SIMSG ISSMGE

ISSMGE BULLETIN

VOL. 19 - ISSUE 4- DECEMBER 2025

Rehabilitating Luanda's pivotal Unicargas Terminal and other stories by our Leading Corporate Associates

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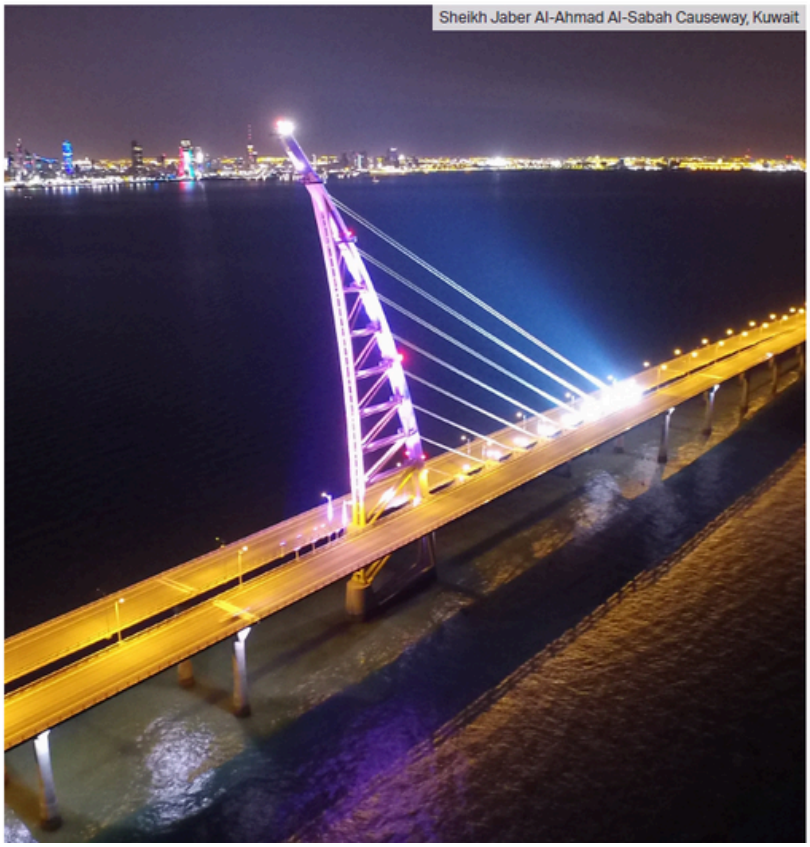
Dar Geotechnical Brochure


Sheikh Jaber Al-Ahmad Al-Sabah Causeway, Kuwait


Fairmont and Raffles Hotels, Qatar

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Editorial Board

Message from the Editor

Prof. Mona Badr
Editor-in-Chief
PI Committee Chairperson

Welcome to our new issue. We begin by acknowledging the delay in publishing this issue and sincerely thank you for your patience .

This closing issue of 2025 is rich with content that reflects the energy of our global community. The landmark 1st Geotech Asia Conference in Goa dominated the last quarter, bringing together major ISSMGE and FedIGS meetings alongside an outstanding technical programme. The ISSMGE ILAM Medal presentation to Prof. Kenji Ishihara in Tokyo was a deeply moving occasion — made all the more poignant by his passing just ten days later. This issue's In Memory section honours both Prof. Ishihara and Prof. Shamsher Prakash, two legends whose contributions to geotechnical engineering remain timeless.

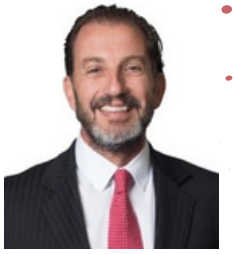
Across the bulletin's sections, readers will find a compelling mix of innovation and real-world impact: GIKEN's press-in piling technology rehabilitating levees in the Netherlands, Dar's comprehensive redesign of Angola's Unicargas Terminal, and society news from New Zealand, Argentina, and Russia-Kazakhstan. A special Disaster Report on the 2025 Myanmar Earthquake (Mw 7.7) delivers critical field observations on liquefaction, infrastructure failure, and lessons for regional seismic resilience.

On the events front, TC209's ISFOG 2025 in Nantes was a resounding success, TC105 launches an exciting new student video competition in 2026, and the countdown to 21st ICSMGE Vienna 2026 is well underway — with nominations for ISSMGE Awards now open.

We invite you to keep the Bulletin vibrant. Share your stories, your research, and your society's achievements with us at Bulletin@ISSMGE.org

From the BOARD

Report #8 by the President



Dear Colleagues,

I hope you all had a wonderful Holiday Season, a Merry Christmas and a Happy New Year !

I first like to apologize for the delay in publishing this bulletin issue and assume the responsibility. I promise to be on time with the next issues.

Presidential Activities in the Last Quarter of 2025

Oct-25	1	Meet the Kenya Geotechnical group to form a Geotech Society	(Virtual / Online)
	1	Prepare an opening speech for IGS Yearly Conference (India)	(Virtual / Online)
	6	7th FedIGS Board Meeting	Goa, India
	7	Meet again Kenya Geotechnical group to form a Geotech Society	(Virtual / Online)
	7	Opening address for 1st GEOTECH ASIA conference	Goa, India
	7	Keynote Lecture at the 1st GEOTECH ASIA conference	Goa, India
	8	Attending the Asian Council Meeting	Goa, India
	9	Attending the 1st Geotech Asia conference	Goa, India
	10	Panel Discussion at the 1st Geotech Asia conference	Goa, India
	11	17th ISSMGE Board Members & BLC Meeting	Goa, India
	14	Meeting HTC Team	(Virtual / Online)
	17	Meet Chad Geotechnical group to form a Geotech Society	(Virtual / Online)
	22	Meet Lebanese Minister of Environment	Beirut, Lebanon
	30	TOC meeting with TC Chairs	(Virtual / Online)
Nov-25	20	Meet Tunis Geotechnical Enginering Society	(Virtual / Online)
	24	Recording the 27th IITT Site Characterization - TC 102	(Virtual / Video)
	26	Meeting CAPG committee members	(Virtual / Online)
Dec-25	3	Recording the 28th IITT Forensic Geotechnical Eng'g - TC302	(Virtual / Video)
	13	Meet Uganda Geotechnical group to form a Geotech Society	(Virtual / Online)
	15	ILAM 2025 ceremony Prof. Ishihara in Tokyo Japan	(Virtual / Online)
	15	Meet President of AUB university	Beirut, Lebanon
	17	Meet Ely Akiki with Carole Farhat for PMGEC Gala Dinner	Antelias, Lebanon
	17	Recording the 29th IITT Geotech Infrastructures Megacities -TC305	(Virtual / Video)
	25	Merry Christmas Greetings Everyone	(Virtual / Video)

I like to start with the most important event in the last quarter of 2025: the 1st Geotech Asia conference in Goa !

Goa, was an event like no other in 2025 where, besides the technical program, and the amazing location, gala dinner andentertainment, there were 4 major meetings:

- FedIGS Board Meeting
- ISSMGE Board Meeting
- Asian Council Meeting
- Indian National Meeting

I can't but thank the Indian Geotechnical Society led by Dr. Anil Joseph, and the organizers of the event; Chapeau Bas.

Report #8 by the President

From the BOARD

Report #8
by the President

& so many Friends...

Report #8 by the President

Another highlight of this quarter was the ceremony in Tokyo for the presentation of the ILAM Medal to Prof. Kenji Ishihara. The ILAM Medal is truly among the most prestigious international awards, granted twice yearly since 2023.

I would like to extend my sincere gratitude to Prof. Albert Shou, ISSMGE Vice-President for Asia, for making the journey and personally presenting the medal to Prof. Ishihara. Although I attended the ceremony online and shared a few words, it was a deeply meaningful occasion.

Sadly, words cannot fully express the sorrow of losing Prof. Ishihara just ten days after this well-deserved recognition. A true legend in geotechnical engineering, he was admired and respected by the global engineering community

From the BOARD

Report #8 by the President

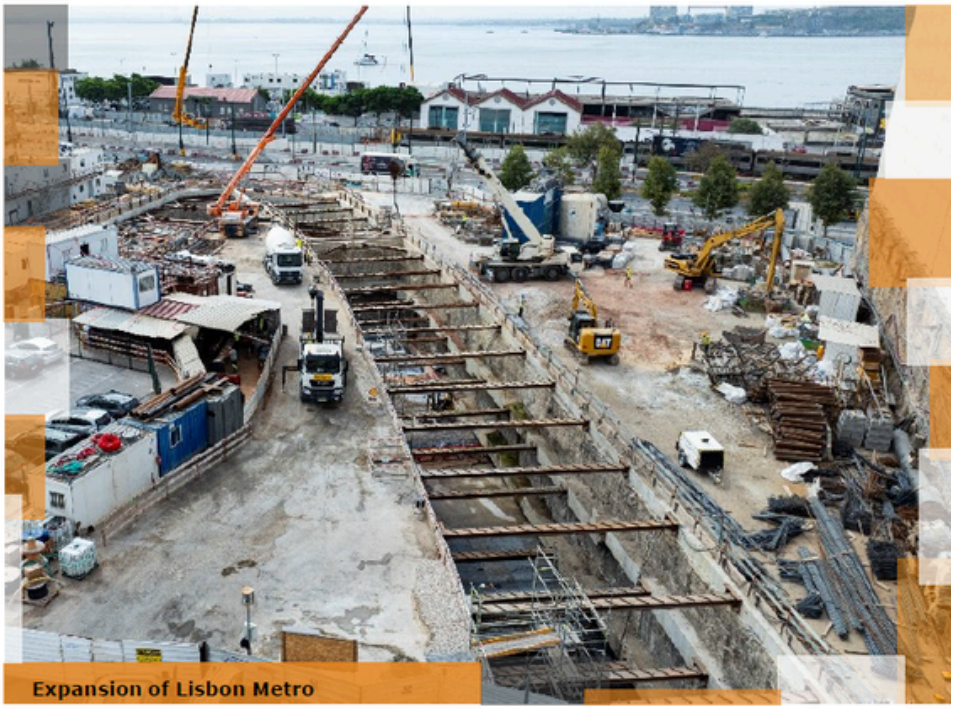
From the BOARD

Report #8 by the President

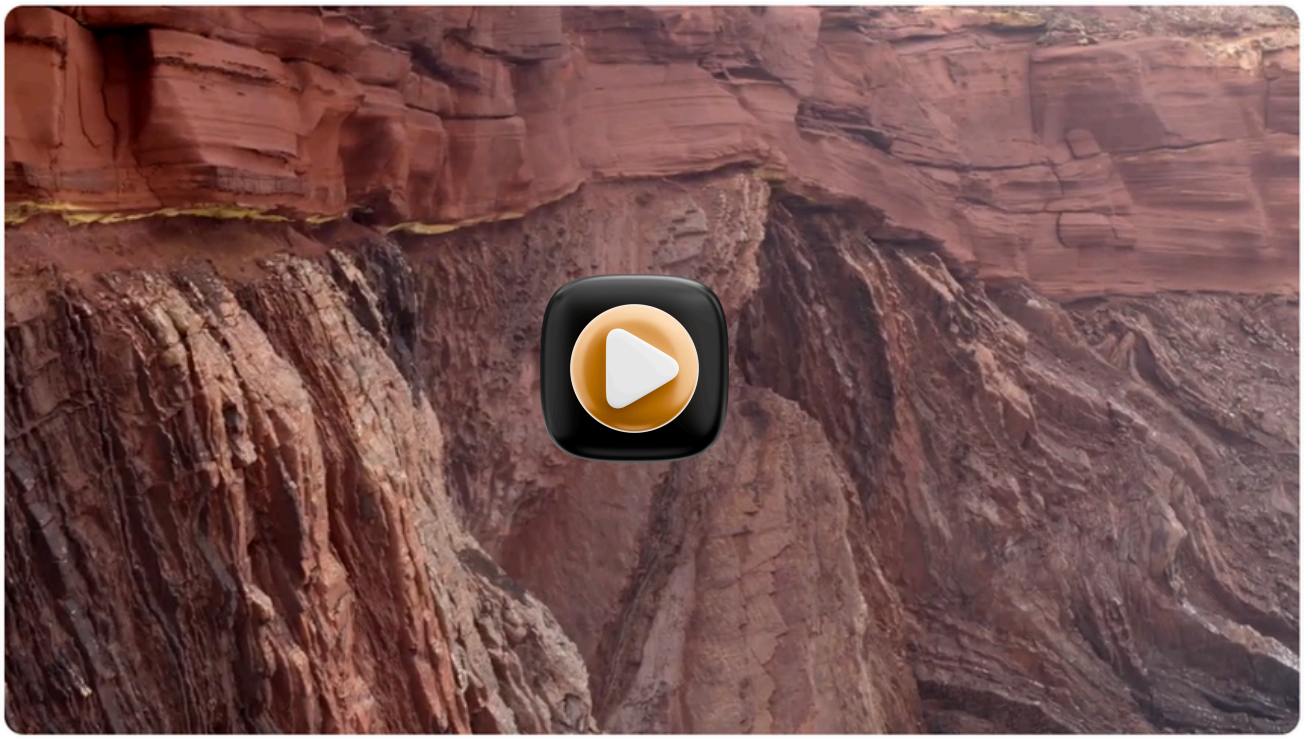
Can you believe we recorded three IITT episodes this quarter? We are truly delivering on our promise to cover the full breadth of geotechnical engineering sub-specialties, with invaluable support from the Technical Committees.

