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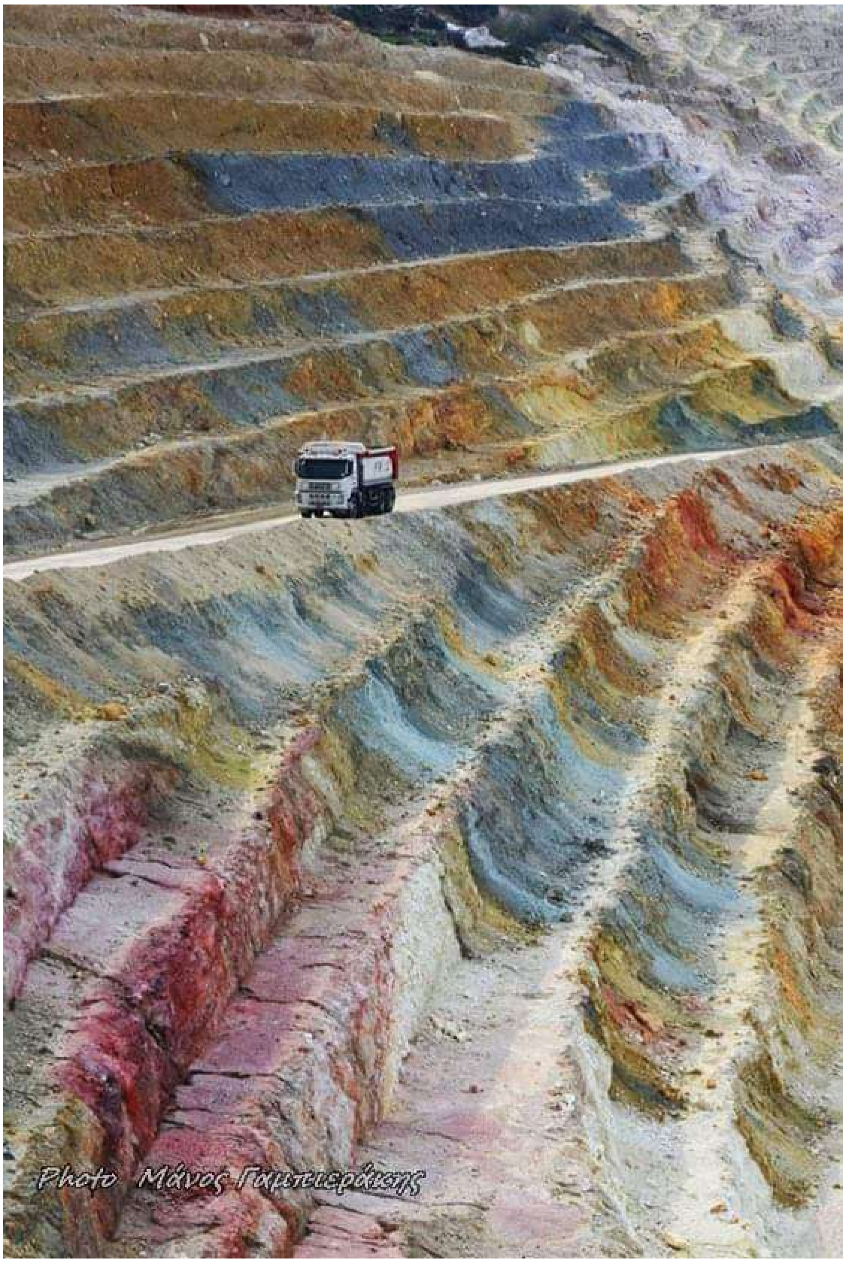
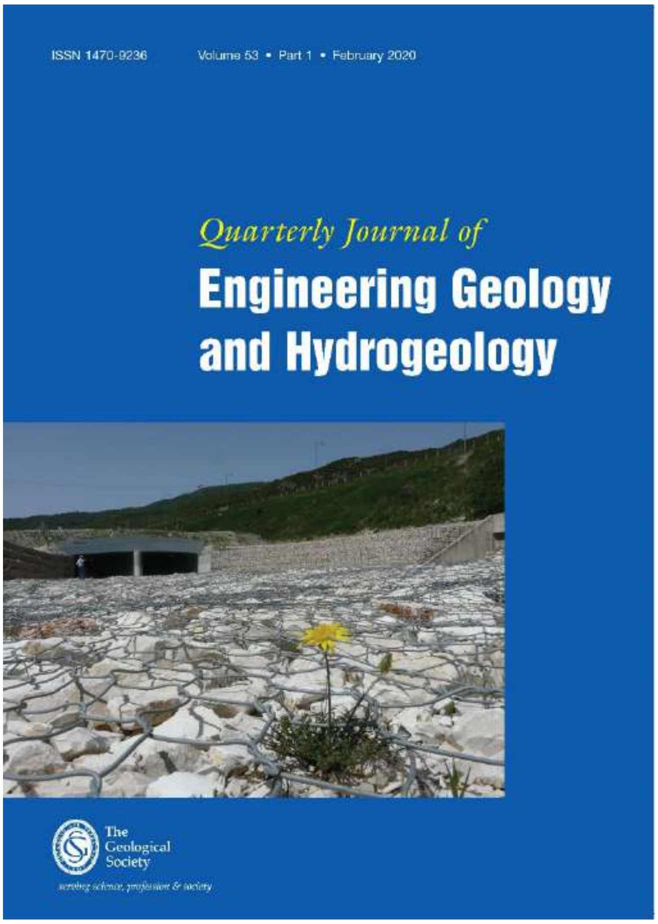


Ορυχείο στην Μήλο

Π Ε Ρ Ι Ε Χ Ο Μ Ε Ν Α

Χωρίς λόγια

Ένα έργο από την Ελλάδα στο εξώφυλλο του Quarterly Journal of Engineering Geology and Hydrogeology



Το γνωστό περιοδικό τεχνικής γεωλογίας και υδρογεωλογίας Quarterly Journal of Engineering Geology and Hydrogeology (QJEGH) θα έχει για το 2020 (τόμος 53 του περιοδικού) στο εξώφυλλο του μία φωτογραφική άποψη από ένα έργο στην Ελλάδα: το τεχνικό κάλυψης του ποταμού Μετσοβίτικου στο Τμήμα 2.4 της Εγνατίας Οδού μεταξύ Μετσόβου και Ιωαννίνων κοντά στον οικισμό Πρινότοπα. Το τεχνικό αυτό κατασκευάστηκε για την υλοποίηση αντιβάρου σταθεροποίησης δύο πολύ μεγάλων κατολισθήσεων ευρισκόμενων εκατέρωθεν της κοίτης του ποταμού. Η φωτογραφία έχει τραβηχτεί από ανάντη του έργου επί των συρματοκιβωτίων της διευθέτησης της κοίτης και δεξιά διακρίνονται τα πρανή του επιχώματος της Εγνατίας Οδού. Το QJEGH διεξάγει κάθε χρόνο διαγωνισμό για την επιλογή της φωτογραφίας που θα υπάρχει στο εξώφυλλό του την επόμενη χρονιά. Η φωτογραφία τραβήχτηκε από τον πρόεδρο της ΕΕΕΕΓΜ Μιχάλη Μπαρδάνη που συμμετείχε στη μελέτη του συγκεκριμένου έργου.

Γεωτεχνικός μελετητής του έργου ήταν η εταιρεία ΕΔΑΦΟΣ Α.Ε., στατικός μελετητής η εταιρεία ΔΟΜΗ Α.Ε. και υδραυλικός μελετητής η εταιρεία ΥΔΡΑΚΤΙΣ Α.Ε. και το έργο σταθεροποίησης της κατολίσθησης της περιοχής κατασκευάστηκε στην πρώτη του φάση από την εταιρεία ΑΚΤΩΡ και στην τελική (οπότε έγινε και η κατασκευή του τεχνικού κάλυψης του Μετσοβίτικου) από την εταιρεία ΕΝΙΠΕΑΣ. Κύριος του έργου κατά την μελέτη και κατασκευή του ήταν η ΕΓΝΑΤΙΑ ΟΔΟΣ Α.Ε.

Σε άλλο σημείο του ενημερωτικού δελτίου μπορείτε να διαβάσετε ένα άρθρο για το έργο αυτό από το ICONHIC 2016.

ΑΡΘΡΑ

Global shortage of engineering skills could put worker safety at risk

A global shortage of engineering skills could put safety of workers at risk, according to a report commissioned by the Royal Academy of Engineering and Lloyd's Register Foundation.

Prepared by the Economist Intelligence Unit, the *Global Engineering Capability Review* measures the abilities of 99 countries to conduct key engineering activities in a safe and innovative way.

It focuses on six measures of engineering capability around the world: the strength and sophistication of the country's engineering industry, the availability and diversity of its engineering labour force, its knowledge base, built and digital infrastructure and safety standards.

The report – part of Engineering X, an international problem-solving collaboration – finds that the UK is lagging behind in the supply of skilled engineers.

In the global engineering index of 99 countries, the UK features in the top 10 of just two categories — knowledge and safety standards. By contrast, Singapore is in the top 10 in five out of the six categories and comes first under labour force, digital infrastructure and safety standards. The US leads the knowledge rankings, in contrast with its safety ranking.

Top performing countries in the six categories

Knowledge: Malaysia

Malaysia is the world's 23rd highest investor in R&D as a percentage of GDP (1.44%) and 24th in the world for patent applications with 1,116 filed in 2018. It also punches above its weight (at 19th) for the number of universities ranked within the world's top 500 for engineering. This belies a global GDP ranking of 41 and reflects a strong emphasis on engineering in education.

Labour force: Iran

Iran tops the index for the highest percentage of graduates (of both sexes) from tertiary education in the fields of engineering, manufacturing and construction, at 30%.

Engineering Industry: Rwanda

Despite ranking 81st overall in this category, Rwanda is ranked 12th for the percentage of medium and large companies in engineering fields as a percentage of all medium and large companies in the country.

Infrastructure: Panama

Panama ranks 24th in this category but is placed joint 13th for quality of port infrastructure, primarily the Panama Canal, which links the Atlantic and Pacific Oceans – a vital passage for global maritime trade.

Digital infrastructure: Estonia

Despite ranking 37th in national internet speed, Estonia's ranking of 9th for both the number of servers and the Digital Adoption Index lift it to 12th place in the overall category index.

Safety Standards: Singapore

Singapore boasts a highly impressive record in this category, leading the overall rankings and topping the Safety Outcomes indicator.

The review aims to provide a baseline to help policymakers, educators and business executives understand their country's relative engineering strengths and to address capability gaps that are barriers to safe and sustainable development.

It offers two specific recommendations.

Countries should strengthen their data collection on a variety of indicators to support safe and innovative engineering, and focus on quality not quantity of engineers.

Engineering X board chair Peter Goodhew said: "We know that engineering offers an important lever by which countries around the world will be able to achieve sustainable development goals.

"This review is important because engineers and engineering cannot perform this role efficiently, effectively and safely without the appropriate infrastructures being in place, and this requires the shared understanding, cooperation and co-ordinated action of policymakers, educators, business executives and others."

He added that there isn't a "one-size-fits all approach", but that "Engineering X has ambitious goals to help".

Meanwhile, Lloyd's Register Foundation chief executive Professor Richard Clegg highlighted the ability of engineers to "support human livelihood and dignity, the improvement of systems and the avoidance of harm".

However, he also emphasised that this is only possible if countries "understand their own engineering strengths, address their weaknesses and acknowledge where there are new and emerging safety challenges to be overcome".

"Many of these safety challenges cannot be tackled by working alone," he said. "We are partnering with the Academy because they can help us build coalitions with willing partners all around the world."

Recommendations for international organisations, governments, industry and the engineering community

Strengthen the evidence base

Many countries struggle to collect and report accurate data on a variety of indicators that could support safe and innovative engineering.

- National data collection and reporting accuracy should be enhanced by implementing best practice in labour force survey methodology and by the better use of survey technology.

- The misalignment on how to categorise an "engineer" and the skills the role requires could be addressed by developing an engineering skills taxonomy and disaggregating the data on engineers collected through labour force surveys.

Focus on quality, not quantity

Countries often face problems not in producing engineers but in producing high-quality engineers who are adequately trained.

- Opportunities are needed for engineering industry-academia collaboration and for ongoing professional development of both recent engineering graduates and experienced engineers.

- Institutions should develop interdisciplinary engineering curricula and alternative education models focused on project-based learning that provide students with real-world engineering experience.

- Transnational collaboration should be encouraged between Engineering Regulation Boards in order to develop international professional certifications that encourage greater labour mobility of quality engineers.

(Catherine Kennedy / New Civil Engineer, 04 Mar, 2020, https://www.newcivilengineer.com/latest/global-shortage-of-engineering-skills-could-put-worker-safety-at-risk-04-03-2020)

The stabilisation of the landslides in Area B, Section 2.4 of Egnatia Highway in Western Greece

M. Bardanis, S. Cavounidis

ABSTRACT

A major landslide on the path of Egnatia Highway in Greece approximately 650m long, 650m wide with a maximum depth, defined by inclinometer readings, of 52m was identified and stabilized by drainage of the landslide material, stabilizing toe berms and other secondary measures. The dimensions of the landslide summed up to a moving landslide volume of approximately 10 million m^3 with a displacement rate of 2cm/year. This landslide was retrogressive with indications of lateral progression too (as a smaller 300x300x20m landslide lies to the west of the major landslide) and lies opposite to an even larger landslide (approximately 1000x1000x70m) with its toe eroded by the same river. An unfortunate decision to begin river training from much further upstream of the river flowing at the toe of the landslide increased river water velocities which led to remarkable erosion of the river bottom, triggering movement of a smaller portion of the landslide mass slipping along a new, deeper sliding surface at a rate of approximately 1-1.5mm/day. Additional stabilization measures were therefore designed which included construction of an 150m long dual tunnel for river training and construction of an additional berm above the tunnel stabilizing both the newly triggered landslide portion and the major landslide lying at the opposite side of the river. The paper presents the characteristics of the major landslide of the area, the measures designed for its stabilization with the major concerns and the experience gained during construction.

Keywords: landslide, drainage, underdrainage pore-pressure profile, sliding mass movement

INTRODUCTION

Egnatia Highway constitutes the main highway in northern Greece connecting the eastern part of the country to the western one. It is 650km long passing often through very harsh geological environment posing demanding requirements for the works involved. Some of the most adverse geological conditions were encountered in the western part of the highway where it crosses through the Pindos mountain region. In the heart of this region the highway passes through a landslide prone area called Area B of Section 2.4 of the highway. The major landslide of the area (Prinotopa landslide) was approximately 650m long, 650m wide with a maximum depth, defined by inclinometer readings, of 52m. These dimensions summed up to a moving landslide volume of approximately 10 million m^3 with a displacement rate in the range of 2cm/year. This landslide was retrogressive with indications of lateral progression too (as a smaller 300x300x20m landslide lies to the west of the major landslide) and lay opposite to an even larger landslide (approximately 1000x1000x70m) with its toe eroded by the same river. The stabilization measures involved stabilization berms (the highway embankments), vertical large diameter drainage wells draining the downslope part of the landslide to a buried river bed found under the landslide mass, a 600m long drainage tunnel with drainage holes, and stabilizing piles and barrettes at the foundation of the stabilizing berms as secondary measures for the overall factor of safety. An unfortunate decision to begin river training from much further upstream increased river water velocities which led to remarkable erosion of the river, triggering movement of a smaller portion of the landslide mass slipping along a new, deeper sliding surface at a rate of approximately 1-1.5mm/day defined by inclinometer readings and surface markers. Additional stabilization measures were therefore designed which included construction of an 150m long dual tunnel for river training and construction of an additional berm above the tunnel stabilizing both the newly triggered landslide portion and the major landslide lying to the opposite side of the river. The paper presents the characteristics of the major landslide of the area and the smaller portion mobilized later, the measures designed for the stabilization of the landslide phenomena of the area with the major concerns and the experience gained during construction.

BRIEF GEOLOGY OF THE AREA – GEOTECHNICAL PROPERTIES

The wider area is dominated by the Pindos and the Ionian zone Flysch. The main tectonic event was the overthrust of the former formation on the latter leading to an extensive zone of a mélange at their contact. This constitutes of materials tectonically disturbed with an almost chaotic structure. In the area of the landslide these are dominated by the siltstone phase all the way down to the bedrock consisting of the in-situ siltstone phase of the flysch with occasional layers of sandstone and conglomerates. The main factor acting as the trigger for the landslides in the specific and wider area is the erosive action of the Metsovitikos river along with precipitation events; the latter being responsible for smaller and local landslips.

The landslide material constitutes of the upper part of the most weathered siltstone flysch and local boulders of limestone (especially closer to the toe of the landslide) and the lower part consisting of less weathered siltstone. The most weathered siltstone of both parts is found locally in the form of silty clay to clayey silt with properties estimated from laboratory tests and in-situ tests as follows: dry unit weight 18-19 kN/m^3, cohesion 20-30 kPa, angle of shearing resistance (peak) 22-24° and residual angle of shearing resistance from ring shear tests on Bromhead type ring shear apparatus 10-12°. The variability of the material is very large indicated by the large range of index properties values: liquid limit from 25 to 55% with an average of 40%, plasticity index from 10 to 35% with an average of 20% and percentage of fines ranging from 35 to 95% with an average of 65%.

IDENTIFICATION OF THE MAJOR LANDSLIDE AND GEOTECHNICAL INVESTIGATION

Cracks and movements on the ground surface of the landslide area have been visible for decades before the construction of Egnatia Highway indicating that the landslide is a palaeolandslide. National and regional roads suffer from cracks, some of them signaling the landslide's western and eastern boundary. These observations were supported by numerous boreholes carried out at various phases. A total of 70 boreholes with a total length of 2500m were drilled, 23 of them with inclinometers and 31 with piezometers (wellpoints, with Casagrande type tips and during the construction of the works with vibrating wire piezometers at various depths). The major landslide of the area was approximately 650m long and 650m wide. The deepest point of movement recorded by inclinometers was 52m from the ground surface at the southwestern part of the landslide. These dimensions summed up to a moving landslide volume of approximately 10 million m^3 with a displacement rate in the range of 2cm/year. Inclinometer readings indicated that the landslide did not have a continuously concave sliding surface plus movements at various depths. This was the main indication of its retrogressive nature. Two parts were identified, the downslope one and the upslope one with their estimated limits shown in plan view in Fig. 1 and the corresponding sliding surfaces in the western part of the landslide shown in Fig. 2. This landslide had also indications of lateral progression too (as a smaller 300x300x20m landslide lies to the west of the major landslide) and lay opposite to an even larger landslide (approximately 1000x1000x70m) with its toe eroded by the same river. An unfortunate decision to begin river training from much further upstream increased river water velocities which led to remarkable erosion of the river triggering movement of a smaller portion of the landslide mass slipping along a new, deeper sliding surface at a rate of approximately 1-1.5mm/day (inclinometers installed there previously did not indicate movements at the depths they appeared after the river erosion). This landslide was 180m long and 140m wide.

The deepest point of movement recorded by inclinometers was 31m from the ground surface. These dimensions summed up to a moving landslide volume of approximately 400 10^3 m^3. A plan view of the major landslide including the smaller portion mobilised is shown in Fig. 1. A section of the western part of the major landslide is shown in Fig. 2.

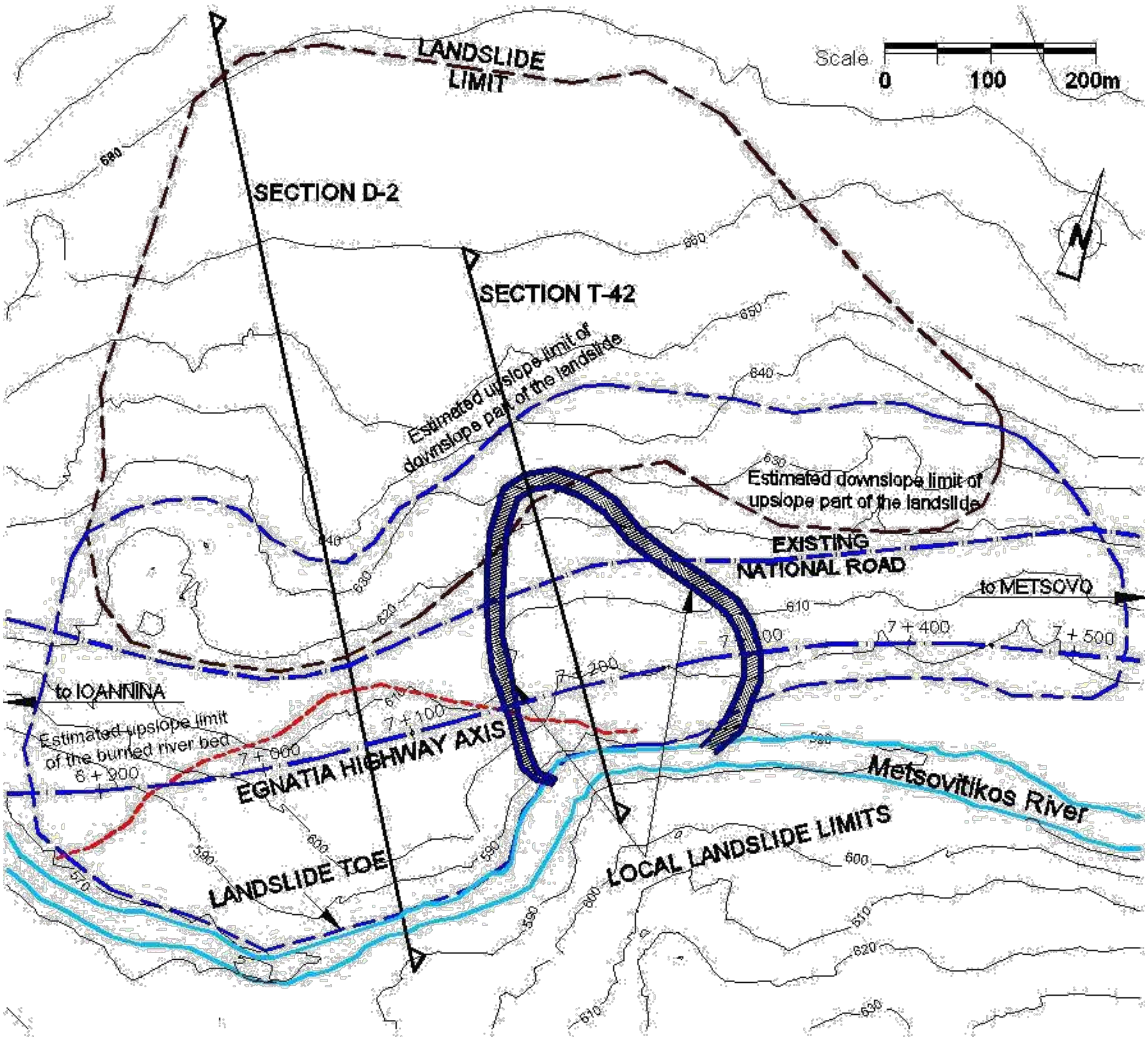


Figure 1. Plan view of the landslides in Area B, Section 2.4, of Egnatia Highway in north-western Greece. The boundaries of the major landslide are shown with the boundaries of the new sliding mass mobilized at a later phase of the construction.

SLOPE STABILITY ANALYSIS AND STABILISATION MEASURES

Pore pressure regime in the landslide mass and its modeling

The south-western part of the landslide seems to have been the first to move, in fact so far that it covered the river bed at the toe of the landslide. Boreholes drilled in that area revealed the presence of an old river bed buried under the landslide mass with thickness similar to the present one of the same river in other locations not affected by landslides. Also, monitoring the water level in these boreholes revealed the presence of a pore water pressure profile initially (close to the ground surface) following the hydrostatic distribution of pore water pressure very closely, and then dropping rapidly to an elevation practically that of the present river level once the buried river bed materials were reached. This type of pore pressure profile is known as an underdrainage pore-pressure profile. Fig. 3 shows a part of the detailed plan view along with a section along the deepest level line of the present river interrupted by the estimated path of the river before the original river bed was covered by the landslide (part AB).

Modeling this pore pressure regime of the south-western part of the landslide was considered critical in order to exploit the presence of the buried river bed as a formation where the landslide materials of that part of the landslide could be drained by large diameter vertical wells drilled from the ground surface all the way down to the buried river bed (on average at 40-45m depth). A large diameter of 1m was selected (rather than smaller boreholes or wells of smaller diameter) to ensure that possible movement of the landslide would not destroy all the boreholes or wells constructed. In order to model the effect of the drainage wells, the initial pore pressure profile had to be modeled first as accurately as possible. This would later support detailed design of the drainage wells and it was also introduced in slope stability back analyses performed for that part of the landslide.

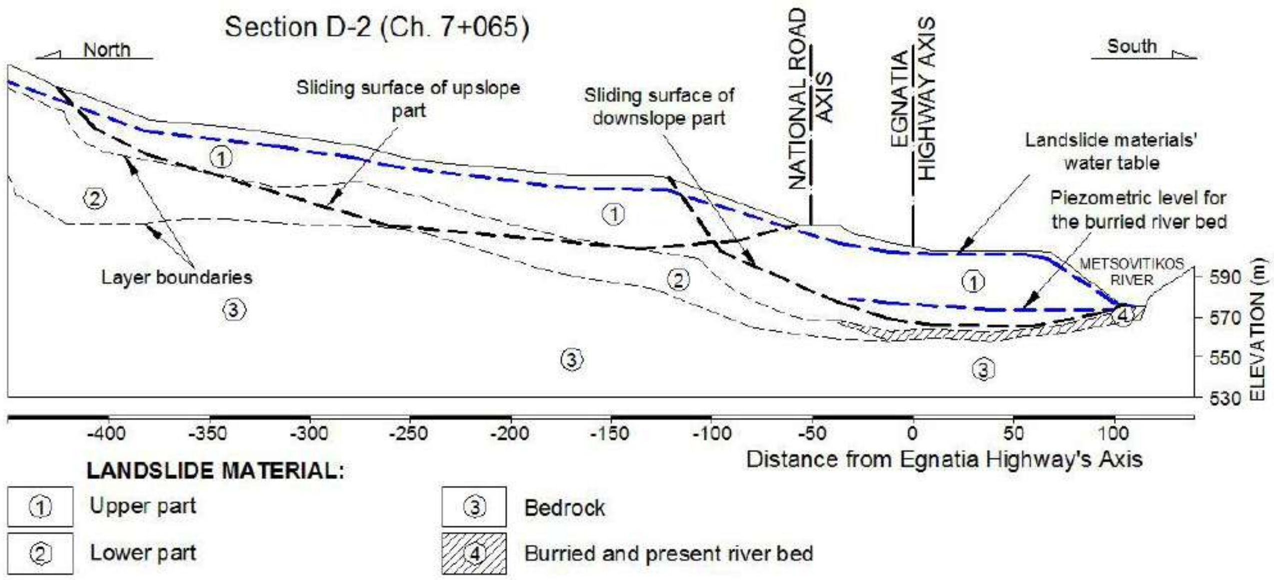


Figure 2. Section D-2 from the plan view in Fig. 1 with the sliding surfaces of the upper and the lower part, the buried river bed, and the layer boundaries identified by the geotechnical investigation.

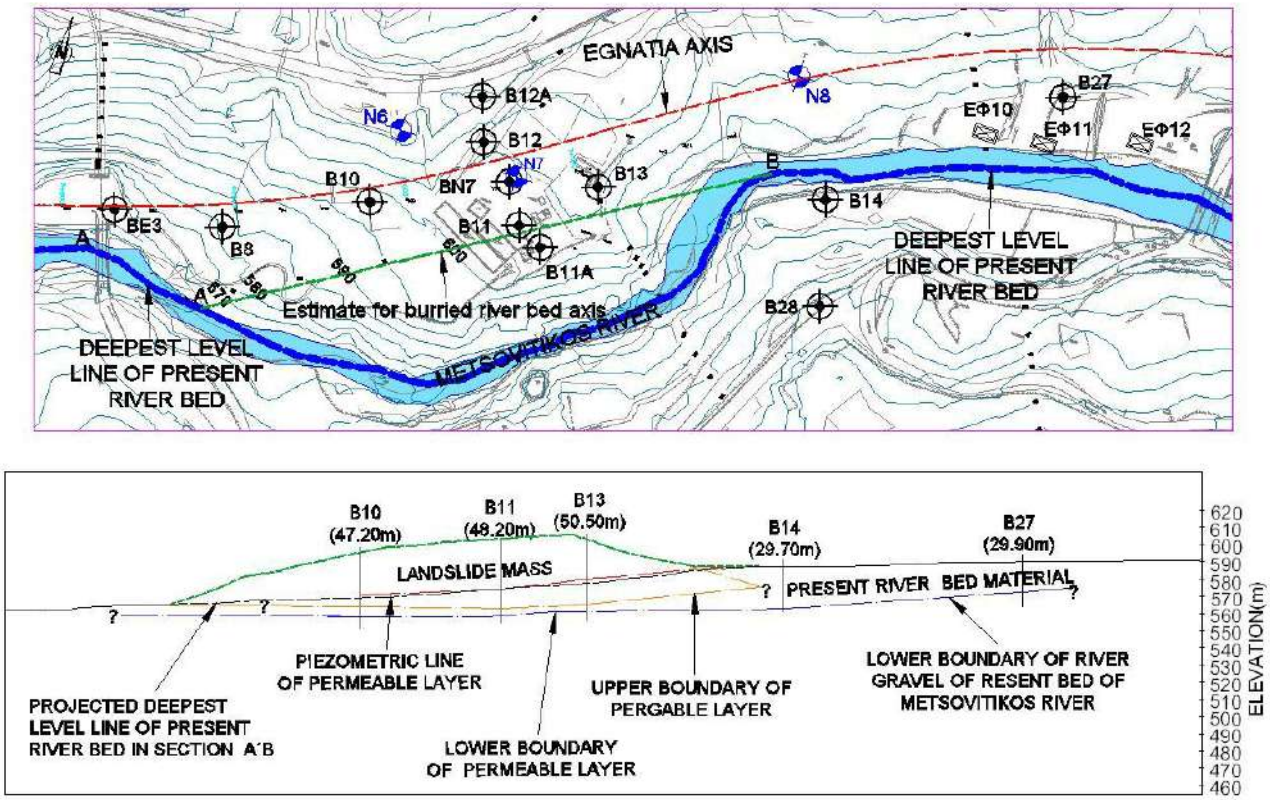
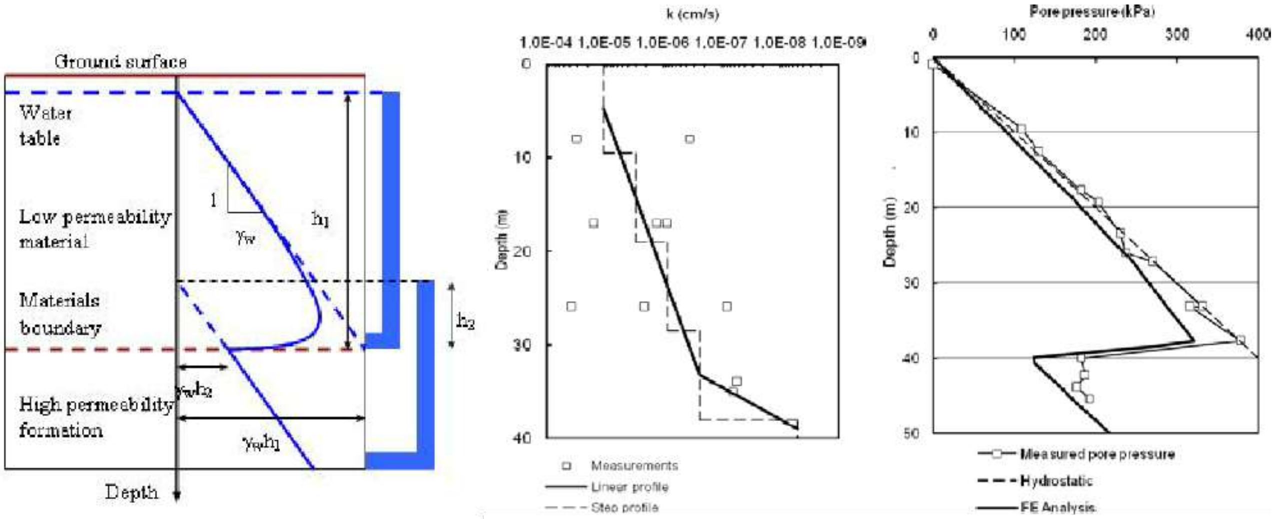


Figure 3. Part of the detailed plan view of the south-western part of the major landslide (top) with the rough estimate of the river before it was covered by the landslide (line AB) and the section along the deepest level line of the river and part AB (bottom).

