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SEPTEMBER 2026 | ATHENS, GREECE



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ΕΠΙΣΤΗΜΟΝΙΚΗ  
ΕΤΑΙΡΕΙΑ  
ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ  
& ΓΕΩΤΕΧΝΙΚΗΣ  
ΜΗΧΑΝΙΚΗΣ

# Τα Νέα

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186

Αρ. 186 – ΑΠΡΙΛΙΟΣ 2024



22 Απριλίου 2024

ISSN: 2732-7248

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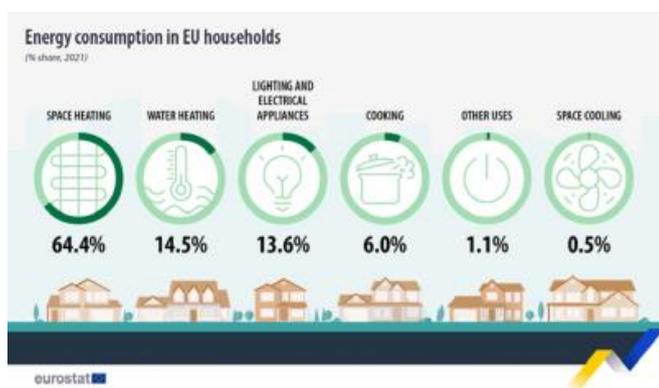
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## Reducing energy consumption with innovative solutions: is the answer beneath our feet?

In a constantly developing world, with a rising population and technological developments, we need energy. Energy and environmental problems are closely related since it is nearly impossible to produce, transport, or consume energy without significant environmental impact.

European energy consumption escalates annually, with buildings responsible for half of the total usage. Residential sectors heavily rely on energy for space heating, cooling, and hot water, contributing up to 80% of consumption according to the latest figures from Eurostat.

In a climate change emergency, it is crucial to develop local and affordable low-carbon energy sources with low environmental impact. When electricity gets cleaner, switching to super-efficient ground source heat pumps for heating and cooling can help cut down on using non-renewable energy and lower CO2 emissions.



Source: [Eurostat](#)

However, high capital investment costs and installation time remain significant barriers to uptake. Despite the enormous potential, geothermal energy systems see fewer installations compared with other renewables. Since the 1980s, the development of Energy Geostructures (EGs) has allowed shallow geothermal energy (SGE) to be exploited from structural concrete elements in contact with the ground (e.g., piles foundations, retaining walls, tunnels) by integrating heat exchanger pipes into them.

Energy Geostructures represents a promising innovation in the realm of sustainable energy solutions. These structures integrate ground heat exchange systems within various ground-contact infrastructures, such as retaining walls, piles, tunnels, and other buried structures. By leveraging the stable thermal properties of the earth, EGs offers an efficient means of heating and cooling buildings, reducing energy consumption, and mitigating environmental impact.

One of the key advantages of EGs lies in their ability to tap into the Earth's natural thermal energy, providing a renewable and low-carbon alternative to conventional heating and cooling systems. By circulating fluid through embedded pipes within the structures, heat exchange with the surrounding ground occurs, allowing for efficient temperature regulation of buildings above.

Despite their considerable potential, EGs face several challenges that hinder their widespread adoption and implementation at a large scale. One of the primary technical chal-

lenges involves the design and optimisation of these structures to ensure optimal heat exchange efficiency while maintaining structural integrity. Achieving the right balance between thermal performance and structural stability requires sophisticated engineering and modeling techniques, as well as careful consideration of site-specific conditions and constraints.

Another technical challenge is the integration of EGs with existing building and infrastructure projects. Retrofitting older structures to incorporate these systems can be complex and costly, requiring coordination among various stakeholders and disciplines.

There is a need for understanding among developers, contractors, and policymakers regarding the benefits and feasibility of these systems. Overcoming misconceptions and promoting education and training initiatives are essential for fostering greater acceptance and uptake within the construction industry. The lack of political awareness and promotion activities creates another barrier to strategic investments for EGS at the city scale, calling for a European network.

### Introducing FOLIAGE COST Action

To address the identified challenges, the [European network for Fostering Large-scale Implementation of Energy Geostructure](#) (FOLIAGE) is a new European network of researchers and engineers, all experts in thermal energy efficiency, geological engineering, and geotechnical engineering. This collaborative network currently gathers 155 researchers, from 32 countries intending to develop collective understanding, share techniques, facilities, and data, and work jointly in disseminating the obtained results across the EU.

*"Foliage is a highly dynamic network in which we bring together stakeholders with different backgrounds and skills to promote the use of Energy Geostructures in civil engineering projects, whether as part of new construction or within the context of retrofitting. We aim to overcome the scientific barriers that hinder the promotion of this technology by acting on the increase of knowledge at different levels: technological issues regarding mechanical and energy design, implementation, and finally the socio-economic issues including financial and life cycle analysis.*

*Prof. Hussein Mroueh, Chair of FOLIAGE*

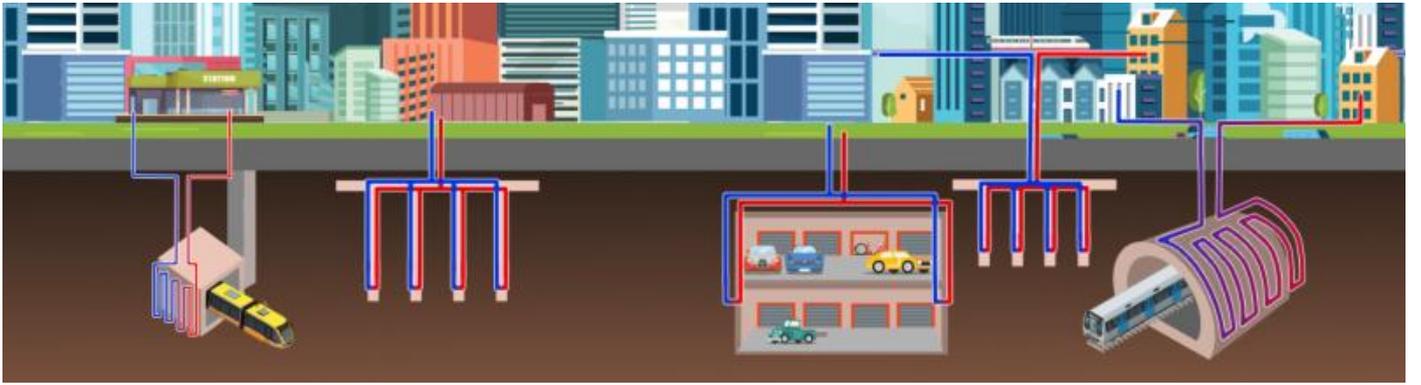
FOLIAGE COST Action is collecting all needed information to reduce these barriers and foster development by creating a multi-disciplinary network between the different stakeholders (local authorities, communities, developers, designers, academics, contractors, ...).

*"We are committed to transferring knowledge to young people and innovators who will be the decision-makers and builders of the future. We are implementing these principles and concepts for the benefit of our university community, as part of a full-scale demonstrator, with three main objectives: demonstrate the effectiveness of the technology; stimulate research in geothermal energies, and re-design our pedagogical provisions"* adds Prof. Hussein Mroueh.

Energy Geostructures represent a promising track for achieving energy efficiency, sustainability, and resilience in the built environment. By collaborating across disciplines and sectors and investing in research, innovation, and policy support, FOLIAGE COST Action aims to unlock the transformative power of EGs and accelerate the transition to a more sustainable future.

### Additional information

View the [Action webpage](#)  
View the [Network website](#)  
[Eurostat Energy consumption data](#)



## April 1886: the Brunkebergs tunnel

### A dry air refrigerator rescued efforts to build a tunnel connecting two parts of Stockholm

In 1886 the most populous part of Stockholm was situated on the north shore of Lake Mälaren and divided into two districts (Norrmalm and Östermalm) by an elevated ridge of stones and gravel.

Unsurprisingly, the ridge was an impediment to traffic and in 1886 The Engineer published a report on work to resolve the issue.

According to our coverage, an officer in the Swedish Royal Engineers, a certain Captain Knut Lindmark, had applied to the municipality of Stockholm to construct a tunnel so that pedestrians could pass through the hill for a fee of two öre.

As part of the deal, Captain Knut would pocket the takings for 50 years, after which the Brunkebergs tunnel would be returned to the city.

"This application was strongly opposed, not only by the owners of adjacent houses, but by engineers who stated that driving a tunnel through loose stones and gravel...would necessarily cause great subsidence...and, consequently, damage to the buildings above," said The Engineer. "The municipality, however, considering the great benefit that would result from the realisation of the project, granted the concession and in the summer of 1884 the works commenced."

The tunnel is 758 feet long, 12 feet eight inches high, and has a width of 13 feet two inches. The works were commenced from the eastern end by driving a heading at the bottom level, which was straightforward as the heading path was entirely granite and blasted by dynamite.

"The enlargement of the heading, however, caused considerable trouble because the crown of the tunnel in several instances passed into fine sand lying close to the rock," said The Engineer. "At such places explosives could not be used."

The driving of the tunnel from the west end introduced difficulties of a more serious nature, because the ground to be pierced consisted entirely of coarse gravel, intermixed with large stones and a small quantity of wet clay.

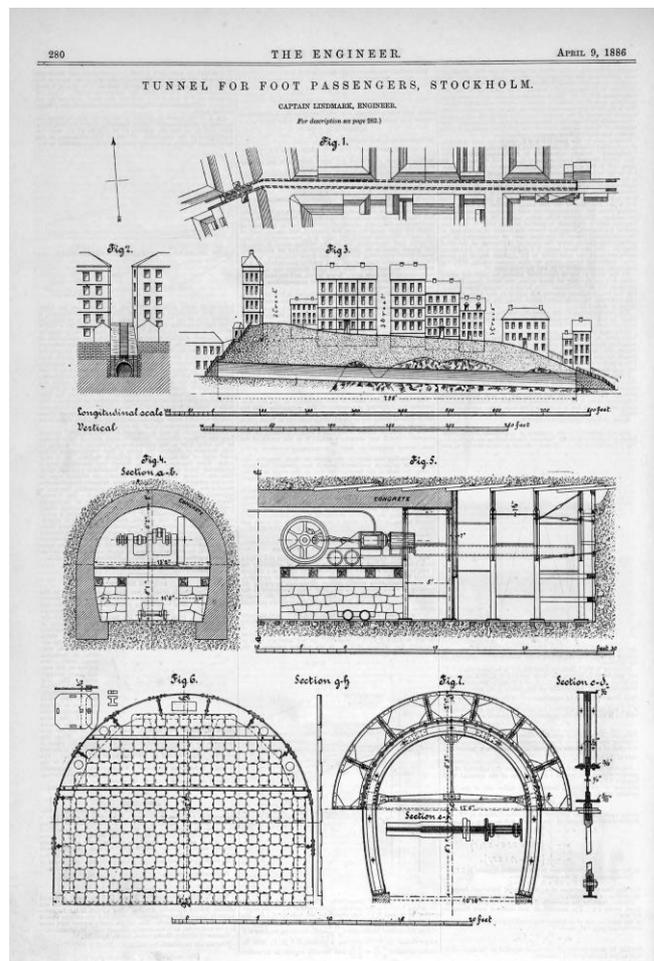
Fifty feet from the mouth, the tunnel passed between two five storey houses built and the distance between them was so small that the sidewalls of the tunnel had to be constructed right under their foundations, which extended down to within 10 feet of the top of the arch.

"The foundations of those houses could not in this case have been brought down to the bottom of the tunnel by underpinning - partly on account of the great depth, but chiefly from the loose nature of the ground," said The Engineer.

An iron wall of plates, 12 inches square, was made to place against the face of the tunnel as the excavation advanced.

"Notwithstanding these precautions, the results were not satisfactory," continued our reporter. "It was found that the gravel, on account of the water and clay it contained, had no cohesion whatsoever, and would pass freely through even a very small opening. The consequence was that a subsidence took place in the ground above; and the excavations had not advanced more than 40 feet when the works had to be stopped."

To overcome this, Captain Lindmark decided to freeze the earth before making the excavation by means of cold air, and for this he obtained a 'Lightfoot' dry air refrigerator capable of delivering about 25,000 cubic feet of cold air per hour.



Page 1 of the original article

The inner part of the tunnel was formed into a freezing chamber by means of a partition wall made of double planking filled in with charcoal.

By running the refrigerator continuously for 60 hours the gravel inside the freezing chamber was frozen into a solid mass to a depth varying from five feet near the bottom of the tunnel to one foot near the top.

"The work was now proceeded with as before, in sections of five foot, the excavation commencing at the top, and the iron wall being built up from above downwards as fast as possible," said The Engineer. "The great difference was that now the whole mass of gravel and stones was solid; indeed, for some eight feet or nine feet from the bottom the iron wall was dispensed with, the gravel forming such a hard and compact mass that it had to be cut away with special tools."

The machine - run on average for 10 to 12 hours - delivered the air at a temperature of 67 degrees below zero Fahrenheit, 'and worked admirably all the time without a single hitch or stoppage of any description.'

The temperature in the freezing chamber was generally from six degrees to 15 degrees below zero Fahrenheit after 10 or 12 hours working, but it soon rose to freezing point when the workmen commenced their operations inside.

After two sections had been excavated, the partition wall was removed forward, and the contents of the freezing chamber varied from 3000 to 6000 cubic feet.

About 80 feet of the tunnel was driven by the aid of the Light-foot refrigerator 'with perfect success'.



# ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ



## Πολυτεχνική Σχολή Τμήμα Πολιτικών Μηχανικών Εργαστήριο Γεωτεχνικής Μηχανικής Εργαστήριο Γεωδαισίας και Γεωδαιτικών Εφαρμογών Εκπαιδευτική Εκδρομή

Το Εργαστήριο Γεωτεχνικής Μηχανικής και το Εργαστήριο Γεωδαισίας και Γεωδαιτικών Εφαρμογών του τμήματος Πολιτικών Μηχανικών του Πανεπιστημίου Πατρών οργάνωσαν για τους φοιτητές του 4<sup>ου</sup> και 5<sup>ου</sup> έτους της κατεύθυνσης εμβάθυνσης «Γεωτεχνική μηχανική- Έργα υποδομής» εκπαιδευτική εκδρομή στις 25-26 Απριλίου 2024 σε μεγάλα έργα υποδομής της Δυτικής Ελλάδας.



