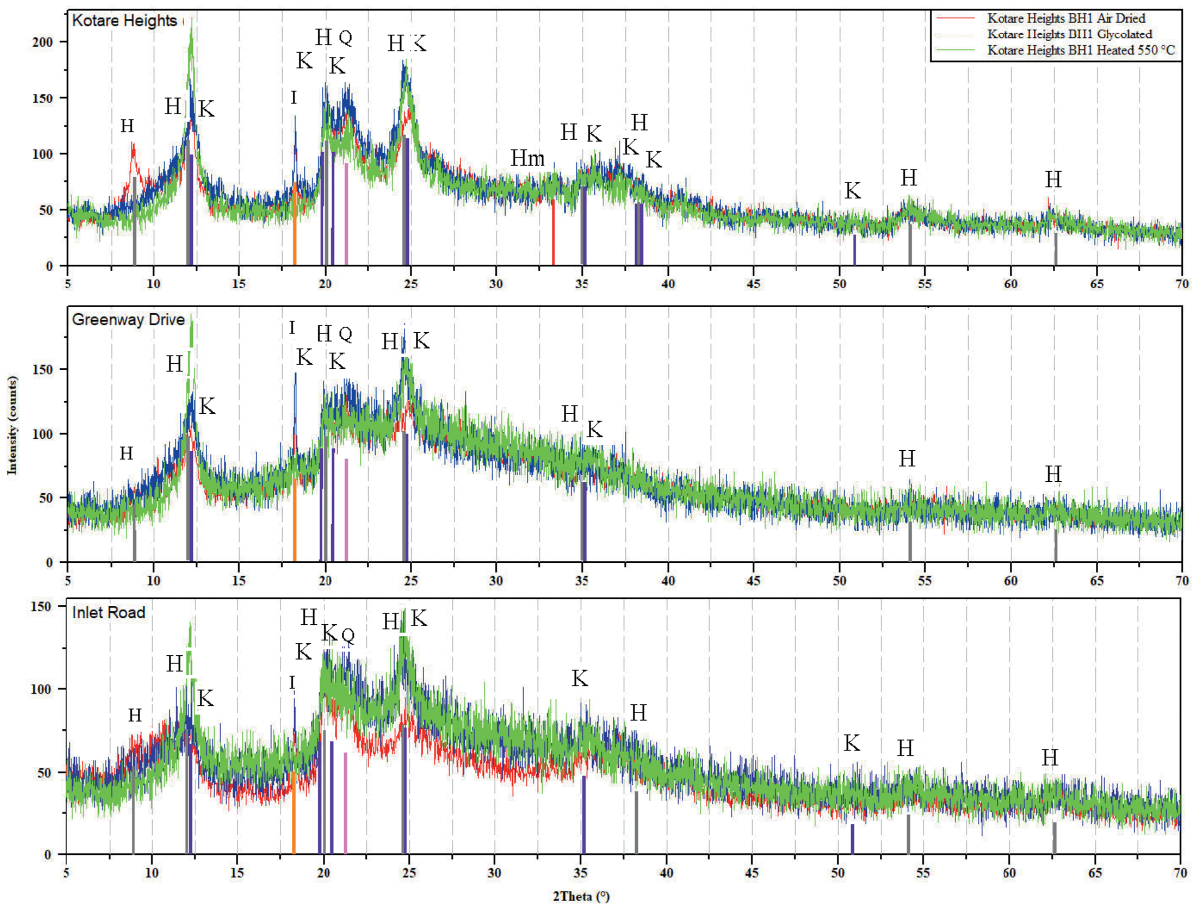


FIGURE 6: XRD diffractograms of all three sites with characteristic mineral peaks labelled: I – illite; H – halloysite; K – kaolinite; Q – quartz and Hm – hematite

6. DISCUSSION

6.1 GEOCHEMISTRY AND MINERALOGY

XRD analysis identified kaolinite, halloysite, smectite, and volcanic glass in the KVG soils, with halloysite determined as being the more dominant clay mineral present. The typical weathering process in such volcanic materials forms allophane, followed by further chemical weathering which then forms halloysite (Wesley, 1973). The presence of halloysite is notable due to its tendency to influence high liquid limits due to the presence of interlayer water. When subjected to intensive drying, halloysite loses this water, often resulting in irreversible changes that affect its in-situ behavior (Wesley, 2010). These changes suggest that conventional Atterberg limit tests may misclassify halloysite-dominant soils as highly expansive, although they exhibit low reactivity in natural conditions.

The absence of smectite peaks in the XRD analysis, despite SEM identification, may indicate smectite's presence in low concentrations or masking by other amorphous materials. These findings accord with other studies on similar basaltic volcanic soils in tropical to subtropical climates, indicating the prevalence of halloysite and kaolinite, with 2:1 clay types like smectite and illite being present in low amounts (Wan et al., 2002). Furthermore, intense summer periods in Northland can lead to complete drying out of surface soils, which is an important climatic consideration given that halloysite clay irreversibly shrinks, where the hydrated analogue (halloysite 10 Å) dehydrates to halloysite 7 Å (Joussein et al, 2005; Moon, 2016; Santagata & Johnston, 2022). The predominance of halloysite in the soil samples tested suggests that KVG soils will have little physiochemical ability to swell. This is further exacerbated considering that the average Northland humidity sits at 80% (Chappell, 2013; Wesley, 2020).

6.2 INDEX PROPERTIES AND VOLUME CHANGE BEHAVIOR

From the samples tested, there is mixed evidence that the soils should exhibit significant volume change behavior. For example, the soils do not fit comfortably into the Casagrande chart 'high swelling potential' envelope of Wesley (2020), although some samples (e.g. Site 5, LL=121%, PI=79%) are very close. This pattern is unsurprising given the soils are not smectite-dominated. Nevertheless, all 21 samples, 17 with a linear shrinkage (>15%) together with all 21 samples liquid limit values (>50%) accord with exceeding the NZS 3604:2011 "good ground" threshold (Table 4). Out of the 6 samples wet-sieved, using the UK's BRE (1993) volume change potential definition, 4 are "low" and 2 are of "moderate" volume change potential (both at Greenway Drive).

Interestingly, from the PSD testing, the soils were generally found to be silty sands or sandy silts, with clay content accounting for only 25.8% on average, although there were variable outcomes. Soils with a lower clay fraction, and clays like kaolinite and halloysite which have negligible swelling potential are accepted as less reactive to moisture changes. The physical attributes of KVG residual soils therefore limits expansivity potential (Boivin et al., 2004; Peng & Horn, 2005), although there is likely to be local variability.

Dry sieve analysis indicated significant cementation upon oven drying, resulting in NZGS (2005) classifications of sandy gravel or gravelly sand with trace silts. The color shift to reddish orange on oven drying reveals the high iron oxide content, which is known to inhibit shrink-swell behavior as iron oxides stabilize soil aggregates, and increase structural cohesion (Zhang et al., 2017). This underscores the utility of also testing mineralogy and geochemistry when evaluating expansivity in KVG soils, which could augment the current shrink-swell testing approaches.

6.3 COMPARISON WITH OTHER VOLCANIC RESIDUAL SOILS

The geochemical similarities between KVG soils and other volcanic residual soils, such as those from Hawaii and southern China, suggest that given similar weathering environments, basaltic soils will weather to comparable residual soils (e.g. Carr et al., 1980). Indeed, KVG soils share a similar kaolinite/halloysite dominance and sesquioxide presence found in soils from Hawaii, China, and Argentina (Brandes et al., 2011; Carr et al., 1980; Zhang et al., 2017). Linear shrinkage results from the KVG accord with values from basaltic residual soils in Leiqiong, China (Zhang et al., 2017), where soil expansivity testing approaches were also problematic (Zhang et al., 2017). Furthermore, cementation, a common feature in tropical red soils, underscores the limitations of remolded shrinkage testing, because remolding disrupts the soil's natural structure and releases adsorbed water into the sample, leading to exaggerated shrinkage measurements (Hobbs et al., 2019; Wesley, 2010; Moon, 2016). The corollary is that more tailored testing methods that accurately reflect the mineralogical and textural properties of the soil may be more appropriate.

It is apparent from the soil samples tested that the Kerikeri Volcanic Group soils can display significant shrinkage effects from existing codified testing methodologies in New Zealand (refer linear shrinkage test presented Table 4). However, there is little anecdotal evidence of shrinkage damage to residential dwellings on KVG soils, in Kerikeri, which is supported by the physiochemical findings presented herein. This accords with what Wesley (2020, p. 82) reported for Auckland, in that that he had not encountered any house damage in Auckland on volcanic soils. Thus, it is possible that the unique weathering of similar volcanic soils over geological time, tempered with Northland's current-day climate (i.e. high annual humidity and intense dry summers), may explain why shrinkage issues generally are not present in Kerikeri. This discord supports the hypothesis that utilizing intense oven drying temperatures and mechanical reworking techniques in current codified soil expansivity tests exacerbate the outcomes for certain geologies, leading to possible over conservativity and negative financial outcomes.

6.4 INITIAL MOISTURE CONTENT BIAS

While the AS2870 shrink-swell test is designed to preserve soil structure, it has demonstrated a susceptibility to initial moisture content (IMC) bias, with final I_{ss} results varying based on the soil's initial moisture content (Rogers et al., 2020). With an albeit limited dataset, a positive correlation was observed between the IMC of the KVG samples from the subject sites, and the final shrink-swell index values (I_{ss}). This accords with previous critique (e.g. Rogers et al., 2020; McDougall & Rogers, 2020) that the test is unreliable, because the soil test at the same site, but in different seasons, would potentially produce a vastly different result. Thus, the resulting foundation design would be dependent on the season in which the site was tested, rather than the actual volume change potential of the soils (e.g. Rogers et al., 2020). Nevertheless, we reported a limited dataset and further corresponding research IMC bias on volcanic residual soils would be welcome.

6.5 ATTERBERG LIMIT TEST BIAS

Despite the limitations of the shrink-swell test, the Atterberg limits testing methodology, or more so, screening procedure, is also problematic, especially for halloysite and allophane-dominant soils, and soils with significant sesquioxide concentrations (Wesley 1973; Fityus & Burton, 2020). First, Atterberg limit testing only offers a qualitative insight into potential soil moisture reactivity, leaving room for subjective error in classification. Second, soil reworking in the test preparation destroys the soil's natural structure, which hinders reactivity. Third, particular minerals such as halloysite and allophane, release interlaminar water which artificially exaggerates the resulting limit values (Wesley, 2010; Fityus & Burton, 2020). Moreover, an additional analysis of the KVG Atterberg limit data indicates a potential correlation between initial moisture content (IMC) and both liquid limit (LL) and plastic limit (PL; Figure 4B), with the PL displaying a stronger relationship with IMC (r^2=0.60). To the best of our knowledge, this potential issue has not been discussed previously in literature, nor scrutinized by researchers that raised similar issues with the AS2870 shrink-swell test. In comparison with datasets from volcanic soils containing halloysite or allophanes, it does appear that clay mineral type plays a role in this correlation between IMC and PL or LL. Indeed, kaolinite-dominant soils show weaker correlations, and halloysite and allophanes dominant soils showing strong positive correlations (see data in: Wesley 1973; Tuncer & Lohnes, 1977; Jaquet, 1990). These datasets support the hypothesis that specific clay types react differently within soil tests codified in Australian and New Zealand Standards.

7. CONCLUSIONS

From soil index and mineralogy testing, this study found that a single, one-size-fits-all soil expansivity testing methodology, may not be suitable for New Zealand's geology and climate, the latter varying from sub-tropical to sub-Antarctic. Indeed, this study demonstrates limitations within current soil expansivity tests, such as AS2870 shrink-swell and Atterberg limits testing, when applied to Kerikeri Volcanic Group (KVG) soils in Northland. The mineralogical composition of KVG soils, dominated by halloysite, with low smectite content, and cementation due to iron oxides, suggests low shrink-swell potential. This is despite particularly high Atterberg limits, which may mislead geo-engineering professionals into overly conservative foundation design recommendations. In particular, results indicate that existing methods are inadequate for accurately classifying the reactivity of KVG soils, failing to account for the specific structural and chemical properties that influence the behavior of volcanic soils under fluctuating moisture conditions. The initial moisture content bias observed in both shrink-swell and Atterberg limit tests compromises the reliability of these methods for soils in humid climates like Northland, where seasonal moisture variations are significant. This underscores the need for developing soil testing protocols that better reflect the environmental and geological context of soils in situ. For KVG soils, a modified approach that includes climate-adjusted preparation (e.g., humidity chamber conditioning) and a focus on geochemical and structural characteristics could improve accuracy.

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Anticipating conditions

– inspiration for conceptual models

Dan Sandilands, Aurecon

Dan Sandilands
Aurecon

Recently I was reviewing a 3D digital ground model and noticed it included some significant errors when checked against the anticipated conditions, and the ground investigation data from which it was produced. These models must be thoroughly reviewed as their algorithms and outputs are not always reliable. Conceptual models should form a key part of the development and review process of any observational model.

The *Guidelines for the development and applications of engineering geological models on projects* (IAEG 2022, 2024) emphasises the importance of conceptual models and provides detailed recommendations on how to prepare them. There are also excellent earlier references such as Fookes (1997, 2000) and Parry et. al. (2014). Despite this IAEG guideline existing for a few years, there does not seem to be an uptick in conceptual models being used by the NZ geotechnical profession.

Our industry is increasingly competitive, being disrupted by digital and AI, and the current economic climate is tough. In some cases ground models are represented only by tables and words which are less informative than pictures, do not communicate risk as effectively, nor are as defendable. We must maintain the creation of effective engineering geological models and the conceptual component is fundamental to this.

For inspiration, two quotes and conceptual models from several projects are presented below.

> *‘If you do not know what you should be looking for in a site investigation, you are not likely to find much of value’*
> (Glossop, 1968)

> *‘Models help you know what to look for: when you find something that does not fit the model you check it out; if it is still out of place, you change the model. The power of the model is more in its ability to anticipate conditions than to predict them precisely’*
> (Fookes, 1997)

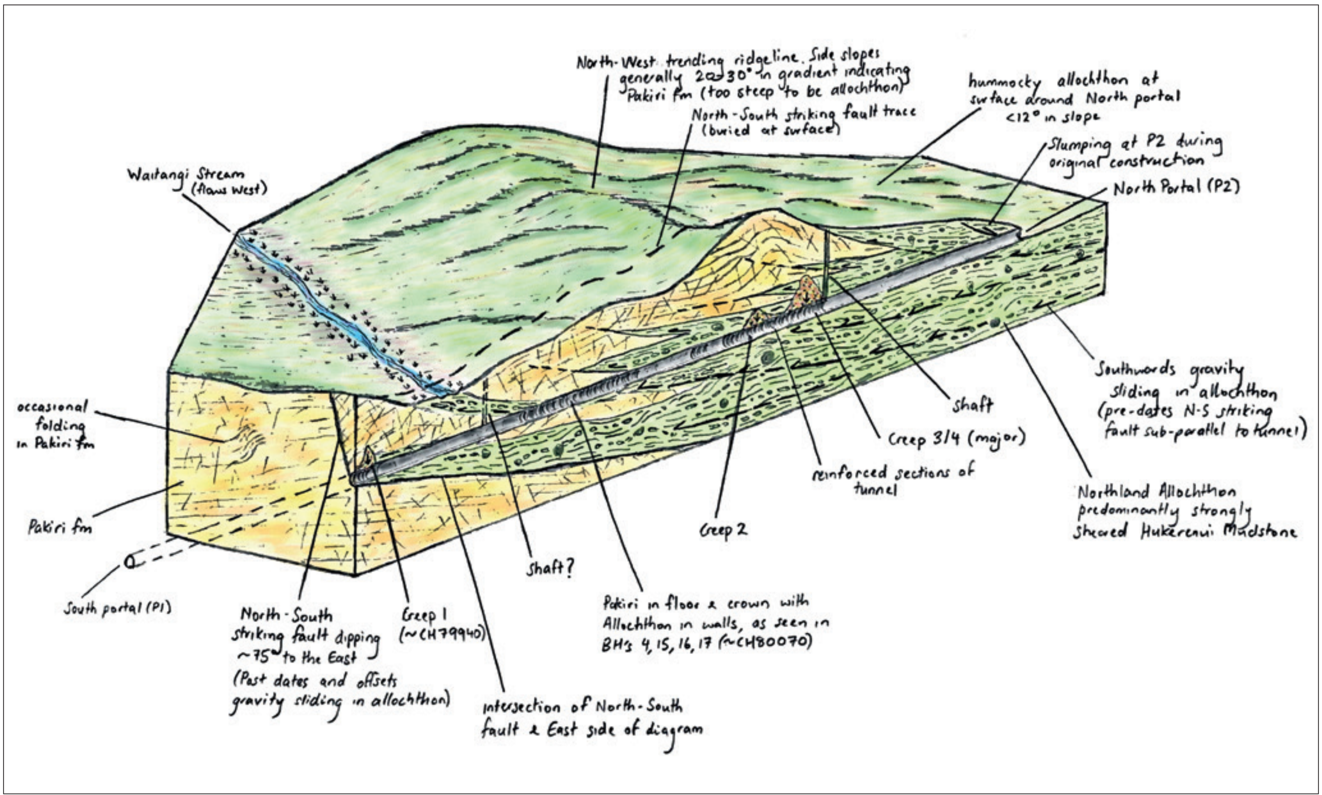


FIGURE 1: Block diagram of a tunnel, based on regional geological setting and desktop information

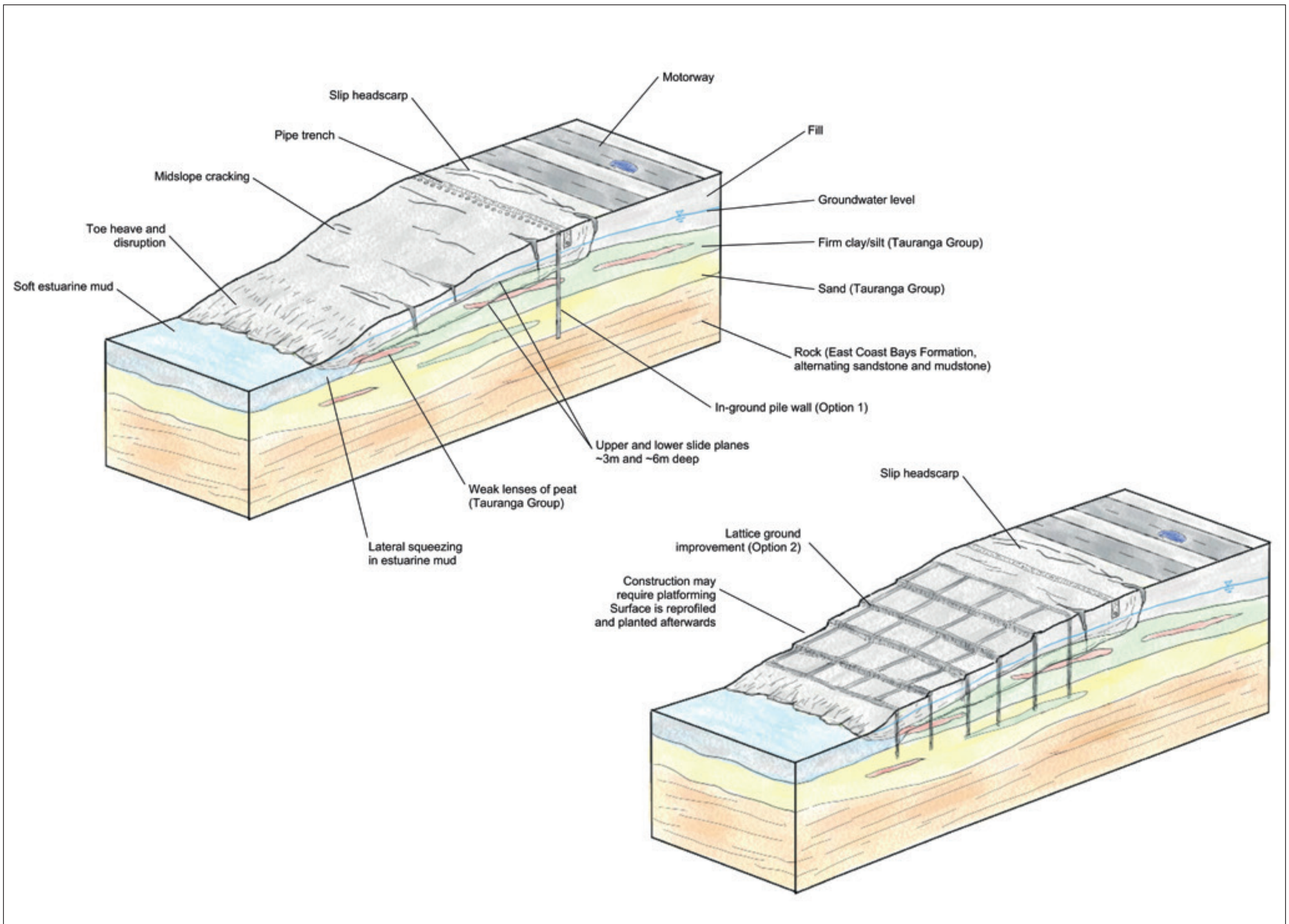


FIGURE 2: Block diagrams presenting conceptual ground conditions and two options for stabilisation of a landslide

