A magical waterfall in Vietnam

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ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ
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Τα Νέα της Ε Ε Ε Ε Γ Μ

163

Gever (Hakkari), Mountains of Kurds

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ΑΡΘΡΑ

Ο θρύλος των υδροηλεκτρικών έργων – Μια διαδρομή από το 1950 μέχρι σήμερα

Ιωάννης Στεφανάκος και Κωνσταντίνος Νικητόπουλος

Κάδος Αναπήδησης Εκχειλιστή ΥΗΕ Θησαυρού σε λειτουργία.
Σύγκριση με αυτοκίνητα στο κάτω διάζωμα.

Η πορεία των Υδροηλεκτρικών Έργων στην Ελλάδα είναι άμεσα συνδεδεμένη με την ιστορία της ΔΕΗ. Στις 20 Ιουλίου 1950 υπογράφτηκε σύμβαση μεταξύ της ελληνικής κυβέρνησης και της αμερικανικής εταιρείας EBASCO, με την οποία η τελευταία αναλάμβανε την ανάπτυξη και τη λειτουργία εθνικού συστήματος ηλεκτρικής ενέργειας. Στις 7 Αυγούστου 1950 ιδρύθηκε η ΔΕΗ. Κατευθυντήριος άξονας ήταν η παραγωγή φθηνής ηλεκτρικής ενέργειας για τη στήριξη της αστικής ανάπτυξης και του εκβιομηχανισμού της χώρας.

Πριν από την ίδρυση της ΔΕΗ είχαν τεθεί σε λειτουργία πολύ μικρά Υδροηλεκτρικά Εργοστάσια την περίοδο 1927 – 1931, συνολικής εγκατεστημένης ισχύος περίπου 6MW. Το πρώτο ενεργειακό πρόγραμμα εκπονήθηκε την περίοδο 1951-1955 από την EBASCO -η οποία είχε αναλάβει την ευθύνη οργάνωσης και λειτουργίας της ΔΕΗ, με κεφάλαια προερχόμενα από το Σχέδιο Μάρσαλ και τις ιταλικές πολεμικές αποζημιώσεις. Τα έργα του πρώτου προγράμματος περιλάμβαναν τον ατμοηλεκτρικό σταθμό Αλιβερίου, τους υδροηλεκτρικούς σταθμούς Λούρου, Άγρα και Λάδωνα, καθώς και την κατασκευή γραμμών μεταφοράς για τη διασύνδεση όλων αυτών των σταθμών.

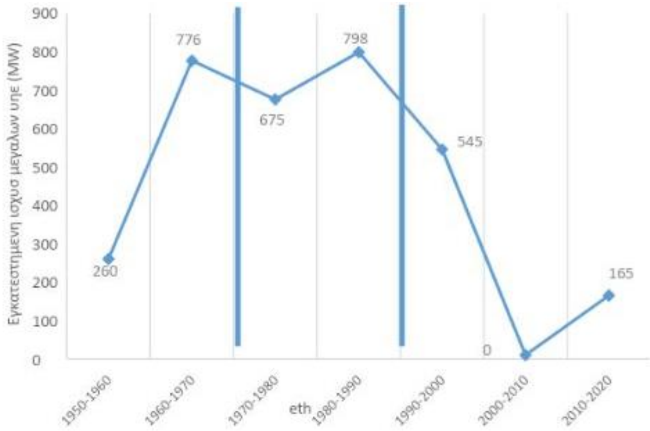
Με το δεύτερο ενεργειακό πρόγραμμα που εκπόνησε η ελληνική πλέον διοίκηση της ΔΕΗ, μετά τη λήξη της σύμβασης με την Ebasco το καλοκαίρι του 1955, οριστικοποιήθηκε η οργάνωση και η μορφή της εκμετάλλευσης της παραγωγής και της διανομής της ηλεκτρικής ενέργειας. Επιπλέον, τέθηκαν σε λειτουργία ο ατμοηλεκτρικός σταθμός Πτολεμαΐδας και ο υδροηλεκτρικός σταθμός Ταυρωπού. Μέχρι το 1960, μέσα σε μια δεκαετία λειτουργίας της ΔΕΗ, εκτός από τα θερμοηλεκτρικά και υδροηλεκτρικά εργοστάσια παραγωγής, κατασκευάστηκαν χιλιάδες χιλιόμετρα γραμμών μεταφοράς και διανομής της ηλεκτρικής ενέργειας, καθώς και πλήθος υποσταθμών μετασχηματισμού του ρεύματος.

Την περίοδο 1950 – 1975 κατασκευάστηκαν οκτώ (8) Μεγάλοι Υδροηλεκτρικοί Σταθμοί ήτοι: Άγρας, Λάδωνας, Λούρος, Ταυρωπός/Πλαστήρας, Κρεμαστά, Καστράκι, Εδεσσαίος και Πολύφυτο, συνολικής εγκατεστημένης ισχύος 1.410 MW.

Την περίοδο 1976 έως και 1996 κατασκευάστηκαν επιπλέον 8 μεγάλοι και 3 μικροί ΥΗΣ ήτοι: Πουρνάρι Ι και ΙΙ, Σφηκιά, Ασώματα, Στράτος Ι και ΙΙ, Πηγές Αώου, Θησαυρός, Πλατανόβρυση, Γκιώνα και Μακροχώρι, συνολικής εγκατεστημένης ισχύος 1.630 MW, στους οποίους περιλαμβάνονται και δύο αναστρέψιμοι Αντλητικοί Σταθμοί, η Σφηκιά και ο Θησαυρός.

Στο διάγραμμα που ακολουθεί φαίνεται σχηματικά η ταχύτατη ανάπτυξη των μεγάλων ΥΗΕ, ιδιαίτερα κατά την 30ετία 1960-1990 από τη ΔΕΗ. Η μεγάλη κάμψη άρχισε από το 1997, μετά την ολοκλήρωση της ένταξης στο σύστημα των μεγάλων Υδροηλεκτρικών Έργων του Νέστου (Θησαυρός και Πλατανόβρυση).

Έκτοτε λόγω των άστοχων, λίαν επιεικώς, ενεργειών των διοικήσεων της ΔΕΗ και παρά τις επίμονες εισηγήσεις των Στελεχών των Υδροηλεκτρικών Έργων, το μόνο μεγάλο ΥΗΕ που εντάχθηκε στο σύστημα είναι αυτό του Ιλαρίωνα το 2013, με τα μακροπρόθεσμα ιδιαίτερα δυσμενή αποτελέσματα που ζούμε σήμερα, λόγω της πλήρους επικράτησης του εισαγόμενου φυσικού αερίου.



Η προσθήκη εγκατεστημένης ισχύος των Υδροηλεκτρικών Έργων στην Ελλάδα

Πρόσωπο κλειδί και πρωτοπόρος για την ανάπτυξη των Υδροηλεκτρικών Έργων στην Ελλάδα υπήρξε ο αείμνηστος Σταύρος Νικολάου (1920-2003). Διετέλεσε πρώτος Καθηγητής στο ΕΜΠ στην Έδρα των Υδραυλικών – Υδροδυναμικών Έργων ΙΙ, την περίοδο 1969-1982.

Ο καθηγητής Νικολάου υπήρξε απόφοιτος του Κολλεγίου Αθηνών και μετέπειτα του ΕΜΠ στα δύσκολα χρόνια της Κατοχής. Στη συνέχεια μετέβη στην Αμερική, όπου έκανε τις μεταπτυχιακές του σπουδές στο περίφημο για την εποχή του Ινστιτούτο Προκεχωρημένων Υδροδυναμικών Ερευνών της Iowa (στο οποίο στη συνέχεια, ως καθηγητής, απέστειλε με έμμεση μεγάλη οικονομική ενίσχυση (υποτροφίες) έναν μικρό αριθμό σπουδαστών του, – μεταξύ των οποίων και ο δεύτερος συγγραφέας του παρόντος άρθρου – και εξειδικεύτηκε στη μελέτη και την κατασκευή φραγμάτων και υδροηλεκτρικών έργων. Επέστρεψε στην Ελλάδα περί το 1960, ως στέλεχος στην κατασκευή του φράγματος Κρεμαστών, (κατασκευαστής του υπόψη έργου η εταιρία Keiser Eng. & Contractors και μελετητής η εταιρεία ECI).

Ακολούθως (1969) εξελέγη καθηγητής του ΕΜΠ και ενέταξε στη διδασκαλία του τα ειδικά μαθήματα που αφορούσαν το σχεδιασμό των Υδροηλεκτρικών Έργων. Εισήγαγε αμέσως τους σπουδαστές του στη γιγαντιαία κλίμακα των μεγάλων Υδροηλεκτρικών Έργων, η δε παρακολούθηση απαιτούσε υψηλών απαιτήσεων συνδυαστική γνώση των κυριότερων κατευθύνσεων της Σχολής των Πολιτικών Μηχανικών (Υδραυλικά, Γεωτεχνικά, Δομοστατικά).

Πως αλλιώς από γιγαντιαία θα μπορούσε να χαρακτηρισθεί η κλίμακα των Υδροηλεκτρικών Έργων, όταν παρουσιάζουν τεχνικά χαρακτηριστικά όπως ο όγκος των 12 εκ. m^3 επιχωμάτων του φράγματος Θησαυρού, (ισοδύναμου κόστους με τα επιχώματα του Αυτοκινητόδρομου της Ιόνιας Οδού μήκους 190 χιλιομέτρων), τα 10km σηράγγων του φράγματος Πηγών Αώου και μάλιστα διαμέτρου έως 7,0m, ο υπόγειος σταθμός παραγωγής του φράγματος Στράτου επιφάνειας κατόψεως 1.400 m^2 και ύψους ισοδύναμου με δεκαεπταώροφη πολυκατοικία?

Το 1972, ίδρυσε στη ΔΕΗ, με αυστηρά ιδιωτικοοικονομικά κριτήρια, το περίφημο Κλιμάκιο Μελέτης Υδροηλεκτρικών έργων (ΚΜΥ) με σκοπό τη μελέτη και την κατασκευή υδροηλεκτρικών έργων από Έλληνες μηχανικούς και Ελληνικές κατασκευαστικές Εταιρείες , δεδομένου ότι, μέχρι τότε, τόσο η μελέτη όσο και η κατασκευή αναλαμβάνονταν από μεγάλους Οίκους του εξωτερικού.

Μέσα σε μόλις τρία (3) χρόνια, λόγω της πολύ ισχυρής προσωπικότητας, της εξαιρετικής ευφυίας, της απαράμιλλης τεχνικής συγκρότησης και της εντιμότητας του καθηγητή Νικολάου, όσο και τον ενθουσιασμό των νέων και λαμπρών μηχανικών που ο ίδιος ενέταξε στο δυναμικό του ΚΜΥ και της ΔΑΥΕ στη συνέχεια, άρχισε η κατασκευή του πρώτου ελληνικής κατασκευής Υδροηλεκτρικού Έργου, του φράγματος Πουρναρίου στον Άραχθο, το οποίο ολοκληρώθηκε και άρχισε να παράγει ενέργεια μέσα στον ελάχιστο χρόνο, για τα ελληνικά δεδομένα, των τεσσάρων (4) ετών. Ακολούθησε η μελέτη και η κατασκευή πολλών άλλων μεγάλων έργων (Σφηκιά & Ασώματα στον Αλιάκμονα, Στράτος στον Αχελώο, Πηγές Αώου κ.ά.).

Ο καθηγητής Νικολάου, δημιούργησε ισχυρές ομάδες νέων Ελλήνων μηχανικών, κυρίως αποφοίτων του ΕΜΠ αλλά και μεγάλων Πολυτεχνείων του εξωτερικού. Οι νέοι αυτοί Μηχανικοί, ηλικίας 25-35 ετών!!!, οι οποίοι μελέτησαν και επέβλεψαν οι ίδιοι την κατασκευή των μεγάλων φραγμάτων της περιόδου από το 1972 και εντεύθεν, πλαισιώθηκαν από λίγους μόνον εμπειρογνώμονες διεθνούς κύρους και έτσι δημιουργήθηκε ένας μοναδικός πυρήνας τεχνογνωσίας στη χώρα, ο οποίος έδωσε ώθηση τόσο σε ελληνικές κατασκευαστικές εταιρείες όσο και σε Έλληνες προμηθευτές, με αποτέλεσμα μια πρωτοφανή ανάπτυξη για τα δεδομένα της χώρας. Από την προσπάθεια αυτή δημιουργήθηκαν μόλις μέσα σε μια 20ετία Υδροηλεκτρικά Έργα Εγκατεστημένης Ισχύος 2.300MW περίπου.

Αυτό το μοναδικό στην Ελλάδα τεχνολογικό επίτευγμα, το οποίο ελάχιστοι το γνωρίζουν σήμερα, κατέστη δυνατό διότι οι νέοι αυτοί Μηχανικοί έκαναν προσωπική τους ιδιοκτησία, για να μιλήσουμε με κοινωνιολογικούς όρους, τον στόχο της κατασκευής των μεγάλων Υδροηλεκτρικών Έργων. Και με την ευφυία τους και τον ενθουσιασμό τους το επέτυχαν.

Για λόγους συγκρίσεως, την μεν 10ετία του ’70 το τότε Υπουργείο Δημοσίων Έργων ησχολείτο κυρίως με έργα επαρχιακής οδοποιίας, τη δε δεκαετία του ’80 με κατασκευή πεζοδρομίων και πλατειών!!

2. ΜΕΓΑΛΑ ΥΗΕ ΜΕ ΕΛΛΗΝΙΚΗ ΤΕΧΝΟΓΝΩΣΙΑ

Από την ίδρυση του ΚΜΥ το 1972 και μετά, αναπτύχθηκαν τα έργα που περιγράφονται παρακάτω. Τα μεγέθη τους και η τεχνική που ακολουθήθηκε παραμένει εντυπωσιακή ακόμα και σήμερα. Τα έργα αυτά αποτέλεσαν την απαρχή εφαρμογής εξειδικευμένης τεχνογνωσίας στην Ελλάδα, ενώ αποτελούν πρωτοπορία με όρους μεγέθους, τεχνογνωσίας και ανταποδοτικότητας, συγκρινόμενα με οποιοδήποτε άλλο μεταγενέστερο εθνικό έργο υποδομής μέχρι και σήμερα.

Ιδιαίτερη μνεία πρέπει να γίνει σε δύο Υδροηλεκτρικά Έργα: του Θησαυρού και της Πλατανόβρυσης στον ποταμό Νέστο.

Ο Θησαυρός είναι ένα από τα ψηλότερα φράγματα της Ευρώπης, με ύψος 175 m, μήκος 480m και όγκο 12 εκ. m^3. Η παροχή του εκχειλιστή αγγίζει την εντυπωσιακή τιμή των 8.250 m^3 /sec.

Το δεύτερο σε μέγεθος υδροηλεκτρικό, αυτό της Πλατανόβρυσης, έχει ύψος 95 m και μήκος 270 m, κατασκευάστηκε δε από κυλινδρούμενο σκυρόδεμα (RCC), πρωτοπόρα τεχνολογία για την Ελλάδα, με τη χρήση ιπτάμενης τέφρας ως τέταρτο συνθετικό στο μείγμα σκυροδέματος. Το πρωτοποριακό αυτό έργο σχεδιάστηκε από ομάδα υπό τη διεύθυνση του στελέχους της ΔΑΥΕ κας Γιούλας Τσικνάκου και νυν στελέχους του Ομίλου ΓΕΚ ΤΕΡΝΑ και υλοποιήθηκε χάριν στις άοκνες προσπάθειές της, εν μέσω μάλιστα ισχυρών αντιδράσεων. Το έργο έτυχε παγκόσμιας αναγνώρισης, λόγω του υψηλού ποσοστού τέφρας και αναφέρεται σε όλα τα Διεθνή Συνέδρια. Τον Απρίλιο του 2007 εγκρίθηκαν οι Εθνικές Προδιαγραφές χρήσης τέφρας, ως πρόσμικτο στο σκυρόδεμα (ΦΕΚ 551-18.04.2007).

ΠΟΤΑΜΟΣ ΑΡΑΧΘΟΣ
Πουρνάρι

Το Πουρνάρι στον π. Άραχθο, απέχει 4km από την πόλη της Άρτας και τέθηκε σε λειτουργία το 1981. Έχει εγκατεστημένη ισχύ 300 MW και ετήσια παραγωγή ενέργειας 437 GWh. Διαθέτει χωμάτινο φράγμα ύψους 102 m με μήκος στέψης 580 m και όγκο φράγματος 9 εκ. m3 με υπερχειλιστή από σκυρόδεμα και σταθμό παραγωγής τεσσάρων (4) μονάδων.

Η συνολική χωρητικότητα του ταμιευτήρα είναι 730 εκ. m^3 και η επιφάνεια κατάκλυσης 20,6 km^2.

ΥΗΕ Πουρνάρι

Πουρνάρι ΙΙ

Το υδροηλεκτρικό έργο Πουρνάρι ΙΙ κατασκευάστηκε κατάντη του ΥΗΣ Πουρναρίου και τέθηκε σε λειτουργία το 2000 με εγκατεστημένη ισχύ 32 MW και ετήσια παραγωγή ενέργειας 52 GWh.

Λειτουργεί ως αναρρυθμιστικός ταμιευτήρας, εξασφαλίζοντας τη συνεχή ροή του νερού στην κοίτη και τις εκβολές του ποταμού Αράχθου, καθ’ όλο το έτος, συμβάλλοντας στην ορθολογική και αποτελεσματική αξιοποίηση των αρδευτικών δικτύων της περιοχής.

Το έργο αποτελείται από χωμάτινο φράγμα στην αριστερή όχθη, μήκους περί τα 2km και ύψους περί τα 15m και από υπερπηδητό φράγμα σκυροδέματος για τη διόδευση των πλημμυρικών παροχών, μήκους 130m.

Η συνολική χωρητικότητα του ταμιευτήρα είναι 4,5 εκ. m^3 και η επιφάνειά του 0,65 km^2.

Στο κτήριο του Σταθμού Παραγωγής στεγάζονται τρείς μονάδες.