Οι φοιτητές και τα μέλη των δύο εργαστηρίων (Αλέξανδρος Θεοχάρης, Κωνσταντίνος Θωμάς, Σταυρούλα Κοντοέ, Χριστόφορος Παππάς, Παναγιώτης Πελέκης και Βασίλης Χριστόπουλος) επισκεφτήκαν την πρώτη μέρα το υπό κατασκευή σύστημα αντλησιοταμίευσης στην περιοχή της Αμφιλοχίας και τη δεύτερη μέρα το υδροηλεκτρικό φράγμα του Μετσοβίτικου. Οι φοιτητές μας είχαν την ευκαιρία να εξοικειωθούν με την κατασκευή διαφόρων γεωτεχνικών έργων: δύο φράγματα, σήραγγες, πολλαπλές αντιστηρίξεις, βαθιά φρέατα ανάπαλσης, βαθιές εκσκαφές και ένα υπόγειο σταθμό παραγωγής ενέργειας!

Ευχαριστούμε θερμά τις εταιρείες ΤΕΡΝΑ S.A., ΤΕΡΝΑ ENERGY, τη Geosysta και τη ΔΕΗ, και τους κ. Βραγκο, Παπαδημητρίου, Στειακάκη, Λεβεντάκη, Ντάλια και Δημητρίου για τη φιλοξενία και τη διάθεσή τους να ξεναγήσουν τους φοιτητές μας στα υπό κατασκευή έργα τους. Η εκπαιδευτική εκδρομή πραγματοποιήθηκε με την υποστήριξη του κ. Τσατσανίφου.

Σταυρούλα Κοντοέ  
Αναπληρώτρια Καθηγήτρια,  
Τμήμα Πολιτικών Μηχανικών Πανεπιστημίου Πατρών



ΔΗΜΟΚΡΙΤΕΙΟ  
ΠΑΝΕΠΙΣΤΗΜΙΟ  
ΘΡΑΚΗΣ

## Πολυτεχνική Σχολή Τμήμα Πολιτικών Μηχανικών Τομέας Γεωτεχνικής Μηχανικής Εκπαιδευτική Εκδρομή

Με χαρά ανακοινώνουμε ότι η 4-ήμερη εκπαιδευτική εκδρομή (24-27/4/2024) του Τομέα Γεωτεχνικής Μηχανικής του Τμήματος Πολιτικών Μηχανικών του Δ.Π.Θ. μόλις ολοκληρώθηκε!

Κατά την διάρκεια της εκδρομής επισκεφθήκαμε και ξεναγήθήκαμε στα παρακάτω τεχνικά έργα:



1. Στα Μεταλλεία Ολυμπιάδας ([Hellas Gold S.A.](#)), όπου παρακολούθησαμε μια γενική παρουσίαση των εγκαταστάσεων, επισκεφθήκαμε το φράγμα τελμάτων «Κοκκινόλακα» και παρακολούθησαμε μια επίδοσης επίδειξη με τους υπερασύγχρο-

νους προσομοιωτές εργασιών διάνοξης σηράγγων και πυροπροστασίας του κέντρου εκπαίδευσης.

2. Στο εργοτάξιο της [GEK TERNA Group of Companies](#) στη Θεσσαλονίκη, όπου παρακολούθησαμε επιτόπου εργασίες κατασκευής έγχυτου διαφραγματικού τοίχου αντιστήριξης και ενημερωθήκαμε για τα στοιχεία και τη διαδικασία κατασκευής του έργου ([GEK TERNA Group of Companies](#), [GEOGNOSI s.a.](#)).



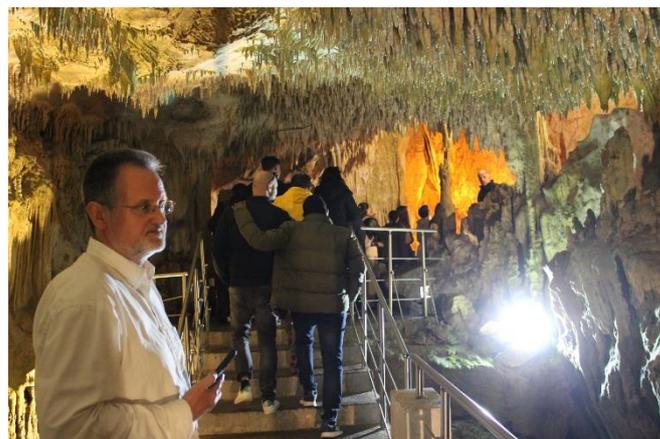
3. Στο εργοτάξιο Πηγαδίτσας της [GEK TERNA Group of Companies](#), όπου ενημερωθήκαμε για τις εργασίες κατασκευής υψηλών ορυγμάτων και τα μέτρα ενίσχυσης και αποστράγγισης που λαμβάνονται, με αποκορύφωμα την εξ αποστάσεως παρακολούθηση ελεγχόμενης ανατίναξης για εκσκαφή / διαμόρφωση πρανούς.



4. Στο εργοτάξιο της Κλεισούρας του [AKTOR SA](#), όπου περιηγήθηκαμε στην κύρια σήραγγα και στη σήραγγα διαφυγής, ενημερωθήκαμε για τα στοιχεία του έργου και την διαδικασία/στάδια κατασκευής τους και παρακολούθησαμε την εξέλιξη των εργασιών προσωρινής υποστήριξης και προχώρησης με ελεγχόμενες ανατινάξεις, ενώ υπήρξαμε και αυτήκοι μάρτυρες ανατίναξης στη σήραγγα διαφυγής.



5. Στο σπήλαιο Δράκου στην Καστοριά, ένα όμορφο φυσικό μνημείο με ιδιαίτερο ενδιαφέρον ως προς τις τεχνικές παρεμβάσεις στην βραχομάζα του σπηλαιού (μέτρα υποστήριξης και πρόσβασης) που το έχουν καταστήσει τουριστικό αξιοθέατο από το 2009.



Last but not least: η εκδρομή ολοκληρώθηκε με μια πολιτιστικού χαρακτήρα επίσκεψη στους Βασιλικούς τάφους της Βεργίνας (Αιγές), στο Νέο Μουσείο και στο Ανάκτορο των Αιγών, του Φίλιππου του Β', που άνοιξε για το κοινό στην αρχή του 2024!



Οι φοιτητές και οι συνοδοί καθηγητές ([Nikos Klimis](#), [Ioannis Markou](#), [Manos Rovithis](#), [Pavlos Asteriou](#), [Theofilos Tzevelekis](#)) εκφράζουμε τις θερμές μας ευχαριστίες προς τους οικοδεσπότες των εργοταξίων που επισκεφθήκαμε [Hellas Gold S.A.](#), [GEK TERNA Group of Companies](#), [AKTOR SA](#) και το προσωπικό τους που μας υποδέχθηκε και μας ξενάγησε. Επίσης, ευχαριστούμε θερμά τους χορηγούς μας [GeoTerra](#), [GEOGNOSI s.a.](#), [Edafomichaniki S.A.](#) και [NAMA Consulting Engineers and Planners SA](#), η συνδρομή των οποίων υπήρξε καταλυτική για την υλοποίηση της εκδρομής!

Καθηγητής Νίκος Κλήμης



**igs** Greece

Αγαπητές και αγαπητοί συνάδελφοι,

Ο **Ελληνικός Σύνδεσμος Γεωσυνθετικών Υλικών** (IGS Greece) σε συνεργασία και με την υποστήριξη της **Intern-**

**tional Geosynthetics Society (IGS)** προτίθεται να διοργανώσει για πρώτη φορά στην Ελλάδα το Επιμορφωτικό Πρόγραμμα **"Educate the Educators" (ETE)**. Το πρόγραμμα αυτό απευθύνεται σε Καθηγητές και Διδάσκοντες στα Πανεπιστήμια και έχει ως στόχο την ενημέρωσή τους ώστε η διδασκαλία αντικειμένων σχετικών με τα γεωσυνθετικά υλικά να περιληφθεί (έστω και ως τμήμα) στα μαθήματα που διδάσκονται στα προπτυχιακά αλλά και στα μεταπτυχιακά προγράμματα σπουδών των Πανεπιστημίων. Πιο αναλυτικά, ο στόχος του προγράμματος αυτού, όπως αναφέρεται στην ιστοσελίδα της IGS, είναι:

"The main goal of this program is to make sure that every student graduating from an undergraduate engineering program receives some basic exposure to geosynthetics. One way to carry out this action is to supply educators with the necessary knowledge and tools to help them integrate geosynthetic topics into their engineering curricula. ETE workshops provide attending professors with a host of re-sources to support this mission."

Περισσότερες πληροφορίες για το πρόγραμμα είναι διαθέσιμες εδώ: <https://www.geosyntheticssociety.org/educate-the-educators-program/>

Για το σκοπό αυτό ο Ελληνικός Σύνδεσμος Γεωσυνθετικών Υλικών έχει ήδη υποβάλλει στην IGS πρόταση διοργάνωσης του προγράμματος στην Ελλάδα, η οποία έχει εγκριθεί.

Το πρόγραμμα θα διεξαχθεί δια ζώσης μέσα στο **πρώτο δεκαπενθήμερο του Οκτωβρίου 2024** (οι ακριβείς ημερομηνίες θα καθοριστούν εγκαίρως ώστε να οργανωθούν οι μετακινήσεις και η διαμονή των συμμετεχόντων) στο **ΚΟΙΝΩΝΙΚΟ ΚΕΝΤΡΟ "ΣΤΑΥΡΟΣ ΧΑΛΙΟΡΗΣ"** (<https://kksxalioris.gr/>) στην **Ξάνθη** και αναμένεται να διαρκέσει **2 ως 3 ημέρες**. Η διάθεση του χώρου για τη διεξαγωγή του προγράμματος είναι ευγενική χορηγία του **Ομίλου ΠΛΑΣΤΙΚΑ ΘΡΑΚΗΣ**, ο οποίος υποστηρίζει ενεργά το πρόγραμμα ως χορηγός. Στο πλαίσιο του προγράμματος θα διεξαχθεί και **τεχνική επίσκεψη** στο εργοστάσιο της εταιρείας ΠΛΑΣΤΙΚΑ ΘΡΑΚΗΣ, το οποίο βρίσκεται σε μικρή απόσταση από τον χώρο διεξαγωγής του προγράμματος, ώστε οι συμμετέχοντες να δουν από κοντά τις διαδικασίες παραγωγής γεωσυνθετικών υλικών από μία Ελληνική εταιρεία διεθνούς εμβέλειας.

Σύμφωνα με την κατάρτιση του προγράμματος, τον ρόλο των επιμορφωτών θα αναλάβουν **2 ως 3 επιστήμονες διεθνούς κύρους** στον τομέα των γεωσυνθετικών υλικών. Ο Ελληνικός Σύνδεσμος Γεωσυνθετικών Υλικών έχει ήδη έρθει σε συμφωνία με τον **Jorge G. Zornberg**, Brunswick-Abernathy Regents Professor, The University of Texas at Austin, Past-President of the International Geosynthetics Society, να αναλάβει τον ρόλο του κύριου επιμορφωτή. Ο Καθηγητής Zornberg έχει πολύ μεγάλη εμπειρία στην διεξαγωγή αντίστοιχων προγραμμάτων σε άλλες χώρες και η παρουσία του αποτελεί εγγύηση για ένα πρόγραμμα υψηλού επιπέδου. Υπενθυμίζεται ότι ο Καθηγητής Zornberg έδωσε, ως Προσκεκλημένος Ομιλητής, την **διάλεξη με τίτλο "Geosynthetic Applications in Railways and Roadways"** στο πρόσφατο 9ο Πανελλήνιο Συνέδριο Γεωτεχνικής Μηχανικής.

Είναι σημαντικό να αναφερθεί ότι η συμμετοχή στο πρόγραμμα είναι **ΔΩΡΕΑΝ** και θα καταβληθεί κάθε δυνατή προσπάθεια ώστε να μειωθεί το κόστος διαμονής των συμμετεχόντων μέσω χορηγιών.

Επειδή, σύμφωνα με τους κανόνες του προγράμματος, η διεξαγωγή του απαιτεί έναν αριθμό συμμετεχόντων, **παρακαλώ πολύ να δηλώσετε την πρόθεσή σας να συμμετάσχετε** σε αυτό συμπληρώνοντας τα ζητούμενα στοιχεία επικοινωνίας στην ακόλουθη **ηλεκτρονική φόρμα** ως την **Τετάρτη, 17 Απριλίου 2024**. Η τήρηση της προθεσμίας είναι πολύ σημαντική για την σωστή οργάνωση του προγράμματος.

<https://forms.gle/VdqaJKawhM9VgPUK6>

Παρακαλώ επίσης να προωθήσετε το παρόν μήνυμα και σε **διδάκτορες, συμβασιούχους διδάσκοντες** (ΠΔ 407, απόκτηση ακαδημαϊκής εμπειρίας κλπ.) που γνωρίζετε ώστε να δηλώσουν και αυτοί την πρόθεσή τους να συμμετάσχουν στο πρόγραμμα.

Είμαι στη διάθεσή σας για κάθε πρόσθετη πληροφορία ή διευκρίνιση και παρακαλώ για τη δήλωση συμμετοχής σας στο πρόγραμμα.

Με εκτίμηση,

Εκ μέρους του Ελληνικού Συνδέσμου Γεωσυνθετικών Υλικών

Ο Πρόεδρος

Ιωάννης Ν. Μάρκου  
Καθηγητής  
Τομέας Γεωτεχνικής Μηχανικής  
Τμήμα Πολιτικών Μηχανικών  
Δημοκρίτειο Πανεπιστήμιο Θράκης



**The February 6th Kahranmanmaras earthquake sequence in Turkiye**

**Technical Report**

**Editors & Reconnaissance Mission Coordinators:** Aristidis Papachristidis, Anastasios Sextos

**Authors:** Garini E., Gazetas G., Giarlelis C., Marinos V., Morretti M., Palieraki V., Pitolakis D., Stefanidou S., Thanopoulos P., Tsiatas G., Tsopelas P., Vintzileou E., Vougioukas E., Zeri C., Cekinmez M., Papachristidis A., Sextos A.