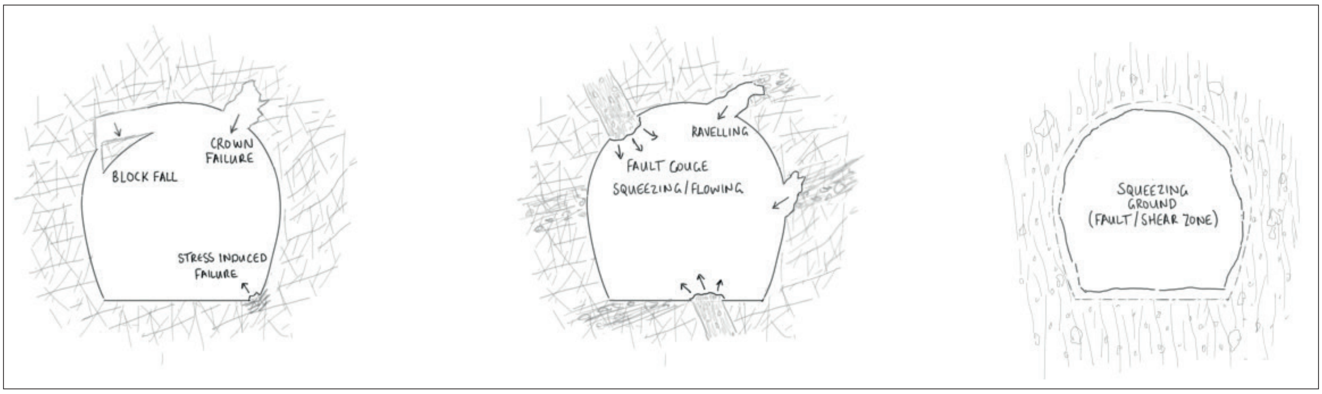


FIGURE 3: Ground behaviour type concepts for a tunnel

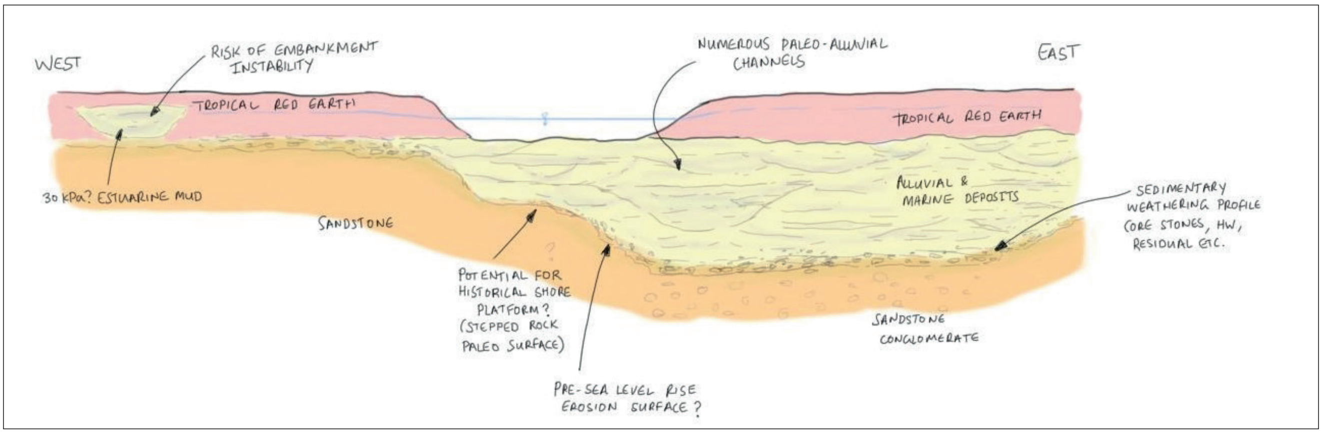


FIGURE 4: Conceptual cross section for a bridge

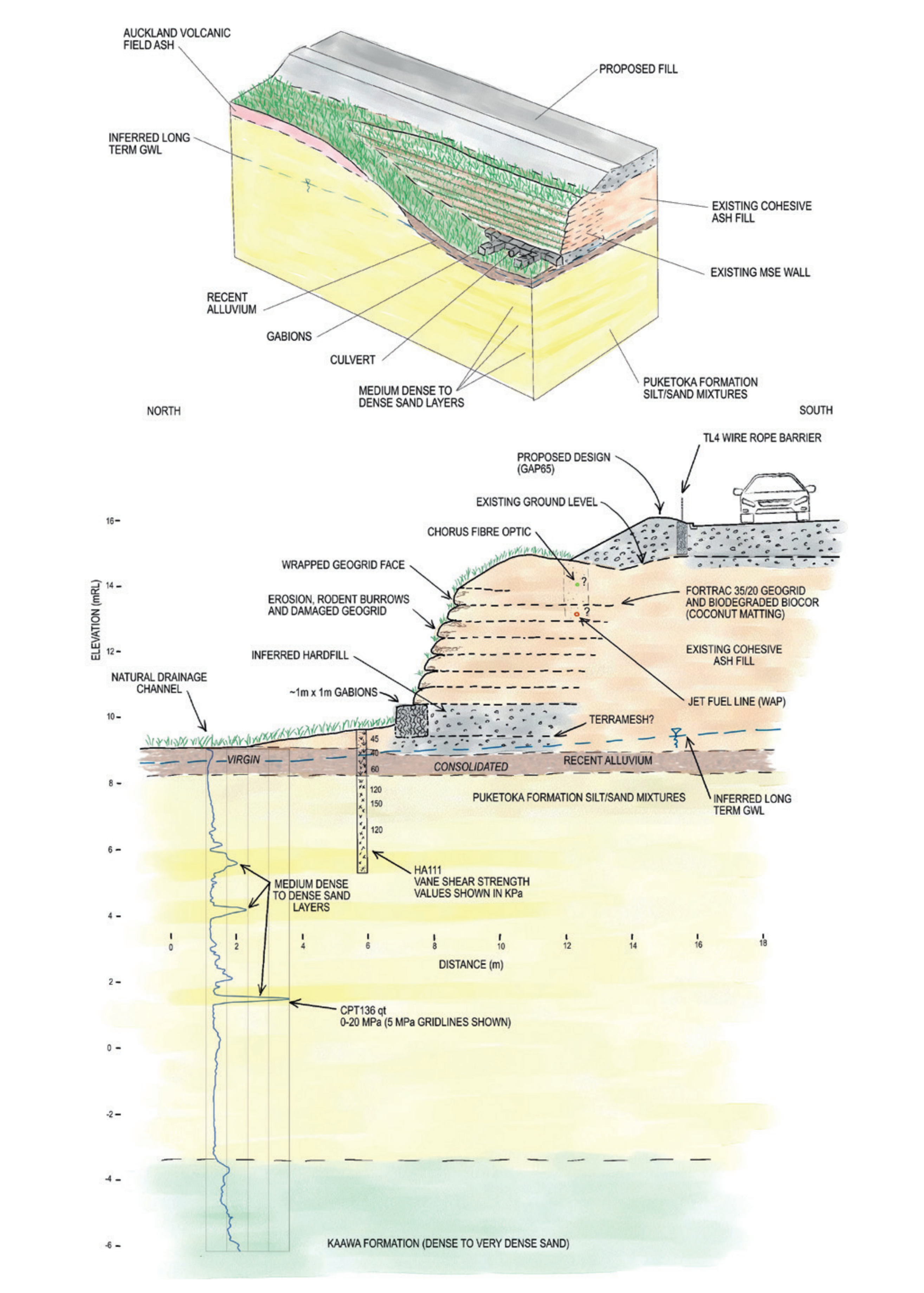
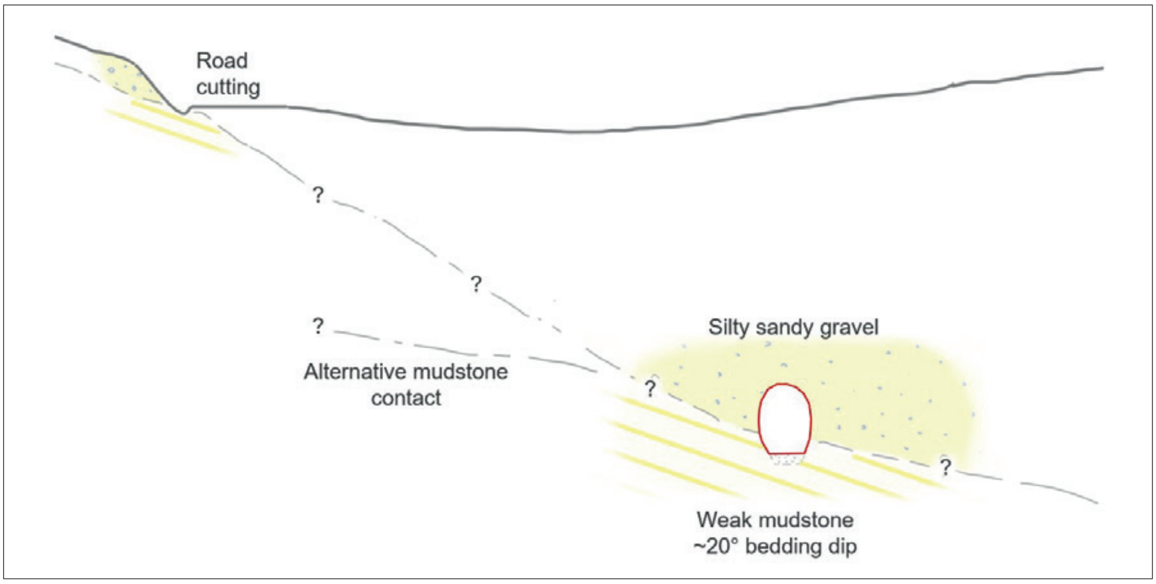


FIGURE 5: Motorway surcharging an old MSE wall, conceptual block diagram above, observational cross section below



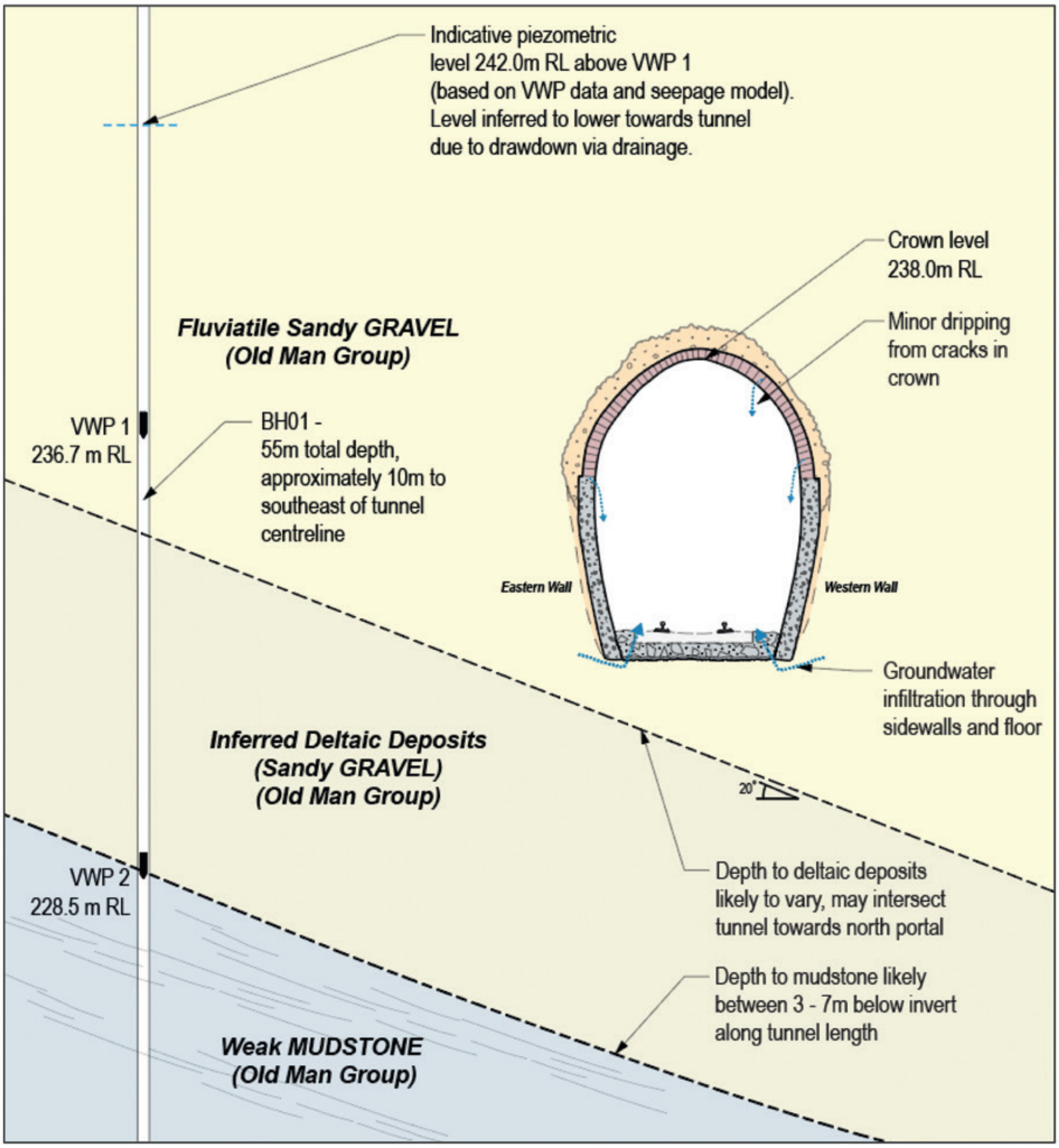


FIGURE 6: Conceptual section for a tunnel above, observational section below (credit: Fraser Monteith)

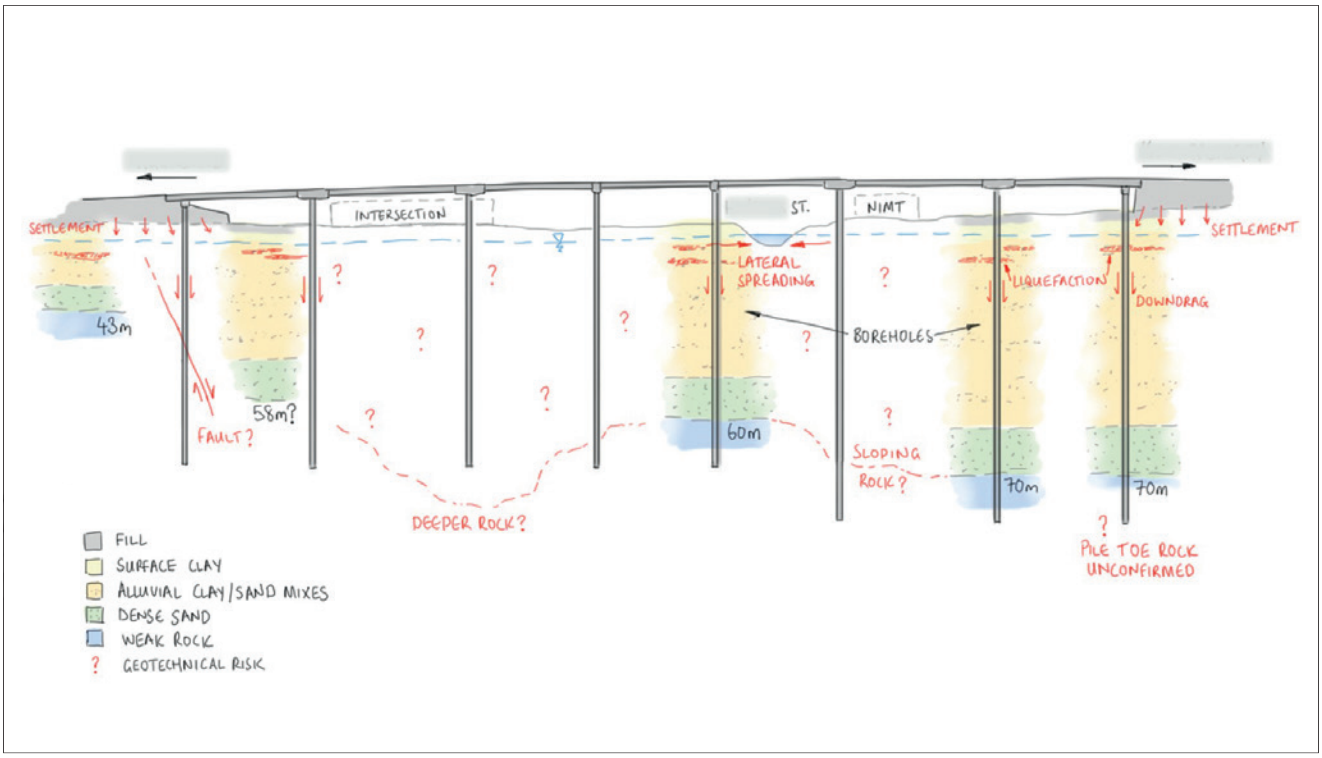


FIGURE 7: Cross section for a bridge, with geotechnical risks highlighted in red based on conceptual conditions