ΠΟΤΑΜΟΣ ΑΩΟΣ
Πηγές Αώου

Ο ΥΗΣ των Πηγών Αώου απέχει 45 km από τα Ιωάννινα και 20 χλμ. βορειοδυτικά του Μετσόβου. Εκτρέπει μικρό μέρος των νερών του ποταμού Αώου προς τον Άραχθο. Τέθηκε σε λειτουργία το 1990 με εγκατεστημένη ισχύ 210 MW και ετήσια παραγωγή ενέργειας 205 GWh. Το κυρίως φράγμα (3 εκ. m^3) και το βοηθητικό (500.000 m^3) είναι στο οροπέδιο Πολιτσών. Υπάρχουν πέντε (5) ακόμη αυχενικά φράγματα.

Η στέψη των φραγμάτων βρίσκεται στο υψόμετρο 1.349m, η μέγιστη στάθμη λειτουργίας στο υψόμετρο 1.343m, η ελάχιστη στάθμη λειτουργίας στο υψόμετρο 1.315m. Όλα τα παραπάνω φράγματα είναι χωμάτινα με εξωτερικές ζώνες από περιδοτίτη, φίλτρα από αμμοχάλικο και έναν κεντρικό αργιλικό πυρήνα.

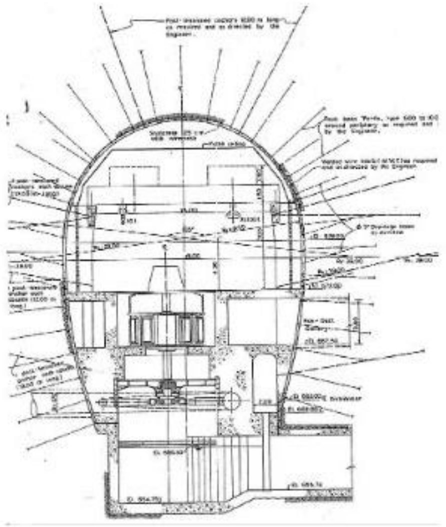
Η συνολική χωρητικότητα του ταμιευτήρα είναι 180 εκ. m^3 και η επιφάνεια κατάκλυσης 11.5 km^2.

Το έργο έχει μεγάλα μήκη υπογείων σηράγγων, που υπερβαίνουν τα 10 km:

Σήραγγα εκτροπής 650m
Σύστημα προσαγωγής 4.080m
Σήραγγα προσπέλασης σταθμού 1.625m
Σήραγγα καλωδίων 850m
Σήραγγα φυγής 2.900m

Επίσης εντυπωσιακά είναι τα κτηριακά έργα:

Ο υπόγειος σταθμός παραγωγής μήκους 65m, πλάτους 16m και ύψους 34,30m
Ο θάλαμος βαλβίδων μήκους 39m, πλάτους 7m και ύψους 11m
Ο θάλαμος μετασχηματιστών μήκους 31m, πλάτους 14m και ύψους 14m



Υπόγειος θάλαμος σταθμού παραγωγής πάνω στον άξονα της μονάδας.

Τεχνητή Λίμνη Πηγών Αώου

Για να γίνουν αντιληπτές από τον αναγνώστη οι διαστάσεις του σταθμού παραγωγής, σημειώνουμε ότι είναι ισοδύναμες με εξ ολοκλήρου υπόγεια δεκαώροφη πολυκατοικία εμβαδού κατόψεως 1.050 m^2!

ΠΟΤΑΜΟΣ ΑΛΙΑΚΜΟΝΑΣ
Σφηκιά

Ο ΥΗΣ Σφηκιάς βρίσκεται 25km νότια της πόλης της Βέροιας, τέθηκε σε λειτουργία το 1985, διαθέτει σταθμό με τρεις μονάδες και έχει συνολική εγκατεστημένη ισχύ 315 MW (3 x 105 MW) και ετήσια παραγωγή ενέργειας 220 GWh.

Ο ωφέλιμος όγκος του ταμιευτήρα είναι 18 εκ. m^3 και η κατακλυζόμενη επιφάνεια είναι περίπου 4,3 km2. Η στάθμη του ταμιευτήρα κυμαίνεται από την ανώτατη στο υψόμετρο +146 έως την κατώτατη στο +141,8, με στάθμη πλημμύρας το +147.

Η σήραγγα εκτροπής είναι επενδεδυμένη με σκυρόδεμα, με μήκος 490m και εσωτερική διάμετρο 7,5 m.

Το φράγμα είναι λιθόρριπτο με κεντρικό αργιλικό πυρήνα και όγκο ίσο με 1,6 εκ. m^3. Το ύψος του είναι 82 m, το μήκος του 220 m και το ελάχιστο πλάτος στη στέψη ίσο με 12 m. Διαθέτει δύο εκχειλιστές με τοξωτά θυροφράγματα διαστάσεων 7,2×9,0 m το καθένα, σήραγγα απαγωγής και έργο εκτόξευσης.

Υπάρχουν τρεις υδροληψίες (μία για κάθε μονάδα) με κεκλιμένες εσχάρες στην είσοδο διαστάσεων 5,6×10,9 m.

Υδροληψίες ΥΗΣ Σφηκιάς (περίοδος κατασκευής)

Αντίστοιχα, υπάρχουν και τρεις σήραγγες προσαγωγής (μία για κάθε μονάδα), με συνολικό μήκος της κάθε μίας ίσο με 161 m και εσωτερική διάμετρο 7,00 m.

Ο Σταθμός Παραγωγής βρίσκεται στο αριστερό αντέρεισμα του φράγματος, είναι ημιυπαίθριος και σε αυτόν λειτουργούν οι τρεις αναστρέψιμες μονάδες κατακόρυφου άξονα, που επιτρέπουν στο σταθμό να λειτουργεί και ως αντλησιοταμιευτικός. Οι διαστάσεις του σταθμού είναι περίπου 85 m μήκος, 47 m πλάτος και 34 m ύψος. Ο σταθμός ισοδυναμεί με δωδεκαώροφη πολυκατοικία επιφανείας κατόψεως τεσσάρων (4) στρεμμάτων.

Στο αριστερό αντέρεισμα επίσης βρίσκεται και ο εκκενωτής πυθμένα του έργου που είναι τύπου σήραγγας από σκυρόδεμα με εσωτερική διάμετρο 3,50 / 3,00 m και μήκος 310 m.

Φράγμα, Υδροληψίες και Σταθμός Παραγωγής ΥΗΕ Σφηκιάς

Ασώματα

Κατάντη του ΥΗΣ Σφηκιάς και 8 km περίπου νότια της Βέροιας, βρίσκεται ο ΥΗΣ Ασωμάτων, που τέθηκε σε λειτουργία το 1985, διαθέτει σταθμό με δύο μονάδες και έχει συνολική εγκατεστημένη ισχύ 110 MW και ετήσια παραγωγή ενέργειας 134 GWh

Ο ταμιευτήρας του έργου έχει χωρητικότητα 53 εκ. m^3, ωφέλιμο όγκο 10 εκ. m3 και κατακλυζόμενη επιφάνεια 2,6 km^2.

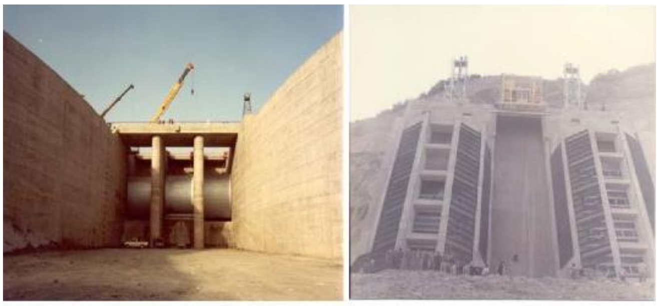
Η στάθμη λειτουργίας κυμαίνεται από το υψόμετρο +81 έως το +85,5 με στάθμη πλημμύρας το +89.

Η σήραγγα εκτροπής έχει μήκος 496 m και είναι πεταλοειδούς μορφής με διάμετρο 7,2 m / 8,5 m.

Το φράγμα είναι χωμάτινο με κεντρικό πυρήνα, ύψους 52 m, μήκους 205 m, με πλάτος στέψης 15 m και όγκο 1,45 εκ. m^3.

Ο εκχειλιστής αποτελείται από τρία τοξωτά θυροφράγματα διαστάσεων 7 x 8 m το καθένα, σήραγγα απαγωγής και έργο εκτόξευσης.

Το έργο διαθέτει δύο υδροληψίες (μία για κάθε μονάδα) με κεκλιμένες εσχάρες στην είσοδο διαστάσεων 4,8 x 9,3 m.



Εκχειλιστής και Υδροληψίες ΥΗΕ Ασωμάτων (κατά την κατασκευή)

Αντίστοιχα, υπάρχουν δύο σήραγγες προσαγωγής με χαλύβδινη επένδυση, μήκους 60 m και εσωτερικής διαμέτρου 6 m.
Ο σταθμός παραγωγής είναι υπόγειος μήκους 54,70m, πλάτους 17,60m και ύψους 42m.

Τέλος, ο εκκενωτής πυθμένα βρίσκεται εντός της σήραγγας εκτροπής.

Ιλαρίωνας

Βρίσκεται στο δήμο Κοζάνης, τέθηκε σε λειτουργία το 2012 και έχει εγκατεστημένη ισχύ 157MW από τις δύο μονάδες του σταθμού παραγωγής και ακόμα 4,2 MW από το ΜΥΗΣ Ιλαρίωνα που εκμεταλλεύεται την οικολογική παροχή στην έξοδο του εκκενωτή πυθμένα του φράγματος, η οποία τέθηκε σε λειτουργία το 2014.

Η ετήσια παραγωγή ενέργειας είναι 270 GWh.

Το Υδροηλεκτρικό Έργο αποτελείται από χωμάτινο φράγμα ύψους 130m, μήκους 540 m, συνολικού όγκου 9 εκ. m^3 περίπου και με ταμιευτήρα ωφέλιμης χωρητικότητας 400 εκ. m^3 περίπου, που καλύπτει 22 km2, στους νομούς Κοζάνης και Γρεβενών.

ΠΟΤΑΜΟΣ ΝΕΣΤΟΣ
Θησαυρός

Βρίσκεται σε απόσταση 60km από την πόλη της Δράμας κοντά στο χωριό Παρανέστι. Τέθηκε σε λειτουργία το 1997. Είναι ο δεύτερος αντλησιοταμιευτικός σταθμός στην Ελλάδα με εγκατεστημένη ισχύ 348 MW με τρεις μονάδες στο σταθμό παραγωγής, ο οποίος είναι υπόγειος μήκους 64m, πλάτους 22m και ύψους 44m.

Η ετήσια παραγωγή ενέργειας είναι 507 GWh.

Το φράγμα είναι το μεγαλύτερο λιθόρριπτο φράγμα της Ελλάδας και ένα από τα ψηλότερα γεωφράγματα της Ευρώπης με ύψος 175m, μήκος 480 m και όγκο 12 εκ. m^3.

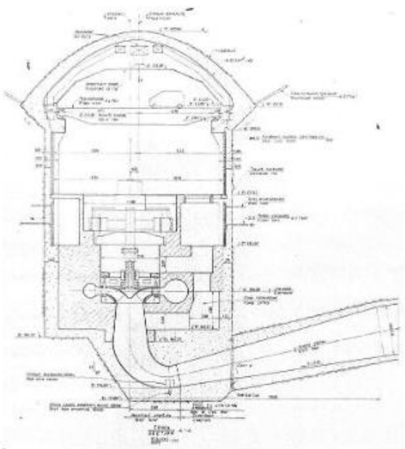
Ο συνολικός όγκος του ταμιευτήρα είναι 705 εκ. m^3 (ωφέλιμος τα περίπου 500 εκ.) και η επιφάνειά του είναι 20 km^2.

Αεροφωτογραφία ΥΗΕ Θησαυρού, όπως φαίνεται από ανάντη

Αεροφωτογραφία ΥΗΕ Θησαυρού, όπως φαίνεται από κατάντη

Το έργο διαθέτει επίσης εκχειλιστή, με θυροφράγματα στο έργο εισόδου, που αποτελείται από τρεις διώρυγες συνολικού καθαρού πλάτους 41m και μήκους περίπου 350m με έργο εκτόξευσης στον κατάντη τμήμα του.

Υπόγειος Σταθμός Παραγωγής ΥΗΕ Θησαυρού



Τομή του υπόγειου Σταθμού Παραγωγής πάνω στον άξονα της μονάδας

Κάδος Αναπήδησης Εκχειλιστή ΥΗΕ Θησαυρού σε λειτουργία.
Σύγκριση με αυτοκίνητα στο κάτω διάζωμα.

Πλατανόβρυση

Κατάντη του ΥΗΣ Θησαυρού βρίσκεται ο ΥΗΣ Πλατανόβρυσης, ο οποίος τέθηκε σε λειτουργία το 1999, έχει εγκατεστημένη ισχύ 116 MW, ετήσια παραγωγή ενέργειας 278 GWh και λειτουργεί για να καλύπτει και ανάγκες άρδευσης.

Το φράγμα είναι ύψους 95 m, μήκους 270 m με όγκο 450.000 m^3 και κατασκευάστηκε από κυλινδρούμενο σκυρόδεμα (RCC), πρωτοπόρα τεχνολογία στην Ελλάδα, με τη χρήση ιπτάμενης τέφρας ως τέταρτο συνθετικό στο μείγμα σκυροδέματος.

Οι ιπτάμενες τέφρες της περιοχής Πτολεμαΐδας, παραπροϊόντα της καύσης του λιγνίτη στους λιγνιτικούς σταθμούς, χαρακτηρίζονται από:

Ανομοιογένεια στη σύστασή τους
Υψηλή περιεκτικότητα (15%-35%) σε διαθέσιμο CaO.
Αξιοσημείωτες υδραυλικές ιδιότητες και ταχεία ανάληψη αντοχών, ιδιαίτερα, αν προηγηθεί άλεση.

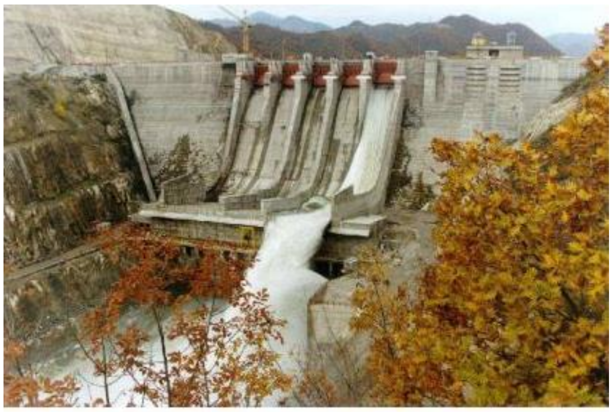
Σύμφωνα με εξειδικευμένες μελέτες (κυρίως από την καθηγήτρια του ΑΠΘ κα Ιωάννα Παπαγιάννη) και τη συμμετοχή του Ειδικού Σύμβουλου Malcolm Dunstan, σχεδιάστηκε με επιμέλεια και αξιοπιστία η σύνθεση του μείγματος σκυροδέματος.

Το μείγμα σκυροδέματος, σύμφωνα με το οποίο κατασκευάστηκε το έργο, περιείχε 50 kg/m^3 τσιμέντο και 225 kg/m^3 επεξεργασμένη τέφρα Πτολεμαΐδας, η οποία είχε υποστεί άλεση -υδρόλυση, σε ειδικό μύλο που κατασκευάστηκε στον λιγνιτικό Σταθμό Πτολεμαΐδας. Το φράγμα ολοκληρώθηκε το 1997, σε διάστημα 1,5 έτους (χρόνος ρεκόρ για το μέγεθός του) και ήταν το υψηλότερο αντίστοιχο της Ευρώπης.

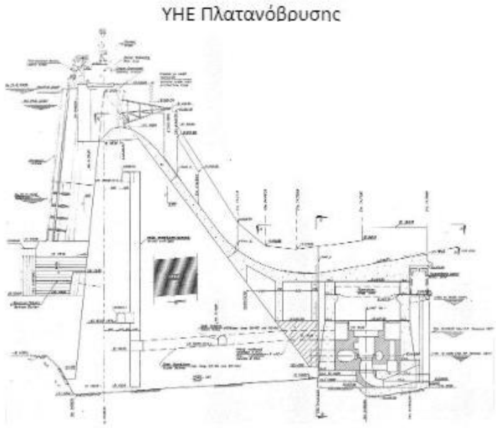
Η τέφρα, ως τέταρτο υλικό στο μείγμα σκυροδέματος, όχι στο κλίνκερ, υποκατέστησε το τσιμέντο κατά 80% και έδωσε την τεχνική λύση για την ομαλή ανάληψη αντοχών με ελεγχόμενη εξώθερμη αντίδραση του μείγματος σκυροδέματος, για την αποφυγή ρηγματώσεων, λόγω ανάπτυξης υψηλών θερμοκρασιών ενυδάτωσης.

ΥΗΕ Πλατανόβρυσης

Η συνολική χωρητικότητα του ταμιευτήρα είναι 57 εκ. m^3 και η επιφάνειά του είναι 3.3 km^2. Ο σταθμός παραγωγής βρίσκεται στον κατάντη πόδα του φράγματος καταλαμβάνοντας σχεδόν όλη την κοίτη, με διαστάσεις μήκους 82m, πλάτους 30m και ύψους περίπου 35m. Στην οροφή του βρίσκεται το έργο εκτόξευσης του υπερχειλιστή του φράγματος.



ΥΗΕ Πλατανόβρυσης



Τομή πάνω στον υπερχειλιστή του φράγματος και τον άξονα της μονάδας του σταθμού.

ΥΗΕ Πλατανόβρυσης.
Κατασκευή φράγματος από κυλινδρούμενο σκυρόδεμα.

ΠΟΤΑΜΟΣ ΑΧΕΛΩΟΣ
Στράτος Ι και ΙΙ

Σε συνέχεια των ΥΗΣ Κρεμαστών και ΥΗΣ Καστρακίου, επί του π. Αχελώου βρίσκεται το ΥΗΕ Στράτου Ι που τέθηκε σε λειτουργία το 1988 με συνολική εγκατεστημένη ισχύ 156 MW και ετήσια παραγωγή ενέργειας 364 GWh.