[https://www.eltam.org/images/nltr/newsletters/2024/the-february6th2023kahranmanmarasearthquakesequenceinturkiyehaee\\_ntua\\_tcg.pdf](https://www.eltam.org/images/nltr/newsletters/2024/the-february6th2023kahranmanmarasearthquakesequenceinturkiyehaee_ntua_tcg.pdf)



**International Society for Soil Mechanics and Geotechnical Engineering**

**ISSMGE News**  
[www.issmge.org/news](http://www.issmge.org/news)

**Highlights of the Special Council Meeting,  
Wednesday, 20th March 2024**

Member Societies attending the Special Council Meeting held online, voted for the ISSMGE to become an Incorporated Society. Incorporation will establish the ISSMGE as a legal entity and enable the Society to continue to hold bank accounts.

Other key points from the Council Meeting are:

The President, Dr Marc Ballouz, launched the New ISSMGE Bulletin, this e-magazine is a quarterly publication.

The next Council Meeting will be in Vienna on Sunday 14th June 2026.

### The 9th ERTC10 Webinar on the Second Generation of Eurocode 7 – Rock Engineering

ISSMGE Secretariat / [ERTC10](#) / 08-04-2024

The 9th ERTC10 Webinar on the "Second Generation of Eurocode 7 Rock Engineering" will be held on Wednesday, 24 April 2024, 15:00-17:00 (CET), and it is open for registration. It is organised jointly by ERTC10, CEN TC250/SC7 and NEN, with support of ISRM for this event.

The webinar will cover the subject of Rock Engineering, which was significantly improved in the second generation of Eurocode 7 compared to the current version. The Experts representing SC7's Rock Engineering Platform (SC7/REP) will explain:

- How rock engineering was implemented in the new code in terms of general rules in EN 1997-1.

- What we can find on relevant ground properties in the new EN 1997-2.

- What design aspects for specific geotechnical structures in EN 1997-3 have to be considered when dealing with rock masses.

As usual, this 2h long webinar is free of charge, and the agenda for this event includes:

**1. Introduction** - [Witold Bogusz](#), Jacobs & Secretary of ISSMGE ERTC10, Poland, together with [Milorad Jovanovski](#), ISRM European Vice President at Large, North Macedonia.

**2. Introduction of rock engineering in the second generation of the Eurocodes** - [Luís M. N. Lamas](#), LNEC, SC7/REP Convenor & ISRM Secretary General, Portugal.

**3. Rock engineering in EN 1997-1 General rules** - Herbert Walter, SC7/REP, Austria.

**4. Rock engineering in EN 1997-2 Ground properties** - José Estaire, CEDEX & SC7/REP, Spain.

**5. Rock engineering in EN 1997-3 - Slopes, foundations and retaining structures** - [Paulo Pinto](#), University of Coimbra & SC7/REP, Portugal.

**6. Rock engineering in EN 1997-3 - Anchors, rock bolts, rock support and groundwater control** - [Natalia Maca](#), Ischebeck Titan Polska & SC7/REP, Poland.

**7. Rock engineering in EN 1997 - Perspectives on the evolution to the third generation** - [John Harrison](#), University of Toronto & SC7/REP, UK.

**8. Q&A session.**

Link to the website with the registration form: <https://euro-code7-rock-engineering.nen-evenementen.nl/>

### Online ground improvement presentation on "Soil-Bentonite Slurry Trench Wall Lateral Deformation, Consolidation, and State-of-Stress"

ISSMGE IT Administrator / [TC211](#) / 10-04-2024

ISSMGE TC-211 will be holding an on-line ground improvement presentation on "Soil-Bentonite Slurry Trench Wall Lateral Deformation, Consolidation, and State-of-Stress" that will be presented by **Professor Emeritus Jeffrey Evans** of Bucknell University (Lewisburg Pennsylvania).

The presentation will be made on Zoom (link=<https://utsmeet.zoom.us/j/89658918418>) at **7 AM US Standard Eastern Time (UTC -5:00) of Friday 26 April 2024**, and the audience will have the opportunity to ask questions at the end of the presentation.

A further description of the presentation and a short biography of the speaker are in the attached presentation [flyer](#).

*Please share this invitation along with the presentation flyer to your network, colleagues and any other persons who may be interested in attending this very interesting topic.*

We look forward to seeing you all on the day.

### 3rd ISSMGE TC222 digital workshop recording published

ISSMGE Secretariat / [TC222](#) / 11-04-2024

The 3rd ISSMGE TC222 digital workshop held on April 4th was a great success. The workshop theme was "Digital Standards for Geotechnical Data" and included state-of-art presentations on:

- An overview of digital geotechnical standards by [Mickaël Beaufile](#)
- The AGS data transfer format by [Neil Chadwick](#)
- The DIGGS data transfer format by [Daniel Ponti](#)
- The bSI IFC Tunnel project by [Jonas Weil](#)

A total of 153 people attended the live event which clearly shows the high interest among both researchers and practitioners on the need for data standardization within the geotechnical domain.

For those of you that could not attend the live event we have published the recording on our TC222 Youtube-channel!

Link to recording. <https://lnkd.in/dWWz2dyW>





## 46th ISRM Online Lecture

The 46th ISRM Online Lecture "Scaled power law failure criterion for rock" by Prof. Carlos Carranza-Torres from University of Minnesota will broadcast on the 20th June

### Prof. Carlos Carranza-Torres Bio



The 46th ISRM online lecture will be delivered by **Prof. Carlos Carranza-Torres**, from USA. The lecture title is: "**Scaled power law failure criterion for rock**". It will be broadcast on the 20th June at 10 A.M. GMT, from the [Online Lecture's page](#).

Professor Carranza-Torres obtained his Bachelor of Science in Civil Engineering from Northeast National University, Argentina, in 1992; his Masters of Science in Engineering Geology from ITC-Delft, The Netherlands, in 1994; and his PhD in Civil Engineering, with an emphasis in geomechanics, from the University of Minnesota, Twin Cities Campus, in 1998. His PhD dissertation, which was supervised by Professor Charles Fairhurst, was on self-similarity analyses of the elasto-plastic response of underground excavations. Based on his PhD work, he wrote several high-impact publications on tunneling using a scaled form of the Hoek-Brown failure criterion. These publications led to an invitation by Professor Evert Hoek to collaborate on an update version of the Hoek-Brown failure criterion which was published in the early 2000s.

For more than 25 years, Dr. Carranza-Torres has been teaching, publishing, and consulting on rock engineering. From 1998 to 2005, he worked as a project engineer for Itasca Consulting Group in Minneapolis, Minnesota. During this time, he participated in several projects requiring application of Itasca's software for the civil and mining engineering industries. Notably, he worked on Yucca Mountain, the radioactive waste repository project in Nevada, United States. In 2005, he left Itasca to become a freelance rock mechanics consultant. In this role, he worked with various consulting companies, participating in the design of major rock engineering projects, such as underground stations for the 2nd Avenue Subway in New York, Admiralty Station in Hong Kong, and the Airport Link in Brisbane, Australia. In 2007, he was invited by the late Dr. Oskar Steffen (a leading geotechnical consultant for open pit mining and one of the three founders of the global mining consulting company SRK), to work for SRK as an external rock mechanics consultant. In this role, and for the past 17 years, he has worked with engineers and geologists from SRK in more than 45 open pit and underground mining projects all over the world.

Dr. Carranza-Torres has also achieved a successful academic career. In 2008, he was hired as an Associate Professor in Civil Engineering at the University of Minnesota, Duluth Campus. In 2012, he was tenured and in 2018, he was promoted to Professor. Dr. Carranza-Torres teaches courses in numerical modeling, computational and applied mechanics, and rock engineering. His field of research is in the development of analytical and numerical techniques for the treatment of rock mechanics problems in mining and civil engineering. The publications resulting from this research are characterized by a balanced blend of analytical and numerical analyses for the

treatment of fundamental problems in rock mechanics, such as loading on rock bolts around circular tunnels, stresses on composite liners in tunnels, stability of shallow circular cavities, failure of slopes, and other important topics.

Dr. Carranza-Torres has delivered more than one hundred invited lectures, short courses, and workshops, and has spent time as a visiting scholar at universities around the world, including University of Louvain, Louvain-la-Neuve, Belgium; University Joseph Fourier, Grenoble, France; Queen's University, Kingston, Canada; EPFL, Lausanne, Switzerland; Universidad de Vigo, Vigo, Spain; Nanyang Technological University, Singapore; Monash University, Melbourne, Australia; Northeastern University, Shenyang, China and others.

Dr. Carranza-Torres is a member of the American Rock Mechanics Association, International Society for Rock Mechanics and Rock Engineering, Geo-Institute of the American Society of Civil Engineers, and the Society for Mining, Metallurgy, and Exploration (SME). He serves on the Editorial Boards of international journals, including Engineering Geology (for which he served as senior editor from 2015 to 2018), International Journal of Rock Mechanics and Mining Sciences, Rock Mechanics and Rock Engineering, and Tunneling and Underground Space Technology.

[Click to watch the lecture.](#)

### News

<https://www.isrm.net>

### New ISRM National Group of Morocco 2024-04-23

It is with great pleasure that we welcome the Comité Marocain de Mécanique des Sols et de Géotechnique - CMMMSG as the new ISRM National Group of Morocco.

### Symposium and Course organised by the ISRM National Group of Mexico in May 2024 2024-04-24

The Mexican Society of Geotechnical Engineering – SMIG (ISRM National Group of Mexico) and the Mexican Association for Tunnelling and Underground Works Association - AMITOS will host the *7th International Symposium on tunnels and shafts in soils and rocks* and a *Pre-Symposium course on injection of rock masses and geotechnical characterization of rock masses and its applications to the design of underground excavations*.

This will be an online event. The course will have sessions on 6, 7 and 9 May, and the Symposium on 14, 16, 21 and 23 May 2024, 8:00-14:00 Mexico City time.

[Click here to download the flyer.](#)

[Click here to visit the event website.](#)



ASSOCIATION  
INTERNATIONALE DES TUNNELS  
ET DE L'ESPACE SOUTERRAIN

AITES

ITA  
INTERNATIONAL TUNNELLING  
AND UNDERGROUND SPACE  
ASSOCIATION

## News

<https://about.ita-aites.org/news>

### ITACET Lunchtime Lecture Series #34 09 April 2024

The thirty-fourth instalment of the Lunchtime Lecture Series will focus on 'New developments in BIM'.

This LLS#34 will run on April 9th at 13:00 CET time

This episode will feature 5 lectures and finish with a Q&A session:

- Introduction - ITA-AITES WG22 activities - Florent Robert
- Digital Engineering – applications and approaches – Alessandro Menozzi
- Sustainable tunnelling projects using BIM – main concepts and opportunities - Rita Sanfilippo
- IFC standard for underground infrastructure projects (IFCTunnel) - Michel Rives
- BIM: Vision of the future - Galina Paskaleva

Sign up for free subscription [here](#)



### See You at WTC 2024 in Shenzhen 19 April 2024

Join us for the World Tunnel Congress 2024 and celebrate the 50th ITA Anniversary!

WTC 2024 is right around the corner! It is going to be held 19 - 25 April at Shenzhen World Exhibition & Convention Center, in Shenzhen, China.

This significant event will encompass the most comprehensive technical content and the largest exhibition in the global tunnelling and underground space sector. With over 1,000 abstracts received from 46 countries, more than 540 full papers submitted, and over 480 papers accepted, the conference showcases the latest innovations, advanced equipment and materials and insights from significant projects. Spanning three days and featuring 40 technical sessions, it provides deep insights from leading experts and introduces the newest global innovations. The event exceeds expectations, drawing 200 world-leading companies from the tunnel industry to participate in the exhibition. As the premier tunnelling nation, Chinese companies exhibit unparalleled enthusiasm for this conference, offering an exceptional opportunity for international participants to engage directly with the local industry.

This year again, the World Tunnel Congress will be hosted as a hybrid event and will offer both in-person and virtual experiences. For people who are unable to attend or otherwise unable to travel, to take part in celebrating the tunnel industry, we offer to participate remotely through the convenience of an interactive virtual format. All participants, even those attending in-person, will have access to the digital platform. The access to the platform will be through an Application

Registration: [World Tunnel Congress 2024 \(wtc2024.cn\)](https://www.wtc2024.cn)

[Take a look at the video!](#)

### Scooped by ITA-AITES #115, 9 April 2024

[Incredible £93bn tunnel that's the world's second longest | World | Japan](#)

[Central Interceptor TBM reaches milestone | New Zealand](#)

[Preparations for WTC2024](#)

[Tunnelling continues at Snowy Hydro | Australia](#)

[UK's huge new £5bn tunnel finally finished but tourists will never be able to walk down it | UK](#)

[Huge HS2 tunnelling machines digging towards Birmingham | UK](#)

[LA Metro completes tunnelling for D Line Subway Extension | USA](#)

[TBM unveiled for T2D | Australia](#)

[When mining goes electric](#)

[The benefits of bridge-tunnels | USA](#)



### BTSYM April lecture

#### Design and Construction of Canterbury Vent Shaft – HS2

Thursday 11th April 2024, Institution of Civil Engineers, 1 Great George Street, Westminster, London  
[https://youtube.com/live/k0ADq3w\\_-YM?feature=share](https://youtube.com/live/k0ADq3w_-YM?feature=share)



**Event Information:**

Canterbury Works Headhouse and Ventilation Shaft serves the Euston Tunnels for both Ventilation and Emergency access. This presentation focuses on the construction of the shaft and tunnels using underpinned segments, sprayed concrete lining, reinforced concrete collars, and cast in-situ secondary lining. The presentation will be delivered by members of the construction and design team.

**Speakers:**

**Joao Ferreira**  
Principal Civil/Geotechnical Engineer, Typsa

**Rickard Barbet**  
Agent, SCS Railways

**William Evett**  
Shift Manager, SCS Railways

high overburdens led to significant geomechanical phenomena due to the tectonic nature of the ground (the "Argilliti a Palombini" formation).



**Speakers:**

**Francesco Grasso Leanza**  
Site Manager, Webuild

**Luigi D'Angelo**  
Representative of the SIGym, international activities  
Project Engineer, Italferr



**BTSYM / SIGym Joint April Webinar**

**Terzo Valico dei Giovi (Giovi 3rd Pass railway)  
Semi-automatic steel ribs: a relevant innovation  
for tunnel temporary lining. Design and  
construction application**

Tuesday, 9 April 2024, Online only - BTS YouTube  
<https://www.youtube.com/watch?v=fyGxbAOISHY>



**Event Information:**

The Giovi 3rd Pass railway is one of the biggest tunnelling projects in Italy. With the 27km twin bore "Valico" tunnel, and the 8km twin bore "Serravalle" Tunnel, it involves every sort of tunnelling challenge, from the presence of natural gas and asbestos, to squeezing ground conditions with tectonised rock, as well as great length and depth, conventional and mechanised tunnelling in poor ground, drill & blast in hard rock, shafts, caverns, and underground fire-fighting points.