The general form of an underdrainage pore pressure profile in low permeability landslide materials overlying a permeable formation in equilibrium with a much lower pore pressure is presented in Fig. 4a. This is a theoretical profile drawn by considering the field measurements on three different cases (Bardanis et al, 2006). The profile follows essentially the hydrostatic pore pressure distribution from a shallow depth from the ground surface down to a small distance from the boundary between low and high permeability materials and then the pressure drops considerably to the much lower value in the underlying permeable formation. Similar pore pressure profiles have been reported by Kennard & Reader (1975), Vaughan & Wallbancke (1975), and Vaughan (1994), who attribute their presence to the decrease in the coefficient of permeability k with depth as a result of stress increase with depth and the corresponding decrease of void ratio. Bromhead & Vaughan (1980), Vaughan et al. (1983) and Vaughan (1989) have investigated the effect of various types of distributions of the coefficient of permeability on the pore pressure profiles. The underdrainage profiles reported in the aforementioned references however are characterised by a gradual decrease in the pore pressure that begins at quite a large distance from the interface between low permeability and high permeability material. Bardanis et al. (2006) have reported underdrainage pore pressure profiles exhibiting a decrease in the pore pressure at a much smaller distance from the interface between low and high permeability formations. These profiles were observed in landslide materials overlying permeable formations like old river beds, and the decrease in pressure was observed in the sub-layer lying only 2-3m above the interface, which contained the sliding surface. In the vicinity of the sliding surface the coefficient of permeability in the vertical direction k_v is expected to decrease even to a lower value than the one corresponding to the stress level at that depth as a result of the orientation of the clay particles parallel to the sliding surface turning the sliding surface into an impermeable "membrane" that inhibits the movement of pore water from the landslide material into the underlying permeable layer. This phenomenon was also observed in the landslide of Area B in Section 2.4 of Egnatia Highway and was modeled numerically by Bardanis et al. (2009). A stepped distribution of the coefficient of permeability of the landslide materials with depth was adopted with a further decrease of this coefficient at the depth corresponding to the sliding surface (Fig. 4b) along with recharge from the ground surface corresponding to hydrologic data for the area. Modeling of the initial pore pressure regime was generally successful as shown in Fig. 4c comparing measured water pressures at various depths with the predicted distribution.



(a) (b) (c)

Figure 4. Pore pressure distribution with depth in low permeability soil overlying higher permeability layer under lower pressure (left), coefficient of permeability stepped distribution with depth in 2.4 Section landslide adopted in the finite element simulation by Bardanis et al.(2009) along with measured values (middle), and measured and predicted by FEM initial pore pressure distribution with depth (right).

Back analysis of the landslide

Two-dimensional back analyses were performed on several sections of the major landslide using the limit equilibrium method (modified Janbu method of analysis) assuming a factor of safety of 1 given the large deformation of this palaeo-landslide. The pore pressure regime introduced was that modeled for the south-western part of the landslide by FEM for sections in that part and the hydrostatic pore-pressure distribution from water tables obtained from piezometers in the rest of the landslide. These back analyses yielded values of the residual angle of friction 14 to 16° for the downslope part of the landslide and 13 to 15° for the upslope part of the landslide. Back analyses were also performed using the pseudo three-dimensional method of analysis (Hutchinson, 1979, Cavounidis, 2010). The residual angle of friction from these analyses was calculated approximately 1-1.5° lower than the aforementioned values.

The presence of one downslope part and one upslope part with their combined sliding surface being concave (Fig. 2) called for a combination of the results of the back analyses. For each section, back analysis of the upslope part was first performed yielding the angle of shearing resistance for that part. Then the common part of the upslope part with the downslope part was "cut" in the back analysis performed and a new analysis was performed obviously yielding a value of factor of safety below unity. The force required to bring the factor of safety of this "cut" upslope part of the landslide to unity again was then calculated. Once this was obtained it was introduced in the back analysis of the downslope part of the landslide with an equal value but opposite (destabilizing) direction. The angle of shearing resistance of the downslope part was calculated in the presence of this force. All forward analyses after that point were performed for the downslope part with the angle of shearing resistance calculated and the presence of the destabilizing force from the upslope part. For the upslope part all stabilization measures were introduced in forward analyses but not in order to calculate a new factor of safety for that part. They were performed in order to obtain a reduced value of the destabilizing force to the downslope part and introduce that to the forward analyses of the downslope part.

Exploitation of the pore pressure regime in the landslide mass for landslide stabilisation

Using the same distribution of the coefficient of permeability with depth and recharge from the ground surface used to predict the initial pore pressure profile, the effect of the vertical drainage wells was investigated numerically. One line of drainage wells was first introduced and the Factor of Safety (FOS) rose to 1.10 to 1.13 depending on the position of the drainage wells line (increasing as the line moved upslope). When two lines of wells were introduced, the FOS rose to 1.24. This value was not considered sufficient and a drainage tunnel with 20m long drainage boreholes from the inside was also introduced (pore pressure regime predicted shown in Fig. 5). The FOS then rose to approximately 1.49. These FOS values were obtained from FEM analyses for steady-state seepage conditions. Given the low permeability values of these materials, transient state seepage FEM analyses were also performed indicating the gradual effect of these drainage measures. Significant changes in FOS started being predicted after 3 months of introducing the drainage measures.

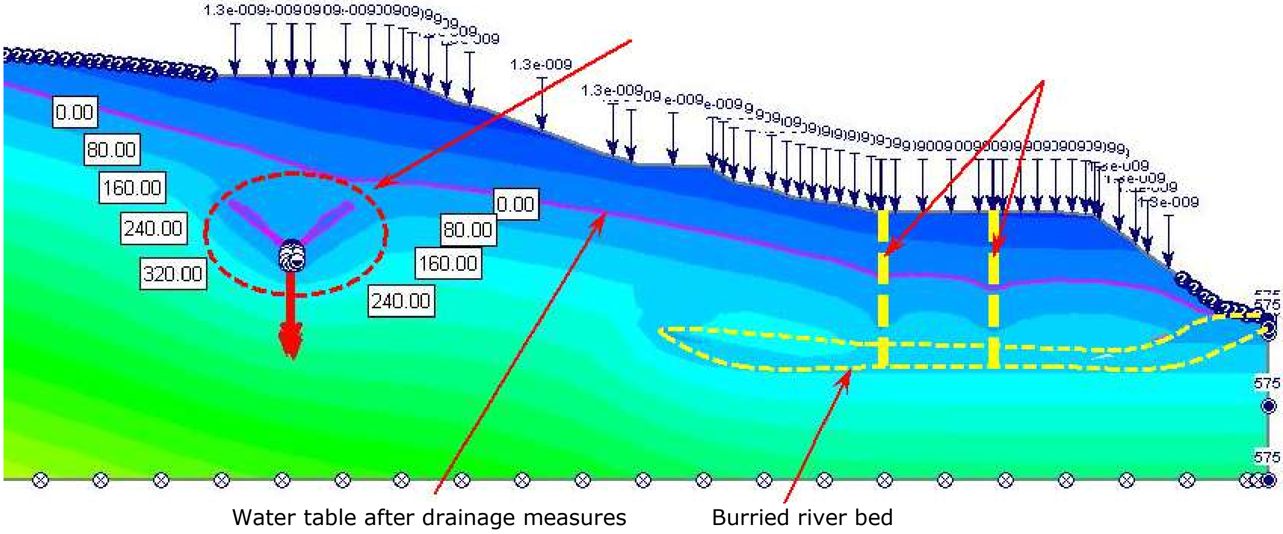


Figure 5. Pore pressure distribution with depth in the landslide material of the western part of the landslide after introducing tvo lines of vertical drainage wells at the downslope part and one drainage tunnel with drainage boreholes below the upslope part (steady state seepage analysis).

Stabilisation measures

The landslide was stabilized by berms (the highway embankments, as the alignment was on purpose directed to pass from the toe of the landslide), barrettes and drainage. Barrettes were predominantly meant to increase local slope stability in the area of the toe embankments which were acting as stabilizing berms. Drainage was implemented in three ways: i) by constructing vertical drainage wells through the landslide material in the south-western part of the landslide overlying the buried river bed, ii) by constructing a 600m long drainage tunnel with an alignment practically perpendicular to the direction of movement of the landslide, and iii) locally with horizontal drainage boreholes in various locations of local excavations, these having a temporary role during temporary local excavations to form bases of berms, and acting only very little afterwards. The drainage wells were drilled on two lines spaced every 5m and were drilled all the way down to the buried river bed intruding at least 3m in that layer (the location of the lines in the plan view is shown in Fig. 6). The drainage tunnel had a fan of drainage holes drilled from inside, approximately 20m long each. The size of the toe berms (the highway embankments was maximized to introduce the maximum increase of the factor of safety for the overall stability of the landslide. Local stability of the berms themselves required construction of piles and barrettes at the toe of these berms. These had only a secondary effect on the overall stability. The factor of safety ranged between 1.35 and 1.5 from section to section. Using the pseudo three-dimensional method of analysis (obviously with the residual angle of shearing resistance obtained from the back analysis using this method) yielded a factor of safety of 1.45.

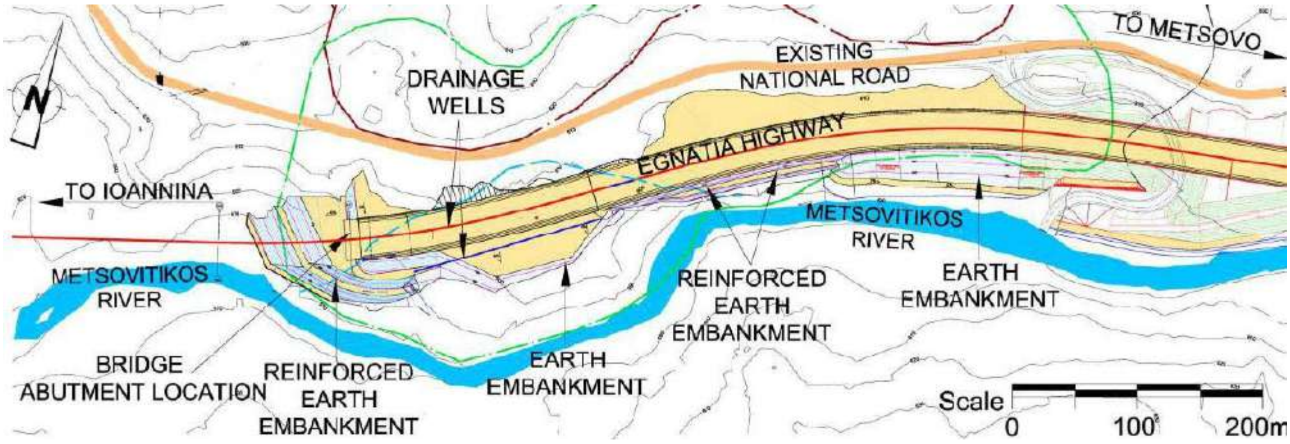


Figure 6. Plan view of the downslope part of the landslide showing the stabilizing berms (highway embankments) and the location of the vertical drainage wells.

A NEW SLIDING MASS

During the final phase of the construction of the stabilization measures an unfortunate decision was made to leave for the end the river bank protection works of the Metsovitikos river flowing along the toe of the landslide. Upstream of the area of interest river training works had already been constructed, increasing average flow velocity in the river downstream of that area. As a result erosion of the river bed of several meters depth took place which had the result of destabilizing a local part of the major landslide in its south-eastern part. New inclinometers were placed, revealing that a new –deeper– sliding surface was now formed passing under the toe berm and close to the tips of the barretes. This local sliding mass had a length of 180m, a width of 140m and a maximum depth recorded on inclinometers of 31m (Fig. 7 showing section T42 located approximately at the centre of the local sliding mass). The large depth of the inclinometers located in the north side of the river called for another inclinometer on the south bank of the river, as it was then suspected that the sliding surface could extend even below the river to the south side. This inclinometer did measure movement, but in the opposite direction and with a movement rate and azimuth corresponding to those of the landslide on the south side of the river. Given the locations of the inclinometers and their readings it was concluded that the new local landslide is a deep-seated one with the final part of the sliding surface towards the toe turning towards the ground surface at a very steep angle (approximately 60°). This is something rarely reported in the literature and it was attributed to the presence of two sliding masses moving towards one another, with their toes essentially "colliding" at their contact along the Metsovitikos river.

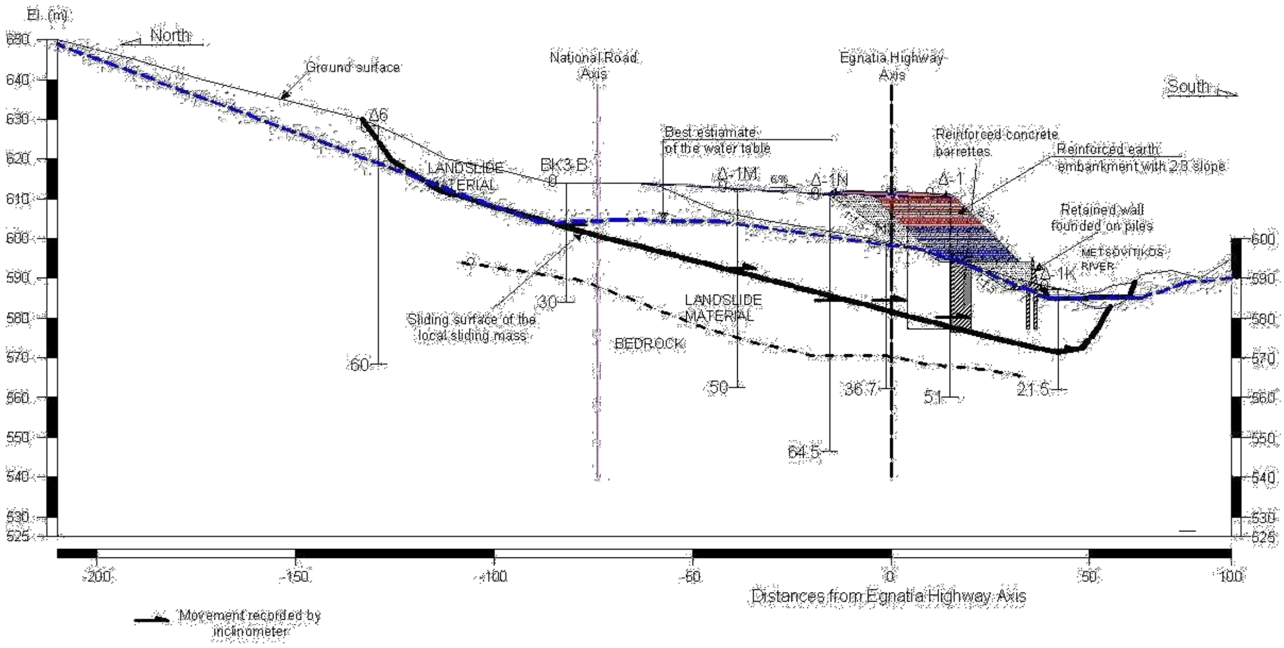


Figure 7. Section T-42 from Fig. 1 showing the sliding surface of the new local sliding mass.

STABILISATION MEASURES OF THE LOCAL SLIDING MASS – COVERING METSOVITIKOS RIVER

The design of the stabilisation measures for the new local landslide had to take account of several factors. The stabilization measures of the major landslide on the north side were practically completed. There was extremely little space at the tow of the new local landslide. This could be broadened by diverting the river to the south and become large enough for an area to construct barrettes or piles and a berm above them; however at the cost of excavating the toe of the landslide in the south side for a significant length of its toe. On top of this, structural elements, especially at an early stage, did not seem fit, due to the very high rates of movement and the need to drill through river gravel for quite some depth, leaving as the only passive stabilization measure the presence of a new berm. Other stabilization measures were also examined, namely:

- drilling vertical wells with pumping; this was rejected as a permanent measure on the basis of operating costs throughout the life of the project, yet it was constructed as a temporary measure to increase stability,
- building very deep barrettes upslope of the highway (ca. 50m deep); this was rejected on the grounds of cost and the risk of damaging the barrettes at an early stage due to the very high rates of movement,
- constructing prestressed anchors from the toe and through the existing embankment toe wall; this was rejected on the grounds of cost as they would have to be very long, and they also carried the risk of destabilizing the major landslide due to the forces applied on the anchors,
- scarp unloading; this was a cheap solution for the new sliding mass, but it was rejected as the unloading excavation stabilizing the new sliding mass would destabilize the major landslide, and
- construction of a drainage tunnel; this was rejected as there was no front to start excavating this tunnel and its location would have to be either in the landslide mass itself (increasing the cost tremendously) or below it which was also approximately 20-25m below the river level also making the construction expensive and difficult to the point of being impossible as well as of very questionable efficiency.

Rejection of all these alternatives left but one solution: to construct a tunnel for the river and build a stabilizing berm above it. This alternative was costly and difficult as the tunnel would have to be built in the river with the river still flowing but it had two serious advantages: i) it was passive, permanent, requiring relatively little maintenance work in the future, and ii) it increased the factor of safety to even higher values of the required ones for the new landslide in the north side, and it increased the factor of safety of the major landslide in the south side significantly (something that was not a requirement from the beginning but at the time of the design it seemed appealing in order to prevent possible unpredictable situations in the future).

This was the solution finally designed and constructed leading to the stabilization of the landslide phenomena of the area.

The tunnel was a twin one both for construction purposes and for serviceability purposes throughout the life of the project. It was constructed from reinforced concrete and it was approximately 150m long and 24m wide. It was designed for horizontal loads corresponding to the anticipated forces applied from the two landslide masses (both from the north and the south). A plan view is shown in Fig. 8 with the earthworks levels (shown in yellow), entrance with the corresponding river training works and the exit works designed for energy dissipation before the river flow continued to the naturally occurring river bank downstream of the exit. Construction of the south branch of the twin tunnel is shown in Fig. 9a and the finally constructed project in Fig. 9b.

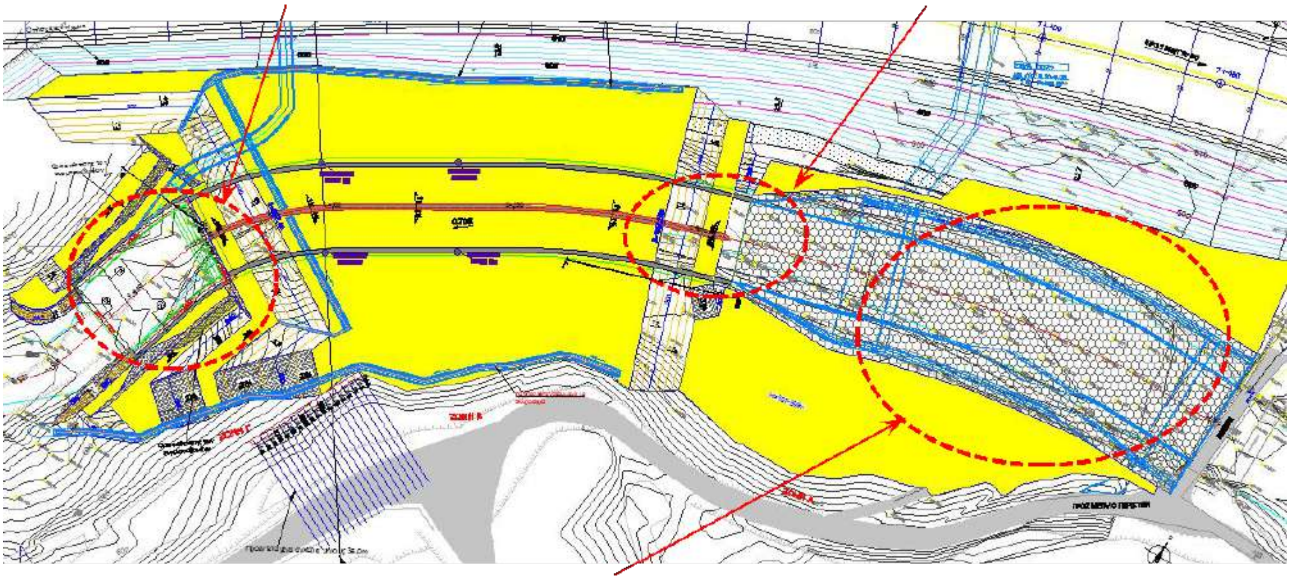


Figure 8. Plan view with the earthworks levels (shown in yellow), entrance with the corresponding river training works and the exit works.

Figure a. a) South branch of the twin tunnel during construction with the river trained to pass from the north side, b) river trained into the constructed south branch before commencing construction of the north branch, finally constructed twin tunnel shown from the entrance, and d) finally constructed twin tunnel shown from the exit.

CONCLUSIONS

A large size retrogressive landslide was successfully stabilized by means of stabilizing berms, barrettes and drainage; the latter achieved by means of a drainage tunnel and the exploitation of a covered old river bed where large diameter drainage wells drilled from the surface drained the landslide material. Two dimensional slope stability analysis was performed using the limit equilibrium method. Pseudo-three dimensional analysis was also performed. Modeling of the pore pressure regime in both types of analysis was supported by steady-state and transient seepage analysis in two dimensions performed by means of the finite element method. In a local area of the landslide an even deeper sliding surface was mobilized after part of the stabilization works had been constructed. This local sliding mass was also stabilized by means of a stabilizing tunnel constructed above a concrete twin-tunnel allowing the river at the berm of the landslide to pass under it. This part of the works had a strict management of the various construction phases but was completed successfully leading to the stabilization of the local sliding mass as well.

ACKNOWLEDGEMENTS

Egnatia Odos S.A. is the owner of the project. First phase works were constructed by a consortium of companies led by AKTOR S.A. The second phase works (local sliding mass stabilisation) were constructed by ENIPEAS S.A. Structural design of the works involved including the twin tunnel was performed by DOMI S.A. Hydraulic design was performed by HYDRACTIS S.A. Geotechnical design was performed by EDAFOS S.A. Several present or past colleagues were involved in the design apart from the authors; Ms Christina Koutsoumba and Ms Christina Mavromati, Civil Engineers, formerly of EDAFOS S.A., having played a major part in the design team. Ms E. Sakoumpenda and Mr E. Charalambakis of Egnatia Odos S.A. and Mr V. Houssiadas, formerly of Egnatia Odos S.A. provided measurements data and contributed from the owner's side.

REFERENCES

Bardanis M, Cavounidis S, Dounias G. Numerical simulation of the pore pressure regime in landslides with underdrainage, Proc. *17th ICSMGE, "The Academia & Practice of Geotechnical Engineering"*, M. Hamza et al. (eds), IOS Press, 2009, 2: 1518-1521.

Bardanis M, Dounias G, Cavounidis S. Examples of low permeability landslide materials with underdrainage from Greece, Proc. *5th Hellenic Conf. on Geot. & Geoenv. Engng*, Xanthi, Greece, 2006, II: 603-610 (in Greek).

Bromhead EN, Vaughan PR. Solutions for seepage in soils with an effective stress dependent permeability, Proc. *Conf. Num. Methods for Non-linear Problems*, 1980, 1: 567-578.

Cavounidis S. The third dimension in slope stability analysis, Proc *. 6th Hel. Conf. on Geotechnical and Geoenvironmental Engineering*, Volos, 29 September - 1 October, 2010, 2: 74-83 (in greek).

Hutchinson JN. Unpublished Lecture Notes on Slope Stability Analysis, Imperial College, 1979.

Kennard MF, Reader RA. Cow Green dam and reservoir, *Proc. Instn Civ. Engrs*, Part 1, 58, May 1975, 147-175. Vaughan PR. *Non-linearity in seepage problems–theory and field observations*, De Mello Volume, Sao Paulo, Edgar Blucher, 1989, 501-516.

Vaughan PR, Kennard RM, Greenwood DA. Squeeze grouting of a stiff fissured clay after a tunnel collapse, Proc. *5th Eur. Conf. Soil Mech.*, Helsinki, Finnland, 1983, 1: 171-176.

Vaughan PR, Wallbancke HJ. The stability of cut and fill slopes in boulder clay, Proc. *Symp. Engng Behaviour of Glacial Materials*, Birmingham, Midland Society for Soil Mechanics and Foundation Engineering, 1975, 209-219.

Το άρθρο παρουσιάσθηκε στο **ICONHIC 2016 1st International Conference on Natural Hazards & Infrastructure, 28-30 June, 2016, Chania, Greece**.

Video Demo: Geogrid Mechanisms Explained

In 2003, the U.S. Army Corps of Engineers defined three primary mechanisms for how geogrids work to stabilize paved and unpaved roads. In an engineering technical letter (ETL), the Corps identified the three primary mechanisms as: lateral restraint, improved bearing capacity, and tensioned membrane effect. Here, we explain the two most important mechanisms, lateral restraint and improved bearing capacity, and demonstrate their effects. (These videos are designed to help you visualize the mechanisms: design is more complex, but based on these ideas.)

Lateral Restraint

For geogrids, lateral restraint is the primary mechanism of the three discussed in the ETL. So, what is it exactly and why is it so important? Lateral restraint is the ability to confine aggregate particles within the plane of the geogrid. Once the aggregate strikes through the apertures of the geogrid, its movement is limited. This increases the stiffness of the stabilized aggregate layer. In other words, when geogrid is used in the design of your paved or unpaved structure, your structure becomes much more efficient at managing the stress imposed by heavy loads because the aggregate moves very little.

This box-of-rocks video offers a simple demonstration of the lateral restraint mechanism at work. You'll see how an unstablized section responds when compared to a section benefiting from the introduction of TriAx Geogrid in an aggregate layer.

Improved Bearing Capacity

Improved bearing capacity, also known as the snowshoe effect, becomes an important mechanism as subgrade soils get weaker. Just as a snowshoe distributes your weight over soft snow, a stiff layer of aggregate and geogrid better distributes loads over soft subgrades.

Improved bearing capacity of the subgrade results from pressure dissipation at the geogrid-subgrade interface. Generally, this mechanism applies to unpaved applications where stabilization is required to yield a stable working surface. However, it also applies to pavement structures, particularly flexible pavements stabilized with a geogrid at the aggregate-subgrade interface.

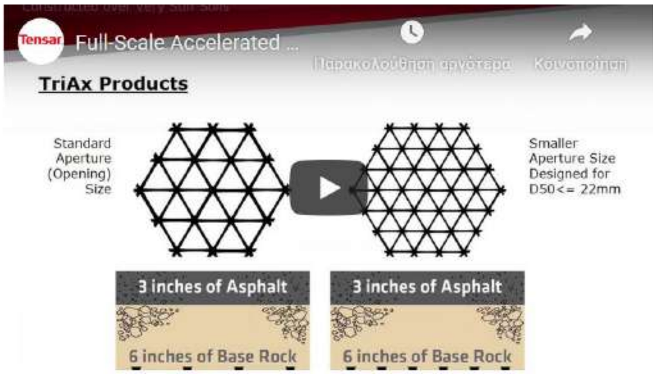
Sand Box Demonstration with TriAx Geogrid: Using soft foam, a weak subgrade condition is simulated to demonstrate the improved bearing capacity realized using TriAx geogrid. Note how the participant's weight is not supported in the unstabilized condition, but is easily carried by the stabilized composite of sand and TriAx Geogrid.

(Bryan Gee, on Feb 20, 2020, https://info.tensarcorp.com/video-demo-geogrid-mechanisms-explained?utm_campaign=WH_Digital%20Advertising_Third-Party&utm_source=Smart-Brief&utm_medium=enewsletter-featured-content&utm_content=blog-geogrid-mechanisms)

TriAx Geogrid Improves Pavement Performance

Many early geogrid studies were performed on unpaved sections over soft soils or on paved sections with soft subgrades. However, recent research by the US Army Corps of Engineers aimed to compare performance of TriAx Geogrid versus conventional methods over stiff to very stiff subgrade soils.

This video provides an overview of the research based on trafficking that exceeded 800,000 ESALs. Findings from this study showed that TriAx Geogrids could reduce asphalt thickness by 25% and aggregate base thickness by 25%, while still improving pavement performance over stiff soils by approximately 62%. Values used within SpectraPave design software, which has been reviewed and validated by independent experts, were also shown to be conservative.



https://www.youtube.com/watch?v=nDWfAj0SVCE&feature=emb_logo

(Tensar International, Feb 11, 2020, https://info.tensarcorp.com/confirmed-triax-geogrid-improves-pavement-performance?utm_campaign=WH_Digital%20Advertising_Third-Party&utm_source=Smart-Brief&utm_medium=enewsletter-featured-content&utm_content=blog-confirmed-geogrid-improves-pavement-performance)

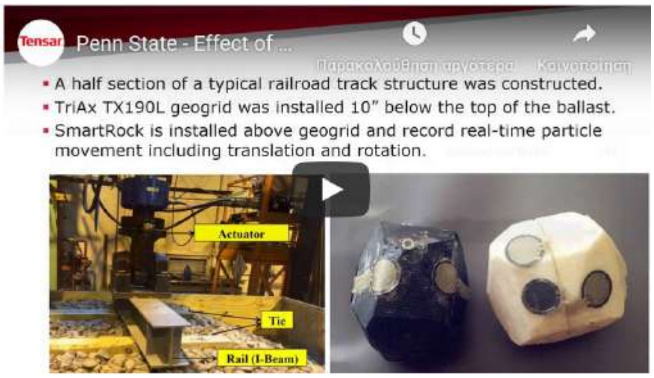
TriAx Geogrid Reduces Ballast Movement

Penn State University presented research findings on ballast movement, rotation and displacement at the annual Transportation Research Board (TRB) meeting in 2016. For the study, a half section of a typical railroad track structure consisting of AREMA No. 4 ballast stone, two crossties, and a rail

(I-beam) was constructed in the ballast box. TriAx Geogrid was installed 10 inches below the top of the ballast. Five hundred load cycles were applied for each test.

"SmartRock," a wireless device with a realistic ballast particle shape, was embedded in the test sections to monitor individual ballast particle movement under cyclic loading conditions, for both stabilized and conventional sections. The results showed that the ballast movement was significantly reduced with TriAx Geogrid.

This video offers an overview of the Penn State Research and the team's key findings.