Ο σταθμός παραγωγής είναι υπόγειος μήκους 66,60m, πλάτους 21,10m και ύψους 48,60m. Για να γίνει αντιληπτό από τον αναγνώστη, το μέγεθος αυτό ισοδυναμεί με υπόγεια δεκαεπταώροφη πολυκατοικία εμβαδού κατόψεως 1.400m2!! Το φράγμα έχει ύψος 26 m, μήκος 1.900 m και όγκο 2,8 εκ. m^3. Η συνολική χωρητικότητα του ταμιευτήρα είναι 15 εκ. m^3 και η επιφάνειά του είναι 8,4 km^2. Αργότερα κατασκευάστηκε το ΜΥΗΣ Στράτου ΙΙ που αξιοποιεί την οικολογική παροχή του ποταμού Αχελώου και τέθηκε σε ισχύ το 1989 με δύο μονάδες και ισχύ ίση με 6,3 MW.

Μεσοχώρα

Το φράγμα της Μεσοχώρας, ισχύος 160 MW, αποτελεί παράδειγμα μέγιστης αβελτηρίας για την Ελλάδα. Περιέργως συνδέθηκε με την πολυθρύλητη εκτροπή του Αχελώου και συγκέντρωσε τους ασκούς του Αιόλου, ενώ προφανώς θα μπορούσε να συνδράμει σημαντικά στο ελλειμματικό ενεργειακό ισοζύγιο της χώρας. Το φράγμα είναι λιθόρριπτο με ανάντη πλάκα σκυροδέματος, ύψους 150m, μήκους στέψης 340 m και όγκο 5,3 εκ. m^3. Ο εκχειλιστής, ο Σταθμός Παραγωγής και οι λοιπές εγκαταστάσεις, είναι ολοκληρωμένες ήδη από το 2001!!, αλλά δεν έχει πληρωθεί ο ταμιευτήρας ώστε να λειτουργήσει.

Το ολοκληρωμένο Φράγμα και Εκχειλιστής του εγκαταλελειμμένου ΥΗΕ Μεσοχώρας

Η συνολική χωρητικότητα του ταμιευτήρα είναι 358 εκ. m^3 και η επιφάνειά του είναι 7,8 km^2. Το κτίριο του σταθμού είναι ημιυπαίθριο με διαστάσεις μήκους 95m, πλάτους 57m και ύψους 37m.

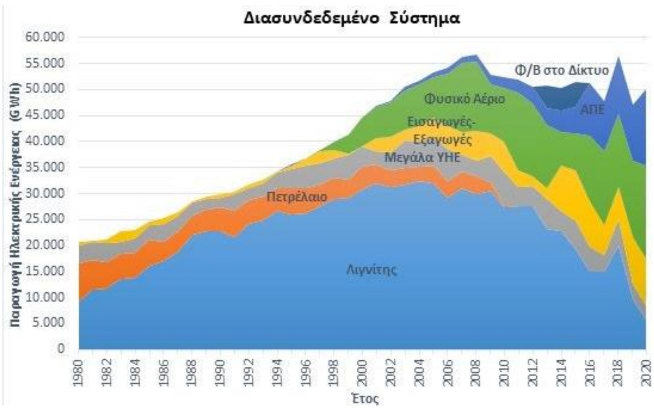
Το έργο έχει τεράστιο κόστος και κάθε χρόνο υπάρχει απώλεια εσόδων για τη ΔΕΗ, της τάξεως των 30 εκατ. ευρώ!!!

ΕΝ ΚΑΤΑΚΛΕΙΔΙ

Το παρόν άρθρο έρχεται να ενημερώσει τους νεότερους ότι η ανάπτυξη των Μεγάλων Υδροηλεκτρικών Έργων πολλαπλής σκοπιμότητας, είναι έργο εθνικής σημασίας, κάτι το οποίο δεν αντελήφθησαν οι διοικήσεις της ΔΕΗ από το 1996 και εντεύθεν. Επίσης και κυρίως αποσκοπεί να δείξει με τον πιο ισχυρό τρόπο πως μια λαμπρή ομάδα νέων μηχανικών του ΕΜΠ κατόρθωσε, εντός μιας εικοσαετίας περίπου, να δημιουργήσει ένα τεχνολογικό επίτευγμα το οποίο δεν έχει ξεπεραστεί ακόμα και σήμερα και το οποίο αποτελεί Εθνική Περιουσία.

Μέσω της ανάπτυξης των Μεγάλων ΥΗΕ, επιτυγχάνεται η βέλτιστη διαχείριση ενός πολύτιμου πόρου. Επίσης λόγω του γεγονότος ότι τα έργα αυτά είναι υψηλής εγχώριας προστιθέμενης αξίας, συμβάλλουν καθοριστικά στην ενεργοποίηση του τεχνικού και κατασκευαστικού δυναμικού της χώρας, περισσότερο από κάθε άλλο έργο υποδομής, λόγω της πολυπλοκότητάς τους.

Στο Διάγραμμα που ακολουθεί παρουσιάζεται διαχρονικά (περίοδος 1980-2020) ο καθοριστικός ρόλος των Υδροηλεκτρικών Έργων στην εξυπηρέτηση του Διασυνδεδεμένου Συστήματος παραγωγής ηλεκτρικής ενέργειας στην Ελλάδα, συνδράμοντας σημαντικά στην απεξάρτηση της παραγωγής Ηλεκτρικής Ενέργειας από το πετρέλαιο.



4. ΥΔΡΟΗΛΕΚΤΡΙΚΑ ΕΡΓΑ: ΤΟ ΜΕΛΛΟΝ

Επενδύοντας περί τα 6-7 δισ. ευρώ (~2.500 ευρώ / KW): ήτοι το 15% μόνον των άστοχων κατά την άποψη μας δαπανηθέντων ποσών για την οριζόντια και όχι στοχευμένη οικονομική ενίσχυση διαφόρων ομάδων κατά την περίοδο του COVID, τα οποία εν πολλοίς διοχετεύθηκαν σε τραπεζικούς λογαριασμούς και στην κατανάλωση:

- Ολοκληρώνονται εικοσιπέντε (25) νέα μεγάλα Υδροηλεκτρικά Έργα.
- Προστίθενται ~ 2.500 MW ισχύος αιχμής στο σύστημα (αύξηση 75%).
- Παράγονται ~ 6.000 GWh ήπιας, ανανεώσιμης και εγχώριας πρόσθετης ενέργειας αιχμής (αύξηση 150%).
- Προστίθενται 5.000 εκ. κυβικά μέτρα αποθήκης νερού (αύξηση 70%).
- Ικανοποιείται ο στόχος του ΕΣΕΚ (31.12.2019) για ποσοστό παραγωγής από ΑΠΕ 61%, στην ακαθάριστη κατανάλωση ηλεκτρικής ενέργειας, μέχρι το 2030.
- Βελτιώνεται η αντιπλημμυρική προστασία των κατάντη πεδινών περιοχών.

- Θωρακίζεται η χώρα για την αντιμετώπιση παρατεταμένων περιόδων ξηρασίας.
- Βελτιώνεται η ενεργειακή μας αυτονομία.

(ypodomes.com, 20 Μαΐου 2022, https://ypodomes.com/o-thrylos-ton-ydroilektrikon-ergon-mia-diadromi-apo-to-1950-mechri-simera)

Το άρθρο εστάλη στο περιοδικό από τον εκ των συγγραφέων Ιωάννη Στεφανάκο με το ακόλουθο σημείωμα:

«Σας στέλνω παρακάτω τον σύνδεσμο μια πρόσφατης δημοσίευσης στον ιστότοπο ypodomes, την οποία ετοιμάσαμε με τον Κώστα Νικητόπουλο και με την πολύτιμη βοήθεια της αναδεξιμιάς μου Ιωάννας Δρ., για την ιστορία των ΥΗΕ της ΔΕΗ, από την εποχή κυρίως του ΚΜΥ, της ΔΜΚΥ, της ΔΑΥΕ μέχρι και την ΔΥΗΠ. Καλό διάβασμα λοιπόν και όμορφες αναμνήσεις για τους παλαιούς ΔΕΗτζήδες...»

The Safest Dam

Michael A. Stevens
Consultant, Boulder, CO E-mail: MStevensRivers@cs.com

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Historical dam failures and associated failure modes are well documented (for example, International Commission on Large Dams 1973, Jansen 1980, Leonards 1987). The principal causes of failure are undetected foundation deficiencies and underestimated spillway floods (ASCE Task Committee 1988). The U.S. Bureau of Reclamation (Water and Power Resource Services 1980) has compiled an extensive list of failure modes to assist those charged with assessing the safety of existing dams. "… There are too many failures in dam engineering" (Leonards 1985).

Conventionally, the selection of the dam type for a given site has been based on the determination of the least expensive dam compatible with site conditions and the proposed service. Safety is achieved by meeting established design criteria, which relies on high values of safety factors to compensate for uncertainties in dam and foundation material properties, and in both the magnitudes and the probability of occurrence of the applied loads. Examples of loading uncertainties are the Probable Maximum Flood (PMF) and the maximum credible earthquake (MCE). Wieland (1999) suggests that the error in estimates of design earthquakes can be 30% or more.

Consider the selection of the Safest Dam to be a conceptual exercise, based on the assumption that adequate foundation conditions can be excavated at an acceptable cost. If this is not possible, it may be that no alternative can be considered truly safe, as is highlighted by Addison (1959, p. 128): "As for the Board's [of Consultants] report on the Sadd el Aali project [Aswan] presented to the Egyptian Government in November, 1954, it was restrained in tone. Its essence was contained in the sentence: 'A rockfill dam equipped with a clay core, upstream blanket and grout cutoff, with dimensions proposed by the Consultants, is as safe as the safest among earth and rockfill dams resting on sediments...' "

Simple guidelines for determining the Safest Dam are proposed. First, when given a choice, pick the solution that is safest. Second, there should be no significant cost penalty for the choice. If the cost of the Safest Dam is greater than that of the best alternative, the difference can be considered the "cost of safety."

Floods

In 1988, the ASCE Task Committee on spillway design flood selection reported that in 1984, some 2,900 nonfederal United States dams had been declared unsafe, with 2,350 of them identified as having inadequate spillway capacities. Clearly, a reassessment of spillway design floods was in order. The approach adopted was designed for safe passage of the PMF for important dams. For dams in America, the Task Committee recommend use of the American Nuclear Society's standard (1981) for establishing the magnitude of the PMF.

Determination of the PMF is a complex task, often compromised by approximations, estimates, and guesses. There is still no certain procedure to permit the upper-limit flood peak to be estimated with confidence. After only a few decades of designing dams for the PMF, changes are being made—some PMFs are being decreased; others are being made larger (for example, Back 1990a). PMFs will be influenced by climate change, but in a manner difficult to estimate. The affects of climate changes from greenhouse gases have been continually revised, toward more severe consequences, which may well have an impact on the safety of existing dams and on design parameters for future works; consequences that may soon be felt for dams.

The upper-limit inflow flood (i.e., the true PMF) to a reservoir is the estimated PMF (however established) plus the error in the estimate. Despite the fact that this error is presently indeterminate, it must be considered in the design of any dam claiming to be the "safest."

Sediment

For design of the Safest Dam, it is assumed that the reservoir ultimately fills with sediment up to the ungated spillway crest, and this is considered to be a part of the normal loading condition.

The Dam

The Safest Dam is a symmetrical trapezoidal-section concrete structure, with upstream and downstream slopes selected to eliminate the need for forming of the faces. Features of conventional gravity dams not considered essential from a long-term safety viewpoint are eliminated in order to minimize cost.

Fig. 1 illustrates the dam, whose layout essentially was foreseen by Raphael (1970) and adapted to incorporate roller-compacted-concrete (RCC) construction techniques by Schrader (1977). Londe and Lino (1992) proposed the adoption of symmetrical section RCC dams for weak foundation conditions, particularly in areas subject to strong earthquake ground motions. Londe and Lino suggested the name "hardfill" for their weak-mix RCC.

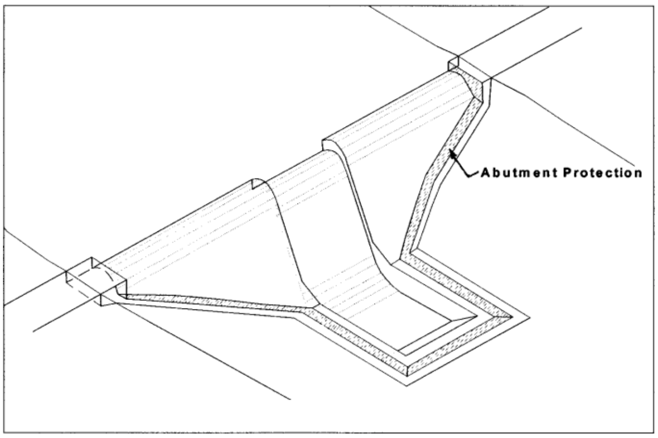

Fig. 1. Safest dam

Back (1990b) introduced the concept of and proposed criteria for the "Ultimate Dam." The Safest Dam complies fully with seven of Back's ten criteria.

As far as the dam itself is concerned, we extend the work of Londe and Lino by proposing that a modified symmetrical RCC dam would be the safest option for a wide range of foundation and abutment conditions as well as being highly competitive from a const viewpoint.

The following design considerations concerning the structural performance of the dam are important.

Foundations. The ideal foundation is fresh, uniform, reasonably strong, non-erodible rock with a high modulus of deformation.

Loads. Except as modified herein, load combinations for design of the Safest Dam follow standard gravity dam design practice for example, U.S. Army Corps of Engineers 1995). The factors relating the upper-limit flood and earthquake to the PMF and MCE are at the discretion of the designer.

Uplift. Given that many foundation drains tend to clog or close up and may not be properly maintained. All drainage works—holes, galleries, and discharge facilities—are eliminated. Since no positive drainage system is provided and no reduction in uplift is allowed, the use of any upstream sealing membrane is unnecessary. Uplift at the foundation and within the dam body is thus considered to vary linearly from hydrostatic pressure due to water at dam crest or maximum flood level to the applicable tailwater pressure for all loading conditions.

Stability. Because of its increased mass and more uniform load distribution on the foundation, combined with the water and silt loads on the upstream face, the symmetrical section is always more stable and less highly stressed than the conventional gravity dam section for the same load condition.

Concrete. As high strength is not required for the Safest Dam, the RCC would typically have a low content of cementitious material (about 50 kg/m^3 for dams up to 100-m high), with nonplastic fines used as a filler to provide adequate paste content. Aggregates would be the most convenient locally available gravels or processed rock.

The resulting concrete is low-modulus, high-creep material with high tensile strain capacity (Schrader 1993) and compressive strength of 7 to 10 MPa at 1 year. A dam constructed of this material is sufficiently deformable to avoid cracking under most loading conditions, including thermal5stress development.

For most aggregates, an unformed, uncompacted face is stable during construction if the slope is 0.8H:1V or slightly greater. Maximum economy, with no diminution in safety, is achieved if both the upstream and downstream faces are constructed in this manner. The crest width is the minimum required for construction convenience.

Galleries. The elimination of galleries is considered to be particularly beneficial from a safety viewpoint, since they can be used for sabotage and constitute a zone of weakness in an area potentially subject to tensile stress under seismic loading. In addition, by their very location, galleries tend to promote seepage.

Seepage. Where necessary, a conventional grout curtain is provided to minimize seepage around the dam via the foundation and abutments. Within the embankment, the permeability of the RCC horizontal joints without bedding mix has an important influence on total seepage through the structure. This factor has no structural significance and almost invariably decreases with time (Schrader 1992).

Instrumentation. Logically, no instrumentation (apart from downstream seepage monitoring) is required for this dam because of its simplicity, deformability, low foundation and internal stresses, low-cement content and acceptance of full uplift pressure.

Spillways

Gated spillways are incompatible with the concept of the Safest Dam for which the outflow from the reservoir must never exceed the inflow. An ungated spillway eliminates any possibility of operator error and is unaffected by the massive amounts of debris commonly accompanying high inflows.

To incorporate an ungated spillway with no significant cost penalty, it will normally be necessary to allow flood discharges to pass over the entire length of the dam crest with abutment protection provided as required. Because of its symmetrical cross section, the Safest Dam can more safely accommodate overtopping than a conventional gravity section.

There are numerous options available to the designer. In many cases, a central service spillway (with capacity equal to say the 500-year flood outflow) and the rest of the crest serving as an auxiliary spillway, will be preferred. In other cases, the entire crest may function as the service spillway. Fig. 1 shows an isometric view of a spillway arrangement compatible with the Safest Dam concept.

Energy Dissipation

An RCC-lined stilling pool or similar type of energy dissipator is incorporated to reduce the velocity of the spillway flow from chute to river speed before it reaches the natural river downstream. The dissipator is an integral part of the dam.

Abutment Protection

Abutment protection is provided by extending the dam RCC beyond the toe as required and by normal geotechnical rock reinforcement measures.

Freeboard and Waves

No provision is made for freeboard for the Safest Dam, the dam crest being set at the higher spillway crest. Wind- or earthquake generated waves can overtop the dam crest without structural consequence.

Roads and Access

A dam designed with emphasis on safety should not be used for road access. With discharge of excess inflows being passed across the entire dam crest operating as an ungated spillway, no bridge is required for operation or maintenance and none should be provided for any other purpose.

Outlet Works

For any RCC dam, regardless of cross section, it is preferable that the outlet works are not incorporated in the body of the dam since they interfere with the rapid placement of RCC and are also a potential source of seepage.

Accessible conduits can and have been loaded with explosives to destroy dams (for example, Jansen 1980). For this reason, the outlet works for the Safest Dam ideally consist of steel-lined conduits through one abutment.

Reservoir Evacuation Works

From the point of view of safety, there is no requirement for reservoir evacuation works to empty the reservoir behind the Safest Dam.

Inspection and Maintenance

Maintenance requirements for the Safest Dam are minimal. This is very important, particularly in places where maintenance funding is limited and maintenance is often deferred or even neglected. Outlet works, gates, and valves are the only mechanical installations. There are few complex features to understand and repair. Monitoring systems are not essential.

Cost and Schedule

Typically, the overall average unit price of all concrete in a dam, built predominantly of conventional low-cementitious content RCC and having a volume of the order of 500,000 m3 is in the \$35 to \$40/m^3 range. The comparable cost range for a high-cementitious material RCC is \$45 to \$50/m^3 (E. Schrader, personal communication, June 1995). These prices include the cost of forms, upstream waterproofing, bedding, and facing mixes, galleries, internal drains, transverse joints, and all conventional concrete. By eliminating all of these features (except spillway crest concrete), reducing the cementitious material by roughly 50%, minimizing RCC placement obstructions, accepting lower-quality aggregate, and minimizing the percentage of conventional concrete in the structure, it is not unreasonable to assume that the unit cost for the proposed mix will be in the range of \$20 to \$25/m^3.