The purpose of the presentation is to provide an overview about the technical innovations designed and implemented for the excavation of a section of the Valico tunnel where the



[www.geosyntheticssociety.org](http://www.geosyntheticssociety.org)

**News**

**Reducing CO2 emissions at Ostend Airport with geotextiles** April 17, 2024

Read how geotextiles helped lower emissions, noise and microplastics release at a Beaulieu International Group airport project.

The latest IGS Sustainability Case study shares the considerable environmental and cost efficiencies enabled by replacing gravel with geotextiles, including reducing CO<sub>2</sub> emissions by more than 77%, at Ostend Airport, Belgium.

The profile is the latest in the IGS Sustainability Case Study series, which showcases the various ways in which geosynthetics can lead to a more sustainable solution. The case studies are available as one-page pdfs so easy to download and share.

You will also be able to hear this case study **live** when it is presented at the upcoming [GeoAmericas 2024](#) conference in Toronto, by Francesco Fontana, Daniele Cazzuffi, and Beau-lieu's Simon De Meyer.

Read the latest profile and more on the IGS Sustainability web page [here](#), which has additional resources including eBooks, videos, and papers.

+++ Does your geosynthetic project demonstrate benefits to the environment? If you would like your project to be featured in an IGS Sustainability Case Study, fill out the [submission form](#).

IGS Student and Young Members have even more ways to help them attend the 5th Pan-American Conference on Geosynthetics. As well as free and reduced rates [Read More >](#)

## Strengthen Your Diversity Strategy At GeoAmericas Lunch April 22, 2024

Respected diversity consultant **Dr Imogen R. Coe** will share tips and tools to better embed diversity in the workplace at the [IGS Diversity Task Force](#) (TF) Lunch at [GeoAmericas 2024](#).



Dr. Coe, founding Dean of the Faculty of Science at Ryerson University (now known as Toronto Metropolitan University), will talk on 'Embracing diversity to drive innovation and leverage talent' before a panel discussion with guests Kristin Sample-Lord, Dawie Marx and Francisco Pizarro.

Industry and government advisor Dr. Coe is described as internationally recognized as a Canadian thought-leader in the areas of inclusion, diversity, equity, and accessibility in science, technology, engineering and math (STEM) subjects. Her talk will offer a better understanding about the value of diversity in the workplace, particularly in how it can unleash creativity, drive innovation and attract new talent.

The post-talk discussion will further explore the opportunities and benefits a diversity strategy could offer within the IGS and wider industry from the unique perspectives of panelists:

- **Kristin Sample-Lord** – member of the Diversity TF, President-Elect of IGS North America, and co-organizer of GeoAmericas 2024 and the forthcoming 13<sup>th</sup> International Conference on Geosynthetics in Montreal in 2026.

- **Dawie Marx** – current chair of the IGS Young Members Committee.
- **Francisco Pizarro** – chair of the IGS Pan-American Regional Activities Committee.

IGS Secretary General Laura Carbone, who is leading the Diversity TF, said: "It is a great pleasure and honor to have Dr. Coe as our guest speaker at the Diversity session. I am looking forward to her presentation and the outcomes we will get from the panel discussion, where the panellists and audience will have the chance to interact."

"I would also like to thank the [IGS Foundation](#) for sponsoring the event."

The talk takes place on **Monday, April 29**, at 12pm to 1.15pm in the Grand Ballroom.

For more information about the Diversity TF, contact Ms Carbone at [carbone@huesker.de](mailto:carbone@huesker.de).

You can also find out more about Dr. Coe on her website [here](#).

+++ There is still time to register for GeoAmericas 2024 – book [here](#).



## News

<https://www.britishgeotech.org/news>

### Dr Angus Skinner 02.04.2024

The BGA is very sad to hear that Dr. Angus Skinner passed away on 1st April 2024.

Angus was a Lecturer in Soil Mechanics at Imperial College from 1967 to 1998, making huge and often understated contributions to the development of the subject through his innovative experimental research into the behaviour of particulate materials. His contributions to the teaching of soil mechanics are also renowned among students, researchers and staff at Imperial College. Angus regularly attended and contributed to lively discussions at BGA events and he will be missed.

Our condolences go to his family.

### Russell Geotechnical Innovations announced as Platinum Sponsor for BGA Annual Conference 10.04.2024

The British Geotechnical Association is pleased to announce that following more than 10 continuous years support as a Gold Sponsor we have invited [Russell Geotechnical Innovations](#) to be our first and sole Platinum Sponsor for our Annual Conference on 12<sup>th</sup> June 2024. Thank you Chris Russell for your loyalty!

## **The May 2024 issue of Ground Engineering is available on line** 17.04.2024

The May 2024 issue of Ground Engineering is available on line. Online access to Ground Engineering (GE) is included in BGA subscriptions.

The May 2024 issue of *Ground Engineering* reports on the piling and foundations work for the redevelopment of the Old War Office in London, and geological investigations for Ebbw Vale train frequency enhancements.

It includes a round table on the past, present and future of the piling industry, and industry view pieces on rethinking the angle of sustainability for foundations, and a new geosynthetic design method for haul roads. The issue also features a piece on professional registration routes, and a technical paper on back analysis to model sewerage repair ground settlements.

In addition, it includes an Engineering Insight Q&A with University of East London's Meghdad Bagheri, as well as the latest news and opinion.

Use [this LINK](#) to view the latest digital issue.

To view the digital editions, along with the rest of GE's online news, opinions, features and technical papers, you need to be signed in. Use the email address you used for your BGA membership to sign in and use the reset password link if you have not yet set a password or have forgotten your password.

If you are having trouble with the signing in process, please contact GE's customer services team using the details listed here: <https://www.geplus.co.uk/contact-us/>

## **2023 BGA Medal Winning Paper announced** 28.04.2024

The British Geotechnical Association (BGA) is pleased to announce that the 2023 BGA Medal has been awarded to the paper "Particle-scale simulations of the compression and shearing of kaolin clay" by John de Bono and Glenn McDowell.

The full reference for the paper is:

de Bono, J P & McDowell, G R (2023) Particle-scale simulations of the compression and shearing of kaolin clay. *Géotechnique*, Ahead of Print, Published online: August 2, 2023 [https://doi.org/10.1680/jgeot.22.00423]

The paper can be accessed via the ICE Virtual Library [HERE](#).

A total of eight entries were received for this year, many of which were of a very high standard, making the selection of the winner by the prizes sub-committee a challenging task.

The Judges found the winning paper to be truly impressive. The paper presents the work undertaken on the modelling of the mechanical behaviour of kaolin clays using the discrete element approach, which resulted in successful simulations in terms of compression and shear. This work opens the way for fundamentally improving our understanding of phenomena such as hysteresis and creep.

The BGA Medal is awarded annually (each calendar year) by the BGA to a paper substantially authored by a BGA member or BGA members published in an international journal or from BGA, ISSMGE and ISRM conferences, and submitted for consideration of the award.

## **Call for submissions - BGA annual conference young engineers' poster competition 2024** 28.04.2024

For many years we have invited students to present their work in the form of posters at the Annual Conference at One Great George Street in London. Recently we inaugurated a

competition for the best poster, for which a prize of £150 is awarded.

We are inviting all Young Geotechnical Engineers to submit pdf posters digitally on any topic of their own work dealing with the engineering behaviour of the ground, whether it be a description of an industrial design or construction project, development of a new piece of equipment, or state-of-the-art research.

Date of event and deadline for submissions

The date of the competition is 12th June 2024 at the [BGA Annual Conference and AGM](#) in London.

The deadline for submissions is midnight on Monday 3rd June 2024.

Posters will be assessed prior to the event by a small group of judges. All posters will be displayed at the conference and the winner announced on the day. Following the event all posters submitted will be available to view on the BGA website.

We encourage as many applicants as possible, as this is a great opportunity for young engineers to showcase their work at this early stage in their careers.

Entry rules

- Entrants should be under 33 years of age on 31st December 2023.
- Candidates are encouraged to be members of the ICE or BGA.
- Posters may be up to A0 in size (1189 mm x 841 mm) but must be in landscape orientation
- Authors may layout the content as they wish but the poster should display "BGA Annual Conference 2024", together with the title of the presentation, the name of author and their affiliation.
- The poster should be submitted as a pdf with a brief CV and completed application form by midnight Monday 3rd June, to [bga@ice.org.uk](mailto:bga@ice.org.uk)

Last years entries can be viewed [HERE](#).

The competition flyer can be downloaded [HERE](#).

The application form can be downloaded [HERE](#).



## **Professor Harry Poulos 2025 Lifetime Achievement Award**

We are proud to recognize Professor Harry Poulos as the recipient of the 2025 Lifetime Achievement Award. Professor Poulos has made outstanding contributions to the geotechnical field, including delivering prestigious lectures such as the 1989 Rankine Lecture, the 2004 Terzaghi Lecture, and the 2009 Terzaghi Oration.



[Rocscience International Conference 2025](#)

# ΘΕΣΕΙΣ ΓΙΑ ΓΕΩΤΕΧΝΙΚΟΥΣ ΜΗΧΑΝΙΚΟΥΣ



CALIFORNIA STATE UNIVERSITY  
**LONG BEACH**

**Department of Civil Engineering and  
Construction Engineering Management  
PhD in Geotechnical Engineering**

I have an opening for a PhD in Geotechnical Engineering at California State University, Long Beach (also known as "The BEACH"). If you are interested in pursuing graduate studies in topics related to infrastructure deterioration and asset management, please submit your application via the link below before July 1st.

<https://lnkd.in/gPvnmk3r>

[Amr Morsy, Ph.D., P.E. Assistant Professor at California State University, Long Beach](#)



**Department of Engineering**

**Research project (PhD Student)**

**The role of fabric anisotropy on cyclic loading of offshore soils: a grain-scale investigation**

Project Description:

**This project is open to applicants until 16 May 2024. The successful candidate will begin their study in September 2024.**

This Research Project is part of the EPSRC CDT in Offshore Wind Sustainability and Resilience's *Offshore wind energy geotechnics* Cluster.

More than 100 countries worldwide have proposed net zero targets in the next few decades. Renewable offshore wind energy plays a critical role on meeting these targets, and this leads to the need for novel design and construction solutions for offshore wind structures that are subjected to dynamic loading conditions (wind, waves, earthquakes, tsunamis) in the harsh offshore environment. Those loads are transferred to the marine soil deposits around the structure foundation, and thus, the degradation of the soil's strength and stiffness in time will dictate the structures' lifespan. This degradation has not been fully understood and cannot be quantified with confidence, mainly due to the complex grain dynamics at the

micro scale and the nature of the repetitive cyclic environmental loads.

This project proposes use of an existing bespoke miniature triaxial shearing experimental apparatus, that unlike traditional triaxial testing devices, will be able to apply cyclic loading on miniature sand samples, while the motion of each of their grains will be observed with the use of existing X-Ray Computed Tomography facilities at Durham University. Grain-scale phenomena during this complex loading condition will be systematically analysed for the first time and new correlations between the evolution of soil's microstructure and the degradation of their strength and stiffness will be generated. Those data will then be used for the development of digital twin samples, that will be analysed computationally using the Level Set Discrete Element Method (LS-DEM). The latter is a micromechanical computational method that allows the simulation of grain-dynamics in particles with realistic shapes, extracted from the XRCT images. Both the experimental and computational output data will set the foundation for the development of new theories and mathematical models in soil mechanics and help engineers to create new design solutions for the acceleration of renewable energy infrastructure exploitation, towards more sustainable and resilient societies.

Granular soils exhibit highly anisotropic mechanical behaviour, mainly due to the non-spherical shape of their grains, with preferred orientations when forming assemblies, often called the orientation of the material's fabric. The orientation of fabric with respect to the orientation of the applied load determines the effect of fabric anisotropy on the material's strength and stiffness, like the role of the orientation of fibres in a loaded composite material.

During loading, fabric anisotropy evolves due to the continuously changing orientations of grains, and the effect on stiffness and strength of soils has been successfully studied macroscopically for monotonic loading. The macroscopic observations of the effects, in combination with a qualitative description of fabric evolution with the use of Discrete Element numerical modelling on idealised granular materials, has led to significant theoretical advances on the mathematical description of fabric anisotropy for monotonic loading. However, the quantification of fabric anisotropy during cyclic loading is much more complicated and still an open research question.

To achieve this research goal, the grain-scale quantification of fabric evolution during cyclic loading, must be thoroughly studied. Microfocus X-Ray Computed Tomography ( $\mu$ CT) has been extensively used for grain-scale experiments in soils, and more recently for quantitative measurements of fabric evolution. Conventional testing setups (e.g., the triaxial apparatus) have been miniaturised to be able to image large numbers of grains at high resolution, and such a device is available in Durham University. The quantification of fabric evolution during cyclic loading is not extensively investigated yet and the alternation of loading from triaxial compression to triaxial extension during cyclic loading is the main key triggering of the anisotropic behaviour of the soil. Finally, by using the XRCT images to develop digital twin samples with an open-source implementation of the LS-DEM method in YADE, grain-scale simulations can complement the experimental data, where the experiments will be used to validate the numerical results. This combination forms a complete characterisation, both experimental and computation, of the evolving properties of the material in cyclic loading.

The goal of the project is to shed light in unexplained phenomena that happens in the micro-scale during the repetitive cyclic loading that offshore soils exhibit next to offshore foundations during complex environmental loading conditions. It will form the foundations for new theories in offshore soil mechanics, specifically considering the complexities of cyclic loading.

## Training & Skills

Student will be trained to use the XRCT facility at Durham University. They will be trained in scientific computing and high-performance computing by the Advanced Research Computing unit at Durham. Finally, you will develop skills on scientific writing, research presentation and communication.