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(Mike Misitigh, on Feb 18, 2020, https://info.tensarcorp.com/research-finding-triax-geogrid-reduces-ballast-movement?utm_campaign=WH_Digital%20Advertising_Third-Party&utm_source=Smart-Brief&utm_medium=enewsletter-featured-content&utm_content=blog-geogrid-reduces-ballast-movement)

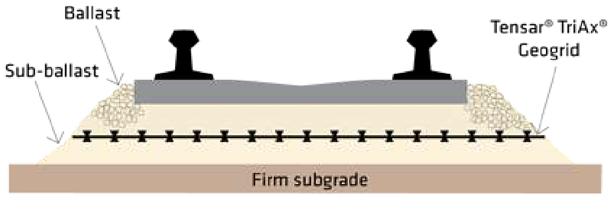
Better, Higher Performing Trackbed Stabilization Solutions for Railway Construction & Maintenance

Railway construction can involve many challenges -- from track support over weak subgrade conditions to bridge abutments and sediment control. As experts in mechanically stabilized earth (MSE) solutions, … developed the Spectra Rail Railway Improvement System to increase the service life of rail track substructures. Geogrids, in combination with aggregate, are used to stabilize sub-ballast and ballast layers, decreasing required roadbed thickness while improving track performance. A cost-effective alternative to conventional solutions, the Spectra Rail System has proved to save significantly on installation and life cycle costs as well.

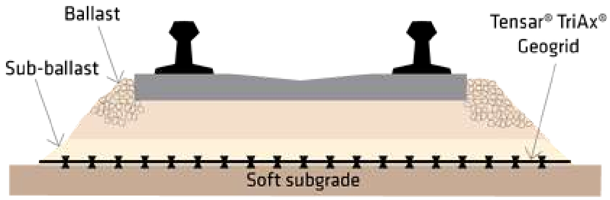
How Geogrids Work: Mechanical Interlock

TriAx Geogrids stabilize ballast and sub-ballast layers through the principle of "mechanical interlock." When unbound aggregate is compacted over a geogrid, the coarser particles partially penetrate through the geogrid apertures and lock into position. As the aggregate layer stiffens, the load distribution over the underlying subgrade is enhanced, increasing its effective bearing capacity. Shear forces imposed within the aggregate layer as a result of trains passing are thereby partially transferred into the geogrid.

In addition, the geogrid's ability to confine aggregate particles significantly reduces lateral spreading of granular particles, a major cause of ballast and sub-ballast settlement. TriAx Geogrids offer strength at low strain in all directions, preventing large deformations within the aggregate. The rigid triangular apertures of TriAx Geogrids are designed to interact with typical railroad ballast and sub-ballast materials to ensure optimum mechanical interlock. Geogrids with larger apertures (for example, Tensar TX190L) are used to stabilize the coarser aggregates typically used for ballast layers.



Ballast stabilization leads to increased maintenance intervals.



Sub-ballast stabilization provides improved bearing capacity.

Cost Benefits: Short-Term and Life Cycle Savings

By significantly reducing the required trackbed thickness, **TriAx Geogrids can typically save up to $30,000 per linear mile of track**. The ease of geogrid installation not only accelerates construction schedules, it also eliminates the cost of special labor and equipment. With the option to install TriAx Geogrids in wet conditions, contractors can maximize their productivity in inclimate weather.

Since TriAx Geogrids can be installed directly over existing weak subgrade soils, the costs associated with subgrade excavation, disposal, and replacement or chemical treatment (along with the set time for chemical treatment) can be eliminated. With shallower excavation, the potential costs associated with the relocation of utilities can be eliminated as well.

Over the long term, TriAx Geogrids preserve the integrity of the railway structure by confining the ballast and sub-ballast layers. This **typically extends the period between maintenance operations by a factor of three to five times and the design life of heavy-duty pavements at intermodal facilities by three to six times**. In reducing the deflection of the trackbed during loading, TriAx Geogrids also extends the life of mechanical track components including rails, ties and insulated joints.

(https://info.tensarcorp.com/tensar-railways?hsCtaTracking=320067a0-01ae-434d-a46a-5807a2f6819b%7C5d40bd40-e995-4d41-a237-c05576c8b94a)

Analysis: 463 non-seismic fatal landslides caused 3 270 deaths in 2019

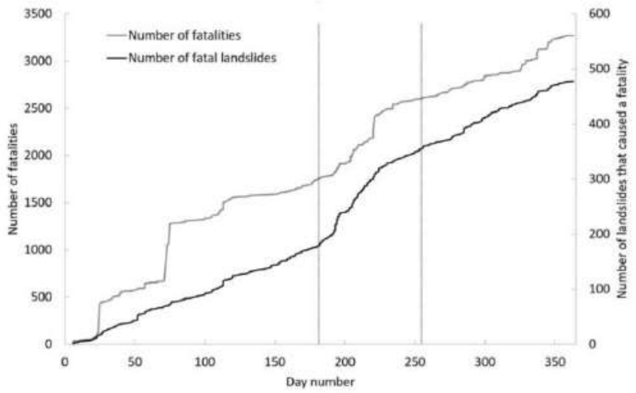
Landslide in Lombardy, Italy - August 2019

In an analysis of the landslide database for 2019 by Dr. Dave Petley, Pro-Vice-Chancellor at the University of Sheffield-- it was shown that 463 non-seismic fatal landslides occurred last year, causing 3 270 deaths. Given the number of deadly landslides, 2019 is the third-worst in the dataset.

The dataset is comprised of information Petley has been collecting since September 2002. It was the basis of a couple of his research publications as well, including many posts he contributed to the American Geophysical Union's (AGU) Earth and space science blog.

Petley revealed the final statistics, showing that 463 non-seismic fatal landslides and 3 270 casualties were recorded in 2019. "In addition, I recorded 14 landslides triggered by earthquakes, with 27 fatalities, but this is undoubtedly a significant underestimate in both respects," he said.

In this graph, the cumulative total number of fatal landslides through 2019 is indicated.



The cumulative total number of fatal landslides (black line, right-hand axis), and the resultant fatalities (grey line, left-hand axis), for 2019. Image credit: Dr. Dave Petley

"I have delineated the most intense period of the summer monsoon in Asia with the vertical black lines-- during this time the number of landslides increases dramatically," Petley wrote.

It was also noted that the fatality data is noisier, as usual, and is dominated by a correspondingly small number of huge events, including the Brumadinho tailings dam failure in Brazil.

In a separate update on landslides from the 2019 Northern Hemisphere monsoon season, Petley stated that the Asian monsoon remains the ruling factor in identifying the overall number of landslides in a particular year.

Landslides outside the summer monsoon season happen at a steady but rising rate, he remarked.

The number of fatal landslides makes 2019 the third-worst year in Petley's dataset. The top record is still held by 2010, with 496 deadly mudslides, while the second is 2009 with 488.

On average, 382 lethal landslides occur every year.

In the first analysis, the higher figures in 2019 were possibly the aftermath of the following: landslides induced by higher than usual incidence of monsoon; the continuous increase in landslips due to mining, and a much higher than normal incidents of deadly mudslides in Africa.

Petley remarked that he will further conduct examinations to verify these hypotheses.

Reference

"Global fatal landslide occurrence from 2004 to 2016" - Froude, M. J. & Petley, D. N. - Natural Hazards and Earth System Sciences - https://doi.org/10.5194/nhess-18-2161-2018.

(Julie Celestial / THE WATCHERS, March 25, 2020, https://watchers.news/2020/03/25/deadly-landslides-in-2019)

Global fatal landslide occurrence from 2004 to 2016

Melanie J. Froude and David N. Petley

Abstract

Landslides are a ubiquitous hazard in terrestrial environments with slopes, incurring human fatalities in urban settlements, along transport corridors and at sites of rural industry. Assessment of landslide risk requires high-quality landslide databases. Recently, global landslide databases have shown the extent to which landslides impact on society and identified areas most at risk. Previous global analysis has focused on rainfall-triggered landslides over short ~ 5-year observation periods. This paper presents spatiotemporal analysis of a global dataset of fatal non-seismic landslides, covering the period from January 2004 to December 2016. The data show that in total 55 997 people were killed in 4862 distinct landslide events. The spatial distribution of landslides is heterogeneous, with Asia representing the dominant geographical area. There are high levels of interannual variation in the occurrence of landslides. Although more active years coincide with recognized patterns of regional rainfall driven by climate anomalies, climate modes (such as El Niño–Southern Oscillation) cannot yet be related to landsliding, requiring a landslide dataset of 30+ years. Our analysis demonstrates that landslide occurrence triggered by human activity is increasing, in particular in relation to construction, illegal mining, and hill cutting. This supports notions that human disturbance may be more detrimental to future landslide incidence than climate.

https://www.nat-hazards-earth-syst-sci.net/18/2161/2018/#top

Late great engineers: Robert Stephenson

Designer of the pioneering Rocket that was to set the blueprint for the trains of the future, Robert Stephenson's career was also influential in the field of Victorian bridge-building writes Nick Smith.

In an early biography of the Stephenson father-and-son engineering dynasty, Samuel Smiles recalls the great railway and civil engineer Robert Stephenson doubting whether the public would be interested in reading about the life of his father George. "If people get a railroad," he is reported to have said, "it is all they want; they do not care how or by whom it is done."

Portrait of Robert Stephenson, by John Lucas.

And yet, the son co-operated in the production of a book that became a Victorian best seller and helped forge the unbreakable association between the name Stephenson and railway engineering. Although often attributed to his father, arguably the most famous locomotive ever built – Rocket – was designed by the son. It's a common confusion arising from the fact that, as David Ross says in his 21st century double-header biography of the two men, to write about one without reference to the other is 'impossible'. But for all the locomotives and railway line surveys, ultimately, Robert Stephenson's legacy is founded on his prowess as a bridge-builder, most notably the Britannia Bridge over the Menai Strait in North Wales.

Born on 16th October 1803 in Northumberland, Robert Stephenson's early life displayed few clues that he would become one of the greatest engineers of the 19th century. While his father George had been born to poor and illiterate parents (George was himself illiterate until the age of 18), Robert's start in life was only marginally better. His father was a brakesman at the local colliery, and by the time he was three, his mother Agnes had died of tuberculosis. The infant Robert was subsequently left with a housekeeper while George departed for Scotland to look for work, eventually returning to the colliery at Killingworth, where he became an expert in steam machinery: the first step in an illustrious career that would make him 'Father of Railways'. Despite having little formal education, George was determined that his son would benefit from one, and at the age of 11, Robert was sent to the Percy Street Academy in Newcastle, where he borrowed books that he would study with his father. In 1813, Robert was apprenticed to a local colliery manager, during which time he constructed a mining compass that he would later use to survey the High Level Bridge in Newcastle upon Tyne.

If people get a railroad, it is all they want; they do not care how or by whom it is done

While Robert was still an apprentice, his father became involved with surveying on the proposed Stockton and Darlington Railway (S&DR). With Robert showing signs of the illness that had accounted for his mother, he was released from his apprenticeship and went to work with his father. After the initial private bill for the S&DR failed before parliament, amendments were made to the route by the father-and-son team with the result that a subsequent bill was passed. George Stephenson, who had recommended the use of steam locomotives, was elected engineer for the project on a yearly salary of £660 that allowed him to send Robert to Edinburgh University (albeit for a less than a year), where he studied natural philosophy, natural history and science. By May 1823 final assent from came from parliament allowing the use of 'loco-motives or moveable engines'. The following month Robert Stephenson & Co was established to build them, with Robert borrowing £500 to pay for his share in the company, a sum that dwarfed his £200 annual salary. By 1824 the S&DR had ordered two steam locomotives and two stationary engines from Robert Stephenson & Co, and the line opened in September 1825.

Robert was not there to see it because by June 1824 he was sailing to South America to oversee the installation of steam machinery in the gold and silver mines newly reopened by the Columbian Mining Association. Robert's motive for taking up an appointment on the other side of the world has divided historians, who have seen his departure from the locomotive company as either because of a disagreement between the Stephensons over financial matters, or an indication that Robert was trying to break free from his father's orbit. Either way, the trip could hardly be described as a success, with illness, labour problems and even a shipwreck thwarting the enterprise. After a brief tour of north America he returned to Britain where he resumed his role managing director of Robert Stephenson & Co, working on locomotive design – notably on Experiment and Lancashire Witch – as well as surveying railway routes and consulting on a tunnel under the River Mersey.

But it was the steam locomotive Rocket that was to be his career landmark of the decade. Designed by Robert and built at Robert Stephenson & Co's Forth Street works in Newcastle, Rocket was by no means the first steam locomotive, despite its reputation for being so. But it was the most technologically advanced design of the time, bringing together several innovations that would establish the template for the steam locomotive for the following century. Rocket – how or when it got its name is unclear – was designed to take part in trials being conducted by the Liverpool and Manchester Railway (L&MR) at Rainhill. Because the line was intended as a predominantly passenger (rather than freight) service, the rules for the competition gave priority to speed and reliability. With weight restrictions in place, a key design decision was to opt for a single pair of drive wheels (the format of Rocket is 0-2-2, ie two driving wheels, two trailing wheels and no leading wheels). Increased efficiency was achieved by a multi-tubular boiler, while other innovations included close-to-horizontal pistons connecting directly to the drive wheels, and a separate firebox.

Stephenson's rocket on display at the National Railway Museum.

Rocket won the competition. The L&MR purchased it and placed an order for four similar units and the line opened on 15th September 1830 in the presence of the Duke of Wellington. This was somewhat overshadowed by the Member of Parliament for Liverpool William Huskisson becoming the first verifiable railway passenger fatality, having been run over by Rocket in a bizarre sequence of events. The resulting coverage of the accident, however, drew the public's attention this new long-distance passenger transport technology.

Running parallel to Robert Stephenson & Co (and with the same directors) was the firm George Stephenson & Son that was contracted to survey a railway route from London to Birmingham. Still in his late twenties, on 20th September 1833 Robert signed the contract to build the 112-mile line from Camden Town to Birmingham on an annual salary of £1500, following which he moved to London, where he later established offices next door to the Institution of Civil Engineers and had the Herald's College draw him up a coat of arms. Consolidation of his career as a railway entrepreneur came in the form of a long list of largely forgotten projects, including advising King Leopold on the Belgian State Railway (for which he was decorated with the Order of Leopold), an ill-fated investment in the Stanhope & Tyne Railroad Company, as well as advising on railways in France, Spain and Italy.

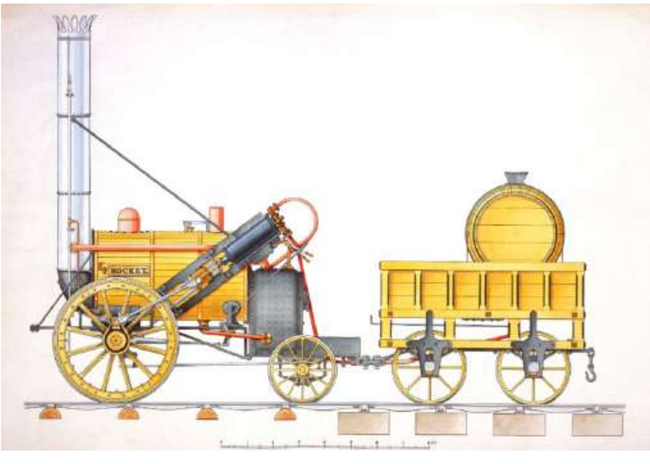


Illustration of Stephenson's rocket.

Robert was also the builder of many long-span railway bridges, of which the jewel in the crown is the Britannia Bridge that connects the island of Anglesey with mainland north Wales. A rivetted tubular bridge of wrought iron rectangular box-section spans supported by stone piers (the central one built on Britannia Rock), the specification insisted on by the Admiralty required the arches to be of sufficient height (100ft) to allow a fully rigged man-of-war to pass beneath. Robert borrowed the construction method from contemporary ship-building techniques and, to commemorate the structure's completion, personally fitted the last rivet in 1850, a year after Queen Victoria opened his High Level Bridge in Newcastle.

Robert Stephenson spent the remainder of his career as the Conservative Member of Parliament for Whitby, his maiden speech in the House being in favour of the Great Exhibition of 1851 (of which he was a commissioner, alongside his friend Isambard Kingdom Brunel), and later speaking against Britain's involvement in the Suez Canal scheme. At the height of his fame, he was also suffering from Bright's Disease (chronic nephritis), which meant that he found the attention from prospective investors overbearing and would retreat to his yacht Titania, describing it as 'the house that has no knocker.' Returning to Britain from Oslo on Titania in 1859 he became seriously ill and died on 12th October 1859, merely days after the passing of Brunel. Such was the national impact of Robert's death, Queen Victoria broke with protocol and granted his funeral cortège passage through Hyde Park, an honour traditionally reserved for royalty.

(THE ENGINEER, 9th March 2020, https://www.theengineer.co.uk/late-great-engineers-robert-stephenson)

ΝΕΑ ΑΠΟ ΤΙΣ ΕΛΛΗΝΙΚΕΣ ΚΑΙ ΔΙΕΘΝΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΝΩΣΕΙΣ

International Society for Soil Mechanics and Geotechnical Engineering

ISSMGE News & Information Circular March 2020

https://www.issmge.org/news/issmge-news-information-circular-march-2020

1. SYDNEY 2021 – 20ICSMGE, 7iYGEC – PAPER ALLOCATION INFORMATION AND CALLS FOR ABSTRACTS

All member societies were sent information on paper allocation on the 19th December 2019. If you have not seen these details, please let the ISSMGE Secretariat (secretariat@issmge.org) know as soon as possible.

2. ISSMGE Awards

Member Societies are hereby called to submit nominations for ISSMGE awards for the 20th International Conference on Soil Mechanics and Geotechnical Engineering to be held in Sydney, Australia, in September 2021. Nominations should be submitted to the Secretary General by the closing date of 1 July 2020. For more information and guidelines for the nomination of the various awards please click here.

3. Bulletin

The latest edition of the ISSMGE Bulletin (Volume 14, Issue 1, Feb 2020) is available from the website: https://www.issmge.org/publications/issmge-bulletin/vol-14-issue-1-february-2020

4. Council Meeting Cape Town, 6th October 2019

Please note that the Minutes of the Council Meeting held in Cape Town in October 2019 have been finalised and are now available from the website at: https://www.issmge.org/the-society/council-meeting-minutes

5. Tables of Giroud et al. (1972-1973)

The French Society (CFMS) is happy to announce the on-line publication of "Tables pour le calcul des fondations par Giroud et al. (1972-1973) - Édition numérique". Please go to: http://www.geotech-fr.org/publications/tables-de-giroud

6. TC Guidelines – update

An updated set of Guidelines for the ISSMGE Technical Committees and Honour Lectures are now available from the website - https://www.issmge.org/filemanager/article/390/Guidelines_for_ISSMGE_Technical_Committees_revised_Nov19.pdf

7. ISSMGE Online Library – Open Access

The ISSMGE Online library (https://www.issmge.org/publications/online-library) is in continuous development – please note the following additions:

17th African Regional Conference on Soil Mechanics and Geotechnical Engineering;

17th European Conference on Soil Mechanics and Geotechnical Engineering,

Australia New Zealand conference series back catalogue,

XVI Pan-American Conference on Soil Mechanics and Geotechnical Engineering (XVI PCSMGE 2019)

9th International Symposium on Geotechnical Aspects of Underground Construction in Soft Ground, Sao Paulo, 2017 (TC204)

8. Are We Overdesigning? A survey of international practice

A joint initiative by the CAPG, the YMPG, TC2015 - Safety and Serviceability and TC304 - Risk. The survey is intended to assess the consistency of calculation models and design methods for a variety of geotechnical structures, and where possible, to compare the results with full scale tests and reliability analyses. To participate in the survey please go to https://www.issmge.org/news/are-we-overdesigning-a-survey-of-international-practice.

9. ISSMGE Foundation

The next deadline for receipt of applications for awards from the ISSMGE Foundation is the 31st May 2020. Click here for further information on the ISSMGE Foundation.

10. 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.

The following are events that have been added since the previous Circular:

ISSMGE Events

GEO-EXPO 2020 SCIENTIFIC AND EXPERT CONFERENCE - PRIJEDOR, BOSNIA AND HERZEGOVINA - 22-10-2020 - 23-10-2020 geotehnika@geotehnika.ba; Website: https://www.geotehnika.ba

MEDITERRANEAN SYMPOSIUM ON LANDSLIDES -07-06-2021 - 09-06-2021 medsymplandslides@gmail.com; Website: https://medsymplandslides.wixsite.com/msl2021

Top-down construction for deep excavations in urban areas - lessons from Hong Kong, London

Διάλεξη που διοργανώθηκε από την British Geotechnical Association και παρουσιάσθηκε στο ICE στις 18 Απριλίου 2018.

Deep excavations in urban areas need to limit ground movements for the protection of surrounding property and generally have limited space for construction.

Top-down construction addresses both issues. Lateral earth support is provided by progressively excavating and constructing permanent robust supporting structures and the completed decks provide working space.

For the majority of underground railway stations bottom-up construction has been adopted. However top-down method can offer substantial savings with no temporary decks and eliminated or reduced temporary strutting.

For buildings with basements, time for completion can be reduced by many months. Early construction of the ground floor can permit early commencement of construction of the super-structure in parallel with completing the underground structures.

Designs and planning for construction of deep underground structures that take account of the interaction between the structures, whether temporary or part of the permanent structure, and the ground, and the method and sequence of construction can be cost effective and efficient.

John Endicott has been based in Hong Kong for some 40 years and will illustrate his talk with examples of using top-down and bottom-up methods in challenging situations such as the West Kowloon High Speed Rail Terminus.

Speaker

Leonard John Endicott

Leonard, an AECOM Fellow in recognition of more than 40 years of engineering excellence in ground engineering, heads their geotechnical practice in the Asia and Pacific Region. He studied at Cambridge University, completing a PhD in 1970 on the deformation of slopes, and is now a Fellow Commoner at St. Catharine's College.

Initially working in London, he worked on the design of steel box girder bridges, space frame structures, and a concrete platform for the North Sea. In 1975 he went to Hong Kong, to work on tender designs for MTR underground railway contracts pioneering soil/structure interaction which is now common-place, where he has been based ever since. He has continued to work on underground railway projects and contributed to the design of more than 100 underground station structures.

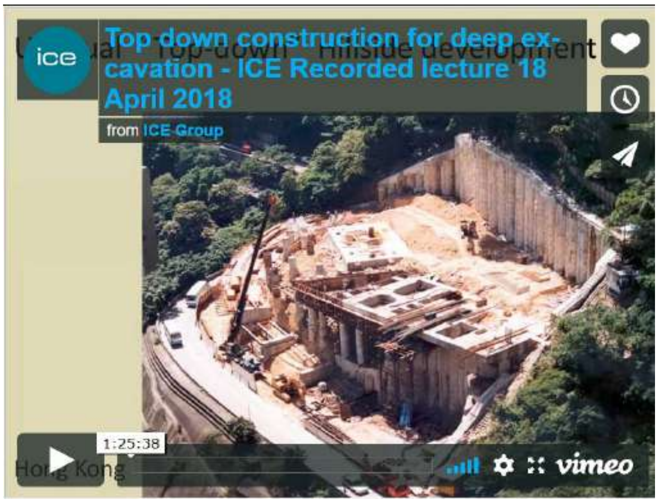
He established and has led a geotechnical practice which has grown to over 500 staff and is engaged in slope works, tunnels, reclamation, foundations and basements. His current responsibilities stretch from India to New Zealand.

He has contributed to the Hong Kong Institution of Engineers as a Member of Council and was a founder of the Geotechnical Division and of the Geotechnical Discipline. He has been a Member of the Town Planning Board in Hong Kong and is a Member of the International Panel of Experts advising the Urban Redevelopment Authority of Singapore.

He has been active at the University of Hong Kong and at Hong Kong University of Science and Technology in supporting and leading MSc programs, examining MPhil and PhD, and steering research, as well as being an Adjunct Professor at both Universities.

He is in frequent demand as a Keynote Lecturer and has authored or joint-authored some 60 technical papers on a wide range of geotechnical topics. Current interests are diverse and include soil/structure interaction, shear creep in soft clays, hydraulic conductivity of rock masses, and geological risk.

Watch this event: https://vimeo.com/271159162



https://ice.org.uk/eventarchive/top-down-construction-in-urban-areas-london?_ccCt=jJPRL5vyO3BnR%7e%7emvD3bafTSFB6eoJ%7erebZLi5pRva8NmkCXPL3N14BLdDPXGoSX

29th ISRM online lecture by Prof. Francois Malan at 10 a.m. GMT, 30 March 2020

Dear ISRM Members and Rock Mechanics Colleagues,

For the 29th ISRM Online Lecture the ISRM invited Professor Francois Malan, from University of Pretoria, South Africa. The title of the lecture is "**Rockburst support in shallow-dipping tabular stopes at great depth**".

The lecture will be broadcast on Monday 30th March, at 10 AM GMT and will remain available in the online lectures dedicated webpage.

Prof Malan started his geotechnical career in 1993 and spent the next 11 years at the Chamber of Mines Research Organisation (later CSIR Miningtek). There he conducted research on the rock mass behaviour in deep tabular mines. His particular interest during this period was the time-dependent behaviour of hard rock and he used this as topic for his PhD thesis. In 2011 he joined Groundwork Consulting and worked on pillar designs and layout problems in the South African platinum industry, geotechnical problems in the deep gold mines and instrumentation development for geotechnical applications. In 2011, he joined the gold mining industry and was appointed as Senior Consultant Rock Engineering of Gold Fields South Africa. These mines were taken over by Sibanye Stillwater in 2013 and he remained with Sibanye Stillwater. In 2018, he joined the University of Pretoria as Associate Professor.

Over the years, he has received various awards for his contributions to rock engineering. These include five gold and silver medals from the South African Institute of Mining and Metallurgy and three Salamon awards from the South African National Institute of Rock Engineering for best publications. The ISRM awarded him the Rocha medal in 2011 and in 2017 he presented the Franklin Lecture at the AfriRock Symposium in Cape Town. One of his PhD students, Dr Michael du Plessis, was also awarded the Rocha medal in 2018. Prof Malan has authored or co-authored over 81 technical papers on rock engineering and he delivered 7 invited keynote addresses at national and international conferences.

Between 2007-2011, Prof Malan served as ISRM Vice-President for Africa. Prior to this, he was also the President of the South African National Institute of Rock Engineering for the period from 2003 -2005. Prof Malan is a Fellow of the South African Institute of Mining and Metallurgy, a Fellow of the South African National Institute of Rock Engineering and a member of the Society of Mining Professors. He acts as a reviewer for several rock engineering journals and is a member of the publications committee of the Journal of the South African Institute of Mining and Metallurgy.

The lecture will remain online so that those unable to attend at this time will be able to do it later. As usual, the attendees will be able to ask questions to the lecturer by e-mail during the subsequent five days. All online lectures are available from **this page**.

ΔΙΑΚΡΙΣΕΙΣ ΕΛΛΗΝΩΝ ΓΕΩΤΕΧΝΙΚΩΝ ΜΗΧΑΝΙΚΩΝ

Άντα Αθανασοπούλου-Ζέκκου
Πρόεδρος του USUCGER

Στο Geocongress 2020, η Άντα Αθανασοπούλου-Ζέκκου εξελέγη Πρόεδρος του United States Universities Council on Geotechnical Education and Research (USUCGER), που είναι ο οργανισμός στις Ηνωμένες Πολιτείες για όλα τα γεωτεχνικά προγράμματα στα Αμερικανικά Πανεπιστήμια. Η θητεία της ως Πρόεδρος είναι 2ετής. Είναι επίσης η νεώτερη Πρόεδρος στην ιστορία του Οργανισμού.

Η Άντα είναι Assistant Professor στο Dept. of Civil and Environmental Engineering, University of California, Berkeley με ενδιαφέροντα σε *Energy, Civil Infrastructure and Climate, GeoSystems*. Στο βιογραφικό της στο USUCGER αναφέρεται:

My research focus and expertise is on assessing and mitigating the impact of multi-hazard stressors on geotechnical engineering infrastructure, with particular emphasis on challenges due to age-related deterioration, population growth and densification, natural and human-made hazards, and new demands from climate change. I particularly investigate (1) the response of flood protection systems such as levees that are old and rapidly deteriorating as well as threatened by increasing demands due to increasing water levels, (2) the performance of critical systems such as ports during earthquakes, (3) the effects of man-induced vibrations from pile driving in dense urban environments and near critical infrastructure such as bridges and retaining walls, and (4) the use of new materials, advanced sensing and next-generation laboratory and field testing to inform us on efficient and sustainable mitigation of aging systems. I use a combination of computational models that are always tied to physical experimental testing in the laboratory or the field, and/or field measurements or monitoring data. My work has involved the development of customized and new experimental setups that allow me to gain insights into the processes involved, the use of advanced computational techniques (finite elements, finite differences and discrete elements), and the incorporation of new materials or monitoring technologies as part of considered mitigation schemes.

Δημήτρης Τερζής: Ο Έλληνας μηχανικός που δημιουργεί μια βιώσιμη εναλλακτική στο τσιμέντο

Συνιδρυτής και επικεφαλής της MeduSoil, η οποία αναπτύσσει μια βιώσιμη και πιο φθηνή εναλλακτική στο τσιμέντο είναι ο Δημήτρης Τερζής, ο ένας από τους τρεις Έλληνες που περιλαμβάνονται στη φετινή ευρωπαϊκή λίστα "30 κάτω των 30" του Forbes στην κατηγορία "Μεταποίηση και Βιομηχανία".

Ο 29χρόνος Δημήτρης Τερζής αποφοίτησε το 2014 από τμήμα Πολιτικών Μηχανικών του Αριστοτελείου Πανεπιστημίου Θεσσαλονίκης. Το 2017 ολοκλήρωσε το διδακτορικό του στη Μηχανική στο Πολυτεχνείο της Λοζάνης (École polytechnique fédérale de Lausanne - EPFL), στο οποίο μέχρι και σήμερα είναι Λέκτορας, υπεύθυνος για το μάθημα "καινοτομία στις κατασκευές και το περιβάλλον".

Το 2018 ίδρυσε την startup εταιρεία MeduSoil η οποία μόλις σε δύο χρόνια έχει συγκεντρώσει κεφάλια ύψους σχεδόν 1 εκατ. ευρώ. Η εταιρεία, η οποία είναι τεχνοβλαστός (spin off) του Πολυτεχνείου της Λοζάνης, δραστηριοποιείται στην ανάπτυξη βιώσιμων υλικών που χρησιμοποιούνται στις κατασκευές.

"Για ένα πράγμα είμαι σίγουρος, πως εάν δεν ακούς τα προβλήματα που πρακτικά αντιμετωπίζουν συνεργάτες ή πελάτες σου, εάν δεν κάνεις τις σωστές ερωτήσεις, εάν δε συζητάς με ανθρώπους που ξεκίνησαν κάτι καινούργιο για να μάθεις και να εμπνευστείς από τις επιτυχίες/αποτυχίες τους, δεν υπάρχει περίπτωση να χτίσεις μία εταιρία που θα κάνει κάτι παραγωγικό και θετικό για την αγορά και την κοινωνία", σημειώνει στο Capital.gr ο Δρ. Τερζής με αφορμή τη συμμετοχή του στη λίστα των "30 κάτω των 30" του Forbes.

"Έτσι βλέπω τη λίστα του Forbes, σαν ένα περιβάλλον όπου θα μάθω, θα ανταλλάξω εμπειρίες και θα τα μεταφέρω όλα αυτά στην ομάδα μου ώστε όλοι μαζί να βελτιώσουμε ό,τι κάνουμε. Αυτό έμαθα να κάνω και σαν ερευνητής, να διαχειριστώ πόρους, γνώση και ερωτήματα ώστε να αφήσω κάτι που λειτουργεί και βελτιώνει δραστικά τις λύσεις σε προβλήματα που θα συνεχίσουν να υπάρχουν", προσθέτει.