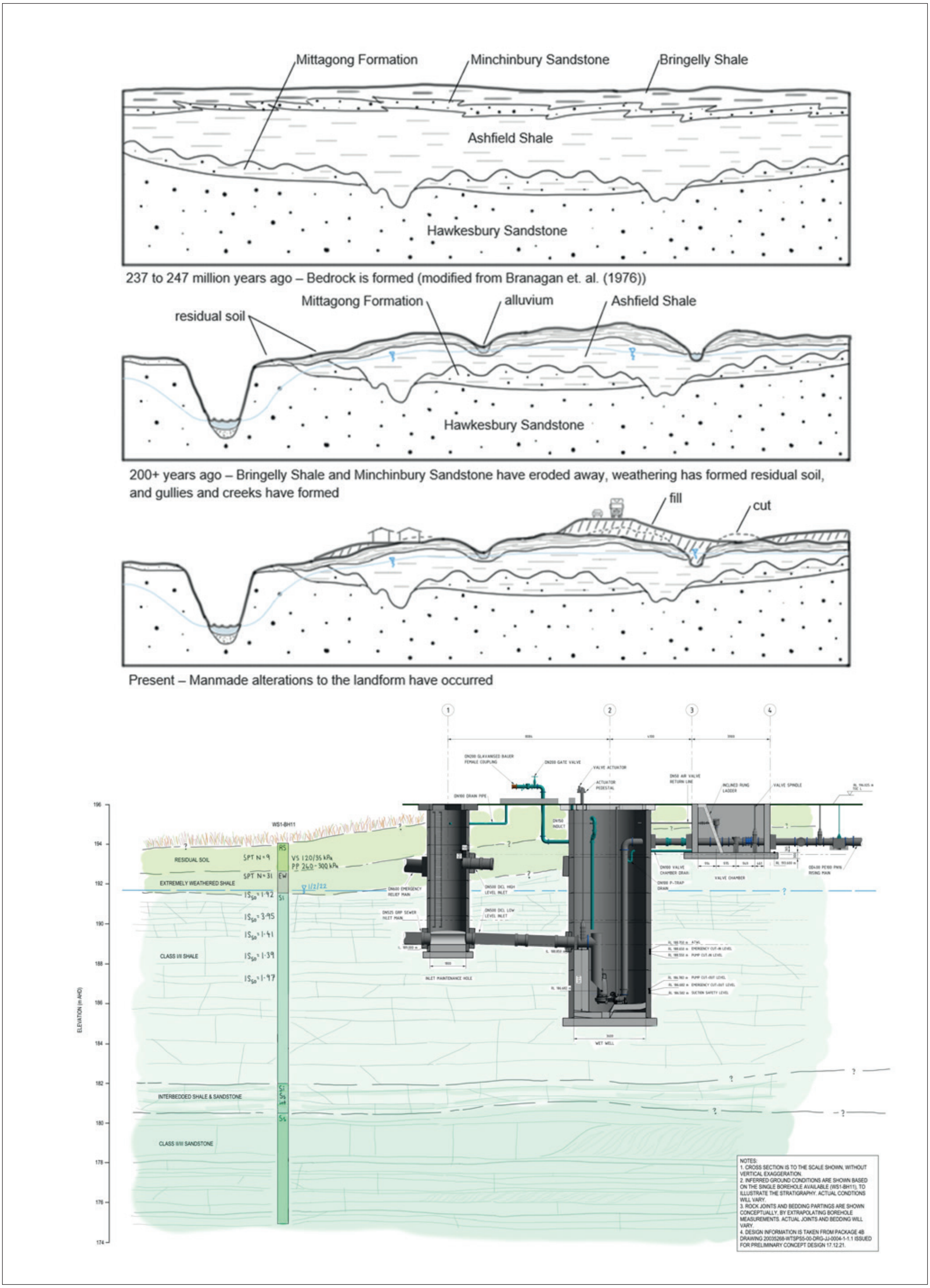


FIGURE 8: Conceptual model taking the 'geoscience time machine' approach above, localised observational model with scaled rock mass shown below

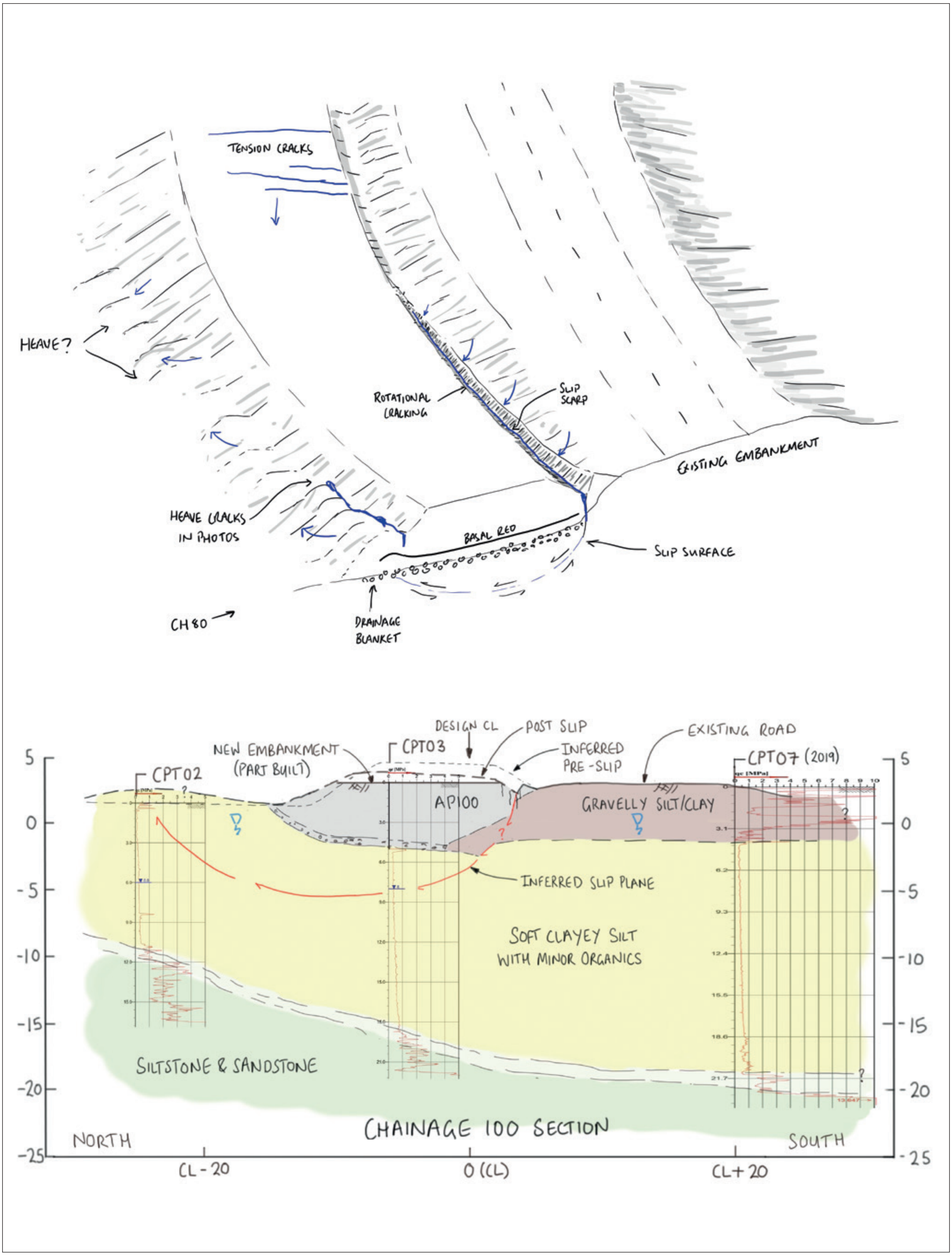


FIGURE 9: Conceptual block diagram of an embankment failure above, observational section below

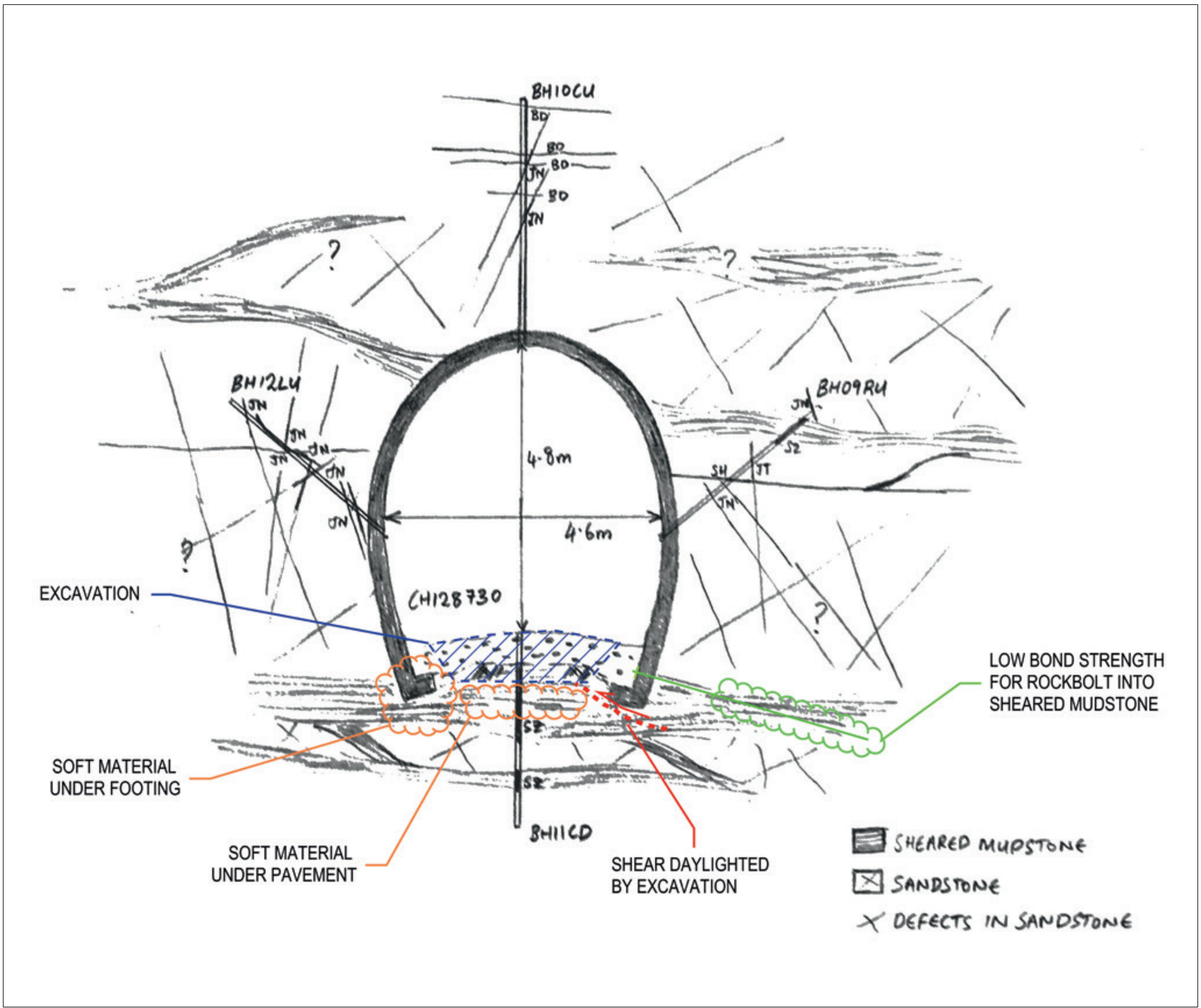


FIGURE 10: Scaled rock mass concept for a tunnel, with boreholes and defect measurements incorporated, and risks highlighted in colour

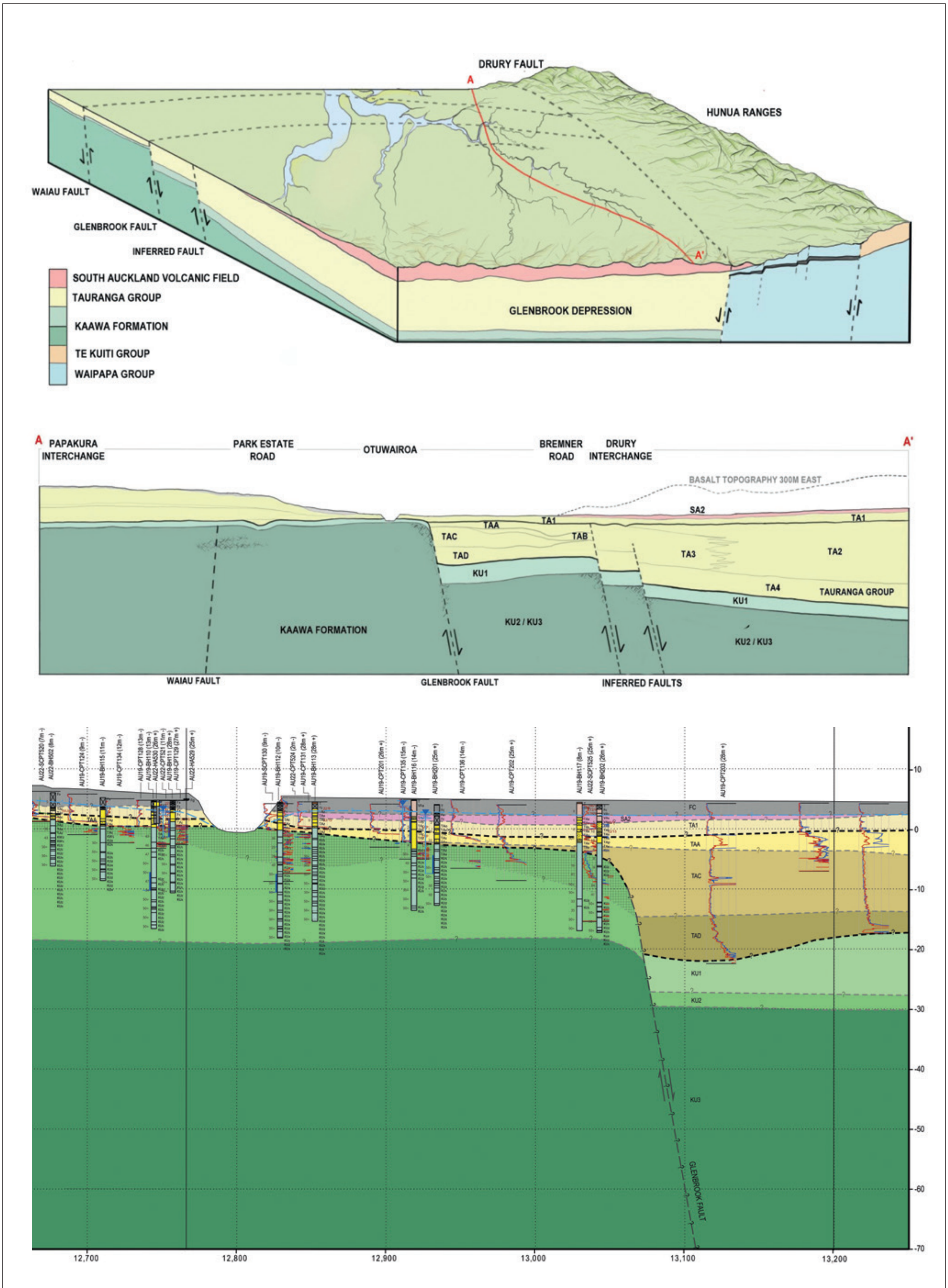


FIGURE 11: Conceptual block diagram and section above, observational section below (credit: Sam MacKay)

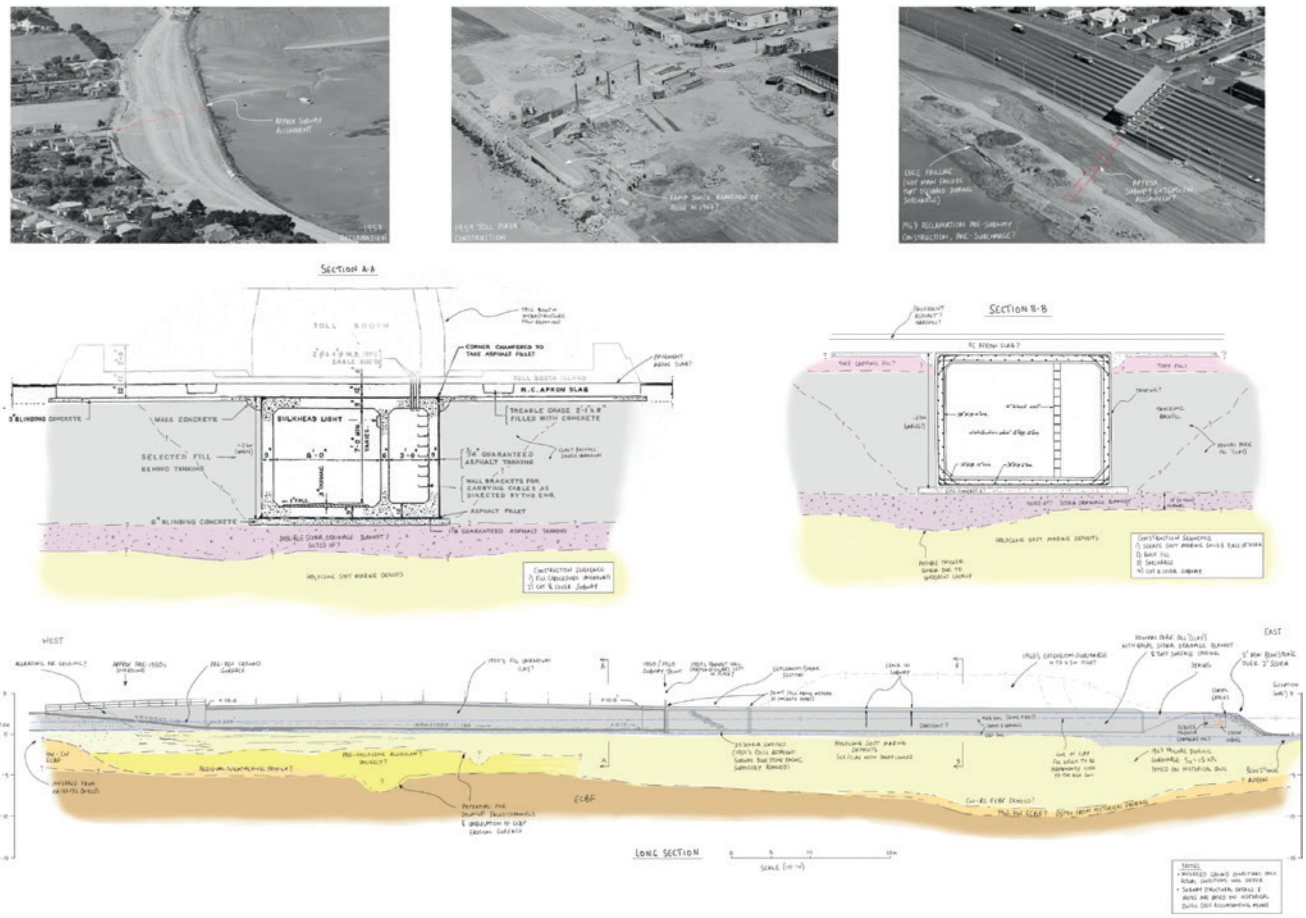


FIGURE 12: Conceptual model developed using historical desktop information

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Lessons Learned from the Liquefaction Analysis

Its Back to Geology – the Soil Behaviour Index (Ic)

Sajjad Anwar, AECOM

Sajjad Anwar
AECOM

ABSTRACT

Based on the latest developments in the field of liquefaction, it is well understood now that the simplified methods or procedures are not applicable to pumice and carbonate rich sands and the risk of liquefaction shall, therefore, be assessed by other means such as undertaking laboratory cyclic triaxial tests under undrained conditions. Ic is one of the most important parameters in simplified liquefaction analysis methods, it is a function of the CPT cone tip resistance and sleeve friction ratio. In simplified liquefaction analysis methods, it is standard practice to use an Ic cut-off value of 2.6 as the dividing line between "clayey" and "sandy" material types. This means soils with Ic ≥ 2.6 are excluded from liquefaction analyses as these soils are considered too clay-rich (plastic) to liquefy, while soils with Ic < 2.6 are included in liquefaction analyses as such soils are considered sand-like (non-plastic) or potentially liquefiable. It is however worth noting here that selecting the recommended standard practice Ic cut-off value of 2.6 as the boundary between "clayey" and "sandy" material types can be overly conservative and can result in uneconomical outcomes for the project. A discussion is made in this article on the selection of correct values of Ic for simplified liquefaction analyses. The limitations of simplified liquefaction analysis methods in the context of pumice and carbonate rich sands are also highlighted.