You will benefit from a taught programme, giving you a broad understanding of the breadth and depth of current and emerging offshore wind sector needs. This begins with an intensive six-month programme at the University of Hull for the new student intake, drawing on the expertise and facilities of all four academic partners. It is supplemented by Continuing Professional Development (CPD), which is embedded throughout your 4-year research scholarship.

## Further Queries

If you would like more information about this project, please let us know by emailing [auracdt@hull.ac.uk](mailto:auracdt@hull.ac.uk).

## Entry Requirements

If you have received or expect to achieve before starting your PhD programme a First-class Honours degree, or a 2:1 Honours degree and a Masters, or a Distinction at Masters level a degree (or the international equivalents) in Civil Engineering, Mechanical Engineering, Applied Mathematics, Applied Physics, or any other Engineering or Physics related degree, we would like to hear from you.

If your first language is not English, or you require a Student Visa to study, you will be required to provide evidence of your English language proficiency level that meets the requirements of the Aura CDT's academic partners. This course requires academic IELTS 7.0 overall, with no less than 6.0 in each skill. Please contact [auracdt@hull.ac.uk](mailto:auracdt@hull.ac.uk) for further guidance or questions.

## How to Apply

Please note, you may only apply for ONE project offered through the EPSRC CDT in Offshore Wind Energy Sustainability and Resilience.

Applications are open until 16 May 2024.

Applications to this project are made via the Durham University admissions system. If you have not applied to Durham University before, you will need to set up an account to enable you to track the progress of your application and upload supporting documents.

Follow this link to apply for CDT projects at Durham University:

<https://studyatdurham.microsoftcrmporals.com/en-US/>

For CDT projects based at Durham University you need to select "PhD Engineering" as your course and "H1A201" as your course code. Please make sure you select "October" intake – although note that the PhD will actually start in September, with the 6-month taught programme, based at the University of Hull.

With your application, you need to upload copies of the following supporting evidence:

- Complete transcripts (and final degree certificate(s) where possible). If your qualification documents are not in English, you will need to supply copies of your original language documents as well as their official translation into English.
- Your Curriculum Vitae (CV).

- A completed Supplementary Application Form (upload when asked for your Personal Statement).

Guidance on completing your Supplementary Application Form:

The EPSRC CDT in Offshore Wind Energy Sustainability and Resilience is committed to generating a diverse and inclusive training programme. As part of our inclusive practices, the Centre adopts a process of assessing applicants' experience, skills and attributes independently of personal details. To enable us to do this, we ask you, as the applicant, to complete the Supplementary Application Form, omitting the following personally identifying information from the form – name(s), ethnic group, nationality, age, gender, religion, disability, sexual orientation. The form is then used by the Panel to assess and select applicants for interview. The form asks for details of your education, training and employment history as well as some specific questions about your motivations and research experience and interests. It is very important that you do not include the personally identifying information specified.

Completing the form

Applicants must:

- Remove references to: Name(s), ethnic group, nationality, age, gender, religion, disability, sexual orientation
- Complete all sections of the form in font and size Calibri 11pt

Please download the [Supplementary Application Form here](#).

Uploading the form

When you have completed the form, please save it as a pdf format and labelled as follows:

Last name\_first name PhD application form

Upload the form as part of your application documents through the Durham University student application portal, when asked to add your Personal Statement. The form replaces the Personal Statement and so you do not need to complete the Personal Statement section.

Our support team will then process the form removing your name and allocating you a number prior to your application being assessed.

## Interviews

Interviews will be held during June and will be conducted by a panel of academics from Durham University.

For an informal discussion please contact [auracdt@hull.ac.uk](mailto:auracdt@hull.ac.uk)

For an informal discussion, call +44 (0) 1482 463331 or contact [auracdt@hull.ac.uk](mailto:auracdt@hull.ac.uk)

<https://auracdt.hull.ac.uk/research-projects/the-role-of-fabric-anisotropy-on-cyclic-loading-of-offshore-soils-a-grain-scale-investigation/>

Lead supervisor: Dr Alexandros Petalas (Assistant Professor - Department of Engineering, Durham University)

Supervisory Team: Professor Will Coombs (Professor - Department of Engineering, Durham University)

# ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

Για τις παλαιότερες καταχωρήσεις περισσότερες πληροφορίες μπορούν να αναζητηθούν στα προηγούμενα τεύχη του «περιοδικού» και στις παρατιθέμενες ιστοσελίδες.

IFCEE 2024 International Foundation Congress and Equipment Expo, May 7-10, 2024, Dallas, USA <https://web.cvent.com/event/c42dd622-dd91-409f-b249-2738e31c9ef5/summary>

8th International Conference on Earthquake Geotechnical Engineering (8ICEGE), 7-10 May, 2024 Osaka, Japan, <https://confit.atlas.jp/guide/event/icege8/top?lang=en>



## **International Symposium Geosynthetics and Sustainability Environmental, Civil and Hydraulic Engineering** 14 May 2024, Delft, Netherlands <https://ngo.nl/symposium24>

The urgency of addressing global warming make innovative solutions necessary within civil and hydraulic engineering. Geosynthetics emerge as a sustainable building method, significantly reducing CO<sub>2</sub> emissions (30-89%) and energy consumption (up to 85%) compared to conventional building materials like concrete and steel.

This symposium, hosted by the NGO and IGS, serves as a platform for knowledge exchange on geosynthetics and sustainability. Renowned experts will provide insights into the latest research and applications, emphasizing the crucial role of geosynthetics in achieving environmental objectives.



GeoShanghai 2024 International Conference on Geotechnical Engineering, May 26 - 29, 2024, Shanghai, China, [www.geo-shanghai.org](http://www.geo-shanghai.org)

2nd annual Conference on Foundation Decarbonization and Re-use, May 28-30 2024, Amsterdam, The Netherlands, <https://foundationreuse.com>

IS-Macau 2024 11<sup>th</sup> International Symposium of Geotechnical Aspects of Underground Construction in Soft Ground, June

14-17, 2024, Macao SAR, China, <https://is-macau2024.skli-otsc.um.edu.mo>

ISC'7 7<sup>th</sup> International Conference on Geotechnical and Geophysical Site Characterization "Ground models, from big data to engineering judgement", June 18-21, 2024, Barcelona, Spain, <https://isc7.cimne.com>

28th European Young Geotechnical Engineers Conference 2024, 25 to 29 June 2024, Demir Kapija, North Macedonia, <https://eygec2024.net>

WCEE2024 18<sup>th</sup> World Conference on Earthquake Engineering, June 30 - July 5, 2024, Milan, Italy, [www.wcee2024.it](http://www.wcee2024.it)

WCEE2024 18<sup>th</sup> World Conference on Earthquake Engineering, June 30 - July 5, 2024, Milan, Italy, [www.wcee2024.it](http://www.wcee2024.it) / Session SHR-7: When science meets industry: advances in engineering seismology stemming from engineering practice, [olga.ktenidou@gmail.com](mailto:olga.ktenidou@gmail.com)

3<sup>rd</sup> ICPE 2024 Third International Conference on Press-in Engineering, 3-5 July 2024, Singapore, <https://2024.icpe-ipa.org>

EGRWSE-2024 5<sup>th</sup> International Conference on Environmental Geotechnology, Recycled Waste Materials and Sustainable Engineering, July 4-6<sup>th</sup>, Warsaw, Poland, <https://iil.sqgw.edu.pl/egrwse-2024>

ICEC2024 SECOND INTERNATIONAL CONFERENCE ON EARTHEN CONSTRUCTION, 8-10 July 2024, Edinburgh, United Kingdom, <https://icec2024.eng.ed.ac.uk>, <https://icec2024.sciencesconf.org>

IS Landslides 2024 International Symposium on Landslides "Landslides across the scales: from the fundamentals to engineering applications" & IS Rock Slope Stability 2024, July 8-12<sup>th</sup>, 2024, Chambéry, France, [www.isl2024.com](http://www.isl2024.com)

EUROCK 2024 ISRM European Rock Mechanics Symposium New challenges in rock mechanics and rock engineering July 15-19, 2024, Alicante, Spain, [www.eurock2024.com](http://www.eurock2024.com)

5<sup>th</sup> ICITG 5th International Conference on Information Technology in Geo-Engineering, August 5-8, 2024, Golden, Colorado, USA, <https://learn.mines.edu/ICITG>

S3: Slopes, Support and Stabilization, August 6-8, 2024, Aurora, Colorado, USA, <https://s3.amazonaws.com/xcd-shared/dfi/Media/S324/2024-S3-CFA-20230807.pdf>

ECSMGE 24 XVIII European Conference on Soil Mechanics and Geotechnical Engineering, 26-30 August 2024, Lisbon, Portugal, [www.ecsmge-2024.com](http://www.ecsmge-2024.com)

4<sup>o</sup> Συνέδριο Φραγμάτων και Ταμιευτήρων, 10 και 11 Σεπτεμβρίου 2024, Αθήνα, [www.qcold-conference.gr](http://www.qcold-conference.gr)

ISIC 2024 4th International Conference of International Society for Intelligent Construction, 10 - 12 September 2024, Orlando, United States, [www.is-ic.org/conferences/2024-isic-international-conference](http://www.is-ic.org/conferences/2024-isic-international-conference)

International Symposium on Dams and Earthquakes, 7<sup>th</sup> Meeting of the EWG, 12 -13 September 2024, Athens, Greece, [link](#).





**18 September 2024, London, United Kingdom**  
<https://sustainability.geplus.co.uk/sustainability2024/en/page/home>

As the construction industry shifts towards sustainable practices, it's more crucial than ever for geotechnical engineers and contractors to step up and take action. This highly anticipated event is designed to bring together the brightest minds in the industry to explore how we can reduce embodied carbon and implement innovative solutions for a more sustainable geotechnical sector.

With competition in the market at an all-time high, it's imperative that contractors and geotechnical engineers are equipped with the knowledge and tools to reduce costs while still delivering sustainable results. Our conference will provide a unique opportunity for attendees to network, share insights and best practices, and develop new ways of thinking about sustainability in geotechnics.

Join us at the GE Sustainability 2024 conference to gain unparalleled access to industry leaders, the latest research and innovations, and the chance to be a part of a community dedicated to driving sustainability forward.



NGM 2024 19<sup>th</sup> Nordic Geotechnical Meeting, 18<sup>th</sup> - 20<sup>th</sup> of September 2024, Göteborg, Sweden, [www.ngm2024.se](http://www.ngm2024.se)

ISRM International Symposium 2024 and 13th Asian Rock Mechanics Symposium (ARMS13), 22 to 27 September 2024, New Delhi, India, <https://arms2024.org>

IS-Grenoble 2024 Geomechanics from Micro to Macro, September 23-27, 2024, Grenoble, France, <https://is-grenoble2024.sciencesconf.org>

International Symposium on Dams and Earthquakes, 7<sup>th</sup> Meeting of EWG, September 25-27, 2024, Athens, [www.eemf.gr](http://www.eemf.gr)

92<sup>nd</sup> ICOLD Annual Meeting & International Symposium on Dams for People, Water, Environment and Development, 29<sup>th</sup> September - 3<sup>rd</sup> October, 2024, New Delhi, India, [www.icold2024.org](http://www.icold2024.org)

5th European Conference on Physical Modelling In Geotechnics, 02 to 04 October 2024, Delft, Netherlands, <https://tc104-issmqe.com/ecpmg-2024>

XVIII African Regional Conference on Soil Mechanics and Geotechnical Engineering, 06 ÷ 09 October 2024, Algiers, Algeria, <https://algeos-dz.com/18ARC.html>

Beyond a Tunnel Vision, October 16th, 2024, Antwerp, Belgium, <https://beyondatunnelvision.eu>

RMCC2023 1<sup>st</sup> International Rock Mass Classification Conference "Rock Mass Classification meets the Challenges of the 21<sup>st</sup> Century", 30-31 October 2024, Oslo, Norway, [www.rmcc2024.com](http://www.rmcc2024.com)

PANAMGEO CHILE 2024 17<sup>th</sup> Pan-American Conference on Soil Mechanics and Geotechnical Engineering, 12-17 November 2024, La Serena, Chile, <https://panamge-ochile2024.cl>

CouFrac 2024 The 4th International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application, November 13-15, 2024, Kyoto, Japan, <https://www.ec-convention.com/coufrac2024/>

3ο Διεθνές Συνέδριο Αρχαίας Ελληνικής και Βυζαντινής Τεχνολογία, 19-20-21 Νοεμβρίου 2024, Αθήνα, [www.edabyt.gr](http://www.edabyt.gr)

ICTG 2024 5th International Conference on Transportation Geotechnics 2024 "Sustainable and Evolving Technologies for Urban Transport Infrastructure", 20 - 22 November 2024, Sydney, Australia [www.ictg2024.com.au](http://www.ictg2024.com.au)



**ICOMOS**  
THEOPHILOS  
international council on monuments and sites

**ICOMOS TheoPhilos ISC Conference**  
**Authenticity from a European Perspective:**  
**30 Years of the Nara Document on Authenticity**  
**November 28-29, 2024, Thessaloniki, Greece**  
<https://theophilos.icomos.org>

### 1. Issues of the Conference

In 2024, heritage conservators commemorate the anniversaries of the preparation of two very important doctrinal documents – the 60th anniversary of the adoption of the Venice Charter (1964) and the 30th anniversary of the adoption of the Nara Document on Authenticity (1994). Both documents have fundamentally shaped the theory of conservation and remain a point of reference for heritage protection.

The Venice Charter is a policy document for the entire protection of monuments, containing, for example, universal definitions of conservation interventions, while the Nara Document on Authenticity concerns a single heritage parameter: authenticity. Despite their different nature, the two documents are interrelated – the Venice Charter identifies authenticity as an important parameter of heritage, and the Nara Document emphasises the importance of the Venice Charter programme. Therefore, the two documents complement each other and their content should be analysed together.

The ISC TheoPhilos organised a scientific conference in Florence in March 2024 titled *Venice at 60: Doctrinal Documents in the Protection of Cultural Heritage*. The conference presentations focused on the analysis of the Venice Charter, the interpretation of its provisions and the assessment of its continuing validity. In the discussion, authenticity was repeatedly referred to as a problem that requires deeper analysis and elaboration. Therefore, the autumn conference of the ISC TheoPhilos, which will be held in Thessaloniki, is entitled Authenticity from a European Perspective - 30 Years of Nara Document on Authenticity.