Τι κάνει η MeduSoil

Ειδικότερα, η εταιρεία της οποίας ηγείται ο Δρ. Τερζής δραστηριοποιείται -κυριολεκτικά- στον πιο βασικό τομέα των υποδομών, το έδαφος και τα θεμέλια. Αναπτύσσει μικρά σωματίδια τα οποία κάνουν το έδαφος πιο ανθεκτικό και πιο σταθερό, μειώνοντας τις πιθανότητες διάβρωσης του εδάφους, η κάποιας καθίζησης.

Μέσω της εισαγωγής βιοϋλικών (biominerals) που αναπτύσσει και παράγει η MeduSoil το έδαφος μετατρέπεται σε πέτρα και σταθεροποιείται με αποτέλεσμα να μπορούν να δημιουργηθούν γερά θεμέλια. Έτσι, μπορούν να κατασκευαστούν κτήρια και άλλες κρίσιμες υποδομές σε εδάφη που αυτό δεν θα ήταν κανονικά εφικτό. Δεν είναι άλλωστε τυχαίο πως το όνομα της εταιρείας είναι εμπνευσμένο από τη Μέδουσα. Το τέρας της ελληνικής μυθολογίας που μετέτρεπε όποιον την κοιτούσε σε πέτρα.

Η τεχνολογία αυτή είναι ιδιαίτερα σημαντική, καθώς σε πολλές αστικές περιοχές ανά τον πλανήτη η οικοδομήσιμη γη έχει περιοριστεί. Ακόμη, καθώς οι υποδομές γερνούν και τα έντονα καιρικά φαινόμενα ενισχύονται τα εδάφη γίνονται ολοένα και πιο ασταθή, θέτοντας την ασφάλεια πολλών κτισμάτων σε κίνδυνο.

Εκτός όμως από την περιβαλλοντική διάσταση του θέματος η εταιρεία στοχεύει να αποκτήσει μερίδιο στην αγορά της σταθεροποίησης του εδάφους, η οποία εκτιμάται ότι μπορεί να φτάσει τα 25 δισ. δολάρια ετησίως. Η MeduSoil προσφέρει μια εναλλακτική στο τσιμέντο και άλλα προϊόντα βασισμένα στο πετρέλαιο που σύμφωνα με την εταιρεία δεν είναι απλά πιο φιλική περιβαλλοντικά αλλά και οικονομικά συμφέρουσα.

Η MeduSoil, διαθέτει πατέντες που βρίσκονται σε ισχύ σε ΕΕ, ΗΠΑ, Ιαπωνία, Κίνα, Βραζιλία και Αυστραλία και στοχεύει να επεκταθεί μέσα στην επόμενη διετία σε τουλάχιστον 15 αγορές. Για τον σκοπό αυτό, μέσα στο 2020 σχεδιάζει να προχωρήσει σε έναν κύκλο χρηματοδότησης ύψους 1,5 εκατ. ευρώ.

Σημειώνεται ότι η λίστα του Forbes φιλοξενεί 300 φερέλπιδες νέους και πιθανούς ηγέτες του αύριο, από 10 διαφορετικούς κλάδους, που επιχειρούν να επανεφεύρουν τόσο την επιχειρηματικότητα όσο και την κοινωνία. Εκτός του Δρ. Τερζή στην φετινή λίστα περιλαμβάνονται άλλοι δύο Έλληνες: Η 29χρόνη Ειρήνη Δεδούση και ο επίσης 29χρόνος Γιώργος Κελεσίδης.

(Capital, 19 Μαρτίου 2020, https://www.capital.gr/forbes/3438798/dimitris-terzis-o-ellinas-mixanikos-pou-dimiourgei-mia-biosimi-enallaktiki-sto-tsimento?utmsource=email)

Dimitrios Terzis

École Polytechnique Fédérale de Lausanne | EPFL · Civil Engineering Institute

Dimitrios Terzis, Ph.D, currently works as a research scientist at the Swiss Federal Institute of Technology (EPFL). He is a Civil Engineer and currently focuses on earth stabilisation applications based on innovative bio-geo-chemical methods.

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ΠΡΟΣΕΧΕΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΚΔΗΛΩΣΕΙΣ

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

Ημερίδα "Ο Ρόλος της Γεωμορφολογίας στη Σύγχρονη Κοινωνία", 29 Απριλίου 2020, Αθήνα

TISOLS

Tenth International Symposium on Land Subsidence

17 - 21 May 2021, The Netherlands

Living with Subsidence
Delft - Gouda, the Netherlands
www.tisols2020.org/tisols2020

Land subsidence, or land-level lowering, is a major problem that threatens the viability and sustainable economic development for millions of people throughout the world, especially in (but not restricted to) highly urbanized coastal areas. It is often a result of overexploitation of groundwater resources. The total costs globally amount up to many billions of dollars annually.

New innovative technologies and approaches are needed to reduce or, in the best case, to stop land subsidence. TISOLS intends to bring together 250 international experts to share the latest research and insights on natural and anthropogenic land-level lowering.

At TISOLS in the Netherlands, we provide a platform to share our understanding of land subsidence, reliable data, and innovative techniques. Ultimately, we aim to increase the acknowledgement of the land subsidence problem in order to devise targeted strategies and solutions for long-term sustainable living conditions in subsiding areas. This means that at TISOLS we take on the challenge that lies in linking hydrological, geotechnical and geological knowledge to policy and socially acceptable solutions.

TISOLS is organized under the auspices of the Unesco IHP Land Subsidence International Initiative. This working group has endeavored to improve and disseminate knowledge on land subsidence since the 1970s, through International Symposia on Land Subsidence, collaborative projects and publications.

Contact

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tisols2020.org

Cities on Volcanoes 11 - Volcanoes and Society: environment, health and hazards, 23-27 May 2020, Heraklion, Crete, https://pcoconvin.eventsair.com/volcanoes11

14th Baltic Sea Geotechnical Conference 2020 Future Challenges for Geotechnical Engineering, 25 ÷ 27 May 2020, Helsinki, Finland, www.ril.fi/en/events/bsgc-2020.html

Nordic Geotechnical Meeting Urban Geotechnics, 25-27 May 2020, Helsinki, Finland, www.ril.fi/en/events/ngm-2020.html

5th Symposium of the Macedonian Association for Geotechnics, 28 ÷ 30 May 2020, Ohrid, North Macedonia, mag@gf.ukim.edu.mk

ICE Virtual Library

Reuse of waste in geotechnical engineering
Upcoming themed issue of
Environmental Geotechnics Journal
www.icevirtuallibrary.com/page/ice-news/cfp-enge-05-2020

Waste is a natural consequence of all human activities and has been generated during the whole of mankind's existence. The last two centuries, however, have added a new dimension to this problem: growth and densification of world population, industrialization, use of combustible fuels, intensive development of technology, social importance of goods consumption, planned obsolescence of products, and input of new synthetic materials, among other factors, have resulted in an alarming magnitude of waste generation.

Reuse and recycling of waste is a must for environmental conservation, reducing waste disposal and exploitation of natural materials, besides bringing forth economic and social gains through the creation of jobs and work posts and the enhancement of energy efficiency. Building materials and pavement construction are the areas in civil engineering where recycled materials have been most intensively used. Geotechnicians can also contribute meaningfully by developing applications of waste as geotechnical materials or, even more boldly, by creating new geomaterials from waste.

This themed issue of *Environmental Geotechnics* on reuse of waste in geotechnical applications aims to show past and on-going practical experience, design and research, as well as proposals for the future.

Topics to be addressed might include:

- Geotechnical and geo-environmental behavior of waste
- Construction technology based on recycled materials and waste
- Lifecycle of geo-environmental materials
- Disasters waste
- Ecoefficiency
- Sustainability of geotechnical works with waste
- Designing with recycled materials
- Legal and regulation aspects of reuse
- Carbon emission in geotechnical works with reuse of waste
- Energy and waste reuse in Geotechnics
- Nanotechnology applied to waste reuse in geotechnics

Submit your 200 word abstract by: 31 May 2020. Full submissions: 31 August 2020

Contact for more information: sam.hall@icepublishing.com

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ICED 2020 First International Conference on Embankment Dams: Dam Breach Modeling and Risk Disposal, 5 – 7 June 2020 in Beijing, China, http://iced-2020.host30.voosite.com

ISGPEG 2020 International Conference on Innovative Solutions for Geotechnical Problems in Honour of Prof. Erol Guler, 11 - 12 June 2020, Istanbul, Turkey, www.isgpeg2020.org/en

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International Conference on Challenges and Achievements in Geotechnical Engineering
11-13 June 2020, Tirana, Albania
emy@greengeotechnics.com

The Albanian Geotechnical Society (AGS) is pleased to invite you to the International Conference on Challenges and Achievements in Geotechnical Engineering, to be held at POLIS University (Tirana, Albania). This conference is organized on the occasion of the 20th anniversary of the foundation of the Albanian Geotechnical Society. This is the 5th international event organized by AGS, following the two conferences held in 2011 and 2015, and the two workshops held in 2004 and 2007. The event is organized in collaboration with POLIS University and is supported by the International Society of Soil Mechanics and Geotechnical Engineering (ISSMGE).

The conference aims to highlight various aspects of geotechnical engineering problems and challenges faced by geotechnical professionals in their everyday practice. We hope to provide an international interactive platform for discussion and collaboration for geotechnical professionals and applicants from all countries are welcomed. Practicing engineers, researchers and students are invited and encouraged to participate, to submit written contributions and also to present their works.

Themes

Papers covering a wide spectrum of geotechnical engineering will accepted.

The following is a list of the conference themes:

− Laboratory testing
− Site investigation/Field testing
− Foundations
− Ground improvement
− Seismicity and mitigation
− Numerical and analytical modeling
− Tunneling
− Rock mechanics
− Geo-environments
− Landslides and slope stability
− Underground construction and deep excavations

Contact Information

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EUROCK 2020 Hard Rock Excavation and Support, 13-19 June 2020, Trondheim, Norway, www.eurock2020.com

DFI Deep Mixing 2020, 15 to 17 June 2020, TBD, Gdansk, Poland, www.dfi.org/DM2020

XIII International Symposium on Landslides - Landslides and Sustainable Development, June 15th – 19th 2020, Cartagena, Colombia, www.scg.org.co/xiii-isl

EGRWSE 2020 - 3rd International Conference on Environmental Geotechnology, Recycled Waste Materials and Sustainable Engineering, 18-20 June 2020, Izmir, Turkey, www.egrwse2020.com

GEE2020 International Conference on Geotechnical Engineering Education 2020, June 24-25, 2020, Athens, Greece, www.erasmus.gr/microsites/1168

E-UNSAT 2020 4th European Conference on Unsaturated Soils - Unsaturated Horizons, 24-06-2020 ÷ 26-06-2020, Lisbon, Portugal, https://eunsat2020.tecnico.ulisboa.pt

IS-Cambridge 2020 10th International Symposium on Geotechnical Aspects of Underground Construction in Soft Ground, 29 June to 01 July 2020, Cambridge, United Kingdom, www.is-cambridge2020.eng.cam.ac.uk

New Date ASIA 2020 Eighth International Conference and Exhibition on Water Resources and Renewable Energy Development in Asia, 30 June - 2 July 2020, Kuala Lumpur, Malaysia, www.hydropower-dams.com/asia-2020

16th International Conference of the International Association for Computer Methods and Advances in Geomechanics – IACMAG - CHALLENGES and INNOVATIONS in GEOMECHAN-

ICS, 01-07-2020 ÷ 04-07-2020, Torino, Italy, www.symposium.it/en/events/2020/16th-international-conference-of-iacmag?navbar=1

7th ICRAGEE International Conference on Recent Advances in Geotechnical Earthquake Engineering and Soil Dynamics, 13 – 16 July 2020, Bengaluru, India, http://7icragee.org

RTG²EE - Recent Trends in Geotechnical and Geo-Environmental Engineering and Education, 15 – 17 July 2020, Bali, Indonesia, https://rtgee.org

5th Annual Urban Underground Space & Tunnelling conference, 20th – 22nd July 2020, Singapore, www.me-assets.com/HTMLEmail/AS-IF5361%20-%20Flyer.pdf

3rd International Conference on Geotechnical Engineering (ICGE – Colombo -2020), 10 - 11 August 2020, Colombo, Sri Lanka, http://icgecolombo.org/2020/index.php

ISFOH 2020 4th International Symposium on Frontiers in Offshore Geotechnics, 16 – 19 August 2020, Austin, United States, www.isfog2020.org

2020 CHICAGO International Conference on Transportation Geotechnics, August 30 - September 2, 2020, Chicago, Illinois, USA, http://conferences.illinois.edu/ICTG2020

New Date WTC 2020 in Malaysia postponed to September 2020 WTC 2020 ITA-AITES World Tunnel Conference, Kuala Lumpur, Malaysia, www.wtc2020.my

EUROGEO WARSAW 2020 7th European Geosynthetics Congress, 6-9 September 2020, Warsaw, Poland, www.eurogeo7.org

37th General Assembly of the European Seismological Commission, 6 to 11 September 2020, Corfu, Greece, www.escgreece2020.eu

6th International Conference on Geotechnical and Geophysical Site Characterization "Toward synergy at site characterisation", 7 ÷ 11 September, Budapest, Hungary, www.isc6-budapest.com

7th International Conference on Industrial and Hazardous Waste Management 15th - 18th September, 2020, http://hwm-conferences.tuc.gr

ACE 2020 14th International Congress on Advances in Civil Engineering, 16-18 September 2020, Istanbul, Turkey, www.ace2020.org/en

27th European Young Geotechnical Engineers Conference and Geogames, 17 – 19 September 2020, Moscow, Russia, https://t.me/EYGEC2020

ICEGT-2020 2nd International Conference on Energy Geotechnics, September 20-23, 2020, La Jolla, California, USA, https://icegt-2020.eng.ucsd.edu/home

EUROENGEO 3RD EUROPEAN REGIONAL CONFERENCE OF IAEG, 20-24 September 2020, Athens, Greece, www.euroengeo2020.org

Fourth International DAM WORLD Conference, 21-25th September 2020, Lisbon, Portugal, https://dw2020.lnec.pt

New Date 88th ICOLD Annual Meeting & Symposium on Sustainable Development of Dams and River Basins, 26th September – 1st October 2020, New Delhi, India, https://www.icold2020.org

☙ ❧

GEO-EXPO 2020

Scientific and Expert Conference
22-23 October 2020, Prijedor, Bosnia and Herzegovina
www.geotehnika.ba

On behalf of the Geotechnical Society of Bosnia and Herzegovina, we are pleased to invite you to take part in the 10th Scientific and Expert Conference GEO-EXPO 2020 in Prijedor, Bosnia and Herzegovina.

GEO-EXPO 2020 will be held on 22nd - 23rd October 2020 at the Hotel Prijedor in Prijedor, Bosnia and Herzegovina.

The aim is to gather geo-experts, professionals and researchers from the countries in the Adriatic-Balkan region and world-wide, concerned with underground engineering, mining, civil engineering, geology, landslides, geotechnics, infrastructure, environmental engineering, hazard and risks.

Themes

The GEO-EXPO 2020 is an opportunity for the scientists, engineers and professionals to present papers and case studies related to:

- underground structures,
- mining,
- civil and environmental engineering,
- landslides in general,
- geotechnical investigation and monitoring,
- geotechnical hazard and risk,
- infrastructure,
- foundations,
- landfills.

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☙ ❧

HYDRO 2020 Strategies for future progress, 24-26 October 2020, Strasbourg, France, www.hydropower-dams.com/hydro-2020

☙ ❧

4th International Conference on Rock Dynamics and Applications (RocDyn-4)
26–28 October 2020 Melbourne, Australia
https://rocdyn.org

The Fourth International Conference on Rock Dynamics and Applications (RocDyn-4) will be hosted in Melbourne, Australia on **28-30 October 2020**. RocDyn-4 is to be organised by Monash University of Australia, in association with University of Cambridge, Nanyang Technological University of Singapore, Tianjin University, and other universities and institutes around the world. The organisers of RocDyn-4 would like to welcome researchers and engineers of the rock mechanics and rock engineering community to Melbourne in 2020 to participate the meetings and the discussions on rock dynamics and applications.

RocDyn-4 conference covers various topics related to rock dynamics and engineering applications, highlighting the innovations in scientific research, technology development, and engineering solution. The topics can range from mathematical and analytical methods, micromechanics constitutive relations, fracture dynamics, rate dependent properties, continuum and discontinuum numerical modelling, laboratory techniques, testing and observation, field measurements techniques, instrumentation and monitoring of dynamic response, multi-scale and multi-physics modelling, earthquake and induced seismology, rock burst monitoring and control, explosion and blasting control, landslide and slope safety, rock block movement and impact structure design, rock fragmentation and fracturing, mechanised rock excavation, support of rock tunnels and caverns under earthquake and other dynamic loads.

On behalf of RocDyn-4 organisers, we look forward to meeting scientists and engineers working on rock dynamic research and practice in Melbourne, to share and to cooperate, with a common aim to advance rock dynamics, from research to engineering.

THEMES

RocDyn-4 is a specialised conference devoting to the discussion on rock dynamics and engineering applications. RocDyn-4 plans to highlight the current scientific research activities and engineering application challenges. The technical presentations will cover all the aspects related to rock dynamics and engineering applications, including, but not limited to the following topics:

- Experimental techniques and laboratory testing;
- Dynamic theories and numerical simulation;
- Dynamic loading on rock structures;
- Dynamic ground support;
- Seismic management in underground excavation;
- Blasting and explosions;
- Earthquake-related engineering issues: structure damage, landslides, etc.;
- Coal mine burst prevent controls;
- Hydraulic fracturing;
- Case studies.

CONTACT

For all queries regarding RocDyn-4, please contact:

RocDyn-4 Conference Secretariat, Email: civeng-RocDyn@monash.edu

New Date GeoAmericas2020 4th Pan American Conference on Geosynthetics, 26-29 October 2020, Rio de Janeiro, Brazil, www.geoamericas2020.com

3rd International Symposium on Coupled Phenomena in Environmental Geotechnics, October 29th – 30th, 2020, Kyoto, Japan, https://cpeg2020.org

5TH World Landslide Forum Implementation and Monitoring the USDR-ICL Sendai Partnerships 2015-2015, 2-6 November 2020, Kyoto, Japan, http://wlf5.iplhq.org

Fourth GeoMEast©2020 International Underground Structures Conference (IUSC), 8-12 November 2020, Cairo, Egypt, http://underground.geomeast.org

ISRM Specialized Conference

CouFrac 2020

International Conference on Coupled Processes in Fractured Geological Media: Observation, Modeling, and Application

November 11 - 13, 2020, Seoul, Korea

http://coufrac2020.org

The CouFrac (International Conference on coupled processes in fractured geological media: observation, modeling, and application) invites you to Seoul, Korea, November 11-13, 2020. The conference, in succession of the 1st one in Wuhan, China in 2018, will focus on new and exciting advances in all areas of coupled processes associated with fractured geological media, including numerical methods, in-situ tests, lab experiments and applications to various subsurface engineering.

Special Sessions

1. Scientific machine learning applications for coupled processes in the subsurface
2. Coupled processes for geological disposal of nuclear waste

General Sessions

1. Coupled Thermo-Hydro-Mechanical-Chemical (THMC) processes in single fractures
2. Numerical modelling of the interaction of coupled thermo-hydro-mechanical processes and complex geological settings and heterogeneities
3. Mechanics of Hydraulic Fracturing in Naturally Fractured Reservoirs
4. Enhanced Geothermal Systems (EGS)
5. Numerical modelling of coupled thermo-hydro-mechanical processes in fractured rocks
6. Advances in discontinuum-based simulation of coupled processes during rock progressive failure
7. Advances in computation of coupled processes in fractured media across scales: numerical modeling and machine learning
8. Mechanics of induced seismicity: managing complexity from lab to field scale
9. Advances in fluid injection induced shear slips on natural fractures

10. Coupled seismo-thermo-hydro-mechanical-chemical processes in natural fracture networks: from field observation to numerical simulation
11. Experimental Studies for Fracture Characterization of Rock across Scales
12. Understanding Individual and Coupled Processes through Geo-architected Materials across Scales
13. Coupled THM hard rock fracture behaviour – laboratory experiments and numerical modelling
14. Coupled THM field experiments in fractured hard rock
15. THMC coupling in geological CO2 storage: from lab to the field scale
16. Coupled multiphysics during coal gas and shale gas extraction
17. Numerical modelling of coupled thermo-hydro-mechanical processes associated with hydraulically induced fracture propagation
18. Long term behavior of fractured geological media under coupled THMC environment
19. Numerical modelling of long term THM coupled processes in fractured hard rock
20. THMC coupling in clays

For further detail information, please visit the Conference website http://www.coufrac2020.org

10th International Conference on Scour and Erosion (ICSE-10), November 15-18, 2020, Arlington, Virginia, USA, www.engr.psu.edu/xiao/ICSE-10 Call for abstract.pdf

6th ICFGE 2020 Forensic Geotechnical Engineering & Geo-Disaster Documentation, December 10-12, 2020 IIT Delhi, India, http://tc302-issmge.com

New Date for 2021 to be announced ARMS11 11th Asian Rock Mechanics Symposium, Challenges and Opportunities in Rock Mechanics, Beijing, China, www.arms11.com

GeoAsia 2021

7th Asian Regional Conference on Geosynthetics: Hazard's Risk Management, Innovation, and Sustainability

March 1-4, 2021, Taipei, Taiwan

MSL 2021 The 1st Mediterranean Symposium on Landslides SLOPE STABILITY PROBLEMS IN STIFF CLAYS AND FLYSCH FORMATIONS, 7-9 June 2021, Naples, Italy, https://medsymplandslides.wixsite.com/msl2021

9th International Conference on Computational Methods for Coupled Problems in Science and Engineering (COUPLED PROBLEMS 2021), 13-16 June 2021, Sardinia, Italy, coupledproblems_sec@cimne.upc.edu

EUROCK TORINO 2021 - ISRM European Rock Mechanics Symposium Rock Mechanics and Rock Engineering from theory to practice, 21-25 June 2021, Torino, Italy, http://eurock2021.com

1st International Conference on Sustainability in Geotechnical Engineering, ICSGE, 27-30 June 2021, Lisboa, Portugal, http://icsge.lnec.pt/#

ICONHIC2021

3rd International Conference on

Natural Hazards & Infrastructure

ATHENS, GREECE | JUNE, 2021

ICONHIC2021 is coming to Athens

We are proud to announce that the 3rd International Conference on Natural Hazards & Infrastructure will take place in June 2021 in Athens, Greece.

2021 marks the 200 years of the Independence of the Greek State and the country's capital is preparing to commemorate this historic anniversary with iconic events throughout the year.

At ICONHIC2021, we proudly endorse these events and invite our delegates to jointly create a major conference, set to define a new era of progress, cooperation and new ideas.

GEOCHINA 2021 - 6th GeoChina International Conference Civil & Transportation Infrastructures: From Engineering to Smart & Green Life Cycle Solution, July 19 to 21, 2021, NanChang, China, http://geochina2021.geoconf.org

PanAm Unsat 2021 3rd Pan-American Conference on Unsaturated Soils, 25-28 July 2021, Rio de Janeiro, Brazil, https://panamunsat2021.com

5th International Workshop on Rock Mechanics and Engineering Geology in Volcanic Fields

9÷11 September 2021, Fukuoka, Japan

Contact Person: Prof. Takatoshi Ito
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SYDNEY 7iYGEC 2021 7th International Young Geotechnical Engineers Conference A Geotechnical Discovery Down Under, 10-12 September 2021, Sydney, Australia, http://icsmge2021.org/7iygec

SYDNEY ICSMGE 2021 20th International Conference on Soil Mechanics and Geotechnical Engineering, 12-17 September 2021, Sydney, Australia, www.icsgme2021.org

International Conference on Textile Composites and Inflatable Structures (MEMBRANES 2021), 13-15 September 2021, Munich, Germany, https://congress.cimne.com/membranes2021/frontal/default.asp

LATAM 2021 – IX Latin American Rock Mechanics Symposium Challenges in rock mechanics: towards a sustainable development of infrastructure, 20-22 September 2021, Asuncion, Paraguay, https://larms2021.com

GeoAfrica 2021 - 4th African Regional Conference on Geosynthetics Geosynthetics in Sustainable Infrastructures and Mega Projects, October 2021, Cairo, Egypt, https://geoafrica2021.org

LARMS 2022

IX Latin American Congress on Rock Mechanics, Rock Testing and Site Characterization
15-18 May 2022, Asuncion, Paraguay

Symposium Themes

- Site characterization,
- Rock mass properties,
- Rock mass classification,
- Foundations,
- Slopes,
- Tunnels,
- Soft Rock,
- Shotcrete

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Eurock 2022

Rock and Fracture Mechanics in Rock Engineering and Mining
13÷17 June 2022, Helsinki, Finland

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

9th International Congress on Environmental Geotechnics
Hightlighting the role of Environmental Geotechnics in Addressing Global Grand Challenges
26-29 June 2022, Chania, Crete island, Greece
www.iceg2022.org

The 9th International Congress on Environmental Geotechnics is part of the well established series of ICEG. This conference will be held on an outstanding resort in the town of Chania of the island of Crete in Greece. The theme of the conference is "Hightlighting the role of Environmental Geotechnics in Addressing Global Grand Challenges" and will highlight the leadership role of Geoenvironmental Engineers play on tackling our society's grand challenges.

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UNSAT2022
8th International Conference on Unsaturated Soils
June or September 2022, Milos island, Greece

cs so

12 ICG
12th International Conference on Geosynthetics
September 18 – 22, 2022, Rome, Italy

cs so

15th ISRM
International Congress in Rock Mechanics
9÷14 October 2023, Salzburg, Austria

Contact Person: Prof. Wulf Schubert
E-mail: salzburg@oegg.at

ΕΝΔΙΑΦΕΡΟΝΤΑ ΓΕΩΤΕΧΝΙΚΑ ΝΕΑ

Massive Landslides Caught on Camera

https://www.youtube.com/watch?v=chWk1v50KfQ

https://www.youtube.com/watch?v=PmLHg-mLrMU

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

https://www.youtube.com/watch?v=aIB_Cd3JzcA

https://www.youtube.com/watch?v=wjUyYIaQ0BY&feature=share&fbclid=IwAR1KRRdecYsoTML7Yfzx_QZSz2utH-BBG7RCtnp4_gUn92yhFYN9pTfMopB8

https://www.youtube.com/watch?v=Vd7eHG2b_tQ

Colorado rethinks dam safety as climate change heightens risk for state's 27 "unsatisfactory" structures

New rules for assessing stability at dams factor in temperature increases and potential for sudden hard rains

A climate-driven shift toward extreme storms has compelled Colorado officials to rethink the safety of hundreds of dams across the state that hold water and mine waste, including 27 high-hazard structures near people that already are listed as deficient.

They're trying to calculate the potential for sudden hard rain resulting in flooding and accelerated erosion that could trigger fatal collapses. It comes down to physics: Climate scientists project temperature spikes by at least 2 degrees Fahrenheit in Colorado before 2070, and warmer air holds more moisture.

New rules taking effect Jan. 1 require tougher dam designs "to account for expected increases in temperature and associated increases in atmospheric moisture." State officials are contemplating structural work costing $100 million a year to boost resilience.

Jeremy Franz, design review engineer for the Colorado Division of Water Resources's Dam Safety division, takes notes before a final inspection of work at Tucker Dam in Arvada on Nov. 20, 2019.

The likelihood that heavier rain may saturate dams and rupture spillways ranks among the multiplying impacts of climate change that are forcing costly responses.

Wildfires burn more uncontrollably, ravaging forests, threatening people who live in the woods and raising firefighting costs. Shrinking mountain snowpack and an overall trend toward aridity is flummoxing farmers and spurring the ski industry to rely more on artificial snow. Heatwaves render increasingly dense, paved-over cities less habitable.

The nation's aging dams have been collapsing more than twice as often as they did before 1980, Stanford University researchers have found. And while dam failures that kill people and spread toxic mud remain rare, risks are rising for the growing numbers of Americans who live and work downstream.

"We recognize that Colorado is already feeling the impacts of climate change," state natural resources director Dan Gibbs said in a written response to questions from The Denver Post.

"We are incorporating climate impacts into our regulatory and policymaking processes. The more our agency can do today, the more prepared future generations will be to lessen the impacts of global warming and protect our communities, public health and natural resources," Gibbs wrote.

Old dams, old assumptions

The 90,580 dams around the nation, including 1,737 in Colorado, were built on assumptions of rainfall and flooding derived from weather data collected before 1980. Hundreds of these dams have been deteriorating nationwide, raising risks that communities could be inundated — and now could deteriorate more rapidly.

For example, a 55-year-old earthen dam above Breckenridge that holds the municipal water supply would inundate the town if it collapsed. Rain and runoff from melting snow, seeping under concrete spillways, has created voids.

"The voids are becoming larger," Breckenridge public works director James Phelps said in a recent interview. Town officials have embarked on a $20 million fix with federal help to be completed by 2023, Phelps said.

"We've definitely been seeing more severe events. We didn't used to get these types of storms," he said. "The weather patterns are more severe, more staccato than they used to be. They are not as predictable as they once were."

Dams built more than 100 years ago to store water for irrigating crops in what now is metro Denver loom among those deemed unsatisfactory. These include the Smith Dam in suburban Lakewood and the Polly Deane Dam above Littleton. Urban housing and commercial development downstream means failures likely would be deadly. Breaches would inundate thousands of people between western mountain foothills and the South Platte River.

Snow covers the Goose Pasture Tarn Dam and Reservoir outside Breckenridge on Nov. 21, 2019.

A Denver Post examination of state records and interviews with dam safety officials found that, among 432 high-hazard dams statewide where failure likely would kill people, 27 are rated by state inspectors as unsatisfactory. A dozen have been classified that way for more than five years, records show.

Colorado's deficient high-hazard dams are, on average, 95 years old, data shows. They're scattered around the state, mostly near where settlers built communities.

Colorado relies on dam owners to maintain structural stability. Most dams are privately owned. A dozen state dam safety engineers conduct annual inspections at the 432 "high-hazard" and about 300 more "significant hazard" dams to assess stability. Low-hazard dams often aren't inspected unless developers are constructing new housing and shops nearby.

Repair decisions are left to the owners. However, state officials have the power to impose restrictions on how much water can be stored behind ailing dams, which creates an incentive encouraging owners to make repairs. Owners often resist. Dam repairs can cost hundreds of millions of dollars.

Ranch operations manager Gilbert Marin Jr. looks out over 70 Ranch Reservoir in Kersey on June 25, 2019. The large new reservoir was built and is owned by Bob Lembke, president of United Water and Sanitation District. The dam is not on the list of the state's deficient or at-risk structures.

"This is not an emergency situation. If we keep the water level under the 2-feet restriction (a drop in the water level required since 1995), it's a safe situation," said Peter Acker, manager of the Agricultural Ditch and Reservoir Company that owns the Smith Dam in Lakewood.

Reinforcing that dam, which enables an emergency "drought" water supply for irrigating metro farms and parks, "is not cost-effective," said Acker, who added that climate change impacts appear uncertain.

"They don't know," he said. "Everybody's just guessing on this climate change thing."

Yet the restrictions mean a huge loss of potential revenue by reducing the amount of water that can be stored. Now amid Colorado's intensifying population growth and development boom, developers, farmers, suburban water providers and state planners are pressing for construction of new dams and expansion of existing dams.