1. SOIL BEHAVIOUR INDEX, Ic

Soil Behaviour Type Index (Ic) is one of the most important parameters in Simplified Liquefaction Analysis method. Ic is a function of the CPT cone tip resistance (qc) and sleeve friction ratio (fs). The term Ic was recommended by Robertson and Wride (1997) and is computed using the following relationship.

$$I_c = \left[\left(3.47 - \log(Q)\right)^2 + \left(1.22 + \log(F)\right)^2\right]^{0.5}$$

Where Q and F are normalised tip and sleeve friction ratios computed as,

$$Q = \left(\frac{q_c - \sigma_{vc}}{P_a}\right)\left(\frac{P_a}{\sigma'_{vc}}\right)^n$$

$$F = \left(\frac{f_s}{q_c - \sigma_{vc}}\right) \cdot 100\%$$

The terms Q and F are used in the soil behaviour type chart as shown below in Figure 1 to classify different soil types.

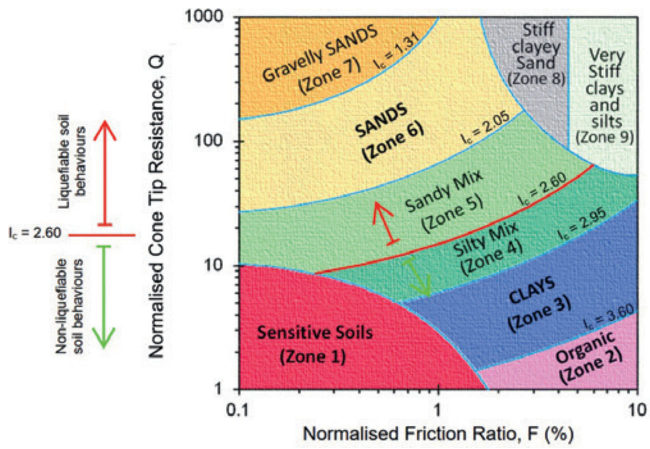


FIGURE 1: Zones for Soil Behavioural Type from CPT using the Normalized Cone Resistance and Friction Ratio (Modified from Robertson 2009)

In typical liquefaction analyses based on CPT data, it is standard practice to classify soils according to soil behaviour type index 'Ic' as shown in Figure 1. If the calculated Ic value is within the range of 2.05 to 2.60, it is classified as "Sandy Mix" soils and falls into Zone 5.

In simplified liquefaction analyses, it is also standard practice to use an Ic cut-off value of 2.6 as the dividing line between "clayey" and "sandy" material types. This mean soils with Ic ≥ 2.6 are excluded from liquefaction analyses as these soils are considered too clay-rich (plastic) to liquefy. While soils with Ic < 2.6 are included in liquefaction analyses as these soils are considered sand-like (non-plastic) or potentially liquefiable. See Figure 1 for further details.

It is worth noting here that the various correlations embedded in simplified liquefaction analysis methods such as Boulanger and Idriss (2014), NCEER (1998, 2009) etc., and used in software like Geologismiki C-LIQ, Rocscience Settle3D or user generated excel sheets, are based on:

- relatively clean silica or normal hard sand (Zone 6 in above Figure 1),
- recent (Holocene) alluvial deposits or man-made fills; and
- laboratory tests undertaken on clean "baby" silica sands.

These correlations convert any soil type field strength parameters, such as CPT cone tip resistance (qc), borehole SPT-N and downhole shear wave velocity (Vs) after overburden stress normalisation to equivalent clean sand qc1Ncs, (N1)60cs, and Vs1cs.

The subscripts, 1 or 1N stand for stress normalisation using 1 bar (100kPa) pressure and 'cs' stands for clean sand. Hence, these correlations, which are embedded in simplified liquefaction analysis methods shall only be used with confidence, if an Ic cut-off value of 2.05 is used (Pyke, R., 2024). The work by other researchers has also confirmed that correlations with relative density (Dr) are only applicable for material with an Ic value < 2.05.

Changing the standard-practice-recommended Ic cut off value of 2.6 to 2.05 in simplified liquefaction analysis methods might be daunting to some of us and may seem unconservative in Sandy mix soils (Zone 5, refer Figure 1), that are still susceptible to liquefaction and settlement. But the error is minor when compared to the error in the other direction when using an Ic cut off value of 2.6.

The use of an Ic cut off value of 2.05 in simplified liquefaction analysis methods is likely to offset other conservatisms in the analyses, such as:

- using maximum ground surface PGA and applying to depths,
- ignoring cementation and soil structure development with time i.e., ageing factor,
- ignoring porewater pressure (PWP) redistribution due to liquefied layers interaction at depths,
- ignoring thin multi clay interbeds interaction and the spatial distribution of sandy layers
- using penetration resistance to determine cyclic strength of the soil,
- uncertainty and correction of fine contents % and their plasticity (PI),
- using relative density (Dr) based correlations to estimate post-liquefaction volumetric strain etc.

These are some of the conservatisms in the simplified liquefaction analysis methods, but this does not necessarily mean that there are no problems at sites that include silty soils that have Ic values between 2.05 and 2.6. What this implies, is that you should not automatically accept the results of a simplified liquefaction analysis, which uses an Ic cutoff value of 2.6 and that more detailed site investigations are called for.

In summary, simplified liquefaction analysis methods are applicable for soils with a behaviour type of clean sand that fall into 'Zone 6' in Figure 1 and, therefore, the Ic cut-off value of 2.05 shall be considered in simplified liquefaction analysis.

Based on this discussion, the following recommendations are advised for further liquefaction analysis performed for sites underlain by normal hard silica sand and or sandy mix soils.

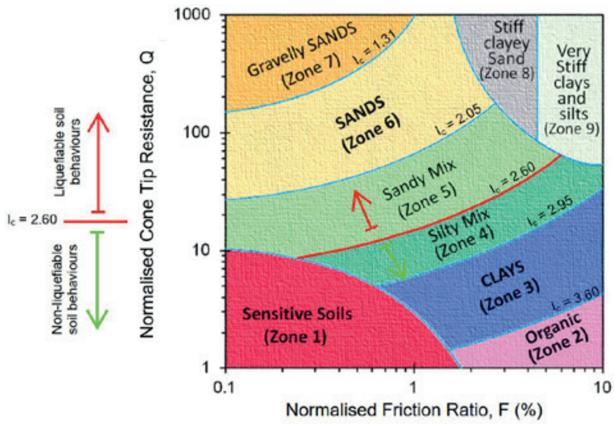
2. LIQUEFACTION ANALYSIS

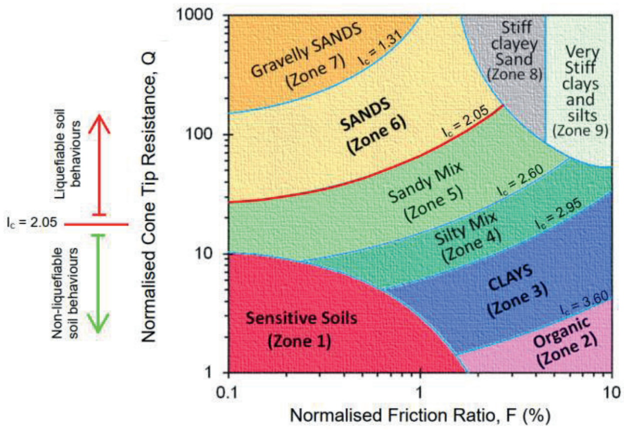
2.1 NORMAL SILICA SANDS AND SANDY MIX SOILS

When undertaking liquefaction analysis using simplified methods such as Boulanger and Idriss (2014) for normal silica sand and sandy mix soils, the following guidance shall be adopted.

- First pass liquefaction analysis shall be undertaken using an I_c cut-off value = 2.6, Fine Content (FC) correction factor, C_{FC} = 0 for estimating FC, Probability of Liquefaction, PL = 15% and ignoring the aging factor.
- If no risk of liquefaction is developing at all design seismic load cases (SLS1, SLS2, ULS), liquefaction assessment shall stop, and no further analyses are required.
- However, if the risk of liquefaction is developing, a further check shall be undertaken using an I_c cut-off value = 2.05, keeping other parameters the same as discussed above.
- If no risk of liquefaction is developing at all design seismic load cases (SLS1, SLS2, ULS), liquefaction assessment shall stop, and no further analyses are required.
- To further validate that the sandy mix soils in Zone 5 (Figure 1) are non-liquefiable, undertake laboratory Plasticity Index (PI) tests to determine that the soil behaviour is clay-like with PI > 12.
- If there is a liquefaction risk developing at one of the design seismic loads cases (SLS1, SLS2, ULS), the soil structure development (aging factor)*, fines content correction factor (CFC), PL % greater than 15%, site past liquefaction history shall be considered before recommending appropriate mitigation measures.

** The author intends to publish an article on aging factor assessment in the future.*





2.2 PUMICE AND CARBONATE RICH SANDS

Both pumice and carbonate rich sands generally have a high critical state friction angle. The relatively higher friction angle values, when compared to normal sand, are a result of the relatively higher angularity (lower roundness) and irregular particle shape (lower sphericity). The pumice particles and carbonate shells are highly crushable, compressible, and lightweight, making the engineering assessment of their properties problematic. The liquefaction resistance of both pumice particles and carbonate shell-rich sands is higher than that of normal sands. This is due to the complex surface texture and the rearrangement of the particles in response to crushing during cyclic loading. This results in an increased resistance to rotation and slippage of soil particles and ultimately results in a more stable soil structure during cyclic load applications.

Because of their relatively higher compressibility, the strain levels required to reach peak shear strength are much larger for pumice and carbonate rich sands in comparison to normal sands. Various studies have been undertaken to validate this and a few are discussed below.

With reference to laboratory undrained cyclic triaxial tests undertaken on pumice rich sand samples collected across the north island of New Zealand within Taupo Volcanic Zone (TVZ) by Asadi et al, (2023), and AECOM, (2024), have shown that the pumice rich sand has relatively higher resistance against liquefaction compared to normal sands of similar relative density. This is shown below in Figure 2, which shows the comparison between the cyclic behaviour of the pumice rich sands compared to normal sand.

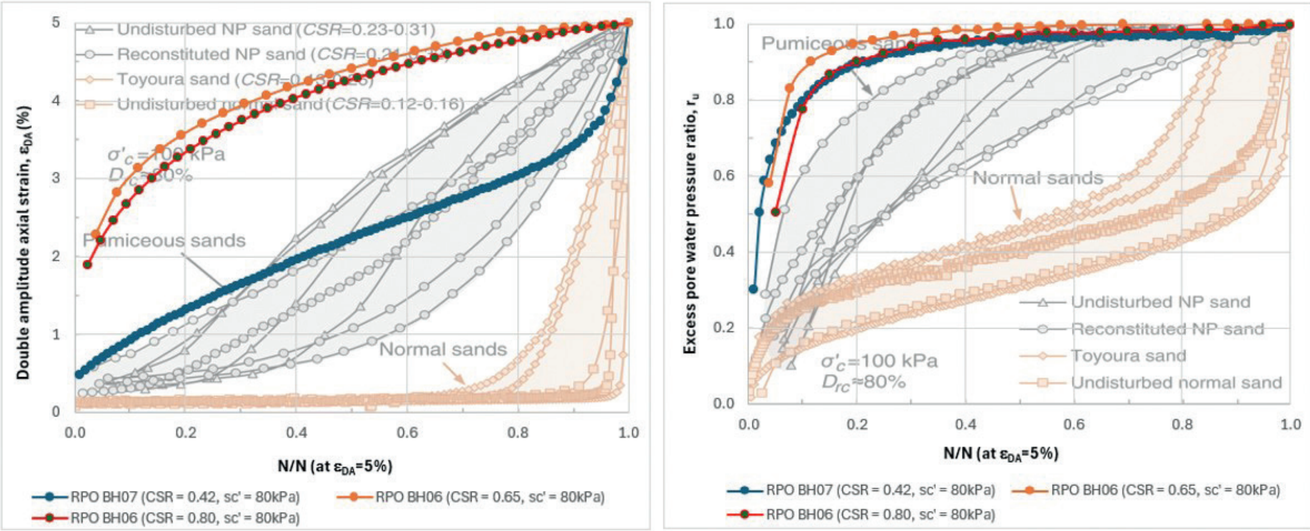


FIGURE 2: **Laboratory Undrained Cyclic Triaxial Test Undertaken on Normal and Pumice Rich Sand (modified after Asadi et al, 2023)**

For determination of the soil Cyclic Resistance Ratio (CRR), simplified liquefaction analysis methods use normalised SPT-N, cone tip resistance, qc and shear wave velocity (Vs) base curves, developed using historic data of observed manifestation of liquefaction. These simplified liquefaction analysis methods normalise soil strength to 1 bar (100kPa) pressure and make correction for the fines content to convert any soils to equivalent clean sands (cs). Therefore, these simplified methods or procedures are not applicable for sands or silts rich with higher contents of pumice or carbonate shells, as case histories or historic data and methods of analysis are predominately based on silica hard sand and/or normal clean sand respectively.

It is well documented and debated in engineering practice that the strength of both pumice and carbonate shell-rich sands are underestimated by penetration testing such as SPT-N and CPT. Therefore, methods that determine the strength of these materials based on shear wave velocity (Vs) should be used instead. However, studies undertaken by Asadi et al (2023) on pumice rich sands and others on carbonate shell-rich sands have shown that due to the crushable and light weight nature of these materials, the shear wave velocity (Vs) is lower than for normal sands. For carbonate shell-rich sands, it was proposed by Wehr (2005) to apply a shell correction factor to correct the measured cone resistance. The measured cone penetration resistance qc is multiplied by the shell correction factor (roughly 1.3 to 1.5), before undertaking a liquefaction analysis.

A sensitivity study undertaken by the author of this article has shown however, that when making a correction for the underestimation of the strength by penetration testing, the increase in cone tip resistance, qc resulted in a lower soil behaviour index type, Ic. Moreover, both carbonate shell and pumice particles are light weight compared to normal sand resulting in lower total and effective overburden stresses. All these factors contribute to a higher normalised cone tip resistance, Q, resulting in a lower Ic value. In fact, soil behaviour should remain the same and an increase in the CPT cone tip resistance, qc or resulting higher material strength should not alter or change its behaviour type. See Figure 3 for further details, where the CPT cone tip resistance was increased by factors of 1.5 and 3.0 resulting in lower Ic values and soil data points are moving upward in soil behaviour type index chart from Zone 5 to 6.

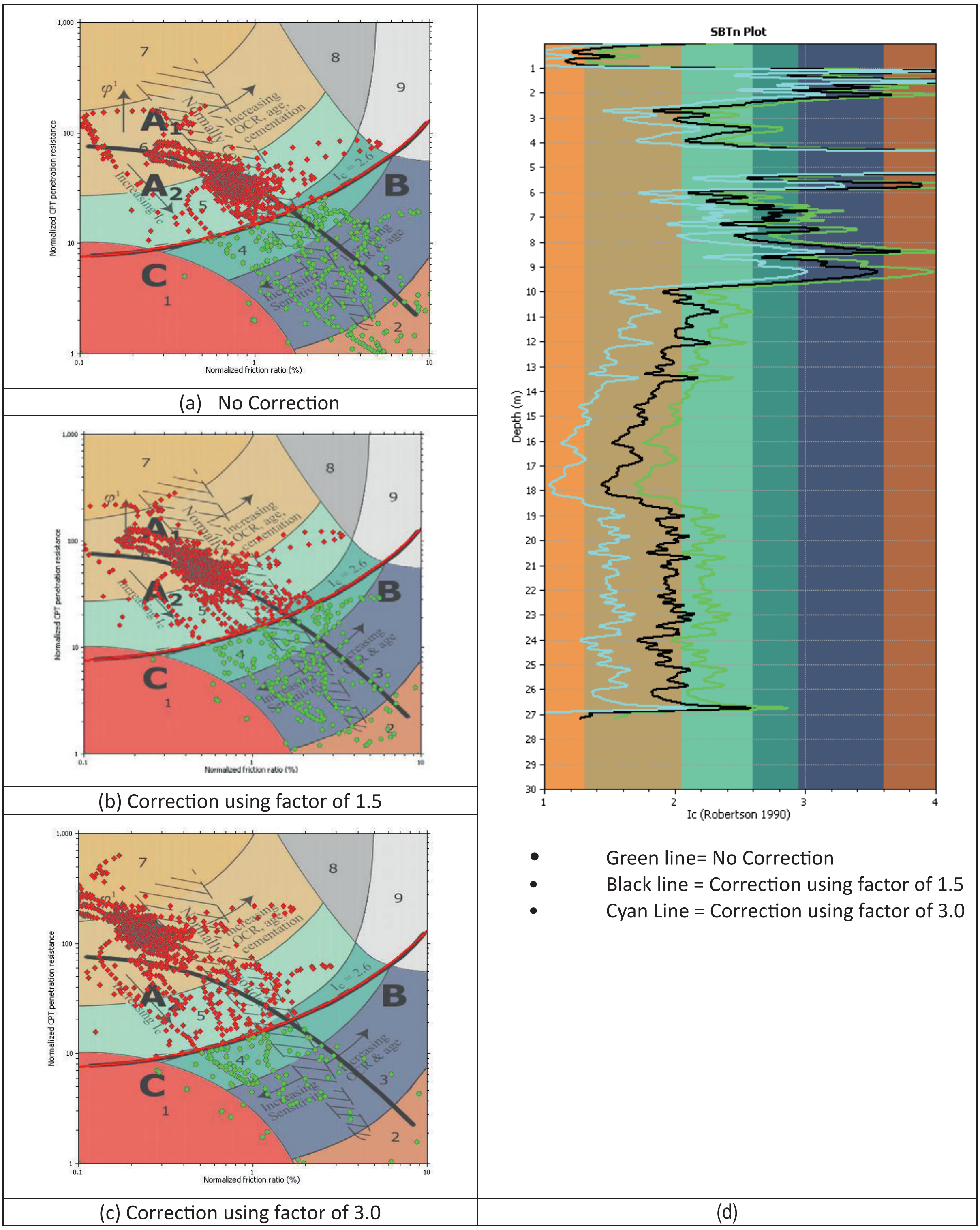


FIGURE 3: Impact of Higher CPT Cone Tip Resistance on Soil Behaviour Type Index, Ic

Despite its limitations and applicability, liquefaction analyses using simplified methods are undertaken by the author for pumice rich sands (pumice contents more than 40%), where CPT cone tip resistance, q_c values were increased prior to analysis using a correction factor of 3. Despite the upper bound value of the correction factor, the simplified methods still resulted in a significant risk of liquefaction development compared to the results of liquefaction analyses undertaken using laboratory cyclic triaxial tests corrected for field conditions. In the author's opinion, the higher depiction of liquefaction risk by the simplified analysis method is attributed to lower I_c values that resulted from higher q_c values.