I would like to extend my sincere appreciation to the TOC, YMPG, and the entire IITT team for their outstanding efforts and the great work being accomplished.

Meet our Leading Corporate Associates



Expansion of Lisbon Metro



ISSMGE Highlights The Best in Geotechnical Engineering

- ISSMGE Outstanding Technical Committee Award
- ISSMGE Outstanding Geotechnical Project Award
- ISSMGE Outstanding Innovator Award
- ISSMGE Outstanding Member Society Award
- ISSMGE Outstanding Paper Published in the International Journal of GeoEngineering Case Histories Award
- ISSMGE Outstanding Public Relations Award
- ISSMGE Outstanding Young Geotechnical Engineer Award

Reinforcing River Levees Using Combined Walls Formed by Steel Sheet Piles and Tubular Piles: A Case Study of the KIJK Construction Project in the Netherlands.

Introduction

The KIJK levee reinforcement project, part of the Dutch Delta Programme, upgrades approximately 10 km of flood defenses along the Hollandsche IJssel River in Zuid-Holland. The levees protect a densely populated area in the Krimpenerwaard, making long-term reliability essential.

Many projects now require low-vibration, low-noise piling methods. Press-in Method of GIKEN has become a key solution and is now being used in one of the country's major levee reinforcement works.

Project Background

The existing earthen levee no longer meets current safety standards and is founded on soft Holocene soils, clay and peat, that pose stability and settlement challenges. The corridor is also highly constrained by nearby houses, utilities, and local roads, leaving little space for conventional construction methods.

Strict noise and vibration limits further restrict the use of conventional pilling methods such as impact driving. Additional environmental, groundwater, and permitting requirements add to the project complexity.

To overcome these constraints, the project employs a combined wall of tubular steel piles and double Z-shaped sheet piles installed with low-noise, low-vibration technologies based on "press-in" piling machines (Gyropress Method™ and Press-in Method). This approach provides a robust solution suited to the soft ground conditions while allowing safe construction within the limited and sensitive project environment

Figure 1. River levee lined by residences

Figure 2. Location (Source: OpenStreetMap)

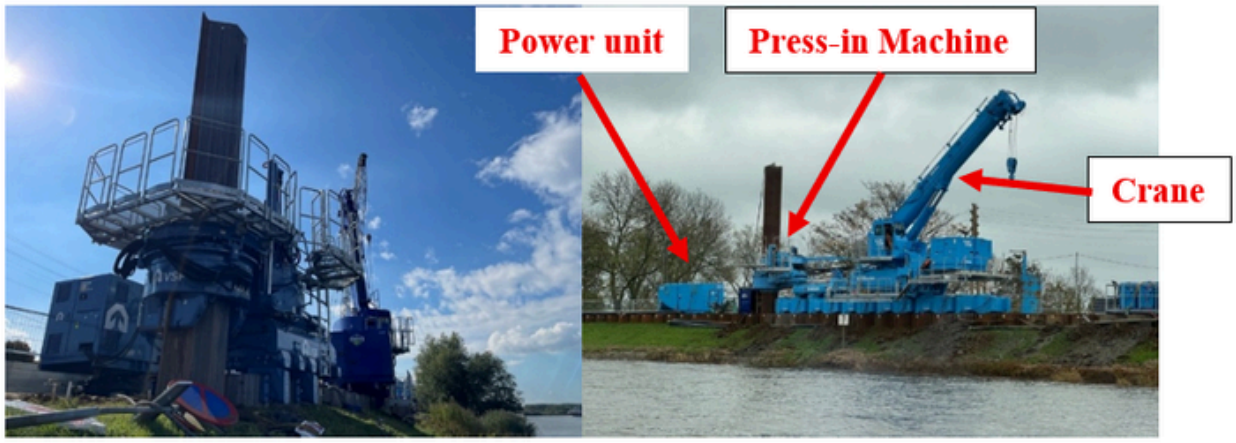
Reinforcing River Levees Using Combined Walls Formed by Steel Sheet Piles and Tubular Piles: A Case Study of the KIJK Construction Project in the Netherlands.

Technology Overview

Two machines are used in the project: the **SILENT PILER™** (Figure 3a), a hydraulic press-in/extraction system for sheet piles, enables quiet, controlled installation and removal in urban and ecologically sensitive areas; and the **GYRO PILER™** (Figure 3b), a rotary cutting press-in system for tubular steel piles, penetrates dense soils efficiently while controlling vibration.

The **combined wall system** integrates tubular piles and interlocking Z-sheet piles. Tubular piles provide primary vertical and lateral support, while sheet piles add lateral confinement, forming a continuous wall and stopping water. This hybrid design enhances stiffness, reduces deformation under hydraulic loads, and ensures long-term flood resilience.

In addition, the piling system saving temporary works (GRB System™) was adopted (Figure 3b). In the GRB System, all the devices (press-in machine, power unit, crane, and pile transporter) are positioned and move forward or backward on the previously installed pile wall. This allows press-in piling work in spatially restricted areas, such as narrow spaces, on slopes, and above water.



a. SILENT PILER for sheet piles b. GYRO PILER for tubular piles

Figure 3. Press-in pilling method, the GRB System (GIKEN Reaction Base System)

Construction Process

The construction sequence began with the installation of the Z-shaped sheet piles using the **SILENT PILER** hydraulic press-in machine. The sheet piles were pressed to their design depth while continuous monitoring ensured proper interlock engagement, verticality, and minimal lateral soil displacement.

Following completion of the sheet pile wall, tubular steel piles were installed on the landward side using the **GYRO PILER** rotary cutting press-in machine.

The roadway was divided into two sections: one for construction and one kept open to traffic (see Figure 4a). This demonstrates the advantage of the Press-in Method of GIKEN, which allows safe and efficient work in very narrow spaces (Figure 4b).

Reinforcing River Levees Using Combined Walls Formed by Steel Sheet Piles and Tubular Piles: A Case Study of the KIJK Construction Project in the Netherlands.

a. Overview of jobsite b. pilling in a narrow space

Figure 4. Site overview and construction process

Global News from Member Societies

New Zealand Geotechnical Society (NZGS)

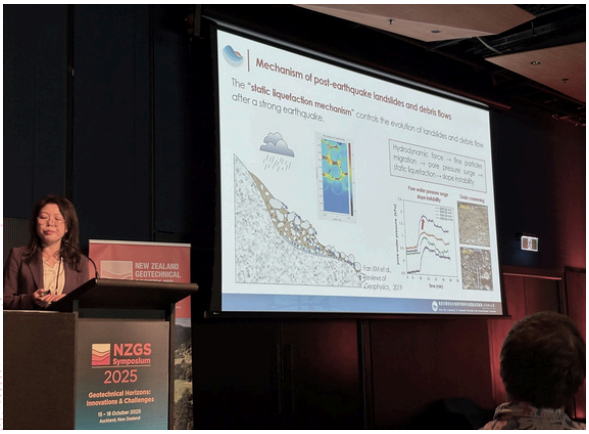
NZGS 2025 Symposium – Geotechnical Horizons: Innovations & Challenges

The New Zealand Geotechnical Society (NZGS) proudly hosted its 22nd NZGS Symposium, "Geotechnical Horizons: Innovations & Challenges", at Auckland's Aotea Centre from 15–18 October 2025. The event brought together more than 500 professionals from across New Zealand and abroad for four days of workshops, technical sessions, and field experiences that reflected the creativity and resilience of the geotechnical community.

The symposium opened with a series of workshops covering topics such as Earthworks: Theory to Practice, Slope Stability in Practice, and In-Situ Testing, delivering immersive, practical learning opportunities for over 100 participants. The main technical programme featured keynote lectures by leading experts, including Prof. Xuanmei Fan (Chengdu University of Technology, China) on cascading hazards, Prof. Kyle Rollins (Brigham Young University, USA) on full-scale liquefaction testing, Prof. Jan Evans-Freeman (University of Canterbury, NZ) on sustainability, and Dr. Burt Look (AGTRE, Australia) on managing engineering uncertainty.

Panel sessions explored the interface between landslide risk management, regulatory frameworks, and seismic design, while the NZ ShakeOut earthquake drill provided a timely reminder of the ever-present seismic challenges faced by Aotearoa. The event concluded with field trips focused on Auckland's volcanic and landslide-prone terrain, highlighting lessons from recent storm-induced slope failures and showcasing the city's ongoing resilience initiatives.

The Symposium Gala Dinner celebrated professional excellence, including the presentation of the 2025 NZGS Geomechanics Lecture Award to Prof. Rolando Orense, as well as recognition for outstanding research and student papers. The event reaffirmed the New Zealand geotechnical community's enduring commitment to collaboration, innovation, and public safety.



Keynote: Prof. Dr. Fan's presentation on Earthquake- and Climate Change-Induced Cascading Hazards: Mechanism and Prediction

Keynote: Prof. Rollins' presentation on Liquefaction-Induced Downdrag and Dragload from Full-Scale Blast Liquefaction Testing

Global News from Member Societies

New Zealand Geotechnical Society (NZGS)

NZGS 2025 Symposium – Geotechnical Horizons: Innovations & Challenges

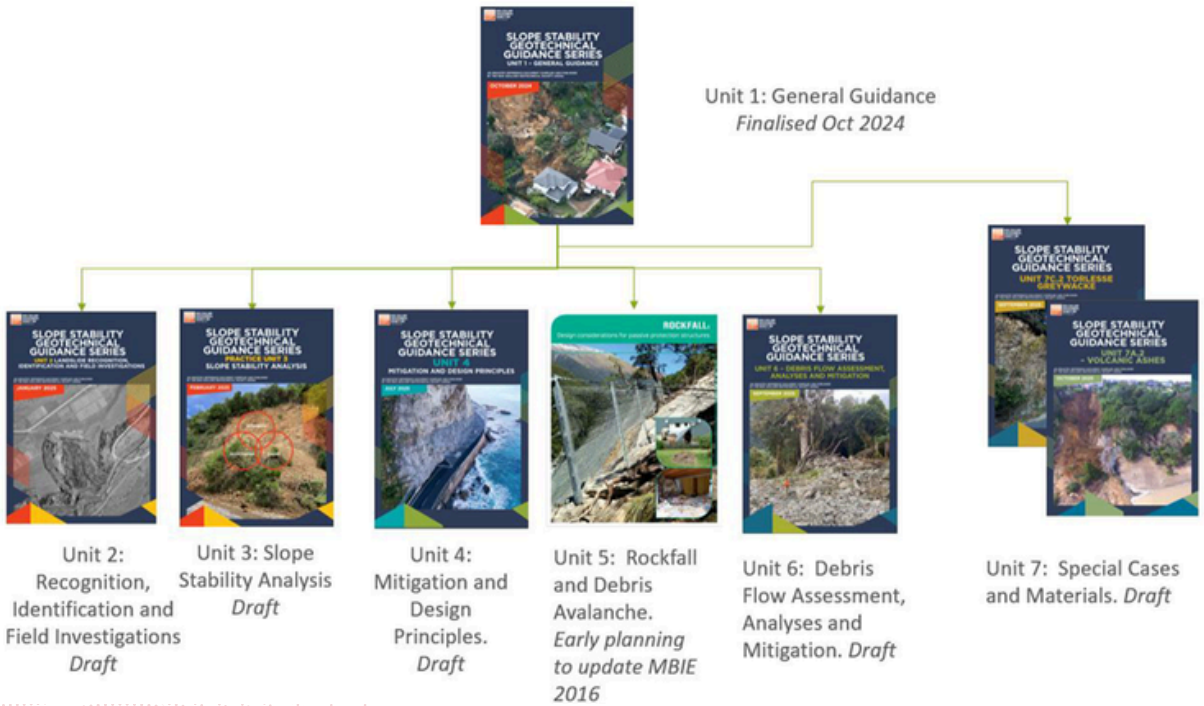
Keynote: Dr Look's presentation on Managing Engineering Uncertainty

Prof. Orense, 2025 NZGS Geomechanics Lecture Award, and K. Azul from the University of Auckland, Best Student Paper

Advancing Slope Stability Guidance

Over the past few years, the New Zealand Geotechnical Society (NZGS) has been developing the national Slope Stability Guidance Project, which aims to deliver nationally consistent, best-practice resources for practitioners dealing with landslides and slope instability in challenging terrain.

The project's multi-unit framework comprises seven guidance documents — all of which are now released to NZGS members for comments and application. These documents incorporate modern approaches, such as probabilistic analysis, limit equilibrium methods, and sustainable design practices.



New Zealand Geotechnical Society (NZGS)

NZGS 2025 Symposium – Geotechnical Horizons: Innovations & Challenges

International interest in the series continues to grow. Feedback received at EUROCK2025 in Norway and collaboration discussions with the Peruvian Geotechnical Society for a Spanish translation of Unit1 highlight its global relevance.