One of the aims of the Nara Document was to broaden the understanding of the concept of authenticity. This was due to the need to take into account the specificity of non-European heritage, as nominated for the UNESCO World Heritage List. The Nara Document broadens and relativises the understanding of authenticity by stating that it should be evaluated con-

textually, in light of the specific cultural setting. It also enumerates the aspects through which authenticity can be analysed and evaluated. The Nara Document has been adopted as the basis for assessing authenticity in the UNESCO World Heritage system, although no formal method for analysing authenticity has been developed (only a descriptive Statement of Authenticity).

The broadening and relativisation of the notion of authenticity has also brought about certain risks. On the conventional understanding of conservation (as exemplified in the Venice Charter), authenticity is the basic parameter that determines the scientific, historical, artistic and cultural value of heritage. The lack or diminution of authenticity has a negative impact on these values – in extreme cases, heritage is devoid of them.

The close relationship between heritage values and authenticity means that the study of authenticity should be a very important element in the assessment of the state of heritage conservation and planned interventions (conservation, adaptation, modernisation). Therefore, there is a need for a methodology for analysing the authenticity of heritage – a methodology that allows for the assessment of the authenticity of a monument in the context of various values, indicate systems/measures of authenticity assessment, and ways of monitoring authenticity.

The scope of European heritage is very large and diverse. There is also significant pressure in Europe to transform heritage and adapt it to modern functions and standards. These actions seriously threaten the preservation of the authenticity and value of heritage. Therefore, there is an urgent need to develop analytical methods for assessing authenticity, taking into account the conditions of protection and the specificity of heritage in Europe.

The discussion on the authenticity of heritage and the methods of its analysis will allow for the development of conclusions that will help in assessing the validity and possibility of further use of both the Venice Charter and the Nara Document on Authenticity.

## 2. Aims and thematic scope of the conference

The aim of this conference is to comprehensively discuss the concept of authenticity in the context of the theory and practice of heritage protection in Europe. The conference will address three groups of problems (in 3 sessions):

1. The Concept of Authenticity as an Element of Conservation Theory / theory
2. The Analysis of Authenticity in Heritage Protection / methodology
3. Authenticity as a Parameter in Conservation Practice – Critical Analysis of Examples / practice

We hope that the conference will be a forum for exchanging views and shaping opinions for many international and national ICOMOS bodies. We invite representatives of all the International Scientific Committees and National Committees of ICOMOS to join us to discuss the current interpretation and use of the notion of Authenticity in heritage protection.

The Organisational Committee ICOMOS ISC Theory and Philosophy of Conservation and Restoration [theophilos@icomos.org](mailto:theophilos@icomos.org)



Geotechnics for Sustainable Infrastructure, 28-29 November 2024, Kathmandu, Nepal, <https://geomandu.ngeotechs.org>



<https://dfi-events.org/dfi-efc25>

DFI and EFFC are hosting a conference on the theme of Geotechnics Reimagined: The New Frontiers in Ground Engineering. It shall take place Wednesday 21st to Friday 23rd May 2025 in Bruges, Belgium.

We live in a time of massive transformation. Our economies are striving to become circular, with essential decarbonisation at a time when we are expanding the infrastructure our societies need.

New technologies, digitalisation, automation and AI are promising new capabilities that need to be tested in the real world. These bring challenges and opportunities for ground engineering in terms of what we can build, how we can use and re-use assets in the ground and how we construct in collaboration with others.

The DFI/EFFC Conference shall show what is innovative right now and explore what the future looks like for ground engineering. Already new collective issues are emerging.

## Topics

- Encompassing the human living environment in design and execution of ground engineering works (works in urban areas devoted to life and to work; safety interaction with inhabitants and commuters);
- Embracing sustainability and reducing CO2 production in foundation design and execution (enhancement of equipment and electrical equipment; concrete mix design, cement type and geopolymer concrete; mix-in-place techniques instead of soil removal; geothermal foundations; minimising and management of spoil);
- Recognizing the impact of digitalization on, and incorporating it into, foundation design and execution (artificial intelligence; construction data logging and management; recent developments in monitoring);
- Re-using and strengthening existing foundations: evaluating geotechnical response and structural strength in view of design life; integrating existing and new foundations (design and technical challenges and advantages; codes and standards);
- Minimizing the impact of foundation works in sensitive urban and / or natural environments (noise; vibrations; public interaction; underwater piling works);
- Risk sharing with development of new sustainable foundation concepts; conflicts with existing codes and standards;
- Broadening the scope of usual ground engineering techniques for special and non-classic applications (developments; case histories);
- Reinventing our business and contractual environment, our procurement methods, our safety culture, and the way we deal with workforce development, diversity, regulations or standards.

Phone: [\(973\) 423-4030](tel:9734234030)

Email: [events@dfi.org](mailto:events@dfi.org)



ISFOF 2025 5th International Symposium on Frontiers in Off-shore Geotechnics, June 9-13, 2025, Nantes, France, <https://isfog2025.univ-gustave-eiffel.fr>

World Tunnel Congress 2025 "Tunnelling into a sustainable future – methods and technologies", 9-15 May 2025, Stockholm, Sweden, [www.wtc2025.se](http://www.wtc2025.se)

EUROCK 2025 - ISRM European Rock Mechanics Symposium Expanding the underground space - future development of the subsurface - an ISRM Regional Symposium, 16-20 June 2025, Trondheim, Norway, <https://eurock2025.com>



**21st International Conference on  
Soil Mechanics and Geotechnical Engineering  
Geotechnical Challenges in a  
Changing Environment  
14 – 19 June 2026, Vienna, Austria  
[www.icsmge2026.org/en](http://www.icsmge2026.org/en)**

1925 Karl Terzaghi published the book "Erdbaumechanik auf bodenphysikalischer Grundlage" in Vienna which is widely regarded as the birth of modern soil mechanics. The **Austrian Geotechnical Society** and the **Austrian Society for Geomechanics** are proud to jointly celebrate the 100<sup>th</sup> anniversary of this milestone in geotechnical engineering. 1929 the first Institute and Laboratory for Soil Mechanics was established at the TU Wien. "Where it all began" is therefore the slogan of the 21<sup>st</sup> International Conference on Soil Mechanics and Geotechnical Engineering (ICSMGE) to be held in Vienna in June 2026. It will be an in-person event because I strongly believe that personal communication and networking is a key component of an international conference. Leading experts in the field have agreed to deliver state-of-the-art lectures and for the first time in this series of conferences a plenary session will be organized by the European Federation of Foundation Contractors (EFFC), providing the industry with the opportunity to present their efforts in battling climate change and reducing CO<sub>2</sub>-footprint of construction industry. I can assure that the organising committee will do everything to make this conference a memorable event, in both, scientific and social aspects and I invite you to come to the beautiful city of Vienna, in the heart of Europe.



**ÖGG** Austrian Society for Geomechanics  
Innsbrucker Bundesstraße 67  
5020 Salzburg, Austria  
Tel.: +43 662 875519  
[office@icsmge2026.org](mailto:office@icsmge2026.org)

**AGS** Austrian Geotechnical Society  
c/o Österreichischer Ingenieur- und Architektenverein  
Eschenbachgasse 9  
A-1010 Vienna  
Austria



ISFMG 2026 12th International Symposium on Field Monitoring in Geomechanics, August 2026, Indian Institute of Technology Indore, India,  
<https://sites.google.com/view/isfm2026/home>



**Eurock 2026  
Risk Management in Rock Engineering -  
an ISRM Regional Symposium  
14-19 June 2026, Skopje, Republic North Macedonia**

Contact Person Name

Prof. Milorad Jovanovski  
Email [jovanovski@qf.ukim.edu.mk](mailto:jovanovski@qf.ukim.edu.mk)



**16th International Congress on Rock Mechanics  
Rock Mechanics and Rock Engineering  
Across the Borders  
17-23 October 2027, Seoul, Korea**

**Scope**

The scope of the Congress will cover both conventional and emerging topics in broadly-defined rock mechanics and rock engineering. The themes of the Congress include but not be limited to the following areas:

- Fundamental rock mechanics

- Laboratory and field testing and physical modeling of rock mass
- Analytical and numerical methods in rock mechanics and rock engineering
- Underground excavations in civil and mining engineering
- Slope stability for rock engineering
- Rock mechanics for environmental impact
- Sustainable development for energy and mineral resources
- Petroleum geomechanics
- Rock dynamics
- Coupled processes in rock mass
- Underground storage for petroleum, gas, CO2 and radioactive waste
- Rock mechanics for renewable energy resources
- Geomechanics for sustainable development of energy and mineral resources
- New frontiers & innovations of rock mechanics
- Artificial Intelligence, IoT, Big data and Mobile (AICBM) applications in rock mechanics
- Smart Mining and Digital Oil field for rock mechanics
- Rock Engineering as an appropriate technology
- Geomechanics and Rock Engineering for Official Development Assistance (ODA) program
- Rock mechanics as an interdisciplinary science and engineering
- Future of rock mechanics and geomechanics

Our motto for the congress is "Rock Mechanics and Rock Engineering Across the Borders". This logo embodies the interdisciplinary nature of rock mechanics and challenges of ISRM across all countries and generations.

# ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

## A Rare Film of Karl Terzaghi featuring also Casagrande, Ruth Terzaghi, Schaffernak, and Forchheimer

Geoengineer.org is extremely pleased to make available to what is, to date, a rare film featuring Karl & Ruth Terzaghi and colleagues. The original material was provided by Prof. Bengt H. Fellenius on October 2018 as a reel (see picture below). It was professionally digitized and the raw footage, was made available online by Geoengineer.org.



The video, which has no audio, features an outing involving Karl and Ruth Terzaghi, Arthur Casagrande, Friedrich (Fritz) Schaffernak, and Philipp Forchheimer along with family members. According to Prof. Fellenius, "the first part of the video is from the City of Graz in Austria, while the second part is from an outing along the River Danube near Vienna in 1930. Schaffernak was then Professor in hydrology at the University of Vienna, and Forchheimer was retired from the same university — Terzaghi's had studied under him. Casagrande, then a student of Terzaghi's, is a very handsome young man of 28 years of age. All can be considered working in the "geotechnical" field and they must have taken time out from their collaborations for the trip. Information on them are given in the book "Karl Terzaghi: The Engineer as Artist" by Richard E. Goodman."

The video starts with Mrs. Schaffernak, wife of Dr. Schaffernak. At 1:26 Schaffernak and Casagrande appear seated, collaborating over some documents. According to Wikipedia, Casagrande "graduated from the Technische Hochschule (TH) in Vienna with a civil engineering degree in 1924, after which he carried on working there as a full-time assistant to Professor Schaffernak in the hydraulics laboratory." At 1:41, two women are featured, who may be Schaffernak's daughters, although that remains unknown. At 2:08, Karl and Ruth Terzaghi are arriving as guests and the group is enjoying a boat ride. At 2:58, Philipp Forchheimer is having a discussion with Karl Terzaghi. At 3:05 Mrs. Forchheimer is featured, before the video ends.

The reel was originally given by Arthur Casagrande to Brit Mitchell of the Waterways Experiment Station. Back in the late 1980s, Brit gave a copy to Prof. Bengt H. Fellenius, who then in October 2018 provided it to Prof. Dimitrios Zekkos and the Geoengineer.org team to digitize and for archival safe keeping. The reel was digitized and made available in September 2019.

If you have more information on the video, or additional relevant information, please write a comment below, or contact Prof. Zekkos or Geoengineer.org.



<https://www.youtube.com/watch?v=06mSuwjEhfs>

(Geoengineer, 17.04.2024, <https://www.geoengineer.org/education/karl-terzaghi/rare-film-of-karl-terzaghi-featuring-also-casagrande-ruth-terzaghi-schaffernak-and-forchheimer>)



## Landslide causes part of building to give way and leaves foundations exposed in Salvador, Brazil



*Image of the building that was affected by the landslide in Salvador (credits: TV Bahia)*

A landslide that occurred in the early hours of Monday, April 8, 2024, at the city center of Salvador, Brazil, left a building hanging with its foundations exposed, among others.

Furthermore, the incident took place sometime between 1 a.m. and 1:30 a.m. local time in the neighborhood of Vale dos Barris, following rather intense rainfall.

More specifically, it is stated that certain parts of the area received precipitation of more than 150 mm in 72 hours, while many neighborhoods saw 50-100 mm of rain within 24 hours.

Itatiaia reported that in Salvador, the capital of the state of Bahia, 9 landslides took place during that night, with five of them being in the central region, while several news outlets report numbers as high as 80.

Three cars and one motorcycle are reported to have been buried in the landslide, while two people got injured, one of

whom was inside the headquarters of the Traffic Superintendence building (Transalvador), that got hit by the collapsed soil mass.

Videos show that the pile foundations of the building remain exposed at the side of the landslide, while at least 14 families were evacuated from it.

Salvador's Civil Defense (Codesal) engineers inspected the building shortly after the incident and reported that there was no threat of immediate collapse.

However, further investigation of its structural integrity was to take place, along with further inspection of the foundations, and slope drainage works.

**Sources:** [www.itatiaia.com.br](http://www.itatiaia.com.br), [www.trbn.com.br](http://www.trbn.com.br), [g1.globo.com](http://g1.globo.com), [www.bahianoticias.com.br](http://www.bahianoticias.com.br)

(Geoengineer.org, Apr, 08, 2024, <https://www.geoengineer.org/news/landslide-causes-part-of-building-to-give-way-and-leaves-foundations-exposed-in-salvador-brazil>)



### Early warning and rockfalls in the 3 April 2024 Mw=7.4 Hualien earthquake

#### Dashcam footage shows the importance of early warning and the value of having a plan.

Yesterday, very interesting dashcam footage emerged of rockfalls triggered by the 3 April 2024 Mw=7.4 Hualien earthquake. The footage is dramatic in itself, but also serves to highlight the value of earthquake early warning systems.

[The most amazing video is the one below, which was posted to Twitter.](#) This video includes two sets of footage:-



More dash cam footage from Taiwan earthquake on 03. Apr 2024



7:44 AM · Apr 9, 2024

The footage is from one of the mountain roads, it is not clear which one. The video captures the earthquake early warning going off at 2 seconds into the video. The driver wisely stops in a rockfall shelter. The rockfalls start at 13 seconds into the video, so the warning period was about 11 seconds

The early warning gives the driver enough time to save themselves. However, this was possible because they had a plan – to stop under a protective structure – and that structure was available. The car in front did not seek protection; it is not clear why. It ended up in a very perilous situation.