Colorado has lost storage space for nearly 118,000 acre-feet of water statewide under the restrictions imposed just on the high-hazard dams, records show. By comparison, Denver Water's long-planned expansion of Gross Reservoir in Boulder County by raising a dam would add about that amount of water storage capacity at a cost of $340 million.

A changing climate's impact

Colorado officials working with federal climate scientists recently conducted a $1.6 million study aimed at improving methods for assessing dam safety in view of projected climate impacts. They worked with the National Oceanic and Atmospheric Administration and the University of Colorado to create computer modeling tools for engineering analysis that factor in weather science to estimate rainfall.

This study drove the initial efforts to boost resilience in the face of climate warming. Colorado's new dam safety rules incorporate an "atmospheric moisture factor," recognizing that sudden intense rain could blow through existing spillways.

Over the next year, state inspectors will conduct reviews and determine where repairs and reinforcements must be made, Colorado dam safety director Bill McCormick said. McCormick recently was elected to serve as president of the National Association of State Dam Safety Officials.

"In the past, we assumed a stationary climate. The methods that we used to determine rainfall were all backward-looking, at historic storms. Now it doesn't seem that is the smartest way to do it anymore," McCormick said.

"Since we have this changing climate, we have the potential of getting behind. We have to change, find ways to look forward."

Costs in Colorado are expected to top $100 million a year, more than twice what state lawmakers have been allocating for dam maintenance. Nationwide, the state dam safety officials association has estimated that fixing all ailing dams, including more than 12,500 high-hazard dams, would cost $70 billion.

Dam owners may be eligible for Federal Emergency Management Agency funds. Colorado officials received a $260,000 grant for engineering work at the Smith and Polly Deane dams in west metro Denver.

Other states around the country face rising risks and likely will be compelled to act as old dams deteriorate and storms intensify, McCormick said. "There are things we can and should be doing. Let's get this on our radar."

Dam failure rates

Catastrophic dam failures in the United States — such as the 2017 Oroville Dam failure that forced evacuations of 190,000 people in California and failures in the 1970s in Idaho and Georgia that claimed 53 lives — have been relatively rare. However, state data shows more than 84 "incidents" requiring quick intervention and dam failures each year. And maps showing "inundation zones" still are kept secret, in line with counterterrorism precautions instituted after the Sept. 11, 2001, attacks — which frustrates residents.

Top: Rescue workers remove a body from the flooding waters near the Toccoa Falls Bible College on Nov. 6, 1977, after a dam burst above the college sending floodwaters through a dorm area. The water also destroyed a wide area of homes. Bottom left: A damaged property is seen under floodwaters in Oroville, Calif., on Feb. 13, 2017. Almost 200,000 people were under evacuation orders in Northern California after a threat of catastrophic failure at the United States' tallest dam. Bottom right: A worker keeps an eye on water coming down the damaged main spillway of the Oroville Dam in Oroville, Calif., on Feb. 14, 2017. A hole in the emergency spillway in the Oroville Dam threatened to flood the surrounding area. (Getty Images file)

Dam failure rates are increasing. Between 1848 and 2017, dams in the United States failed at an average rate of 10 a year, according to a 2018 engineering study from Stanford University's National Performance of Dams Program. Colorado had 88 dam failures, more than other states except for Georgia and South Carolina where relatively recent flooding blew out hundreds of small dams. After 1980, dams nationwide failed at an average rate of 24 a year, the study found. And 3.8% of dam failures in the United States led to one or more deaths.

The last major dam failure in Colorado happened suddenly in 1982. Deterioration of the earthen Lawn Lake Dam in Rocky Mountain National Park led to a breach that released 220 million gallons of water, killing three people and causing $31 million in damage around the town of Estes Park.

Some of the worst disasters worldwide resulted from failures at old mines. Colorado and other western states that for more than a century prioritized mineral extraction are left with massive earthen dams that hold mine waste in what are meant to be permanent impoundments.

When floods trigger breaches at mine dams, billions of gallons of mud gush downward, inundating communities, destroying land and vegetation, and clogging waterways.

Colorado officials for years exempted the state's five mine waste dams from dam safety regulations. However, state mining regulators oversee the mine dams, said Russ Means of the Colorado Division of Reclamation, Mining and Safety.

Four are located at Climax Molybdenum facilities west of Denver. The risk is that coarse, wet sediment could become too saturated, leading to loss of stability, Means said. But mine waste dams in the state appear safe, built to withstand heavy rain over 24 hours from "100-year storms," he said. "These are high priority sites. These sites are inspected monthly."

Colorado's new rules may be extended to mine waste dams as protocols to guide future maintenance, state officials said.

Fixing dams jibes with interest in Colorado for more water storage capacity to enable population growth and development. When assessing the stability of old dams, owners and state overseers have identified options not only to regain use of restricted storage but also to expand dams and reservoirs.

"We need to look at where we can add storage safely and economically," McCormick said. "For us, public safety is the first priority. But we also understand economics."

(Bruce Finley | bfinley@denverpost.com | The Denver Post, December 1, 2019, https://www.denverpost.com/2019/12/01/colorado-dam-safety-climate-change)

History, Mapping, and Hydraulic Monitoring of a Buried Stream under a Central Business District

Marcus F. Aguilar, Randel L. Dymond, and David R. Cooper

Abstract

The terminal effect of urbanization on streams is their burial in culverts, with their disappearance from the visible landscape eventually resulting in their disappearance from the local perspective. This case study describes the historical research, logistical planning, and execution of a mapping and hydraulic monitoring program to characterize a stream with intermittent flooding issues that was buried under the Roanoke Virginia, central business district at the beginning of the twentieth century. This includes (1) a review and synthesis of the historical literature pertaining to the stream and springs; (2) a description of the methodology used to map the stream tunnels in a confined space under high vehicular traffic; and (3) the deployment and preliminary results of a distributed flow-depth monitoring program. The methodology presented can be used by other localities addressing flooding issues caused by buried streams, and the results of the monitoring program demonstrate the value of this effort in directing infrastructure improvement spending and identifying water quality issues. A complete characterization of buried streams is critical to provide a benchmark as Roanoke and other localities invest in stream and watershed capital-improvement projects with the intent of improving hydrologic function.

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https://ascelibrary.org/doi/full/10.1061/%28ASCE%29WR.1943-5452.0001131

Ultimate Pullout Capacity of Vertical Anchors in Frictional Soils

Azmayeen Rafat Shahriar, Mohammad Shariful Islam, and Rowshon Jadid

Abstract

This paper presents an analytical model for the estimation of the ultimate pullout capacity of vertical anchors embedded in frictional soils. The analytical model developed using the principle of limit equilibrium will be capable of capturing more realistic variations in pullout capacity because of its inherent capability to consider three-dimensional failure scenarios, anchor roughness, and anchor material effects. The analytical model was verified with three-dimensional numerical simulations. In addition, the predictions from the proposed model were compared to several pullout capacity prediction models using 86 experimental data points from literature. Results show that the present model can predict the pullout capacity of shallow and intermediate anchors with more accuracy and reliability than the available pullout capacity prediction models. In addition, a comprehensive parametric analysis is also presented. Some of the basic conclusions are: the demarcation aspect ratio between a single and continuous anchor is 10 rather than 5; the omission of the contribution from side flanks to the ultimate pullout capacity resulted in a discrepancy of as much as 37.4%; and δ/φ' does not remain constant, irrespective of the embedment depth ratio and anchor aspect ratio.

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https://ascelibrary.org/doi/10.1061/%28ASCE%29GM.1943-5622.0001576

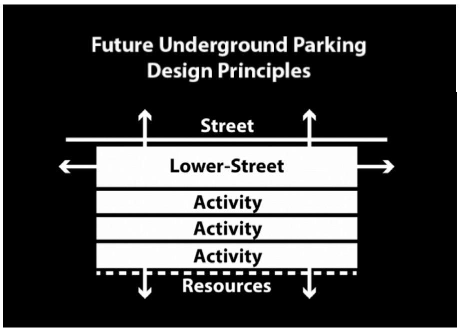
DPA-X and indigo group explore the future car parks of the mobility revolution

DPA-X, the integrated research platform of dominique perrault's practice, has carried out a major study of underground parking architecture. the firm has teamed up with **indigo group**, the world's largest car park operator, to imagine what the parking garage of the future could look like. *'it is clear that tomorrow's car park will no longer be a simple inert storage space, but that it will be transformed to integrate changes in mobility by becoming a place at the service of users and vehicles,'* says the introduction to the report, which is titled 'car park futures — opportunities in the underground'.

DPA-X and indigo group will be launching an international architecture competition on designboom that will explore the car parks of the future and how they will facilitate the mobility revolution. read more about the report below and stay tuned as more details about this exciting opportunity will be announced on designboom soon.

Parking du capitole, toulouse

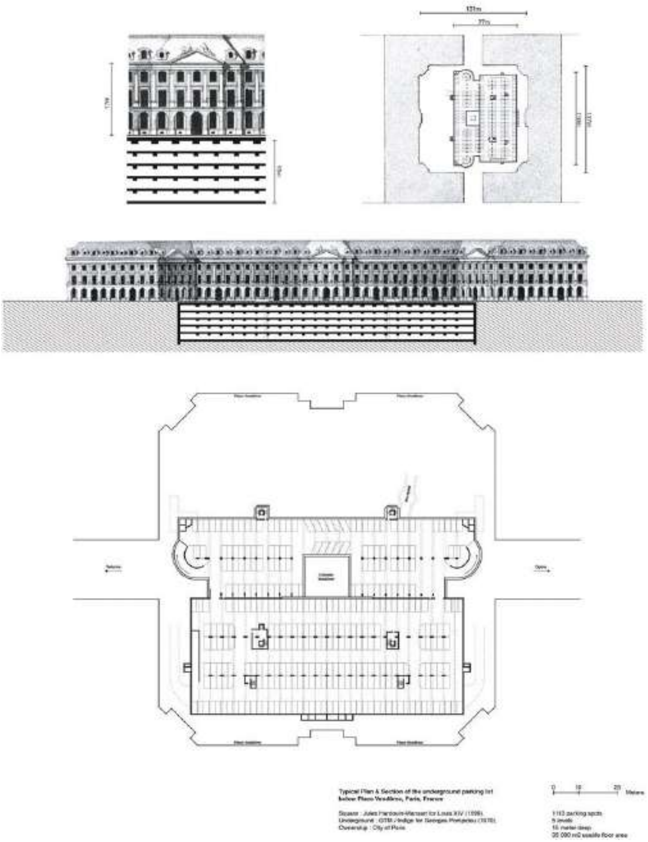
the study says that the underground parking garages of the future will host a range of programs and services, from logistics and storage areas to mobility services and energy management. by questioning the common perception of underground spaces being dark and hostile places, the study seeks to embrace these subterranean settings as resources that complement urban activity at ground level.



Design principles

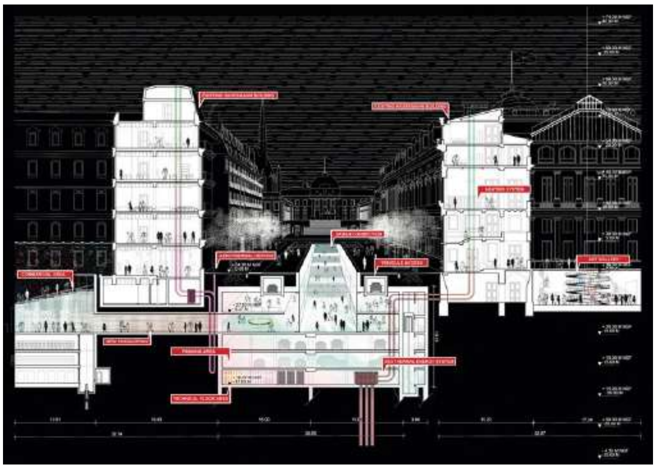
the study begins by asking three questions: what answers can underground car park infrastructure bring to the current mobility revolution?; can subterranean spaces be diversified in terms of program to respond to the many challenges raised by emerging mobilities?; can subterranean spaces be redefined through design to serve users' daily life and become a common consideration for planners?

the team began by analyzing the history and location of underground car parks, such as the invisible garage beneath *place vendôme* in paris. built by GTM, now **indigo group**, a five-storey parking garage allows the historic plaza above to retain its original appearance and serve as a public square for pedestrians. **DPA-X** points out that underground car parks have no façade and only interiors — they are mainly defined by their sites.



Place vendôme, paris

the study also examines the modern streetscape and its embedded utilities and services, including: sewage, water, gas, electricity, phone lines, internet cables, and even transit routes. with available space in cities becoming increasingly rare, the report views the metropolitan underground as an untapped resource.



Street profile — 21st century

after examining a number of precedents, the report identifies four scenarios for underground parking garages: car park retrofit; deep square; deep avenue; and deep ground. the first scenario, 'parking retrofit', concerns the re-conversion of existing underground car parks, mainly in dense historic metropolitan areas. the 'deep square' is a city square typology where amenities are integrated underground to open up the surface level or to service a multi-purpose hall, while the 'deep avenue' is a multi-level street infrastructure that can be 'unrolled' below the main circulation axes of dense metropolises. finally, the 'deep ground' scenario consists of creating a thick common ground below and between buildings integrating services and utilities.

Scenario 01: parking retrofit

the report concludes by considering the sustainability of underground buildings, stating that they are 'naturally more sustainable'. the analysis adds that both new and reconverted underground car parks could achieve the highest level of sustainability certifications. other relevant issues, such as digital mapping and the design requirements of self-driving vehicles, are also examined. read the report in full on DPA-X's website https://dpa-x-homepage-test01.squarespace.com/carpark-futures-indigo.

Groundscaping and transport connection

Cultural spaces in a reconverted underground parking lot

Scenario 02: deep square

A multi-purpose markethall spread over several levels

Dedicated logistic areas for users and businesses

Scenario 03: deep avenue

Doubling the street with a service level

Non-human light industries occupy the lowest levels and use the ground's energy

Scenario 04: deep ground

A thick common ground servicing several buildings at once

Multimodal transportation hub

Project info:

Car park futures — opportunities in the underground sub_estate for **indigo group** a report by **DPA-X** consultancy with **dominique perrault architecture**

Download the PDF report:
https://drive.google.com/drive/folders/15h3Kj-cAvb1iVUWR4yhWBeInT3GbfDRR

(Philip Stevens / designboom, Feb 28, 2020, https://www.designboom.com/architecture/dpa-x-indigo-group-future-car-parks-mobility-revolution-02-28-2020)

The landslide-induced TGV (high speed train) accident in France yesterday

Yesterday, 5 March 2020, a TGV (high speed train) struck a landslide between Strasburg and Vendenheim in the Bas-Rhin area of France. The train remained upright, not least because it appears that it was a glancing blow rather than a direct collision, but 22 people were injured, one seriously. The best news report, with thanks to Scott Johnson, is in L'Usine Nouvelle.

The landslide is a large rotational slip in a slope in a cutting. The displacement of the mid-section is quite large, but little of the debris appears to have reached the tracks. This prevented a more serious accident. The train, which had 348 passengers on board, was travelling 270 kilometres per hour (170 miles per hour) at the time of the collision.

The line is quite new – Wikipedia indicates that it was constructed in the period between 2010 and 2016. A failure on this scale will inevitably cause concern, and is surprising. News reports indicate that the landslide was triggered by heavy rainfall. Interestingly, this is being described as an "accident intolerable" – i.e. an unacceptable accident – by the local trade union.

The 5 March 2020 landslide that derailed a TGV (high speed train) in France.

After the accident, the train came to a stop at about 48.729, 7.514, based on matching images to Google Earth. The accident must have been to the southeast of this point. The most likely location appears to be 48.719, 7.538, but this is very tentative.

Landslide-induced train accidents occur fairly often around the world, sometimes with very serious consequences. It is very unusual for an accident to affect a modern high speed line, especially in well-designed earthworks, which would typically have been constructed with a c.125 year design life. Thus, understanding the causes of this accident will be a priority.

Comment

The local geology of this failed slope may be unique compared to the surrounding terrain. The failure occurs on the flank of a hillock probably underlain by sandstone with a limestone carapace. There is also dolomite and chalk in the region. The scarp shows some geometric, high-albedo surfaces that I interpret as evidence of structure in resistant dolomite or chalk. The geology also appears to differ on either side of the track … is the track on a geologic discontinuity? These subsurface geologic conditions have the makings of slope failure without sufficient engineering measures to improve the factor of safety. Additionally, surface drainage is likely the major contributing factor to triggering the failure. There is a paved road that slopes down towards the failed slope. I can't find imagery to support observations, but there may be no drainage ditch or just a shallow one along the road. At the crest of the hillock approaching the bridge abutment to the west of the failure, the road is cut on both sides forming a channel for rainfall to accumulate and divert downslope towards the failure. Furthermore, there are no obvious diversion trenches, lined or unlined, along contour of the slope. The slope is micro-benched for shallow stability and has two or three larger benches for global stability but there is no obvious slope reinforcement. Just by looking at the imagery and a small-scale geologic map it seems obvious that this slope should have had better surface drainage, sub-drainage, and slope reinforcement. I really wonder what led the engineering team to consider that slope reinforcement wasn't necessary. We will probably learn the geologic model was too conceptual and not site-specific enough… they probably used the subsurface exploration for the bridge abutments as the design basis for the slopes instead of drilling and trenching the slopes themselves. Failure of engineered slopes along major infrastructure is intolerable. We must accept some risk from large natural slopes as a practicality, but once we investigate, design and engineer a slope there is close to zero tolerance even if the risk of failure is never eliminated with engineering measures (*Bob Sas*).

(AGU / The Landslide Blog, 6 March 2020, https://blogs.agu.org/landslideblog/2020/03/06/tgv-1)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΣΕΙΣΜΟΙ

Seismic insulation helps Parthenon survive the centuries

The Parthenon has survived all manner of natural assaults since its construction in 438 BC, but engineers have only recently discovered why it still stands despite the many earthquakes it has endured. The structure has no foundation but it does have protection against quakes due to its three forms of seismic insulation.

Full Story: Greek Reporter blog

(SmartBrief, ASCE, 10/7/2019, https://www.smartbrief.com/s/2019/10/seismic-insulation-helps-parthenon-survive-centuries-0)

The Engineering Secrets That Enabled the Parthenon to Survive Time, Nature — and Man

The Parthenon, the icon of Western civilization, which stands in splendor on Acropolis Hill in Athens, has stood for 2,500 years, miraculously surviving the ravages of time, nature and mankind.

For decades, engineers, architects and scientists have wondered exactly how this ingenious structure has successfully stood the test of time to continue to tower majestically over the Greek capital.

This architectural and engineering wonder, with its height, width and depth defining the very concept of perfect proportion, has kept its secrets for many centuries since its completion in the year 438 BC.

That is, until engineers and architects recently revealed the Parthenon's design and construction secrets.

After several studies, it has been recently revealed that, despite the fact that the temple of the Parthenon does not even have a foundation, it has triple anti-seismic protection which is responsible for keeping it upright after the many earthquakes and upheavals of the past 25 centuries.

According to civil engineer Niki Timotheou, studies of its architectural and structural form have shown that the Ancients had already discovered what we today call "seismic insulation."

The temple, according to Timotheou, successfully contradicts all theories of modern civil engineering because even though it has no foundation whatsoever, and stands right on bedrock, it has three means of insulating itself against earthquakes.

This triple insulation, as the engineer explained, is located in different parts of the structure. The first point consists of the layers of enormous, extraordinarily smooth marble slabs on which the Parthenon stands.

The second is found in the metal joints attached to the plates of each layer, around which lead has been poured. Lead not only has the vital property of protecting the iron from rust, but additionally, its softness and elasticity absorb any kind of tremor, and part of the tremor's kinetic energy is thereby converted into thermal energy in the lead.

The third insulation point is located in the pillars of the structure, which are not made of single columns of rock, despite their appearance from afar. The ancient Greeks already knew that in order to withstand the vibrations of the earth, all the columns had to consist of "slices," which were perfectly carved and matched with each other.

The result of this triple-insulating formula, Timotheou noted, was that the seismic waves on the earth's surface push one layer of marble slabs over the other at the same time as all the joints of the building absorb the kinetic energy produced by the quake.

Additionally, the way the columns were positioned allows the entire building to oscillate, but not to collapse, in the event of a sizable earthquake.

After the affront of having its interior used as an ammunition dump by the Ottomans and the subsequent explosion caused by artillery fire from a Venetian attack on Sept. 26, 1687, the iconic building continued to stand, despite being damaged.

Considering its great age, its location in an active seismic zone and the fact that it was the site of an explosion, the Parthenon's survival seems nothing less than a miracle, even taking into account its brilliant engineering.

Watch the fascinating documentary below:

https://www.youtube.com/watch?time_continue=228&v=toz7dqlU6Io&feature=emb_logo

(Philip Chrysopoulos / GREEK REPORTER, Oct 2, 2019, https://greece.greekreporter.com/2019/10/02/the-engineering-secrets-that-enabled-the-parthenon-to-survive-time-nature-and-man-video/)

Bridge protection in catastrophic earthquakes

Anchoring technology saves lives with robust seismic bridge restraining systems

More than 1 million people have died in the 1800 magnitude 5+ earthquakes recorded worldwide since 2000.

Bridges are the most vulnerable parts of a transport network when earthquakes occur, obstructing emergency response, search and rescue missions and aid delivery, increasing potential fatalities.

While engineers have designed structures to withstand destructive natural forces like extreme winds and tornadoes, catastrophic earthquakes such as the 2010 Haiti earthquake (over 310,000 fatalities) or the 2011 Tōhoku earthquake in Japan (over 20,000 fatalities) remain a challenge.

To mitigate the impacts of such major earthquakes, a team of researchers at University of Technology Sydney (UTS) have a developed an application for ground anchors as the main seismic resisting system for ultimate protection of bridges against catastrophic earthquakes.

Led by Associate Professor Behzad Fatahi and supported by Mootassem Hassoun (PhD Candidate) at the School of Civil and Environmental Engineering this new application can protect bridges against earthquake levels well above code recommendation.

Despite the stringent design codes enforced globally, and technological advancement in seismic design and protection of structures, more effort is required to lower fatality rates and financial losses. This is particularly relevant as rapid urbanisation creates higher population concentrations in seismically active zone such as Japan and Indonesia where 230,000 were recorded nationally following a single earthquake in 2004.

Associate Professor Fatahi and his team have developed an advanced three-dimensional computer model to simulate and evaluate the seismic capacity of anchored bridges subjected to some of the world's most catastrophic earthquakes.

Ground anchors are constructed from high tensile capacity steel cables commonly used to support deep excavations in city centres. The cables are light and flexible but can carry tremendous pulling capacity.

They are embedded into the ground behind the bridge, avoiding any effects on the bridge aesthetic looks, and grouted for a certain length in order to secure the anchors into the ground. The proposed ground anchors are passive and flexible, which allows the bridge to expand and shrink during its normal seasonal cycles without cracking.

The benefit of this technology is its low cost and high effectivity: it is cheap yet delivers incredible strength and energy dissipation into the ground - a material that is technically free.

"Our findings prove that bridges restrained with ground anchors have a superior seismic behaviour compared to traditional or even modern bridges with modern seismic protection devices such as viscous dampers," said Associate Professor Fatahi.

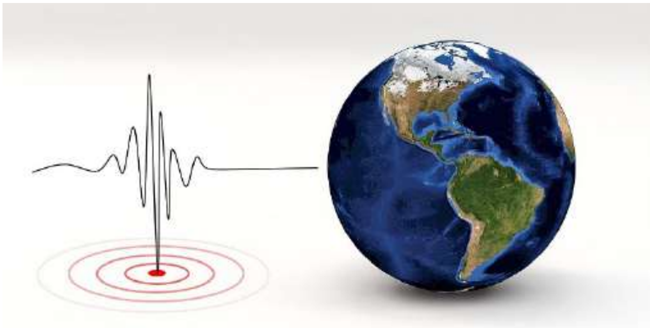
This increases the feasibility of bridges with much lighter and economical foundations, and reduced size and cost of safe bridge construction while maintaining - or even increasing - the capacity of the bridge to sustain significant earthquake motions.

The team tested their solution for many high magnitude earthquakes, including the massive 1995 Kobe earthquake in Japan, which damaged nearly 400,000 structures. Their research shows that bridges equipped with the novel ground anchor technology could survive catastrophic earthquakes and remain nearly undamaged while bridges designed using conventional seismic mitigation techniques had collapsed.

Many nations could build or amend earthquake safe bridges at a low cost, as it can also be adopted to retrofit older bridges designed and constructed to previous codes and therefore under-designed against large earthquakes.

(EurekAlert / University of Technology Sydney, 9-Dec-2019, https://www.eurekalert.org/pub_releases/2019-12/uots-bp120919.php)

Duke U. engineers' new model could help predict earthquakes (+ video)

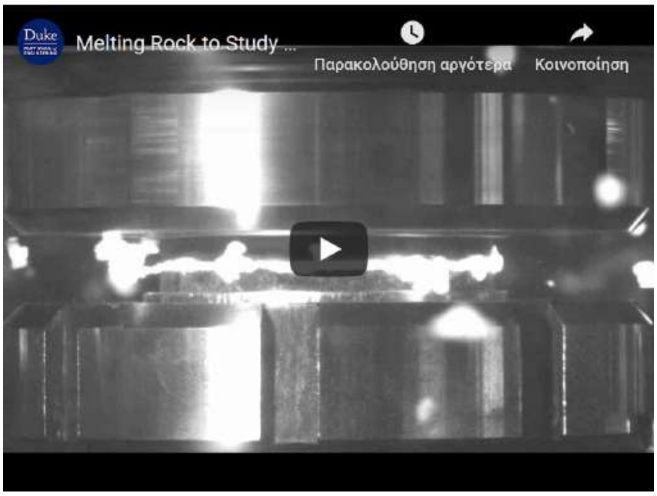


Engineers at Duke University have devised a model that can predict the early mechanical behaviors and origins of an earthquake in multiple types of rock. The model provides new insights into unobservable phenomena that take place miles beneath the Earth's surface under incredible pressures and temperatures, and could help researchers better predict earthquakes—or even, at least theoretically, attempt to stop them.

The results appear online on January 17 in the journal Nature Communications.

"Earthquakes originate along fault lines deep underground where extreme conditions can cause chemical reactions and phase transitions that affect the friction between rocks as they move against one another," said Hadrien Rattez, a research scientist in civil and environmental engineering at Duke. "Our model is the first that can accurately reproduce how the amount of friction decreases as the speed of the rock slippage increases and all of these mechanical phenomena are unleashed."

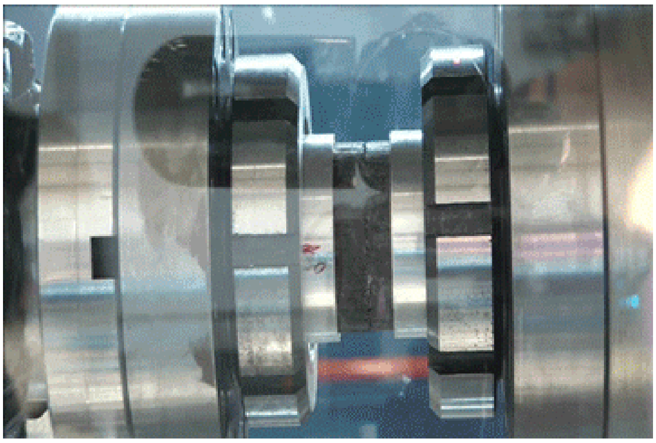
For three decades, researchers have built machines to simulate the conditions of a fault by pushing and twisting two discs of rock against one another. These experiments can reach pressures of up to 1450 pounds per square inch and speeds of one meter per second, which is the fastest underground rocks can travel. For a geological reference point, the Pacific tectonic plate moves at about 0.00000000073 meters per second.



Melting Rock to Study the Origins of Earthquakes
https://www.youtube.com/watch?v=Ig-GizAuSDg&feature=emb_logo

"In terms of ground movement, these speeds of one meter per second are incredibly fast," said Manolis Veveakis, assistant professor of civil and environmental engineering at Duke. "And remember that friction is synonymous with resistance. So if the resistance drops to zero, the object will move abruptly. This is an earthquake."

In these experiments, the surface of the rocks either begins to turn into a sort of gel or to melt, lowering the coefficient of friction between them and making their movement easier. It's been well established that as the speed of these rocks relative to one another increases to one meter per second, the friction between them drops like a rock, you might say, no matter the type. But until now, nobody had created a model that could accurately reproduce these behaviors.



Researchers twist rock discs against one another under large amounts of pressure at high speeds to simulate what happens during earthquakes at fault lines. New models from Duke engineers are the first that can accurately reproduce how the amount of friction decreases as the speed of the rock slippage increases and the rock undergoes a phase change. Credit – Giulio DiToro (University of Padova), Elena Spagnuolo and Stefano Aretusini (National Institute of Geophysics and Volcanology, Rome).

In the paper, Rattez and Veveakis describe a computational model that takes into account the energy balance of all the complicated mechanical processes taking place during fault movement. They incorporate weakening mechanisms caused by heat that are common to all types of rock, such as mineral decomposition, nanoparticle lubrication and melting as the rock undergoes a phase change.

Researchers twist rock discs against one another under large amounts of pressure at high speeds to simulate what happens during earthquakes at fault lines. New models from Duke engineers are the first that can accurately reproduce how the amount of friction decreases as the speed of the rock slippage increases and the rock undergoes a phase change. Credit – Giulio DiToro (University of Padova), Elena Spagnuolo and Stefano Aretusini (National Institute of Geophysics and Volcanology, Rome).

After running all of their simulations, the researchers found that their new model accurately predicts the drop in friction associated with the entire range of fault speeds from experiments on all available rock types including halite, silicate and quartz.

Because the model works well for so many different types of rock, it appears to be a general model that can be applied to most situations, which can reveal new information about the origins of earthquakes. While researchers can't fully recreate the conditions of a fault, models such as this can help them extrapolate to higher pressures and temperatures to get a better understanding of what is happening as a fault builds toward an earthquake.

"The model can give physical meaning to observations that we usually cannot understand," Rattez said. "It provides a lot of information about the physical mechanisms involved, like the energy required for different phase transitions."

"We still cannot predict earthquakes, but such studies are necessary steps we need to take in order to get there," said Veveakis. "And in theory, if we could interfere with a fault, we could track its composition and intervene before it becomes unstable. That's what we do with landslides. But, of course, fault lines are 20 miles underground, and we currently don't have the drilling capacity to go there."

This work was supported by the Southern California Earthquake Center (118062196) under the National Science Foundation (EAR-1033462) and the United States Geological Survey (G12AC20038).

(Ken Kingery / WRAL TechWire, January 21, 2020, https://www.wraltechwire.com/2020/01/21/duke-u-engineers-new-model-could-help-predict-earthquakes-video)

Manolis Veveakis
Assistant Professor of Civil and Environmental Engineering

Manolis Veveakis earned a Ph.D. in 2010 from the Department of Mechanics of the National Technical University of Athens, Greece. Before joining Duke University, he was a Senior Lecturer at UNSW's School of Petroleum Engineering since 2014 and a Research Scientist in CSIRO's Division of Earth Sciences and Resource Engineering before that. Veveakis holds a Diploma (BSc+MEng) in Applied Mathematics and Physics (MEng in Materials Engineering), an MSc in Applied Mechanics and a PhD in Geomechanics.

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Research Interests

Geomechanics, theoretical and applied mechanics, and thermodynamics, with emphasis in multiphysical modelling of plasticity of solids, solid-fluid interactions, friction laws and rheology of geomaterials.