Upcoming Events

Landslide Risk & Geo-Education International Workshop - https://landsliderisk.nz/
27 April – 3 May 2026 | Queenstown, New Zealand – REGISTRATION OPEN

New Zealand invites you to a landmark international event – the **1st International Joint Workshop of Joint Technical Committee 1 and Joint Technical Committee 3**.
The theme, *"Landslide Risk & Geo-Education"*, unifies the full lifecycle of landslide risk management, from risk assessment to communication and education. The workshop will bring together global leaders to share advances, develop best-practice guidelines, and strengthen collaboration between research, practice, and education.

Hosting this event in Queenstown — New Zealand's natural classroom for landslide risk management — underscores a national commitment to integrating science, policy, and community engagement in hazard resilience.

EARLY NOTICE: NZGS is pleased to announce that the next **Australasia Regional Conference will be held in Christchurch in April 2028.**

Global News from Member Societies

Argentine Society of Geotechnical Engineering (SAIG)

Prof. Virginia Sosa
President of (SAIG)

The Argentine Society of Geotechnical Engineering (SAIG) is a non-profit association that maintains the spirit of a small group of founders who, for more than 75 years, have promoted the development and dissemination of knowledge of Soil Mechanics, Rock Mechanics and Geotechnical Engineering in the Argentine Republic. SAIG is an active participant in the activities of the International Society for Soil Mechanics and Geotechnical Engineering (ISSMGE) and the International Society for Rock Mechanics (ISRM). Furthermore, the organisation participates in international technical committees and undertakes various activities that contribute to the dissemination and advancement of geotechnical engineering in the Argentine Republic. Since 1968, it has been responsible for the organisation and sponsorship of meetings, seminars, conferences and congresses, the purpose of which has been to create spaces for professional discussion and the promotion of best practices in the construction of national works.

The consolidation of national congresses

Successive editions of the Argentine Congress of Soil Mechanics and Geotechnical Engineering (CAMSIG) have become benchmark events for geotechnical engineering in Argentina and the wider region. The primary objectives of these congresses are as follows: to facilitate exchange between the academic community, professionals and entrepreneurs; to present technological advances and recent research on land exploration and geotechnical issues; to promote cooperation between companies, universities and organisation, contributing to local, national and regional development.

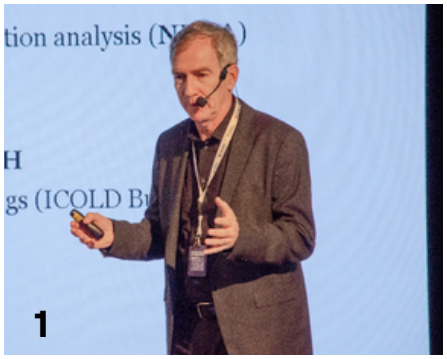
Argentine Society of Geotechnical Engineering (SAIG)

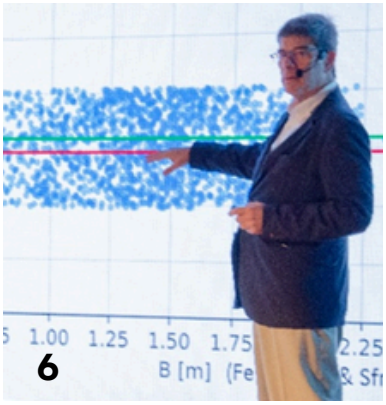
Keynote and Thematic Lectures

A pivotal component of the XXVII CAMSIG was constituted by keynote lectures and thematic conferences delivered by preeminent specialists in the field. The keynote lectures afforded participants

the opportunity to hear from both international and national experts, who shared their expertise and experience in geotechnical engineering. The distinguished keynote speakers in attendance were Professor Oscar Vardé (Argentina), Professor Fernando Schnaid (Brazil), Professor Nilo Consoli (Brazil) and Professor Jorge Zornberg (United States-Argentina). Each of these individuals addressed pivotal and contemporary aspects of the discipline, thereby enriching the debate and providing participants with technical updates.

Furthermore, the event comprised thematic lectures by Professor Alejo Sfriso, Professor Dante Bosch, and Professor Clara Mozejko. These experts explored subjects pertinent to the geotechnical community, offering particular viewpoints and research findings that augmented the conference's academic programme.





1. **Ph.D Fernando Shnaid**
2. **Ing. Oscar Vardé**
3. **Ph. D. Jorge Zornberg**
4. **Ph. D. Nilo Consoli**
5. **Dra. Ing. Clara Mozejko**
6. **Dr. Ing. Alejo Sfriso**
7. **Mg. Ing. Dante Bosch**

Global News from Member Societies

Argentine Society of Geotechnical Engineering (SAIG)

Pre-conference activity

Short course: 'Geosynthetics in Road Design'
A half-day specialised course on geosynthetics in road construction was delivered by Professor Jorge Zornberg, with 91 participants. The course covered the applications, properties, and design methodologies of geosynthetics in road construction, including practical case studies pertinent to the sector.

Post-conference activities

In the course of the extension of SAIG's free programme, two workshops were organised at the Faculty of Engineering at the University of New England (UNNE), with a view to specific audiences.The following activities are offered by the PROGEO Network for geotechnical engineering teachers at universities in the Argentine Republic (established in 2012) and the recently formed TECGEO Network for geotechnical technicians and laboratory technicians. The two workshops had a positive impact on training, the exchange of experiences and the creation of collaborative networks, thus contributing to the continuous improvement of geotechnical engineering in Argentina.

7th PROGEO Workshop for Geotechnical Engineering Teachers

Topic: The following paper will examine the organisation, production and dissemination of multimedia resources for geotechnical testing.
This workshop represents a continuation of the collaborative endeavours initiated in 2012 between educators and SAIG. The workshop was organised by two general coordinators of the PROGEO network, namely Professors Virginia Sosa and Diego Manzanal, who have been promoting the network since its inception. The workshop was designed as a hybrid event, addressing the topic of 'Organisation, Production and Dissemination of Multimedia Resources for Geotechnical Testing'. The event commenced with an introduction to the subject by experts in the field. A total of 45 university professors participated in the hybrid format, developing resources and sharing experiences for innovation in teaching and research.

Argentine Society of Geotechnical Engineering (SAIG)

1st TECGEO Workshop for Geotechnical Testing Technicians

Topic: The following paper will set out the procedures for identifying and stabilising dispersive soils. This event marks the inauguration of the Network of Geotechnical Technicians of the Argentine Republic, a collaborative initiative aimed at establishing a forum for knowledge exchange and professional collaboration. The primary objective of this network is to enhance and reinforce the technical aspects of geotechnical studies, with a particular focus on promoting continuous professional development to ensure the integrity and reliability of testing methodologies. The event was organised by the general coordinator of the TECGEO network, Professor Jirina Tirner. The workshop was held at the Laboratory of the Department of Applied Geosciences of the Faculty of Engineering of the UNNE. A total of 44 technicians and laboratory staff participated in the study, conducting laboratory experiments with samples of natural and treated soil. Participants subsequently subsequently digitised the results and prepared technical reports

Conclusion

The 27th Conference of the Argentine Geotechnical Society (CAMSIG) represented a new momentum for the Argentine geotechnical community. The conference served to consolidate the federalisation of knowledge, professional excellence and inter-institutional cooperation. The active involvement of companies, institutions and professionals, in conjunction with the establishment of new networks, indicates a favourable future for the discipline and its challenges in the country.

THE RUSSIAN-KAZAKHSTAN RESEARCH SEMINAR

WITH INTERNATIONAL PARTICIPATION (THE THIRD FADEEV CONFERENCE)

The Russian-Kazakhstan Research Seminar with international participation "THE EXPERIENCE OF NUMERICAL METHODS IN GEOTECHNICS" was held on December 8, 2025, in St. Petersburg on the 18th floor of "Azimut" hotel (the conference hall provides a magnificent view of the city). It commemorated professor A. B. Fadeev, an outstanding scholar and geotechnical engineer. The subtitle of the seminar was the "Third Fadeev Conference".

The seminar was organized by the Russian Society for Soil Mechanics, Geotechnics and Foundation Engineering, the Kazakhstan Geotechnical Society, ISSMGE Committee TC305 "Megacities", and the Georeconstruction Institute.

Alexander Fadeev was the first in the Soviet Union and then the Russian Federation to apply numerical methods to solve geotechnical problems. The software "Geomechanics" developed under his supervision was the first national tool for numerically analyzing soils and foundations. Professor Fadeev's students have subsequently become leading experts in computational geomechanics both in Russia and abroad.


A. B. Fadeev

The conference generated keen interest in the professional society. The hall accommodated 150 seats and there was no spare room for most of the event. The majority was the attendees were Bachelor, Master and PhD students, as well as young experts working in computational geomechanics. This level of attendance was perhaps the best evidence of viability of the ideas of Professor A. B. Fadeev

THE RUSSIAN-KAZAKHSTAN RESEARCH SEMINAR

WITH INTERNATIONAL PARTICIPATION (THE THIRD FADEEV CONFERENCE)

The conference was opened by Professor A. Zhussupbekov (L.N. Gumilyov Eurasian National University, Astana, Kazakhstan), Professor A. G. Shashkin (Russian Society for Soil Mechanics, Geotechnics and Foundation Engineering Board member, the director general of "Georeconstruction" Institute), and Dr. Kh. Z. Bakenov (honorary member of Kazakhstan Geotechnical Society), who spoke of A. B. Fadeev as their teacher.

Zhussupbekov (left) and Kh. Z. Bakenov (right)

The invited keynote lecture was delivered was by Professor Victor N. Kaliakin, a leading expert in the field of computational geomechanics and constitutive modeling from University of Delaware (USA). This lecture was divided into two 90-minute presentations titled "Rate Independent Elastoplasticity - A Synthesis" and "Generalized Florin/Biot Formulation - A Framework for Numerical Implementation". This represented a logical continuation of the tradition of conducting international conferences and inviting outstanding international experts started by Professor A. B. Fadeev. Lecturing in both Russian and English, Professor Kaliakin shared with the audience his assessment of tools for creating finite element models, as well as the advantages and disadvantages of different types of mixed finite elements suitable for modeling and analyzing saturated soils.

V. N. Kaliakin (left) and K. G. Shahskin (right)

THE RUSSIAN-KAZAKHSTAN RESEARCH SEMINAR

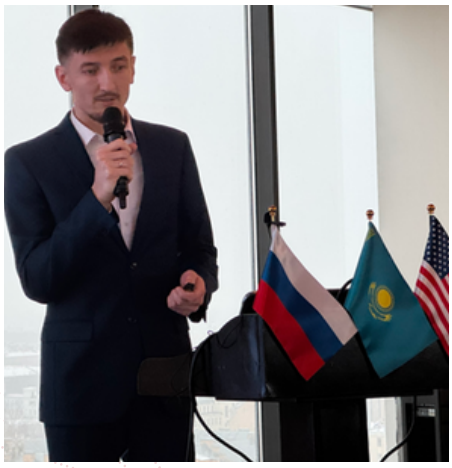
WITH INTERNATIONAL PARTICIPATION (THE THIRD FADEEV CONFERENCE)

K. G. Shahskin ("Georeconstruction" Institute, St. Petersburg, Russia) then gave the lecture titled "Physical basics of deformation hardening at shape-changing strains", which was based on using statistics to model the behavior of soils.

A group of authors including Professor V. N. Paramonov, Professor I. I. Sakharov ("Georeconstruction" Institute) and Professor S. A. Kudryavtsev (Far Eastern State Transport University, Khabarovsk, Russia) next spoke of solving problems of freezing and thawing of soils with a help of the finite element method.

Professor V. N. Paramonov (left) and professor I. I. Sakharov asking a question (right)

The representatives of R&D Enterprise "NIP-Informatika" (St. Petersburg, Russia) then shared the results of development of a national geotechnical computer program. S. A. Voronkov discussed the implementation of contact elements in unmatched grids of finite elements. E. V. Fedorenko next spoke of problems of application of the finite element method in design practice.



S. A. Voronkov (left) and E. V. Fedorenko (right)

THE RUSSIAN-KAZAKHSTAN RESEARCH SEMINAR

WITH INTERNATIONAL PARTICIPATION (THE THIRD FADEEV CONFERENCE)

V. A. Vasenin ("Georeconstruction" Institute) next presented the results of long-term observations of settlements of buildings in St. Petersburg measured for 30-150 years. He paid special attention to the issue of reconstruction of a compressive curve in order to define preconsolidation pressure. The speaker proposed a method of assessment of natural lateral soil pressure and the method of engineering calculation of non-linear settlements of buildings and structures.

P. G. Dolgov (Geotechfem LLC, Dubai, UAE) shared the experience of numerical modeling of stress-strain behavior of stone columns (crushed stone piles) bored in soil.

V.A.Vasenin (left) and P. G. Dolgov (right)

N.T. Alibekova delivered a presentation prepared by a group of researchers from L.N. Gumilyov Eurasian National University (Astana, Kazakhstan) headed by Professor A. Zhussupbekov devoted to creation of a geoinformation database to design foundations in the Republic of Kazakhstan.