For a 100-m high dam with a 5-m crest width, the volume ratio for the symmetrical section to the standard gravity section is 1.9:1, indicating that the cost of the symmetrical section is, for all practical purposes, equal to that of the gravity section for the same height.

Other cost reductions result from the elimination of internal access ways, drilled drain holes in the foundation, permanent abutment adits, and mechanical drainage facilities in the dam, as well as reduced instrumentation requirements and recurrent operation and maintenance costs. Based on these considerations, the total cost of the Safest Dam itself may well be lower than that of a conventional section RCC gravity dam.

Typically, the length of diversion conduits for the Safest Dam is increased by approximately 20% due to the longer footprint of the Safest Dam. Constructing outlet works outside the body of the dam likely produces a significant cost penalty. Spillway costs are essentially equal for both dam types.

Other Considerations

Two additional considerations should be mentioned.

Power Outlets

In the case of a powerhouse at the toe of the dam, it is often not economically feasible to avoid incorporating the intake in the body of the dam. Disruption to RCC placement can be minimized by bringing the power conduits through the dam horizontally in the intake block and continuing them down the face to the powerhouse. This approach has been adopted for two recent 100-m high RCC dams in Indonesia (Day et al. 1999).

Sediment Flushing Works

If sediment-flushing facilities are adopted, the most efficient arrangement incorporates conduits through the base of the dam.

Conclusions

Taking into account increased public preoccupation with dam safety issues and the uncertainty in determination of extreme loading conditions (particularly in developing countries), a modified dam type, designated as the Safest Dam, is postulated.

The Safest Dam is a low-strength, symmetrical section RCC embankment constructed on any rock foundation that is considered acceptable for a conventional gravity dam of the same height. The ungated spillway, occupying the entire dam crest length, discharges along the downstream face of the dam into a preformed concrete-lined energy dissipator. The dominant feature of the Safest Dam is simplicity.

The Safest Dam:

- Satisfies conventional stability requirements, without reliance on elements of uncertain long-term reliability—specifically, foundation and internal drainage and waterproofing facilities.
- Safely passes the upper-limit inflow design flood without the outflow peak ever exceeding the inflow peak under any circumstances.
- Loads its foundation in compression over the entire contact area and the maximum principal stress within the dam is compressive under all normal and unusual load combinations.

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BC's Historic Landslides – What They Are and How We Manage Them

Sign at a historic slide area, in the Cariboo.

BC's historic landslides are large-scale tracts of land that move over time, impacting communities, roads and bridges.

They may "creep" as slowly as a few millimetres a day or year. Then, they can "reawaken" and move downward more rapidly and dramatically, like areas in the Cariboo – burying or washing out roads, at times cutting off communities.

What can't be seen below the ground, is what's at play. Geologic materials such as clay, silt, sand, gravel and even rock can collapse due to changes in groundwater.

The movement over time of these slides is what distinguishes them from more "typical" short-term, instantaneous slide events like debris flows, or rock falls, which typically occur due to rain events, freeze-thaw cycles or warming temperatures. (Though both water and temperature can re-awaken a historic slide.)

Historic slides can be massive, complex and extremely challenging and expensive to manage and stabilize. For example, Ten-Mile Slide northeast of Lillooet is 200 metres wide at Highway 99 and 300 metres long. About 750,000 cubic metres in size, it's part of a large inactive "tunnel earthflow."

What to Do with Historic Slides?

Historic slides can have a major impact on the people who live and travel an area. So, what can be done to manage these situations?

When it comes to solutions for highways, roads and bridges that have been affected, we look at numerous factors like engineeering, construction, environment, community and Indigenous considerations to ensure that our transportation infrastructure is safe and reliable for motorists.

Generally, we have three approaches:

- Monitor and make improvements, while inspecting regularly to assess changes, patterns and hazard levels, and conducting maintenance as required.
- Local realignment, or simple stabilization methods such as removing water from the slide, taking away some materials (e.g. rock, sand, clay) from the slide's "crest" (highest point) to reduce the slide's driving force, or placing reinforcing materials at the slide's "toe" (bottom area) to resist the slide's force.
- Provide permanent alternative access, or stabilize the slide with a structural solution which may include retaining walls and/or soil anchors.

Each slide is different, each scenario is different. West Fraser Road, south of Quesnel, which washed out in five places in 2018, is one area where moving the road to a more stable area was the best option. Construction work began in 2021, on a new bridge and a 5.6-kilometre stretch of road.

How decisions are reached is also complex, and multiple aspects are examined for each situation, including economic activity, travel time, community connectivity, environmental impacts and costs (to name only a few). We have identified some below:

Recognizing the impacts of changing weather patterns, we have continued to evolve our strategy. Our design engineers and consultants are considering how future climate events will affect infrastructure and what can be done to make our roads and bridges more resilient, so they remain reliable and open.

Some works include upsizing culverts, building bridges where culverts are no longer suitable, redesigning drainage channels for future flow and armouring of water channels. This approach considers climate adaptation is over the life of our infrastructure. Additionally, we're incorporating design stabilization approaches that are more resilient to the impacts of climate change.

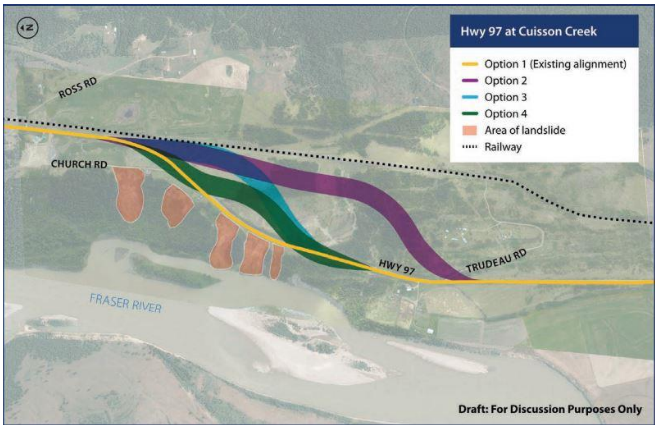
Following are a few case studies of how we've handled historic slides.

Cariboo Road Recovery – Works, Assessment in Progress

Cariboo Road Recovery Projects where historic slides have reactivated.

Changing weather patterns have reactivated historic slides with dramatic results, from Williams Lake to just north of Quesnel. Recent higher-precipitation spring and summer seasons have combined with spring snow melt. Major wildfires in the area have damaged vegetation, making it less effective at absorbing moisture and holding soil together. The resulting additional water in the ground contributed to unprecedented slides and road washouts in 2020 and 2021.

Recovery projects are being undertaken to address major transportation impacts at 10 locations, some of which have more than one slide area. Preliminary road options are being considered for all 10 sites. Community engagement is ongoing with information available about each site's characteristics, preliminary road options, plans and processes, and a presentation captured on video. Resident feedback is being sought to identify local considerations, as we evaluate various possibilities. Further investigations, feedback and other considerations will all play a role as we move toward a long-term solution.



Preliminary road options being considered along Highway 97, at Cuisson Creek, where there are five slides (shown in peach).

Work underway in these areas involves conceptual design for repairs and alternate alignments, geotechnical and hydrotechnical investigations, and climate-resilience and environmental reviews. Geotechnical monitoring includes electronic remote sensing and evaluation of the slide area, monthly aerial LiDAR (laser scan) surveys, slope monitoring and subsurface investigation.

Among the 10 Cariboo sites, is the historic Highway 97 at Cottonwood Hill slide which reawakened in 2020. Although the slide remains active with ongoing monitoring, travel through the area is safe.

Distortion caused by Cottonwood Slide

Another area, Quesnel-Hydraulic Road, was closed after multiple historic landslides reactivated there during the 2020 spring freshet. Unstable slopes, and continuing erosion at the Fraser River, make the affected segment unsafe for public use. French Road serves as an alternate route.

Geotechnical investigation at Quesnel-Hydraulic Road, in December 2021.

Section of Quesnel-Hydraulic Road buried by slide.

When Kersley Dale Landing Road was found to be unsafe due to ongoing slide movement, five households with no other way to access their properties, had to be evacuated. A temporary access road was built, and residents returned home in late 2021. Options, including road relocation, are being considered.

During construction of the temporary access route for Kersley Dale Landing Road residents.

Ten Mile Slide – Soil Anchor Stabilization

Ten Mile Slide, located within the Xaxli'p First Nation community, northeast of Lillooet on Highway 99, is a highly dynamic slide. It has been described as ancient, and since 1988, the slide's average movement has ranged from 10 millimetres a day to up to 50 millimetres a day.

For a few years, slide activity required the stretch to be limited to 24/7 single-lane alternating traffic, commercial vehicle load restrictions were required, and considerable road maintenance was needed.

This portion of Highway 99 is the primary connector between Lillooet, Xaxli'p and Kamloops, and vital to local communities and the regional economy. The Ministry of Transportation and Infrastructure and Xaxli'p worked collaboratively over time to reach a long-term solution to the slide's ongoing movement, and engineering consultants and construction contactors performed extensive analysis and extraordinary works.

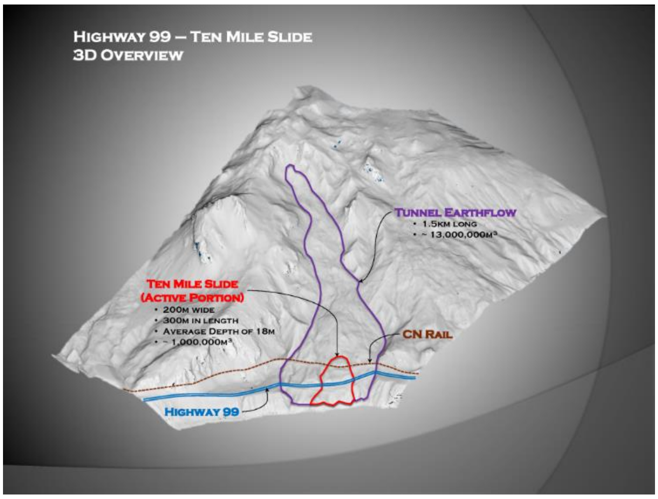


Image from ministry open house display boards

In October 2021, structural stabilization concluded. The final solution was 276 soil anchors installed through individual 2.5 metre square concrete blocks above Highway 99. Below the highway, there is a tied back concrete pile retaining wall composed of 148 large-diameter piles with 125 tie-back anchors (closeup photos here). Geotechnical Engineer Tom Kneale describes the lower structure, "Like a whole bunch of football players standing at the bottom of the hill, holding the slide back."

Structural stabilization at Ten-Mile Slide

This section of highway was also re-aligned and restored to two lanes. In the short-term, the road remains a gravel surface until the site settles, which is anticipated to be in late 2023.

Seeking Solutions in Shifting Circumstances

Managing historic slides takes a great deal of analysis to assess the slide's behaviour and then, with expert information and community input, to choose the best option. Like the slide and the earth itself, things shift and change, just as our climate is changing. Our commitment is to keep you moving safely through it all.

We hope you've found this explanation of historic slides, their impacts and how we manage them, to be informative and interesting. For other geotechnical topics see these blogs:

- Dig into the Work of a Geotechnical Engineer
- What Happens After a Rock Hits a BC Highway
- Our Geoscientists Dig Deep to Keep BC Highways Moving Safely
- What Happens After a Washout Hits a Highway
- Three Ways We are Working to Protect BC Highways from Climate Change

Thanks to BCG Engineering, whose project summary we drew on, for the section on Ten-Mile Slide.

(TranBC, 3 May 2022, https://www.tranbc.ca/2022/05/03/bcs-historic-landslides-what-they-are-and-how-we-manage-them)

Bio-inspired geotechnical engineering: principles, current work, opportunities and challenges

Alejandro Martinez, Jason Dejong, Idil Akin, Ali Aleali, Chloe Arson, Jared Atkinson, Paola Bandini, Tugce Baser, Rodrigo Borela, Ross Boulanger, Matthew Burrall, Yuyan Chen, Clint Collins, Douglas Cortes, Sheng Dai, Theodore DeJong, Emanuela Del Dottore, Kelly Dorgan, Richard Fragaszy, J. David Frost, Robert Full, Majid Ghayoomi, Daniel I. Goldman, Nicholas Gravish, Ivan L. Guzman, James Hambleton, Elliot Hawkes, Michael Helms, David Hu, Lin Huang, Sichuan Huang, Christopher Hunt, Duncan Irschick, Hai Thomas Lin, Bret Lingwall, Alen Marr, Barbara Mazzolai, Benjamin McInroe, Tejas Murthy, Kyle O'Hara, Marianne Porter, Salah Sadek, Marcelo Sanchez, Carlos Santamarina, Lisheng Shao, James Sharp, Hannah Stuart, Hans Henning Stutz, Adam Summers, Julian Tao, Michael Tolley, Laura Treers, Kurtis Turnbull, Rogelio Valdes, Leon van Paassen, Gioacchino Viggiani, Daniel Wilson, Wei Wu, Xiong Yu, Junxing Zheng

Abstract

A broad diversity of biological organisms and systems interact with soil in ways that facilitate their growth and survival. These interactions are made possible by strategies that enable organisms to accomplish functions that can be analogous to those required in geotechnical engineering systems. Examples include anchorage in soft and weak ground, penetration into hard and stiff subsurface materials and movement in loose sand. Since the biological strategies have been 'vetted' by the process of natural selection, and the functions they accomplish are governed by the same physical laws in both the natural and engineered environments, they represent a unique source of principles and design ideas for addressing geotechnical challenges. Prior to implementation as engineering solutions, however, the differences in spatial and temporal scales and material properties between the biological environment and engineered system must be addressed. Current bio-inspired geotechnics research is addressing topics such as soil excavation and penetration, soil–structure interface shearing, load transfer between foundation and anchorage elements and soils, and mass and thermal transport, having gained inspiration from organisms such as worms, clams, ants, termites, fish, snakes and plant roots. This work highlights the potential benefits to both geotechnical engineering through new or improved solutions and biology through understanding of mechanisms as a result of cross-disciplinary interactions and collaborations.

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Instantaneous tracking of earthquake growth with elastogravity signals

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Abstract

Rapid and reliable estimation of large earthquake magnitude (above 8) is key to mitigating the risks associated with strong shaking and tsunamis[1]. Standard early warning systems based on seismic waves fail to rapidly estimate the size of such large earthquakes[2,3,4,5]. Geodesy-based approaches provide better estimations, but are also subject to large uncertainties and latency associated with the slowness of seismic waves. Recently discovered speed-of-light prompt elastogravity signals (PEGS) have raised hopes that these limitations may be overcome[6,7], but have not been tested for operational early warning. Here we show that PEGS can be used in real time to track earthquake growth instantaneously after the event reaches a certain magnitude. We develop a deep learning model that leverages the information carried by PEGS recorded by regional broadband seismometers in Japan before the arrival of seismic waves. After training on a database of synthetic waveforms augmented with empirical noise, we show that the algorithm can instantaneously track an earthquake source time function on real data. Our model unlocks 'true real-time' access to the rupture evolution of large earthquakes using a portion of seismograms that is routinely treated as noise, and can be immediately transformative for tsunami early warning.

Main

The sudden displacement of rock mass induced by an earthquake generates density variations that, in turn, modify the Earth's gravity field. The signal associated with these transient gravity perturbations propagates at the speed of light, much faster than the fastest elastic waves (P-waves) [8,9,10]. Recent theoretical studies have shown the potential for earthquake early warning systems (EEWS) that are based on the gravity signals that would be measured by a future generation of gravity-gradient sensors[11,12], yet to be developed. In practice, existing inertial sensors (for example, seismometers) measure a combination of the direct gravity perturbations and their induced elastic response, named prompt elastogravity signals (PEGS)[13,14]. PEGS detection on real data is difficult for two reasons. First, the amplitude of the direct gravity perturbations is very small. Second, the induced elastic response tends to cancel out the gravity effects on seismometer recordings, especially in the early portion of the signal. The combination of these effects results in detectability limited to a time window preceding the P-wave arrival, which depends on epicentral distance (between a few seconds to a few tens of seconds), where PEGS reach their maximum amplitudes (a few nm s^{-2} at most)[14,15]. Nevertheless, PEGS could prove beneficial for EEWS. First, they travel at the speed of light and might provide extra time for alert. Second, PEGS do not saturate, as opposed to P-waves recorded by near-field seismometers that may clip during large earthquakes. Finally, given the wavelength of the signal and the smoothness of the generated wavefield[14], the spatial complexity of the rupture does not substantially affect PEGS amplitudes[15]. For this reason, PEGS dependence on earthquake magnitude, focal mechanism and source time function (STF) has the potential to improve early characterization of earthquake size and source parameters, under a simple point-source approximation[15,16]. In this work we show that PEGS can efficiently be used to improve operational EEWS.

Given the expected level of background noise, previous works have suggested a limit for PEGS detectability to earthquakes with magnitude (M_w) above 8 (refs. [15,16]). The occurrence of $M_w > 8$ earthquakes poses a difficult challenge for conventional EEWS. On the one hand, subduction megathrust earthquakes require accurate and fast estimates of final magnitude to mitigate the risk associated with strong shaking and to forecast the potential size of tsunami waves[17,18,19]. On the other hand, EEWS based on point-source algorithms that rely on the first few seconds of P-waves tend to produce saturated magnitude estimation for such large earthquakes. One reason is that instruments saturate for very large events. Another more fundamental reason is that the early portion of seismograms simply does not contain enough information to distinguish between small and large earthquakes (which have longer duration) at the very early stage of rupture[5]. An example of this paradigm is the performance of the EEWS of the Japan Meteorological Agency (JMA) during the 2011 $M_w = 9.0$ Tohoku-Oki earthquake, which underestimated the final M_w of the event to around 8.1 (ref. [20]). Although the deterministic nature of earthquake rupture is still debated, a growing amount of evidence suggests that earthquake ruptures are not deterministic[21]. Therefore, EEWS should be designed to track the moment release as the rupture unfolds instead of forecast the final earthquake magnitude[3,22]. Over the last decade, finite-fault EEWS based on global navigation satellite system (GNSS) data have emerged as a new tool with which to overcome the magnitude saturation problem[23,24,25,26,27,28]. Nevertheless, subjective choices required in GNSS data selection and/or preprocessing[24,25] may result in large uncertainties. Moreover, the fast responses achieved for megathrust earthquakes[26] have recently been questioned and attributed not to the predictive power of GNSS data—which would enable the estimation of an earthquake's final magnitude before the rupture is over—but to prior constraints and regularization-induced artefacts[22]. A deep learning model based on GNNS data has recently been proposed to overcome these limitations[29]. Although it proved promising, as for other finite-fault approaches, it requires a priori assumptions on slip distribution. Finally, all existing EEWS suffer from unavoidable latency, owing to the speed at which the information is carried by P-waves, and therefore produce a time-shifted version of the earthquake STF.