It is therefore recommended that the simplified analysis method should not be used for liquefaction risk assessment of sands containing more than 40% pumice

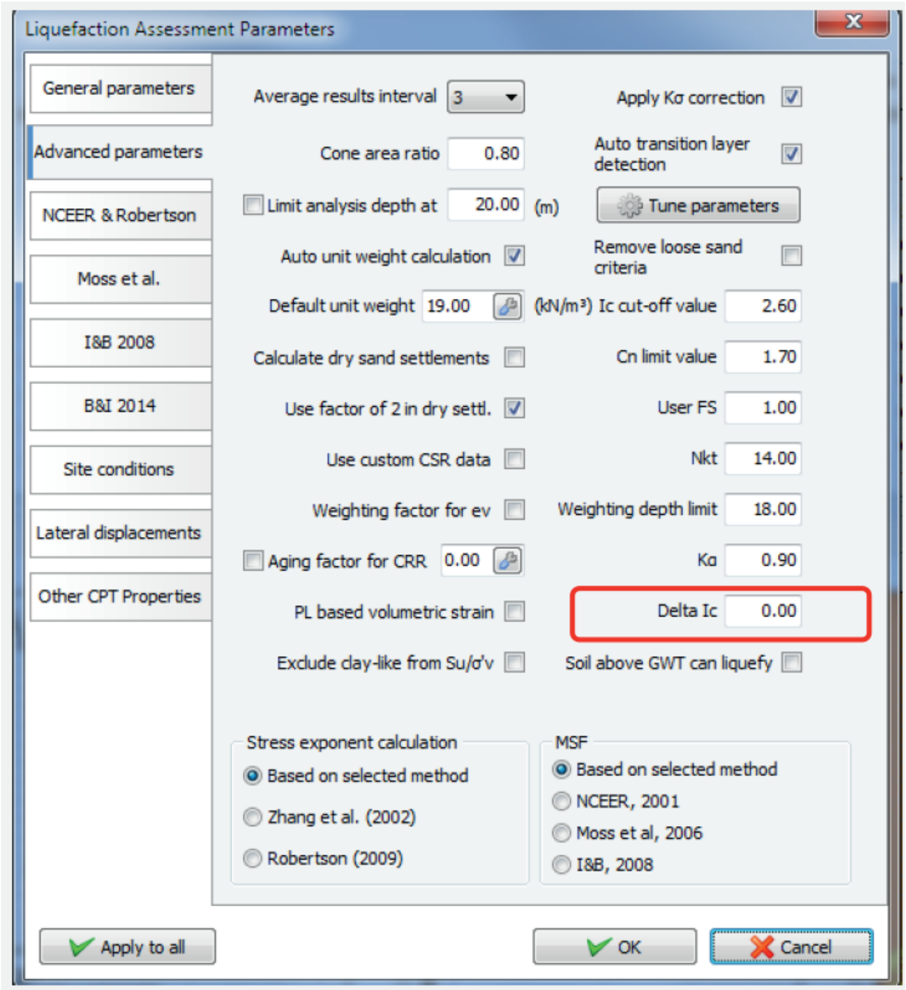


FIGURE 4: C-LIQ Software Input for Ic Correction

and/or carbonate shell contents. Instead, laboratory cyclic triaxial tests (minimum of 3) shall be performed to assess liquefaction risk of these special soil types. Refer Anwar et al. (2025) for more details on the procedure for assessing liquefaction risk based on laboratory cyclic triaxial tests.

In cases where liquefaction analyses using simplified methods have to be undertaken using CPT data without a correction for lower CPT cone tip resistance (qc) due to carbonate shells and pumice particle crushing by CPT cone, then the I_c values shall be adjusted in the simplified liquefaction analysis.

The method of adjusting I_c values in response to an increase in tip resistance (q_c) in simplified methods is similar to densification ground improvement methods, where after densification, an increase in cone tip resistance results in lower I_c values being erroneously considered for liquefaction. Hence, an adjustment or correction factor ΔI_c is proposed by Robertson to correct for changes in I_c and is included in Geologismiki C-LIQ software. The snip of the C-LIQ software input menu showing input for ΔI_c value for correction is provided below in Figure 4.

In densification ground improvement methods, Ic adjustment factors are estimated by comparing the Ic values estimated from CPT before and after densification. However, this can't be done in the case of carbonate and pumice rich sands. Instead by trial and error, the ΔIc value is adjusted until no liquefaction is predicted by simplified analyses.

Considering the outcome of laboratory cyclic triaxial tests, simplified liquefaction analyses were undertaken by the author in C-LIQ software using pumice rich sands CPT data without correction for a lower qc. The analyses were undertaken using default input parameters in C-LIQ software i.e. CFC = 0 for Fines Content correction, PL = 15% and ignoring the aging factor in the Boulanger & Idriss (2014) simplified liquefaction triggering method.

The analyses have shown that when the study site is subjected to a PGA of 0.66g generated by an earthquake Mw = 6.25, an adjustment factor of ΔIc = 0.8 is required to compensate for underestimation of pumice rich sands strength. The adjustment factor ΔIc is reduced to 0.3, when the I_c cut-off value of 2.05 is used instead of standard practice recommended value of 2.6. See the summary of these results in Figure 5 for further details.

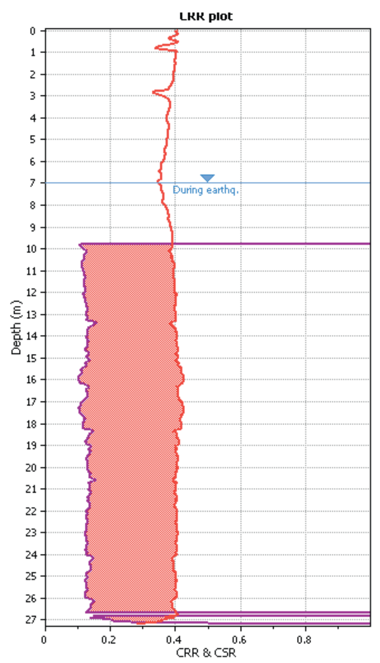
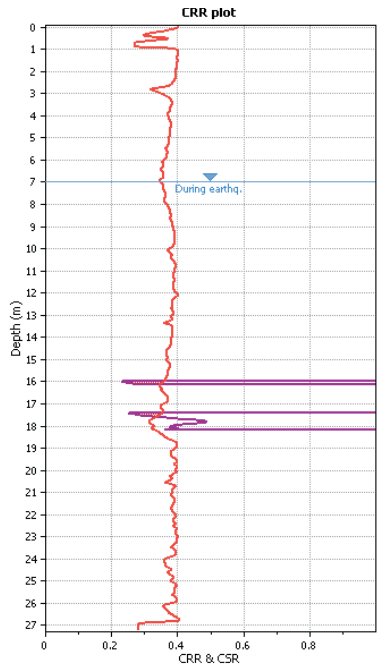
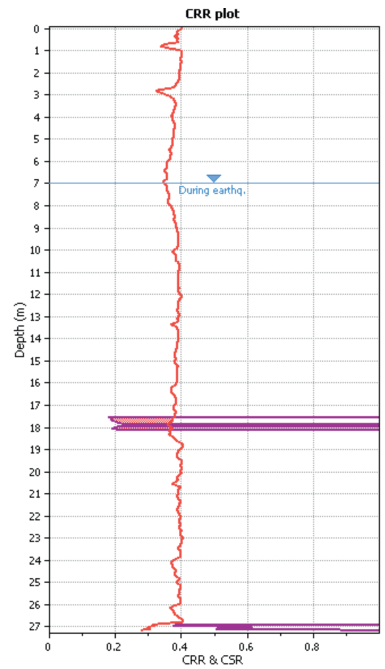
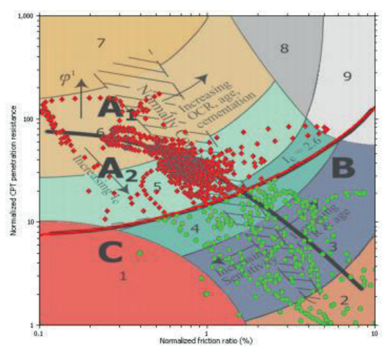
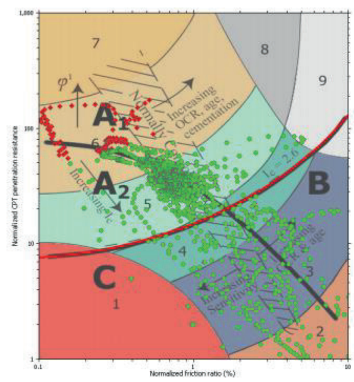
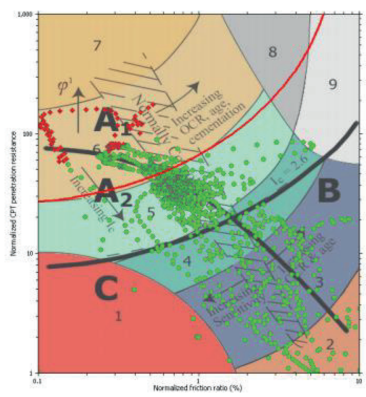
Pumice-rich Sandy Soil **PGA = 0.66g, Mw = 6.25, GW = 7mbgl** **I_c cut-off = 2.6**, C_{FC} = 0 for estimating FC, PL = 15% and ignoring aging factor in the Boulanger & Idriss (2014) liquefaction triggering procedure, **ΔI_c = 0**	Pumice-rich Sandy Soil **PGA = 0.66g, Mw = 6.25, GW = 7mbgl** **I_c cut-off = 2.6**, C_{FC} = 0 for estimating FC, PL = 15% and ignoring aging factor in the Boulanger & Idriss (2014) liquefaction triggering procedure, **ΔI_c = 0.8**	Pumice-rich Sandy Soil **PGA = 0.66g, Mw = 6.25, GW = 7mbgl** **I_c cut-off = 2.05**, C_{FC} = 0 for estimating FC, PL = 15% and ignoring aging factor in the Boulanger & Idriss (2014) liquefaction triggering procedure, **ΔI_c = 0.3**
		
		

FIGURE 5: Summary of Liquefaction Analysis Result

3. CONCLUSION

The following conclusions are drawn based on this study.

- Use of the standard practice Ic cut-off value of 2.6 as the boundary between "clayey" and "sandy" material types can be overly conservative in simplified liquefaction analyses and can result in an uneconomical outcome for projects.
- Simplified liquefaction analysis methods are applicable for soil behaviour types of clean sand and therefore, an Ic cut-off value of 2.05 shall be considered in simplified liquefaction analyses.
- To further validate that the sandy mix soils, where an Ic value of 2.05 is used, are non-liquefiable, undertake laboratory Plasticity Index (PI) tests to determine that the soil behaviour is clay-like with PI > 12.
- Simplified analysis methods should not be used for liquefaction risk assessments of sands containing more than 40% pumice and/or carbonate shell contents. Instead, laboratory cyclic triaxial tests (minimum of 3 tests) shall be performed to assess the liquefaction risk of these special soil types.

Refer to Anwar et al (2025) for further details on the procedure to assess liquefaction risk based on laboratory cyclic triaxial tests.

- If liquefaction analyses using simplified methods are still to be undertaken using CPT data without a correction for lower CPT cone tip resistance (qc) due to carbonate shell and pumice particle crushing by CPT cone, then the Ic values shall be adjusted in simplified liquefaction analyses similar to densification ground improvement methods.

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Foundation Correction Works on Soft Soils

Insights from practice

Manamea Koteka – Tonkin + Taylor

Manamea Koteka
Tonkin + Taylor

ABSTRACT

Peat/organic soils are characterised by low undrained shear strength, high compressibility and are susceptible to significant ground settlements, which create challenges for engineers and developers. Since construction in 2015, a housing subdivision in South Auckland has been impacted by ground settlement and distortions to foundations and superstructures. The patterns of distortions are indicative of differential settlements resulting from mixed foundation types, being part-piled and part-ground bearing over soft compressible peat.

Mixed foundations are sometimes used where dwellings are built adjacent to or over services, with piles being used to transfer loads to below the level of the services. A number of dwellings within the subdivision, which were constructed with mixed foundation types, have required regular intervention works to maintain dwelling serviceability. Foundation distortion correction works were trialed on one damaged property with the purpose of proving the adopted remedial methodology.

The remedial works involved disconnecting piles and implementing staged and cycled surcharge loading with water tanks on the foundation slab. This method was used to verify the performance of the slab and to measure the dwelling response to the change of support. Water tanks were positioned near the locations of the most significant distortions and subjected to loading cycles over several weeks while monitoring changes in floor distortion. The trial results successfully demonstrated compliance of the intervention works with the performance expectations of the New Zealand Building Code.

This paper presents the challenges and solutions implemented on the trial property during the foundation distortion correction works.

1. INTRODUCTION

New Zealand is experiencing rapid expansion and population growth, which is increasing the demand for land development. A general scarcity of high-quality land has resulted in investment and development of land with less favorable geotechnical characteristics, including over soft soils. Soft soils are commonly associated with poor geotechnical performance characteristics, including low strength, high compressibility (often with slow consolidation rates) and are susceptible to creep related movement; they may be organic or inorganic in nature.

This paper presents a case study from one such development over soft organic soils where dwellings have experienced long term differential settlements, principally arising from the use of mixed foundation types (piles and ground bearing elements). Whilst the dwellings have performed reasonably well (no loss of structural integrity but some serviceability issues), it is likely that without any intervention, ongoing settlement would result in more significant damage, likely requiring substantive repairs and/or rebuild works.

The trial intervention works were aimed to:

1. Reduce current distortions in the building foundation to more acceptable levels.
2. Substantially reduce the risk of the need for future structural interventions over the dwelling's design life.
3. To mitigate the need for ongoing repair and maintenance requirements to a level akin to routine homeowner maintenance operations, accommodating expectations for ageing and wear and tear of fabrics.
4. Prove the suitability of the intervention works and demonstrate compliance of the dwelling performance to the requirements of the New Zealand Building Code.

2. BACKGROUND

The trial property was constructed in 2015 and comprises of a 4 bedroom, single-storey dwelling constructed on a rib-raft slab foundation covering an area of approximately 160 m^2 with two piles along the north-eastern corner of the property (in proximity to a buried service line) as shown in Figure 1. The dwelling superstructure is of timber frame construction, with a metal tile roof with mixed weatherboard and brick veneer cladding.

Published geological mapping indicates that the trial property is underlain by alluvial sediments of the Tauranga Group, comprising Holocene-age and Pleistocene-age soils. These sediments comprise a combination of organic/peaty soils (Holocene-age) and pumiceous (inorganic) clays, silts, and sands (Pleistocene-age). The subdivision area is underlain by relatively compressible soils that are susceptible to consolidation, creep settlements, and seasonal shrink-swell movement. Site investigations undertaken have identified an approximate 10 m thick layer of these compressible soils.

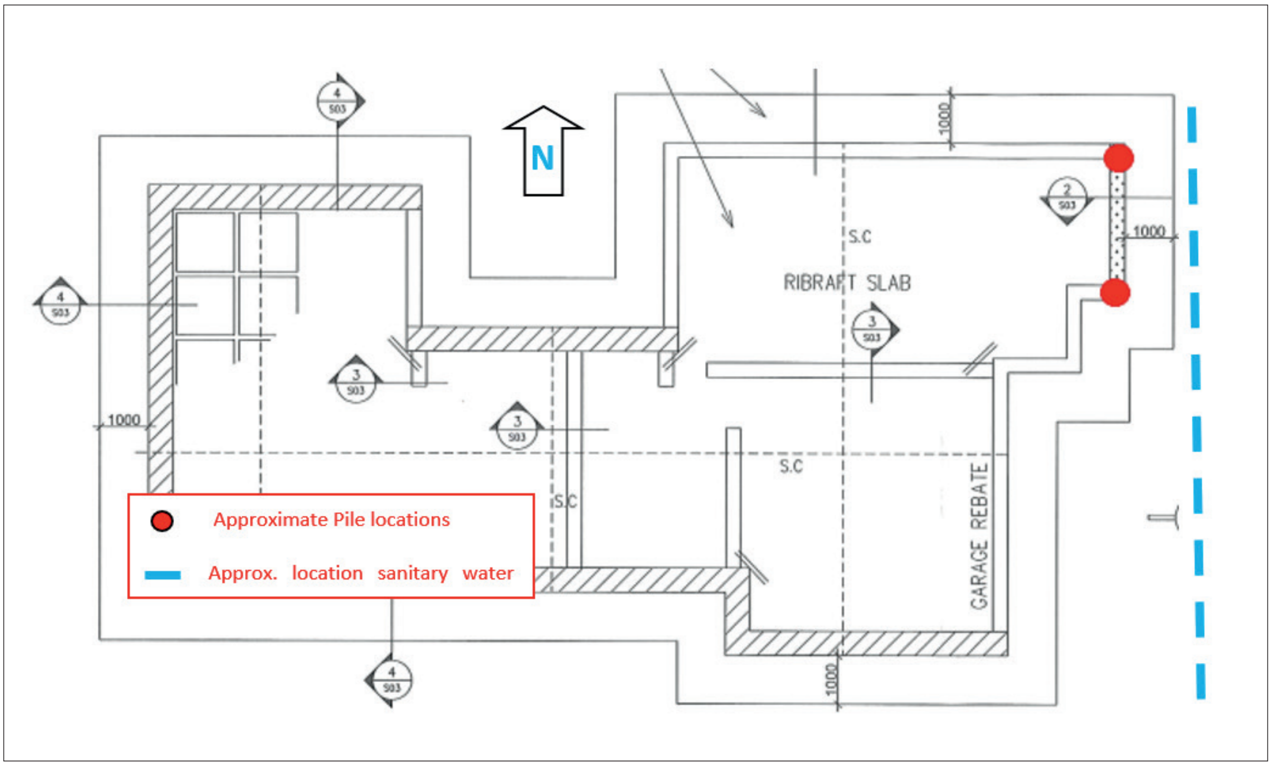

FIGURE 1: Floor plan layout annotated with pile and sanitary line location

3. TRIAL WORKS

Before initiating any physical works on the trial property, a comprehensive investigative process was carried out. The following steps were taken in this process:

3.1 VISIBLE DAMAGE ASSESSMENT

The history of maintenance works required on the dwelling is consistent with the effects of differential foundation movements. This is particularly evident on the north-eastern edge of the property, where the foundation transitions from being supported on piles to being ground-bearing.

Prior to the commencement of the trial interventions, a comprehensive visual inspection was conducted on the property. Internally the damage observed at the property was generally confined to the area where differential distortions have arisen due to mixed foundation support types (i.e. piled foundations and ground bearing raft). Internal damage included cracking of gib boards and linings, particularly within 2 m to 3 m of the piled locations, with cracking generally being diagonal and emanating from corner openings in the timber frames (i.e. doors and windows). Door and window frames were out of plumb or had apparent maintenance adjustments to hinges (Figure 2) and trimming of door panels associated with planar distortions of the framing around openings. Localised bowing of gib-bracing sheets, which were orientated perpendicularly and close to the line of the pile support area, also provided evidence of local distortion but no actual structural rupture. The internal gib board and bracing around the front of the property were removed to allow visual inspection of timber framing. No damage to the timber framing was observed, it was noted that some local and minor separation between the base plates and the top of the floor slab had locally occurred.

Externally there was no apparent damage to external weatherboards or brick cladding (the latter being remote from pile locations). Evidence of distortional movements within the internal building fabric over areas of the dwelling remote from the piles (i.e. >3 m distant from pile locations) has been identified but was of very minor nature.

At the location of the piled foundations, a gap had developed between the underside of the rib-raft foundation and the soil surface. The gap extended approximately 2 m distance from the location of the piles back into the dwelling footprint (i.e. the floor slab was acting in a suspended mode in this locality). However, remote from the piles, the foundation slab and superstructure had performed well with no apparent evidence of distress or significant foundation distortions. It is therefore likely, where the slab is not distorted by differential settlements associated with mixed foundation types (i.e. adjacent ground bearing and piled elements), the effects of settlement and shrink-swell are within design performance expectations.