V. M. Polunin (St. Petersburg State University of Architecture and Civil Engineering, St. Petersburg, Russia) stipulated on continuation of the tradition of developing geotechnical software at the university which was initiated by Professor A. B. Fadeev, as well as on particularities of teaching students the basics of non-linear numerical calculations

N. T. Alibekova (left) and V. M. Polunin (right)

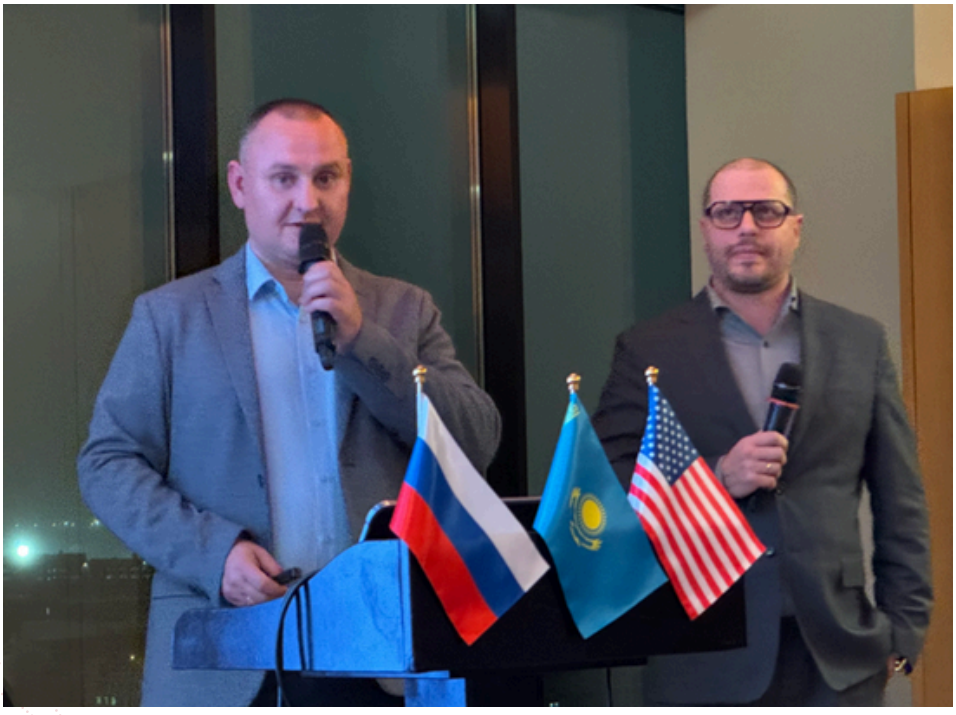
THE RUSSIAN-KAZAKHSTAN RESEARCH SEMINAR

WITH INTERNATIONAL PARTICIPATION (THE THIRD FADEEV CONFERENCE)

This topic was continued by PhD students of the Chair of Geotechnics (St. Petersburg State University of Architecture and Civil Engineering). D. A. Paskacheva spoke of the problems of making an elasto-plastic model of soil behavior under plane strain conditions. D. S. Korablev then described the numerical solution of the problem of distribution of temperature fields in soils.

D. A. Paskacheva (left) and D. S. Korablev (right)

I. I. Dementiy (SK "Raidex", LLC, Russia) and A. I. Korpach (N.M.Gersevanov Research Institute of Bases and Underground Structures, Moscow, Russia) shared their experiences of designing soil strengthening and implementation using the technology of continuous hollow auger for seismic conditions in Almaty, Kazakhstan.



A. I. Korpach (left) and I. I. Dementiy (right)

THE RUSSIAN-KAZAKHSTAN RESEARCH SEMINAR

WITH INTERNATIONAL PARTICIPATION (THE THIRD FADEEV CONFERENCE)

I. P. Diakonov (Graduate School of Management, St. Petersburg State University, St. Petersburg, Russia) next delivered a report touching the acute problem of financing underground development of historical cities.

Talal Awwad (Damascus University, Syria) made a presentation focusing on parametric numerical research on a role of soil viscosity in the development of negative lateral skin friction of pile.

P. Diakonov (left) and Talal Awwad (right)

Next was presented the recorded lecture of Dr. Yoshinori Iwasaki (Iwasaki Geo Engineering Office, Japan) regarding the features of the artificial base of the Bayon Temple in Angkor (Cambodia) constructed as a thick sand mound.

The conference concluded with a virtual technical tour of St. Petersburg which was facilitated by the panoramic windows of the conference hall located on the 18th floor. Professor A. G. Shashkin, who acted as the guide, focused on the history of construction and development of strains in St. Petersburg's largest Russian orthodox church – St. Isaac's cathedral.

A special excursion and technical tour to the General Staff Building and the Main Building of the State Hermitage (St. Petersburg) and Catherine Palace in Pushkin was organized for foreign guests of the seminar. Some guests also attended the performance of the ballet "Nutcracker" in the historic Mariinsky Theatre.

The seminar Organizing Committee acknowledges, with gratitude, the support of the sponsors of the seminar, namely the Russian companies "Geostroi", "Georeconstruction", NIP-Informatika, "Raidex", and the Kazakh company KGS, Ltd.

A. G. Shashkin

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Rehabilitating Luanda's pivotal Unicargas Terminal

Dr. Mohamed Mansour
Associate Principal Engineer
Geotechnical & Heavy Civil Engineering
Dar - Sidara Company

One of the world's most prominent and reputable port operators, Abu Dhabi Ports is investing significantly in the rehabilitation, development, upgrade, and enhancement of the Unicargas Terminal. This existing terminal is a lynchpin component of the Port of Luanda, Angola's critical port and logistics centre, which serves as a major gateway not only to Angola but also to Central and West Africa and as one of the most significant trade pathways towards landlocked African countries.

Working with Abu Dhabi Ports as well as port stakeholders in Angola, Dar conducted on-site condition assessments, prepared a master plan, and delivered building and port infrastructure designs

to ensure that this terminal can compete globally, contribute to sustainable development and economic growth in Angola, and deliver exceptional value to the Angolan people.

A critical port and logisticshub for Angola and Africa

Located on the West African Coast, the Port of Luanda is Angola's primary seaport and most critical logistics hub – playing an essential role in the national domesticeconomy and handlingthe majority of the nation's container and general cargo volumes. The port functions as a large public corporation with autonomy over its administrative, financial, and property operations. Positioned in the centre of Angola's most populous and economically active region, it enables efficient cargo transfer to inland areas via an extensive rail and highway network. As such, it also serves as a major transshipment hub for Central-West Africa, facilitating maritime trade access for landlocked countries such as the Democratic Republic of Congo and Zambia. The port is strategically poised to accommodate projected growth in container traffic, which is expected to rise significantly over the next decade. To do so effectively, however, the Port of Luanda is seeking to develop, enhance, and upgrade existing assets to enhance the port's ability to capture trade movements and attract more opportunities. And most prominent among those is the Unicargas Terminal, a critical component of the Port of Luanda, which is undergoing significant development.

Meet our Leading Corporate Associates

Rehabilitating Luanda's pivotal Unicargas Terminal

1

Figure 1 The Port of Luanda is strategically located on the West African Coast and in the centre of Angola's most populous and economically active region.

A world-renowned port operator, with a vision for enhancingglobal connectivity

Enter Abu Dhabi Ports, one of the world's most reputable port operators. Its Ports Cluster, a division of AD Ports Group, owns and manages 10 ports and terminals that drive trade, build capacity, and connect Abu Dhabi to global markets. This cluster emphasises sustainable growth and builds partnerships with major local and international market leaders, including ADNOC, COSCO SHIPPING Ports, CMA CGM Group, MSC Shipping, and Autoterminal Barcelona. Their goal is to diversify and expand capacity to meet the evolving demands of customers while firmly establishing Abu Dhabi as a premier global trade and logistics hub.

In line with this mission, AD Ports Group is supporting an ambitious venture to modernise the Unicargas Terminal and enhance logistics within the terminal, over the next three years.

To deliver this ambitious vision, AD Ports engaged Dar to perform a comprehensive condition assessment for the port's existing facilities and operations. Building on that assessment, Dar would then develop a new master plan and FEED design for the project facilities as well as prepare the tender documents for selecting a design-and-build contractor for the new offshore quay wall and the onshore yard works at the Unicargas

Terminal. Additionally, Dar was tasked with assessing and developing a concept design for the rehabilitation of an adjacent site, known as the "Temporary Yard," which will serve as an interim facility until the main terminal at Unicargas is fully operational.

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Rehabilitating Luanda's pivotal Unicargas Terminal

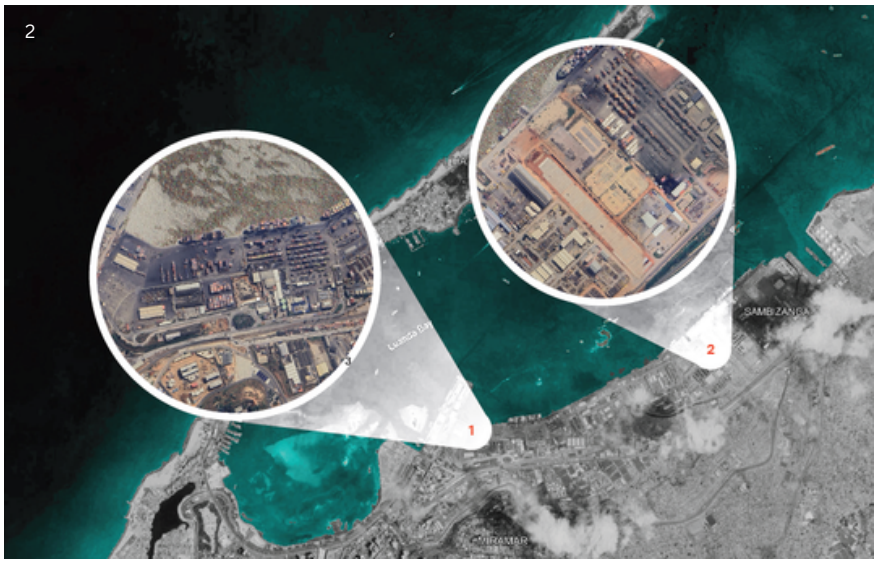

Figure 2 The locations of the Unicargas Terminal (1) and the Temporary Yard (2) within the Port of Angola

Figure 3 Satellite imagery of the Unicargas Terminal and Temporary Yard.

From the outset, Dar aimed to deliver designs that align with stakeholder goals and meet the Abu Dhabi Ports' financial, operational, and technical criteria by addressing the current operational limitations, through several strategies

- Value Engineering: Minimising CAPEX and leveraging existing conditions while ensuring compliance with international port standards.
- Operational Efficiency: Establishing a consistently high-quality and effective
- operational framework.
- Container Yard Optimisation: Expanding container yard space to gain additional ground slots and increase annual TEU capacity.
- RoRo and General Cargo Optimisation: Enhancing the layout and functionality of RoRo and general cargo terminals.
- Sufficient Facilities and Infrastructure: Delivering buildings and infrastructure that fully support operational needs

Assessing current port conditions and facilities

Dar's team began with a comprehensive and meticulous facilities condition assessment for the Terminal and the adjacent sites. The current berthing facilities at the port include a container berth and a general cargo/Ro-Ro berth, primarily serving smaller feeder to medium-sized container vessels, RoRo vessels such as car carriers, and bulk vessels such as the Supramax and Handymax.

Dar's condition assessment identified several shortcomings hampering the growth of the Unicargas Terminal. The existing quay wall is insufficient for accommodating
larger vessels, and the infrastructure requires upgraded design in line with international standards. Terminal pavements are currently inadequate to support heavier equipment loads, and the existing equipment limits the throughput capacity of the multipurpose terminal. Additionally, the infrastructure is in poor condition; light poles do not provide sufficient illumination for multipurpose operations, buildings are not fit for full operational capacity, and internal infrastructure lacks necessary signage for efficient operation.

Rehabilitating Luanda's pivotal Unicargas Terminal

Figure 4 The port's existing components.

Figure 5 The project's limits, berths, and yard zones.

Based on the assessment, the Unicargas terminal design works were segmented into two main zones:

- **The Operational Zone** encompasses the apron where activities between the ship and the Container Terminal and the General Cargoand RoRo Terminals occur, as well as the Container StackingAreas, General CargoArea, and RoRo Area.
- **The Landside Facilities Zone** includes the access control gate, customs inspection shed, administration and welfare buildings, machinery workshop, and other buildings and infrastructure components.

Rehabilitating Luanda's pivotal Unicargas Terminal

Figure 6 The Container Berth Zone.

Figure 7 The General Cargo Berth Zone

Figure 8 The RoRo Berth Zone.

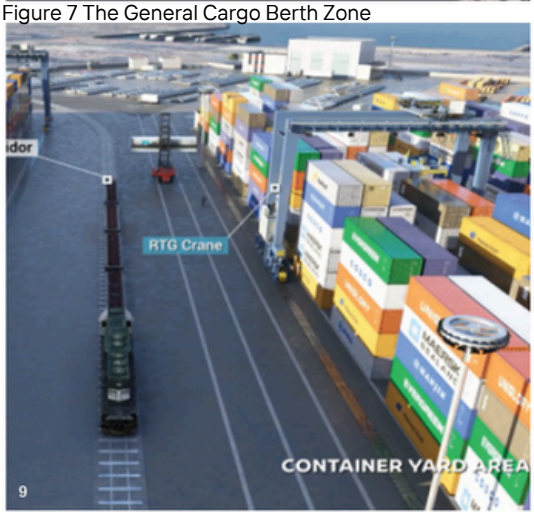

Figure 9 The existing railway and container stacking area.