In this context, we show that a convolutional neural network (CNN)[30] approach can leverage the information carried by PEGS at the speed of light to overcome these limitations for large earthquakes. Successful applications of deep learning in seismology have provided new tools for pushing the detection limit of small seismic signals[31,32] and for the characterization of earthquake source parameters (magnitude and location)[33,34,35] with EEWS applications[29,36,37]. Here we present a deep learning model, PEGSNet, trained to estimate earthquake location and track the time-dependent magnitude, $M_w(t)$, from PEGS data before P-wave arrivals.

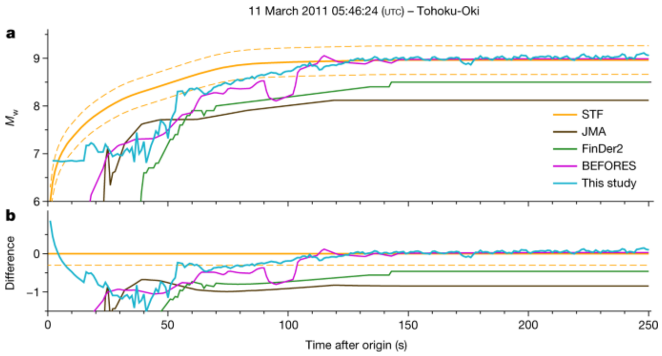
…

Implications for early warning

We have demonstrated instantaneous tracking of moment release for large earthquakes (Fig. 3). Our results promote PEGS as a new class of observables, easily accessible from the recordings of currently deployed broadband seismometers worldwide, for practical application in early warning systems that are currently limited by the speed of P-waves. In the context of EEWS, PEGSNet can complement any existing algorithm (either seismic- or GNSS-based), to improve M_w latency estimation and accuracy for $M_w > 8.3$ megathrust earthquakes. For example, PEGSNet could be combined with a recent deep learning model based on GNSS data[29] to eliminate intrinsic latency due to P-wave speed.

At the same time, PEGSNet can immediately prove critical for tsunami early warning for which M_w estimation within a few minutes is vital. Continuous updates of current M_w can be fed to predictive models of tsunami waves height, helping mitigate the associated risk.

Fig. 3: Moment tracking of the 2011 M_w 9.0 Tohoku-Oki earthquake.



a, Comparison of PEGSNet $M_w(t)$ predictions (blue) with the source time function (STF) of the Tohoku-Oki earthquake[40] (orange) and with the results of three existing EEWS (JMA[20], FinDer2[41] and BEFORES[24]). Dashed orange lines indicate ±0.3 magnitude units. **b**, Difference between the predicted M_w of various algorithms (PEGSNet in blue) and the 'true' STF as shown in **a**. The solid orange line indicates a difference of zero, the dashed orange line a difference of −0.3 M_w units (underestimation).

Our results suggest that PEGS can play a key part in the early characterization of rupture evolution for large earthquakes. For such events, PEGS data represent a new and independent source of information to constrain the magnitude in real time.

PEGSNet requires only a few modifications to be implemented in real time. Once trained, PEGSNet predictions are quasi-instantaneous, although some latency could be introduced by the preprocessing step. Although tailored here to earthquakes from the Japanese subduction zone, PEGSNet can be easily adapted to other seismic networks and regions and source mechanisms. In particular, PEGSNet portability to other regions only requires the availability of noise recordings for the seismic network of interest.

Nature **volume 606**, pages 319–324 (2022),
https://www.nature.com/articles/s41586-022-04672-7

ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

ΕΛΛΗΝΙΚΗ ΕΠΙΣΤΗΜΟΝΙΚΗ ΕΤΑΙΡΕΙΑ ΕΔΑΦΟΜΗΧΑΝΙΚΗΣ & ΓΕΩΤΕΧΝΙΚΗΣ ΜΗΧΑΝΙΚΗΣ

Time Capsule της ISSMGE

Τα περιεχόμενα του Time Capsule της ISSMGE είναι διαθέσιμα στον ιστότοπό της: (https://www.issmge.org/the-society/time-capsule) σε τρία μέρη, A, B, C. Στο Part A θα βρείτε τη συμμετοχή της ΕΕΕΕΓΜ από τον Σπύρο Καβουνίδη (http://www.hssmge.gr/2022_2_HELLENIC-SSMGE-CAVOUNIDIS.pdf) και στο Part C τη βιντεοσκοπημένη συνεδρία για το Time Capsule Project στο Sydney, που αρχίζει με ένα επαγγελματικό βίντεο με πολλές φωτογραφίες από τη συμμετοχή της ΕΕΕΕΓΜ. Από το βίντεο (https://www.issmge.org/news/sydney-launch-of-the-issmge-time-capsule) συνιστώ επίσης την παρουσίαση του Harry Poulos (8:18-19:29).

Μαρίνα Πανταζίδου

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SIMSG ISSMGE

International Society for Soil Mechanics and Geotechnical Engineering

ISSMGE News & Information Circular May 2022

https://www.issmge.org/news/issmge-news-and-information-circular-May-2022

1. ISSMGE COUNCIL MEETING SUNDAY 1ST MAY 2022

At the Council Meeting in Sydney, Dr Marc Ballouz was elected as the next President of ISSMGE for the period 2022 - 2026. The Vice-Presidents will be:

Africa - Professor Marawan Shahien
Asia - Professor Keh-Jian Shou
Australasia- Mr Graham Scholey
Europe - Professor Lyesse Laloui
North America - Professor Walter Paniagua
South America - Professor André Assis

Other key points from the Council Meeting are:

- The next quadrennial international conference (21 ICSMGE) will be held in Vienna, Austria 28 June 3 July 2026.
- The next Council Meeting will be in Nur-Sultan, Kazakhstan, 14-18 August 2023, on occasion of the XVII Asian Regional Conference.

2. ISSMGE TIME CAPSULE 2022 LAUNCHED IN SYDNEY

Watch the 60 minute video of the plenary session at the 20th ICSMGE conference (1-5 May 2022).

https://www.issmge.org/the-society/time-capsule/part-c

3. NEWS FROM TC209 OFFSHORE GEOTECHNICS

ISSMGE Offshore Geotechnics is delighted to announce that Professor Richard Jardine of Imperial College has been invited to deliver the 6th McClelland Lecture. Scheduled for September 2023 at the SUT - Society for Underwater Technology's Offshore Site Investigation and Geotechnics (OSIG) 9th International Conference Innovative Geotechnologies for Energy Transition. For more information, please see https://www.issmge.org/article/announcing-the-6th-mcclelland-lecturer-professor-richard-jardine.

4. ISSMGE BULLETIN

The latest edition of the ISSMGE Bulletin (Volume 16, Issue 1, February 2022) is available from the website https://www.issmge.org/publications/issmge-bulletin/vol16-issue-1-february-2022

5. ISSMGE FOUNDATION

The next deadline for receipt of applications for awards from the ISSMGE Foundation is the 31st May 2022. Click **here** for further information on the ISSMGE Foundation.

6. CONFERENCES

For a listing of all ISSMGE and ISSMGE supported conferences, and full information on all events, including deadlines, please go to the Events page at https://www.issmge.org/events. However, for updated information concerning possible changes due to the coronavirus outbreak (ie. postponements, cancellations, change of deadlines, etc), please refer to that specific events website.

Many events have been rescheduled and we update the Events page whenever we are advised of changes.

The following are events that have been added to the Events page on the ISSMGE website since the previous Circular:

ONLINE INTERNATIONAL CONFERENCE ON TRANSPORTATION GEOTECHNICS - 01-06-2022 - 03-06-2022 Online, Thiruvananthapuram, India; Language: English; Organiser: LBS Institute of Technology for Women, Thiruvananthapuram, India; Contact person: Dr. Jayamohan J (Member TC 107, ISSMGE); Address: Professor, LBS Institute of Technology for Women; Phone: +919447017088 Fax: +914712343395; Email: jayamohanj@lbsitw.ac.in; Website: http://lbt.ac.in/

Fifth Symposium of MAG / Second Conference of Regional Geotechnical Societies / ISRM Specialised Conference - 23-06-2022 - 25-06-2022 Ohrid Lake Riviera, Hotel Metropol, Macedonia; Languages: English, Southslavic; Organiser: Macedonian Association for Geotechnics; Contact person: Assoc. Prof. Igor Peshevski; Address: blvd. Partizanski odredi No.24; Phone: +389 72 307 567; Fax:

+389 2 311 88 34; Email: pesevski@gf.ukim.edu.mk; Website: https://mag.net.mk/v-mag-symposium-28-30-5-2020/; Email: mag@gf.ukim.edu.mk

4TH INTERNATIONAL CONFERENCE ON INFORMATION TECHNOLOGY IN GEO-ENGINEERING (04 - 05 AUG 2022) - 04-08-2022 Virtual Online Conference, Singapore; Language: English; Organiser: Geotechnical Society of Singapore; Website: https://www.4iticg.org/; Email: sc.chian@nus.edu.sg

5TH CENTRAL ASIAN CONFERENCE ON SOIL MECHANICS AND GEOTECHNICAL ENGINEERING 05-10-2022 - 07-10-2022 Samarkand, Uzbekistan; Language: English; Organiser: Uzbekistan Geotechnical Society; Contact person: Yodgor Obidov; Address: Lolazor street, 73; Phone: +998904526035; Email: conference.uzgs2022@gmail.com; Website: http://geotechnics.uz

GEO-EXPO 2022 Scientific and Expert Conference - 21-10-2022 - 22-10-2022 Hotel Prijedor, Prijedor; Bosnia & Herzegovina; Languages: Bosnian, Croatian, Serbian, English Organiser: Geotechnical Society of Bosnia and Herzegovina; Contact person: Sabrina Salkovi; Address: Urfeta Vejzagia 2; Phone: +38761451701; Email: eotehnika@geotehnika.ba; Website: https://www.geotehnika.ba;

UNDERGROUND CONTRUCTION PRAGUE 2023 - 29-05-2023 - 31-05-2023 Clarion Congress Hotel Prague, Language: English; Organiser: The Czech Tunnelling Association ITA-AITES; Contact person: Czech Tunnelling Association ITA-AITES; Address: Koeluská 2450/4; Phone: +420 702 062 610; Email: pruskova@ita-aites.cz; Website: https://www.ucprague.com/ ; Email: masin@natur.cuni.cz

NUMERICAL METHODS IN GEOTECHNICAL ENGINEERING 2023 - 26-06-2023 - 28-06-2023 Imperial College London; Language: English; Organiser: Imperial College London; Contact person: Email: numge2023@imperial.ac.uk Website : http://imperial.ac.uk.

28TH EUROPEAN YOUNG GEOTECHNICAL ENGINEERS CONFERENCE AND GEOGAMES 04-10-2023 - 07-10-2023 National Research Moscow State University of Civil Engineering, Russia; Language: English; Organiser: Russian Society for Soil Mechanics, Geotechnics and Foundation Engineering; Contact person: PhD Ivan Luzin ; Address: NR MSUCE, 26 Yaroslavskoye shosse; Phone: +7-495-287-4914 (2384); Email: youngburo@gmail.com; Website: https://www.eygec28.com/

2ND INTERNATIONAL CONFERENCE ON CONSTRUCTION RESOURCES FOR ENVIRONMENTALLY SUSTAINABLE TECHNOLOGIES - 20-11-2023 - 22-11-2023 Fukuoka International Congress Center, Fukuoka, Japan; Language: English; Organiser: Kyushu University; Contact Information: Secretariat of CREST 2023; Address: Room No. 1124, West Building 2, Kyushu University 744 Motooka, Nishi-ku, Fukuoka, Japan; Phone: +81 092-802-3369; Email: info@ic-crest.com; Website: https://www.ic-crest.com/

Dr Marc Ballouz elected as ISSMGE President 2022 – 2026 at the Sydney Council Meeting

At the Council Meeting in Sydney, Dr Marc Ballouz was elected as the next President of ISSMGE for the period 2022 - 2026. The Vice-Presidents will be:

Africa - Professor Marawan Shahien
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Europe - Professor Lyesse Laloui
North America - Professor Walter Paniagua
South America - Professor André Assis

Dr Marc Ballouz

Other key points from the Council Meeting are:

The next quadrennial international conference (21 ICMSGE) will be held in Vienna, Austria 14-19 June 2026.

The next Council Meeting will be in Nur-Sultan, Kazakhstan, 14-18 August 2023, on occasion of the XVII Asian Regional Conference.

ISSMGE Secretariat / General / ISSMGE Council Meeting, Sunday 1 May 2022

Fifth TC309/TC304 Student Contest (groundwater time-series forecasting) in MLRA2021

MLRA2021 groundwater time-series forecasting

Machine learning prediction event for the international conference in "Machine learning & Risk assessment in geoengineering"

The machine learning competition is organized as an event at the MLRA2021 (Machine Learning and Risk Assessment in geoengineering) Conference in Wroclaw, Poland, in October 2021 (conference website). The results from the contest are presented here:

- Organizers: Tom F. Hansen, Bruno Stuyts, Jian Ji & Zhongqiang Liu
- Award Committee: Tom F. Hansen, Bruno Stuyts, Jian Ji, Zhongqiang Liu & Jianye Ching
- Contest question: https://www.kaggle.com/c/mlra2021/overview.
- TC309/TC304 Student Contest 1st Place Award: pdf
- Encouragement awards: pdf1; pdf2

Thanks to all the participants and congratulations to the winners!

Dongming Zhang / TC309 / 03-05-2022

Sydney launch of the ISSMGE Time Capsule

ISSMGE IT Administrator / Time Capsule Project / 12-05-2022

TC222 Member Newsletter No. 1

International Society for Soil Mechanics and Geotechnical Engineering

TC222 - Geotechnical BIM and Digital Twins

NEWSLETTER

May 2022 Issue No. 1

Delighted to announce the start-up of TC222

With an increased focus on Building Information Modelling (BIM) and Digital Twins (DT) in Geotechnics among practitioneers and in academia, ISSMGE has launced a new TC to cover these rapidly evolving themes. The board of TC222 hope you will join us on this journey to evolve BIM and DTs in the field of geotechnical engineering.

Join us for a workshop after the summer holidays

We are looking forward you to join us for a workshop on BIM and Digital Twins in in September 2022. Exact dates of the workshop will be announced in June during the TC222 member meeting. The workshop agenda is not yet finalized, however there will be selected short presentations on the BIM and Digital Twin state-of-art in the AEC sector, as well as group discussions on relevant topics.

Invitation to the first TC222 member meeting in June 2022

We are planning the first team meeting to kick-off the TC222 activities in 2022. As a first meeting, we will go through the terms of reference and discuss future plans.

Agenda

- Welcome to the newest TC in ISSMGE
- An introduction to the core members
- The Terms of Reference - a brief walkthrough
- Planned activities for 2022

Where: Online event - Teams
Invitation will be sent per email to all TC222 members

Date: 28.06.2022

Time: 11.00 - 12.00 (CEST)

Share among your network!

The TC is actively seeking more members to join from both academia and the industry. New members may be either nominated by their national branch of the ISSMGE society, or as corresponding members. Please share the news of the TC222 start-up with your network and peers!

Get in touch with us

Want to join the TC222 member meeting and did not recieve an invitation? Send an email to mats.kahlstrom@ngi.no.
Also, feel free to contact us with any questions regarding TC222, preferably using the online form on the TC website.

https://www.issmge.org/committees/technical-committees/applications/geotechnical-bim-and-dt

Mats Kahlström / TC222 / 20-05-2022

The 2nd ISSMGE ERTC10 Webinar on "Numerical Methods in the next generation of Eurocode 7"

The ISSMGE ERTC10 "Evaluation of Eurocode 7", in cooperation with CEN TC250/SC7 (European standardization committee responsible for EC7) and NEN (Dutch standardization organization), is organizing its 2nd Webinar related to the ongoing evolution of our main standard covering geotechnical design. This time the event will be focused on "**Numerical Methods in the next generation of Eurocode 7"**.

The event will be held online on the **7th of July 2022 at 15:00-17:00 CEST** (2h). Participation is **free of charge**.

The agenda and the team of presenters for this event will include:

1. Dr Georgios Katsigiannis (ERTC10 Chair, EKFB, UK): Introduction
2. Dr Colin Smith (University of Sheffield, UK): The overview of provisions given in the new code regarding numerical methods
3. Dr Hoe Yeow (COWI, UK): Application of advanced numerical methods in EC7 framework and presentation of two design examples of application of numerical methods in line with EC7
4. Q & A session

For those who might miss the Webinar but would be interested in the subject, the recording of the presentations and the materials will be made available sometime after the event.

Registration details and more information can be found at NEN website dedicated to the event:

https://numerical-methods-inthenext-generation-euro-code7.nen-evenementen.nl/

Witold Bogusz / ERTC10 / 16-05-2022

Scholarship of Teaching and Learning: Formally recognized by ASEE

The American Society for Engineering Education (ASEE) amended its Constitution and added a Vice President for Scholarship to the Board, as voted by the ASEE Board of Directors in February 2022 and approved by the members in a ballot that took place in April-May 2022. According to the text introducing the ballot to the ASEE members:

"This addition recognizes the importance of scholarly avenues for our members and enables a strategic emphasis on this valuable dimension of ASEE activities. **The definition of scholarship has expanded substantially in recent decades to include not only peer-reviewed publication and intellectual property but also multimedia or digital products** (video, podcasts, etc.) as well as any future mechanisms of information transfer. The Vice President for Scholarship would steward ASEE's leadership and growth in engineering education scholarship."