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΓΕΩΛΟΓΙΑ

Οι αμμόλοφοι δεν σχηματίζονται τυχαία

Βρετανοί ερευνητές μελέτησαν τις κινήσεις των αμμόλοφων με στόχο να κατανοήσουν με ποιον τρόπο αυτοί σχηματίζονται.

Έχετε αναρωτηθεί ποτέ βλέποντας φωτογραφίες μιας ερήμου εάν ο σχηματισμός των αμμόλοφων γίνεται τυχαία ή εάν «κρύβεται» κάποια λογική πίσω από την εμφάνιση του ξηρού επιβλητικού τοπίου;

Μία ομάδα επιστημόνων από το Πανεπιστήμιο του Κέιμπριτζ έθεσε το ίδιο ερώτημα και με μία σειρά πειραμάτων, τα αποτελέσματα των οποίων δημοσιεύτηκαν στην επιστημονική επιθεώρηση «Physical Review Letters», απέδειξε ότι καθώς οι αμμόλοφοι παρασύρονται από το νερό αλληλεπιδρούν με τους γειτονικούς αμμόλοφους απωθώντας τους. Η αλληλεπίδραση αυτή οδηγεί στο σχηματισμό συγκεκριμένων μοτίβων άμμου.

Αποκρυπτογραφώντας τις κινήσεις

Μέχρι σήμερα οι ερευνητές γνώριζαν ότι οι αμμόλοφοι αλλάζουν θέση εξαιτίας φυσικών παραγόντων όπως ο αέρας ή το νερό, αλλά δεν κατανοούσαν με ποιον τρόπο σχηματίζονται συγκεκριμένα μοτίβα, όπως αμμόλοφοι με όμοια απόσταση ο ένας από τον άλλον. Κλειδί για την κατανόηση αυτής της γνώσης είναι η μελέτη του τρόπου με τον οποίο η αλλαγή της μορφής ενός αμμόλοφου επηρεάζει τη μορφή ενός γειτονικού.

«Υπάρχουν διαφορετικές υποθέσεις για την αλληλεπίδραση των αμμόλοφων», εξήγησε σε σχετικές δηλώσεις του ο διδακτορικός φοιτητής και πρώτος συγγραφέας της δημοσίευσης **Κάρολ Μπάσικ**. *«Η μία υπόθεση υποστηρίζει ότι αμμόλοφοι διαφορετικού μεγέθους συγχωνεύονται μέχρι να σχηματίσουν έναν τεράστιο αμμόλοφο. Η άλλη υπόθεση υποστηρίζει ότι οι αμμόλοφοι συγχωνεύονται εν μέρει και ανταλλάσουν άμμο μέχρι το ύψος τους να εξισωθεί και ως εκ τούτου να παρασύρονται από τον αέρα ή το νερό ομοιόμορφα».*

Αλληλεπίδραση μέσω στροβιλισμών

Τα αποτελέσματα των ερευνητών ωστόσο δεν επιβεβαίωσαν καμία από αυτές τις υποθέσεις. Αντίθετα, προέκυψε μία καινούρια θεωρία βασισμένη στα εν λόγω αποτελέσματα, σύμφωνα με την οποία καθώς κινείται ένας αμμόλοφος παρασυρμένος από το νερό δημιουργεί στροβιλισμούς στο πίσω μέρος του, οι οποίοι ωθούν τον επόμενο αμμόλοφο να απομακρυνθεί σταδιακά από τον πρώτο. Με αυτόν τον τρόπο σχηματίζονται συγκεκριμένα μοτίβα άμμου.

Για να καταλήξουν σε αυτό το συμπέρασμα, οι ερευνητές σχημάτισαν δύο αμμόλοφους μέσα σε ένα σύστημα ρέοντος νερού. Οι επιστήμονες παρατήρησαν ότι ο πρώτος αμμόλοφος άρχισε να κινείται πιο γρήγορα, όμως σταδιακά επιβραδύνθηκε, ενώ παράλληλα η άμμος του δεύτερου αμμόλοφου άρχισε να κινείται σε κατεύθυνση αντίθετη από αυτή του πρώτου. Τελικά, οι δύο αμμόλοφοι κατέληξαν αντιδιαμετρικά σε μεγάλη απόσταση μεταξύ τους.

Τα επόμενα βήματα των επιστημόνων θα είναι να ποσοτικοποιήσουν αυτές τις κινήσεις χρησιμοποιώντας δορυφορικές εικόνες. Όπως οι ίδιοι υποστηρίζουν, τα αποτελέσματα είναι πολύ σημαντικά για εκτάσεις όπου η μετακίνηση των αμμόλοφων αποτελεί σοβαρό πρόβλημα, όπως στην περίπτωση στενών πορθμών ή περιοχών όπου λόφοι άμμου καλύπτουν το οδικό δίκτυο.

(Τσιμπούκης Πάνος / ΤΟ ΒΗΜΑ, 05.02.2020, https://www.tovima.gr/2020/02/05/science/oi-ammolofoi-de-sximatizontai-tyxaia)

Wake Induced Long Range Repulsion of Aqueous Dunes

Karol A. Bacik, Sean Lovett, Colm-cille P. Caulfield, and Nathalie M. Vriend

Abstract

Sand dunes rarely occur in isolation, but usually form vast dune fields. The large scale dynamics of these fields is hitherto poorly understood, not least due to the lack of longtime observations. Theoretical models usually abstract dunes in a field as self-propelled autonomous agents, exchanging mass, either remotely or as a consequence of collisions. In contrast to the spirit of these models, here we present experimental evidence that aqueous dunes interact over large distances without the necessity of exchanging mass. Interactions are mediated by turbulent structures forming in the wake of a dune, and lead to dune-dune repulsion, which can prevent collisions. We conjecture that a similar mechanism may be present in wind driven dunes, potentially explaining the observed robust stability of dune fields in different environments.

https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.124.054501

Η Γη είχε 372 μέρες το χρόνο πριν 70 εκατομμύρια χρόνια

Η Γη περιστρεφόταν πιο γρήγορα στο τέλος της εποχής των δεινοσαύρων πριν περίπου 70 εκατομμύρια χρόνια, από ό,τι σήμερα, πράγμα που είχε ως αποτέλεσμα το 24ωρο της μέρας να είναι κατά μισή περίπου ώρα μικρότερο (23,5 ώρες) και το έτος να έχει 372 αντί για 365 μέρες

Η Γη περιστρεφόταν πιο γρήγορα στο τέλος της εποχής των δεινοσαύρων πριν περίπου 70 εκατομμύρια χρόνια, από ό,τι σήμερα, πράγμα που είχε ως αποτέλεσμα το 24ωρο της μέρας να είναι κατά μισή περίπου ώρα μικρότερο (23,5 ώρες) και το έτος να έχει 372 αντί για 365 μέρες, καθώς ο πλανήτης πραγματοποιούσε περισσότερες περιστροφές στη διάρκεια ενός χρόνου.

Αυτό είναι το συμπέρασμα μιας νέας ευρωπαϊκής επιστημονικής έρευνας που βασίστηκε στη μελέτη των απολιθωμάτων ενός αρχαίου μαλάκιου της Ύστερης Κρητιδικής Περιόδου. Οι ερευνητές, με επικεφαλής τον γεωχημικό Νιλς ντε Βίντερ του Ελευθέρου Πανεπιστημίου των Βρυξελλών, έκαναν τη σχετική δημοσίευση στο περιοδικό παλαιοωκεανογραφίας και παλαιοκλιματολογίας «Paleoceanography & Paleoclimatology».

Το αρχαίο μαλάκιο σαν αχιβάδα, που βρέθηκε στα σημερινά βουνά του Ομάν (μια περιοχή που τότε ήταν τροπικά ρηχά νερά) αναπτυσσόταν γρήγορα και κάθε μέρα πρόσθετε στο σώμα του δακτυλίους ανάπτυξης, όπως συμβαίνει με τους κορμούς των δέντρων, κάτι που επιτρέπει τη δενδροχρονολόγηση. Οι επιστήμονες χρησιμοποίησαν λέιζερ για να μετρήσουν με ακρίβεια τους δακτυλίους αυτούς και να κάνουν νέες εκτιμήσεις για τη διάρκεια της μέρας πριν 70 εκατ. χρόνια.

Επιπλέον, η ανάλυση δείχνει ότι οι θερμοκρασίες των ωκεανών εκείνης της εποχής ήσαν πολύ υψηλότερες από τις σημερινές, φθάνοντας ακόμη και τους 40 βαθμούς Κελσίου τα καλοκαίρια και ξεπερνώντας τους 30 βαθμούς το χειμώνα. Τα εν λόγω μαλάκια εξαφανίστηκαν μαζί με τους δεινόσαυρους της ξηράς μετά την πτώση μεγάλου αστεροειδούς στην περιοχή του Μεξικού πριν 66 εκατομμύρια χρόνια.

Η διάρκεια του έτους δεν έχει αλλάξει στην εξέλιξη της Γης, όμως ο αριθμός των ημερών του έτους συνεχώς μικραίνει, καθώς οι μέρες μεγαλώνουν, κάτι που οφείλεται στην επιβράδυνση της περιστροφής του πλανήτη μας, καθώς η Σελήνη απομακρύνεται με ρυθμό 3,82 εκατοστών ετησίως. Όσο πιο μακριά βρίσκεται το φεγγάρι, τόσο πιο αργά κινείται η Γη γύρω από τον εαυτό της και άρα τόσο μεγαλώνει η διάρκεια μιας πλήρους περιστροφής, δηλαδή μιας μέρας.

(in.gr, 12 Μαρτίου 2020, https://www.in.gr/2020/03/12/tech/gi-eixe-372-meres-xrono-prin-70-ekatommyria-xronia)

Subdaily-Scale Chemical Variability in a *Torreites Sanchezi* Rudist Shell: Implications for Rudist Paleobiology and the Cretaceous Day-Night Cycle

Niels J. de Winter, Steven Goderis, Stijn J.M. Van Malderen, Matthias Sinnesael, Stef Vansteenberge, Christophe Snoeck, Joke Belza, Frank Vanhaecke, Philippe Claeys

Abstract

This study presents subdaily resolved chemical records through fossil mollusk shell calcite. Trace element profiles resolve periodic variability across ~40-µm-thin daily growth laminae in a Campanian *Torreites sanchezi* rudist bivalve. These high-resolution records are combined with seasonally resolved stable isotope and trace element records that allow shell-chemical variability to be discussed on both seasonal and daily scale. A combination of layer counting, spectral analysis of chemical cyclicity and chemical layer counting shows that the rudist precipitated 372 daily laminae per year, demonstrating that length of day has increased since the Late Cretaceous, as predicted by astronomical models. This new approach to determine the length of a solar day in geologic history through multiproxy chemical records at subdaily resolution yields considerably more control on the uncertainty of this estimate. Daily chemical variability exceeds seasonal variability in our records, and cannot be explained by diurnal temperature changes. Instead, we postulate that rudist shell chemistry is driven on a daily scale by changes in light intensity. These results together with those of stable isotope analyses provide strong evidence that *Torreites* rudists had photosymbionts. Bivalve shell calcite generally preserves well. Therefore, this study paves the way for daily-scale reconstructions of paleoenvironment and sunlight intensity on geologic time scales from bivalve shells, potentially allowing researchers to bridge the gap between climate and weather reconstructions. Such reconstructions improve shell chronologies, document environmental change in warm ecosystems, and widen our understanding of the magnitude of short-term changes during greenhouse climates.

(Paleoceanography and PaleoclimatologyVolume 35, Issue 2, 05 February 2020, https://agupubs.onlinelibrary.wiley.com/action/doSearch?target=default&ContribAuthorStored=Winter,%20Niels%20J&SeriesKey=25724525)

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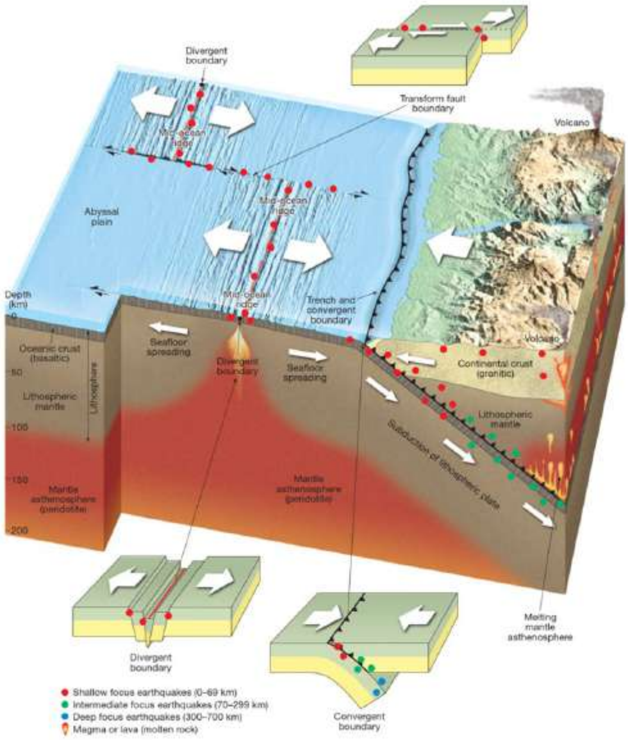
Όρια Τεκτονικών Πλακών - Ρήγματα



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How do we tell the difference between geologic ages?

Which is longer, an era or an epoch?

From the emergence of life to mass extinctions, Earth has gone through incredible changes in its 4.6 billion years. With so much history, how can researchers keep track of what happened when?

You can see the different layers of rock laid down over time in Utah's slot canyon in Grand Staircase-Escalante National Monument.

The system many scientists have settled on is the International Geologic Time Scale (laid out here in the International Chronostratigraphic Chart), which breaks geologic time into five units. From the longest to the shortest and most precise, those units are eons, eras, epochs, periods and ages.

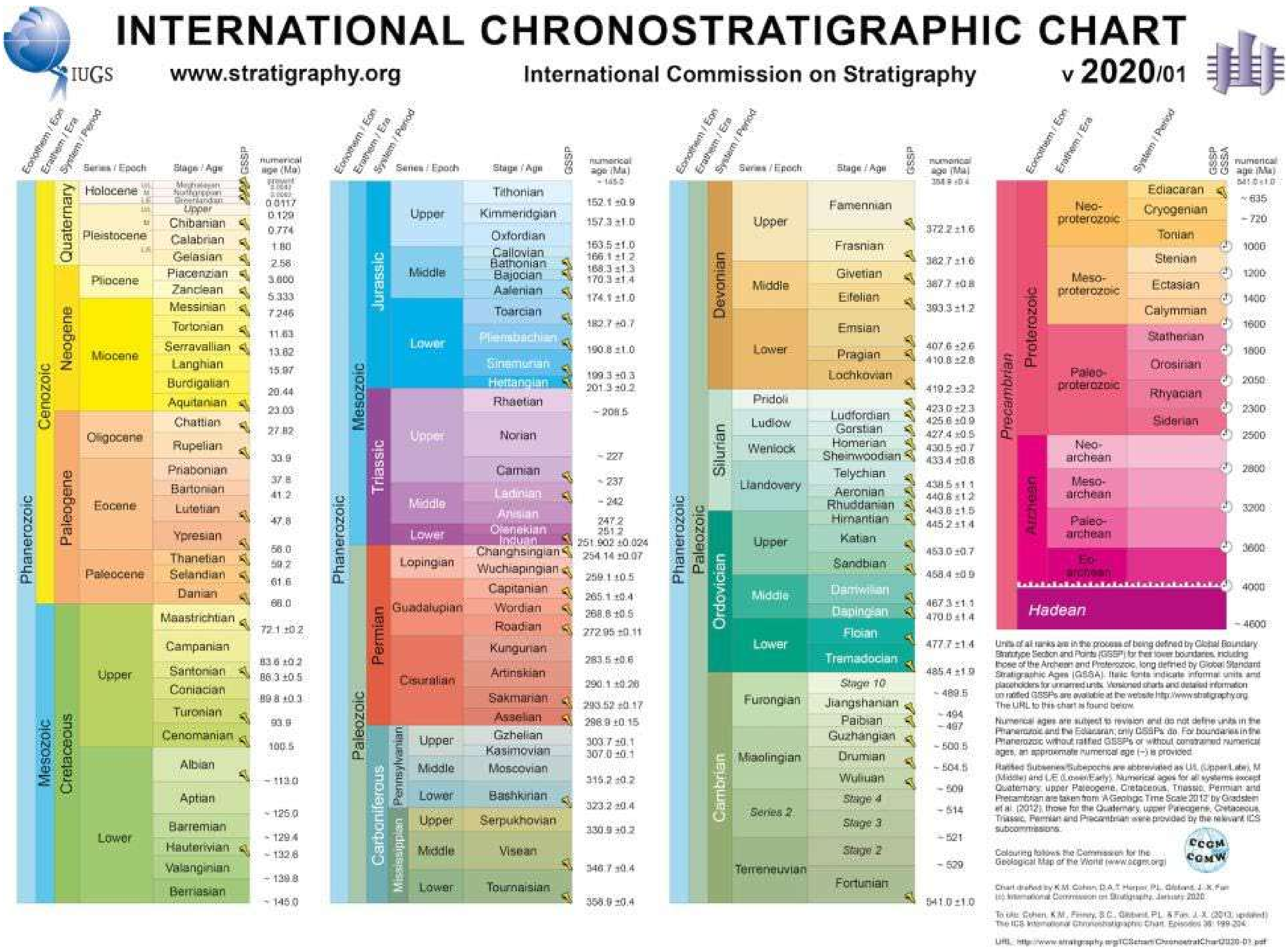
The various stages of geologic time are "defined by visible changes in the fossil record," according to Jacquelyn Gill, associate professor of paleoecology and plant ecology at the University of Maine. Fossils are a handy tool in this dating work for a few reasons. For one, life has likely been around for about 90% of Earth's existence, so the history of Earth is paralleled by the history of life. Fossils are also useful because changes in the fossil record reflect changes in ecology, that is, the relationships between living things and their environment. These changes in Earth's ecology tend to reflect the major events in the planet's history, Gill said.

One important moment in geologic time was the transition from the Mesozoic era to the Cenozoic era about 65 million years ago. The change was spurred by the asteroid impact that eventually killed the nonavian dinosaurs.

"That was one bad afternoon that took time to play out fully," Gill told Live Science. The effects of that bad day have rippled through the tens of millions of years since. It ushered in our current era and allowed mammals and flowering plants to thrive.

"If you [were to] time travel, that's [the earliest point] when you'd know you were on planet Earth," Gill said of the early Cenozoic era, "at least until some weird mammal ran by."

But you don't have to get your hands on a time machine to appreciate the magnitude of the change between the Mesozoic and the Cenozoic. Careful study of a rock layer can be enough to help a researcher figure out its age. For example, the impact credited with ending the Mesozoic era and beginning the Cenozoic era is marked with a layer containing unusually high levels of iridium, which is much more common in meteors than in the Earth's crust.



The International Chronostratigraphic Chart of 2020.

Other changes in mineral and element ratios can offer evidence of Earth's tumultuous history, too. For instance, a little more than 5 million years ago, tectonic activity closed the Strait of Gibraltar, eventually causing the Mediterranean Sea to shrink and its mineral content to spike. This event occurred during the Messinian age and marked the end of the Miocene epoch and the beginning of the Pliocene epoch, about 5.3 million years ago.

"Salt and gypsum deposits are now observable in many of the countries that surround the Mediterranean and are now exposed as rocks above the modern sea level," because of tectonic activity in the millions of years since it happened for the last time, according to Karl Wegmann, an associate professor of geology at North Carolina State University.

Recent advances in geochronology, or rock dating, allow geologists to measure radioactive decay and "assign very precise absolute ages to geologic events," Wegmann told Live Science via email. To do this, geochronologists calculate the age of rocks by comparing the proportions of certain isotopes, or elements that have a different number of neutrons in their nuclei than normal. All of these approaches fit together like a jigsaw puzzle to give researchers a common language for discussing the distant past.

The geologic time scale is a scientific tool, but it's also an artifact of history. Objectively measuring properties like radioactive decay can tell researchers when layers of rock formed, but it's up to scientists, who are often building on the work of their predecessors, to decide how to slice and dice the data into geologic time frames. One of the most contentious questions in chronostratigraphy is how to define our own time.

"The Holocene is kind of an arbitrary epoch," Gill said. The Holocene epoch began about 12,000 years ago when Earth began warming after the last ice age. But according to Gill, the end of that ice age, even though it coincided with the transition to a new epoch, isn't of greater geological importance than the end of the ice ages before it.

Even today, scientists are still naming new windows of time, including the Chibanian age, named after a Japanese prefecture where the sediment defining the age was found. Many scientists and others claim that humans' recent effect on the planet merits the declaration of a new age, the Anthropocene, while other scholars say the Capitalocene more accurately conveys the social systems that have so greatly affected the planet since the Industrial Revolution.

(Grant Currin / Live Science Contributor, 8 March 2020, https://www.livescience.com/why-geolotic-time-periods.html)

Σαντορίνη, τα μυστικά του βυθού της

Για τους επιστήμονες είναι μια πραγματικά συναρπαστική στιγμή. Καθώς τα δεδομένα που λήφθηκαν το 2015 με τη χρήση τεχνολογιών αιχμής στη θαλάσσια έρευνα, αρχίζουν να μπαίνουν σε σειρά, αποκαλύπτουν τι συμβαίνει κάτω από τον βυθό της Σαντορίνης, βαθιά μέσα στη γη, εκεί όπου η λάβα του ηφαιστείου συναντά το υπέδαφος του πυθμένα. Για πρώτη φορά, οι συνεργαζόμενοι Έλληνες και ξένοι επιστήμονες απόκτούν εικόνα για τον μαγματικό θάλαμο: τη θέση του, τη γεωμετρία του και –το ζητούμενο– τη δυναμική του.

Μέχρι πριν από λίγα χρόνια, η γνώση μας για το ηφαίστειο της Σαντορίνης προερχόταν κυρίως από την επιφάνεια: από τους ηφαιστειολόγους, σεισμολόγους και γεωλόγους που ανέλυαν τις δομές των πετρωμάτων και τα ίχνη των ρηγμάτων, αναζητώντας (συχνά με τη βοήθεια της αρχαιολογικής έρευνας) απαντήσεις για το τι συνέβη το 1.630 π.Χ. περίπου, κατά τη διάρκεια της μεγάλης έκρηξης που έδωσε στο νησί το σημερινό του σχήμα και το εντυπωσιακό του φυσικό ανάγλυφο.

Τα τελευταία χρόνια, η έρευνα επεκτάθηκε στον πυθμένα, η χαρτογράφηση του οποίου παρείχε σημαντικά κομμάτια νέας γνώσης. Το 2015, χάρη στην επιμονή της Εύης Νομικού, επίκουρης καθηγήτριας Ωκεανογραφίας στο Πανεπιστήμιο Αθηνών (και καταγόμενης από τη Σαντορίνη) και την υποστήριξη της Έμιλι Χουφτ, αναπλ. καθηγήτριας Γεωεπιστημών και Ηφαιστειολογίας στο Πανεπιστήμιο του Ορεγκον και έπειτα από μήνες προετοιμασίας, πραγματοποιήθηκε μια μοναδική στη Μεσόγειο υποθαλάσσια έρευνα.

Το αμερικανικό ερευνητικό σεισμικό σκάφος «Marcus Langseth», το μόνο στον κόσμο που έχει την τεχνολογία να ερευνά βαθιά μέσα στον πυθμένα, έφτασε στο διασημότερο νησί της Ελλάδας. Επρόκειτο για μια ιδιαίτερα ακριβή επιστημονική αποστολή, αδύνατο να πραγματοποιηθεί αυτοτελώς από μια χώρα όπως η Ελλάδα, που χρηματοδοτήθηκε από το National Science Foundation (NSF).

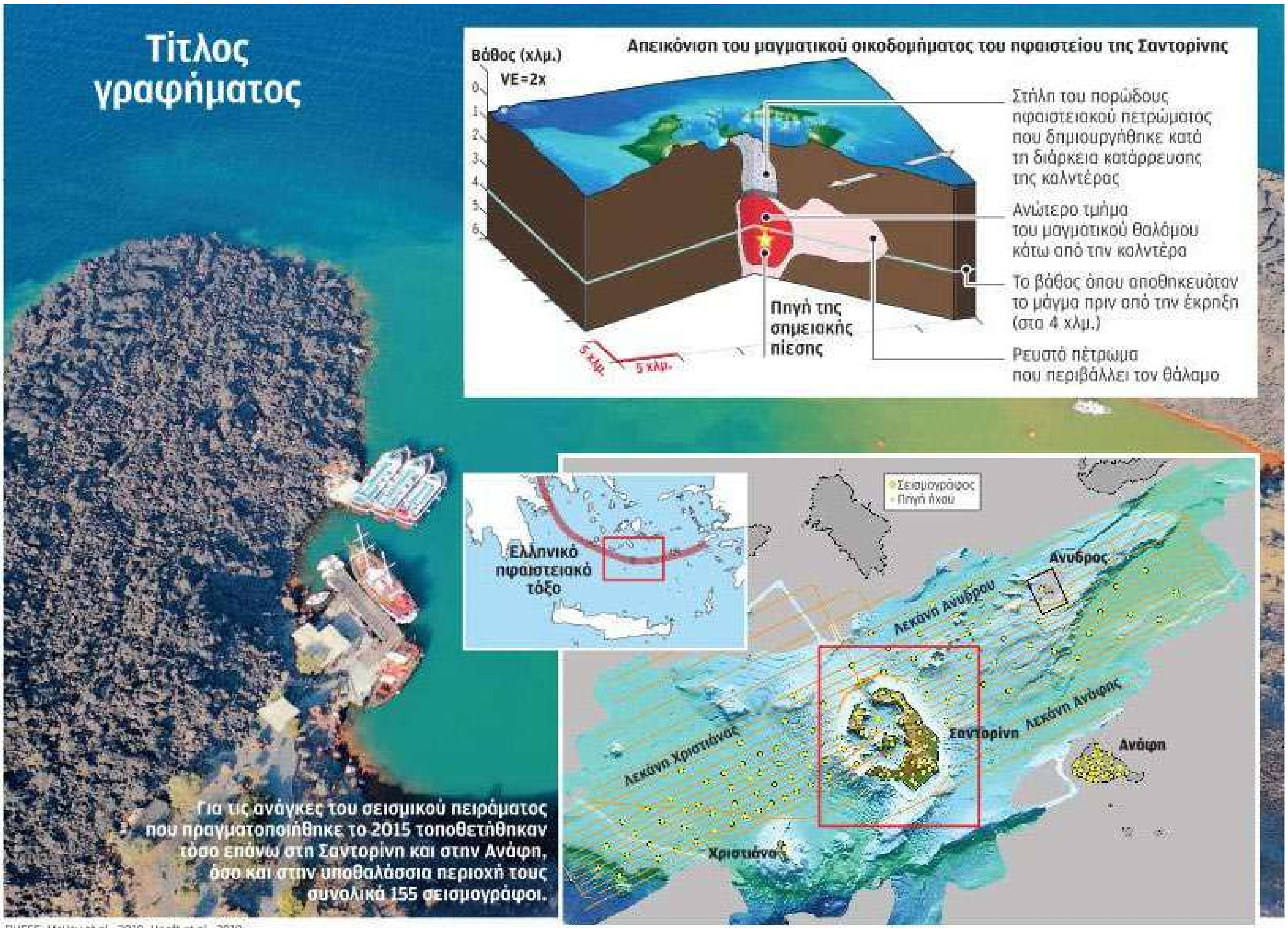
Η επιστημονική του ομάδα (στην οποία συμμετείχαν από ελληνικής πλευράς το Πανεπιστήμιο Αθηνών και το Αριστοτέλειο Πανεπιστήμιο) πόντισε 90 σεισμογράφους στον πυθμένα και τοποθέτησε ακόμα 65 στην ξηρά (της Σαντορίνης και των γύρω νησιών). Στη συνέχεια, για 26 ημέρες, με τη βοήθεια 36 ειδικών σεισμικών οργάνων που παράγουν ηχητικά κύματα (στην επιστημονική ορολογία ονομάζονται airguns, δηλαδή αεροβόλα) το ερευνητικό σκάφος έστειλε βαθιά μέσα στη γη ηχητικά κύματα, καταγράφοντας μέσα από τους σεισμογράφους στην ξηρά και στη θάλασσα τον χρόνο που τα κύματα χρειάζονταν για να φθάσουν σε διαφορετικά σημεία του ηφαιστείου. Τα αποτελέσματα της έρευνας έχουν ήδη δημοσιευθεί σε διεθνή επιστημονικά περιοδικά από τα μέλη της ερευνητικής ομάδας τον τελευταίο χρόνο.

Τρισδιάστατη εικόνα

«Τους τελευταίους μήνες αρχίζουν να μας έρχονται πληροφορίες για τα πρώτα 5 χιλιόμετρα κάτω από τον πυθμένα, στην καρδιά της Καλντέρας», εξηγεί στην «Κ» η κ. Νομικού. «Για πρώτη φορά έχουμε μια τρισδιάστατη εικόνα για το πώς είναι το ανώτερο κομμάτι του μαγματικού θαλάμου». Η ανακάλυψη αυτή είναι ιδιαίτερα σημαντική, καθώς μας παρέχει πολύτιμες πληροφορίες: «Γνωρίζουμε ότι στα πρώτα 3 χλμ. περίπου, υπάρχει ένα πορώδες υλικό που θεωρούμε ότι συγκεντρώθηκε εκεί από τη Μινωική έκρηξη. Η ζώνη που καλύπτει –περίπου 3 χλμ.– είναι μάλλον μικρή, μέχρι σήμερα πιστεύαμε ότι ολόκληρη η επιφάνεια της Καλντέρας –περίπου 10 χλμ.– θα ήταν καλυμμένη με αυτό το υλικό. Ο μαγματικός θάλαμος ξεκινά περίπου σε βάθος 3 χλμ., πιο ρηχά από ό,τι πιστεύαμε (περίπου 4,5 χλμ.) βασιζόμενοι μόνο σε επιφανειακά και δορυφορικά στοιχεία. Ο όγκος του ανώτερου τμήματος του μαγματικού θαλάμου εκτιμάται προς το παρόν στα 35 κυβικά χιλιόμετρα. Σαφέστερη εικόνα θα αποκτήσουμε όταν ολοκληρωθεί η επεξεργασία των στοιχείων από μεγαλύτερα βάθη –φιλοδοξούμε να φθάσουμε έως τα 11 χλμ.– οπότε και θα δούμε τι γίνεται στην καρδιά του μαγματικού θαλάμου».

Η επιστημονική έρευνα δεν αφορά μόνο την περιοχή του μαγματικού θαλάμου, αλλά ολόκληρη την περιοχή γύρω από τη Σαντορίνη. «Εκτός από τον θάλαμο, το πείραμά μας συνδυάζεται και με τις μεγάλες τεκτονικές δομές και τα ρήγματα γύρω από τη Σαντορίνη.

Συνδυάζοντας τη γνώση μας από την επιφάνεια με τα νέα, βαθιά δεδομένα, αποκτούμε εικόνα και για το πώς προεκτεί-



ΠΗΓΕΣ: McVey et al., 2019, Hooft et al., 2019

Η ΚΑΘΗΜΕΡΙΝΗ

νονται τα σεισμικά ρήγματα σε βάθος. Έτσι δημιουργείται ένας υποθαλάσσιος τεκτονικός χάρτης, που δείχνει πώς είναι κατακερματισμένος ο βυθός της Σαντορίνης».