Designing the rehabilitation and upgrade of a critical terminal

From the outset, Dar's main priority was to bring the project's ambitious vision to life by developing a comprehensive design that fulfilled client expectations and carefully catered to needs of the future operator. This approach centred on creating a feasible, constructible, and robust structural system capable of withstanding the diverse loads and conditions anticipated throughout its lifecycle.

Developing the master plan

Dar reviewed and enhanced the project's master plan through a feasibility study aimed at identifying the development requirements needed to extend the project's lifespan by 50 years. The updated master plan was developed in line with the port's evolving needs and focused on improving current conditions. Based on this framework, the team established the project's technical and financial parameters, defined optimal quay wall lengths and utilisation patterns, specified the types and sizes of vessels to be served, and outlined the layout and functions of the yard's facilities.

The STS cranes,RTGs, trucks, and light poleswere all carefully positioned to ensure unobstructed circulation for both trucks and RTGs. Additionally, the reach stackers' operational needs were met by providing the sufficient clearance area

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Meticulous and comprehensive site survey works

To provide a better understanding of the site conditions and its context, Dar's specialists conducted site assessments and investigations, including bathymetric and topographic surveys, data collection efforts, and condition assessments for the existing facilities. These assessments comprised an onshore condition assessment for the onshore facilities and an underwater condition assessment for the existing quay wall and scour protection.

Dar's specialists also designed a comprehensive geotechnical site investigation program to assess soil stratigraphy, study subsurface conditions, and gather key data on the soil's physical and mechanical properties essential for the design. This program involved borehole drilling along with the associated in-situ and laboratory testing to assess the geotechnical conditions, as well as the necessary CBR tests to assess the existing pavement conditions.

A Dynamic Mooring Analysis (DMA) was also carried out, considering various scenarios to reflect real berthing conditions, including the expected spacing between quay wall bollards and fenders. The analysis results

- covering both operational and extreme conditions
- confirmed the robustness of the design Dar's team was preparing, providing assurance that operations can proceed without restrictions for the designated vessels.

Meanwhile, other consultants engaged by Abu Dhabi Ports conducted essential environmental studies as part of a comprehensive environmental impact assessment. These evaluations were crucial, aligning with Dar's commitment to delivering services responsibly and sustainably by minimising disruptions to marine life and reducing any potential long-term environmental impacts from construction to the absolute minimum.

Designing an economical quay wall

To leverage cutting-edge technologies and industry best practices observed in recent global port developments,

Dar's experts evaluated and proposed various quay wall designs. These designs considered local factors such as stakeholder requirements, budget constraints,

value engineering principles, challenging soil conditions, time limitations, and constructability. However,one of the most significant major challenges that faced the design team during the design of the new quay was

the presence of an existing quay wall with unknown parameters, which necessitated extensive consideration of the limits and the conditions of the existing quay wall, which itself is formed of buried caissons.

Based on the findings from the study, the Dar team determined that the optimal solution involvesconstructing a front diaphragm wall in front of the existingquay wall (caissons). This diaphragm wall will be anchored with tie rods to a rear dead-man (pile) and will include intermediate piles to support the rear STS crane load.

Rehabilitating Luanda's pivotal Unicargas Terminal

Designing an economical quay wall, Cont.

During the design phase, comprehensive analyses were performed using advanced numerical modelling to simulate the intricate soil-structure interactions. These analyses enabled the designers to evaluate the quay wall's performance under various loading conditions, incorporating complex soil and concrete constitutive
models and parameters that accurately represented the quay wall's actual dimensions. The modelling also took into account factors such as soil-structure behaviour, construction stages, load cases, tidal influences, and challenging geometries and boundary conditions.
Various load combinations and seismic effects were considered to ensure the design adhered to the latest international and local standards while meeting both strength and serviceability requirements

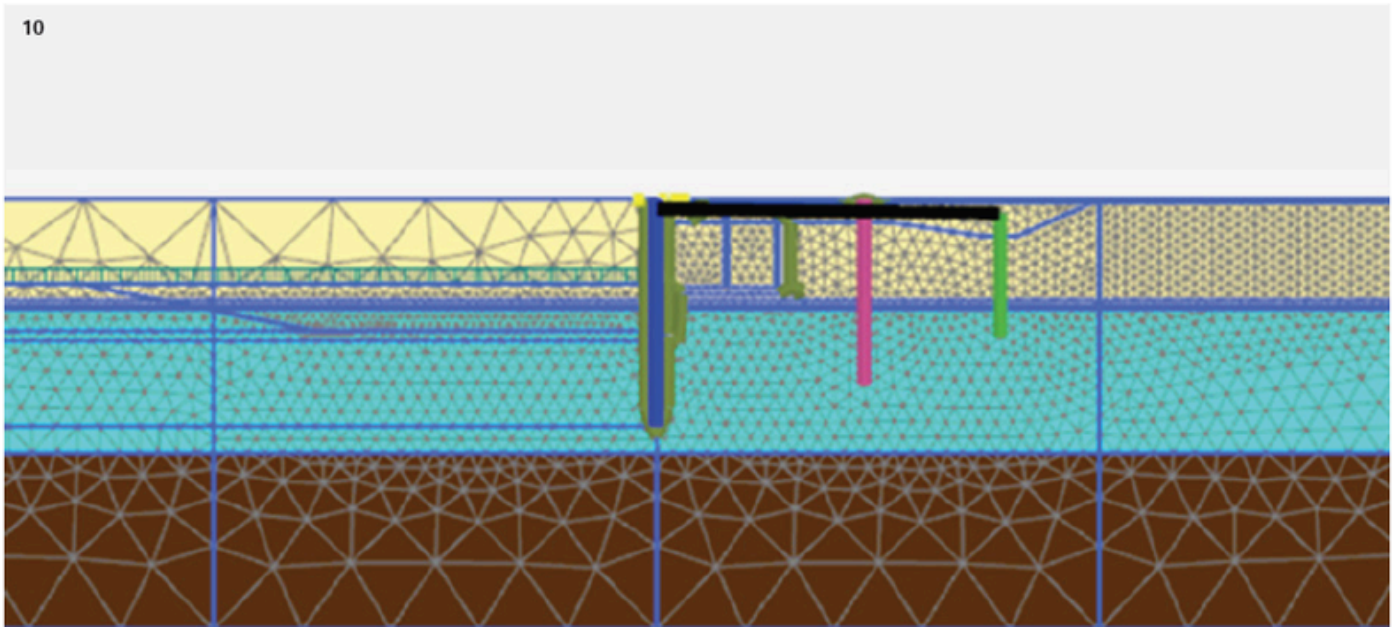

Figure 10 A sample of the PLAXIS 2D finite element model utilised as part of Dar's comprehensive analyses.

Yard onshore works

In addition to the marine works, Dar developed the yard layout design, which encompassed the types, locations, and areas of various operational and administrative buildings, along with pavement designs tailored to anticipated traffic loads and volumes. The design also specified the locations and sizes of stacking yards. It incorporated the geometric design for the yard roads, includinggrading, signage, and road markinglayouts. The designswere meticulously crafted to comply with international engineering best practices and to meet the futureoperator's requirements.
Additionally, Dar designed the terminal yard facilities, including utility lines for cables, water and sewage services, telecommunications, high-mast lighting, and related service buildings.

Rehabilitating Luanda's pivotal Unicargas Terminal

Figure 11 The locations of the main buildings.

Buildings, pavements, and infrastructure

An extensive value engineering assessment concluded that rehabilitating existing facilities within the site would prove to be less than optimal. The new master plan, therefore, proposes several new buildings, including an administrative building, a workers welfare building, a machinery workshop building, and a custom inspection shed structure.

Elsewhere, various value engineering solutions were developed to optimise paving design for specific zones, based on pavement conditions, CBR test results, and new requirements linked to usage changes. Different pavement options, each with specific cross-sections, were selected for the project's zones based on the unique usage

and stress levels in each area. Primarily, interlock and rigid pavement structures were designed to accommodate expected traffic loads and suit the subgrade soil conditions. The interlock pavers and rigid concrete pavement design for the quay apron were developed in compliance with international and local standards, including the empirical design methods outlined in the 1993 AASHTO Guide for Design of Pavement Structures.

The pavement design for heavy-duty and medium-duty interlock pavers was developed in alignment with the Structural Design of Heavy-Duty Pavements for Ports and Other Industries by the British Port Association (BPA Manual, 4th Edition), as well as Part 101: Code of Practice for the Structural Design of Pavements Using Modular Paving Units.

Dar also designed critical wet and dry utility networks and infrastructure, to ensure

effective operations across the Terminal.

Rehabilitating Luanda's pivotal Unicargas Terminal

Figure 12 The Administration Building.

Figure13 The Workers Welfare Building.

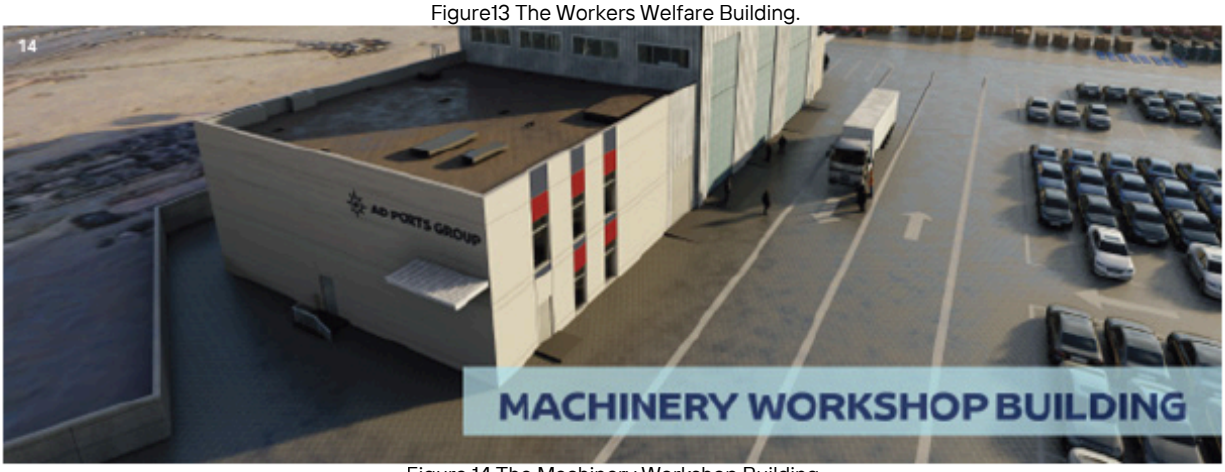

Figure 14 The Machinery Workshop Building.

Figure 15 The open-structure Custom Inspection Shed.

Rehabilitating Luanda's pivotal Unicargas Terminal

Figure 16 Mainly labels the pump rooms 1 and 2.

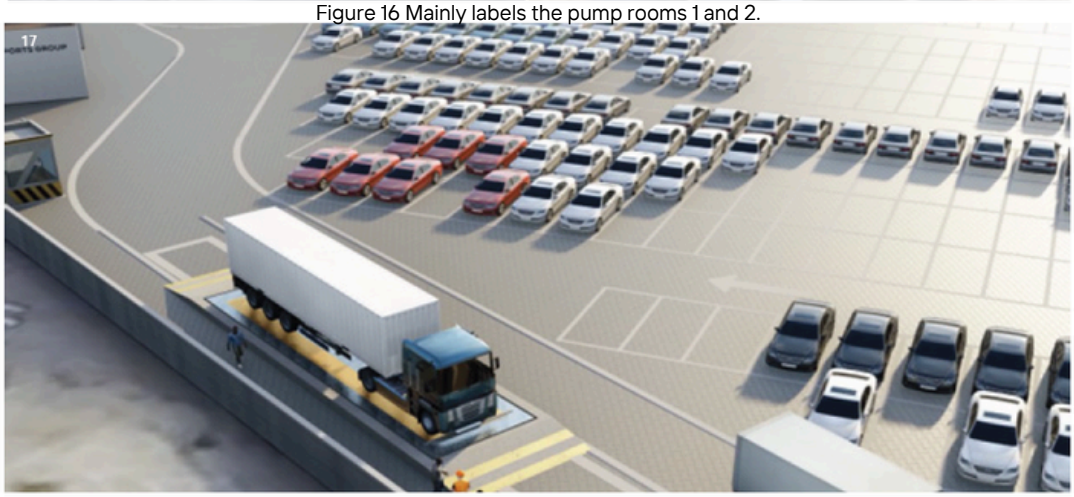

Figure 17 The weighbridge near the fence.

Figure 18 The locations of the different gates.

Rehabilitating Luanda's pivotal Unicargas Terminal

Operational characteristics and efficiency

The handling system Dar designed for the terminal focuses on the efficient integration of equipment necessary for managing the flow of goods between the vessel and the quay wall area. This includes transporting goods from the quay wall to the stacking yard, stacking and unstacking items, and facilitating the movement of goods between the stacking yard and landside operations.