TC306's "Time Capsule" report uses the following **definition for the Scholarship of Teaching** by Borrego et al. (2008): **an activity that is public, open to critique and evaluation, and results in products that others can use and build on** (it also involves inquiry and investigation, focusing particularly on student learning). This enriched version of educational activities allows for greater recognition and reward attached to teaching (see earlier relevant TC306 news item) by infusing teaching with research practices, thus also paving the way for peer-critiqued and peer-reviewed educational materials.

TC306 invites contributions from the wider geotechnical engineering community to help bring this bright future for Education sooner for Geotechnical Engineering Education.

Reference

Borrego, M., R.A. Streveler, R.L. Miller and K.A. Smith (2008). A new paradigm for a new field: Communicating representations of engineering education research, J. of Engineering Education, 97:2:147-162.

Marina Pantazidou / TC306 / 26-05-2022

ISRM

International Society for Rock Mechanics and Rock Engineering

News

https://www.isrm.net

15th ISRM International Congress 2023, Salzburg - call for abstracts open until 31 May 2022-05-04

The Austrian Society for Geomechanics is happy to invite you to the 15th International ISRM Congress in Salzburg, Austria in October 2023. Salzburg is the city where the ISRM was founded in 1962, and traditionally research meets industry. The preparation for the congress is in full swing.

Abstract submission is now open until 31 May 2022. In particular, we encourage young engineers and scientists to actively participate and submit papers.

Do you want us to keep you updated? Join the mailing list here.

If you have questions, ask us. We are ready → www.ISRM2023.com.

If you want to see the venue of the Congress and the city click here.

Wulf Schubert
President of the Austrian Society for Geomechanics
Chairman of the ISRM Congress 2023

CouFrac 2022: Special Session on Machine Learning for Coupled Processes in the Earth Sciences and Engineering 2022-05-10

A Special Session on Machine Learning for Coupled Processes in the Earth Sciences and Engineering will be Convened by Mengsu Hu and Laura J. Pyrak-Nolte. Click here to download the flyer of this Special Session.

CouFrac 2022 is an ISRM sponsored specialized conference, that will take place in Berkeley, USA, 14-16 November. Click here to go to the conference website.

2nd European Rock Mechanics Debate - "What model for what application in rock mechanics" on 9 June 2022-05-11

The title of the debate is "*What model for what application in rock mechanics*". It will take place on 9 June, at 15:00 CEST (13:00 GMT).

The debate will feature the participation of Heinz Konietzky from Germany and Jonny Sjöberg from Sweden and will be chaired by Philippe Vaskou from France.

A flyer with the contents and indicative rules of this debate can be downloaded here. In this flyer you will find the Zoom link to join the meeting (maximum of 100 participants) and the ISRM YouTube channel link where it will be broadcast.

Leandro R. Alejano
ISRM VP for Europe

ARMS 12, Hanoi, Vietnam - deadline for abstract submission extended to 10 June 2022-05-12

The Vietnamese Society for Rock Mechanics (VSRM) invites you to attend the ISRM Regional Symposium 12th Asian Rock Mechanics Symposium - ARMS12, to be held on 22-26 November 2022 in Hanoi, and informs that the deadline for abstract submission for ARMS 12 has been extended to 10 June 2022.

The Symposium topics are:

A: Physical properties of Rocks – Testing Techniques
B: Rock Mechanics & Engineering in Petroleum Engineering
C: Rock Mechanics & Engineering in Civil Engineering and Mining
D: Rock Mechanics applied to the Protection and Reinforcement of Global Geoparks, Ancient Sites, ...
E: Numerical Methods in Rock Mechanics and Numerical Modeling
F: Geodynamic Hazards - Reinforcement and Prediction
G: Geo –disaster Prediction and Monitoring System
H: Application AI and IoT in Rock Mechanics and Engineering

Click here for the conference flyer

Fifth ISRM Young Members' Seminar (YMS) on 27 May 2022-05-16

The ISRM Young Members' Seminar (YMS) Series is a new ISRM Young Members Group initiative. It consists of a series of virtual events with the goal of providing a global platform for ISRM young members to share knowledge, experiences, and ideas. More details on the YMS are available on this page.

After four very successful editions, the fifth ISRM Young Members' Seminar will take place on 27 May at 6 P.M. GMT with two speakers, from Canada and USA:

- Directional and 3D-Confinement-Dependent Fracturing, Strength and Dilation Mobilization in Brittle Rocks - Masoud Rahjoo (AECOM - Canada)
- Stochastic Discrete Element Modeling for Pillar Strength Determination: a First Step in a Risk-Based Pillar Design Approach - Juan José Monsalve (Virginia Tech University - USA)

You can join using the Zoom link created for each Seminar and you can participate in the question and answers period. The Seminars will also be live-streamed to the ISRM YM's YouTube channel, where they will be stored. **Click here to download the flyer**.

Stay tuned for details on the 5th edition from the YMS organising committee.

Sevda Dehkhoda
Chair of the ISRM Young Members Committee

Scooped by ITA-AITES #67, 10 May 2022

Chinese young engineers shine in building Malaysia's mega rail project

Views sought on Stonehenge tunnel carbon claims | UK

Shaoxing Metro Line 1 completed | China

Ruakuri Cave: The underground experience that needs to be on your bucket list | New Zealand

Bengaluru Metro's Urja sets single-day tunnelling record | India

VTA approves design review for BART to San Jose extension | United States of America

Scarborough Subway Extension tunnel boring machine getting into position to prepare for tunneling | Canada

Shield machine to dig undersea tunnel to discharge 'treated water' has not yet been approved nor has the local government | Japan

Live performance marks Tideway's tunnel completion | UK

5 things you (probably) didn't know about Massey Tunnel | Canada

Scooped by ITA-AITES #68, 24 May 2022

Blue Mountains road tunnel to stretch more than 11 kilometres | Australia

Hampton Roads Bridge Tunnel Expansion: Crews working to mold 2,400 rings for new tunnels | United States of America

Tunnels could speed mass transit under downtown | United States of America

Transport for London searching for contractors to take on Elephant and Castle Station tunnelling work | UK

Exploring the underground tunnels that help Hong Kong weather storms | China

Tunnel boring machine completes work for Grand Paris Express line 17 | France

India is planning to build its first underwater road-cum-rail tunnels across Brahmaputra | India

China completes construction of 20km Yuelongmen Tunnel

Nominations open for 8th Edition of the ITA Tunnelling Awards

Breakthrough completes Italian leg of high-speed Brenner Base Tunnel | Italy-Austria

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BRITISH TUNNELLING SOCIETY

HS2 Chiltern Tunnels
A Brief Project Introduction & Progress Update from Align JV after 1 year of Tunnelling

Speakers:

James Reilly MEng – Senior TBM Engineer (Florence)

Shannon O'Keeffe CEng MICE MIEAust CPEng NER RPEQ – TBM Manager

Tunnelling on the Central 1 (C1) section of HS2 Phase One that Align is delivering commenced a year ago on the 7th of May with the launch of Align's first TBM Florence. This presentation will give a brief overview of the project and an update on progress & achievements to-date, including innovations that have been introduced to expedite progress and enhance safety performance.

This is an in-person event which can also be streamed online at: https://youtu.be/H5KbTCqAD6Q.

BRITISH TUNNELLING SOCIETY YOUNG MEMBERS

Underground Construction Chemicals used in Tunnelling and Mining

Robin Swift - TBM Projects Manager, Normet UK Ltd

Workshop agenda:

1. Introduction to underground construction practices using chemical products

2. Networking coffee break

3. Hands-on demonstration of concrete admixtures, construction chemicals and various types of grouting materials (Polyurethane, acrylic, microfine and TBM annulus grout)

Thursday 19th May 2022 at 15:00 to 17:30 hrs, Institution of Civil Engineers, One Great George Street, Westminster, London SW1P 3AA

☙ ❧

Geo Legends S02 E03 - Bob Holtz

https://www.youtube.com/watch?v=ItbsbwCNQG8

The Geo-Legends series features our most eminent members. In episode 3 of season 2, Steve Kramer of the University of Washington interviews Bob Holtz, Professor Emeritus at the University of Washington. Bob was the 2010 Terzaghi Lecturer, and was named a Distinguished Member of ASCE in 2007.

He talks about everything from his youth in Arizona and New Mexico, his time spent overseas, the importance of working with students, writing his seminal textbook, and a lot more!

Special thanks to Barry Christopher and Paul Mayne.

Music in this episode: Sonic Youth - Sunday. From the 1998 album A Thousand Leaves.

Geo-Institute of ASCE, 10 May 2022

Overview of Revisions to FERC's Dam Safety Program

Thanks for joining us for part 1, 2, or 3 (or more than one) of the Federal Energy Regulatory Commission (FERC) dam safety regulation updates. It was great to hear from FERC staff, then the consultants, and then the dam owners. A reminder that you can watch all three of these sessions on our Youtube channel!

Panel 1: FERC Q&A: https://youtu.be/2BuPf5diAn0

Panel 2: Consultants: https://youtu.be/mlJq99ckREw

Panel 3: Dam Owners: https://youtu.be/ZAe-0R4CBYM

Be sure to check out all the other great stuff we have on Youtube – GEOSTRATA Extra, Geo-Legends, G-I award lectures, and so much more!

Have a great summer and be sure to stay connected to G-I!

Bradley Keelor
Director, Geo-Institute of ASCE

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Professor Chungsik Yoo Becomes New President of FedIGS

Dr. Chungsik Yoo was recently elected to a four year term as the new president of FedIGS (The international federation of geoscience societies). He is a professor at Sungkyunkwan University in Korea and is president of IGS (International Society of Geosynthetics, which is one of our three sister societies in FedIGS.

ΔΙΑΚΡΙΣΕΙΣ ΕΛΛΗΝΩΝ ΓΕΩΤΕΧΝΙΚΩΝ ΜΗΧΑΝΙΚΩΝ

ICE Publishing Awards 2022

Βράβευση άρθρων των Παναγιώτη Σιταρένιου, Ευάγγελου Κεμεντζετζίδη και Γεώργιου Κουρετζή στο Géotechnique

George Stephenson Medal - Second best paper overall

Hydro-mechanical analysis of a surficial landslide triggered by artificial rainfall: the Ruedlingen field experiment των Panagiotis Sitarenios, Francesca Casini, Amin Askarinejad and Sarah Springman, *Géotechnique*, https://doi.org/10.1680/jgeot.18.P.188

Abstract

This paper interprets the hydromechanical behaviour of a steep, forested, instrumented slope during an artificial rainfall event, which triggered a shallow slope failure 15 h after rainfall initiation. The soil's mechanical response has been simulated by coupled hydro-mechanical finite-element analyses, using a critical state constitutive model that has been extended to unsaturated conditions. Failure occurs within a colluvium shallow soil cover, characterised as a silty sand of low plasticity. The hydraulic and mechanical parameters are calibrated, based on an extended set of experimental results, ranging from water retention curve measurements to triaxial stress path tests under both saturated and unsaturated conditions. Rainfall is simulated as a water flux at the soil surface and suitable boundary conditions account for the hydromechanical interaction between the soil cover and the underlying bedrock. The results are compared with field data of the mechanistic and the hydraulic responses up to failure and are found to provide a very satisfactory prediction. The study identifies water exfiltration from bedrock fissures as the main triggering agent, resulting in increased pore pressures along the soil–bedrock interface, reduced available shear strength and cause extensive plastic straining, leading to the formation and propagation of a failure surface.

https://www.icevirtuallibrary.com/doi/full/10.1680/jgeot.18.P.188 ή https://www.icevirtuallibrary.com/doi/pdf/10.1680/jgeot.18.P.188?download=true

Παναγιώτης Σιταρένιος School of Energy, Construction and the Environment, Coventry University, Coventry, UK.

David Hislop Award (also known as the Offshore award)

Frequency effects in the dynamic lateral stiffness of monopiles in sand: insight from field tests and 3D FE modelling, των Evangelos Kementzetzidis, Andrei V. Metrikine, Willem G. Versteijlen, Federico Pisanò, *Géotechnique*, https://doi.org/10.1680/jgeot.19.TI.024

Abstract

With the offshore wind industry rapidly expanding worldwide, geotechnical research is being devoted to foundation optimisation – most intensively for large-diameter monopiles. The analysis and design of monopiles still suffers from significant uncertainties in relation to cyclic/dynamic loading conditions. The aim of this work is to shed new light on dynamic soil–monopile interaction, based on the results of unique full-scale experiments performed at the Westermeerwind wind park (Netherlands). The response of a 24 m long, 5 m diameter monopile to harmonic lateral loading of varying amplitude and frequency is inspected. The analysis of original field measurements (soil accelerations and pore pressures) enables the lateral stiffness observed at the monopile head to be linked to dynamic effects occurring in the surrounding soil. The interpretation of measured data is supported by three-dimensional finite-element studies, also looking at the influence of drainage conditions and monopile size. The set of results presented supports the need for dynamics-based monopile design, as higher frequencies gain relevance in the most recent offshore wind developments.

https://www.icevirtuallibrary.com/doi/full/10.1680/jgeot.19.TI.024 ή https://www.icevirtuallibrary.com/doi/pdf/10.1680/jgeot.19.TI.024?download=true

Ευάγγελος Κεμεντζετζίδης Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft, the Netherlands.

Tso Kung Hsieh Award - Paper on Structural Dynamics (nominated by SECED)

Physical modelling of lateral sand–pipe interaction, των Yousef Ansari, George Kouretzis, Scott William Sloan, *Géotechnique*, https://doi.org/10.1680/jgeot.18.P.119

Abstract

This paper presents a series of physical modelling tests performed to measure the resistance developing during lateral dragging of a rigid pipe buried in loose to very dense dry sand. The experiments were performed in a small-scale prototype developed to model sand–pipe interaction during relative ground movement episodes while accurately controlling the density and uniformity of sand around the pipe. Digital imaging and particle image velocimetry equipment are integrated with the rig, so as to track the evolution of the failure surface developing in sand with increasing pipe displacements. Auxiliary components of the rig allow investigation of the effects of pipe kinematic constraints and embedment method on the results obtained. Accordingly, the measurements obtained with the developed prototype are compared against results from similar studies, with the intention of shedding some light on the scatter observed in published data, and on the provisions from different pipe stress analysis guidelines. It is shown that current simplified methods may underestimate the lateral reaction developing on pipes in very dense sand beds, and analysis models built around these methods may under-predict pipe strains. To alleviate this, a modified expression is proposed for estimating the peak reaction of lateral elastoplastic soil springs, and an upper bound of this reaction is provided for design purposes.

https://www.icevirtuallibrary.com/doi/full/10.1680/jgeot.18.P.119 ή https://www.icevirtuallibrary.com/doi/pdf/10.1680/jgeot.18.P.119?download=true

Γεώργιος Κουρετζής Priority Research Centre for Geotechnical Science and Engineering, Faculty of Engineering and Built Environment, The University of Newcastle, Australia.

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Ευαγγελία Γεωργάντζια
Vice Chair of the
ICE NW Graduates and Students committee

I feel honoured to have been selected as Vice Chair of the ICE NW Graduates and Students committee. Looking forward to working closely with our Chair Jenna-May Hill & junior Vice Chair Giuliana Kyerematen to establish a constructive relationship and share responsibilities. Ready to act as an informal lightning rod for the board and beyond. Looking forward to this exciting journey ahead!

Evangelia Georgantzia, 23.05.2022

ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

4th International Conference "Challenges in Geotechnical Engineering" CGE-2022, 1 to 3 June 2022, Kyiv, Ukraine www.cgeconf.com

The 17th Danube - European Conference on Geotechnical Engineering, 7-9 June, 2022, Bucharest, Romania, https://sites.google.com/view/17decgero

3rd European Conference on Earthquake Engineering and Seismology (3ECEES), 19-24 June 2022, Bucharest, Romania, https://3ecees.ro

PRF 2022 Progressive Failure of Brittle Rocks, June 20-24th, 2022, Flatrock, NC, USA, www.prf2022.org

3rd International Symposium on Geotechnical Engineering for the Preservation of Monuments and Historic Sites, 22-24 June 2022, Napoli, Italy, https://tc301-napoli.org

CPT'22 5th International Symposium on Cone Penetration Testing, 26-29 June 2022, Bologna, Italy, http://cpt22.org

Workshop on soil erosion for Europe – Emerging challenges, 27-29 June 2022 (WEBEX - Online) Landslides and soil erosion. Chair: Nikolaos Tavoularis ntavoularis@metal.ntua.gr

IS-Cambridge 2020 10th International Symposium on Geotechnical Aspects of Underground Construction in Soft Ground, 28 - 30 June 2022, Cambridge, United Kingdom, www.is-cambridge2020.eng.cam.ac.uk

5.ICNDSMGE – ZM 2020 5th International Conference on New Developments in Soil Mechanics and Geotechnical Engineering, June 30 to July 2, 2022, Nicosia, Cyprus, https://zm2020.neu.edu.tr

ICONHIC2022: THE STEP FORWARD - 3rd International Conference on Natural Hazards & Infrastructure, 5 – 7 July 2022, Athens, GREECE, https://iconhic.com/2021

RocDyn-4 4th International Conference on Rock Dynamics an ISRM Specialized Conference, 17-19 August 2022. Xuzhou, China, http://rocdyn.org

ISFOG 2020 4th International Symposium on Frontiers in Offshore Geotechnics, 28 – 31 August 2022, Austin, United States, www.isfog2020.org

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics – IACMAG 30-08-2022 – 02-09-2022, Torino, Italy, www.iacmag2022.org

WTC 2022 World Tunnel Congress 2022 - Underground solutions for a world in change, 2-8 September 2022, Copenhagen, Denmark, www.wtc2021.dk

11th International Symposium on Field Monitoring in Geomechanics, September 4 - September 7, 2022, London, UK, https://isfmg2022.uk

7th European Geosynthetics Conference, 4 to 7 September, 2022, Warsaw, Poland, https://eurogeo7.org

3rd European Conference on Earthquake Engineering & Seismology, September 4 – September 9, 2022, Bucarest, Romania, https://3ecees.ro

Eurock 2022 Rock and Fracture Mechanics in Rock Engineering and Mining, 12÷15 September 2022, Helsinki, Finland, www.ril.fi/en/events/eurock-2022.html

IAEG XIV Congress 2022, Chengdu, China September 14-20, 2022, https://iaeg2022.org

28th European Young Geotechnical Engineers Conference and Geogames, 15 – 17 – 19 September 2022, Moscow, Russia, https://www.eygec28.com/?