«Σούπερ μάρκετ καταστροφών»

Χάρη στα νέα στοιχεία, οι επιστήμονες σταδιακά «απομόνωσαν» τη ζώνη η οποία θεωρείται πιο ενεργή. «Πρόκειται για τη ζώνη που δημιουργείται από δύο νοητές γραμμές, η πρώτη από το Κολούμπο έως την άκρη της Θηρασιάς και η δεύτερη παράλληλα στο ύψος της Καμένης, από το σημείο που βρίσκονται διατεταγμένοι ηφαιστειακοί κρατήρες. Είναι η ζώνη στην οποία εκτιμούμε ότι πρέπει να εστιάσουμε την προσοχή μας στη διαχείριση ενός ενδεχόμενου κινδύνου. Γενικώς, οι ηφαιστειακές εκρήξεις είναι προβλέψιμες, το ηφαίστειο βρίσκεται σήμερα σε φάση ηρεμίας, ωστόσο είναι καλό να γνωρίζουμε το πώς λειτουργεί όχι μόνο για επιστημονικούς λόγους, αλλά και για να οργανώνουμε σωστά την προστασία του».

Το πιο τουριστικό νησί της χώρας, με σχεδόν 2 εκατ. επισκέπτες κάθε έτος, είναι για τους επιστήμονες ένας μαγευτικός τόπος. «Για εμάς η Σαντορίνη είναι... ένα σούπερ μάρκετ φυσικών καταστροφών: περιλαμβάνει ηφαιστειακές εκρήξεις, παλιρροϊακά κύματα, μεγάλα υποθαλάσσια ρήγματα, κατολισθήσεις», λέει η κ. Νομικού. «Όπως όλοι οι άνθρωποι, βέβαια, και οι επιστήμονες θαυμάζουμε το μοναδικό της ανάγλυφο και το μελετάμε στη χέρσο και τη θάλασσα. Για εμένα, που κατάγομαι από τη Σαντορίνη και την επισκέπτομαι συχνά, το ηλιοβασίλεμα παραμένει το ίδιο μαγευτικό, απλά όχι από τα ίδια σημεία».

(Γιώργος Λιάλιος / Η ΚΑΘΗΜΕΡΙΝΗ, 13.03.2020, https://www.kathimerini.gr/1069260/article/epikairothta/ellada/santorinh-ta-mystika-toy-vy8oy-ths)

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Ol Doinyo Lengai

Ol Doinyo Lengai as seen from Lake Natron at the north

Ol Doinyo Lengai (Oldoinyo Lengai), "Mountain of God" in the Maasai language, is an active volcano located in the Gregory Rift, south of Lake Natron within the Arusha Region of Tanzania, Africa. Part of the volcanic system of the East African Rift, it uniquely produces natrocarbonatite lava. The 1960 eruption of Ol Doinyo Lengai led to geological investigations that finally confirmed the view that carbonatite rock is derived from magma.

Ol Doinyo Lengai is unique among active volcanoes in that it produces natrocarbonatite lava, a unique occurrence of volcanic carbonatite. A few older extinct carbonatite volcanoes are located nearby, including Homa Mountain.

A large maar stands out at the base of the SW flank of Ol Doinyo Lengai on 20 October 2018.

Whereas most lavas are rich in silicate minerals, the lava of Ol Doinyo Lengai is a carbonatite. It is rich in the rare sodium and potassium carbonates, nyerereite and gregoryite. Due to this unusual composition, the lava erupts at relatively low temperatures of approximately 510 °C (950 °F). This temperature is so low that the molten lava appears black in sunlight, rather than having the red glow common to most lavas. It is also much more fluid than silicate lavas, often less viscous than water. The sodium and potassium carbonate minerals of the lavas erupted at Ol Doinyo Lengai are unstable at the Earth's surface and susceptible to rapid weathering, quickly turning from black to grey in colour. The resulting volcanic landscape is different from any other in the world.

The carbonatite ash spread over the surrounding grasslands leads to a uniquely succulent, enriched pasture. This makes the area a vital stage on the annual wildebeest migration, where it becomes the nursery for the birth of several thousand calves.

Typically, the volcano’s activity is confined to its summit. But occasionally, the Mountain of God can roar to life in more dramatic fashion: On September 4, 2007, the volcano belched out a plume of ash that extended at least 11 miles downwind. Lava running down the north and west flanks ignited burn scars that were visible from space.

A view into the summit crater of Ol Doinyo Lengai on 20 October 2018 shows clear evidence of recent flow activity in the form of multiple dark spots of fresh lava that has recently emerged from hornitos and fissures. The lava cools to a pale color very quickly, forming the contrasting background to the fresh flows. The summit crater is 300 m across and 100 m deep. Courtesy of Cin-Ty Lee (Rice University).

The record of eruptions on the mountain dates to 1883. Flows were recorded between 1904 and 1910 and between 1913 and 1915. A major eruption in June 1917 deposited volcanic ash up to 48 kilometres (30 mi) away. An eruption took place for several months in 1926. An eruption between July and December 1940 deposited ash as far as Loliondo, 100 kilometres (62 mi) away. Several minor eruptions of lava were observed in 1954, 1955, and 1958. Minor eruptions of lava were observed in the early 1960s.

A major eruption occurred on 14 August 1966. Geologists J. B. Dawson and G. C. Clark visited the crater a week later and reported seeing "a thick column of black ash" that rose for approximately 1,000 metres (3,000 ft) above the volcano and drifted away northwards towards Lake Natron. When they climbed the cone-shaped vent, they reported seeing a continuous discharge of gas and whitish-grey ash and dust from the centre of the pit.

A view into the crater floor at Ol Doinyo Lengai on 2 March 2019 showed a vent with both fresh (dark brown) and cooled (gray-white) carbonatite lavas and hornitos on the floor of the crater. The darkest material on the crater floor is from recent flows. Courtesy of Aman Laizer, Tanzania.

Volcanic activity in the mountain caused daily earth tremors in Kenya and Tanzania from 12 July 2007 until 18 July 2007 at 8.30pm in Nairobi. The strongest tremor measured 6.0 on the Richter scale. Geologists suspected that the sudden increase of tremors was indicative of the movement of magma through the Ol Doinyo Lengai. The volcano erupted on 4 September 2007, sending a plume of ash and steam at least 18 kilometres (11 mi) downwind and covering the north and west flanks in fresh lava flows.

Image of 1966 eruption

The 2007 eruption continued intermittently into 2008. At the end of February it was reported to be gathering strength, with a major outburst taking place on 5 March. Periods of inactivity were followed by eruptions on 8 and 17 April. Eruptive activity continued until late August 2008. A visit to the summit in September 2008 discovered that lava emission had resumed from two vents in the floor of the new crater. Visits to the crater in March/April 2009 showed that this activity appeared to have ceased.

In October 2010, two separate lava flows and a small lava lake were photographed in an overflight.

Solidified lava in the crater of Ol Doinyo Lengai.

The volcano resumed natrocarbonatite lava flow which started to fill the large crater from the 2007-2008 eruption. As of July 2013, there is a large active hornito on the western edge of the crater floor. During June, residents near the volcano reported several earthquakes. The new crater is inaccessible and climbers have only occasionally

https://en.wikipedia.org/wiki/Ol_Doinyo_Lengai

https://www.nationalgeographic.com/news/2017/07/tanzania-volcano-eruption-ancient-humans-science/

https://volcano.si.edu/volcano.cfm?vn=222120

Piece of lost continent discovered beneath Canada

The continent fragmented more than 150 million years ago.

Scientists found an ancient continent's chemical fingerprints in rock samples taken from Baffin Island in Nunavut, Canada.

A piece of a lost continent has been discovered lurking beneath Canada — and the evidence was hiding in rocks that originated in Earth's interior, where diamonds form.

The secret was concealed in a type of diamond-bearing volcanic rock, known as kimberlite. Kimberlite originates deep underground in magma in Earth's mantle, and picks up hitchhiking diamonds as it hurtles toward the surface during volcanic eruptions. The kimberlite, from Baffin Island in northern Canada, was collected by a diamond mining and manufacturing company.

Scientists found that the mineral chemistry of the Baffin Island kimberlite matched that from an ancient and long-lost continent that formed nearly 3 billion years ago and broke up 150 million years ago. A portion of that "lost" continent still anchors part of North America, and based on the location of the kimberlite samples, the size of that ancient slab is about 10% bigger than previously thought, researchers reported in

"Finding these 'lost' pieces is like finding a missing piece of a puzzle," lead study author Maya Kopylova, a geologist with the University of British Columbia in Canada, said in a statement.

Earth's land masses, or continents, didn't always look the way they do now. The first continents emerged when Earth was just a restless baby planet. These ancient and enormous rocky slabs, called cratons, then shattered to form smaller land masses.

"One fragment of the North Atlantic craton is now part of Scotland," Kopylova told Live Science in an email. Another fragment is part of Greenland, and one more is part of Labrador in eastern Canada.

"Now we have found one more fragment on Baffin Island," she said.

For hundreds of millions of years, plate tectonics pushed continents together to form giant supercontinents, only to pull them apart and push them together again. The last of the supercontinents, Pangaea, began to separate about 200 million years ago, and by around 60 million years ago, the continents had split into the seven that we know today: Africa, Antarctica, Asia, Australia, Europe, North America and South America.

Though the planet's first continents fragmented and were lost to time, remnants of the long-lost land masses survive to this day, as stable cores in our modern continents. The kimberlite samples from Baffin Island, which came from a depth of nearly 250 miles (400 kilometers), bore chemical similarities to mantle rock samples from underneath part of the North Atlantic craton in Greenland, according to the study.

Under most remnants of ancient continents, the upper mantle contains about 65% olivine — "the main mineral of the upper mantle" — and about 25% of another mineral called orthopyroxene, Kopylova said. By comparison, the mantle makeup under the North Atlantic craton is about 85% olivine and around 10% orthopyroxene. And the mineral ratio in the Baffin Island kimberlite was a close match to the North Atlantic craton, Kopylova said.

Now, scientists know "with certainty" that part of Baffin Island was at some point joined with the North Atlantic craton, "rather than with other ancient continents," according to Kopylova.

This is the deepest location where scientists have found a piece of the North Atlantic craton, greatly expanding their view of the first continents from Earth's distant past, the researchers reported.

"Previous reconstructions of the size and location of Earth's plates have been based on relatively shallow rock samples in the crust, formed at depths of 1 to 10 kilometers [0.6 to 6 miles]," Kopylova said in the email. With these new findings, "our knowledge is literally and symbolically deeper," she added.

The findings were published online Jan. 7 in the Journal of Petrology (https://academic.oup.com/petrology/advance-article-abstract/doi/10.1093/petrology/egz061/5697922?redirectedFrom=fulltext).

(Mindy Weisberger - Senior Writer / LIVESCIENCE, 26 March 2020, https://www.livescience.com/lost-continent-diamonds-canada.html)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΠΕΡΙΒΑΛΛΟΝ

Τρεις Έλληνες στη λίστα του Forbes με τους Ευρωπαίους "30 κάτω των 30"

Τρία ελληνικά ονόματα φιγουράρουν στην ευρωπαϊκή λίστα του Forbes "30 κάτω των 30".

Η λίστα φιλοξενεί 300 φερέλπιδες νέους και πιθανούς ηγέτες του αύριο, από 10 διαφορετικούς κλάδους, που επιχειρούν να επανεφεύρουν τόσο την επιχειρηματικότητα όσο και την κοινωνία.

Οι δύο από τους τρεις Έλληνες δραστηριοποιούνται στον κλάδο "Επιστήμη & Υγεία". Πρόκειται για την 29χρονη **Ειρήνη Δεδούση** και τον 29χρονο **Γιώργο Κελεσίδη**.

Ο τρίτος Έλληνας ονομάζεται **Δημήτρης Τερζής,** 29 ετών, και προέρχεται από τον κλάδο "Μεταποίηση & Βιομηχανία".

Σύμφωνα με το Forbes, η Ειρήνη Δεδούση είναι Επίκουρη Καθηγήτρια στο Πανεπιστήμιο TU Delft όπου κάνει έρευνες πάνω στην περιβαλλοντική επίδραση των εκπομπών καύσης. Η τελευταία της δημοσίευση ήταν στο περιοδικό Nature, ενώ έχει κερδίσει και μια θέση στους New York Times χάρη στο εύρημά της ότι η ατμοσφαιρική ρύπανση εκτιμάται ότι ευθύνεται για το 5% έως 10% των πρόωρων θανάτων στις ΗΠΑ. Η Ειρήνη συνεισέφερε, επίσης, στην έρευνα της Volkswagen.

Η έρευνα του Γιώργου Κελεσίδη πάνω στην νανοδομή της αιθάλης τού χάρισε το Βραβείο Ερευνών της IBM το 2017 και έβαλε τα θεμέλια για το διδακτορικό του. Έκτοτε, εντρύφησε στην έρευνα για να αποδείξει ότι η αιθάλη, αντί του μεθανίου, θα μπορούσε να είναι ο δεύτερος μεγαλύτερος παράγοντας πρόκλησης της υπερθέρμανσης του πλανήτη μετά το διοξείδιο του άνθρακα εξαιτίας της αυξημένης απορρόφησης φωτός και της νηματώδους μορφής της.

Ο Δημήτρης Τερζής είναι ένας εκ των ιδρυτών της MeduSoil η οποία παράγει βιώσιμα υλικά για κατασκευαστικά και περιβαλλοντικά έργα. Τα υλικά αυτά είναι εμπνευσμένα από τα βιομεταλλικά στοιχεία και έχουν φτιαχτεί έτσι ώστε να ανθίστανται στη διάβρωση και τις φυσικές καταστροφές. Σε λιγότερο από δύο χρόνια, η εταιρεία άντλησε 1 εκατ. δολάρια σε δωρεές και κεφάλαια επιχειρηματικών συμμετοχών και αναμένει έσοδα 500.000 δολαρίων το τρέχον έτος.

Η ευρωπαϊκή λίστα "30 κάτω των 30"

Η φετινή λίστα του Forbes είναι το αποτέλεσμα χιλιάδων υποψηφιοτήτων, πολλών μηνών έρευνας και τελικής έγκρισης από την επιτροπή των ειδικών. Το αποτέλεσμα: 300 νέοι οραματιστές που με τόλμη αναδιαμορφώνουν 10 κλάδους σε 32 ευρωπαϊκές χώρες.

Κάποια ονόματα μπορεί να είναι γνώριμα, όπως αυτό του Ncuti Gatwa. Ο γεννημένος στη Ρουάντα, Σκοτσέζος ηθοποιός έγινε διάσημος χάρη στο ρόλο του ως "Eric Effiong" στη σειρά του Netflix "Sex Education". Ο Gatway έχει επαινεθεί για την ειλικρινή ενσάρκωση του ρόλου του ως ομοφυλόφιλου μαύρου εφήβου, που ανέδειξε μια κατηγορία ανθρώπων που ανήκουν στη μειοψηφία. Πολλοί υποψιάζονται ότι η σειρά είχε αντίκτυπο και εκτός οθόνης: η κυβέρνηση της Ουαλίας πρόσφατα έκανε τη "σεξουαλική αγωγή" υποχρεωτικό μάθημα στα σχολεία.

Η λίστα φιλοξενεί κι άλλους celebrities όπως το μοντέλο Cara Levigne, η τεννίστρια Simona Halep και η μουσικός Carmen Vanderberg.

Άλλα ονόματα μπορεί να μην σας είναι και τόσο οικεία. Αν και λίγοι γνωρίζουν το όνομά του, ο 29χρονος CEO Hanno Renner ίδρυσε μία από τις ταχύτερα αναπτυσσόμενες startups της Ευρώπης, την Personio, για να βοηθήσει άλλες startups και μικρομεσαίες επιχειρήσεις να ανταγωνιστούν για τα καλύτερα ταλέντα. Με έδρα το Μόναχο, ο επιχειρηματίας έχει αντλήσει 130 εκατ. δολάρια. Η πλατφόρμα εύρεσης ανθρώπινου δυναμικού που ίδρυσε, εκμηδενίζει τα διοικητικά καθήκοντα (που μπορεί να καταλαμβάνουν το 42% της δουλειάς του HR) και εστιάζει σε αυτό που πραγματικά έχει σημασία: τους ανθρώπους.

Η λίστα με αριθμούς

Η μέση ηλικία της λίστας είναι 27 (το νεότερο μέλος είναι 11 ετών)

Το 64% των μελών είναι ιδρυτές ή συνιδρυτές.

Τα πιο πολλά κεντρικά γραφεία των εταιρειών βρίσκονται σε Ην. Βασίλειο, Γερμανία, Γαλλία, Σουηδία, Ισπανία, Ολλανδία.

Τα μέλη εργάζονται κατά μέσο όρο 62 ώρες την εβδομάδα.

Το 83% θεωρούν προνόμιο για την καριέρα τους το γεγονός ότι δεν έχουν "πατήσει" τα 30.

Οι εφαρμογές χωρίς τις οποίες δεν μπορούν να ζήσουν (με σειρά προτεραιότητας): WhatsApp, Spotify, Google Maps, Instagram, Twitter, Slack

Ο No 1 μέντορας (με σειρά): Elon Musk, Bill Gates, Richard Branson, Naval Ravikant, Jeff Bezos, Michelle Obama

Δείτε αναλυτικά τη λίστα με τους 300 νέους κάτω των 30 από 10 κλάδους https://www.forbes.com/30-under-30/2020/europe/#230ecbac62d3.

(Capital, 17 Μαρτιου 2020, https://www.capital.gr/forbes/3438137/treis-ellines-sti-lista-tou-forbes-me-tous-europaious-30-kato-ton-30)

ΕΝΔΙΑΦΕΡΟΝΤΑ - ΛΟΙΠΑ

This Norwegian bridge is also an art museum

New museum: This is The Twist -- a bridge that also functions as an art museum.

Doing the twist: The museum's name comes from the rolled roof, that creates a twisting effect. The unusual curve design catches the attention.

A striking bridge meets an intriguing modern art museum meets the splendor of the Norwegian natural landscape in the Twist -- the latest project from BIG-Bjarke Ingels Group, located about an hour's drive from Oslo.

The Twist -- a new addition to the Kistefos Sculpture Park -- connects the two sides of the Randselva River via a multipurpose walkway.

The museum's name comes from the rolled roof, an intriguing stylistic choice.

Sweeping views: The walkway-slash-museum has stunning views over the Randselva River.

Sculpture park: Kistefos Sculpture Park is located at the site of a former wood pulp mill and opened in 1996.

Power of nature: It's located in a beautiful spot in Norway, surrounded by natural forestry.

"The Twist is a hybrid spanning several traditional categories: It's a museum, it's a bridge, it's an inhabitable sculpture," says Bjarke Ingels, Founding Partner & Creative Director, BIG.

Visitors to Kistefos can cross the Twist to complete their circuit of the park, while also admiring the bridge as an attraction in its own right.

The museum is made up of three distinct galleries with sweeping views over the river and sculpture park.

The double-curve of the museum's exterior is created via straight aluminum panels arranged, as BIG describes it, "like a stack of books" -- each panel is shifted ever so slightly forward.

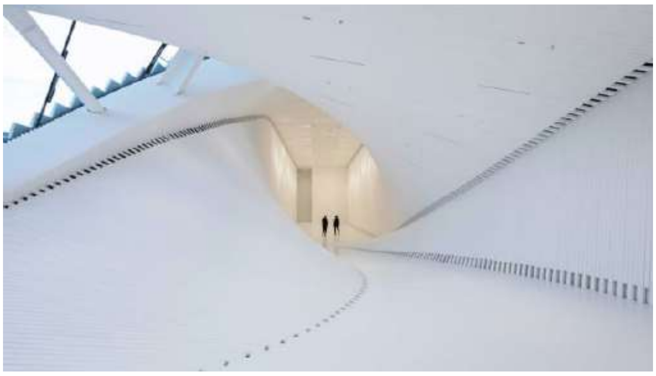
This oxymoron is at the heart of the Twist's aesthetic appeal: straight panels creating a curved effect.

Photographs of the building have an eerie, otherworldly feel -- this manmade bridge-museum-hybrid seemingly rising inconspicuously out of its natural surroundings.

Inside, the vibe is just as notable, a space-age aesthetic heeding inspiration from the natural landscape.

"The Twist has been an extremely complex building to construct, yet the result is simple and striking," says David Zahle, Parner at BIG. "From an array of straight elements, the museum was constructed in an industrial manner as both a piece of infrastructure and as a building reflecting its natural surroundings.

Kistefos Sculpture Park is located at the site of a former wood pulp mill. It's been a staple of the Norwegian cultural scene for the past two decades, spotlighting work by prolific Japanese artist Yayoi Kusama and Icelandic environmentalist Olafur Eliasson, to name just two.



Striking interior: Inside, the aesthetic is also striking. The twist effect creates an intriguing visual.

"A stack of books": The double-curve of the Twist is created via straight aluminum panels -- as BIG describes it, they're arranged "like a stack of books."

Deceptively simple: David Zahle, Parner at BIG, said the building was "extremely complex" to construct.

Officially opened as of September 2019, the Twist is a compelling new edition to this Scandinavian art hub.

(Francesca Street / CNN, 22nd October 2019, https://edition.cnn.com/travel/article/norway-art-museum-bridge-twist)

Platonic Solids Secret

They relate to the 5 Elements of Creation: Fire, Earth, Air, Water and Ether.

The 5 and only unique geometric shapes that exist within the sphere, where all lines are equal, all vertices touch the sphere, and all faces are the same are the Phive Platonic or Regular Solids.

Their real secret is not the individual shapes, but rather the nesting or embedding of the 5, one within the other like Russian Dolls, that forms a highly intelligent code underpinning higher dimensional physics and atomic structure, beyond current human comprehension.

(https://www.facebook.com/groups/1090462624321556/?multi_permalinks=3062300097137789&notif_id=1583336258256832&notif_t=group_activity

Living bridges

Researchers are looking into new materials to lay the foundations for living structures that respond to their environment. They aim to create self-sustaining infrastructures that can monitor their condition and even repair themselves.

Living structures such as this traditional bridge in India made of vines provide a source of inspiration for entirely new materials.

When Eleni Chatzi is not busy reading technical papers about vibrating bridges, smart infrastructures and data-driven engineering, she enjoys immersing herself in science fiction novels. “I like pondering unconventional ideas and imagining a world that is yet to come,” says Chatzi, Professor of Structural Mechanics at ETH Zurich. Indeed, there is a ring of sci-fi to it when she talks about applications that her research could someday lead to. One such futurist vision is bridges that grow out of a handful of seeds and consist entirely of organic material.

This 38-year-old civil engineer, whose professorship has received funding from the Albert Lück-Stiftung since 2010, specialises in structural health monitoring. Chatzi diagnoses the health of dams, bridges, wind turbines, aircraft and vehicles using sensors, algorithms that convert and process signals, and machine learning. Currently, engineers have to either externally install the sensors needed to measure tension, deformation, acceleration, wind and strain, or incorporate these devices into the initial structural design. "However, this is usually an extra expense and a disruptive factor, especially on building sites," explains Chatzi. Crews have to install countless cables to transmit the measured data to a central computer for analysis. "That's why we'd like to develop infrastructures and machines with intrinsic intelligence that are aware of their condition even without externally mounted sensors," says Chatzi.

Conscious concrete

An unprecedented class of materials provides the underpinning for this kind of self-aware infrastructure – and researchers around the world have been busy exploring their mysteries for the past few years. One example is intrinsic self-sensing concrete. Mixed with carbon fibres, carbon nanotubes and nickel powder, this material monitors its condition autonomously to provide information about cracks, moisture or unusually heavy loads. This data is coaxed from the structure by applying voltage and constantly measuring the electrical resistance.

A second line of research into materials with self-healing properties points in a similar direction. Last year, in a project inspired by plant photosynthesis, US researchers presented a polymer that can repair itself by reacting with carbon dioxide in the surrounding air. Other groups are working with bacteria that form lime when exposed to rainwater and other moisture. Added to concrete, they can seal small cracks on their own. Experiments are underway with microvascular networks that release "healing" fluids when an injury occurs. Responding much like the human organism to a skin wound, they polymerise to fill the fractures.

Incorporating biological functions

"We're seeing a fusion of materials science and biology," says Mark Tibbitt, Professor at the Macromolecular Engineering Laboratory at ETH Zurich. He notes that in the past, chemical and other engineers had looked to nature primarily for inspiration for mimicking properties such as the ability of the leaves of the lotus flower to repel water. "Today, we're trying to incorporate biological functions into materials." These efforts are fuelled by breakthroughs in materials science and biotechnology. DNA engineering and new molecular biological methods such as CRISPR/Cas gene editing can now serve to introduce new biological functions into cells for very specific purposes. Additive manufacturing using 3D printers enables high-resolution, data-based material design. Combining concepts from a number of fields – chemical engineering, polymer chemistry, materials science and systems biology – Tibbitt's research aims to develop soft, tissue-like polymers for biomedical applications.

"The fascinating thing about living organisms is that they perceive their environment, react to it and even heal themselves when injured. We want to instil these qualities in materials and infrastructures," says Tibbitt. He believes future applications could include houseplants that clean the air and change the colour of their leaves to call attention to air quality, and buildings that change with the seasons to keep their interior climate comfortable.

Tibbitt met Eleni Chatzi a year ago at an event for exploring radically new avenues of research. Although the two work on very different scales, they often talk about the same concepts. Recurring topics include materials that can "heal" themselves. Recently, they began to foster dialogue among researchers at ETH about living, self-sensing and self-healing materials and infrastructures. Materials scientists, chemical, civil and electrical engineers, biologists and computer scientists have all joined in to develop materials with the goal of working at different scales right from the start instead of scaling them at a later stage. "ETH Zurich is the perfect hub for this venture because it has so much expertise in all the key areas," says Tibbitt. An initial workshop and a symposium are scheduled to take place in spring 2020 for experts to discuss the matter. The idea is to define research questions and then launch the first transdisciplinary projects.

Living with animated environments

This is a fresh avenue of research that Chatzi and Tibbitt have embarked upon, and at this stage there are many more questions than answers. One big question is how to assure safety and stability when infrastructures develop a life of their own. Another is how humans and animals will react to an engineered environment consisting of living organisms. And what happens if a synthetic organism leaches from a new building material into surrounding waters? "We have to think about bioethical questions and safety concerns from day one," says Tibbitt.

Such risks also present great opportunities: concrete production accounts for around eight percent of today's global CO2 emissions. Entire strips of sandy beaches are being sacrificed to the global construction boom. Many landfills are overflowing with rubble from demolished buildings. Organic infrastructures with closed material cycles – such as bridges made of remarkably robust plant fibre – offer a sustainable alternative. If damaged, they could repair themselves. At the end of their service life, they could simply break down into individual compostable components.

(Samuel Schlaefli / Globe magazine, 03.01.2020, https://ethz.ch/en/news-and-events/eth-news/news/2020/01/biodegradable-bridges.html)

Δέκα αρχιτεκτονικά θαύματα χτισμένα πάνω στο νερό

Η οικοδόμηση πάνω το νερό είναι ένα άλλο τολμηρό βήμα των ανθρώπων στην προσπάθειά τους να κατακτήσουν το αδύνατο.

Οι άνθρωποι πάντα είχαν εμμονή με την κατασκευή τέτοιων δομών που όχι μόνο αντέχουν σε βάθος χρόνου, αλλά αψηφούν και τους νόμους της φυσικής. Σε αυτές τις κατασκευές περιλαμβάνονται από τους Κρεμαστούς Κήπους της Βαβυλώνας μέχρι τους σύγχρονους ουρανοξύστες στο Ντουμπάι, που αγγίζουν τα σύννεφα.

Η οικοδόμηση πάνω το νερό είναι ένα άλλο τολμηρό βήμα των ανθρώπων στην προσπάθειά τους να κατακτήσουν το αδύνατο. Ακολουθούν μερικές από τις πιο εντυπωσιακές κατασκευές.

Burj Al Arab, Ντουμπάι

Το Burj Al Arab (Πύργος των Αράβων) είναι ένα πολυτελές ξενοδοχείο στο Ντουμπάι. Είναι ένα από τα ψηλότερα ξενοδοχεία στον κόσμο και το έβδομο ψηλότερο στον κόσμο. Το Burj Al Arab βρίσκεται σε ένα τεχνητό νησί και συνδέεται με την ηπειρωτική χώρα από μια ιδιωτική κυρτή γέφυρα. Το σχήμα της δομής έχει σχεδιαστεί για να μοιάζει με το ιστίο ενός πλοίου. Διαθέτει ελικοδρόμιο κοντά στην οροφή σε ύψος 210 μέτρα πάνω από το έδαφος.

Η Παναγία των Βράχων, Μαυροβούνιο

Η Παναγία των Βράχων είναι μια από τις δύο νησίδες (η άλλη είναι ο Άγιος Γεώργιος -Sveti Đorđe) που βρίσκονται μπροστά στην πόλη Πέραστ, στον κόλπο του Κότορ, στο Μαυροβούνιο. Αποτελεί μέρος της Εθνικής και Ιστορικοπολιτικής Περιοχής του Κότορ που ανακηρύχθηκε Μνημείο Παγκόσμιας Κληρονομιάς της Ουνέσκο, το 1979. Πρόκειται για μια τεχνητή νησίδα που πάνω σε αυτή είναι χτισμένη η ομώνυμη εκκλησία (της Παναγίας των Βράχων) ενώ υπάρχει και ένα μουσείο και ένα κατάστημα με αναμνηστικά. Η εκκλησία κατασκευάστηκε το 1632 και ενενήντα χρόνια μετά έγιναν εργασίες επέκτασής της και κατασκευάστηκε ο τρούλος. Το κτίριο έχει υποστεί μια σειρά ανακαινίσεων κατά τη διάρκεια των αιώνων και είναι πλέον ένα διάσημο μουσείο.

Υδραγωγείο Veluwemeer, Ολλανδία

Είναι μια γέφυρα όπως καμία άλλη που συνδέει τη χώρα με το Flevopolder, γνωστό και ως το μεγαλύτερο τεχνητό νησί στον κόσμο. Το υδραγωγείο έχει 25 μέτρα μήκος και 19 μέτρα πλάτος. Έχει βάθος 3 μέτρα το οποίο επιτρέπει εύκολα μικρά σκάφη αναψυχής να περνούν πάνω από το τούνελ. Περίπου 28.000 οχήματα περνάνε κάθε μέρα και υπάρχει μια διάβαση

πεζών εξοπλισμένη για το κοινό για να απολαύσει τη θέα.

Βενετικές νήσοι, ΗΠΑ

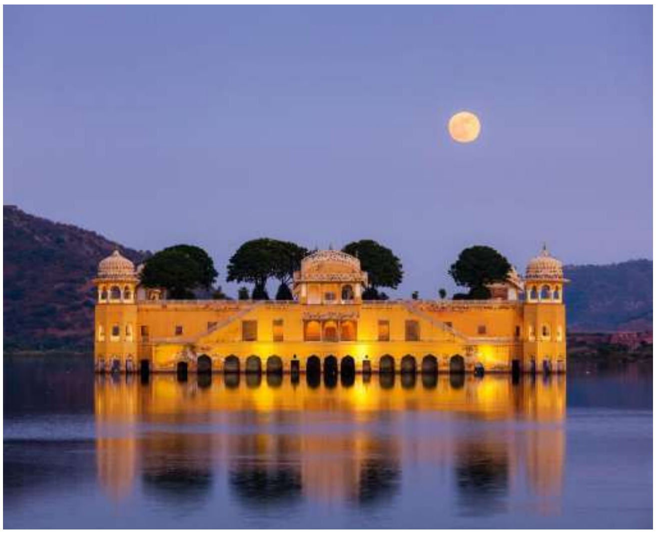
Βρίσκονται στο Μαϊάμι και είναι μια συσσώρευση τεχνητών νησιών που υπάρχουν από την δεκαετία του 1920. Η περιοχή φιλοξενεί πλέον πάνω από 13.000 κατοίκους και αποτελείται από υπέροχα κτίρια και δέντρα που δεν μαρτυρούν ότι ολόκληρο το έδαφος είναι τεχνητό.