3.2 INVESTIGATIONS

3.2.1 Floor Level Survey

The profile of the foundation slab was evaluated through laser survey measurements of relative levels on the surface of the rib-raft foundation.

Recorded differential levels across the entire dwelling footprint were of the order of 90 mm. No significant cracking or step changes in the floor slab profile were identifiable. The general absence of damage to majority of the property suggested that some of the apparent distortions in the floor slab are likely to be partially associated with as-built construction tolerances.

Maximum tilt on the surface of the floor slab was assessed to be (locally) up to approximately 1 Vertical: 50 Horizontal.

FIGURE 2: (a) Adjusted door hinge and (b) Crack in the corner of door frame, showing clear signs of movement.

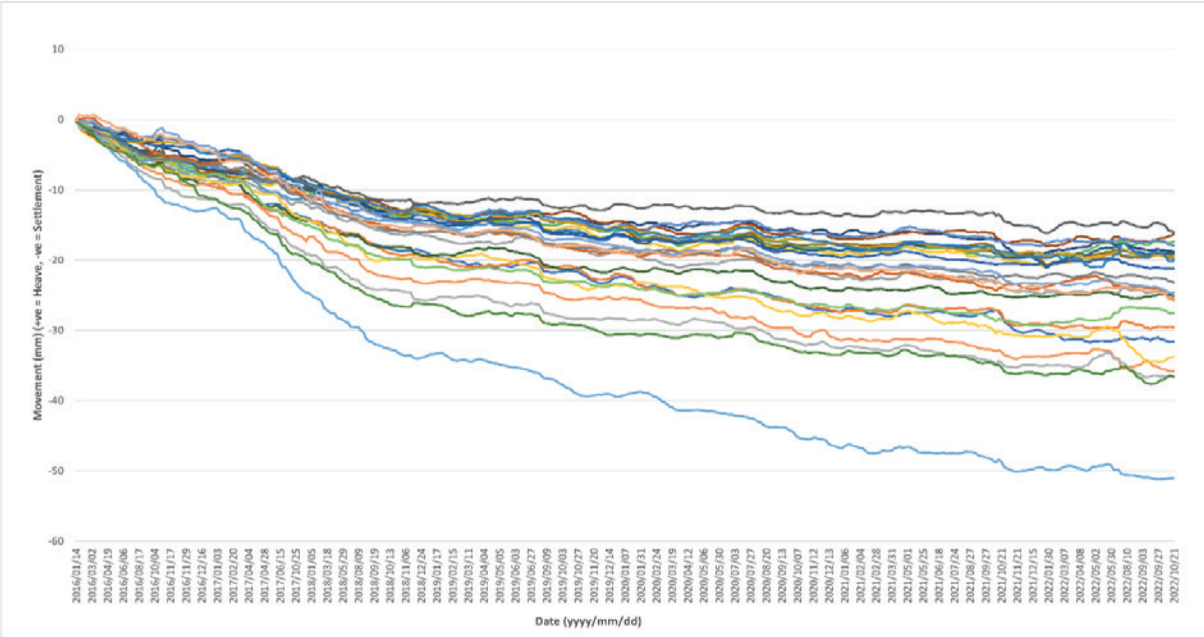

FIGURE 3: Ground Movement using InSAR data

3.2.2 Intrusive Investigations

Boreholes and Coreholes

Boreholes were drilled as part of a broader investigation of the subdivision, and logs confirm the local geological profiles are generally consistent across the wider development and consistent with previous investigations and expectations from published geological mapping.

Several coreholes were drilled through the floor slab to identify the potential for local yielding or damage within the slab as a consequence of the observed distortions.

CCTV – sanitary water pipeline

The sanitary water pipeline, which runs along the eastern boundary of the lot, was inspected by CCTV survey before and following completion of the foundation distortion correction works, confirming its location during the survey.

Terrestrial and InSAR Surveys

Terrestrial survey monitoring had been undertaken at a select number of locations across the broader sub-division area. The terrestrial monitoring covers an eleven-month period from October 2021 to September 2022. The resulting survey data suggest that seasonal shrink-swell movement occurs within a range of approximately +/-5 mm. There is also evidence within the data of an overall underlying settlement trend of up to approximately 7 mm/year (likely survey tolerance of +/-2 mm) for the subdivision.

Additionally, to provide supplementary assessment of the longer-term settlement trends across the subdivision, satellite interferometry data (InSAR) has also been acquired and analysed. The InSAR data demonstrates that, over the period 2016 to 2021, settlements within the broader area have been continuing to develop, albeit at rates which are diminishing with time.

The settlement trends apparent from both the terrestrial and InSAR are generally compatible and confirm that the overall subdivision is subject to both local and area wide settlement trends (including seasonal shrink-swell movements). The InSAR data is presented in Figure 3.

3.3 THEORETICAL EVALUATION

Distortions in the waffle slab surface profile were processed to assess the structural performance of the foundation slab. This evaluation aimed to assess the risk of unseen plastic deformation or cracking in the floor slab. The calculations suggested a risk that the floor slab might have yielded. However, it was also recognised that the theoretical assessment was sensitive to several critical assumptions, including floor levels at the time of construction, and the theoretical damage did not correlate with any physically observed damage to the floor slabs.

To address this potential theoretical failure (which would necessitate structural remedial works to the floor slab structure, if confirmed), coreholes were drilled through the concrete floor slab adjacent to the affected area to confirm if damage was apparent. Observations from these cores revealed very minor hairline cracking but no signs of significant structural damage. Therefore, it was concluded that the physical performance observations of the distortions in the structure and slab were more reliable than theoretical assessments that relied on several unknown variables or assumptions.

FIGURE 4: (a) Jacks between jacking beam and underside of the rib-raft foundation and (b) Pile Cut

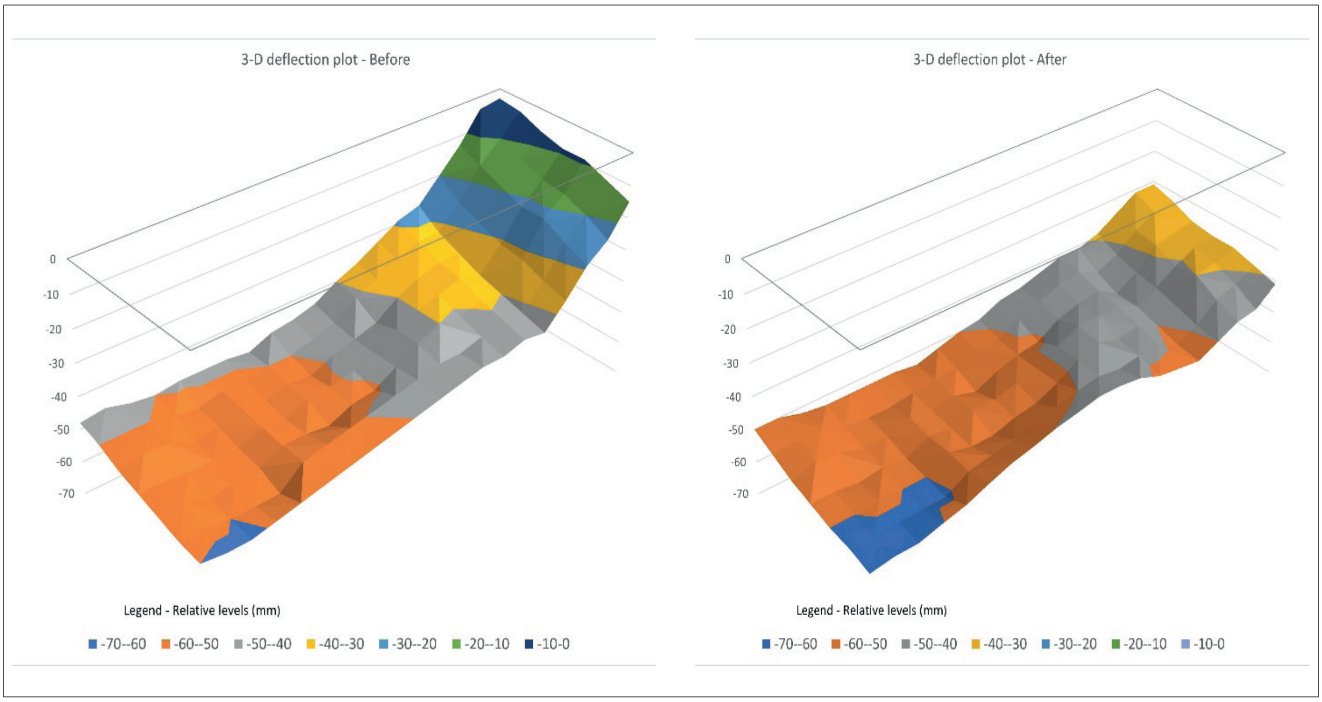

FIGURE 5: Floor slab profiles (a) before pile cutting, and (b) after pile cutting

3.4 PHYSICAL WORKS

The trial works were designed to correct distortions under the self-weight and targeted surcharging, by disconnecting the piles that support the north-eastern elevation of the property. The works included the staged and cycled surcharge loading of the slab to verify the performance of the slab and dwelling response to the change of support.

3.4.1 Preparation Stage

The first stage of the works was to install a temporary support beam to the lower portion of the timber piles and place jacks between the beam and the underside of the rib-raft foundation. The foundation loads were then transferred to the beam and the lower portion of the piles by engaging the jacks. Once the foundation load had been released from the top of the piles a short sectional length of pile was cut out and the jacks were lowered. Prior to the pile cut, the internal gib-bracing panels were slackened to promote the shape correction.

The raft responded to the release of the hydraulic jacks by settling immediately by approximately 20 mm to 25 mm. However, the gap between the underside of the rib-raft foundation and the soil surface did not close completely and the gap between the cut surfaces of the piles also remained open.

3.4.2 LOADING STAGE

As a supplementary stage of the trial, water tanks were then placed within the front portion of the house (between the location of the piles and the area of maximum angular distortion in the slab). The three tanks were progressively filled with water and then the loading cycled over a number of weeks whilst changes in the distortion of the floor slab were monitored. The impact of the change of support conditions on the shape of the floor slab was observed by monitoring the distance between marker pins fixed to the upper and lower sections of the pile and intermittent checks on the level profiles on the surface of the rib-raft foundation. The load cycling initially induced approximately a further 5 mm to 10 mm of settlement.

4. RESULTS

The overall changes in the ground floor profile achieved by these works are illustrated in Figure 5 by the following 3-D representations of the floor surface within close proximity to the piled area.

It is considered that movement response to the imposed floor loading, using water tanks, indicated that the slab remained and performed in an elastic mode during the load-reload cycles, despite the imposed floor loading exceeding the design floor loading of 1.5 kPa and the slab cantilevering in excess of 2 m.

Based on the results of the trial, there was a reduction in differential settlement of the order of approximately 30 mm with no further damage to the fabric of the dwelling. This outcome indicates that the composite performance of the slab and superstructure is resilient and can continue to function without the support of the piles. i.e. the performance of the structure does not rely on the piles and the performance of the buried sanitary pipe is unlikely to be impacted by bearing pressures from the foundation slab itself.

A significant period of monitoring (>1 year) would be required to evaluate and gain confidence in long-term estimates of settlement and building performance in this area. However, extrapolation of the InSAR data (Figure 3) indicates that further settlement of approximately 40 mm over the next 50 years is credible. Therefore, the following three potential performance scenarios were considered:

1. All movement comes to an abrupt halt. This is an unlikely scenario. If this were the case, there is a very low residual risk of re-intervention works being required.
2. Movement continues uniformly beneath the entire structure, at or below the currently identified diminishing settlement rates (InSAR data), until such point that the pile ends re-engage. Provided total movement remains consistent beneath the floor plan then no further damage is likely (the cut pile gap being sized to avoid re-contact).
3. As a result of the new loading regime, the area of the house in the vicinity of the piles undergoes a short-term acceleration in rates of settlement compared to the rear of the house. In this case, existing differential settlements in the critical areas should continue to diminish but may require further ongoing and short-term maintenance interventions (i.e. gib/doors) because of the higher initial rate of localised movement after the internal finishes are reinstated.

Following the completion of these works, the house underwent refurbishment, which included the fitting of gib, tidying up, re-setting of door and windows and decorating. The dwelling is now occupied. Observations over the last year, post-reinstatement, point to a notable improvement in performance with no evidence of further damaging distortions. There is no discernible ongoing differential settlement, indicating the effectiveness of the trial works.

5. CONCLUSION

The interventions, which involved disconnecting piles and implementing staged and cycled surcharge loading with water tanks, satisfied and met the objectives of the trial. Along with predictions of future performance (based on post remedial observations to date and predictions of long-term settlement from InSAR data) the works have been used to demonstrate that the performance requirements of the New Zealand Building Code have been met and will likely be satisfied for a further 50 years.

The trial demonstrated the challenges and unique geotechnical issues posed by construction on soft soils particularly if mixed foundation systems are used. While some degree of settlement is likely to continue, it is anticipated to diminish over time and remain manageable within the scope of standard homeowner maintenance following the correction works. The findings from this study can provide insights into similar situations, particularly in dwellings within this subdivision displaying compatible construction forms and distortions (albeit mixed foundation types should generally be avoided). The results from the trial interventions also prove the feasibility and effectiveness of foundation correction works as a robust strategy to mitigate substantial potential future settlement damage in such terrains.

CHALLENGE ACCEPTED.

In Memory

John Philip Blakeley

(1940 - 2025)

John Blakeley had a wide and varied career as a geotechnical engineer working both as a consulting engineer and as an academic.

John graduated with a Master's degree in civil engineering from the University of Canterbury. He also completed a Master of Science in civil engineering, specialising in engineering geology, from the University of Illinois.

Returning to New Zealand, John was employed by the Ministry of Works on the Kaimai tunnel project. In 1965 he accepted a role at the University of Canterbury where he taught geotechnical engineering. In 1971 he began work with Beca Carter Hollings and Ferner. He was involved with many projects in New Zealand and in Indonesia.

In 1981, John took the role of Executive Officer of Applied Research at the University of Auckland. In 1988 he became Executive Director for the Centre of Advanced Engineering at Canterbury. After moving to Auckland in 2000, John lectured at Unitec. John served as President of IPENZ in 1997.

From: https://www.engineeringnz.org/programmes/heritage/engineering-oral-histories/john-philip-blakeley-1940-/


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From the Archives

We were sad to hear of the passing of John Blakeley earlier this year. John was a life member of Engineering New Zealand and the following two articles from the 64th edition of *NZ Geomechanics News* were printed in 2002 around the time he was nominated for Life Membership.

JOHN P. BLAKELEY – LIFE MEMBER NOMINEE

Autobiographical Profile

My first encounters with geotechnical engineering were during summer vacations as an engineering student in the early 1960s – the half-completed Ohakuri earth dam on the Waikato River; then earthworks for the southern outlet (Cobham Drive) in Hamilton and investigations for the railway lowering through the city centre; and finally reclamation and earthworks for the Wellington motorway near the Ngauranga Gorge.

After a brief period as a graduate on the Matahina power project at about the time of river diversion, I returned to Canterbury University to undertake a ME degree supervised by Pip (P. J.) Alley who was an earlier pioneer of soil mechanics in New Zealand. Some years earlier he had become an individual member of the International Society for Soil Mechanics and Foundation Engineering and had strongly advocated the formation of a New Zealand national committee.[1] This was my real introduction to geotechnical engineering and was followed by a year studying for a Masters degree on a Fulbright Travel Grant in the Civil Engineering Department at the University of Illinois. Key people there teaching my courses were Professors Ralph Peck (Earth Dams and Foundation Engineering) and Don Deere (Rock Mechanics and Engineering Geology). I returned to New Zealand in mid 1965 feeling that I now had a good grounding in the geotechnical field.

This was followed by three years as a site engineer supervising geological and geotechnical investigations and early construction work on tunnel approaches for the Kaimai Railway Deviation project (including the 5.5 mile long tunnel). Among the key geological people I worked with were the then Government Volcanologist in Rotorua, Jim Healy and the Chief Engineering Geologist for DSIR, Les Oborn.

I left the project shortly before underground construction work commenced in order to gain some design experience in Wellington, then was appointed a Lecturer in Civil Engineering at the University of Canterbury in early 1969 teaching soil mechanics courses. Soon after arrival there, one day I received a telephone call from Ralph Tonkin, then Chairman of the NZ National Society for Soil Mechanics and Foundation Engineering, inviting me to join the management committee as an IPENZ representative which I accepted with alacrity. The following year I put forward a proposal to establish NZ Geomechanics News and was appointed editor with the first issue being produced in November 1970.

In early 1971 I moved to Auckland to join Beca Carter Hollings & Ferner Ltd where I helped establish the geotechnical engineering section which I led for the next ten years. I was involved in a wide variety of geotechnical engineering work including two major overseas projects – the soils investigation for the Arun LNG plant in North Sumatra, Indonesia and providing geotechnical services to the Inco nickel mining project in Sulawesi, also in Indonesia. Key people I worked with over this period included Sir Ron Carter; Alan Watt and Warwick Prebble (during the earlier years); and Peter Riley and Dr Do Van Toan (in the later years).

After moving to Auckland I continued my involvement on the Society's management committee (which changed its name to the NZ Geomechanics Society in 1972), becoming convenor of Auckland activities in 1974 and Chairman of the Society from 1977–80 and during that period detailed planning was carried out for the 3rd Australia – NZ Conference on Geomechanics held in Wellington in May 1980.

In 1981 I left consulting engineering to move in new directions and also left the management committee of the Society soon after, but I have continued my membership of the Society since and taken pleasure in its continued growth and especially in the flourishing of *NZ Geomechanics News.*

Following a request from IPENZ, I became Chairman of a President's Task Force (with Terry Kayes, and Ken Hayman representing ACENZ) in 1983–85 which looked into the Ruahihi and subsequently the Whaeo canal collapses from the point of view of the profession and the lessons to be learned. This led on to my becoming a member of the IPENZ Council (and subsequently the Board) from 1988–99 including becoming President of IPENZ in 1997.

In my 12 years as Executive Director of the Centre for Advanced Engineering (CAE) at the University of Canterbury (1988–2000), although its principal activities were in the area of energy and electricity supply and waste and risk management, I took particular pleasure from the outcomes of the first CAE major project on "Lifelines in Earthquakes: Wellington Case Study" which I initiated and which led to ongoing lifeline engineering studies in New Zealand. CAE was also involved in studies on earthquake response including co-publishing with EQC the "Wellington after the Quake" conference proceedings in 1995 and also the Review of the Edgecumbe Earthquake in 1998.

Although my main field of professional engineering interest is now in sustainable energy, I will continue to take an interest in the Society and its activities and would be greatly honoured to become a Life Member.

[1] Blakeley, J.P. (1978): "Twenty Years on – a history of the NZ Geomechanics Society," *NZ Geomechanics News* No. 16, June 1978.

A Tribute to John P. Blakeley

By Mick Pender

Life membership is recognition of the contribution a member has made to the Society. In John's case the outstanding contribution was his initiation of New Zealand Geomechanics News in 1970. This publication has appeared twice a year ever since, John being editor for four years from 1970 to 1973. From modest beginnings it has grown into the sophisticated publication we receive now. No doubt John opens each new issue with a satisfied smile. The content has expanded to the extent that it has now moved well beyond the "news" function originally intended, having become a respectable technical publication which also fulfils a news function. In fact, the time might be right to consider a change in name to something like "NZ Geotechnics" or "NZ Geotechnical Engineering" or "Geotechnical Practice and Problems in NZ".