International Workshop on Advances in Laboratory Testing of Liquefiable Soils, 17 September 2022, Kyrenia, North Cyprus, https://nce2022.ktimo.org

10th International Conference on Physical Modelling in Geotechnics (ICPMG 2022), September 19 to 23, 2022, KAIST, Daejeon, Korea, https://icpmg2022.org

11th International Conference on Stress Wave Theory and Design and Testing Methods for Deep Foundations, 20 - 23 September 2022, De Doelen, Rotterdam, The Netherlands, https://www.kivi.nl/afdelingen/geotechniek/stress-wave-conference-2022

10th Nordic Grouting Symposium, 4 - 6 October, 2022, Stockholm, Sweden, https://www.ngs2022.se/

Smart Geotechnics 2022, 6 October 2022, London UK, https://smartgeotechnics.geplus.co.uk/smartgeotechnics/en/page/home

IX Latin American Rock Mechanics Symposium - Challenges in rock mechanics: towards a sustainable development of infrastructure, an ISRM International Symposium, 16-19 October 2022, Asuncion, Paraguay, http://larms2022.com

5ο Πανελλήνιο Συνέδριο Αντισεισμικής Μηχανικής και Τεχνικής Σεισμολογίας, 20-22 Οκτωβρίου 2022, Αθήνα, https://5psamts.eltam.org

2022 GEOASIA7 - 7th Asian Regional Conference on International Geosynthetics Society, October 31 – November 4, 2022, Taipei, Taiwan, www.geoasia7.org

CouFrac 2022 - 3rd International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application, November 14-16, 2022, Berkeley, California, USA, https://coufrac2022.org

Piling & Ground Improvement Conference 2022, November 16-18, 2022, Sydney, Australia, https://events.americantradeshow.com/pilingconference2022

AUSROCK Conference 2022, 6th Australasian Ground Control in Mining Conference –an ISRM Regional Symposium, 29 November – 1 December 2022, Melbourne, Australia, www.ausimm.com/conferences-and-events/ausrock/

16th ICGE 2022 – 16th International Conference on eotechnical Engineering, Lahore, Pakistan, 8-9 December, 2022, https://16icge.uet.edu.pk/

4th African Regional Conference on Geosynthetics – Geosynthetics in Sustainable Infrastructures and Mega Projects, 20-23 February 2023, Cairo, Egypt, www.geoafrica2023.org

ASIA 2023, 14 - 16 March 2023, Kuala Lumpur, Malaysia, www.hydropower-dams.com/asia-2023

88th ICOLD Annual Meeting & Symposium on Sustainable Development of Dams and River Basins, April 2023, New Delhi, India, https://www.icold2020.org

UNSAT 2023 - 8th International Conference on Unsaturated Soils, 2-5 May 2023, Milos island, Greece, www.unsat2023.org

World Tunnel Congress 2023 Expanding Underground Knowledge & Passion to Make a Positive Impact on the World, 12 - 18 May 2023, Athens, Greece, https://wtc2023.gr

NROCK2022 - The IV Nordic Symposium on Rock Mechanics and Rock Engineering, 24 – 25 May 2023, Reykjavic, Iceland, www.nrock2023.com

3rd JTC1 Workshop on "Impact of global changes on landslide risk",7 – 10 June 2023, Oslo, Norway, https://jtc1-2023.com

9th International Congress on Environmental Geotechnics Highlighting the role of Environmental Geotechnics in Addressing Global Grand Challenges, 25-28 June 2023, Chania, Crete island, Greece, www.iceg2022.org

17ARC 17th Asian Regional Geotechnical Engineering Conference, 14-18 August 2023, Nur-Sultan, Kazakhstan, https://17arc.org

IS-PORTO 2023 8th International Symposium on Deformation Characteristics of Geomaterials, 3rd - 6th September 2023, Porto, Portugal, www.fe.up.pt/is-porto2023

Innovative Geotechnologies for Energy Transition, 12-14 September 2023, London, UK, www.osig2023.com

SAHC 2023 13th International Conference on Structural Analysis of Historical Constructions "Heritage conservation across boundaries", 12-15 September 2023, Kyoto, Japan, https://sahc2023.org/

XII ICG - 12th International Conference on Geosynthetics, September 17 – 21, 2023, Rome, Italy, www.12icg-roma.org

2023 15th ISRM Congress, International Congress in Rock Mechanics Challenges in Rock Mechanics and Rock Engineering, 9÷14 October 2023, Salzburg, Austria, https://www.isrm2023.info/en/

6th World Landslide Forum "Landslides Science for sustainable development", 14 to 17 November 2023, Florence, Italy, https://wlf6.org

World Tunnel Congress 2024

Shenzhen, China

China is the official host of the ITA-AITES World Tunnel Congress 2024 and 50th General Assembly.

The General Assembly which took place on June 30th by video-conference, has confirmed the candidacy of Shenzhen to organise the WTC 2024.

XVIII European Conference on Soil Mechanics and Geotechnical Engineering

25-30 August 2024, Lisbon, Portugal

Organiser: SPG
Contact person: SPG
Address: Av. BRASIL, 101
Email: spg@lnec.pt
Website: http://www.spgeotecnia.pt

ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

Malvik: an interesting landslide on the E6 highway in Norway

On Wednesday 4 May 2022 an interesting landslide occurred on the E6 highway near to Malvik in Norway. The site of the landslide appears to be 63.403, 10.804. The best image that I have found of the landslide has been posted on the nettavisen.no site:-

The aftermath of the landslide at Malvik in Norway on 4 May 2022.

One person was caught up in the landslide. Fortunately he was recovered from the landslide in a conscious condition. An image from tv2 shows the impact of the landslide on the road:-

The aftermath of the 4 May 2022 landslide at Malvik in Norway.

As per the comments below, there is also a Google Streetview of the site: https://goo.gl/maps/x1TmWHaaTZj6Msi98

It is probably very fortunate that there were not more casualties from this serious incident, given that it occurred at about 1 pm local time.

It is clear from the images that the landslide occurred at a site of ongoing groundworks, and indeed the injured individual worked for a subcontractor at the site. Note the backhoe located immediately below the back scarp of the landslide, heavily tilted, suggesting a rotational failure that has transitioned into an earthflow.

In the aftermath of the landslide 100 local residents were evacuated from areas around the site, but they have now been allowed to return home. The E6 road is now closed.

The online newspaper nrk.no reports that this stretch of road has ongoing works for the construction of a new motorway. The most recent Google Earth image of the site, from September 2018, shows that the site was forested.

(Dave Petley / THE LANDSLIDE BLOG, 5 May 2022, https://blogs.agu.org/landslideblog/2022/05/05/malvik-1)

☙ ❧

Images of the deadly landslides in Recife, Brazil

Over the last few days heavy rainfall has triggered another wave of deadly landslides in urban areas in Brazil, this time in the Recife area. As of this morning reports indicate that 93 people have died in the rains, with 26 more missing.

One of the worst events occurred in the Jardim Monte Verde neighbourhood, in the southwest part of the metropolitan area of Recife. Here, a large landslide inundated a number of houses at the foot of the slope:-

The landslide in the Jardim Monte Verde area of Recife, which killed at least 20 people.

This appears to be a landslide in heavy weathered and denuded residual soil, probably with some element of static liquefaction, judging by the debris and the runout. At least 20 people were killed at this site, including eleven members of a single family.

There were also landslides in Camaragibe city. UOL News has this image of another large failure in residual soil, with a possible smaller failure further around the slope:-

A landslide in Camaragibe city to the west of the city of Recife in Brazil.

Reports indicate that at least six people have been killed in landslides in Camaragibe.

Globo has a before and after image of a landslide in the Cohab neighbourhood of Recife:-

Before and after images of a landslide in the Cohab neighbourhood of Recife, Brazil.

Once again the deadly cost of urban landslides in Brazil is evident. The country has suffered multiple events of this type over the years, and more will occur in the future. A paper published a few years ago (Bandeiro and Coutinho 2015) recorded 214 landslide fatalities in the Recife area between 1984 and 2012, and noted that *"… the management activities in risk areas in Brazil need to be upgraded (structural and non-structural actions). Many people are living in a risk situation on hillsides and it is impossible to eliminate this risk in the short term."*

Reference

Bandeiro, A.P.N. and Coutinho, R.Q. 2015. Critical Rainfall Parameters: Proposed Landslide Warning System for the Metropolitan Region of Recife, PE, Brazil. *Soils and Rocks*, **38** [1], 27-48.

(Dave Petley / THE LANDSLIDE BLOG, 31 May 2022, https://blogs.agu.org/landslideblog/2022/05/31/recife-1)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΣΕΙΣΜΟΙ & ΑΝΤΙΣΕΙΣΜΙΚΗ ΜΗΧΑΝΙΚΗ

Model unlocks real-time estimation of large earthquakes and provides earlier warning of tsunamis

Recently discovered speed-of-light prompt elastogravity signals (PEGS) have raised hopes for rapid and reliable estimation of large earthquake magnitude (above M8) to help mitigate the risks associated with strong shaking and tsunamis.

- PEGS allowed the creation of a new model that could deliver more reliable size estimates of large-magnitude earthquakes. This is crucial, particularly for predicting tsunamis, which often take an extra 10 or 15 minutes to arrive.

While PEGS have not been tested for operational early warning, researchers show they can be used in real-time to track earthquake growth instantaneously after the event reaches a certain magnitude.

"We develop a deep learning model that leverages the information carried by PEGS recorded by regional broadband seismometers in Japan before the arrival of seismic waves," study authors, led by Andrea Licciardi, said.[1]

"After training on a database of synthetic waveforms augmented with empirical noise, we show that the algorithm can instantaneously track an earthquake source time function on real data.

"Our model unlocks 'true real-time' access to the rupture evolution of large earthquakes using a portion of seismograms that is routinely treated as noise, and can be immediately transformative for tsunami early warning."

Researchers used hundreds of thousands of simulated earthquakes before testing the model on the real data set from 2011 M9.0-9.1 Tohoku earthquake.[2]

The model accurately predicted the earthquake's magnitude in about 50 seconds—faster than other state-of-the-art early warning systems.

"The gravity signals are too weak to be used for detecting earthquakes smaller than magnitude 8.3 with current technology, and the system is unlikely to provide much extra advance warning in earthquake zones that are already blanketed in seismometers," says Richard Allen, a seismologist at the University of California, Berkeley.

However, they could deliver more reliable size estimates of large-magnitude earthquakes, which is crucial, particularly for predicting tsunamis, which often take an extra 10 or 15 minutes to arrive, Allen says.

"With this technique, seismologists in Japan could have accurately determined Tohoku's magnitude and issued proper alerts 1 or 2 minutes after the beginning of the earthquake," said Jean-Paul Ampuero, a seismologist at Côte d'Azur University and co-author of the paper.

"In 2011, it took hours. It would have been fantastic."

References:

[1] Instantaneous tracking of earthquake growth with elastogravity signals – Andrea Licciardi et al. – Nature – May 11, 2022 – DOI https://doi.org/10.1038/s41586-022-04672-7 – OPEN ACCESS

[2] Gravity signals could detect earthquakes at the speed of light – Science – May 11, 2022

(THE WATCHERS, Sunday, May 15, 2022, https://watchers.news/2022/05/15/new-model-unlocks-true-real-time-access-to-the-rupture-evolution-of-large-earthquakes)

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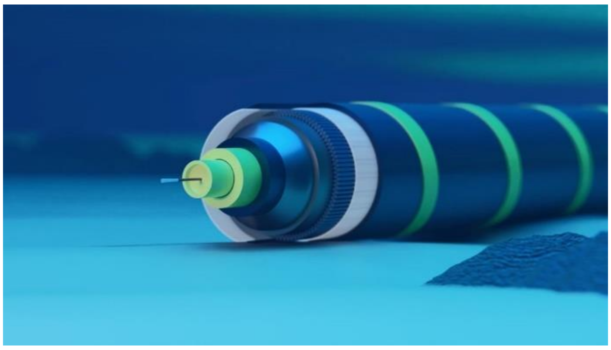
Subsea cables turned into sensor arrays

Scientists at the National Physical Laboratory (NPL) have successfully demonstrated a new technique that transforms undersea power and telecom cables into arrays of environmental sensors.



According to the team, the technique could allow scientists to acquire continuous, real-time environmental data from the bottom of seas and oceans for the first time. The results are published in *Science*.

In a statement, Giuseppe Marra, principal research scientist, NPL said: "This new technique opens a new era for Earth monitoring by providing for the first time a feasible solution to the lack of environmental data from the bottom of seas and oceans. We can now harness existing underwater cables as a valuable tool for Earth sciences and beyond. This breakthrough is a perfect example of how ultra-stable optical frequency metrology can transition from the laboratory to improve our understanding of the world and also deliver tangible benefits to society."

Installing and maintaining permanent ocean-floor sensors is challenging and expensive, so only a handful exist globally. This has left a gap in geophysical data, limiting scientists' understanding of the Earth's structure and its dynamic behaviour.

Previous work by NPL and its partners in 2018 showed that submarine cables could be repurposed as sensors to detect underwater earthquakes by using ultra-stable interferometric techniques. However, one cable could act only as a single sensor, and measurements were limited only to the integrated changes over the entire length of the cable.

Davide Calonico, researcher, INRiM, said: "Our seminal work in 2018 turned coherent laser interferometry from a laboratory technique to a powerful tool for geophysical sensing, and today a new step forward confirms it can be extended to thousands of kilometres, reaching even the most remote areas of our planet."

The NPL-led team, which included researchers from Edinburgh University, the British Geological Survey, the Istituto Nazionale di Ricerca Metrologica (INRiM), and Google, tested the technique on a 5,860km-long intercontinental submarine optical fibre link between the UK and Canada.

The team showed the detection of earthquakes and ocean signals, such as waves and currents, on individual spans between repeaters spread across the entire transatlantic connection. The optical fibre in each span acted as a sensor.

In this research up to 12 sensors were implemented along the cable. Future upgrades will increase this number to 129 and the data from these sensors can be recorded continuously and in real time.

By applying this new method to the existing network of submarine cables, huge areas of the ocean floor can poten-tially be instrumented with thousands of permanent real-time environmental sensors, transforming underwater telecoms infrastructure into an array of geophysical sensors.

Integrating this cable-based approach with current seismometer-based networks means the method has the potential to substantially expand the global earthquake monitoring infrastructure from land to the seafloor where only a handful of permanent seismometers are currently installed. The method does not require any change to the underwater infrastructure, providing for the first time an affordable and scalable solution for sea floor monitoring on a global scale.

Due to optical fibre cable's sensitivity to environmental perturbations, this research also opens up the possibility of monitoring for other natural phenomena, such as improving the understanding of deep-water flows.

Research results provide evidence that the method could potentially be used for detecting tsunamis. Enabling the real-time detection of tsunami-inducing earthquakes closer to their off-shore epicentre could save lives by giving national governments crucial extra time to warn of an impending incident.

The research team now plans to test the method on multiple submarine cables, including those in more seismically active areas such as the Pacific Ocean.

(THE ENGINEER, 23 May 2022, https://www.theengineer.co.uk/content/news/subsea-cables-turned-into-sensor-arrays)

Optical interferometry–based array of seafloor environmental sensors using a transoceanic submarine cable

G. Marra, D. M. Fairweather, V. Kamalov, P. Gaynor, M. Cantono, S. Mulholland, B. Baptie, J. C. Castellanos, G. Vagenas, J.-O. Gaudron, J. Kronjäger, I. R. Hill, M. Schioppo, I. Barbeito Edreira, K. A. Burrows, C. Clivati, D. Calonico, and A. Curtis

Underwater optical cables can be used to monitor seismic disturbances and ocean currents, but the signal tends to be integrated over the entire length of the cable, which can be thousands of kilometers long. Marra *et al*. were able to isolate individual segments of a 5800-kilometer-long cable for seafloor monitoring. Because undersea cables have repeaters every 90 kilometers, these segments could each be used as vibrational sensors when coupled with a laser source. This approach allowed the authors to better constrain the location of an earthquake through triangulation, thus offering a method for much better spatial resolution for undersea monitoring. —BG

Abstract

Optical fiber–based sensing technology can drastically improve Earth observations by enabling the use of existing submarine communication cables as seafloor sensors. Previous interferometric and polarization-based techniques demonstrated environmental sensing over cable lengths up to 10,500 kilometers. However, measurements were limited to the integrated changes over the entire length of the cable. We demonstrate the detection of earthquakes and ocean signals on individual spans between repeaters of a 5860-kilometer-long transatlantic cable rather than the whole cable. By applying this technique to the existing undersea communication cables, which have a repeater-to-repeater span length of 45 to 90 kilometers, the largely unmonitored ocean floor could be instrumented with thousands of permanent real-time environmental sensors without changes to the underwater infrastructure.