Of course, the other point to note is the horrendous situation on the uncovered sections of the road once the rockfalls started. This was a living hell.

The second set of footage in the above video also shows the early warning alarm being triggered, the driver seeking shelter and massive rockfall activity. Here, it is clear that even within the shelter there is significant risk of harm.

[There are two further videos in the tweet below, from another location, but showing a similar outcome:-](#)



More footage of Taiwan earthquake on 03. April 2024



3:22 AM · Apr 9, 2024

[And finally, there is this one:-](#)



Taiwan earthquake dash cam footage in the mountain 03. Apr 2024



6:50 PM · Apr 8, 2024

[The videos are summarised in a news report posted to Youtube by Taiwan News Formosa TV:-](#)



<https://www.youtube.com/watch?v=A31FwHKAiA>

But this segment also carries another piece of footage at the end, which was a video of the mountains captured by a passenger in a plane that was flying overhead. This is a still from that footage:-



Landslides in the Central Mountains of Taiwan triggered by the 3 April 2024 Hualien Earthquake. Credit: [Taiwan News Formosa TV](#)

The Hualien earthquake has provided fresh insight into landslide processes in steep mountain areas during large earthquakes.

(Dave Petley / THE LANDSLIDE BLOG, 10 April 2024, <https://eos.org/thelandslideblog/hualien-earthquake-early-warning>)



### Investigation finds Sweden landslide triggered by man-made factors



An investigation into a landslide that destroyed part of a highway in Sweden last September has found that it was trig-

gered by excavation material that was illegally dumped at a nearby construction site by "negligent" workers.

Three people are facing criminal charges in relation to the police investigation into the [landslide near E6 at Stenungsund](#) on September 23 last year.

The significant landslide was around 150m long and caused the road to move more than 50m in some places. It wrecked 10 cars, a wooded area, and a business area with a gas station and a fast-food restaurant.



An investigation into the causes of the landslide has determined that it was caused by man-made factors as no natural cause has so far emerged, according to a report by Swedish news website [SVT Nyheter](#).

Chief prosecutor Daniel Veivo Pettersson told a press conference in March that the landslide had been triggered by a nearby construction site where too much excavated material had been piled up, putting excessive strain on the ground below.

"At this stage, we consider it negligent, in this case grossly negligent, to have placed so much excavated material on the site," Pettersson said.



[SVT Nyheter](#) has reported that the people facing charges are all connected to the construction site near the highway. They are suspected of "gross public negligence, causing bodily harm and unauthorised environmental activities". The suspects deny all charges.

Pettersson said that the landslide is suspected to have started east of the E6 – where the construction of a business park was underway.

Images of the nearby construction site after the landslide showed a very high embankment of fill material next to the motorway.



(Thames Menteth / GROUND ENGINEERING, 11 April, 2024, <https://www.geplus.co.uk/news/investigation-finds-sweden-landslide-triggered-by-man-made-factors-11-04-2024/>)

### Landfill may have triggered damaging landslide in Sweden, experts say

A large landslide that destroyed part of a highway in south west Sweden may have been caused by landfill material.



(Thames Menteth / GROUND ENGINEERING, 29 September, 2023, <https://www.geplus.co.uk/news/landfill-may-have-triggered-damaging-landslide-in-sweden-experts-say-29-09-2023/>)

According to the prosecutor, workers dumped a larger amount of excavated material than permitted in that area, without taking necessary measures.

He told the press conference that 74,000m<sup>3</sup> of excavated material had been handled at height, which is roughly 50,000m<sup>3</sup> more than the municipality had given permission for. In the slope that collapsed, the area is believed to have been filled with twice as much mass as was allowed.

The site in question had permission to be loaded with 50kPa and the assessment from the criminal investigation is that the land was loaded with three times that amount.

The findings of the investigation correspond with landslide expert and University of Hull vice-chancellor Dave Petley's theory that the [underlying cause of the failure could have been the dumping of material high on the slope.](#)

In a blog post last year, he wrote: "An initial working hypothesis would be that the mass of material deposited on what has become the headscarp of the landslide has destabilised the slope, triggering failure. The weather conditions at the time were rainy, and there has been heavy rainfall in recent days, but this has not been exceptional."

#### Contractors appointed

Following the landslide, the Swedish Transport Administration appointed engineering consultancy Cowi to carry investigations at the site and plan the reconstruction of the E6.

Cowi's work involves carrying out a large number of geotechnical and environmental engineering investigations. These include mapping soil properties and groundwater conditions, with particular focus on the properties of the clay and the depth of the landslide, looking at possible contamination in the soil masses, and the dimensioning and projecting of geotechnical reinforcements and road construction drainage.

"It is the highest priority for the Swedish Transport Administration, and thus for Cowi, to restore the E6 as soon as possible, but never at the expense of safety, neither during field investigations and during the construction period nor for those who have to travel on the road," said Cowi Sweden's technical director for geotechnics Mats Ekenberg.

"We are working hard to be sure that all aspects of the reconstruction, from dewatering to stability checks, have been taken into account."

Swedish construction and engineering company Peab was appointed to rebuild the E6.

[Swedish Radio](#) reported last week that the Swedish Government wants to give the Swedish Transport Administration an extra SEK1bn (£74.3M) to repair the E6 motorway following the landslide.

# ΕΝΔΙΑΦΕΡΟΝΤΑ - ΣΕΙΣΜΟΙ & ΑΝΤΙΣΕΙΣΜΙΚΗ ΜΗΧΑΝΙΚΗ

## Part of the San Andreas fault may be gearing up for an earthquake

The Parkfield section of the San Andreas fault is sending mixed messages before a time of expected increased seismic risk.



(Image credit: FREDERIC J. BROWN/AFP via Getty Images)

A section of the San Andreas fault where earthquakes occur regularly may give off a distinct signal before it trembles to life, new research finds. The signal hints at the opening and closing of cracks beneath the subsurface.

This section of faultline, known as Parkfield in Central California, shakes regularly about every 22 years. It last ruptured in 2004, so another [earthquake](#) may be imminent. However, the signal is not currently occurring at the fault segment, and the section isn't behaving exactly like it did the last time it ruptured, according to a study published March 22 in the journal [Frontiers in Earth Science](#).

The differences might mean the next quake won't happen right away, or they might mean that the epicenter of the quake will be different from 2004's epicenter, which was just southeast of the tiny town of Parkfield. There will be no way to know until the next quake actually happens, said study lead author [Luca Malagnini](#), the director of research at the National Institute of Geophysics and Volcanology in Italy.

"We are waiting," Malagnini told Live Science.

The San Andreas fault marks the boundary between the Pacific and North American [tectonic plates](#). South of Parkfield, the fault is locked, meaning the two plates do not move against one another. North of Parkfield, the San Andreas fault moves freely, with the plates creeping against one another at a constant rate of 1.4 inches (3.6 centimeters) a year. Parkfield is a transitional zone between these two regimes. When this region of the fault rumbles to life, it gives off a quake of around magnitude 6. Because of the remote location, these quakes rarely threaten human life or property, though quakes on one fault can affect stresses on other nearby faults, Malagnini said.

But researchers watch Parkfield closely in hopes of finding activity that will help them predict when the next quake will occur. Being able to detect reliable precursors to earthquakes

— strain on rocks for example, or changes in permeability under the surface — would help scientists warn people about imminent temblors, potentially saving lives. Parkfield, with its recurring quakes, might be a good place to look for these clues to extrapolate to more dangerous fault segments. But so far, that goal has been elusive.

In the new research, Malagnini and his colleagues measured seismic wave attenuation, or how sound waves lose energy as they move through Earth's crust. Attenuation is related to the permeability of rock, Malagnini said. In the period of stress before an earthquake, cracks open and close in the strained rock around the fault. The new study found that before the 2004 earthquake at Parkfield, the attenuation of low-frequency waves rose in the six weeks prior to the quake, while the attenuation of high-frequency waves fell.

This, Malagnini said, is the result of strain on the rocks as the Pacific plate in the west moves against the North American plate to the east. As the stress builds, long cracks ranging in size from several hundred feet to 1 mile (1.5 kilometers) long open up in the subsurface. These long cracks take up some of the strain on the surrounding rocks, so shorter cracks in the rock close up. This decline in short cracks and increase in long cracks explains the bifurcation in the energy loss of different seismic waves, Malagnini said.

Right now, there are hints that Parkfield is entering the final phase of its quiet period, Malagnini said. The timing is right, for one thing: Parkfield has "skipped" quakes before, but those missed quakes in the 22-year cycle occurred when nearby, unrelated earthquakes changed the stresses in the region. There have been no such quakes this time. Another possible hint is that the variation in the attenuation measurements has dropped very low since 2021. A similar drop in this measurement occurred in 2003 before the 2004 Parkfield quake.

However, Malagnini said, there is not yet any evidence of the bifurcation of the attenuation measurement that preceded the 2004 quake. He suspects the next quake will hit at Parkfield this year, he said, but the epicenter may not be in the same place as it was in 2004, meaning these measurements will look different.

Malagnini won't be attempting to forecast the next quake down to the day, but he hopes that after it happens, he and his team can tease out signals to look for in the future.

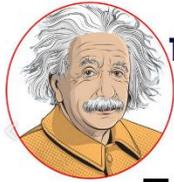
"I'll be waiting for the next earthquake," Malagnini said. "And then we'll look back."

(Stephanie Pappas / LIVESCIENCE, 9 April 2024, <https://www.livescience.com/planet-earth/earth-quakes/part-of-the-san-andreas-fault-may-be-gearing-up-for-an-earthquake>)

# ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ

Civil

## The 17 Equations



### That Changed The World



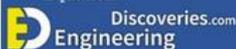
$$E=mc^2$$

E = energy  
m = mass  
C = the speed of light

$$E_{\text{tower}} = \sum_{i=1}^N E_{0i}$$

## 17 Equations that Changed the World

1. Pythagoras's Theorem	$a^2 + b^2 = c^2$	Pythagoras, 530 BC
2. Logarithms	$\log xy = \log x + \log y$	John Napier, 1610
3. Calculus	$\frac{df}{dt} = \lim_{h \rightarrow 0} \frac{f(t+h) - f(t)}{h}$	Newton, 1668
4. Law of Gravity	$F = G \frac{m_1 m_2}{r^2}$	Newton, 1687
5. Wave Equation	$\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$	J. d'Alembert, 1746
6. The Square Root of Minus One	$i^2 = -1$	Euler, 1750
7. Euler's Formula for Polyhedra	$V - E + F = 2$	Euler, 1751
8. Normal Distribution	$\Phi(x) = \frac{1}{\sqrt{2\pi\rho}} e^{-\frac{(x-\mu)^2}{2\rho^2}}$	C.F. Gauss, 1810
9. Fourier Transform	$f(\omega) = \int_{-\infty}^{\infty} f(x) e^{-2\pi i x \omega} dx$	J. Fourier, 1822
10. Navier-Stokes Equation	$\rho \left( \frac{\partial v}{\partial t} + v \cdot \nabla v \right) = -\nabla p + \nabla \cdot \mathbf{T} + \mathbf{f}$	Navier, Stokes, 1845
11. Maxwell's Equations	$\nabla \cdot \mathbf{E} = 0 \quad \nabla \cdot \mathbf{E} = 0$ $\nabla \times \mathbf{E} = -\frac{1}{c} \frac{\partial \mathbf{H}}{\partial t} \quad \nabla \times \mathbf{E} = \frac{1}{c} \frac{\partial \mathbf{H}}{\partial t}$	J.C. Maxwell, 1865
12. Second Law of Thermodynamics	$dS \geq 0$	L. Boltzmann, 1874
13. Relativity	$E = mc^2$	Einstein, 1905
14. Schrodinger's Equation	$i\hbar \frac{\partial}{\partial t} \Psi = H\Psi$	E. Schrodinger, 1927
15. Information Theory	$H = -\sum p(x) \log p(x)$	C. Shannon, 1949
16. Chaos Theory	$x_{t+1} = kx_t(1 - x_t)$	R. May, 1975
17. Black-Scholes Equation	$\frac{1}{2} \sigma^2 S^2 \frac{\partial^2 V}{\partial S^2} + rS \frac{\partial V}{\partial S} - rV = 0$	Black, Scholes, 1990



### 1. The Pythagorean Theorem

This theorem is foundational to our understanding of geometry. It describes the relationship between the sides of a right triangle on a flat plane: square the lengths of the short sides, a and b, add those together, and you get the square of the length of the long side, c.

This relationship, in some ways, actually distinguishes our normal, flat, Euclidean geometry from curved, non-Euclidean geometry. For example, a right triangle drawn on the surface of a sphere need not follow the Pythagorean theorem.

### 2. Logarithms

Logarithms are the inverses, or opposites, of exponential functions. A logarithm for a particular base tells you what power you need to raise that base to get a number. For example, the base 10 logarithm of 1 is  $\log(1) = 0$ , since  $1 = 10^0$ ,  $\log(10) = 1$ , since  $10 = 10^1$ , and  $\log(100) = 2$ , since  $100 = 10^2$ .

The equation in the graphic,  $\log(ab) = \log(a) + \log(b)$ , shows one of the most useful applications of logarithms: they turn multiplication into addition.

Until the development of the digital computer, this was the most common way to quickly multiply together large numbers, greatly speeding up calculations in physics, astronomy, and engineering.

### 3. Calculus

The formula given here is the definition of the derivative in calculus. The derivative measures the rate at which a quantity is changing. For example, we can think of velocity, or speed, as being the derivative of position — if you are walking at 3 miles per hour, then every hour, you have changed your position by 3 miles.

Naturally, much of science is interested in understanding how things change, and the derivative and the integral — the other foundation of calculus — sit at the heart of how mathematicians and scientists understand change.

### 4. Law of Gravity

Newton's law of gravitation describes the force of gravity between two objects, F, in terms of a universal constant, G, the masses of the two objects,  $m_1$  and  $m_2$ , and the distance between the objects, r. Newton's law is a remarkable piece of scientific history — it explains, almost perfectly, why the planets move in the way they do. Also remarkable is its universal nature — this is not just how gravity works on Earth, or in our solar system, but anywhere in the universe.

Newton's gravity held up very well for two hundred years, and it was not until Einstein's theory of general relativity that it would be replaced.