Various equipment options were considered in the design to streamline the handling and transportation of different containers and cargo items, as well as to assist employees moving between the various zones of the port. Examples of utilised equioment include rail span STS cranes, gantry span RTG cranes, empty container handlers, reach stackers, tractor trailers, mobile harbour crane, ships gear, forklifts, and shuttle busses.

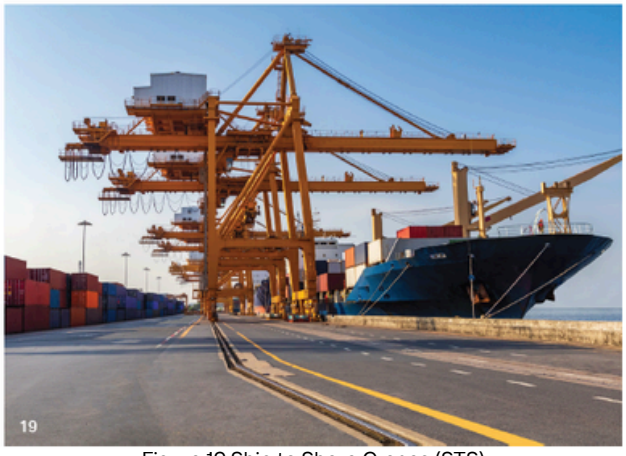

Figure 19 Ship to Shore Cranes (STS)

Figure 20 Empty handlers.

Figure 21 Rubber Tyred Gantry Cranes (RTG).

Figure 22 Reach Stacker (RST)

Figure 23 Internal Transfer Vehicles (ITV)

A rehabilitated and optimised terminal, for Angola

The designs developed by Dar triggered significant achievements and substantial enhancement of the project's characteristics, as exemplified by key metrics across the board:

- Optimising the container yard yielded an additional 384 ground slots.
- The storage capacity of the Laden Container increasedby 86,201 TEUs per year.
- Optimising the RoRo and General Cargo Terminals and utilising 50% of the storage capacity from General Cargo yielded an additional capacity of 6,805 cars per year.
- The newly designed master plan demonstrates that the increase in ground slots for containers from 1,422 to 1,806 has resulted in an 8.8% increase in the calculated Internal Rate of Return (IRR)and a 7.1% improvement in the annualised Return on Investment (ROI).

Rehabilitating Luanda's pivotal Unicargas Terminal

The design process took into account the available CAPEX, with the aim of implementing all necessary operational and terminal improvements without raising the capital expenditure, while adhering to the principles of value engineering and cost reduction.

Dar was honoured and privileged to be able to contribute to this exceptional vision, which aims to boost the performance and competitiveness of the Unicargas Terminal, enhancing Angola's and Africa's global connectivity, driving sustainable development within the local economy, and significantly expanding future opportunities for growth.

Disaster Reports

Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

Hemanta Hazarika, Professor, Kyushu University, Japan
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1.Introduction

On March 28, 2025, at 12:50 MMT, a Mw 7.7 earthquake struck near Mandalay, Myanmar, along the Sagaing Fault at a shallow depth of 10 km. This earthquake was one of the largest to hit the region in decades and caused widespread destruction across central Myanmar. Its impacts extended beyond Myanmar's borders, with shaking felt in neighboring countries as well. The scale of damage to infrastructures, buildings, and cultural heritage sites underscored the seismic vulnerability of the country.

Under the leadership of the first author, a reconnaissance mission was organized by the **Japanese Geotechnical Society (JGS)** immediately after the Earthquake. The mission aimed to document the extent and characteristics of ground and structural damage,as well as to collectperishable data that could support future hazard assessment and mitigation efforts. In collaboration with the Myanmar Geosciences Society (MGS), the Federation of MyanmarEngineering Societies (MES),and several international partners, the field survey was conducted from June 13 to 16, 2025. The team carried out site inspections in the earthquake-affected areas of two major cities—Naypyidaw and Mandalay—which suffered notable ground failures and structural damage (Fig. 1). Observations were supplemented by interviews with local residents and engineers, and the collection of photographic and geotechnical data for subsequent analysis. The findings provide valuable insights into seismic hazards in Myanmar and recommendations for risk reduction in the future.

Fig. 1: Investigation route and locations

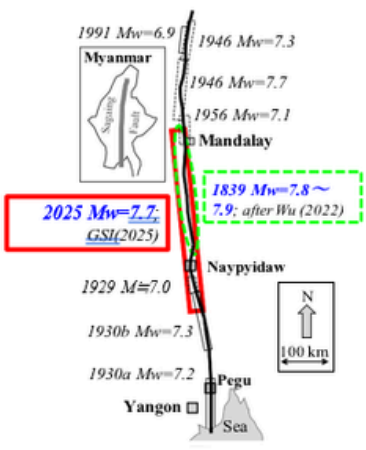

Fig. 2: Historical earthquakes caused by Sagaing fault (Modified from Soe and Watkinson, 2011 and Wang et al., 2014)

Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

2. Earthquake characteristics

The 2025 Myanmar Earthquake originated along the Sagaing Fault, a right-lateral strike-slip fault that trends north–south across central Myanmar (Brown and Leicester, 1933; West, 1937; Dey, 1968; Socquet et al.,2006; Aung, 2009;Tsutsumi and Sato, 2009). The Sagaing Faultis recognized as one of Southeast Asia's most seismically active fault systems and has generated numerous historical earthquakes (Fig. 2, after Soe and Watkinson, 2011; Wang et al., 2014).

It is noteworthy that the 2025 event occurred within a previously identified seismic gap along the fault (Hurukawa and Maung, 2011), as indicatedby the red and green boxes in Fig. 2. The ruptureextended over a distance of approximately 400–460 km, producing strong ground motions across a wide region. Recent seismological investigations (Melgar et al., 2025; Diao et al., 2025; Ye et al., 2025) further suggest the occurrenceof a supershear rupture, whereinthe rupture frontpropagated at a velocity exceeding the shear-wave speed of the crust.

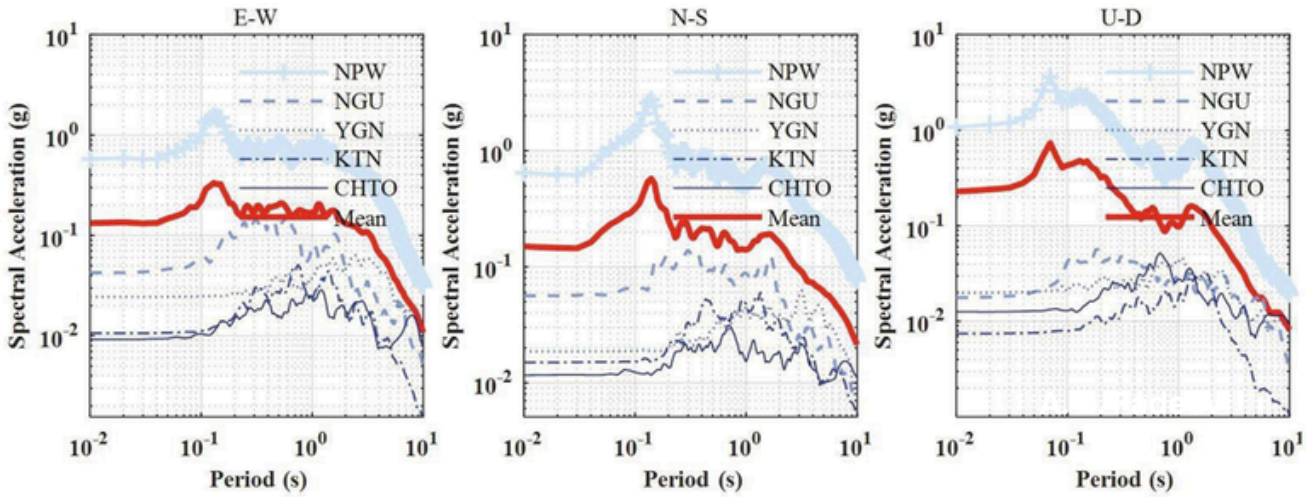

Fig. 3: Spectral acceleration based on seismograph data (Wang et al., 2025)

Recorded seismograph data and subsequent analyses carried out by Wang et al. (2025) revealed varied characteristics depending on location. In Naypyidaw, the records were dominated by short-period motions, while in Yangon long-period components were more prominent. In Mandalay, close to the epicenter, the peak ground acceleration was recorded at around 0.18 g, though the data reliability was uncertain. These results indicate a complex distribution of seismic energy across the affected region (Fig. 3).

3. Observed geotechnical and infrastructural damage

The earthquake severely impacted Myanmar's transportation network, especially the Yangon–Mandalay Highway (Asian Highway No 1: AH1). Extensive liquefaction-induced settlement was observed in a location near Pegu along the Yangon–Mandalay Highway, leading to uneven road surfaces and distorted alignment (Photo 1). Bridge abutments were damaged due to lateral spreading of soils, resulting in severe structural failure (Photo 2). In adjacent farmland, utility poles had toppled, further illustrating the extent of lateral ground displacement.

Disaster Reports

Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

Photo 1: Liquefaction induced damage to road

Photo 2: Abutment damage

In Mandalay City, the construction site of a new shoppingmall in Amarapura township exhibited tracesof liquefaction despite reported countermeasures such as groundwater lowering (Photo 3). This suggests that the countermeasures were insufficient under strong shakingconditions. Nearby road also sufferedextensive damage (such as lateral spreads, cracks and voids beneath roads) due to liquefaction and slope failures, with kerb displacement measuredup to 2.5 meters. Such large-scale soil movements indicatethat the road embankment possible was constructed using loose river sands, which are highly vulnerable to liquefaction (Photo 4).

Mandalay City is surrounded by two major rivers: the Ayeyarwady River to the west and the MyitngeRiver to the south (Fig. 4). The Myitnge River embankments experienced large-scale failures, leading to toppling of bridge piers and completely blocking the AH-1 (Photo 5). In some locations of the river embankment, fluidized flow exceeding10 meters destroyedas many as 30 houses and resultedin human casualties (Photo 6).

In another location of Mandalay city, the damage of bridge piers was observed, with one pier settling by about 1.5 meters (Photo 7). Insufficient embedment of foundations could have contributed to the scale of the damage. These failures highlight the combined effects of liquefaction, weak foundation soils, and hydraulic influences, which pose serious risks to riverine infrastructure in Myanmar.

Photo 3: Sand boils at shopping mall site

Photo 4: Liquefaction-induced damage to the nearby road surface

Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

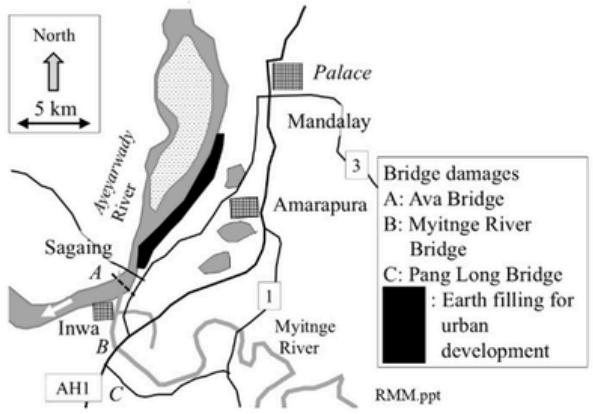

Fig. 4: Location of Amarapura township (From Towhata and Hazarika, 2025)

(a) View from the north

(b) View from the south

Photo 5: Riverbank landslides and bridge pier collapse

Photo 6: Landslides and collapse of houses

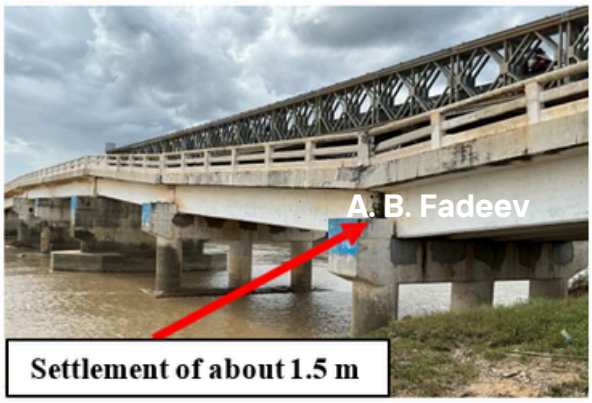

Photo 7: Bridge pier settlement

4. **Building damage**

In Nyaung Pin Gyi Su Village, near Naypyidaw, an elementary school experienced significant differential settlement due to liquefaction. Cracks developed in the walls, and misalignment of rain gutters was observed (Photo 8). Widespread sand boiling occurred throughout the village (Photo 9). Dynamic Cone Penetration Tests (DCPT) performed by the authors revealed that the soil at the investigated site was very loose, with a converted N-value of less than 5, and a shallow groundwater table approximately 1.2 meters below the ground surface. These findings confirm the high susceptibility of the site to liquefaction and associated ground deformations.