SCIENCE, 19 May 2022, Vol 376,Issue 6595, pp.874-879, DOI: 10.1126/science.abo1939, https://www.science.org/doi/10.1126/science.abo1939

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΓΕΩΛΟΓΙΑ

Seismic and gravity survey in Thinia Valley of Kefalonia Island

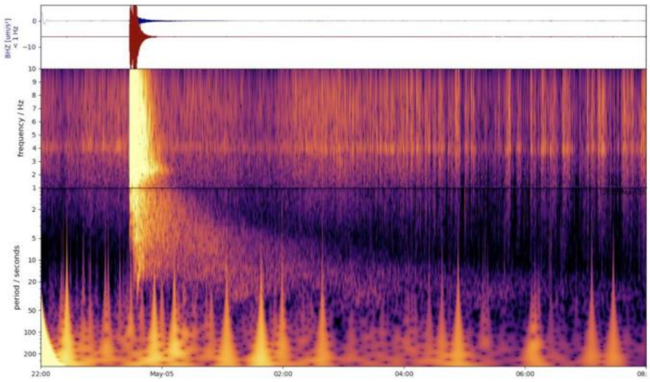
National Technical University of Athens (NTUA), Uppsala University (UU) and Politechnico di Torino (POLITO) with their geophysical research groups have collaborated for a seismic survey (active and passive) and a gravity survey in Thinia Valley of Kefalonia Island in Greece sponsored by the Odysseus Unbound Foundation (OUF). The stratigraphy and the tectonic status of the survey area is to be detected in an island of intense earthquake activity. In more detail, the geophysical models with formations like land slide material, marine sediments and the limestones underneath can provide useful information of the geological history and the tectonic regime. Hundreds of wireless geophones that came from Uppsala used for active seismics along with the NTUA seismic source for 3 profiles of about 1000m and for well-designed passive acquisition setup. Academics, postdocs and PhD students in one spirit of excellent collaboration and exchange of knowledge acquired data and are willing for the best results after the appropriate processing and interpretation. The atmosphere in the field and the great effort in a beautiful island is to be remembered….

https://www.linkedin.com/feed/update/urn:li:activity:6933884455489044480/

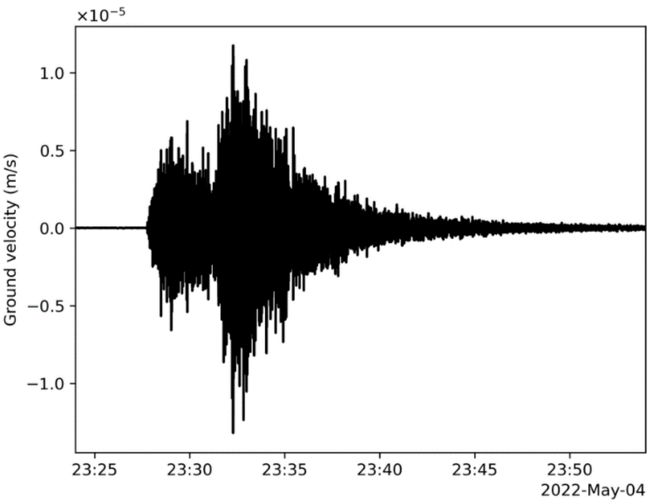
ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ

NASA’s InSight Records Monster Quake on Mars

Estimated to be magnitude 5, the quake is the biggest ever detected on another planet.



This spectrogram shows the largest quake ever detected on another planet. Estimated at magnitude 5, this quake was discovered by NASA’s InSight lander on May 4, 2022, the 1,222nd Martian day, or sol, of the mission. Credit: NASA/JPL-Caltech/ETH Zurich Full Image Details



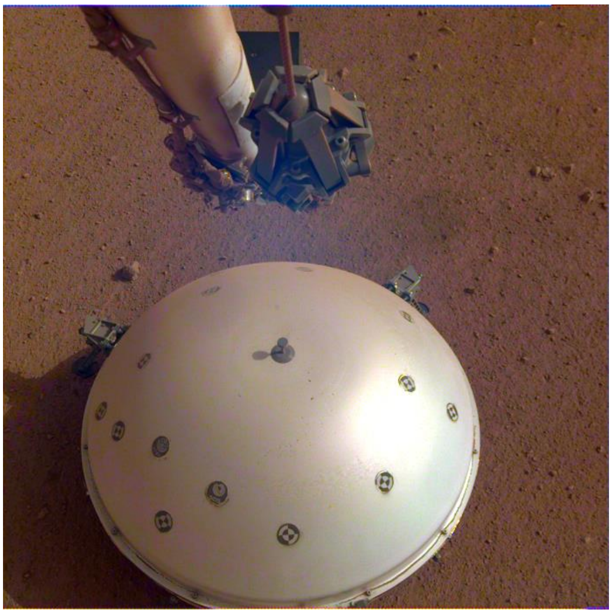
InSight's Seismogram of Big Martian Quake

This seismogram shows the largest quake ever detected on another planet. Estimated at magnitude 5, this quake was discovered by NASA's InSight lander on May 4, 2022. Credit: NASA/JPL-Caltech

NASA’s InSight Mars lander has detected the largest quake ever observed on another planet: an estimated magnitude 5 temblor that occurred on May 4, 2022, the 1,222nd Martian day, or sol, of the mission. This adds to the catalog of more than 1,313 quakes InSight has detected since landing on Mars in November 2018. The largest previously recorded quake was an estimated magnitude 4.2 detected Aug. 25, 2021.

InSight was sent to Mars with a highly sensitive seismometer, provided by France’s Centre National d’Études Spatiales (CNES), to study the deep interior of the planet. As seismic waves pass through or reflect off material in Mars’ crust, mantle, and core, they change in ways that seismologists can study to determine the depth and composition of these layers. What scientists learn about the structure of Mars can help them better understand the formation of all rocky worlds, including Earth and its Moon.

A magnitude 5 quake is a medium-size quake compared to those felt on Earth, but it’s close to the upper limit of what scientists hoped to see on Mars during InSight’s mission. The science team will need to study this new quake further before being able to provide details such as its location, the nature of its source, and what it might tell us about the interior of Mars.



This image shows InSight’s domed Wind and Thermal Shield, which covers its seismometer, called Seismic Experiment for Interior Structure, or SEIS.

“Since we set our seismometer down in December 2018, we’ve been waiting for ‘the big one,’” said Bruce Banerdt, InSight’s principal investigator at NASA’s Jet Propulsion Laboratory in Southern California, which leads the mission. “This quake is sure to provide a view into the planet like no other. Scientists will be analyzing this data to learn new things about Mars for years to come.”

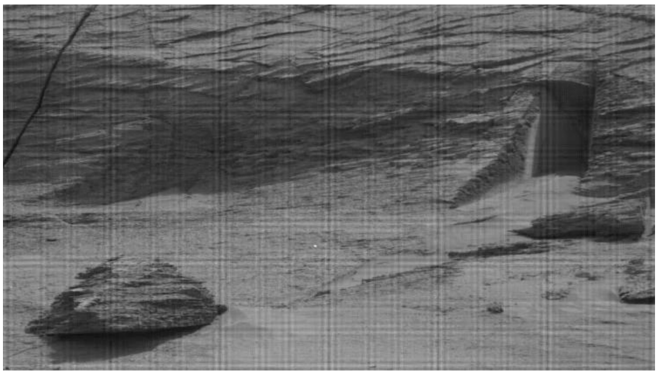
The large quake comes as InSight is facing new challenges with its solar panels, which power the mission. As InSight’s location on Mars enters winter, there’s more dust in the air, reducing available sunlight. On May 7, 2022, the lander’s available energy fell just below the limit that triggers safe mode, where the spacecraft suspends all but the most essential functions. This reaction is designed to protect the lander and may occur again as available power slowly decreases.

After the lander completed its prime mission at the end of 2020, meeting its original science goals, NASA extended the mission through December 2022.

(NASA / Jet Propulsion Laboratory, California Institute of Technology, May 9, 2022, https://www.jpl.nasa.gov/news/nasas-insight-records-monster-quake-on-mars)

NASA's Curiosity Rover Spotted a 'Doorway' on Mars

Though it looks like the entrance to an alien tomb, mission scientists say it's a natural feature.



The Curiosity rover took a photo of the odd structure on May 7, 2022, as it climbed Mount Sharp on Mars.

NASA's Curiosity rover took a photo of a Lovecraftian feature on the surface of Mars last week: a seemingly rectangular and shadowy opening in the planet's exposed rock that looks as if it leads into the Martian underground.

The image was captured on May 7 by the Curiosity rover's Mastcam while it ascended Mount Sharp. While the grainy black-and-white image may have conspiracy theorists over the moon, it almost definitely doesn't show the entrance to an underground alien society.

"It's just the space between two fractures in a rock," Ashwin Vasavada told Gizmodo in a phone call today. Vasavada is a project scientist in the Mars Science Laboratory, and he said the formation is definitely not the entrance to a video game's dungeon level. "We've been traversing through an area that has formed from ancient sand dunes," he said. These sand dunes were cemented together over time, creating the sand-stone outcrops Curiosity is passing by.

Vasavada told us that the fracture is only about a foot tall and that, once these sand dunes were compacted together, they were buried and unburied over time as the sand on Mars' surface shifted. During this process, the sandstone was under varying pressure, causing it to buckle and fracture in different places. "The fractures we see in this area are generally vertical," he explained. This particular doorway-shaped fracture likely formed in one of two ways.

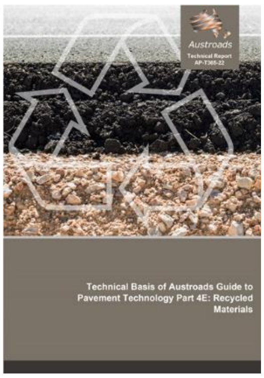
"I think what we have here [is] either two vertical fractures, where the middle piece has been removed, or one vertical fracture, and the blocks have moved apart a little bit," Vasavada said.

The Curiosity rover has been trawling around Mars since it landed in August 2012 in Gale Crater. The rover has since covered 17.3 miles (27.84 kilometers) in 3,472 Martian days, or 'sols'. When Curiosity isn't collecting rock and soil samples, it's taking photos using its panoramic Mastcam (mast + camera).

This photo from Curiosity is another example of our tendency to see familiar forms in an unfamiliar landscape. In the past, people have thought they've seen all kinds of out-of-place things on Mars, including a squirrel and spoon.

(Kevin Hurler / GIZMODO, 5/13/22, https://gizmodo.com/nasa-mars-curiosity-rover-doorway-1848922393?utm_source=Nature+Briefing&utm)

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ



Literature review assessed current research on incorporation of recycled materials in pavements

Austroads has released a review of Australian and New Zealand research on the incorporation of recycled materials in pavements to inform the update to the *Guide to Pavement Technology Part 4E: Recycled Materials*.

Materials science, technology, and research have substantially progressed in recent years increasing the range of recyclable materials and their use across a wider array of applications. "As recycled materials are continually evolving, it is paramount that they are rigorously scrutinised before we use them in our public infrastructure," said Ross Guppy, Austroads Transport Infrastructure Program Manager.

Focusing on performance impacts, potential environmental health and safety risks, economics and societal impacts, the literature review assessed the currently available research, specifications, and standards for reclaimed asphalt pavements, industrial slag, recycled crushed glass, construction and demolition waste concrete and masonry, coal combustion products, plastics, and crumb rubber used in pavement construction.

The analysis highlighted that incorporating recycled materials in road pavements can be more economically and environmentally friendly than virgin materials while providing equal or better performance.

"Our review also showed that in Australia and New Zealand specifications do not exist for most recyclable materials, which significantly constraints their uptake by road and transport authorities," said Ross.

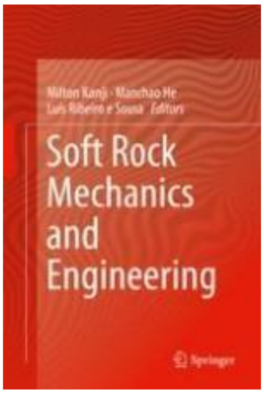
To ensure the performance and longevity of recycled materials are maximised, a needs assessment protocol is to be developed alongside a recycled material specification for pavements.

The findings of the review will be used to update Australian and New Zealand guidelines and to provide transport agencies and industry with independent advice to make more informed decisions about the incorporation of recyclable materials into pavements.

"The research presented in the report will be reflected in the *Guide to Pavement Technology* for a better understanding of suitable applications, restraints, and impacts of recycled materials on infrastructure, sustainability, and society," said Ross. "Enabling enhanced material recovery and providing higher quality assets will play a significant role in driving the uptake of recyclables."

Download the report

https://austroads.com.au/latest-news/literature-review-assessed-current-research-on-incorporation-of-recycled-materials-in-pavements



Soft Rock Mechanics and Engineering

Editors: Prof. Dr. Milton Kanji, Manchao He, Prof. Dr. Luís Ribeiro e Sousa

This book offers a practical reference guide to soft rock mechanics for engineers and scientists. Written by recognized experts, it will benefit professionals, contractors, academics, researchers and students working on rock engineering projects in the fields of civil engineering, mining and construction engineering.

Soft Rock Mechanics and Engineering covers a specific subject of great relevance in Rock Mechanics – and one that is directly connected to the design of geotechnical structures under difficult ground conditions. The book addresses practical issues related to the geomechanical properties of these types of rock masses and their characterization, while also discussing advances regarding in situ investigation, safety, and monitoring of geotechnical structures in soft rocks. Lastly, it presents important case histories involving tunnelling, dam foundations, coal and open pit mines and landslides.

Chapter 1. Introduction
Chapter 2. Engineering View of Soft Rocks
Chapter 3. The Geology of Soft Rocks
Chapter 4. Mudrocks as Soft Rocks: Properties and Characteristics
Chapter 5. Sandstones in Dam Foundations and Tunnels
Chapter 6. Geomechanical Characterization of Evaporitic Rocks
Chapter 7. Site Investigation for Soft Rock Mass
Chapter 8. Evaluation of Geomechanical Properties of Soft Rock Masses by Laboratory and In Situ Testing
Chapter 9. Interaction Between Water and Soft Rocks
Chapter 10. Weathering of Rocks in Brazil
Chapter 11. Weathering, Erosion, and Susceptibility to Weathering
Chapter 12. Degradation Processes in Civil Engineering Slopes in Soft Rocks
Chapter 13. Mining Slopes in Weathered and Weak Rocks
Chapter 14. Correlation of Soft Rock Properties
Chapter 15. Deformation Mechanism of Soft Rock
Chapter 16. Soft Rock Roadway Reinforcement
Chapter 17. Large Deformation Support for Engineering Soft Rocks
Chapter 18. Rock Mass Classification of Chalk Marl in the UK Channel Tunnels Using Q

Chapter 19. Applications of the GSI System to the Classification of Soft Rocks

Chapter 20. Soft Rocks in Underground Hydroelectric Schemes

Chapter 21. Tunnelling in Weak Rock

Chapter 22. Face Stability of Tunnels in Soft Rocks

Chapter 23. Characterization of Soft Rocks in Brazilian Coal Beds

Chapter 24. Soft Rocks in Dam Foundation and Dam Sites

Chapter 25. Soft Rock as a Dam Construction Material

Chapter 26. Correction to: Characterization of Soft Rocks in Brazilian Coal Beds

Συμμετοχή Ελλήνων

Chapter 4. Mudrocks as Soft Rocks: Properties and Characteristics

Abstract

Soft rocks comprise the geological materials with poor mechanical characteristics that span the range between soils and hard rocks. Mudrocks are part of the broader group of soft rocks which correspond to fine-grained, clay-rich detrital sedimentary rocks. As mudrocks constitute more than 60% of all sedimentary rocks and occur frequently in geological sequence, they are often encountered in construction sites either in their natural undisturbed state or as construction materials. Mudrocks can show a range of engineering behaviours as function of their composition and structural features; however, by reputation, they are regarded as poor engineering materials in construction displaying low strength and durability as well as susceptibility to volume changes. This chapter aims to provide a framework of the main geological and engineering geological aspects of mudrocks that control their engineering properties and behaviour. With this concern, the key controls on the formation of mudrocks, the terminology used to classify fine-grained sedimentary rocks and the main geological and geotechnical characteristics of mudrocks, including the relevant laboratory techniques are presented as well as the geological and engineering geological classifications of mudrocks are reviewed. Finally, a set of case studies of mudrocks encountered in commonly occurring civil engineering works are described.

Filipe Telmo Jeremias, Juan Montero Olarte, António B. Pinho, Isabel M. R. Duarte, **Haris Saroglou**, Mario Camilo Torres Suárez

Chapter 19. Applications of the GSI System to the Classification of Soft Rocks

Abstract

The chapter deals with the geotechnical classification of weak and complex rock masses. The term "weak rock mass" instead of "soft rock" is generally used in this chapter to highlight better the nature of the examined geomaterial. The weak rock masses that are examined in this study are generated by tectonical compression or weathering either the parent rock is initially soft or not. Cases, where the decreasing of the quality is expressed on the rock mass scale and not necessarily on the primary low intact rock strength is thus presented.

Use of the GSI rock mass classification system and the associated m, s and a parameter relationships linking GSI with the Hoek–Brown failure criterion provides a proven, effective and reliable approach for prediction of rock mass strength for surface and underground excavation design and for rock support selection. The need for geological definition of rock mass properties required as inputs into numerical analysis, allowing for characterisation of even the most problematic of weak and complex rock masses. Back-analyses of tunnels, slopes and foundation behaviour using the approach attest to its reliability. New or revised GSI charts for weak and complex rock masses are presented in this chapter. Specific key engineering geological characteristics that differentiate various igneous, metamorphic and sedimentary rock units one from each other and generates weak (soft) forms are presented.

Marinos Vassilis

Chapter 21. Tunnelling in Weak Rock

Abstract

The methodology and design procedures for tunnelling within weak rock are nontrivial in nature. Prior to determining the proper tunnelling technique and ground/rock support method, a tunnel design engineer must utilize the data obtained from the site investigation, rock classification and characterization. This chapter summarizes key components associated with weak rock tunnelling. It also includes practical design considerations associated with a Case Study of the Driskos Twin Tunnel as part of the Egnatia Odos Motorway that was constructed in Northern Greece. A section on numerical modelling highlights the challenges and state of the art of such analyses. Finally, a state-of-the-art fiber optic strain sensing technique is included in order to highlight its potential use in future tunnel design, operation and maintenance considerations as warranted by the Observational Method.

Nicholas Vlachopoulos, Bradley Forbes, **Ioannis Vazaios**

(Springer International Publishing 2020, https://www.springerprofessional.de/en/soft-rock-mechanics-and-engineering/17426632)

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

GeoWorld

Geo-Trends Review
www.mygeoworld.com/geotrends/issues/19-may-2022

Κυκλοφόρησε το τεύχος αρ. 19 - Μαΐου 2022 του ηλεκτρονικού περιοδικού Geo-Trends Review με τα ακόλουθα περιεχόμενα:

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Bulletin Vol. 16, Issue 2 - April 2022 circulated

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Cristiana Ferreira resource, 29 Apr 2022

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Hamzah M. B. Al-Hashemi resource, 06 Mar 2022

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Lucy Wu YMPG, 16 Apr 2022

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Seequent, The Bentley Subsurface Company PLAXIS, 06 May 2022

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Geoengineer.org news, 08 Apr 2022

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Bentley Systems PLAXIS, 19 May 2022

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IGS NEWSLETTER – May 2022

Helping the world understand the appropriate value and use of geosynthetics

httpwww.geosyntheticssociety.org/newsletters

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  - Panel Discussion: Geosynthetics for Sustainable Development, May 17 REGISTRATION INFORMATION
  - Geosynthetic-Reinforced Soil Structures: Developments from Walls to Bridges, May 24 REGISTRATION INFORMATION
  - GRI-GM13 Update, May 11 - repeat event REGISTRATION INFORMATION
- Calendar of Events

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