### 5. The square root of -1

Mathematicians have [always been expanding the idea of what numbers actually are](#), going from natural numbers, to negative numbers, to fractions, to the real numbers. The square root of -1, usually written  $i$ , completes this process, giving rise to the complex numbers.

Mathematically, the complex numbers are supremely elegant. Algebra works perfectly the way we want it to — any equation has a complex number solution, a situation that is not true for the real numbers:  $x^2 + 4 = 0$  has no real number solution, but it does have a complex solution: the square root of -4, or  $2i$ . Calculus can be extended to the complex numbers, and by doing so, we find some amazing symmetries and properties of these numbers. Those properties make the complex numbers essential in electronics and signal processing.

### 6. Euler's Polyhedra Formula

Polyhedra are the three-dimensional versions of polygons, like the cube to the right. The corners of a polyhedron are called its vertices, the lines connecting the vertices are its edges, and the polygons covering it are its faces.

A cube has 8 vertices, 12 edges, and 6 faces. If I add the vertices and faces together, and subtract the edges, I get  $8 + 6 - 12 = 2$ .

Euler's formula states that, as long as your polyhedron is somewhat well behaved, if you add the vertices and faces together, and subtract the edges, you will always get 2. This will be true whether your polyhedron has 4, 8, 12, 20, or any number of faces.

Euler's observation was one of the first examples of what is now called a [topological invariant](#) — some number or property shared by a class of shapes that are similar to each other. The entire class of "well-behaved" polyhedra will have  $V + F - E = 2$ . This observation, along with Euler's solution to [the Bridges of Königsberg problem](#), paved the way to the development of topology, a branch of math essential to modern physics.

## 7. Normal distribution

The normal probability distribution, which has the familiar bell curve graph above, is ubiquitous in statistics.

The normal curve is used in physics, biology, and the social sciences to model various properties. One of the reasons the normal curve shows up so often is that it [describes the behavior of large groups of independent processes](#).

## 8. Wave Equation

This is a differential equation, or an equation that describes how a property is changing through time in terms of that property's derivative, as above. The wave equation describes the behavior of waves — a vibrating guitar string, ripples in a pond after a stone is thrown, or light coming out of an incandescent bulb. The wave equation was an early differential equation, and the techniques developed to solve the equation opened the door to understanding other differential equations as well.

## 9. Fourier Transform

The Fourier transform is essential to understanding more complex wave structures, like human speech. Given a complicated, messy wave function like a recording of a person talking, the Fourier transform allows us to break the messy function into a combination of a number of simple waves, greatly simplifying analysis.

The Fourier transform is at the heart of modern signal processing and analysis, and data compression.

## 10. Navier-Stokes Equations

Like the wave equation, this is a differential equation. The Navier-Stokes equations describes the behavior of flowing fluids — water moving through a pipe, milk being mixed into coffee, air flow over an airplane wing, or smoke rising from a cigarette. While we have approximate solutions of the Navier-Stokes equations that allow computers to simulate fluid motion fairly well, it is still an open question ([with a million dollar prize](#)) whether it is possible to construct mathematically exact solutions to the equations.

## 11. Maxwell's Equations

This set of four differential equations describes the behavior of and relationship between electricity (E) and magnetism (H).

Maxwell's equations are to classical electromagnetism as Newton's laws of motion and law of universal gravitation are to classical mechanics — they are the foundation of our explanation of how electromagnetism works on a day to day scale. As we will see, however, modern physics relies on a quantum mechanical explanation of electromagnetism, and it is now clear that these elegant equations are just an approximation that works well on human scales.

## 12. Second Law of Thermodynamics

This states that, in a closed system, entropy (S) is always steady or increasing. Thermodynamic entropy is, roughly speaking, a measure of how disordered a system is. A system that starts out in an ordered, uneven state — say, a hot region next to a cold region — will always tend to even out, with heat flowing from the hot area to the cold area until evenly distributed.

The second law of thermodynamics is one of the few cases in physics where time matters in this way. Most physical processes are reversible — we can run the equations back-wards without messing things up. The second law, however, only runs in this direction. If we put an ice cube in a cup of hot coffee, we always see the ice cube melt, and never see the coffee freeze.

## 13. Relativity

Einstein radically altered the course of physics with his theories of special and general relativity. The classic equation  $E = mc^2$  states that matter and energy are equivalent to each other. Special relativity brought in ideas like the speed of light being a universal speed limit and the passage of time being different for people moving at different speeds.

General relativity describes gravity as a curving and folding of space and time themselves, and was the first major change to our understanding of gravity since Newton's law. General relativity is essential to our understanding of the origins, structure, and ultimate fate of the universe.

## 14. Schrodinger's Equation

This is the main equation in quantum mechanics. As general relativity explains our universe at its largest scales, this equation governs the behavior of atoms and subatomic particles.

Modern quantum mechanics and general relativity are the two most successful scientific theories in history — all of the experimental observations we have made to date are entirely consistent with their predictions. Quantum mechanics is also necessary for most modern technology — nuclear power, semiconductor-based computers, and lasers are all built around quantum phenomena.

## 15. Information Theory

The equation given here is for [Shannon information entropy](#). As with the thermodynamic entropy given above, this is a measure of disorder. In this case, it measures the information content of a message — a book, a JPEG picture sent on the internet, or anything that can be represented symbolically. The Shannon entropy of a message represents a lower bound on how much that message can be compressed without losing some of its content.

Shannon's entropy measure launched the mathematical study of information, and his results are central to how we communicate over networks today.

## 16. Chaos Theory

This equation is [May's logistic map](#). It describes a process evolving through time —  $x_{t+1}$ , the level of some quantity  $x$  in the next time period — is given by the formula on the right, and it depends on  $x_t$ , the level of  $x$  right now.  $k$  is a chosen constant. For certain values of  $k$ , the map shows chaotic behavior: if we start at some particular initial value of  $x$ , the process will evolve one way, but if we start at another initial value, even one very very close to the first value, the process will evolve a completely different way.

We see chaotic behavior — behavior sensitive to initial conditions — like this in many areas. Weather is a classic example — a small change in atmospheric conditions on one day can lead to completely different weather systems a few days later, most commonly captured in the idea of [a butterfly flapping its wings on one continent causing a hurricane on another continent](#).

### 17. Black-Scholes Equation

Another differential equation, Black-Scholes describes how finance experts and traders find prices for derivatives. Derivatives — financial products based on some underlying asset, like a stock — are a major part of the modern financial system.

The Black-Scholes equation allows financial professionals to calculate the value of these financial products, based on the properties of the derivative and the underlying asset.



### Στα Χνάρια της Ιεράς Οδού από τον Κεραμεικό στην Ελευσίνα

Την Τετάρτη 24 Απριλίου 2024 η ΒΑΣΗ ΠΕΤΟΜ-ΤΕΕ & ΕΣΤΑ-ΜΕΔΕ (εκπρόσωποι των συνταξιοδικών σωματείων μηχανικών ΠΑΝΕΛΛΗΝΙΑ ΕΝΩΣΗ ΟΜΟΤΙΜΩΝ ΜΕΛΩΝ ΤΕΕ και ΕΝΩΣΗ ΣΥΝΤΑΞΙΟΥΧΩΝ ΤΑΜΕΙΟΥ ΑΣΦΑΛΙΣΗΣ ΜΗΧΑΝΙΚΩΝ ΚΑΙ ΕΡΓΟΛΗΠΤΩΝ ΔΗΜΟΣΙΩΝ ΕΡΓΩΝ) έκανε αρχαιολογική περιήγηση κατά μήκος της Ιεράς Οδού, η οποία θεωρείται ως η αρχαιότερη οδός της Ευρώπης και ξεκινούσε από το Δίπυλο στον Κεραμεικό και έφθανε στην ιερή πόλη της Ελευσίνας.

Ίχνη της αρχαίας οδού διακρίνονται σε αρκετές θέσεις κατά μήκος της διαδρομής, μεταξύ των οποίων τα ακόλουθα:



Ανεσκαμμένο τμήμα της Ιεράς Οδού πλησίον του σταθμού ΕΛΑΙΩΝΑΣ του ΜΕΤΡΟ

### Γέφυρα Κηφισού Ποταμού – Τα εξ αμάξης

«Ο Κηφισός ήταν ο μεγαλύτερος ποταμός της Αττικής που λατρευόταν ως θεότητα με ανθρώπινα χαρακτηριστικά. Στην πε-

ριοχή που διέτρεχε ο ποταμός Κηφισός αναπτυσσόταν ο αθηναϊκός Ελαιώνας, μια εύφορη κοιλάδα με περιβόλια, αμπέλια και οπωροφόρα δένδρα, κυρίως ελιές.

Κατά περιόδους το ποτάμι γινόταν ορμητικό, άλλαζε πορεία, πλημμύριζε και προκαλούσε καταστροφές. Για τη διάβασή του είχε κατασκευαστεί λίθινη τοξωτή γέφυρα με πέντε τουλάχιστον τόξα, όπως προκύπτει από τα τρία βάθρα στήριξης που αποκαλύφθηκαν στις ανασκαφές για την κατασκευή του Μετρό.

Κατά τη διέλευση της λατρευτικής πομπής από τη γέφυρα γίνονταν οι λεγόμενοι *γεφυρισμοί*, δηλαδή τα σκωπτικά πειράγματα του συγκεντρωμένου πλήθους στους διερχόμενους με άμαξες μύστες και αξιωματούχους των Ελευσινίων Μυστηρίων. Οι τελευταίοι ανταπαντούσαν με ανάλογα σχόλια, τα *εξ αμάξης*, όπως είναι γνωστά έως σήμερα». (από την πινακίδα της Αρχαιολογικής Υπηρεσίας).



Αναπαράσταση της αρχαίας γέφυρας (σχέδιο: Αρχιτέκτων Δ. Κουκουλάς) – με χρώμα δείχνονται τα σωζόμενα βάθρα



Βάθρα αρχαίας γέφυρας Κηφισού

Σύμφωνα με τους αρχαιολόγους, η θεμελίωση της γέφυρας έγινε πάνω σε Αρουραίο Λίθο (Κροκαλοπαγές κοκκινωπό πέτρωμα που χρησιμοποιείται σε μέρη αφανή, συνήθως θεμελιώσεις. Παρουσιάζει αντοχή μόνο εγκιβωτισμένο και αποκλειστικά σε θλίψη. Εφαρμόζεται ευρέως στην οικοδομική από το τέλος του 5ου αι. π.Χ. γιατί η μεταφορά και η επεξεργασία του

είναι πολύ λιγότερο δαπανηρές από του μαρμάρου. ENCYCLOPAEDIA OF THE HELLENIC WORLD).

Αρουραίος Λίθος (ερυθρό Λατυπο-Κροκαλοπαγές): Αποτελείται από θραύσματα λευκού Τριαδικού ασβεστόλιθου και γκρι Κρητιδικού ασβεστόλιθου των περιοχών Αιγάλεω – Χαϊδαρίου όπου και εντοπίζονται αρχαία λατομεία.



# ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ



Founded in March 1971, The BTS celebrated its 50th anniversary in 2021. To mark this milestone, we have spent the past few years producing a celebratory book. This will be going to print in August 2024, ready for delivery to your door in September/October 2024.

This, near A4 landscape, book contains around 900 pages and stories from 200+ people who built tubes, sewers, road tunnels, etc; which are packed with photographs, diagrams and double page fold-outs.

Over 200 authors (covering all roles required to build a tunnel) have contributed more than 500 stories, which vary widely in style and subject, from descriptions of a life in tunnelling to details on specific projects such as: 'preparing gas caverns for royal inspection', 'site investigation work in Yemen using a camel', 'repairing Locos on the Channel Tunnel', 'Carp farming in Stratford', and 'Transporting 10m long steel bars through Cairo on a tram'.

Many should be imagined told in their natural habitat – with the audience having just emerged from a hard shift underground and now leaning against a public bar with a pint in hand.

Written by proud tunnellers, this book will be of interest to all who work or have worked in tunnelling, whether BTS Members or not.

Technical jargon is largely avoided and is explained where it occurs, and technical detail is kept to a minimum – this is mostly a book about people. Therefore, this book is accessible to all, with friends and family of those in the industry encouraged to get themselves a copy – it will help to explain why your friend/relative spent 50 years working away from home, in uncomfortable and unpleasant conditions, working through the pain barrier every day / night, and still wouldn't swap a moment of it.

Civil engineers, geotechnical and ground engineers, other engineers, and members of the general population who have a curiosity for construction will find much of interest in these pages.

Finally, this should be compulsory reading for all the technically minded who are approaching the end of their school education. If you hadn't thought of tunnelling as the career for you, is it time to think again?

## **BTS 50 Anniversary Book Sample**

You may download here a 24-page 'taster' version to get an idea of what the finished book will look like. Clearly this is only a very small sample, with the final book containing around 900 pages from over 200 authors, and weighing 3.7kg! In order to protect against damage and general scruffiness, the book will be printed with laminate covers (hardback) and no dust jacket.

Download:

[https://firebasestorage.googleapis.com/v0/b/bts-org-uk.appspot.com/o/downloads%2FBTS\\_BLAD\\_2024\\_v6.pdf?alt=media&token=fce8e42d-74fc-4799-bf18-729dea5e0952](https://firebasestorage.googleapis.com/v0/b/bts-org-uk.appspot.com/o/downloads%2FBTS_BLAD_2024_v6.pdf?alt=media&token=fce8e42d-74fc-4799-bf18-729dea5e0952)

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# ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ



IGS NEWSLETTER – April 2024

Κυκλοφόρησε το IGS Newsletter της International Geosynthetic Society με τα ακόλουθα περιεχόμενα:

*Helping the world understand the appropriate value and use of geosynthetics*

[www.geosyntheticssociety.org/newsletters](http://www.geosyntheticssociety.org/newsletters)

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- International Geotechnical Innovation Conference in (IGIC 2024) [READ MORE](#)
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- Calendar of Events



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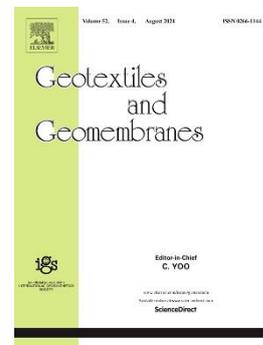
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## ΕΚΤΕΛΕΣΤΙΚΗ ΕΠΙΤΡΟΠΗ ΕΕΕΕΓΜ (2023 – 2026)

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