Another initiative John completed was a brief, but valuable, history of the first couple of decades of the Society, published in Geomechanics News 16, June 1978. Information such as this is so easily lost unless someone, in this case John, takes the initiative and talks with the early players and then commits the findings to print. From 1977 to 1980 John was Chairman of the Society and so had overall responsibility for the organisation of the 3rd Australia – New Zealand Conference on Geomechanics held in Wellington in 1980.

John's career moved beyond the geotechnical world in the early 1980s, but he has maintained an interest in the Society. He contributed to the development of a proposal for Practice Colleges within IPENZ and he gave a spirited address on this topic to the Society Symposium on Land Development held in Hamilton in 1996. As things came to pass the Practice College idea was not implemented but the Chartered Professional Engineers Act 2002 sees the realisation of many of John's proposals. He was President of IPENZ in 1997/1998.

My earliest memories of John Blakeley go back to undergraduate days at the University of Canterbury. John was a few years ahead of me and whilst I was in my first and second professional years he was doing a Masters degree on the compaction properties of Port Hills Loess. My fellow undergraduates and I were aware of a particularly industrious person in the laboratory and in the library. This awareness was heightened by the frequent references that the two academics teaching soil mechanics then, Pip Alley and Tom Dodd, made to the work that John was doing.

After completing this ME degree in 1964 John had the good fortune to be awarded a Fulbright Travel grant and went to the University of Illinois where he completed a taught masters degree in soil mechanics and foundation engineering. Ralph Peck and Don Deere were members of the teaching team at Illinois at that time.

On returning to NZ John worked on the Kaimai tunnel project and associated major infrastructure. This was followed by a period lecturing at the University of Canterbury, after which he spent about 10 years with Beca Carter Hollings and Ferner in Auckland.

In 1981 he became Executive Officer of the Applied Research Office at the University of Auckland (a predecessor of Auckland UniServices Ltd) until 1988 when he moved to the University of Canterbury as the first Executive Director of the Centre for Advanced Engineering, a position he held until 2000. He then moved back to Auckland and now practises as an engineering consultant, and a part-time Research Fellow in the Centre for Sustainable Engineering Initiatives at UNITEC where he also teaches environmental law, environmental impact assessment and professional practice in the School of Civil and Environmental Engineering. He is also the present Convenor of the Sustainable Energy Forum, a national body which promotes policies to encourage energy efficiency and renewable energy technologies and has also been working for IPENZ in co-ordinating efforts in Auckland to assist immigrant engineers in finding suitable employment, including running courses to help them in this regard. He is a Patron of the Register of Engineers for Disaster Relief NZ (RedR).


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International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) Report, June 2025

Rolando Orense, Meenakshi Patel

Rolando Orense
Rolando Orense is a Professor at the Department of Civil & Environmental Engineering, University of Auckland. He is currently the NZGS representative to the ISSMGE.

Graham Scholey
Graham Scholey is a Technical Director at WSP Australia. He is currently the ISSMGE Vice President for Australasia.

Meenakshi Patel
Meenakshi Patel is a Geotechnical Engineer from ENGEO. She is currently the NZGS YGP ISSMGE Representative.

THE ISSMGE (https://www.issmge.org/) is the pre-eminent professional body representing the interests and activities of Engineers, Academics, and Contractors all over the world who actively participate in geotechnical engineering. The ISSMGE is a global organisation that provides a focus for professional leadership to some 90 Member Societies and around 20,000 individual members. As of March 2025, there are 1,050 NZGS members affiliated with ISSMGE, making us the largest national society (per capita).

This report presents a brief update on the recent and planned activities for the next 6 months.

ICSMGE2026 IN VIENNA, AUSTRIA

The 21st International Conference on Soil Mechanics and Geotechnical Engineering (21 ICSMGE 2026), with the theme "Geotechnical Challenges in a Changing Environment", will be held in Vienna, Austria, on 14–19 June 2026. This is the most prominent conference of ISSMGE and is a major global event for the geotechnical engineering community, focusing on the latest advancements and research in the field. With the slogan "Where it all began", the conference also celebrates the 100th anniversary of the publication of Karl Terzaghi 's book "Erdbaumechanik auf bodenphysikalischer Grundlage" in Vienna, widely regarded as the birth of modern soil mechanics.

Further details about the conference are available here: https://www.icsmge2026.org/en/.

8IYGEC IN GRAZ, AUSTRIA

The 8th International Young Geotechnical Engineers Conference (8iYGEC) will be held before the ICSMGE 2026 in Graz, Austria, from 11-14 June 2026. It will once more bring together young engineers (under 35 years of age) from around the world to exchange their experiences and ideas in geotechnical engineering. Each ISSMGE Member Society was requested to nominate two representatives to attend. Senior geotechnical engineers will deliver keynote lectures and engage with the young engineer delegates during the technical sessions.

Further details about the conference are available here: https://www.tugraz.at/institute/ibg/events/8iygec.

FIRST CALL FOR THE ISSMGE 2026 TIME CAPSULE

The ISSMGE envisages the creation and sealing of a physical time capsule in 2026. This will be opened in one hundred years from the time of sealing, in 2126. The physical time capsule will include published printed material and physical objects related to current and past practices in geotechnical engineering.

The first call for the ISSMGE 2026 Time Capsule is published at the following link: https://htc.issmge.org/physical-time-capsule. This call is addressed to potential donors who are requested to submit proposals for published material printed on paper only for preservation in the physical time capsule.

Proposals for the first call must be made on the HTC form, accessible through the same webpage, before June 2025. A second call devoted more specifically to objects will follow in June 2025.

If you have any ideas, please contact the NZGS ISSMGE Representative (Rolando Orense r.orense@auckland.ac.nz).

INCREASING REGIONAL MEMBERSHIP IN AUSTRALASIA

This is a shared initiative of AGS and NZGS to engage with geotechnical professionals in Fiji and encourage the formation of a new national geotechnical society to represent Fijian geotechnical engineers. While there is no progress to report, everyone is encouraged to contact the ISSMGE VP (Graham Scholey graham.scholey@wsp.com) or the NZGS ISSMGE Representative (Rolando Orense r.orense@auckland.ac.nz) for any ideas or connections in Fiji or the other South Pacific Islands.

UPCOMING ISSMGE CONFERENCES

Other ISSMGE conferences planned in 2025 that NZGS members are encouraged to attend include:

- 8th Asian Conference on Geosynthetics (GeoAsia8), 10-13 June (Brisbane, Australia)
- Geotechnical Engineering Education GEE 2025, 2-4 July (Nancy, France)
- 9th International Symposium for Geotechnical Safety and Risk, 24-27 August (Oslo, Norway)
- Geotech Asia 2025, 7-10 October (Goa, India)
- DFI 50th Anniversary Conference on Deep Foundations, 20-23 October (Nashville, USA)
- 17th International Conference on Geotechnical Engineering & 8th International Symposium on Natural Hazards, 4-5 December (Lahore, Pakistan)

ISSMGE AWARDS

The ISSMGE currently offers the following awards to recognise those individuals and bodies who have made important contributions to our profession, society, and the world:

- Lifetime Achievement Medal
- Outstanding Technical Committee
- Outstanding Geotechnical Project
- Outstanding Innovator
- Outstanding Member Society
- Outstanding Paper Published in the International Journal of Geo-Engineering Case Histories
- Outstanding Public Relations Award
- Outstanding Young Geotechnical Engineer Award
- Bright Spark Lecture

In addition, the following two awards are made at the discretion of the President and the Immediate Past President, respectively.

- Terzaghi Oration
- Kevin Nash Gold Medal

Details of each award are available here: https://www.issmge.org/the-society/issmge-awards

ISSMGE ACTIVITIES

See the ISSMGE website – http://www.issmge.org/ for full details of all ISSMGE activities.

International Association for Engineering Geology and the Environment (IAEG), June 2025

Report for New Zealand, Ross Roberts

Ross Roberts
Ross is Chief Engineer at Auckland Council. He is a chartered geotechnical engineer and professional engineering geologist with over twenty years' experience. Ross a permanent member of the New Zealand Landslides National Advisory Group, a steering committee member of the AGS Landslide Risk Management guidelines project, a past Chair of the New Zealand Geotechnical Society, and the New Zealand representative on the IAEG Council.

Lauren Foote
Lauren is an Engineering Geologist at consultancy WSP. She is New Zealand's representative on the IAEG Young Professionals Group and is a Professional Engineering Geologist who has been involved with land damage assessments following the 2010-2011 Canterbury Earthquake Sequence and the 2016 Kaikoura Earthquake. She specialises in hazard assessment and mitigation, with a particular focus on landslides.

Ann Williams
Ann is a technical specialist in the fields of engineering geology and hydrogeology. As a manager of some 630 people, a Board Member of Engineering New Zealand, past Chair and Life member of the New Zealand Geotechnical Society Inc., and past Vice President of the IAEG, Ann has significant first-hand experience of the opportunities for women in the discipline and is somewhat dismayed at the number of firsts still to be had for women in Engineering Geology in 2024.

1 WHAT IS IAEG AND HOW DO WE FIT?

All NZGS members also join one (or more) of the three international societies that NZGS represents in New Zealand; the International Association for Engineering Geology and the Environment (IAEG), the International Society for Rock Mechanics and Rock Engineering (ISRM), and the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE).

NZGS is represented on the IAEG Board (Executive Committee) by Anthony Bowden, IAEG Vice President for Australasia (one of six regions). Each country that is part of a regional group has an independent vote in Council meetings, and I carry this vote on behalf of the NZGS.

2 IAEG WORLD CONGRESS – DELFT 2026

The next big event in the IAEG Calendar is the World Congress. This is the highlight of the circuit for engineering geologists, so anyone who can make it to Europe in late October 2026 should seriously consider making the journey.
More information can be found on the conference website (https://www.iaeg2026.org/150970/home). The abstract submission deadline has been extended to 01 July 2025, so get in quickly!

3 NEW ZEALAND IS IAEG'S LARGEST NATIONAL GROUP

New Zealand continues to punch above its weight in the international scene. We attract major events – not least the upcoming Landslide Geo-education and Risk Workshop 2026 – because of our great membership numbers. Thank you to all of you who join IAEG and enjoy the many benefits of membership. If you're not a member, remember that you are very welcome to join more than one of the international societies – it's worth it for the direct benefits (more below) as well as for raising the profile of New Zealand so we can continue to bring great international events to our shores.

4 YOUNG ENGINEERING GEOLOGISTS

The Young Engineering Geologists Group of IAEG remains very active, and all members are encouraged to participate. Lauren Foote is the IAEG YGP representative within NZGS. Young Engineering Geologists (anyone under 40) should contact Lauren, check out the IAEG YEG website (https://iaeg.info/yegs/) and for the most current activity, follow their great webinars on YouTube (https://www.youtube.com/@iaegyeg), articles in the IAEG Connector and posts on LinkedIn (https://www.linkedin.com/company/international-association-of-engineering-geology-and-the-environment).

5 WOMEN IN ENGINEERING GEOLOGY

The IAEG is committed to increasing the involvement and inclusion of women in the activities and opportunities of the Association. This is part of a wider drive to build diversity in the organisation, and to give equal opportunity to all members. The Women in Engineering Geology Group (WEG), representing the interests of Women in the field of Engineering Geology, is open to participation by any member of the Association, not just women. It is administered by a Women in Engineering Geology Committee (WEGC), led by our own Ann Williams. Find out more about the group on the IAEG website (https://iaeg.info/weg/info/).

6 REGISTER NOW FOR THE WEBSITE & JOURNAL

All NZGS members who have affiliated to IAEG are eligible to access resources on the IAEG website, including free access to the highly regarded Bulletin of Engineering Geology and the Environment, the official journal of the IAEG. It's ranked as one of the top global journals in our discipline, so is well worth keeping up to date with.

All affiliated members should have received an email (in July) with the subject line "Welcome to IAEG members Area" from membership@iaeg.info giving you a username and password. You will need to follow these instructions to access the membership benefits of IAEG including the journal. If you're struggling, please contact me or email membership@iaeg.info.

7 IAEG MANAGEMENT UPDATE

The most recent executive board meeting was held on 22-23 May 2025 (where we were represented by Anthony Bowden and Ann Williams). Key items from this meeting include:

- Membership continues to grow, and now stands at over 6,000
- Members are encouraged to complete their online digital profiles on the IAEG website to get best value from it. Each IAEG affiliated member should have received a token to allow initial access. Contact us if you haven't received this.
- Queenstown will host an Executive Committee meeting in April 2026 as part of the Landslide Geo-education and Risk conference.
- A database of global accreditation systems is being developed.
- A decision will soon be made on the potential for a joint FedIGS conference bringing together the international societies in one great conference (likely 2030). A call for the 16th IAEG Congress (to be held in 2031 to allow for the FedIGS conference) will be made soon.
- IAEG Commissions are being reviewed to ensure that they are active and valued. Their publications in the Bulletin will be made available as open access.

International Society for Rock Mechanics and Rock Engineering (ISRM)

Report for New Zealand – June 2025

Eleni Gkeli

Eleni is a Technical Director for Engineering Geology with 27 years of experience in the geotechnical profession, specialised in rock slope engineering and tunnels. Eleni's experience was gained in large infrastructure projects in Greece and in New Zealand. Eleni has been working in New Zealand since 2012, initially with WSP (former Opus) and more recently with Stantec. She has been involved in a range of projects in the transportation, water and land development sectors many of these involving design of infrastructure in rock formations. Eleni has been involved in the NZGS since 2016 in a variety of roles. She was the NZGS Chair for the term 2021 to 2023 and has just recently been appointed as the New Zealand liaison for ISRM.

Mohamud Hassan

Mohamud Hassan graduated from Canterbury with a professional master's degree in engineering Geology. He currently works as an engineering geologist at Bathurst Resources Limited, working at Stockton Mine, one of New Zealand's largest open-cast mines. His responsibilities include geotechnical risk management, highwall slope stability analysis, and hydrogeological modelling, utilising advanced software like Vulcan and Rocscience. He oversees multiple active pits, dealing with extreme weather conditions and the challenges of rock mass variability. He is passionate about fostering connections among young professionals, raising awareness about ISRM's initiatives, and nurturing future leaders in rock mechanics. Outside of his professional life, Mohamud enjoys hiking, tramping, reading literature, playing rugby/soccer, and socializing.

ISRM BOARD AND COUNCIL MEETINGS, 16 AND 17 JUNE 2025 – PRESIDENTIAL ELECTION

The 2025 ISRM Board and Council meeting will be held during the Eurock 2025 Conference in Trondheim, Norway. Eurock 2025 is ISRM's international symposium for this year. Eleni Gkeli will represent the New Zealand Geotechnical Society at the Council meeting.

The election of the ISRM President for the term 2027-2031 is scheduled for 16 June 2025 during the ISRM Council meeting. The elected candidate will join the Board as President-elect immediately and officially assume the role of President after the ISRM International Congress in 2027, set to take place in Seoul, Korea. The candidates for the ISRM Presidency are Pinnaduwa Kulatilake, nominated by Sri Lanka, and Sergio Fontoura, nominated by Brazil, Argentina, Mexico, and Paraguay.

Professor Sergio Fontoura served as Vice-President for Latin America from 2015 to 2019, promoting ISRM initiatives, expanding its presence in the region, and fostering collaboration among member countries. In recognition of his contributions, he was elected as a Fellow of ISRM in 2022. He has actively participated in various ISRM commissions and contributed to global projects and initiatives. Professor Fontoura also created and mentored RockBowl, an educational initiative that brings together students worldwide to learn about rock mechanics.

Professor Pinnaduwa Kulatilake has a notable record of research, teaching, and service in Rock Mechanics and Rock Engineering. He has over 40 years of experience in rock mechanics, rock engineering, and applications of probabilistic, statistical, and numerical methods to civil, mining, and geoengineering. He formed the ISRM Commission on "Estimation of Rock Mass Strength and Deformability" and has been serving as Chair since April 2024. Prof. Kulatilake chaired the First ISRM Commission Conference on Estimation of Rock Mass Strength and Deformability held in Lima, Peru on December 6th, 2024, jointly organized by the SLRMES and Peruvian Geo Engineering Society.

Both candidates have significant credentials and qualifications. The New Zealand Geotechnical Society, following discussion in the management committee, has chosen to support the candidacy of Sergio Fontoura as the ISRM next President.

17TH ISRM INTERNATIONAL CONGRESS – THE BID OF THE NEW ZEALAND GEOTECHNICAL SOCIETY

The NZGS has submitted a proposal to host the 17th International Congress of the ISRM in Christchurch, scheduled for September 2031. We are grateful for the strong support from Tourism New Zealand and Christchurch NZ in this endeavour and extend our sincere appreciation.

The undersigned, Romy Ridl, and Christoph Krauss, members of the

Congress bidding committee, will support the NZGS bid by delivering an oral presentation at the 2025 Council meeting in Trondheim, Norway. The team has made significant efforts to promote New Zealand as the perfect host for the 2031 ISRM Congress and we wish them good luck. The final decision will be made at the ISRM Council meeting in 2026 in Japan.

49TH ISRM ONLINE LECTURE

The 49th ISRM Online Lecture was given by Professor Robert Zimmerman, from Imperial College London, UK. The title of his lecture is "Fluid Flow in Fractured Rocks". The lecture is available on the online lectures dedicated webpage. Prof. Zimmerman obtained a B.S. and M.S. in mechanical engineering from Columbia University, and a Ph.D. from the University of California at Berkeley. He has been a lecturer at UC Berkeley, a staff scientist at the Lawrence Berkeley National Laboratory, and Head of the Division of Engineering Geology and Geophysics at KTH in Stockholm. He is currently Chair in Rock Mechanics at Imperial College London. Prof. Zimmerman conducts research on the hydromechanical behaviour of fractured and porous rocks, fluid flow in porous media, rock failure and rock fracture, with applications to petroleum engineering, underground mining, radioactive waste disposal, and subsurface carbon sequestration.

ROCHA MEDAL 2027

Nominations for the Rocha Medal 2027 are to be received by the ISRM Secretariat by 31 December 2025. The winner will be announced during the 2026 ISRM International Symposium in New Delhi, India, and will be invited to receive the award and deliver a lecture at the ISRM International Congress in 2027. Please send your nominations for New Zealand to secretary@nzgs.org.

ISRM YOUNG MEMBERS' SEMINAR ON THE ISRM YOUNG MEMBERS YOUTUBE CHANNEL

The last Young Members' Seminar took place on 13 March and featured presentations from researchers from China and Australia:

- Predicting Peak Shear Strength of Rough Rock Joints via Normal Deformability Test - Yingchun Li (Dalian University of Technology, China)
- Micro-and macro-scale class-II fracture behaviour of brittle rocks in well-controlled Brazilian tests - Fauzan Yudho Pratomo (University of Adelaide, Australia)
- Granular Materials' Dynamics and Bio-consolidation - Yuqi Song (Monash University, Australia)

The Seminar is available on the ISRM Young Members YouTube channel.

SESSION ON INTERGENERATIONAL DIALOGUE IN GEOTECHNICS AT THE 74TH GEOMECHANICS COLLOQUIUM AUSTRIA - PARTICIPATE IN THE SURVEY!

ISRM have received a request from the organisers of the 74th Geomechanics Colloquium (Salzburg, Austria, 9-10 October 2025) to share with the ISRM members a "Survey to explore potential differences between generations in geotechnical engineering and neighbouring disciplines".

The online survey explores generational differences in the geo-disciplines with respect to technology, values, work habits and more, and aims to learn lessons for the future. Participate in this interesting survey by following this link (https://forms.office.com/e/zbV9tvqhQ7).