Disaster Reports

Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

Photo 8: Damage to school buildings

Photo 9: Traces of sand boils in the village

Photo 10: Sky Villa condominium in Mandalay

Photo 11: Structural damages in lower storeys of buildings (Nepyidaw)

In Mandalay city, the 12-storey Sky Villa Condominium, constructed in 2017, collapsed completely, with its lower stories (up to the 4th floor) crushed (Photo 10), resulting in 207 fatalities. The building featured a pilot is-style design, where the ground floor consisted primarily of columns with very few shear walls. This

configuration is known to exhibit poor seismic performance, as observed during the 1995 Kobe Earthquake in Japan. Similar patterns of soft-storey failure(Photo 11) were observed in several other apartment and hotel buildings, where severe cracking and crushing were concentrated in the lower floors, while the upper floors remained relatively intact. The repeated occurrence of such soft-storey collapses highlights a fundamental design deficiency that must be urgently addressed in future seismic design codes and retrofitting programs, particularly for reinforced concrete buildings in high-risk areas.

Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

5. **Observed fault and associated damage**

Fault-induced dislocations were observed at numerous locations during the field survey. Photo 12 illustrates one such example in Sagaing, near Mandalay, where the displacement was purely horizontal with no vertical component.

An important observation on fault rupture was obtained approximately 140 km south of Mandalay(Photo 13), where a surveillance motion camera captured both the ongoing ground shaking and the onset of fault rupture. This video footage was made available on the web shortly after the event. Interestingly, there was a time lapse of about five seconds between the beginning of strong shaking and the initiation of fault displacement. This delay appears to contradict the previously mentioned super shear hypothesis, in which rupture propagation exceeds the shear-wave velocity. It is possible, however, that the super shear behavior was a localized phenomenon, as suggested by Ye et al. (2025), who reported that the rupture became super shear only after it had propagated approximately 200 km south of the epicenter, near Mandalay.

Photo 12: Right-lateral fault dislocation in Sagaing (Left bank of the Ayeyarwady River, near Mandalay)

Photo 13: Fault dislocation in a solar power station

Photo 14: Contrast of damage of two adjacent houses on the opposite side of fault dislocation in Photo 12

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Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

Notably, in Sagain area, building damage was concentrated within approximately 50 meters of the fault trace (Photo 14). An under-construction building (left to the damaged house) remains unaffected. This observation implies that the damage was primarily caused by surface soil deformation rather than strong ground shaking.

Photos 15(a)-(e) show the fault dislocation and its impacton surface structures in Naypyidaw, where the observed ground motion intensity was high (Fig. 3). Photo 15(a) shows a right-lateral displacement consistent with that observed in Sagaing (Photo 12), accompanied by significant shear deformation of the ground surface.Photo 15(b) displaysa building situateddirectly atop the fault rupturethat sustained severe damage, as further evident from the interior shown in Photo 15(c). In contrast, a room located about ten

meters away from the rupture (Photo 15(d)) suffered much less damage. This again confirms that the primary cause of fault-induced damage was surface deformation rather than ground shaking.

A noteworthy finding during the survey was the absence of landslides on natural slopes. Photo 15(e) depicts the continuation of the fault rupture toward the north of the site. Despite extensive damage to buildings and numerous failures in man-made slopes and fills, the small natural cliff in this photograph remained intact. This lack of failure in natural hill slopes was consistently observed at many other sites as well.

(a) Right-lateral dislocation (looking eastward)

(b) Main building resting directly on the fault dislocation

(c)Damage inside the main building

(d) The same building ten meters away from the fault (leftward in (b))

Damage Caused by the 2025 Myanmar Earthquake and Lessons Learned

(e) Continuation of fault rupture on the northern side of the site

Photo 15: Fault dislocation in the Children's Specialized Hospital in Nepyidaw

6. **Cultural heritage damage**

The earthquake caused devastating losses to Myanmar's rich cultural heritage. Temples, pagodas, and historic buildings collapsed or were severely damaged. Photo 16 shows one such damage of a pagoda constructed during 19th century. The reconstruction of these heritage sites raises a fundamental question: whether to prioritize authentic restoration using original materials or to focus on rapid recovery using modern methods.

Photo 16: Destroyed Me Nu Brick Monastery in Inwa

Authentic restoration is time-consuming and technically demanding, but it preserves cultural and spiritual values. Rapid reconstruction ensures continuity of cultural practices but risks diminishing historical authenticity. This dilemma was also faced in Japan after major earthquakes, where ancient temples were restored using modified designs. The Myanmar case underscores the need for policies that balance heritage preservation with seismic safety.

7. **Regional and long-distance effect**

The earthquake's effects extended beyond Myanmar, with noticeable damage in Bangkok, Thailand, nearly1,000 km from the epicenter. A few of the city'shigh-rise buildings suffered from long-period ground motions, which induced resonance and amplified shaking. Although super shear mechanism is sometimes claimed to be responsible for this long-distance impact, there is so far no evidence that super shear ground motion is not affected by attenuation or decay and can maintain its energy over along distance. It is more reasonable that the thick soil deposit in Bangkok amplified the motion and made the long predominant period of shaking.

There are historical evidences that previous strong earthquakes in the Sagaing Fault were associated with sloshing of canal water in Bangkok; Mw = 7.8-7.9 in 1839 (Prinya and Sodsri, 1983) and Mw
= 7.3 in December 1930 (Brown and Leicester, 1933). Water sloshing in canal suggests the dominance of long-period earthquake motion in Bangkok

8. **Key lessons learned**

The reconnaissance revealed several urgent lessons:

- Seismic Monitoring: Myanmar currently has very few seismic observation stations. Expanding a dense, low-cost but reliable seismic network is critical for early warning and hazard assessment.
- Micro zonation: Urban areas such as Mandalay and Yangon need detailed micro zonation studies to map liquefaction susceptibility and site amplification zones.
- Design Weaknesses: The collapse of pilotis-style buildings and the ineffectiveness of groundwater lowering measures show that structural and geotechnical design standards must be revised.
- River Embankments: The failures along the Myitnge River demonstrated the extreme vulnerability of embankments constructed of loose fill. Strengthening and monitoring of riverbanks are necessary to prevent similar disasters.
- Cultural Heritage: Preservation strategies must strike a balance between authenticity and resilience, ensuring heritage sites can withstand future earthquakes while maintaining cultural value.
- Regional Preparedness: Countries neighboring Myanmar, particularly Thailand, must recognize that long-period ground motions from large earthquakes can affect them significantly. Cross-border collaboration in seismic hazard studies is also vital.

9. **Conclusions**

The 2025 Myanmar Earthquake has reinforced the seismic risk posed by the Sagaing Fault system. The event caused a wide spectrum of damage, including liquefaction-induced failures, slope failures, building collapse, and cultural heritage destruction. The reconnaissance survey confirmed that Myanmar's infrastructure and building stock remain highly vulnerable to strong earthquakes.

Moving forward, Myanmar must prioritize:

- Strengthening foundations and embankments against liquefaction.
- Retrofitting vulnerable soft-storey structures.
- Expanding seismic monitoring networks.
- Developing regional hazard assessments that incorporate long-period seismic impacts.

The findings of this reconnaissance are not only important for Myanmar but also provide critical lessons for seismic risk management throughout Southeast Asia. By acting on these lessons, academia, governments and industries can reduce future losses and build greater resilience against major earthquakes

Acknowledgements

The reconnaissance survey was made possible through the financial support of the Japanese Geotechnical Society, Tokyo, Japan. The authors gratefully acknowledge this generous assistance. The survey was also greatly facilitated by the invaluable support and cooperation of the Myanmar Geosciences Society (MGS) and the Federation of Myanmar Engineering Societies (MES). The authors wish to express their sincere gratitude to Dr. Sone Han, President of MGS; Mr. Khin Maung Htaey, President of MES; and Prof. Day Wa Aung of Yangon University for their significant support and warm hospitality during the field visit. Special thanks are also extended to Mr. Shotaro Kubota of Kawasaki Geological Engineering Co., Ltd., Tokyo, Japan, for his considerable contribution towards our preparation for the survey.

References:

1. Aung, H.H. (2009):Earthquake potential in Myanmar. Advancesin Geosciences Vol. 13: Solid Earth (SE), 265–280.
2. Brown, J.C. and Leicester, P. (1933): The Pyu earthquake of 3rd and 4th December, 1930 and subsequent Burma earthquakes up to January1932. Memoirs of the Geological Survey of India, Vol. 62, 1-140.
3. Dey, B.P. (1968): Aerial photo interpretation of a major lineament in the Yamethin-Pyawbwe quadrangle. Union of Burma Journal of Science and Technology, 1(3), 431–443.
4. Diao, H., Ren, Y., Wen, R. , Si, H. and Koketsu, K. (2025): Supershear rupture process of the 2025 Myanmar earthquake as derived from joint inversion of near-field and teleseismic waveforms. Earthquake Engineering and Engineering Vibration, Vol. 24, 917–925.
5. Hurukawa, N. and Maung, P.M. (2011): Two seismic gaps on the Sagaing Fault, Myanmar, derivedfrom relocation of historical earthquakes since 1918. Geophysical Research Letters, 38(1), https://doi.org/10.1029/2010GL046099.
6. Geospatial Authorityof Japan (2025): https://www.gsi.go.jp/cais/topic20250328_Myanmar.html.
7. Melgar, D., Weldon, R., Wang, Y., Bato, M.G., Aung, L.T., Shi, X., Wiwegwin, W., Khaing, S.N., Min, S., Thant, M. and Speed, C. (2025): Supershear source model of the 2025 M7. 8 Myanmar earthquake and paleoseismology of the Sagaing Fault: regions of significant overlap with past earthquakes. Seismica, Vol. 42.

References:

8. Prinya N. and Sodsri, S. (1983): Earthquakes data of Thailand and adjacent areas 624 BC-1983 AD. Special Publication, Vol. 1, Geological Society of Thailand, Asian Institute of Technology, https://web.archive.org/web/20220304 010732/http://www.dmr.go.th/bgs_ebook3/document/DMR-05_ 0503.PDF as of June, 2025.
9. Socquet, A., Vigny,C., Chamot-Rooke, N., Simons, W., Rangin, C. and Ambrosius, B. (2006): India and Sunda plates motion and deformation along their boundaryin Myanmar determined by GPS, Journalof Geophysical Research, 111, B05 B05406.
10. Soe, T.T. and Watkinson, I.M. (2017): The Sagaing Fault, Myanmar, Myanmar: Geology, Resources and Tectonics, Memoirs of Geological Society, London, 48(1), 413–441.
11. Towhata, I., and Hazarika, H. (2025): Damage Reconnaissance after the 2025 Mandalay (Myanmar) Earthquake, In Proceedings of the International Workshop on 30 Years of the Great Hanshin-Awaji Disaster, Kobe, Japan.
12. Tsutsumi, H. and Sato, T. (2009): Tectonic geomorphology of the southernmost Sagaing fault and surface rupture associated with the May 1930 Pegu (Bago) earthquake, Myanmar. Bulletin of the Seismological Society of America, 99(4), 2155–2168.
13. Wang, Y., Sieh,K., Tun, S. T., Lai, K-Y., and Myint, T. (2014): Activetectonics and earthquake potential of the Myanmar region, Journal of Geophysical Research: Solid Earth, 119 (4), 3767–3822
14. Wang, H., Weng, R., Peng, Z., Ren, Y., Qiang, S. and Liu, Y. (2025): Integrated source-site effects on seismic intensity in the 2025 Myanmar earthquake from the three-component ground motion simulations by stochastic finite-fault method, Earthquake Engineering and Engineering Vibration: Special Issue, Vol. 24, 901–915.
15. West, W.D. (1937)Earthquakes in India, Nature, 139(3530), 1118–1118.
16. Wu, S.H. (2022): Re-estimating the magnitude of 1839 Ava earth-quake through geomorphic mapping and macroseismic records, central Myanmar, Master thesis, Department of Geo-sciences, National Taiwan University, Taipei, Taiwan.
17. Ye, L., Lay, T. and Kanamori, H. (2025) The 28 March 2025 Mw 7.8 Myanmar earthquake: Preliminary analysis of an ~480 km long intermittent supershear rupture. The Seismic Record, 5(3), 260–269.

Corporate Associates Corner

Corporate Associates Presidential Group (CAPG) Activities

Dr. Roger Estephan
Corporate Associate Presidential Group

The Corporate Associates Presidential Group (CAPG) continues to strengthen its presence and impact within the global geotechnical community through a range of initiatives and exposure opportunities designed to elevate the Corporate Associates member visibility, foster collaboration, and promote innovation.

Have a look at the newly offered CA dedicated Webpage!

CAPG is proud to offer a dedicated webpage for each Corporate Associate member company on the ISSMGE website, under the section Corporate Associates | ISSMGE. This platform provides a valuable opportunity to showcase the Corporate Associates organization's expertise and leadership in geotechnical engineering.

The dedicated Webpage of each CA member has the following key features:

- **Company Services Overview :** Highlight your company's services, unique projects, and contributions to the geotechnical community on a dedicated webpage on the ISSMGE website
- **Company Logo and Website Link:** Display your corporate logo and direct visitors to your official website for easy access and engagement.
- **Exclusive Showcases for Platinum and Journal Sponsors :** Upload promotional materials such as brochures, videos, or presentations for download directly from your dedicated page.

This initiative is part of CAPG's continued commitment to recognizing the contributions of its members and strengthening connections across the geotechnical community.