Punta Della Dogana, Βενετία

Η Βενετία είναι μια από τις πόλεις που στέκονται και περιβάλλονται από νερό. Ανάμεσα στα πολλά όμορφα κτίρια, αυτό που ξεχωρίζει είναι το Punta Della Dogana, το οποίο αρχικά κατασκευάστηκε για να λειτουργήσει ως τελωνείο και σχεδιάστηκε από τον Giuseppe Benoni, αρχιτέκτονα του 17ου αιώνα. Συνέχισε να λειτουργεί ως τελωνειακή εγκατάσταση μέχρι το 1980 και το 2009 μετατράπηκε σε εκθεσιακός χώρο και παραμένει μέχρι σήμερα.

Τζαλ Μαχάλ, Ινδία

Το παλάτι Τζαλ Μαχάλ βρίσκεται στη λίμνη Μαν Σαγκάρ και ήταν το σπίτι των βασιλιάδων Rajput, οι οποίοι είχαν εμμονή με την αρχιτεκτονική τέχνη. Χτισμένο τον 18ο αιώνα από τον Maharaja Jai Singh II, το παλάτι καλύπτει μια έκταση 121 εκταρίων και είναι ένα από τα πιο επισκεπτόμενα και φωτογραφισμένα κτίρια. Δυστυχώς για τους μελλοντικούς επισκέπτες, το ιστορικό παλάτι θα μετατραπεί σε ξενοδοχείο και δεν θα είναι προσβάσιμο για πολλούς κατοίκους της περιοχής.



Pampus, Ολλανδια

Πηγαίνοντας πιο νότια, προς το κέντρο της χώρας, αξιοσημείωτο είναι το τεχνητό νησί Pampus, που δημιουργήθηκε στα τέλη του 19ου αιώνα και βρίσκεται κοντά στο Άμστερνταμ, στο IJmeer και ανήκει στην αμυντική γραμμή του Άμστερνταμ (Stelling van Amsterdam). Είναι ανοιχτό για το κοινό τους μήνες Απρίλιο-Οκτώβρη. Το φρούριο κατάφερε να επιβιώσει από πολλά ιστορικά γεγονότα, όπως τον 2ο Παγκόσμιο Πόλεμο, όταν λεηλατήθηκε και εγκαταλείφθηκε από κατοίκους του Άμστερνταμ.

Πέμπερχολμ, Δανία

Η τεχνητή νησίδα Πέμπερχολμ βρίσκεται στο στενό Έρεσουντ και ανήκει στη Δανία. Δημιουργήθηκε στο πλαίσιο της ανέργεσης της γέφυρας Έρεσουντ, που συνδέει την Κοπεγχάγη με το Μάλμε της Σουηδίας. Ο κύριος λόγος για την κατασκευή του νησιού ήταν να έχει ένα σημείο διασταύρωσης μεταξύ της υποθαλάσσιας σήραγγας και της γέφυρας. Η σήραγγα χτίστηκε για να δώσει την ευκαιρία στα μεγάλα πλοία να περάσουν το Έρεσουντ χωρίς να ανησυχούν για το ύψος της γέφυρας. Άλλος λόγος είναι ότι θα δημιουργούσε πρόβλημα στο αεροδρόμιο της Κοπεγχάγης (Kastrup), που βρίσκεται σε κοντινή απόσταση από την άκρη της γέφυρας.

Παλάτι Deeg Water, Ινδία

Χτισμένο μεταξύ των λιμνών Rup Sagar και Gopal Sagar, το παλάτι χτίστηκε για τους ηγέτες Jat και σχεδιάστηκε με το ίδιο στυλ που έχει το Mughal που είναι μοναδικό στο Άγκρα και το Δελχί. Η κατασκευή του παλατιού ολοκληρώθηκε το 1772. Το Deeg Water είναι πλέον ανοικτό στους επισκέπτες.

Αεροδρόμιο Kansai, Ιαπωνία

Μηχανικοί στην Ιαπωνία σχεδίασαν ένα αεροδρόμιο πάνω σε τεχνητό νησί για να αντιμετωπίσουν τους σεισμούς και τα τσουνάμι. Τρία βουνά, 10.000 εργαζόμενοι και πάνω από 80 πλοία χρειάστηκαν για την κατασκευή του αεροδρομίου Kansai από το 1987 έως το 1990. Άνοιξε επίσημα το 1994 και εξακολουθεί να λειτουργεί χωρίς κανένα πρόβλημα μέχρι σήμερα.

Το νησί των Κύκνων, Γαλλία

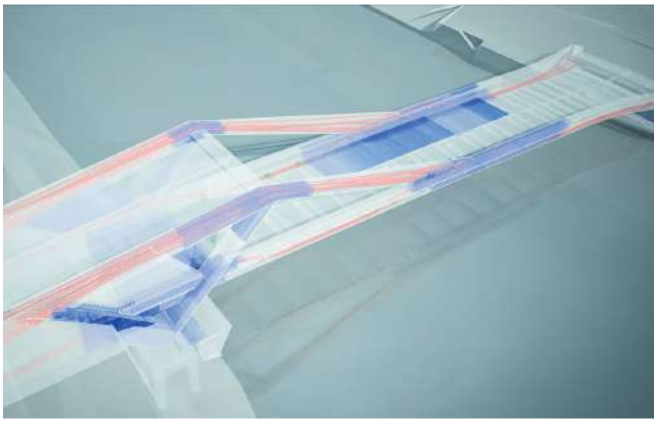
Το Ile aux Cygnes ή αλλιώς νησί των Κύκνων είναι ένα τεχνητό νησί που κατασκευάστηκε στον ποταμό Σηκουάνα στο Παρίσι το 1827 για να προστατεύσει τη γέφυρα Pont de Grenell. Το Ile aux Cygnes είναι γεμάτο δέντρα, ενώ ένα αντίγραφο του Αγάλματος της Ελευθερίας το στολίζει. Το νησί διασχίζεται από τρεις γέφυρες, το Pont de Bir-Hakeim, το Pont Roulle και το Pont de Grenell.

(Newsroom, HuffPost Greece, 03.03.2020, https://www.huffingtonpost.gr/entry/deka-architektonika-thaemata-chtismena-pano-sto-nero_gr_5e5929d4c5b60102210fbbaa)

Overcoming Boundaries

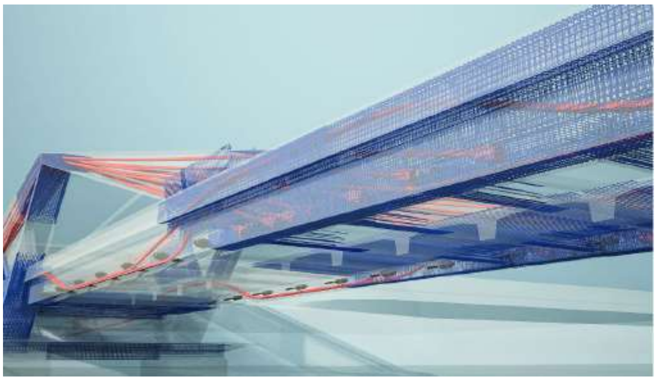
Olten has a new landmark: the Aare Bridge, which was given over to traffic in April 2013 as part of the "Olten Region Relief" (Entlastung Region Olten, ERO) project.

Thanks to the 3D visualization, the planning association commissioned to manage the project were able to show that the main intersections of the static system could meet all requirements relating to the installation of reinforcements and pretensioning measures, despite their minimal dimensions. The planning association for the "maya" project chose a bold approach as its competition entry for the new Aare Bridge: With a width of just under 104 meters, the structure spans the river without supports. The planning association's proposal in May 2005 therefore won the competition, in which a total of 69 projects were entered. The team that came first was formed of engineering firms Bänziger Partner AG (Baden) and ACS- Partner AG (Zurich), as well as architect Eduard Imhof (Lucerne) and landscape architects David und von Arx (Solothurn). They were commissioned by the canton of Solothurn to project manage and super-vise the construction of the new bridge structure.



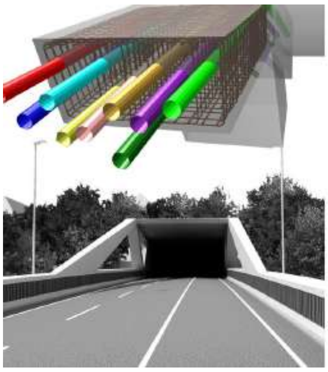
The bridge bears a single-spanned cantilever beam with a trough section. Both main supports simultaneously form the side guardrail system and sound-proofing, spanning the River Aare with a width of 88.50 meters. The supports are suspended from the tunnel portal using pre-tensioned concrete sails, making the portal structure a static part of the bridge. Around 40 meters of the adjacent cut-and-cover tunnel acts as a counterbalance for the tension in the portal. A concrete shed covers the portal area and provides soundproofing and a stable balancing system. Pre-tensioned cross girders are arranged between the bridge's main supports which support the carriageway slab. These act as simple beams with a span width of between 13.60 and 17.50 meters.

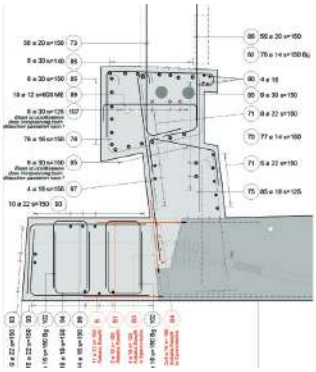
Planning was carried out in a 3D model using Allplan when the competition project was being developed. Just like later in the implementation phase, engineering firm Bänziger Partner AG developed the formwork plans, whilst ACS-Partner AG was responsible for the static design and the development of reinforcement and pretensioning plans. As Rudolf Vogt, co-owner of ACS-Partner, explains, the Aare Bridge was the first project that he and his staff developed in 3D: "Looking back, I can say that it was the perfect project to benefit from 3D modeling as the basis for both the formwork plans and the reinforcement and pre-tensioning plans." However, he also points out how important it is that the designers who have been entrusted with this task possess good spatial awareness: "Because bringing the spatial structures into the two-dimensional implementation plans requires a high level of understanding in this regard," says Rudolf Vogt, based on his experience. So that the 3D data sharing between both engineering firms worked perfectly, the software settings needed to be coordinated with one another beforehand. "Once these conditions have been met, it will work perfectly," explains Rudolf Vogt.



The main challenge for reinforcement and pre-tensioning was at the highest point of the structure: The longitudinal beams (which act as a link to the cut-and-cover tunnel), the angled support (which stands on the abutment), and the concrete sail (which braces the bridge's longest support) come together here on both outer sides. These construction parts are not only reinforced for strength, but are also pre-tensioned and come together in a knot, which therefore becomes the element under the greatest stress in the overall structure. Despite the high level of stress, the planners wanted to keep the dimensions as small as possible and were therefore required to prove the feasibility of the proposed design for this knot to the client and the testing engineer. "Thanks to the visualization in the 3D model, we were able to prove the feasibility of the dimensions for the knot we selected with reinforcement and pre-tensioning," explains Rudolf Vogt. Furthermore, a sample knot that was true to size was created on the construction site to check that everything would work in the final version. "Our conclusion as far as feasibility is concerned was therefore also confirmed on site," adds Rudolf Vogt.

For bridge construction engineer Rudolf Vogt, one thing is clear: "The reinforcement and pre-tensioning plans for this level of complexity in the structure could only be tested in the 3D model." It is only thanks to the spatial representation that its possible to see into the relevant part of the structure in order to detect missing reinforcements or incorrect joint lengths, for example. But it is not just Rudolf Vogt who appreciates the benefits of 3D; the iron layer also managed much better on the construction site thanks to the spatial visualizations shown on the plans. "We reproduced individual details in 3D in both the formwork plans and the reinforcement and pre-tensioning plans and thereby gained some very good results," reports Rudolf Vogt.





Project Information at a Glance

Focus: Structural design planning from draft to implementation

Software used: Allplan Engineering

maya planning association:
Bänziger Partner AG, Baden (general management)
ACS-Partner AG, Zurich
David & von Arx Landschaftsarchitektur, Solothurn

Client: Amt für Verkehr und Tiefbau (Department for Transport and Civil Engineering), canton of Solothurn

Project Data

Planning start date: 2005
Construction start date: 2008
Completion: 2014
Length including portal area: 140.00 m
Width: 15.60 m
Bridge area: 2200 m²
Height above the River Aare: approximately 5 m

(https://www.allplan.com/fileadmin/user_upload/countries/international/pdfs/references/Case_Study_Aare_Bridge_Olten_EN_US.pdf)

Xinjiang's long and winding road with more than 600 hairpin bends

In Xinjiang, a 75km (47-mile) stretch of road snakes back and forth over a mountainous incline as it reaches a height of 4,100 metres (13,450ft) above sea level.

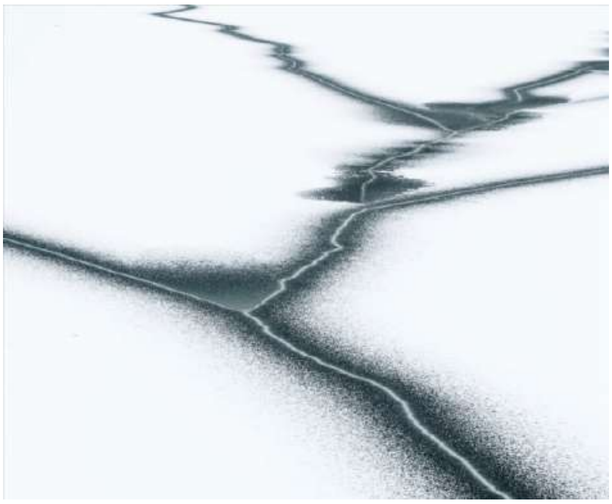
Chinese state media reports said the road has more than 600 hairpin bends.

(Holly Chik / South China Morning Post, November 8, 2019, https://www.scmp.com/video/china/3036852/xinjiangs-long-and-winding-road-more-600-hairpin-bends)

https://www.youtube.com/watch?v=vFQP7qNJp8E&feature=emb_logo

Single analysis predicts crack propagation

Researchers at the University of Illinois at Urbana-Champaign believe they can pinpoint the location and direction of a critical crack in a structure with a single analysis.



New system predicts propagation of cracks

Finding out where and with what orientation a surface crack is most likely to initiate is a critical part of analysing and designing a structure.

"This new method allows us to simplify the analysis tremendously, because instead of having to do an analysis for every single potential location of a crack along the surface of a certain structure, we perform a single analysis of the uncracked domain, which is much cheaper and faster to solve. This reduces the amount of computational work by orders of magnitude," said Philippe Geubelle, a professor in the Department of Aerospace Engineering.

To get a precise estimate of the energy release rate, the current method requires a numerical analysis with a very fine grid to discretised the structure, especially in the vicinity of the crack. In a statement, Geubelle said this new method uses topological derivatives to get an estimate of what the energy release would be if a crack showed up at any location and with any this orientation along the surface of a 3D structure.

"Using this technique, we can immediately pinpoint the location and orientation that corresponds to the highest energy release rate – meaning the highest energy available for crack propagation. If the energy release rate is smaller than the fracture toughness, the crack won't propagate. However, if the energy release rate approaches the value of the fracture toughness, then the structure will need a redesign."

According to UI, the new method can be combined with commercial finite element software packages such as Ansys, Abaqus, and Nastran.

"What this method allows us to do is to say, 'give me a complicated shape and complex loading conditions, and we will tell you the most probable location where a surface crack is going to start.'" Geubelle said.

(THE ENGINEER, 26th March 2020, https://www.theengineer.co.uk/predicting-crack-propagation)

Energy Release Rate Approximation for Small Surface Cracks in Three-Dimensional Domains Using the Topological Derivative

Kazem Alidoost, Meng Feng, Philippe H. Geubelle, Daniel A. Tortorelli

Abstract

The topological derivative describes the variation of a response functional with respect to infinitesimal changes in topology, such as the introduction of an infinitesimal crack or hole. In this three-dimensional fracture mechanics work, we propose an approximation of the energy release rate field associated with a small surface crack of any boundary location, direction, and orientation combination using the topological derivative. This work builds on the work of Silva et al. ("Energy Release Rate Approximation for Small Surface-Breaking Cracks Using the Topological Derivative," J. Mech. Phys. Solids **59**(5), pp. 925–939), in which the authors proposed an approximation of the energy release rate field which was limited to two-dimensional domains. The proposed method is computationally advantageous because it only requires a single analysis. By contrast, current boundary element and finite element-based methods require an analysis for each crack length-location-direction-orientation combination. Furthermore, the proposed method is evaluated on the non-cracked domain, obviating the need for refined meshes in the crack tip region.

(*J. Appl. Mech*. Apr 2020, 87(4): 041004 (12 pages), Paper No: JAM-19-1481 https://doi.org/10.1115/1.4045793, **Published Online:** January 17, 2020, https://asmedigitalcollection.asme.org/appliedmechanics/article-abstract/87/4/041004/1072192/Energy-Release-Rate-Approximation-for-Small?redirectedFrom=fulltext)

Crane Accident due to overload

Συγκρίνοντας τις μάζες που εμπλέκονται, αυτή η έκβαση είναι προφανής ακόμη και στο μάτι. Πρώτα η ασφάλεια.

(Από τον συνάδελφο Γιάννη Μεταξά / Civilengineer365 / https://www.facebook.com/civilengineer365/videos/895892400860533/)

ΑΝΑΜΝΗΣΕΙΣ ΔΙΑΚΟΠΩΝ

Καταρράκτες Νιαγάρα

Niagara Falls is a group of three waterfalls at the southern end of Niagara Gorge, spanning the border between the US state of New York and the Canadian province of Ontario. The largest of the three is Horseshoe Falls, also known as Canadian Falls, which straddles the international border between Canada and the United States. The smaller American Falls and Bridal Veil Falls lie entirely within the United States. Bridal Veil Falls are separated from Horseshoe Falls by Goat Island and from American Falls by Luna Island, with both islands situated in New York as well.

The Canadian Horseshoe Falls

American Falls (large waterfall on the left) and Bridal Veil Falls (smaller waterfall on the right)

The American, Bridal Veil, and Horseshoe Falls as seen from the Skylon Tower

Located on the Niagara River, which drains Lake Erie into Lake Ontario, the combined falls have the highest flow rate of any waterfall in North America that has a vertical drop of more than 50 metres (160 ft). During peak daytime tourist hours, more than 168,000 m^3 (six million cubic feet) of water goes over the crest of the falls every minute. Horseshoe Falls is the most powerful waterfall in North America, as measured by flow rate.

Geology

The features that became Niagara Falls were created by the Wisconsin glaciation about 10,000 years ago. The retreat of the ice sheet left behind a large amount of meltwater that filled up the basins that the glaciers had carved, thus creating the Great Lakes as we know them today. Scientists argue there is an old valley, St David's Buried Gorge, buried by glacial drift, at the approximate location of the present Welland Canal.

Niagara Escarpment

When the ice melted, the upper Great Lakes emptied into the Niagara River, which followed the rearranged topography across the Niagara Escarpment. In time, the river cut a gorge through the north-facing cliff, or cuesta. Because of the interactions of three major rock formations, the rocky bed did not erode evenly. The top rock formation was composed of erosion-resistant limestone and dolomite of the Lockport Formation. That hard layer of stone eroded more slowly than the underlying materials. The aerial photo in next page clearly shows the hard caprock, the Lockport Formation (Middle Silurian), which underlies the rapids above the falls, and approximately the upper third of the high gorge wall. Immediately below the hard-rock formation, comprising about two-thirds of the cliff, lay the weaker, softer, sloping Rochester Formation (Lower Silurian). This formation was composed mainly of shale, though it has some thin limestone layers. It also contains ancient fossils. In time, the river eroded the soft layer that supported the hard layers, undercutting the hard caprock, which gave way in great chunks. This process repeated countless times, eventually carving out the falls.

As Niagara falls migrates upstream, the shape of the crest has alternated over time from a horseshoe shape, as seen in the crest lines in 1678, 1764, 1842 and the current crest line; and a V-notch shape as seen in the crest line of The Falls in 1819. Erosion rates tend to be slower in times when The Falls is in a horseshoe shape due to water being spread over the longer crest line

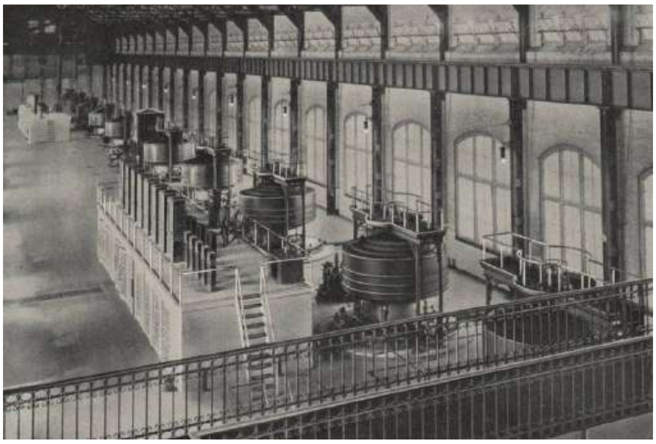
Submerged in the river in the lower valley, hidden from view, is the Queenston Formation (Upper Ordovician), which is composed of shales and fine sandstones. All three formations were laid down in an ancient sea, their differences of character deriving from changing conditions within that sea.

About 10,900 years ago, the Niagara Falls was between present-day Queenston, Ontario, and Lewiston, New York, but erosion of their crest has caused the waterfalls to retreat approximately 6.8 miles (10.9 km) southward. The Horseshoe Falls, which are about 2,600 feet (790 m) wide, have also changed their shape through the process of erosion; evolving from a small arch to a horseshoe bend, to the present day gigantic V. Just upstream from the falls' current location, Goat Island splits the course of the Niagara River, resulting in the separation of the mostly Canadian Horseshoe Falls to the west from the American and Bridal Veil Falls to the east. Engineering has slowed erosion and recession.

The current rate of erosion is approximately 30 centimeters (1 ft) per year, down from a historical average of 0.91 m (3 ft) per year. According to the timeline of the far future, in roughly 50,000 years Niagara Falls will have eroded the remaining 32 kilometres (20 mi) to Lake Erie and cease to exist.

Hydroelectric power

The enormous energy of Niagara Falls has long been recognized as a potential source of power. In 1893, Westinghouse Electric was hired to design a system to generate alternating current on Niagara Falls, and three years after that this large-scale AC power system was created (activated on August 26, 1895). The Adams Power Plant Transformer House remains as a landmark of the original system.



Ten 5,000 HP Westinghouse generators at Edward Dean Adams Power Plant

Πλέοντας και κάτω από τον καναδικό καταρράκτη

Ο Εκδότης και το μέλος της ΕΕΕΕΓΜ Φάνη Τσατσανίφου με τον καναδικό καταρράκτη στο βάθος (Αύγουστος 2019)

Niagara Falls at Sunset (360° view)

https://www.facebook.com/groups/1090462624321556/?multi_permalinks=3060381337329665&notif_id=1583257824949359&notif_t=group_activity

ΝΕΕΣ ΕΚΔΟΣΕΙΣ ΣΤΙΣ ΓΕΩΤΕΧΝΙΚΕΣ ΕΠΙΣΤΗΜΕΣ

Soil Mechanics

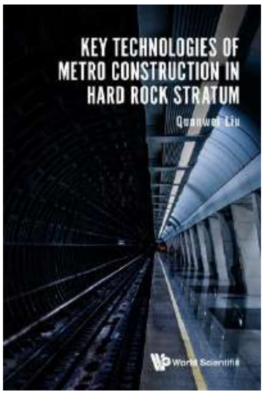
Hongjian Liao, Hangzhou Li, Zongyuan Ma

This book also doubles as a textbook with an explanation of basic theory, knowledge, and skills in soil mechanics as well as the most updated codes and standards in China. Also included are guidelines at the beginning of each chapter and English–Chinese–Japanese translations of frequently-used words and expressions in the Appendix. It aims to be a reference book for students and technical staff in civil engineering, hydraulic engineering, mining engineering, and transportation engineering.

Contents:

- Preface
- Basic Characteristics and Engineering Classification of Soils
- Permeability of Soil and Seepage Force
- Stress Distribution in Soils
- Compression and Consolidation of Soils
- Shear Strength
- Bearing Capacity
- Stability of Slopes
- Lateral Earth Pressure and Retaining Walls
- Constitutive Model of Soil and Characteristics of Special Soil
- Appendix

(World Scientific, October 2020)



Key Technologies of Metro Construction in Hard Rock Stratum

Quanwei Liu

This book is a comprehensive and objective study of the theory and construction methods of metro construction in hard rock stratum. It is based on the construction of the Qingdao metro and provides key techniques for metro construction in hard rock stratum in a systematic manner. Detailed data, accurate charts and pictures are provided to guide future metro construction in hard rock stratum in China.

Divided into six chapters, *Key Technologies of Metro Construction in Hard Rock Stratum* covers various construction technologies in hard rock stratum including (1) drilling and blasting construction technology, (2) open-cut station construction technology, (3) subsurface excavated station construction technology, (4) grouting reinforcement technology in adverse geological section, and (5) standardized metro construction technology. It can be used as reference for design, construction, monitoring or supervision staff as well as teachers and students engaged in metro and underground construction to facilitate exchange of ideas.

Contents:

- Introduction
- Drilling-Blasting Tunnel Construction Technology in Hard Rock Stratum
- Open-Cut Station Construction Technology
- Subsurface Excavated Station Construction Technology
- Grouting Reinforcement Technology of Poor Geological Section
- Green Construction and Standardized Site Construction

(World Scientific, September 2020)

Advanced Series on Ocean Engineering
Tsunami
Engineering Perspective for Mitigation, Protection and Modeling

V Sundar, S A Sannasiraj, K Murali and V Sriram

The most pertinent tsunami related issues such as water borne debris during tsunami flooding, design loads to incorporate for impact forces on coastal zone infrastructure, detection and warning are meticulously incorporated in this book.

Modelling of various coastal processes have proven to be successful in the recent past, which includes extreme events such as storm surge, cyclone, etc. The possible provisions for computational/numerical tsunami modelling and real physical modelling in laboratory are elaborated. The propagation, evolution and run-up of tsunami waves and their associated non-linear dynamics are discussed.

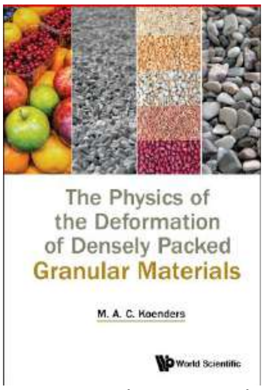
The significant inferences from the experts who have had hands-on experience working with the extensive magnitude of a tsunami disaster reported on the signature studies and post-facto effects of the 2004 Indian Ocean Tsunami, with respect to the damages along the Indian coast.

Contents:

- Tsunami Generation, Propagation and Effects
- Tsunami Driven Debris and Its Impact
- Tsunami Hazards and Aspects on Design Loads
- Behaviour of Shoreline between Groin Field and Its Effect on Tsunami Propagation
- Signature Studies (Tamil Nadu, Kerala, Andaman and Nicobar Islands)
- Post-Facto Evaluation Along Tsunami Affected Stretches
- Tsunami Detection
- Effectiveness of Coastal Vegetation on Impacts due to Tsunami

- Tsunami Generation in the Laboratory
- Tsunami Propagation Modeling
- Tsunami Evolution and Run-up
- Tsunami Impact Modeling

(World Scientific, March 2020)



The Physics of the Deformation of Densely Packed Granular Materials

M A C Koenders

This book is of interest for those that are concerned professionally with granular materials: civil engineers, geologists and geophysicists, chemical engineers, pharmacists, food technologists, agriculturalists, biologists and astronomers.

Granular materials play a role in nearly all human activities. For example, users of sand, from children in sandpits to sophisticated geotechnical engineers, know that it is a fascinating — and to some extent, unpredictable — material. In addition to sand, which itself may be of many compositions, there are various types of materials including gravel, fine-particle aggregates as employed in cosmetics, pharmaceuticals, dust, crushed rock and granules that occur in a domestic environment, such as breakfast cereals, sugar, salt and (instant or ground) coffee granules.

The aim of the book is to present a theory that explains the physics behind the phenomena during the deformation of densely packed granular media. The physics that describes such features is rather subtle and is developed from the micro to macro level (the latter is the continuum mechanics level that is used in practical applications). It requires the analysis of anisotropy and the heterogeneity of the packing evaluated against the background of a frictional inter-particle interaction.

Contents:

ΗΛΕΚΤΡΟΝΙΚΑ ΠΕΡΙΟΔΙΚΑ

ITA @ news

https://about.ita-aites.org/publications/archives-ita/ita-news/

Κυκλοφόρησε το τεύχος 71, Μαρτίου 2020 της ITA με τα παρακάτω περιεχόμενα:

- MESSAGE FROM JINXIU (JENNY) YAN, ITA PRESIDENT
- Postponing of WTC2020
- ITA shows what underground space brings to cities at 10th World Urban Forum
- Russian Tunnelling Association celebrates its 30th Anniversary
- WTC 2021: Call for Abstracts
- ITA Working Group 23 held Webinars
- Australasian Tunnelling Conference 2020
- First ITA and ITACUS workshop at the new ITA HQ is great success
- Exco and Young members visited CERN jobsite in Geneva
- Growth Below wins Emerging Ideas Award 2020 at Better Cities Film Festival
- Catching up with ITAtech
- Geneva researchers are launching a futuristic idea: why go to Mars when the tunnel is so close?


AMITOS photo contest - Grand prize winner:
Fortino Hernández "Túnel ferroviario Manzanillo"

International Geosynthetics Society

Κυκλοφόρησε το IGS Newsletter της International Geosynthetics Society με τα παρακάτω περιεχόμενα:

IGS NEWSLETTER – March 2020

Helping the world understand the appropriate value and use of geosynthetics

https://www.geosyntheticssociety.org/wp-content/uploads/2020/02/IGS-Newsletter-March-2020.pdf

- 2020 IGS Membership Renewals READ MORE
- Chapters: Don't forget to submit your 2019 Chapter Report! READ MORE
- Calling on all GeoAmericas Young Members! READ MORE
- GeoAmericas 2020: Rio de Janario Awaits You! READ MORE
- Inspiring Program at EuroGeo7 READ MORE
- IGS Chapter Focus: United Kingdom READ MORE
- We're Hiring! READ MORE
- Deadline for IGS Council Nominations is 1 March 2020! READ MORE
- Calendar of Events

READ MORE AT GEOSYNTHETICSSOCIETY.ORG

ΕΚΤΕΛΕΣΤΙΚΗ ΕΠΙΤΡΟΠΗ ΕΕΕΕΓΜ (2019 – 2022)

ΕΕΕΕΓΜ

Τομέας Γεωτεχνικής
ΣΧΟΛΗ ΠΟΛΙΤΙΚΩΝ ΜΗΧΑΝΙΚΩΝ
ΕΘΝΙΚΟΥ ΜΕΤΣΟΒΙΟΥ ΠΟΛΥΤΕΧΝΕΙΟΥ
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«ΤΑ ΝΕΑ ΤΗΣ ΕΕΕΕΓΜ» «αναρτώνται» και στην ιστοσελίδα www.hssmge.gr