The survey takes about 15 minutes, and the results will be anonymized. This survey is part of the "Generational Dialogue in Geotechnics" session at the Austrian Geomechanics Colloquium 2025. Survey participants can also receive the results via email.

IN MEMORY OF

It is with great sadness that we inform of the passing of Professor Richard Goodman. Professor Goodman's immense contributions to rock mechanics and geological engineering have greatly influenced the rock mechanics and rock engineering field, and his work has guided and inspired many professionals around the world. Professor Goodman's research, including block theory, the DDA method, and the Goodman Jack, has been groundbreaking. Beyond his innovations, he was a dedicated teacher and mentor who shaped the careers of many students, leaving a lasting impact on the rock mechanics and rock engineering community.

Prepared by
Eleni Gkeli
ISRM NZ liaison

Young Geoprofessionals Reports

Christoph Kraus – Young Geoprofessionals Representative

Christoph Kraus
Christoph is a Professional Engineering Geologist (PEngGeol) at Beca, and the current NZGS Young Geo-Professionals Coordinator. Christoph's key interests and expertise include analysing complex geology and developing geological models, landslide risk assessments, as well as the assessment and mitigation of natural hazards. He is experienced in geological mapping and ground investigations, having conducted fieldwork in a range of different geological settings throughout New Zealand, in Samoa, Patagonia and Antarctica.

Outside of work, Christoph's interests include travel, exploring the outdoors, football, photography, and spending time with his young family.
ygp@nzgs.org

THERE HAS BEEN a lot going on in the YGP space since the last edition of *NZ Geomechanics News,* and there is plenty more to look forward to in 2025 and 2026. I have provided an update on some of the activities and plans below.

As always, if you are keen to be involved or have ideas for future events and opportunities, please feel free to get in touch.

REGIONAL YGP MINI SYMPOSIA AND YGP BREAKFAST SESSION AT THE NZGS2025 SYMPOSIUM

As mentioned in the December 2024 issue, we had four extremely successful regional mini symposia across New Zealand last year, with what may have been the largest total number of delegates to date.

As part of their prize, the winners from last year's mini symposia will present their winning presentation during a dedicated YGP breakfast session at the NZGS Symposium in October this year. If you are attending the Symposium, please head along to the breakfast session to support our YGPs and listen to their fantastic presentations.

We will continue with the successful YGP mini symposia, and this year's symposia will be run in November. I'm also excited to announce that the NZGS committee has decided that going forward we will offer a stipend to the winner (as judged by the mentors) of each of the 4 regional symposia. The stipend will either go toward attending the NZGS symposium (in the year prior to a NZGS symposium), or toward attending another conference or other professional development. This is an extension of the stipends that we have traditionally provided to mini symposia winners in years prior to NZGS symposia, and is an important investment into the future of our industry by providing our YGPs with ongoing support for professional development opportunities.

Keep an eye on the weekly newsletter for more information closer to the time.

15TH YOUNG GEOTECHNICAL PROFESSIONALS CONFERENCE (15YGPC) IN ADELAIDE, SOUTH AUSTRALIA

A highlight of the past few months was the 15th Young Geotechnical Professionals Conference (15YGPC) in Adelaide, South Australia. The conference was another great success, and for more information please have a read of the conference report in this issue of *NZ Geomechanics News*.

PUBLIC OUTREACH AT THE EARTHFEST IN DUNEDIN

In November last year Lauren Foote and I represented NZGS at the EarthFest in Dunedin, which is a public outreach event associated with the annual conference of the Geoscience Society of New Zealand. The aim of EarthFest is to ignite people's interest in earth science concepts and careers through a range of interactive exhibits, displays, and demonstrations. At our NZGS booth we had an interactive activity set up, where children and their families could carry out their own geotechnical investigations using geological models made of playdough and using straws for boreholes. The activity was a huge success with families, and especially with children between about 4-10 years old. As part of the event, Lauren and I also presented a brief talk each on careers in the geotechnical industry.

FIGURE 1. Our NZGS booth at the EarthFest in Dunedin last year.

LaGER2026 IN QUEENSTOWN

We are currently progressing well with our preparations for the first international joint workshop of JTC 1 and JTC 3 on Landslide Geo-Education and Risk (LaGER2026), which will be hosted in Queenstown next year. As part of developing the conference programme, we are currently working on organising dedicated early career researcher and YGP events. At this stage we are planning to include a panel discussion on career paths, as well as a networking event for early career researchers and YGPs.

For more information please visit: https://landsliderisk.nz/

COLLABORATION WITH INTERNATIONAL SOCIETIES

At the end of last year, I was fortunate enough to have the chance to (virtually via Teams) present the 2024 guest lecture to the joint young member's Austria (J-YMA) group of the Austrian Society for Geomechanics. It was a great chance to showcase some of the amazing work that we are doing in New Zealand, and to share ideas and experiences in the discussions after the presentation. We are currently looking to set up a similar guest lecture from an Austrian YGP to the NZGS later this year. Please keep an eye out in the newsletter for more info.

Separately, the NZGS international society young professional coordinators Lauren Foote (IAEG), Meenakshi Patel (ISSMGE), Mohamud Hassan (ISRM), and I continue to meet monthly to share ideas and discuss what is going on in the international societies.

Society Branch Reports

SEE THE EVENTS DIARY OR WWW.NZGS.ORG FOR FUTURE EVENTS

Hamilton branch

BEN McKAY

Ben is a geotechnical engineer with CMW Geosciences, based in Hamilton. He has over 10 years of industry experience, with practical background experience in both construction and mining in NZ/AUS. Bens key interests include landslide assessment, liquefaction, ground improvement and earthquake engineering. When he is not at work, he can be found rock climbing or pottering in his garden.

NEIL KUMAR

Neil Kumar is an Engineering Geologist at Beca in Hamilton, bringing 15 years of work experience to the table. He initially worked in the mineral exploration and mining industry, with the past six years dedicated to Engineering Geology. Beginning his career in Fiji, Neil relocated to New Zealand to join Beca. His experience spans a diverse range of projects and various ground investigation techniques. Outside of work he enjoys outdoor activities involving gardening and exploring nature.

THE WAIKATO BRANCH HAS had a shuffle up of branch reps over the last few months… Ben McKay & Neil Kumar have joined the team, vowing to take up the torch from Jessel Ladwa and Ben Smith. Thank you for the effort over the last few years here team.

The Waikato Branch was treated to an excellent evening talk by Dr Baqer Asadi, Dr Sadeq Asadi and Dr Rolando Orense, presenting their award-winning paper *Empirical assessment of liquefaction resistance of crushable pumiceous sand using shear wave velocity.* Hosted at the Hamilton CMW office, the audience and speakers alike enjoyed the active engagement with each other and plenty of learning was had!

While the new representatives would love to hear from members regarding topics or ideas for future events – all ideas welcome! A few activities are planned for mid 2025, but there is still plenty of the year left for get-togethers and learning opportunities, including more informal events for members to meet other like-minded geo-professionals in the Waikato area. Your input will help us better serve the needs of our local NZGS community - we look forward to an active and (hopefully) enriching remainder of 2025!

Ben McKay & Neil Kumar

Tauranga branch

KIM DE GRAAF

Kim is a Senior Lecturer at the University of Waikato and a Senior Geotechnical Engineer with ENGEO and is based in Tauranga. Kim's experience includes earthworks, detailed seismic assessments, building foundation design, 3Waters projects and resilience. Kim's research interests cross a broad range of geotechnical areas including the behaviour of pumiceous soils, ground improvement and soil-foundation-structure-interaction.

MATT PACKARD

Matt works as a Geotechnical Engineer at ENGEO's Tauranga office. He has over 20 years industry experience, working primarily within the mostly sunny Auckland and Bay of Plenty regions. He has an interest in resilience based seismic design, complex retaining wall design and soft ground engineering and is currently looking after a number of challenging projects across our geologically diverse country. An NZGS Branch Co-ordinator for the Bay of Plenty in a past life, he's come back on board to help pester NZGS members into presenting more local events.

RHIANNON ROBINSON

Rhiannon is a Chartered Professional Engineer in Geotechnical Engineering with Engineering New Zealand Te Ao Rangahau. Rhiannon has worked as a Geotechnical Engineer with Beca since graduating from the University of Auckland in 2018 with a Bachelor of Civil Engineering with honours. Initially she worked for the Beca Auckland branch before transferring back to her hometown of Tauranga at the start of 2021.

THE REPRESENTATIVES OF the Tauranga NZGS branch, Kim, Matt, and Rhiannon, continue to carry forth their roles in planning and executing exciting events for our Tauranga members. The team have been working hard on planning and organising branch events for 2025, with two exciting branch events in the pipeline.

First in the series is a Site Walkover of The Pitau Development set for 8th May 2025, organized in collaboration with Engineering New Zealand. This event promises a display of crucial engineering elements like perimeter retaining, basement works, stormwater systems, and foundation construction as employed in a major development featuring apartment towers and far-reaching amenities. Following this, on 21st May 2025, the community will commemorate the 20-Year Anniversary of the 18th May 2005 Bay of Plenty Storm Event. Marianne O'Hallaran and Tony Cowborne are set to provide reflections about the storm's devastating impact on homes and infrastructure, tackling topics including local geotechnical challenges and the evolution of engineering practices in response to such phenomena.

Keeping the momentum throughout the year, there are plans to host an updated walkover of the completed structures and infrastructure of the Takitimu Northern Link (TNL) Stage 1.

The Tauranga branch representatives are always eager to hear fresh ideas for future presentations. Hence, if you have one, remember that Kim, Matt, or Rhiannon are only a message away!

Kim De Graaf , Matt Packard, and Rhiannon Robinson

Hawke's Bay

TOM GRACE

Tom is a geologist who has worked for consulting companies on a large range of projects — predominately mineral exploration, mining feasibility & development and geotechnical projects in Southeast Asia, Canada, Australia and New Zealand. Tom has a strong interest in ground testing (CPT, surface and downhole geophysics, downhole testing).

THE HAWKE'S BAY branch recently hosted Vassilis Marinos during his whirlwind NZ tour. It was a great opportunity to get together to hear such a knowledgeable speaker - many thanks to the committee members who facilitated his trip. Approximately 25 local practitioners attended with good representation across local businesses and disciplines. The discussion before and after highlighted how the group appreciated having both geotechnical engineers and engineering geologists in project teams. The messages delivered during the presentation aligned well with the slope stability guidance being released.

Tom Grace

ABOVE Taranaki branch.

Taranaki

LAURA JOHNSTON

Laura is a Graduate Geotechnical Engineer with HD Geo in New Plymouth and enjoys getting "hands on and hands dirty" in the field. Laura first graduated in 2010 from University of Plymouth, UK with BSc (Hons) in Geography and Ocean Science and has recently re-trained and graduated with NZDE (Civil) from Western Institute of Technology Taranaki and is continuing their academic journey with postgraduate study from University of Auckland.

THE TARANAKI BRANCH finished 2024 with a flourish of events. In October Jethro Neeson from Stanley Grey presented on the NZGS slope stability guidance and sparked discussion on best practises for slope stability assessment for Taranaki volcanic ash soils.

November 2024 saw the team at Red Jacket host a presentation from Michael and Jamieson of Cirtex. An engaging show and tell of some of their products, including a small scale version of their interlocking MagnumstoneTM retaining wall blocks. If you are curious to know more about Cirtex products and how they can integrate into your next project, their team are happy to help.

February 2025 saw a more casual affair, with drinks and nibbles at Shining Peak brewery to welcome everyone to the New Year and introduce our new branch rep Laura Johnston of HD Geo. Laura has always been keen to help behind the scenes and is now officially stepping into the role of co-coordinator, alongside Matt.

Our next event on 23rd May 2025 is the highly anticipated site visit to check out the progress at the Te Ara o Te Ata - Mt Messenger bypass project. Geotechnical Lead, Danny Beasant, will take us through some of the complex challenges and the geotechnical engineering solutions that make up this project. Stay tuned for a full insight into our visit next issue.

Laura Johnston

WE WOULD LIKE to extend our sincere appreciation to our advertisers in the *NZ Geomechanics News*. Your continued support plays a vital role in helping us bring a high-quality edition of the magazine to our readers.

Thank you for partnering with us!
Teresa Roetman

NEW ZEALAND GEOTECHNICAL SOCIETY INC

The New Zealand Geotechnical Society (NZGS) is the affiliated organization in New Zealand of the International Societies representing practitioners in Soil mechanics, Rock mechanics and Engineering geology. NZGS is also affiliated to the Institution of Professional Engineers NZ as one of its collaborating technical societies. The aims of the Society are:

a) To advance the education and application of soil mechanics, rock mechanics and engineering geology among engineers and scientists.
b) To advance the practice and application of these disciplines in engineering.
c) To implement the statutes of the respective international societies in so far as they are applicable in New Zealand.
d) To ensure that the learning achieved through the above objectives is passed on to the public as is appropriate.

All society correspondence should be addressed to the Management Secretary (email: secretary@nzgs.org).
The postal address is NZ Geotechnical Society Inc, PO Box 12 241, WELLINGTON 6144.

Management Committee 2024

POSITION	NAME	EMAIL
Chair	Philip Robins	chair@nzgs.org
Vice Chair	Ioannis Antonopoulos	awards@nzgs.org
Treasurer	Emilia Stocks	treasurer@nzgs.org
Immediate Past Chair	Eleni Gkeli	committee@nzgs.org
Elected Member	Jesse Beetham	committee@nzgs.org
Elected Member	Richard Justice	committee@nzgs.org
Elected Member	Martin Larisch	committee@nzgs.org
Elected Member	Liam Wotherspoon	committee@nzgs.org
Co-opted YGP Representative	Christoph Kraus	ygp@nzgs.org
Co-opted *NZ Geomechanics News* Editors	Camilla Gibbons Robert Kamuhangire	editor@nzgs.org
Co-opted Website Editor	Jordan Moll Wendy Weng	website@nzgs.org
IAEG NZ Representative	Ross Roberts	secretary@nzgs.org
ISRM NZ Representative	Eleni Gkeli	secretary@nzgs.org
ISSMGE NZ Representative	Rolando Orense	secretary@nzgs.org
Appointed Secretary	Teresa Roetman	secretary@nzgs.org

EDITORIAL POLICY

***NZ Geomechanics News* is a biannual bulletin issued to members of the NZ Geotechnical Society Inc.**

Readers are encouraged to submit articles for future editions of *NZ Geomechanics News*. Contributions typically comprise any of the following:

- technical papers which may, but need not necessarily be, of a standard which would be required by international journals and conferences
- technical notes of any length
- feedback on papers and articles published in *NZ Geomechanics News*
- news or technical descriptions of geotechnical projects
- letters to the NZ Geotechnical Society or the Editor
- reports of events and personalities
- industry news
- opinion pieces

Please contact the editors (editor@nzgs.org) if you need any advice about the format or suitability of your material.

Articles and papers are not normally refereed, although constructive post-publication feedback is welcomed. Authors and other contributors must be responsible for the integrity of their material and for permission to publish. Letters to the Editor about articles and papers will be forwarded to the author for a right of reply. The editors reserve the right to amend or abridge articles as required.

The statements made or opinions expressed do not necessarily reflect the views of the New Zealand Geotechnical Society Inc.

NEW ZEALAND GEOTECHNICAL SOCIETY INC

NZGS Membership SUBSCRIPTIONS

Annual subscriptions cost $135 per member. First time members will receive a 50% discount for their first year of membership; and student membership is free. Membership application forms can be found on the website http://www.nzgs.org/membership.htm or contact the NZGS Secretary on secretary@nzgs.org for more information.

Letters or articles for *NZ Geomechanics News* should be sent to editor@nzgs.org

MEMBERSHIP

Engineers, scientists, technicians, contractors, students and others who are interested in the practice and application of soil mechanics, rock mechanics and engineering geology are encouraged to join.

Full details of how to join are provided on the NZGS website http://www.nzgs.org/about/

Please remember to contact the Management Secretary (Teresa) if you wish to update any membership, address or contact details. If you would like to assist your Branch, as a presenter or sponsor, or to provide a venue, refreshments, or an idea, please drop a line to your Branch Co-ordinator or Teresa. If you require any information about other events or conferences, the NZGS Committee and NZGS projects, or the International Societies (IAEG, ISRM and ISSMGE) please contact the Secretary on secretary@nzgs.org You may also check the Society's website for Branch and Conference listings, and other Society news: www.nzgs.org

Advertisers' Directory

ADVERTISING

NZ Geomechanics News is published twice a year and distributed to the Society's 1000 plus members throughout New Zealand and overseas. The magazine is issued to society members who comprise professional geotechnical and civil engineers and engineering geologists from a wide range of consulting, contracting and university organisations, as well as those involved in laboratory and instrumentation services. NZGS aims to break even on publication, and is grateful for the support of advertisers in making the publication possible.

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1. All rates given per issue and exclude GST
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National and International Events

2025

24-27 August
Oslo, Norway
9^{th} International Symposium for Geotechnical Safely and Risk

28 September - 2 October
Quebec, Canada
3^{rd} International Workshop on Landslides in Sensitive Clays

9-12 September
Krakow, Poland
XXI Technical Dam Control International Conference (TKZ2025)

8-12 September
Windhoek, Namibia
4^{th} African Regional IAEG Conference

16-17 September
Birmingham, UK
Earthworks 2025 Conference

17-20 September
Incheon, Korea
7^{th} International Symposium on Transportation Soil Engineering in Cold Regions (Transoilcold2025)

7-10 October
Goa, India
Geotech Asia 2025

15-18 October
Auckland, NZ
NZGS2025 Symposium

10-14 November
Perth, Australia
19^{th} Australasian tunnelling Conference (ATC2025)

26-28 November
Sydney, Australia
3^{rd} International Conference on Geomechanics and Geoenvironmental Engineering (iCGMGE)

27-29 November
Khaka, Bangladesh
15^{th} Asian Regional Conference IAEG

2026

28-30 January
Taguig, Phillippines
2026 Southeast Asian Geotechnical Conference

25-28 March
Beirut, Lebanon
Pan Mediterranean Geotechnical Engineering Conference

14-17 April
Ho Chi Minh City, Vietnam
8^{th} International Conference on Geotechnics, Civil Engineering and Structures

28-1 May
Queenstown, New Zealand
Landslide Geo-Education and Risk 2026 – JT1 & JTC3 Workshop

14-19 June
Vienna, Austria
21^{st} International Conference On Soil Mechanics and Geotechnical Engineering

6-10 August
Indore, India
12 International Symposium on Field Monitoring in Geomechanics 2026

24-26 August
Delft, Netherlands
International Conference on Advances and Innovations in Soft Soil Engineering

14-19 September
Skopje, North Macedonia
EUROCK 2026

31-5 November
Delft, The Netherlands
XV IAEG World Congress

16-18 September
Athens, Greece
LARMS2026 – X Latin American Congress on Rock Mechanics – an SRM Regional Symposium

13-16 October
Oslo, Norway
6^{th} International Conference on Information Technology in Geo-Engineering

22-26 November
Fukuoka, Japan
ARMS14 – 14th Asian Rock Mechanics Symposium – 2026 ISRM International Symposium

2027

12-14 May
International Symposium Cone Penetration Testing CPT'27

17-23 October
Seoul, Korea
16th ISRM International Congress on Rock Mechanics

2028

9-12 March
Chicago, USA
18^{th} Pan American Conference on Soil Mechanics & Geotechnical Engineering & Geo Congress 2028

2029

1-5 September
Southampton, UK
6^{th} International Conference on Transportation Geotechnics

LINKS ARE AVAILABLE FROM THE NZ GEOTECHNICAL SOCIETY WEBSITE WWW.NZGS.ORG