Check the newly added online Enrolment and Payment webpage!

The CAPG is pleased to announce that online Enrolment and Payment are now available via CAPG Membership Enrolment and Payment Portal | ISSMGE

The following QR Codes provide direct access to two main pages:

Joining CAPG Joining CAPG | ISSMGE

CAPG Membership Enrolment and Payment Portal

Corporate Associates Corner

PLATINUM MEMBER

WAGSTAFF PILING

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TENCATE GEOSYNTHETICS
menard
SEEQUENT
Teclab ltd
Naue
GH 上海港湾集团 GEOHARBOUR
SIEMENS energy
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TETRA TECH COFFEY
GEOQUEST
aurecon
CONETEC
Tensar A Division of CMC
Deltares
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smec
dar
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GHD
Geomil equipment
JAN DE NUL
srk consulting
VATTENFALL
GDS
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inora
GIKEN
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KELLER
ap van den berg
rocscience
APAGEO

SILVER MEMBER

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GHMD CONSULTORES
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Technical Committees Activities

TC105 "Geo-mechanics from micro to macro"

New Student Video Competition to Promote Junior Researchers

The ISSMGE Technical Committee 105 (TC 105) will host a new student video competition beginning in 2026. The goal of the video competition is to provide a platform for master's and Ph.D. students to gain exposure throughout the TC 105 community more frequently than during the quadrennial international symposium organized by the technical committee. While prior quadrennial symposia, such as the most-recent IS-Grenoble hosted in Grenoble, France in 2024, featured a student poster competition, the video competition is envisioned as providing an annual opportunity for students to show their best work to peers and gain exposure that may lead to future collaboration or employment opportunities.

The video competition will involve submission of a 10-minute recorded video in which a student describes their research. The competition will feature experimental, computational, and theoretical tracks. Students have the freedom to be creative and record PowerPoint slides, laboratory work, or any other format of video that captures the essence of their research. The TC 105 committee will judge videos based on clarity, originality, technical depth, and communication quality. Winning videos will be highlighted on the ISSMGE website and links will be provided on the TC 105 LinkedIn page. ISSMGE has generously provided support for awards totaling £500 to help advance this initiative.

This initiative is being led by Prof. Ryan Hurley (Johns Hopkins University) with support from TC 105 Chair Itai Einav (University of Sydney) and the remainder of the TC 105 board. The video competition was inspired by the success of a similar initiative within the American Society for Civil Engineers (ASCE) Engineering Mechanics Institute (EMI) Granular Materials Technical Committee (GMTC).

The submission platform for the competition can be found at the QR code below and here:

https://forms.office.com/e/V6KF3TRSYm

Technical Committees Activities

TC209 ISFOG Conference 2025
The International Marine Geotechnical Engineering event in Nantes

From 9 to 13 June 2025, the Cité des Congrès in Nantes hosted ISFOG 2025, the fifth edition of the International Symposium dedicated to Marine geotechnics.

660
Participants

40
Countries

386
Presentations

422
Articles

6
Keynote lectures

17
Scientific themes

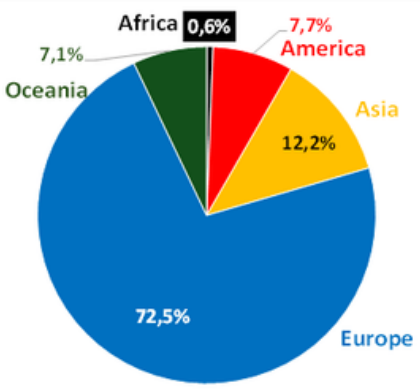
Created in 2005, the ISFOG symposium series initially focused on applications related to offshore oil and gas production, before enlarging to the challenges of Energy transition and Marine Renewable Energy (MRE). After Perth (2005 and 2010), Oslo (2015) and Austin (2022), ISFOG (2025) was held for first time in France, reflecting the dynamism of the French community in this field.

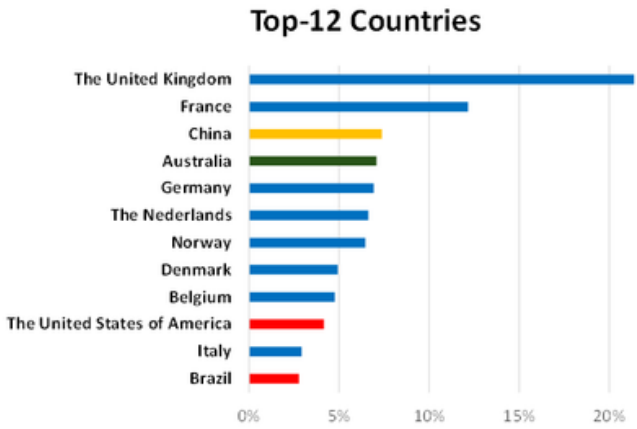
This event was mainly led by the French mirror group 'Marine Geotechnics' of TC209 of the ISSMGE, with the active support of the French Society for Soil Mechanics and Geotechnical Engineering (CFMS). The group worked on the project since September 2019, also contributing to the French Technical Recommendations on fixed (2020,) and floating (2024) wind turbine foundations (see references). At the heart of the organisation was the GERS-CG geotechnical centrifuge laboratory of Gustave Eiffel University in Nantes (https://cg.univ-gustave-eiffel.fr/), with logistical support from the PCO ASconnect.

Special attention was paid to young researchers, with a preferential pricing policy for students, who represented 20% of participants. This was made possible thanks to the commitment of 26 sponsors, whose support contributed greatly to the success of the Symposium

Technical Committees Activities

TC209 ISFOG Conference 2025
The International Marine Geotechnical Engineering event in Nantes





660 registered participants, 20% of whom are students

The welcome ceremony, held on Monday 9 June, brought together:

- Pr. Fabrice EMERIAULT, President of the CFMS,
- Dr Éric GAUME, Director of the Nantes Campus of Gustave Eiffel University,
- Dr Aziliz GOUEZ, Vice-President of Nantes Métropole, in charge of higher education and research

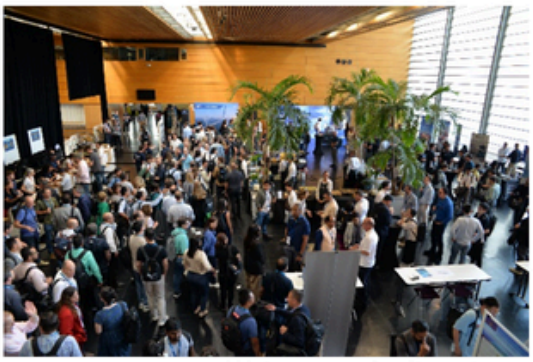

Luc Thorel, Elisabteh Palix

Fabrice Emeriault


Eric Gaume

Aziliz Gouez

Welcome ceremony



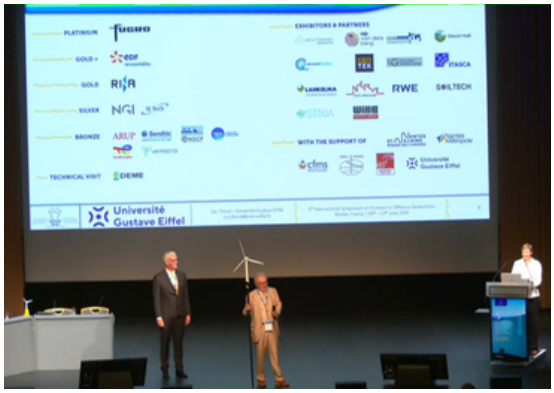
Welcome cocktail on the mezzanine floor among the exhibitors / Local organising team

Technical Committees Activities

TC209 ISFOG Conference 2025
The International Marine Geotechnical Engineering event in Nantes

During the opening ceremony, led by co-chairs Elisabeth PALIX and Luc THOREL, Alain PUECH, Honorary Member of the Organising Committee, struck the brigadier (a wooden staff made especially for the occasion) on the ground three times, officially declaring the symposium open.

Six keynote lectures were given by academics and practitioners, including one by ISFOG 2025 co-chair Elisabeth PALIX on the geotechnical work and challenges involved in French offshore wind turbines. The prestigious ISSMGE McClelland Lecture was given by Philippe JEANJEAN (BP America).
Two Bright Spark Lectures were presented, one by our colleague Dr Christelle ABADIE (who joined Gustave Eiffel University at the end of 2023) and the other by Shengjie RUI (NGI).




C. Leblanc / A. MuirWood (Wood Thilsted)


Elisabeth Palix (EDF Renouvelables)

Lizhong Wang (Zhejiang Univ.)


Britta Bienen (Univ. Western Australia)

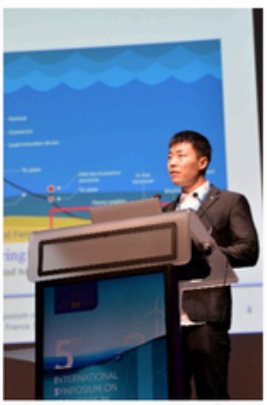

Finn Lovholt (Norwegian Geotechnical Institute)


Carl Erbrich (Fugro)

6 keynote lecturers


Christelle Abadie receives from Phil Watson and Sylvie Bretelle the Bright Spark Lecture Award at the opening of the first plenary session.

Philippe Jeanjean presents the 7th McClelland Honorary Lecture of TC209 of the ISSMGE


Shengjie Rui, winner of the Bright Spark

TC209 ISFOG Conference 2025
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The plenary session lectures will be posted on the GERS-CG laboratory's YouTube channel.
The second and third days started with 'Open mind lectures', one delivered by Christophe Gaudin (UWA) entitled 'Wave energy: the new gold rush?' and the other by Marie-Anne Cambon (Ifremer) entitled 'Down to the bottom: diving at 3,600 metres depth exploring amazing deep-sea ecosystems'.

Twelve theme lectures were presented in plenary sessions, as well as 17 flash presentations selected among the best contributions of the 422 papers received and published in the Proceedings.
Finally, the chairmanship of each session respected gender parity, with one woman and one man. This sets a strong example for future conferences in our field and was praised on social media, among others by the president of the European Platform of Leading Geotechnical Institutes (ELGIP), Prof. Hauke ZACHERT.
In addition to the scientific sessions and exhibition, a technical visit at sea was organised, providing an opportunity to discover the Saint-Nazaire wind farm and the experimental site of the OPEN-C foundation, a member of GIS Theorem (https://theorem-infrastructure.org/) alongside Gustave Eiffel University.

The Proceedings are in open access:

Abadie C.N., Li Z., Blanc M., Thorel L. Proceedings of the 5th Int. Symp. Offshore Geotechnics (ISFOG2025), Nantes 9-13 june 2025. ISBN: 978-2-85782-758-0, DOI: 10.53243/ISFOG2025, https://www.issmge.org/publications/online-library?database=132&conference=133 , 2912p. https://univ-eiffel.hal.science/hal-05198889

TC209 ISFOG Conference 2025
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References

Recommendations for planning and designing foundations of offshore wind turbines (2020), CFMS. Available at https://www.cfms-sols.org/sites/default/files/rapport_final_eoliennes_offshore_angl_2020-10-30_-_archive.pdf)

Recommendations for Planning and designing anchor foundations of floating wind turbines (2024), CFMS. Available at a cost of 20€ here

Puech A. and Ropers F. (2025). A French recommended practice for planning and designing anchor foundations of floating wind turbines. Proc. 5th ISFOG 2025, Nantes, France.

In Memory

Prof. Kenji Ishihara

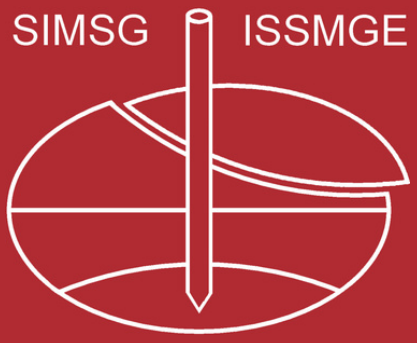
Professor Kenji Ishihara (1934–2026) was a globally respected pioneer in Geotechnical Earthquake Engineering. Born in Chiba, Japan, he earned his BS (1957), MS (1959), and PhD (1963) from the University of Tokyo. His outstanding contributions to cyclic soil behavior, liquefaction, and seismic stability—documented in more than 300 papers and his landmark book Soil Behaviour in Earthquake Geotechnics—have shaped the field worldwide. He also held leading roles within the ISSMGE and received numerous prestigious honors in recognition of his lifelong impact, most recently the ISSMGE International Lifetime Achievement Medal (ILAM). He is survived by his wife Miyoko, three daughters, and many grandchildren, and his passing was announced on January 4, 2026.

Prof. Shamsher Prakash

Prof. Shamsher Prakash passed away in India in December 2025. He leaves a legacy of mentored students, professionals, friends, colleagues, and so much more. Professor Prakash spent over four decades teaching and conducting research at Missouri University of Science and Technology. He was elected a Distinguished Member of American Society of Civil Engineers in 2011, and the Shamsher Prakash Award and Lecture is awarded annually by ASCE to a younger geotechnical engineer. He'll be greatly missed.

Upcoming Events

Thank you for being part of our international family!



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